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# **Cell and Molecular Biology**

**Dr. A. Indira Priyadarsini**

**Dr. I. S. Chakrapani**

**AIIP**

# **CELL AND MOLECULAR BIOLOGY**

**FIRST EDITION**

## **Authors**

**Dr. A. Indira Priyadarsini**

**Dr. Inavolu Srinivasa Chakrapani**

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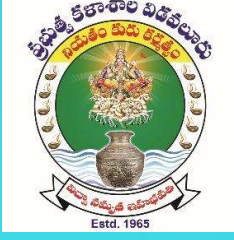
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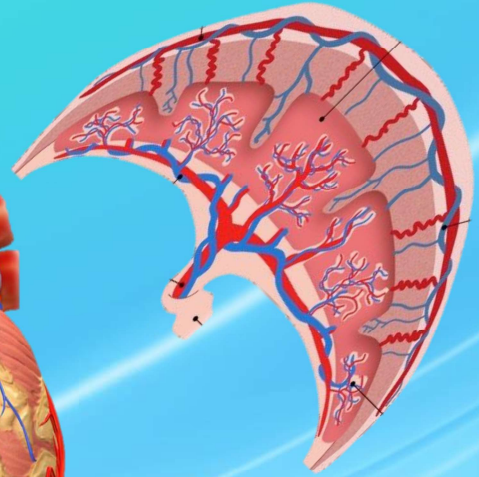
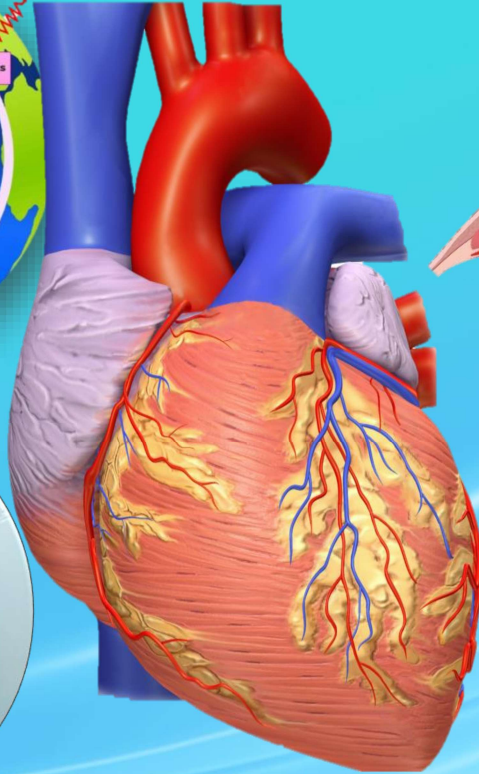
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బి.యస్సీ-IV వ సెమిస్టర్



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*This compilation will be of great help to the students.*

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*I congratulate the Dr N. Sreenivas, Lecturer in Zoology, Department of P R Government College (Autonomous), Kakinada and Dr I. S. Chakrapani, Lecturer in Zoology PRR & VS Government Degree College, Vidavaluru for this good initiative.*

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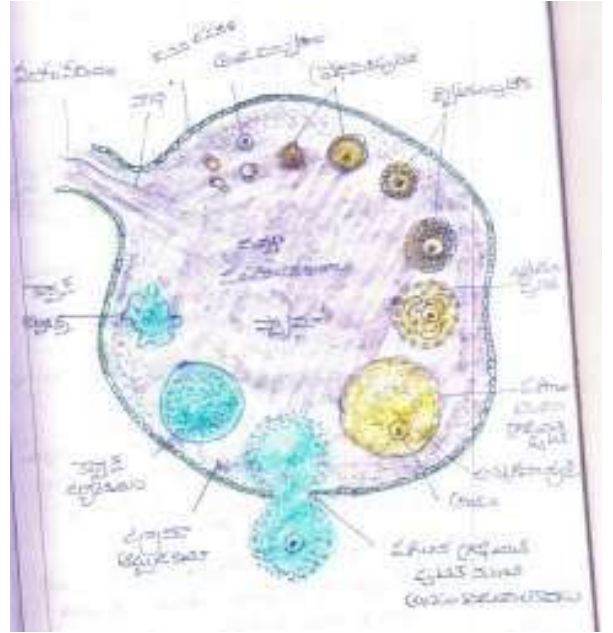
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పాఠశాల

# అండజననం (Oogenesis)

## స్త్రీబీజకోశం నిర్మాణం

అండజననం అండాశయంలో జరుగుతుంది. అండ మాతృకణాల నుంచి అండాలు ఏర్పడే విధానాన్ని అండ జననం అంటారు. సకశేరుకాలలో ఒక జత స్త్రీ బీజకోశాలు (అండాశయాలు) ఉదర కుహరంలో పృష్ఠ దేహ కుడ్య ప్రాంతంలో అతికి ఉంటాయి. పక్షులలో ఎడమ స్త్రీ బీజకోశం మాత్రం ఉంటుంది. మానవులలో స్త్రీ జీవి రెండు X క్రోమోజోమ్ ల కలయికవల్ల ఏర్పడుతుంది. X క్రోమోజోమ్ పై TDF కారకం లోపించడంవల్ల పిండాభివృద్ధి సమయంలో బీజకోశ వల్కలం (Gonadal cortex) స్త్రీ బీజకోశంగా విభేదనం చెందుతుంది. స్త్రీ బీజకోశం ఏర్పడిన సమయంలో ప్రాథమిక బీజ కణాలు (Primordial Germ cells) స్త్రీ బీజకోశం/అండాశయంలోకి వలస చెందుతాయి. పిండాభివృద్ధి సమయంలో స్త్రీ బీజకోశం అభివృద్ధి చెందుతుంది. స్త్రీ బీజకోశం వెలుపల ఉపకళా కణాలతో కూడిన ఒక స్తరం ఏర్పడుతుంది. ఈ స్తరంలోని కణాలను జనన ఉపకళాకణాలు (Germinal epithelial cells) అంటారు. అండాశయంలోని మిగిలిన లోపలి ప్రాంతం సంయోజక కణజాలంతో నింపబడుతుంది. దీన్ని స్ట్రోమా అంటారు. జనన ఉపకళాకణాలు

సమ విభజన చెందడం ద్వారా ఏర్పడే కొత్త కణాలు స్ట్రోమాలో చిన్న చిన్న గుంపులుగా ఏర్పడతాయి. ఒక్కొక్క గుంపును గ్రాఫియన్ పుటిక (Graffian follicle) గా పిలుస్తారు. ఒక గ్రాఫియన్ పుటికలో బాగా అభివృద్ధి చెందిన ఒక కణం అండ మాతృకణం (Oogonium) గా ఏర్పడుతుంది. మిగిలిన కణాలు పుటికాకణాలుగా ఉండి అభివృద్ధి చెందే అండానికి పోషక పదార్థాలను అందచేస్తాయి. అండ మాతృకణం విభజనలోకి ప్రవేశించడం ద్వారా ప్రాథమిక అండమాతృకణాలు (Primary oocytes)గా ఏర్పడతాయి.





**డా.యన్. శ్రీనివాస్**

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## II SEMESTER



*e- content*

## ANIMAL DIVERSITY-II

# BIOLOGY OF CHORDATES



**SREENIVAS-CHAKRAPANI-ANILKUMAR**

# Biology of Chordates

(Text book for UG II-Sem Zoology)

Dr.N.Srinivas, Dr.I.S.Chakrapani & Dr.P.Anilkumar

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**II SEMESTER**

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**ANIMAL DIVERSITY-II**

# **BIOLOGY OF CHORDATES**

## **MODULE-I (PROTOCHORDATES)**

- 1.1. General Characters and Classification of Chordates upto classes.
- 1.2 Salient features of Urochordata and Cephalochordata Salient features of Cyclostomes
- 1.3 General Characters and Classification of Fishes upto sub class level,
- 1.4. Structure and life-history of *Herdmania*, Significance of retrogressive Metamorphosis.

# **MODULE-I**

## **INTRODUCTION**

Animal kingdom is basically divided into two sub kingdoms:

(a) Nonchordata- including animals without notochord.

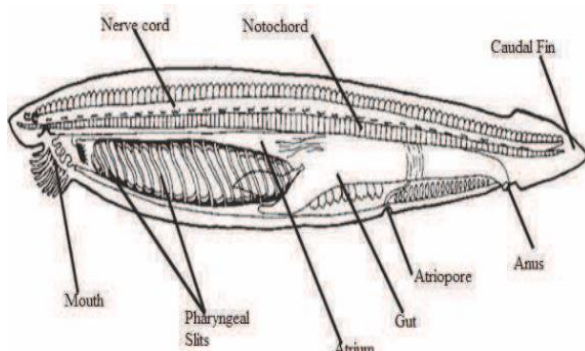
(b) Chordata- This comprising animal having notochord or chorda dorsalis. While the Chordata has a notochord at some stage during the life, it is not known to exist in the Nonchordata.

- The Chordata is the animal phylum with which everyone is most intimately familiar, since it includes humans and other vertebrates. However, not all chordates are vertebrates.

- All chordates have the following features at some stage in their life (in the case of humans and many other vertebrates, these features may only be present in the embryos).

- Pharyngeal slits – a series of openings that connect the inside of the throat to the outside of the

“neck”. These are often, but not always, used as gills.



- Dorsal tubular nerve cord – A bundle of nerve fibers which runs down the “back”. It connects the brain with the lateral muscles and other organs.

Pharyngeal slits dorsal nerve cord & Notochord

- Notochord – cartilaginous rod running underneath, and supporting, the nerve cord.

- Post-anal tail – an extension of the body posts the anal opening.

## **ORIGIN OF CHORDATES**

It is believed that chordates originated from invertebrates. However, it is difficult to determine from which invertebrate group of the chordate developed.

It is almost constant that chordate ancestors were soft bodied animals. Hence, they were not preserved as fossil.

Many theories have been put forward to explain the evolution of chordates, few of them are as follows:

### **(a) COELENTERATE THEORY:**

According to this theory chordates developed from coelenterates.

It is believed that radial symmetry coelenteron, cnidoblasts etc, disappeared and advanced characters developed to give rise the chordates.

This theory infers that chordate might have acquired higher characters independently. This theory is not acceptable.

**(b) ANNELID THEORY:** This theory suggests that the chordates have evolved from an annelid stock, like many chordates the annelids show bilateral symmetry, metasmerism, head, lateral coelome complete digestive tract, closed circulatory system, haemoglobin, etc.



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**ANIMAL DIVERSITY-II**

# **BIOLOGY OF CHORDATES**

## **MODULE-II (FISHES & AMPHIBIA)**

- 2.1. *Scoliodon*: Morphology, structure of Heart, Brain and sense organs.
- 2.2. Migration in fishes and types of scales - Dipnoi fishes
- 2.3 *Characters and Classification of Amphibia upto orders*
- 2.4. *Rana* : Morphology, respiratory system, structure of heart, Brain and reproductive systems only.

# **MODULE-II**

## External Features of Dogfish (Scoliodon):

### Shape, Size and Colour:

Dogfish (Scoliodon) has a long, laterally compressed spindle-shaped body tapering at both ends. The fully grown specimen measures from 30 to 60 cm in length. The colour of the body is dark grey above and pale white beneath, while the portions of the caudal fin are more or less dark. Body surface is rough due to backwardly directed spines of placoid scales embedded in the dermis.

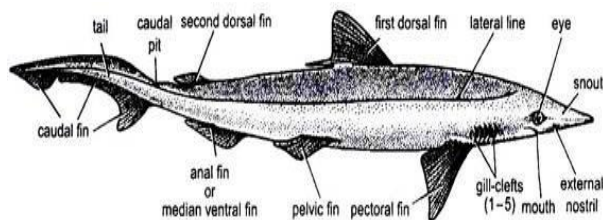


Fig. 14.1. Scoliodon. External features.

### Division of Body:

The body is divisible into head, trunk and tail, though there are no distinct boundaries between these regions.

#### (i) Head:

The head is strongly compressed dorso-ventrally and is produced in front into a wedge-shaped snout or rostrum.

#### (ii) Trunk:

The trunk is almost elliptical in transverse section. Its thickest part lying in front of the middle of the body. The trunk gradually tapers behind into the tail.

#### (iii) Tail:

The tail is laterally compressed and is bent upwards at a small angle and fringed with a caudal fin. Such a tail is known as heterocercal tail.

#### Fins:

Dogfish (Scoliodon) is provided with two sets of fins which are flattened expansions of the skin supported by cartilaginous rods and horny fin rays- these are unpaired or median fins and paired lateral fins.

#### (i) Median Fins:

The median fins are two dorsal fins, a ventral or anal fin and a caudal fin. The first dorsal fin is large and triangular in shape and is situated a little in front of the middle of the body. It has a basal lobe. The second dorsal fin is also triangular in outline but is very small and is situated midway between the first dorsal and the tip of the tail. The caudal fin extends along the dorsal and ventral



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**ANIMAL DIVERSITY-II**

# **BIOLOGY OF CHORDATES**

## **MODULE-III (REPTILIA)**

- 3.1. *Characters and Classification of Reptilia upto orders*
- 3.2. *Calotes: Morphology, digestive system, urinogenital system and Brain*
- 3.3. *Identification of Poisonous snakes*

# **MODULE-III**

## REPTILIA: CHARACTERS AND CLASSIFICATION

Reptiles are cold-blooded vertebrates, breath by lungs and having the body covered by scales or scutes.

General characters:

- ✚ They are inhabitants of terrestrial and aquatic (both marine and freshwaters) environments.
- ✚ Their skin is dry, cornified and usually covered by **epidermal** scales or scutes. There are a few integumentary scent glands secreting pheromones during breeding seasons.
- ✚ Single external nasal opening is present on the snout. Ear drums are slightly depressed.
- ✚ Two pairs of pentadactyle limbs are present. The limbs end in clawed digits.
- ✚ The cloacal opening is either transverse or longitudinal.
- ✚ A post-anal tail is present.
- ✚ The heart is composed of two auricles and a partially divided ventricle. There are right and left systemic arches.
- ✚ The kidney is metanephric type.
- ✚ Mullerian duct persists as oviduct in female and Wolffian duct is retained as vas deference in male. Males possess copulatory organs.
- ✚ Twelve pairs of cranial nerves are present.
- ✚ Vomero-nasal organ (Organ of Jacobson) is well-developed.
- ✚ Single occipital condyle in the skull is present for the attachment with atlas.
- ✚ Mandible consists usually six pieces of bones.
- ✚ Vertebrae are procoelous. Sternum is greatly developed with ribs.
- ✚ Cleidoic eggs are large. The calcareous shell serves for protection against desiccation and external injury. The shell is porous for gaseous exchange.

- ✚ Fertilisation is internal.
- ✚ Embryos are provided with extra-embryonic membranes, like amnion, chorion and allantois.



**II SEMESTER**

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**ANIMAL DIVERSITY-II**

# **BIOLOGY OF CHORDATES**

## **MODULE-IV (AVES & MAMMALS)**

- 4.1. General characters of Aves and Classification of Mammals- comparison of Prototheria, Metatheria and Eutheria
- 4.2. Pigeon (*Columbia livia*) : Exoskeleton, respiratory system, structure of heart,
- 4.3. Migration in birds and its significance, Flight adaptation in birds
- 4.4. Dentition in Mammals,

# **MODULE-IV**

# GENERAL CHARACTERS OF AVES

## Introduction:

Class Aves includes birds, bipedal vertebrates. Birds are unique in having feathers as their exoskeleton. Aves originated from theropod dinosaurs in Jurassic period and modernized in the cretaceous period. **T.H.Huxley** called birds

“**Glorified reptiles**”. **J.Z. Young** described them as the “**Masters of air**”. Ornithology is the study of birds.

## General characters of Aves

- Birds are cosmopolitan and found in all continents, seas and most islands.
- Their wide occurrence is due to their power of flight, which enables them to reach places unreachable to other animals.
- Most of them can fly and a few have lost the power of flight.

## Body temperature:

- They are **homeothermic (warm blooded)** and the body temperature provides high metabolic rate for quick energy supply.
- Birds are **endothermic**, and expend a lot of energy to keep warm.

## Body form and appendages:

- The body is boat shaped and streamlined.
- It is divisible into **head, neck, trunk and tail**.
- The forelimbs are modified into wings for flight which are supported by powerful flight muscles attached to the sternum.
- Each fore limb has 1 to 3 digits and each hind limb has 1 to 4 digits.

- The hind limbs are used for perching, walking, hopping, wading, swimming etc.
- Skin is dry and thin except for uropygial or oil gland on the tail.
- Body is covered by epidermal horny skeleton of feathers which conserve body heat, help in flight and provide colouration to the birds.

## Endoskeleton:

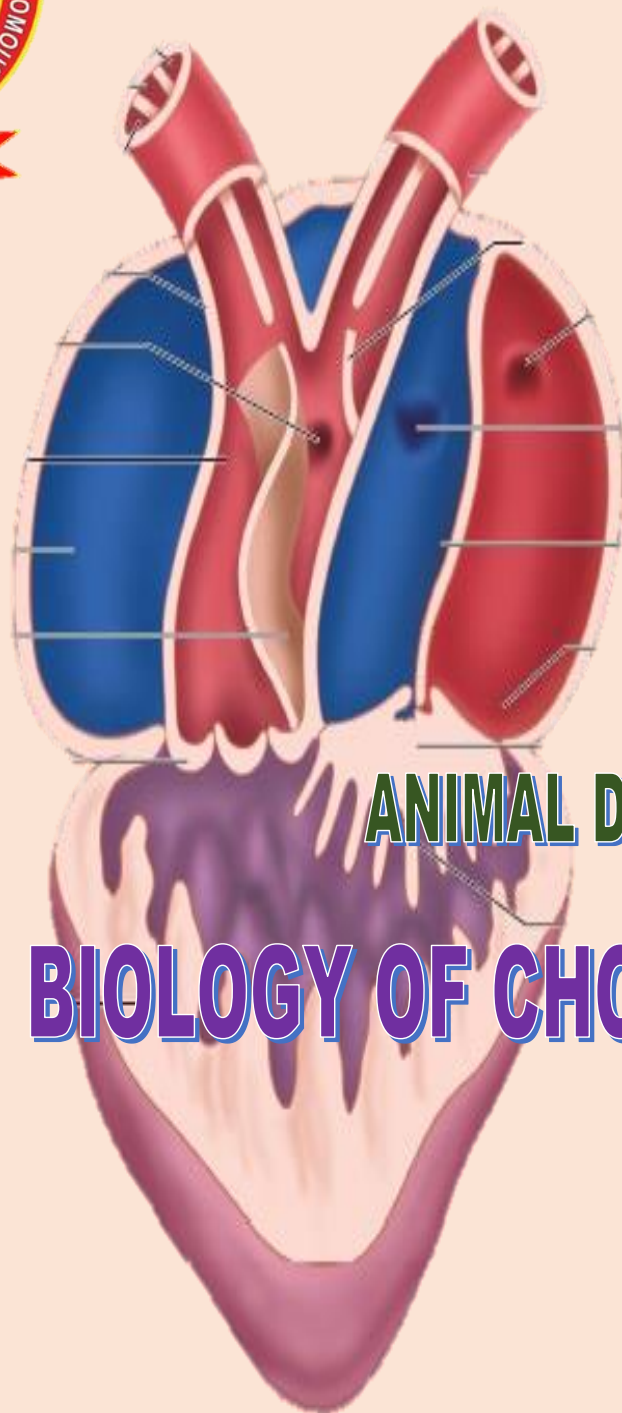
- The endoskeleton is bony, but delicate and light.
- Skull is **monocondylic**, i.e., with single occipital condyle.
- Sternum is usually large and with a median keel for the attachment of flight muscles.
- Bones are pneumatic, i.e., contain air cavities to reduce weight.

## Digestive system:

- Mouth has a wide gap and jaws are covered with horny sheaths to form strong beaks.
- Beaks are adapted to various modes of feeding: seed-crushing, fruit-scooping, fish-tearing, nectar-sipping, wood-chiselling, grain-pickling etc.
- Teeth are absent and food is swallowed un masticated.
- The **crop** stores and softens food.
- Alimentary canal often has additional chambers; **crop and gizzard**.
- Gizzard is muscular to crush and churn the softened food.
- Some birds keep stone in the gizzard to effectively crush seeds and grains. Alimentary canal leads to the cloaca.
- The cloaca is divided into three linear compartments: i.e., anterior **coprodaeum** middle **urodaeum**



**II SEMESTER**



**e- content**

**ANIMAL DIVERSITY-II**

**BIOLOGY OF CHORDATES**

**SREENIVAS-CHAKRAPANI-ANILKUMAR**



# Applications of Deep Learning (DL) Techniques in Detecting Breast Cancer and Malignant Cells

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**Abstract**--According to the most recent statistics, the most common type of cancer globally is the breast carcinoma and kills close to 900,000 people annually. Early and accurate diagnosis of the illness can increase the likelihood of successful treatment and lower the mortality rate. In fact, an early diagnosis can help stop it from spreading and prevent the premature victims from getting it. Researchers who study cancer have a number of difficulties when attempting to differentiate between benign and malignant tumors as well as attempting to make judgments about benign and metastatic breast carcinoma. Examine the effectiveness of automated deep learning algorithms at identifying malignant cells in women's breasts and cancer stage. This paper suggests applying deep learning algorithms to whole-slide pathology images in order to possibly increase diagnostic efficacy and accuracy. The convolutional neural networks (CNN), sparse auto encoders (SAE), and stacked sparse auto encoders are illustrations of techniques of deep learning were used in this research work. There are numerous public mammographic databases available. The methods discussed in this paper are put to the test using the mini-MIAS mammographic database. The stacked sparse auto encoder performs better, this method has to be tested in a clinical setting before being used. It has higher accuracy and precision as compared to CNN and SAE. Better diagnostic performance was achieved by several deep learning methods. Deep learning algorithms are used to better reliably identify tiny tumors while detecting breast cancer via a mammogram.

**Keywords:** Breast Cancer, Malignant cells, deep learning, CNN, Stacked sparse auto encoders, SAE

## I. INTRODUCTION

According to a reputable source like the Centers for Disease Control and Prevention (CDC), breast carcinoma is one of the frequently causing type of cancer in women. Depending on a number of variables, there are wide variations in the probability of healing breast cancer and the nature of a woman's tumour. 2 of the biggest factors are the disease's stage when she receives her diagnosis and aspects. This cancer develops in the breast cells. Most of the time one of the two breast regions named as the lobules or the ducts is where the cancer first appears. A cancerous condition called adipose tissue, which is found in your breast, is also possible both the fibrous connective tissue and

tissue. Unchecked cancer cells could potentially frequently spread to unaffected tissue of breast and can reach to the lymph nodes situated below the arms [1].

According to medical experts, breast cancer is brought on by the unchecked proliferation of aberrant breast cells that are alleged the nodules of lymph or other areas of the body, in addition to the breast, to have migrated and expanded like Meta Size. Finding these undesirable cells quickly is crucial to avoid the consequences of the following stage possible to stop their spread as soon as is practical. If a tumour is discovered, the initially a physician will first assess whether the swelling is benign by looking at whether or whether it can be divided into not harmful that is benign and harmful that is malignant types. Both forms of cancer can be treated and prevented using different methods. Malignant cells have the potential to migrate to other body parts, whereas other one do not transform into cancer and don't spread throughout the body.

All of these illnesses are a result of the lack of a screening tool of that caliber and quality which can spot early signs of cancer. A patient would benefit if there was a tool like this one. In fact, be prepared to begin treatment as soon as feasible, and seek to prevent the proliferation of cancerous or unwanted cells. However, such a device doesn't exist at the moment. Almost always, successful treatment of any illness depends on receiving an early diagnosis. Most sufferers are not able to identify their sickness earlier than it develops into an incurable stage. It makes a difference in the rise in the number of fatalities worldwide. Breast cancer represents one of the illnesses that has a potential of being cured when discovered in its early stages. That's why early disease diagnosis stops the disease from migrating to other parts of body.

Medical experts struggle to come up with treatment plans that might increase a person's physical and mental survival time because there are no prognostic models available. Therefore, in order to increase accuracy, it takes time to identify the tactic that results in the lowest rate of error. There was a need for a latest disease prediction system that made use of machine learning because the

presently available procedures to detect breast carcinoma, such as mammography, scanning, and biopsy, require a lot of time. This method uses algorithms that shorten the time needed for classification of the tumour, increase the precision through which cells are located, and speed up the classification process.

Thermography has grown in popularity during the past few years, especially as a cervical cancer screening tool [12]. This is due to the alluring realities of its own reasonably secure invention as well as the possibility of later enhancements made feasible by cutting-edge technical advancement. The goal of the present study in this field is to develop a more conclusive tumour outcome that can be accepted by a large group of people and used as a prescription for screening of breast carcinoma. In a related vein, breaking through the restrictions that have lately emerged because of the laborious screening process, especially when photo needs to be prepared. Since of continual advancements in the field, imaging using thermographic, as a technology and the applications it may support have been given fresh life. The monitoring for breast cancer that is carried out with the use of thermography is probably one of its greatest uses. Despite this, thermography hasn't yet been proven to be the best technique for completing this particular task. Additionally, most medical experts would prefer to receive the results of a mammogram instead of the ones of a thermograph considering that the procedure is not entirely risk-free. Because of this, if it is significantly improved, thermal imaging screening mammography has the possibility of emerging as a competitive alternative [15].

The results of this research point to the use of a Convolutional Neural Network, or CNN, for testing of image and remediation in sort to lessen the disadvantages previously mentioned.

## II. LITERATURE REVIEW

1) *Screening Techniques*: Breast cancer screening techniques based on imaging and genetics have been the focus of numerous studies. Moreover, to the finest of our information, no study that combines both of these methods has been conducted. The researchers of [2] presented a thorough overview of the many techniques used for histological image analysis to identify breast carcinoma. These techniques are based on CNN. Based on the dataset that was used, the authors categorised their study. The events are listed in reverse chronological order, beginning with the most recent one. The results of this study indicate that ANNs were initially used in the field of histological analysis around the year 2012. The algorithms that were used the most commonly were ANNs and PNNs. However, textural and morphological qualities were mostly used in feature extraction research. CNN were clearly advantageous for the detection and prescription of breast cancer, which ultimately resulted in more effective treatment.

2) *Algorithms for Disease Prediction*: For the purpose of creating predictions for non-communicable diseases, many algorithms were used (NCDs). The effectiveness of a

variety of other classification techniques was investigated and compared by the authors of [3]. The classification algorithms were applied to eight different NCD datasets using a 10-fold cross validation strategy and eight different classification methods. These were subjected to the region under the curve analysis and rated as an accuracy indicator. The NCD datasets, according to the authors, include useless and noisy data. In the presence of this noise, NN, SVM, and KNN all shown robustness. Additionally, they suggested that by using specific pre-processing techniques, the problem of irrelevant attributes may be eliminated, leading to an improvement in accuracy rates. In order to diagnose a range of human illnesses, natural inspiration computing (NIC) approaches have been created and put into practise. The authors of [4] presented five insect-based NIC diagnostic algorithms and examined how useful they are for spotting diabetes and cancer. The authors claim that it successfully identified a number of tumours (breast, ovarian, prostate and lung). ABC that was directed and neural networks were combined to detect breast cancer. In addition, the authors developed a technique that is quite effective for detecting leukaemia and diabetes. They got to the end that the use of NICs in conjunction with other categorization techniques results in more precise and encouraging results. They emphasised the need for further research to be completed in order to identify the various disease and diabetes phases. Evidence was provided by the authors of [5] that supported the utility of NNs in classifying diagnosed cancer, mostly in the early stages of the sickness. According to their study, a number of NNs have shown some promise in the identification of cancerous cells. The imaging technique, however, necessitates a substantial amount of processing resources in order to pre-process the images.

3) *Automation in Diagnostics system*: There are so many data analysis, deep learning, data mining and machine learning techniques that are related to breast cancer detection were discussed by the authors of review article [6]. This evaluation of breast cancer research papers looked on the whole 29 publications in machine learning, 6 articles addressing the issues associated with them, and 8 articles on convolutional neural networks. The authors noted that genetics used in very few researches, the majority of publications used imaging. The main methods used in the genetic study of breast cancer were the random forest (RF), decision tree, and support vector machine (SVM). On the other hand, imaging techniques used a range of algorithms, including CNNs and Naive Bayes.

However, at the other side, the researchers in [7] focused their emphasis on gene mutation as a technique of breast cancer diagnosis. They stated that the reverse genetics categorization stage will now do gene discovery, genetic annotation, and genetic detection of mutation in order to determine if there is a presence of malignancy.

They found that many strategies, including SVMs, regression, neural networks, probabilistic models, and deep learning, may be used. Additionally, they listed the many approaches that can be used to understand how nucleotides

relate to feature extraction. This is because a sizable amount of information in the manner of a string sequence is included in DNA sequencing. The authors of [8] evaluated recent studies that used a range of imaging modalities and deep learning to treat breast cancer. By concentrating on the architecture, datasets, applications, and assessments involved, they gave these inquiries a structure. Utilizing three different modality, they concentrated on creating framework of deep learning for imaging of breast (ultrasound, scanning, mammography and magnetic imaging). They concentrated their work on utilizing DLR-based CAD systems to give data that were current in terms of breast cancer imaging. They used CNNs for categorization as well as private datasets in their research. The analysis of these surveys will lead to my contribution, which will be to conduct concurrent sequencing of genes and imaging studies to predict breast malignancy and gather more data that will help with the easy detection and therapy of breast cancer.

#### 4) Classification of Mammography images:

Additionally, we will make recommendations to researchers who are interested in conducting studies in this area. The researchers of [9] propose an intuitive method for classifying mammography images as non-migrating, migrating or normal using a number of machine learning techniques. RF, SVM and CNN are examined for their parallels and distinctions. Researchers came to the decision that CNN is the best classifier as a result of the simulation, since it uses morphological and filtering operations to intuitively categorise digital mammograms.

The dataset from UW Hospital is used by the author in [10]. Data visualization and ML techniques like k-nearest neighbours, naive Bayes, SVM, logistic regression, decision trees, rotation forest and random forests, were practiced using this collection. These various machine learning techniques and visualisations were applied using the programming languages python Minitab, and R. Investigations were done to see how each procedure compared and differed from the others. The planned technique showed an improvement in exactness exhibitions, and the outcomes using the calculated relapse model that incorporated every one of the qualities showed the most extreme level of order precision (97.9%). The parallels and contrasts of SVM, Logistic Regression, Naive Bayes, and Random Forest were examined in [11]. The Wisconsin dataset of breast cancer is used to do the comparison. RF had the lowest mistake rate and the best accuracy (99.76%) of all the algorithms tested. All of the experiments were performed in a simulated environment using the Anaconda Data Science Platforms.

The authors [12] proposed a strategy for identifying the many kinds of breast cancer in order to treat it. The classification of the different types of breast cancer is then done using a neural network technique, with a focus on the back-propagation neural RBF and MLP. The nine features available in this data set correspond to the input layer of the neural network. The NN will classify the input information into two different forms of cancer (benign and malignant).

When RBF neural network was utilized, the method that was developed and tested on the database had a classification recurrence rate of 97 percent. The authors [13] examined and compared two different classifiers, namely Markov blanket and Naive Bayes- tree augmented estimating networks, with the purpose of developing an ensemble model for predicting the intensity of breast masses. The following methodology was created to aid medical practitioners in deciding whether or not to perform a breast biopsy on a suspicious reports of a mammogram. Based on Bayesian classifiers, the authors have found, are a practical substitute for a number of different approaches that can be applied in medical applications. BN has proven to be a useful tool in the realm of emergency care, because to their potent symbol, handling of ambiguity, and when numerous alternatives are feasible on the basis of evidence that is supplied, authors [14] decide to follow Bayesian networks (BN). Considering that Bayesian networks have their own symbolic representation, they are considered to be a successful methodology.

### III. METHODOLOGY

The breast cancer detection via mammography images, the suggested method leverages deep learning approaches based on human intelligence. In Fig. 1, the various steps of the suggested system are depicted.

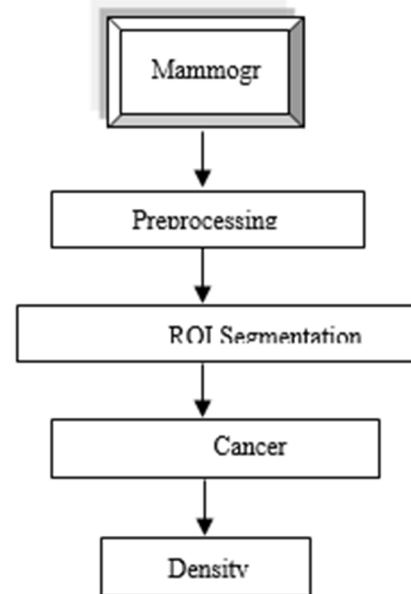


Figure 1: Flowchart depicted the proposed method.

1) *Imaging Input Methods:* To analyse the organ located inside the human body, a specific modality must be chosen among all those that are available in medical imaging. This will provide us a plethora of knowledge about how diseases work. The reports on the anatomy of a lesion are generated via X-ray images (mammograms), which are used in the given method.

2) *Preprocessing of Image:* The many phases of the preprocessing approach are depicted in Figure 2.

Mammograms frequently contain radio-opaque artefacts like labels and wedges as well as digitization sounds like straight lines. The methodology of preprocessing in the computerized detection process includes the recognition of the muscle region that is pectoral and the extraction of the breast profile.[16] The preprocessing step involves the median filter and other morphological processes to remove radio-opaque artefacts and noise, respectively.

3) *ROI Segmentation*: ROI is a specific area or portion of the original image that must be filtered out in order to execute additional operations on it. The outlines the stages involved in ROI segmentation. For the excision of pectoral muscles, a segmentation method is region based called initial region growth is initiated.[16] In this method of segmentation, the first seed point is chosen along with the additional nearby pixels that will be applied to the region.

4) *Deep Learning for Cancer Detection*: By examining the simple features discovered in the earlier levels of the network, the topologies of "human brain-inspired" nonlinear deep models create complex characteristics in the network's deeper layers. These characteristics show to be excellent descriptors in object recognition issues. [17] The features are iteratively encoded at the time of the phase of training of these models, and the learnt weights are then adjusted for better network optimization. Either supervised learning using CNN or unsupervised learning with autoencoders is possible for the features. A classifier which is trained predicts the labels from the features supplied into it via the layerwise learning technique. A label for an unknown image should be correctly predicted by the trained network. In this study, features from the mammography are learned unsupervisedly using a sparse autoencoder[18].

5) *Risk Scoring*: Mammograms can be classified as dangerous or regular maps the patches into label space depending on the score density of the patches immediately following categorization.. Even if at minimum one of the components regions is thick, mammograms are deemed hazardous. Similar to multiple instance learning, this method is used. [19]

6) *Techniques of Deep learning*: In fields including biology, robotics, and medicine, deep learning algorithms can be used for pattern identification, classification, and grouping. The most recent advancements in the field have been made because too deep learning (DL) techniques. Data representation using multilayered multidimensionalis the key component of deep learning, which frequently takes the form of a NN with some more than 2 layers. [20] These techniques enable the automatic synthesis of higher level data descriptions (features) based on lower level ones.

1. *Autoencoder*: An autoencoder is made up of an encoder and a decoder. The encoder component uses  $h^e(.)$  to convert the input from  $x$  to  $z$ . The decoder component seeks to recover the initial input  $x$  from the encoder. The decoder generates

the result  $\hat{x}$ , which is a rough reconstruction of the initial input  $x$ . Unsupervised training of an autoencoder utilising unlabeled data results in an output that replicates the input. The minimization of a cost function occurs during the training phase. Cross-entropy is the frequently employed cost function because it stagnates less frequently than mean square error. The encoder portion of the autoencoder uses  $h^e(.)$  to map the input vector  $x$  to the vector  $z$  as seen below:

$$z^e = h^e(w_e x + b_e) \quad (1)$$

Where  $h^e(.)$  is the activation function,  $w_e$  is the weight matrix,  $b_e$  is the bias vector. A hyperbolic tangent, sigmoid and rectified linear function could be the activation function. The proposed system makes use of the sigmoid function,  $h^e(x) = \frac{1}{1+e^{-x}}$ . Utilizing the capability  $h^d(.)$ , the auto encoder's decoder switches the encoded portrayal  $z$  over completely to an unpleasant remaking of the first information vector  $x$  as seen beneath:

$$\hat{x} = h^d(w^d x + b^d) \quad (2)$$

Where  $h^d$  is the decoder's transfer function,  $w^d$  is the weight matrix, and  $b^d$  is the bias vector.

2. *Sparse Autoencoders (SAE)*: An autoencoder's sparsity is introduced when a regularizer is applied to the cost function [20]. The average output stimulation value of a neuron serves as the basis for this regularizer. A neuron's average output activity measure is described as follows:

$$\hat{p}_i = \frac{1}{n} \sum_{j=1}^n z_i^e(x_j) = \frac{1}{n} \sum_{j=1}^n (w_i^{eT} x_j + b_i^e) \quad (3)$$

$n$  is the total number of training examples,  $x_j$  is the  $j$ th training example,  $w_i^{eT}$  is the  $i$ th row of the weight matrix  $w^e$ , and  $b_i^e$  is the  $i$ th entry of the bias vector,  $b^e$ . If a neuron's output activation value is high, the neuron is active. With a low output stimulation value, the hidden layer neuron only responds to a sparse number of training samples by firing. By including a component in the cost function that limits the values of  $\hat{p}_i$ , it is possible to train the neurons to only fire in response to a limited set of training values. Each neuron specializes by reacting to a property that is merely represented in a part of the training cases.

3. *Sparse Autoencoder Stacked or SSAE*: Basic stacked sparse auto encoders (SAEs) can be layered together to create an SSAE, with the first layer as a output feeding into the following layer's input. The SSAE in this work is created by stacking three SAEs. There are four covert layers in each of these SAEs. The softmax classifier comes next.

4. *Convolutional Neural network (CNN)*: A CNN differs from a standard back propagation neural network (BPN) in that directly acts on an image to

extract the essential characteristics for classification, as opposed to the BPN's usage of extracted, manually created picture features. Fully connected layers, Convolutional layers, classification layers, and pooling layers etc. are frequently used in CNN construction.

#### IV. RESULTS AND DISCUSSION

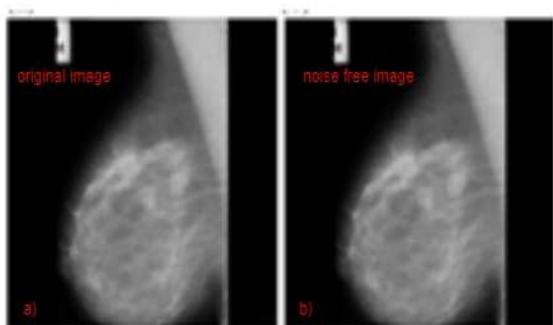
There are numerous public mammographic databases available. The methods discussed in this paper are put to the test using the mini-MIAS mammographic database.

1) *Data source*: There are 332 digitised films totaling 1124 pictures in the database. The radiologist provides the ground truth markers for each mammography in addition to the locations of any anomalies.

2) *Preparation*: Noise removal from digital mammograms, artefact suppression, and background removal are among of the preprocessing steps. The sections that follow discuss the outcomes from each of these phases.

Elimination of digital noise The digitization noises contained in the input image are removed using a 2D median filtering with a 3X3 neighbourhood window, as shown in figure. Figure shows the final image after the digitization lines have been removed.

3) *ROI Segmentation*: Pectoral muscle should be excised prior to the detection stage due to its undesirable impact on the identification of breast cancer. Using the SRG procedure, the pectoral muscle is removed. Fig. 2b depicts the grown area. By multiplying the final grayscale mammography image with this image the fragmented breast muscle by the preprocessed grayscale image (Fig. 2a).



**Figure 2:** Mammogram image is showing the difference in a) Original one and b) without Noise .

4) *Cancer Detection through Deep learning*: The following processes are involved in the implementation of the DL method for cancer detection: input creation, deep network design, network training, and network testing. CNN, SAE, and SSAE are the deep learning techniques that were utilised in this study.

*CNN*: The creation of a CNN requires the determination of the best value for a number of variables, including learning rate which affect accuracy, runtime, etc. Because

setting a greater learning rate causes inferior performance while setting a lower learning rate lengthens training time. Although the runtimes are longer, which improves accuracy.

*Spatial Auto encoder*: A sparse auto encoder is built by modifying the network's measurement and other settings to ensure that the network produces the best results possible given the input data at hand. The training procedure and decoder function is among the parameters that must be taken into account when building the network. By contrasting, it is discovered that the linear transfer function provides the best accuracy output.

#### V. CONCLUSION

In the proposed work, mammographic pictures are used to diagnose breast cancer utilizing DL techniques including CNN, stacked sparse auto encoder, and SAE. In this study, mammograms from the readily accessible mini-MIAS database were used. The mammograms are initially prepared to eliminate background, pectoral muscle, digitization noise, radio-opaque artefacts, and other factors that interfere with the deep network's ability to detect malignancy. The suggested model has classified dense mammography pictures with an accuracy of up to 96.9% for, 97.8% for SAE, and 99.1% for SSAE.

Deep learning techniques are used in mammogram breast cancer diagnosis to identify tiny masses more precisely, differentiate between cancerous and non-cancerous lesions, and offer quantifiable data about such tumours if they are cancerous. This helps breast cancer patients receive treatment early and protects other women from the discomfort and nervousness of having a biopsy.

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# Retinal blood vessel segmentation using AI

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**Abstract-** Retinal microvascular is a dependable marker of abnormalities in vessel morphology, that have been linked to a variety of clinical disorders, both in ocular and metastatic disease. However, accurate vessel segmentation, which would be intricate- and time-intensive, is required for objective and statistical evaluation of the retinal blood vessels. In terms of segmenting retinal vessels, artificial intelligence (AI) has shown a significant amount of promise. In this study, the fundus images retinal blood vessel is segmented using deep learning methods. The data set required for this study is collected from the Kaggle website and pre-processed using various techniques to make it compatible with the deep learning models. The pre-processed images are then segmented using deep learning models such as LadderNet and UNet. The efficiency of the deep learning models are validated using performance metrics such as Intersection of Union (IoU), accuracy and F1 score. This study shows an accuracy of 0.98% using the UNet deep learning model and it is deemed to be an efficient model than the pre-existing models.

**Keywords-** Retinal blood vessel, Artificial Intelligent, Deep learning, UNet, LadderNet, Segmentation.

## I. INTRODUCTION

Retinal blood vessels, classification of the blood vessels and their structural details is crucial for the computer-aided identification and treatment of various ailments. Numerous research has focused at how these eye abnormalities relate to the properties of the retinal blood vessels. Some fatal systemic ailments, such as cardiovascular conditions and neurological conditions, can also be shown in fundus imaging. It is hypothesized that a number of retinal blood vessels morphological features are connected to illness susceptibility and advancement. The very first step to scientifically evaluating the fundus image vasculature and statistically understanding the morphological features is retinal blood vessels segmentation, which is the segmentation of visible vessels from a fundus image. These methods enable for the collection of statistical data that is nonintrusive or in vivo. The primary goal of recognising and pinpointing retinal vessels is to differentiate the various vascularization structure tissues of the retina from the perspective of the fundus image. Scientist's attention has been drawn to the recognition of

retinal vessels due to the availability of non-invasive fundus imaging technology and the key details obtained from of the vascularization framework for the identification and prognosis of a broad range of retinal pathogenesis. Using fundus camera equipment, retinal blood vessels can be imaged efficaciously and non-invasively. Developing scientific proof encompassing translational evidence suggests that morphologies in retinal blood vessel sections are initial markers of cardio-metabolic risk and outcome similar to any illness. As a result, data from large population-based-related appears to work is required to determine the essence of these morphometric leanings. Numerous processes have been used to investigate retinal images. While these offer a variety of retinal vessel lists, they are frequently restricted in terms of research and numerical value, and have constrained processing, including the ability to distinguish between venous system and capillaries. As a result, developing a reliable method for retinal image examination technique and generating a rich quantification of retinal vasculature in large numbers of fundus cases.

The authors of [1] suggested a novel U-form DL structure based on lighter weight convolution blocks to sustain high segmentation performance while minimizing computation cost. As an additional contribution, data pre - processing and feature extraction steps for retinal image and blood vessel features were postulated. On GPU NVIDIA GTX 980 systems, the accuracy rate of the model proposed in this study is greater than the other such image processing techniques, with accuracy rate of 0.98% in 0.48 seconds for every individual image, in both. Correspondingly, the authors of [2] proposed a model that performs pixel-based extraction of features. Dice and Jaccard were employed to calculate the similarity measure between both the segmentation process and the ground truth. The system's precision was 96.18% and 94.56% for drive and stare database. The investigational outcomes demonstrate that the proposed method produces acceptable results. The authors of [3] proposed a new architecture called Bridge-net to proficiently utilise framework of the retina's blood vessels. Their model integrates RNN and a CNN to provide frame of reference

before producing the risk map of the retina's blood vessels. When compared to other methods, their experimental findings demonstrate that their approach produces good outcomes. The authors of [4] presented an attention-based pyramid scene parsing U-Net segmentation method. Their experimental findings demonstrate that PSP-UNet segmentation method, which would be centred on a niche mechanism that positively affects the detection capability of retinal blood vessel pixel resolution, represses the interruption of extraneous information, and improves network segmentation results, which really is better compared to the U-Net method and a few other mainline retinal blood vessels segmentation methodologies currently in use. After conducting image-specific pre-processing, the authors of [5] proposed to use a standard VSSC Net to segment the retinal blood vessels both the cardiac angiogram and the fundus images. On the basic ocular and cardiomyopathy imaging studies sets of data, the VSSC Net demonstrated enhanced accuracy values. The researchers of [6] proposed an automated method for segmenting and retrieving clinically useful functionalities from retinal blood vessels, which is crucial for assisting doctors and eye professionals in diagnosing various eye diseases and assessing proper intervention. The suggested system's primary process consists of two crucial phases: segmentation and diagnostic extraction of features. The authors of [7] proposed a new method for segmenting retinal blood vessel segments in medical data predicated on density-based cluster analysis of implementations to noise and structural reconstruction. In this study, performance criteria such as sensitivity and the area under the curve were increased significantly. The researchers in [8] postulated a wavelet-based classification method for this procedure of blood vessel segmentation in order to achieve more exact outcomes than previous methods. The accuracy rate of the segmentation stage achieved is near to 97% with a lesser time sophistication. The authors of [9] developed a new layered U-shape attention system (NUA-Net) with enhanced lesion reliability for efficient vascular segmentation in retinal fundus images. This novel method linked encoder-decoder sections using a recursive skip-connection multilevel structure to retrieve discriminating ocular functionalities from rich local specifics. Based on 2D retinal pictures captured by a fundus camera, the researchers of [10] hypothesized a strategy for segmenting retinal blood vessels and analyzed the efficacy of several approaches for a more precise and dependable outcome. To evaluate the efficacy of our study approaches, performance metrics such as Sensitivity, Specificity, and Accuracy are used, with respective values of 94.27%, 87.86%, and 95.61% for two separate datasets. In [11], the authors proposed a CNN based on a simpler form of a U-Net architectural style that integrates residual connections as well as batch normalization in the up- and downscaling stages. As input, the system takes areas retrieved from the main image and is trained using a novel loss function that takes into account the spacing of the each pixel to the vascular space.

The following is how the article is constructed: Section 2 briefs about the work proposed in this study. Section 3 describes the deep learning models used in this study to segment the retinal blood vessels. Section 4 gives the detailed description about the results achieved in this study and section 5 gives the conclusion of this study.

## II. PROPOSED WORK

The main objective of this study is to segment the retinal blood vessel which happens to be a reliable biomarker in detecting various chronic diseases. In this study the required fundus retinal images are collected from the Kaggle website. The collected raw image dataset is then pre-processed using methods such as grayscale conversion where the raw dataset is converted to grayscale from the original RGB coloured image, standardization where the quality of the dataset is improved by transforming and standardizing the dataset, the contrast of the image dataset is amplified in a limited manner using the CLAHE technique and finally the overall brightness of the dataset is controlled using the gamma adjustment technique. The pre-processed image dataset is then subjected to deep learning models and segmented using efficient models like LadderNet and UNet. The output of the segmented images are then validated using performance metrics. The figure 1 given below shows the work flow followed in this study.

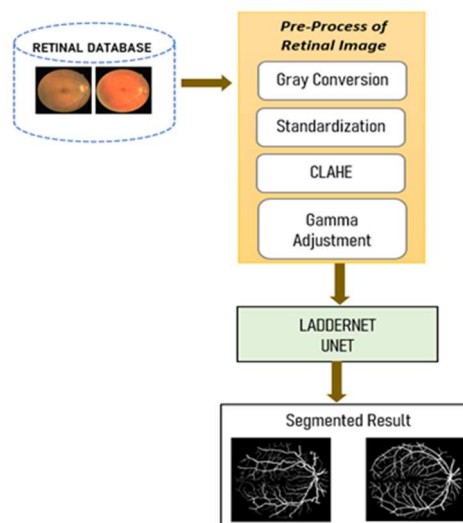


Figure 1. Flowchart of the proposed work

### A. Data Acquisition

As the ultimate aim of this study is to segment the retinal blood vessel, the required dataset for the study is collected from the Kaggle website [11]. The collected dataset were fundus images of the retina obtained from 400 diabetic patients between age range of 25-90 years old. Out of the total set of images 40 images were selected randomly of which 33 images does not show any retinal ailment while the remaining

7 images show signs of retinal ailment. Figure 2 given below shows the sample images of the retinal images collected for this study.

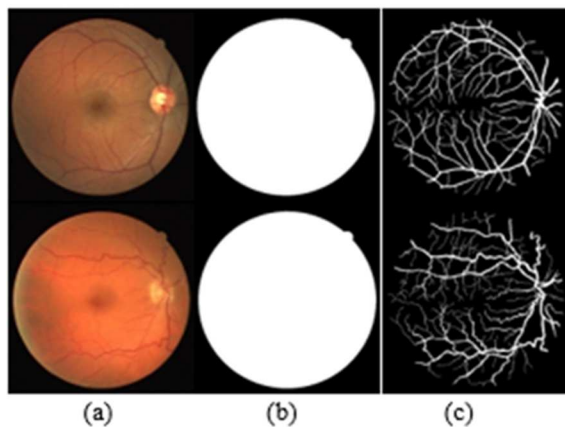


Figure 2. Sample images from the dataset

From figure 2, the image (a) shows the fundus images of the retina, which is obtained by reflecting light to form a 2D representation of the 3D retina. The image (b) shows the masked image of the retina and the image (c) shows the ground truth blood vessel extracted image of the retina.

#### B. Grayscale Conversion

For computer guided diagnostics, grayscale conversion has indeed been implemented in healthcare profession. It is particularly important since ultrasonography, X-ray, and CT scan images largely rely on them to provide the appropriate guidance and care. Rather than actively working on colour images, grayscale approximations are frequently employed for retrieving features because doing so streamlines the process and uses less computing capabilities. Furthermore, adding extra features could enhance the number of training data required to achieve satisfactory accuracy, and colour might be of limited utility in so many instances. In this study, the collected raw images are converted to grayscale from initial RGB coloured image to make them less complex and to reduce the computational time [16].

#### C. Standardization

The process of standardization involves downscaling dataset variables to give them the characteristics of a conventional normal distribution. Standardization causes the parameters to be scaled such that the mean and standard deviation are, respectively, 0 and 1. This method, which rescales extracted features using a range of values between 0 and 1, is beneficial for optimization techniques. Whenever the characteristic distribution is either normal or gaussian, this approach is very helpful.

#### D. CLAHE

Contrast Limited Adaptive Histogram Equalization is used to neutralize image data (CLAHE). CLAHE is a contrast over-amplification modification of Adaptive Histogram Equalization (AHE). CLAHE tends to work with distinct classes of an image called tiles rather than the entire image. After that, the untrue boundaries are removed by merging adjacent tiles with bilinear interpolation. It can be used to improve the contrast of an image. To minimize the issue with noise enhancement, CLAHE restricts contrast enhancement. The gradient of the transformation function determines the contrasts enhancement in CLAHE near a particular image pixel.

#### E. Gamma Adjustment

A nonlinear modification known as gamma adjustment is generally applied for every pixel of the target image. Most of the time, linear operations like multiplication, reduction, and arithmetic are applied to all of the pixels. Gamma adjustment is responsible for applying nonlinear methods on the target image's pixel and changing the picture's intensity applying nonlinear methods on the target image's pixel and changing the picture's intensity as a result. It's critical to keep a consistent gamma value; it cannot be always too low or excessively high [12]. With the exception of low luminance's, when it is linear to keep from having an indefinite derivation at luminance zero, gamma adjustment is just a power law transformation.

### III. DEEP LEARNING MODELS FOR SEGMENTATION

For segmenting and categorizing numerous ailments, DL and AI are crucial in the healthcare area. AI may be used to create extremely accurate and effective models that enable physicians to detect and treat diseases in their earliest stages even without large resources found in specialized hospitals. In this study two different deep learning models are used to segment the retinal blood vessels from the dataset images. The efficient deep learning model is then classified using performance metrics to find the most efficient model [17].

#### A. U-Net

U-Net is a deep learning model that has been offering cutting-edge efficiency in several medical picture segmentation issues. The u-net is a CNN design used in quick and accurate image segmentation. The model's design was expanded and changed from a fully CNN's original design in order to operate with less training images and produce more accurate segmentation. The system has a u-shaped structure because it has a contractual path and an expanding path. The contractual path is a pretty standard convolutional network, consisting of repetitive convolutional application followed by a ReLU and a max pooling procedure. A general description of this model would be an encoder system accompanied by a decoder system [13]. The encoder focuses on the covenant layers, preceded by the pooling layer. It is employed to

retrieve the variables in an image. To enable localization, the second portion decoder employs transposed convolution. The U-net design is homogeneous and is divided into two main sections: The left segment is known as the contracting path and is made up of the basic convolution process. The right segment is a broad path made up of 2D convolution layer that have been inverted. Segmentation is carried out end-to-end using U-Net. Whenever a raw image data is used as the input, the result is a segmented map. Each pixel is classified by U-Net to ensure that the both input and output have the same magnitude.

*B. LadderNet*

LadderNet is a deep learning model that has many combinations of encoder-decoder branching and skip interconnections between every pair of neighbouring decoder and decoder branching for each level. Several U-nets are connected in a chain to form LadderNet. Designed for semantic segmentation, LadderNet is a multiple branch CNN model. LadderNet can be thought of as a sequence of U-Nets. Sections 1 and 2 can be thought as a U-Net, and Sections 3 and 4 as yet another U-Net. There seem to be skip interconnection at levels A-D among two U-Nets. Unlike U-Net, which concatenates functionalities from encoder strands with functionalities from decoder strands, they sum functionalities from two branches [14]. But more U-Nets can be connected to form more complex system structures. Due to skip connections and residual blocks, LadderNet has more data - flow pathways and may be regarded as an ensemble of FCN. The similarity to an ensemble of FCNs enhances classification precision, while shared weights inside every residual block minimize parametric count. Segmentation is critical for detecting retinal diseases [18].

IV. RESULT AND DISCUSSION

The main goal of this study is to segment the retinal blood vessels from the fundus images in order to diagnose chronic retina ailments. Initially to start this study the dataset required for this study is collected from the Kaggle website. The collected raw image dataset consists of fundus images of 33 retinal images that doesn't have any chronic retinal diseases and 7 images that shows symptoms of chronic retinal diseases. These raw images which are not compatible with the deep learning model initially are subjected to pre-processing steps that makes these images compatible with the deep learning models to initiate segmentation [20]. The pre-processed image dataset is then subjected to deep learning models such as LadderNet and U-Net. The deep learning models then segment the images and the efficiency of the model is calculated using performance metrics. The performance metrics used in this study are IoU (Intersection of Union), Accuracy and F1 Score. Table 1 given below shows the performance of the models and the calculated values are tabulated for both the deep learning models.

TABLE 1. PERFORMANCE VALUES OF THE DEEP LEARNING MODELS

Metrics	LadderNet	U-Net
IoU	0.9512	0.9758
Accuracy	0.9545	0.9804
F1 Score	0.8313	0.8495

From table 1, it is given that the IoU of the deep learning models LadderNet is about 0.95% whereas the U-Net model has higher value when compared LadderNet of about 0.97%. The accuracy of the U-Net model is higher when compared between the two models of about 0.98% whereas LadderNet has only about 0.95%. The F1 score of LadderNet model is about 0.83% whereas U-Net model has higher score of about 0.84%. Figure 3 given below shows the graphical representation of the deep learning model performance on retinal blood vessel segmentation [19].

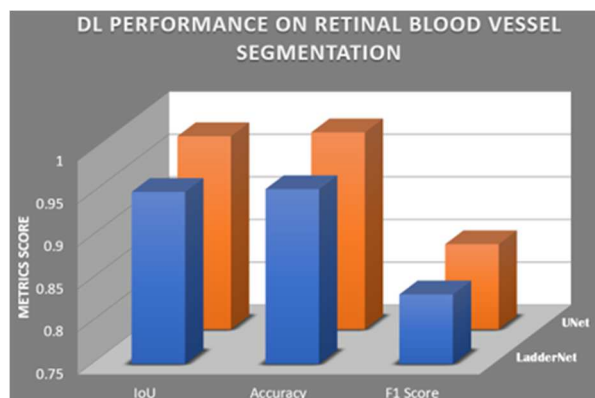


Figure 3. Graphical representation of DL model's performance on retinal blood vessel segmentation

From figure 3, it is seen that that the U-Net modal has higher accuracy, IoU and F1 score than the LadderNet model, stating that the U-Net model is more efficient than the LadderNet model in segmenting the retinal blood vessels. Figure 4 given below shows the resulting predicted image using U-Net deep learning model.

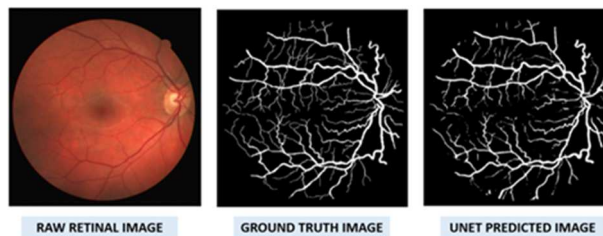


Figure 4. Resulting predicted image using U-Net deep learning model

Figure 4 given above shows the comparison of the raw retinal input image given to the DL model and the ground truth image used as a reference and the output predicted image using the U-Net DL model.

V. CONCLUSION

There has recently been progress in the development of novel computer-aided methodologies for the classification and segmentation of retinal vessels, with clinical applications taking precedence. The segmentation of blood vessels is a crucial component in the statistical analysis of the retinal fundus images. Thus, it is critical for ocular doctors and ophthalmologists to have an automated process that can assist them in the segmentation and retrieval of significant medical attributes from retinal blood vessels during early treatment and diagnosis evaluation of a broad range of ocular diseases. In this study, deep learning models were used to segment retinal blood vessels in order to aid in the diagnosis of chronic retinal ailments. Dataset containing fundus images of the retina were collected from the Kaggle website and pre-processed. The image dataset was then subjected to deep learning models such as LadderNet and U-Net for the segmentation process. The efficiency of the models was determined using performance metrics such as IoU, accuracy and F1 Score. This study showed a 0.98% of accuracy using the U-Net deep learning model to segment the retinal blood vessels with high IoU value of 0.95% and F1 score of 0.83%. The theoretical calculations derived from the proposed method develop competitive average values compared to the latest methods. In terms of precision and accuracy, the suggested technique outperforms all leading methods. Furthermore, it surpasses most state-of-the-art methods while avoiding the computational expenses involved with these methodologies.

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# Artificial Intelligence Based Early Diagnosis of Sepsis

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**Abstract**—Sepsis is a major killer of those who are already in a serious condition. The morbidity and death rates in this field remain high, despite the fact that medical technology has been advancing steadily over the last several years. This is due mostly to people not beginning therapy quickly enough and doctors not following best practices. Medical decision support solutions have advanced greatly with the help of artificial intelligence (AI), a rapidly developing sector in the medical industry. Great promise has been shown in its ability to anticipate patients' clinical conditions and aid clinical decision-making. Early prediction, prognosis evaluation, mortality prediction, and optimum treatment are just few of the areas where algorithms developed using artificial intelligence may be put to use. This article summarizes the most recent research on AI based clinical decision support in sepsis as well as explains how this cutting-edge technology might aid in sepsis prediction, identification, sub phenotyping, prognostic evaluation, and clinical treatment. We also spoke about the difficulties of using this non-conventional approach in clinical practice.

**Keywords**—Sepsis, Artificial Intelligence, Machine Learning, Disease Prediction using AI.

## I. INTRODUCTION

There has been a consensus definition of sepsis since 2015: "life-threatening organ failure due to a dysfunctional host response to infection." The prior definition, developed in 1992, relied on measures of systemic inflammation, but this one is more accurate. The most severe type of sepsis is septic shock, which occurs when the body's immune system and circulatory system fail simultaneously. It was also recommended that "adequate routine microbiologic cultures be collected before initiating antimicrobial treatment in patients with potential sepsis or septic shock if doing so yields in no considerable delay in the commencement of antimicrobials," which is in line with the new sepsis

classification. An analysis of the global mortality rate and occurrence of hospital-treated sepsis covering the years 2003-2015 discovered that sepsis and severe sepsis accounted for 16.9% and 25.76% of all in hospital mortalities, respectively, adding up to 5.28 million deaths annually utilizing the old description of sepsis and severe sepsis. Sepsis was responsible for 2% of all hospitalizations and 16.8% of all fatalities in hospitals in the United States in 2008 [1]. About 1.5 million individuals in the United States are affected with sepsis each year, and 250,000 of them die. In 2008, it was anticipated that treating these people would cost the United States \$15.1 billion. The revised criteria yielded an estimated yearly incidence of 838/100,000 for sepsis in Germany, three times greater than the rate of severe sepsis. Sepsis has a mortality rate of at least 9%, while septic shock has a mortality rate of at least 39%. This is a lot more than, say, the 5-6% mortality rate associated with acute myocardial stroke. Sepsis mortality is strongly correlated with age [2].

In hospitals, normally sepsis is one of the main reason of death. Patients at chance of heart failure, worsening, unanticipated ICU admittance, or death, as well as the necessity for hospital admission, were successfully identified by NEWS [3]. In cases of severe sickness when the warning signals are easily ignored, such as sepsis, scoring systems may be used as a tool to anticipate the need for operative admission and expected outcomes.

Earlier, more effective treatments may be possible if declining physiological indicators are detected sooner. Advance warning scores may assist shape a pre-alert strategy or identify particular pre-hospital therapy for sepsis patients, which may make a huge difference in their prognoses. Patients with sepsis have a better chance of survival if their condition is diagnosed and treated quickly. Patients' outcomes need to improve if they can be identified and treated sooner. Because effective treatment is

time-dependent, positive results are closely linked to good management in emergency medicine environments and emergency rooms (ED). Despite guidelines for patient treatment that emphasize the golden hour and the silver day, transfers from the ED to the ICU are often delayed. Similarities between the signs and symptoms of sepsis and those of other prevalent illnesses make it difficult for clinicians to reliably diagnose the condition [4].

II. LITERATURE REVIEW

The term "artificial intelligence" was coined during the 1955 Dartmouth Conference, when participants discussed the potential of then-new computing technology to let them build sophisticated robots with some of the same qualities as human intelligence [5]. Artificial intelligence progressed slowly, though, because of computing and memory power limitations. The most common use of AI based methods in sepsis is machine learning.

To make judgements and forecast future occurrences, the most fundamental kind of machine learning use algorithms to assess and acquire from data. Machine learning is a technique that allows computers to learn how to do a job without being explicitly programmed to do so (Figure 1). Even in the earliest phases of AI research, machine learning has made an appearance.

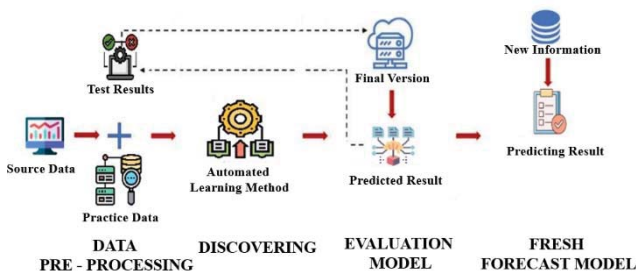


Fig. 1. Architecture of the Machine Learning Model [6]

There are many different ways to categorize machine learning. The machine learning algorithms are illustrated in Figure 2. Before the advent of deep learning, even small improvements in sepsis care using typical machine learning techniques were incredibly challenging [7].

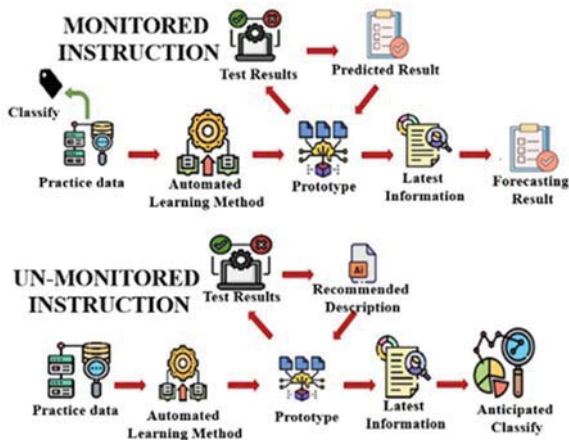


Fig. 2. Machine Learning Algorithms [8]

Initially, deep learning used deep neural networks to address the issue of feature expression. A DNN was not a novel idea in and of itself; rather, it was just a neural network

architecture with numerous hidden layers. If anyone wanted to boost the effectiveness of deep network training, they may modify the neuron connections and activation techniques. The success of deep learning in a number of healthcare applications, such as sepsis control, opens the door to its use in clinical settings [9]. The search for relevant literature was performed in (PubMed). We considered research articles, narrative reviews and systematic reviews published up through October 31, 2022. Full-text abstracts were not considered. ('machine learning' OR 'neural network' OR 'AI' OR 'sepsis') AND ('relevant literature') were used to discover the articles that were examined [10]. We were able to track down 400 separate publications. The articles included in the final batch were selected to offer the viewer the greatest possible broad overview of the issue, and the review is not intended to be exhaustive. Various research papers and reviews were chosen, and we also cited other narrative reviews. None of the writers have undertaken any original research with human or animal subjects for this article; rather, it is based solely on the results of other studies. The process of the method is shown in the figure 3. Existing medical warning scores for sepsis are not established on advanced mathematical models, but AI has the ability to give fast and accurate diagnosis. Using machine learning (ML) techniques trained on patient

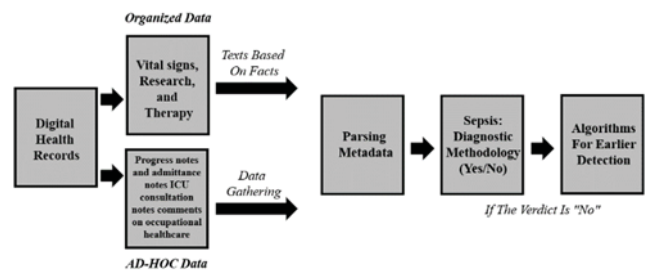


Fig. 3. Implementation of AI in Sepsis Early Prediction [11]

information, often drawn from electronic health records, biological signals, and laboratory findings, a decision support system might be built for earlier detection of sepsis. This scoping review will examine research on artificial intelligence techniques for detecting sepsis in its earliest stages. The phrases artificial intelligence (AI) and machine learning (ML) are not easily defined, and their use varies widely amongst writers. We have no strong opinions on the matter. Instead, we want to be comprehensive, thus any (mathematical) model that can be implemented digitally and has the potential to enhance sepsis detection accuracy will be considered for inclusion in our evaluation. When we talk about AI or ML here, we're really talking about a wide variety of mathematical models. Like the definitions of AI and ML, the language used to describe techniques that may determine whether or not a patient is at high risk for developing sepsis differs. It seems that in the literature, terms like "detect," "confirm," "predict," "recognize," and its derivatives (sensing, etc.), and "infer" are used consistently. We shall make a distinction between "detection" and related terminology and "diagnosis," the latter of which, in our opinion, should refer to a clinical benchmark for determining if a patient has sepsis. High-risk sepsis prediction will be referred to as "detect" or "detects" throughout.

### III. AI IMPLEMENTATION IN ADVANCED SEPSIS DETECTION AND FORECASTING

The probability of death increases every hour sepsis patients continue without care. Knowing when sepsis may strike will enable us to start treating patients as soon as possible. The core of the first-generation sepsis forecasting system is experimental clinical decision rules (CDR), which are often applied to data received from bedside vitals. For instance, the bedside monitor collects five physiological indicators per minute. Only a few of the characteristics that make up the data streams that are subsequently classified by and blood pressure. With a mean detection rate of 82.8%, the model's Area Under Receiving Operational Characteristics (AUROC) of 0.779 indicates that it can accurately forecast the incidence of sepsis [12]. The basic artificial intelligence algorithm for sepsis early warning is shown here. A probabilistic model with an AUROC of 0.849 has been developed to assist in the identification of people at risk of sepsis. It measures six sepsis-related characteristics. The tool may be used to screen any hospitalized patient, and the results will be delivered to careers instantly [13].

There are more approaches to employ AI to treat sepsis now that deep learning has advanced. Bi-Directional Gated Recurrent Units (GRU) is a deep learning system that considers a broad variety of physiological, scientific, and demographic factors. With an AUROC of 0.968, our model is capable of predicting the beginning of sepsis six hours in advance. Our method performs far better than current artificial intelligence algorithms for sepsis diagnosis. A method for early sepsis identification that is based on deep learning is also available. Using EMR data, a unique algorithm was created that can predict the start of sepsis by hours and has an AUROC of 0.782. Yet another sepsis detection technique uses a CNN and an LSTM network separately. The model's quality is evaluated using conventional standards of accuracy and clinical applicability, and the effectiveness of the intervention is assessed using suppressive medication and blood cultures that are administered earlier than expected. In the three hours before to the onset of sepsis, there was a 0.849 AUROC [14].

An explainable AI framework for sepsis early detection has been developed by certain researchers as an alternative to the previously discussed deep learning. They created a model using publicly accessible data from ICUs and tested it on a covert sample to make sure it complied with the challenge's requirements. The interpretable AI model is trained for real-time sepsis prediction and is capable of retrieving 164 features per hour. To show the interpretability of the sepsis real-time predictions, we carefully evaluate the effects of each feature. In addition to being exceedingly effective at estimating sepsis risk in real time, the algorithm also provides insightful information about that risk. On the other hand, traditional supervised models often only perform well in a narrow range of tasks, while ensemble learning performs well in all domains. A kind of deep learning known as "ensemble learning" combines many "weakly supervised" models into a single "strongly supervised" model. If one weak classifier makes a prediction that is off, the other weak classifiers may make up for it, which is one intended advantage of ensemble learning. Recently, an ensemble learning framework for sepsis prediction and an autonomous feature extraction strategy employing long-term and short-term memory (LSTM) neural networks were developed. This

approach combines deep characteristics with synthetic features acquired from cutting-edge clinical data. With the use of ensemble learning, sepsis was detected 6 hours in advance. Results show how the model may help with an early sepsis diagnosis. The process of the method is shown in the figure 4.

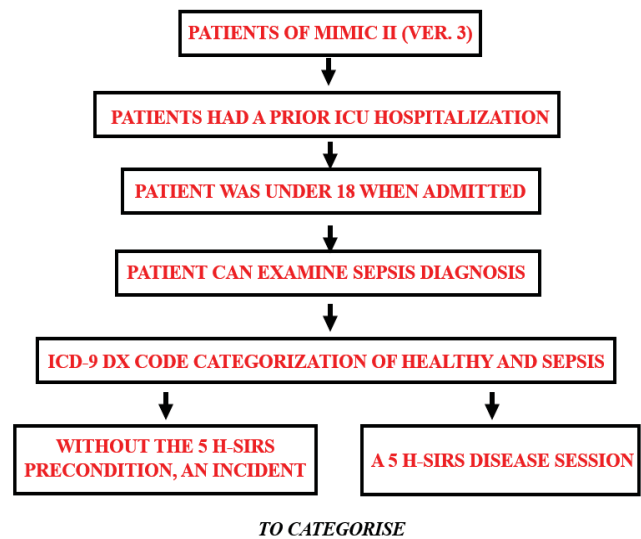


Fig. 4. Working Mechanism for Result Driven

Advance Forecasting of severe septic- One area of innovation in healthcare strategy is the creation of decision support systems that drew on improvements in machine learning. One of the active topics is predicting the onset of septic shock. To enhance clinical outcomes and advance real-time resource optimization in healthcare, several research have created intelligent decision support technologies for septic shock. With an AUROC of 0.9389 a sensitivity of 82.9%, and a specificity of 87.34 %, the model utilizing the Random Forest method fared finest. Investigations have also combined physiological parameters from the EHR with variables gleaned from natural language recognition in clinical health record data to create septic shock forecasting model, such as XG-Boost. The best approach among them has a median advanced warning of 6.5 hours, allowing for intervention several hours before the commencement of septic shock.

A recent branch of machine learning called transfer learning enables the spread of algorithms across multiple therapeutic settings. Transfer learning was included in order to evaluate how well AI Sepsis Expert predicted extended septic shock in the ED, and the viability of increasing external efficacy in the second site was confirmed. The effectiveness of this AI in forecasting deferred septic shock at 9 and 12 hours has the best AUROC of 0.79. Transfer learning significantly enhances the model's applicability and confirmability.

Enhancing the accuracy of Sepsis Detection- The presence of sepsis is often followed by the failure of several organ systems. However, the lack of characteristic clinical signs of multi-organ failure adds to the difficulty of sepsis identification and reduces diagnostic accuracy. Several research projects have created low-cost automated diagnostic technologies to address the difficulties associated with existing sepsis diagnosis. In [15], the authors build a temporal deep convolutional network architecture for sepsis

prediction and test it with three different types of validation data. The chosen model proved robust, and it may be used as a hospital-wide early diagnostic tool for sepsis. This diagnosing application's accuracy and precision were much better than those of competing methods. Another paper detailed the creation of an AI system for diagnosing sepsis and compared its efficacy to the SOFA score approach of diagnosis. To diagnose sepsis, the method relied on 102 clinical variables that were both previously chosen and chosen dynamically.

The AI was created with the help of the anonymized data. Several machine learning techniques' efficacies were evaluated using 4-fold cross-validation, and the highest-scoring approach, XGBoost based on a decision tree, was ultimately utilized to create the AI programme. The well-known AI algorithm has an AUROC of approximately 0.876 but a low SOFA score of 0.612. This artificial intelligence programme was created using data from actual EMRs of patients suffering from sepsis, together with hand-picked characteristics and XGBoost. A sepsis diagnosis made during the first few days of symptoms typically has an accuracy rate of above 80%. The health sector, medical personnel, and patients may all benefit from the prompt and correct reaction of this AI algorithm, which will allow physicians to deploy effective treatment approaches early, leading to decreased medical expenditures and better patient prognosis. According to the findings, the model outperforms human physicians utilizing the same characteristics by a significant margin. The AUROC is 93 percent, the sensitivity is 92.98 percent, and the specificity is 78.87 percent. Fertility, cervicovaginitis, newborn fever, dyspnea, hematocrit levels, gender, bradypnea, band cell, syringe usage, and infant weight are the 10 most important criteria in the assessment of neonatal sepsis.

#### IV. DIAGNOSIS AND RISK ASSESSMENT OF SEPSIS USING ARTIFICIAL INTELLIGENCE

Most individuals who are hospitalized due to an infection end up dying from sepsis. The current death rate is still excessive. Clinical decision-making and death rates may both benefit from the adoption of more accurate evaluation methods for the prediction of sepsis. The likelihood of a patient dying in the first 72 h after being admitted to the intensive care unit (ICU) may be predicted using a DNN model trained using LSTM. Multi-center study AUC was 0.867, whereas single-center study AUC was 0.847. This LSTM-based model might aid doctors in early identification of patients with poor prognosis, allowing them to "re-triage" and alter treatment strategies. Patients with sepsis-related AKI have varying clinical presentations and outcomes. To better treat patients with similar conditions, AI may classify them into different sub-phenotypes based on their level of risk. Deep learning was employed in a research to identify the sub phenotype of septicemia AKI and make predictions about the likelihood of death and the requirement for dialysis within 4 weeks. Type 1 AKI patients had the lowest dialysis needs (4%), and their 4-week death rate after AKI is likewise the lowest (22.77%). Subtype 3 has a mortality rate that is 1.87% higher than Type 1 after adjusting for risk factors.

In a similar manner, [16] employed AI to categorize the forms of organ failure seen in severe sepsis in the ICU, and they found clinically significant sepsis categories with diverse variations of organ dysfunction. Segmentation is

done via SVMs, SVM ensembles, and gradient boost trees. There are presently no reliable methods to predict the morbidity of sepsis-related coagulation abnormalities. The effectiveness of AI in predicting death in ED patients with probable disease or sepsis has also been assessed. Different AIs were tested to see how well they could classify ED patients with sepsis and predict whether or not they would die. RF, C4.5 decision tree, SVM, and artificial neural network were the four supervised learning techniques examined. As a consequence, the best discriminating effect is achieved by SVW and ANN when physiological variables are included. It has promising practical applications in evaluating sepsis categorization and prognosis. Additionally, the deep learning-based algorithm CNN with SoftMax may be used to forecast mortality in ED patients who are thought to have an infection. Early detection of patients in severe condition may be greatly aided by using deep learning.

Managing Sepsis using AI tools - Fluid sensitivity in sepsis may be predicted using the progressive leg rise (PLR), although this hydrodynamic challenge is often not used due to the patient's lack of mobility. Aiming towards anticipating fluid reaction. Transthoracic echocardiography data was used to train a machine learning model for the diagnosis of sepsis and septic shock. In comparison to PLR's hemodynamic reaction, the findings indicate that the most effective model is partial least regression (PLS), with an AUC of 0.965. Collapsibility of the defective vein artery, velocity-time summation, S-wave, E/Ea proportion, and E-wave are among the most important characteristics in echocardiography. Strategies for fluid management in sepsis patients were reported on in separate research. The "capped" setting for fluid volume delivery during the first 24hrs in the ICU is correlated with an increased risk of death, according to a study that employed causal inferred technologies to get that conclusion.

For over a decade, experts have advocated the use of "sepsis packs," a collection of treatments aimed at mitigating the severity of sepsis's negative effects. The fatality rate from sepsis remains high, and sepsis package compliance is subpar despite these advances. With the use of the Model Cell conceptual framework, researchers from other fields were able to compare actual death rates with those projected by using data from similar acute care institutions. According to the findings, the overall mortality rate dropped dramatically as bundle compliance rose. Nearly two-thirds of the variation may be explained by compliance alone in the linear model. The median fatality rate fell even lower, to 5.279%, when analyzing just the last 12 months of the experiment. When thinking about how to treat sepsis, knowing its root cause is crucial. The Inflammatrix bacterial-viral non-infected version classifier is a neural-network classification method that may be used to evaluate patients on admission who may be infected. Reduced healthcare expenses, better infection detection, and a halt to the development of sepsis are all possible outcomes. Because of their altered physiological state, patients in the intensive care unit (ICU) are at a higher risk of contracting an infection, and a number of environmental infections may further raise this risk. Antibacterial dosing in the intensive care unit (ICU) might become complicated for a number of reasons. These obstacles prevent the conventional antibiotic dosing regimen from accomplishing the aims associated to excellent patient outcomes. Innovative dosing algorithms using AI was created to aid in the modification of antibiotic medication in

intensive care unit (ICU) patients, and one of these techniques was via Bayesian forecasting. Antibiotic programmes may be tailored to individual patients based on their unique clinical features using data gathered through therapy monitoring.

The outcomes of using AI to quality enhancement activities were presented in research. The deep learning-based sepsis detection and treatment software Sepsis Watch was integrated into standard clinical practice. A better ability to diagnose and treat sepsis is the driving force behind Sepsis Watch. It was developed with input from statisticians, data analysts, data scientist, and physicians who collaborated on a performance improvement task report. Implementing Sepsis Watch in everyday clinical treatment is possible, as shown by the findings, and the process has also facilitated the development of locally based machine learning initiatives. The influence that using AI algorithms had on nursing staff ability to detect sepsis early on was also discussed, as was the nurses' expertise using the technological tools created by AI algorithms. In the scenario presented, nurses actively engaged in the procedure of technological integration may make quick judgements in the early detection of sepsis.

As of the year 2020, COVID-19 may be found in every region of the globe. Patients infected with the virus have intense respiratory issues and are at risk for various consequences, including streptococcus pneumoniae, sepsis, septic shock, and multiple organ dysfunction. Finding efficient means of saving money and time is essential for reducing the impact of sickness. Research integrates systems biology and AI-based technologies to scour the whole medication market for new therapies for COVID-19. The effects of pixantrone and melatonin on COVID-19 were validated using the GUILDify v2.0 Web server as an alternate way. The therapeutic benefits of medication combinations for respiratory disorders are also predicted [17-18]. Sepsis is a complicated and variable disease with a wide variety of pathogenic causes and processes. The onset of systemic inflammation is the defining characteristic of this condition. Noninfectious forms of the acute inflammatory response syndrome (SIRS) can present with comparable symptoms. Given the same pharmacological and genetic features of sepsis and SIRS, clinical differentiation between the two is challenging. This may be because not enough attention has been paid to identifying the critical genes or pathways involved in the development of these illnesses. Differentiating sepsis from SIRS is feasible with the use of reasonably used genetic indicators that are suitable for diagnostic testing. Using two-tier gene scanning and ANN data mining technologies, researchers were able to find biomarkers that may be utilized to diagnose SIRS, sepsis, and septicemia in patients using publicly available gene expression data sets.

Creating and testing digital twin models that mimic critically sick patients may help doctors predict how sepsis patients will respond to therapy using causal AI. In this study, we used a combination of agent-based modelling, discrete event modeling, and Neural nets to simulate the treatment impacts and interactions of key organs at different phases, with the results shown by means of pertinent clinical indicators. While comparing the digital twin's anticipated reaction to the patient's actual response during advance treatment of a serious illness, the AI model was demonstrated to be surprisingly accurate. With a trustworthy

digital twin model at their disposal, doctors may simulate the outcomes of treatments before implementing them on actual patients.[19-23]

## V. CONCLUSION

In some conditions, including sepsis, the possibility of developing AI-based medical services may equal or even surpass the competence of professionals. In spite of this, health care is a dynamic and intricate industry with stringent standards for patient protection. Patients might be harmed by a malfunction in the technology. Human physicians and safety engineers have little to no say in the decision-making process when an AI system is involved, and it may be difficult to grasp exactly how the AI system arrives at its conclusions. Artificial intelligence (AI)-based technologies have less safety restrictions and ethical restraints than traditional healthcare treatment. Because of the intricate nature of the sepsis clinical situation, numerous factors may influence the final outcome. Although the mathematical model displays the needs of many clinical situations, satisfying these needs during the technical design phase is challenging. In this way, the system's software behavior could not accurately represent the intended therapeutic outcomes. Unfortunately, the current solution to this issue—limiting the quantity of information input—may have unexpected repercussions. The loss of an insensible fluid would be one example. It can't be saved digitally, which may trigger an AI reminder to replenish the fluid supply. However, the doctor can see that the patient has been soaked in reality. Further, unlike human clinicians, machines are unable to reason on the most crucial material while interpreting data. For instance, doctors could decide to ignore very anomalous test findings that might have been caused by sample, screening, or documenting mistakes. There are also issues with the AI model itself, such as the fact that much research has only trained and verified the model using the same clinical cohort without considering the model's generalizability to different populations. Extra comprehensive testing is required to demonstrate the usefulness of these models in terms of clinical or other consequences. Many challenges will arise along the process of putting AI into clinical practice. Unfortunately, few businesses now have the resources to hire enough AI specialists and develop the necessary IT skills to put AI into clinical practice, which includes tasks like evaluating, combining, continuously monitoring, and recalibrating AI. There is also a pressing need to address concerns about the privacy and trustworthiness of digital data collecting and processing. In addition, most healthcare systems lack the resources necessary to effectively incorporate AI into the present process. There is still a long way to go before decision making and prediction models can be properly integrated into the world's existing healthcare systems. For the time being, there is a significant chasm between the development of AI techniques and their use in actual clinical settings. Experts in sepsis clinical treatment cannot be replaced by AI. Until they can verify that the findings can be updated prospectively in numerous situations, AI-based techniques should always be utilized as development tools.

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# IoT Based Mobile App for Continuous Health Monitoring of the Person

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**Abstract**—In the sphere of medicine, IOT is meant to keep people safe and healthy plays a crucial part in communicating with doctors and patients through the use of health monitoring equipment and lowering healthcare costs in the future years. The internet of things (IoT) is making the world a smarter and more efficient village by allowing a variety of sensors and smart gadgets to gather and analyse data for a variety of reasons. As a result of these smart things, the healthcare system is growing wiser. When basic health facilities lack comprehensive medical care infrastructure, emerging countries gain. However, there is currently no specialized architecture for smart health units that can allow for this gathering and transferring patient health information to headquarters hospitals where live patient assistance is offered. Here, a smart IoT-based healthcare system is proposed, which includes a smart medical kit linked to sensors and a server for frequent health tracking. This smart medical kit is associated with sensors to measure the health parameters like body temperature, blood pressure, and heart rate for the effective function of the body. The proposed idea can alert the patient and their relatives in case of any abnormalities in their health parameters and also get suggestions from the doctor without physical contact with the doctor.

**Keywords**—Heart rate, Temperature, Blood Pressure, IoT, Blynk.

## I. INTRODUCTION

The Internet of Things (IoT) has become a globally acknowledged network technology and heavily researched area. Sensors are employed in practically every product today, from ordinary items to Sensor-based exhaustive medical systems, and industry surveillance systems are now booming. [1]. The Internet of Things (IoT) makes our lives smarter, efficient, and productive. The prototype device [2] uses a mobile phone as the data transferring platform to deliver user-friendly speech recognition and alert functionality. Because of insufficient and ineffective healthcare services to satisfy the expanding demands of a growing population with chronic conditions, health care is becoming ever more difficult to manage. Many smart or medical sensors have emerged as a result of technological advancements, which continually assess individual patient behavior and properly forecast a problem. Data collected by such sensors may be utilized for a variety of reasons by a variety of actors, including physicians, patients, family, and healthcare facilities. Reports that explain the patient's health state are created by combining analytics

and sensor data. This platform may also include data from a variety of sensors to provide mechanisms for monitoring, processing, visualizing, storing, and sending notifications about a patient's status and vital signs in real-time through Internet standards. Different types of sensing devices are employed in healthcare, depending on their qualities, usefulness, and efficiency. The growth of the IoT in the field of medicine is shown in Fig. 1 and the statistics taken from the grandviewresearch.com website.

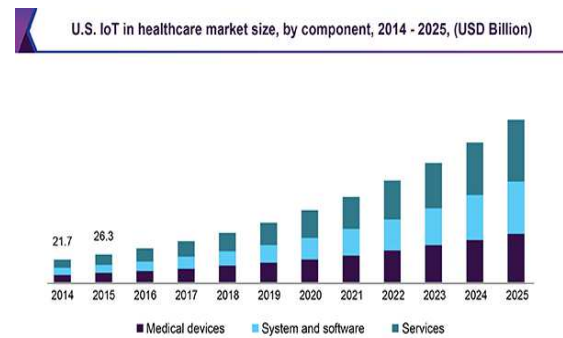


Fig. 1. IoT in health care

These networked IoT devices produce massive amounts of data that suppliers must handle well, which might be a big burden. The Internet of Things Analytics (Particle) process is used to address the difficulty of storing and analyzing large amounts of data. Using approaches such as information extraction and information analytics, the raw data is transformed into meaningful and therapeutically significant information. It is expected that by 2020, more than 50-55 % of raw data analysis approaches would be able to better handle the stream of data created by instrumented devices and applications. Mobile phone-based health assessing solutions are growing increasingly mostly as the information and technology revolution continues. These technologies can gather significant health data and deliver comments to doctors and patients [3]. Enabling everyone to assess their health to seek emergency treatment in the case of any unconditional emergency can save a person's life. In the long term, the adoption of such process moves may save the government money on medical expenditures [4]. Integrating cellular data with a healthcare system based on an open-source Android architecture has become fairly straightforward as a result of the high accessibility of mobile internet access [5].

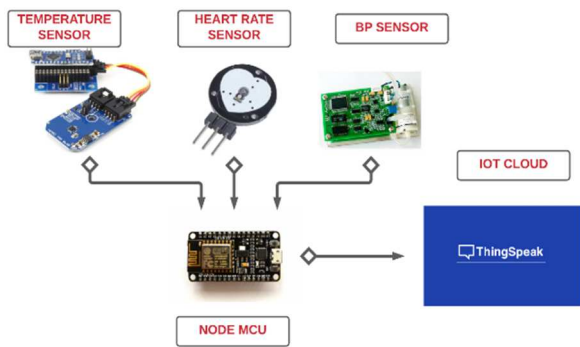


Fig. 2. Block diagram

The implementation of IoT in health monitoring systems has provided us with significant growth in the improvement of contemporary medical treatment [6]. Sensors have gotten smaller as a result of advancements in VLSI technology, allowing for the creation of wearable solutions. Devices are getting more effective and powerful as a result of persistent internet access. IoT-based health monitoring gadgets keep an eye on a patient 24 hours a day, seven days a week. The gadgets create essential signals by assessing statistical data at every critical point [7]. Patients may be remotely monitored and appropriate actions are taken in the event of an emergency since IoT-based gadgets are always linked to the internet. Health tracking systems and IoT-based health tracking systems have considerable distinctions. IoT integration in health monitoring systems is a difficult challenge [8]. The following are some of the difficulties: The majority of IoT efforts have yet to be deployed successfully. The Internet of Things produces a massive amount of data, which necessitates the use of specialized big data for proper management. For IoT systems, security is a major concern. In the case of flawed or obsolete security systems, hackers might readily get sensitive private data from users. Because it is not up to date with current security measures, obsolete infrastructure might cause difficulties. Fig. 2 shows the overall block diagram of the proposed idea.

## II. LITERATURE SURVEY

Pang and his team demonstrated a monitoring approach using an Android smart phone. The system may capture and process data on the server and send it to the smart phone terminal through a socket, allowing it to monitor the target location from anywhere within the range of a wireless network. Sensor data is collected from temperature, humidity, infrared, and CO2 sensors. A pervasive health system [9] using mobile phones was created to help chronic patients manage their diseases while out and about. This system includes patient health monitoring, diaries for various illnesses or symptoms, and social sharing of recorded information. Analyzes IoT-based patient monitoring. Chronically ill patients can benefit from an IoT-based patient monitoring system [10]. This method's goal is to improve patients' quality of life by giving them more control over their diet and exercise habits. Instructions to obtain measurements through sensors and recommendations and exercises are equally effective in improving patients' eating habits as the created model for the system [11]. Current human health monitoring systems have some flaws, such as a rising number of users and submitted data, no user assurance, poor real-time performance, and low data usage. This project develops an IoT-based health monitoring system [12]. The device can

continually monitor heart rate, blood pressure, pulse, body temperature, and other vital indications. In this project, wireless sensors save data for health monitoring. The data is integrated using the Internet of Things to enable real-time monitoring (IoT). The proposed approach improved the current health monitoring platform's accuracy and stability [13-14]. The author in suggests a smart monitoring system based on IoMT. This study describes a full health paradigm that includes a remote health-monitoring system. It gathers critical patient information and sends it to the physicians. This technique saves time for both the patients and the doctors. In the event of an emergency, the physicians will be able to assist the patient right away [15]. Many scholarly publications discuss IoT-enabled versus non-enabled health monitoring systems, both in terms of functionality and cost. R. Ali Khan et al. explain the system design of a wireless body area sensor network for health monitoring purposes [16-17]. Authors in proposed a mobile phone accessory-based wireless health monitoring system [18]. The patient's heart rate is communicated utilizing a smart phone with this method. It is made up of a single microcontroller chip. This type is the least but it has the benefit of extending the battery life.

## III. PROPOSED SYSTEM

A smart health assessment system checks body temperature, blood pressure, and heart rate using a variety of sensors, with the values being relayed using an ESP8266 with the support of an IoT platform to provide a comprehensive picture of one's health.

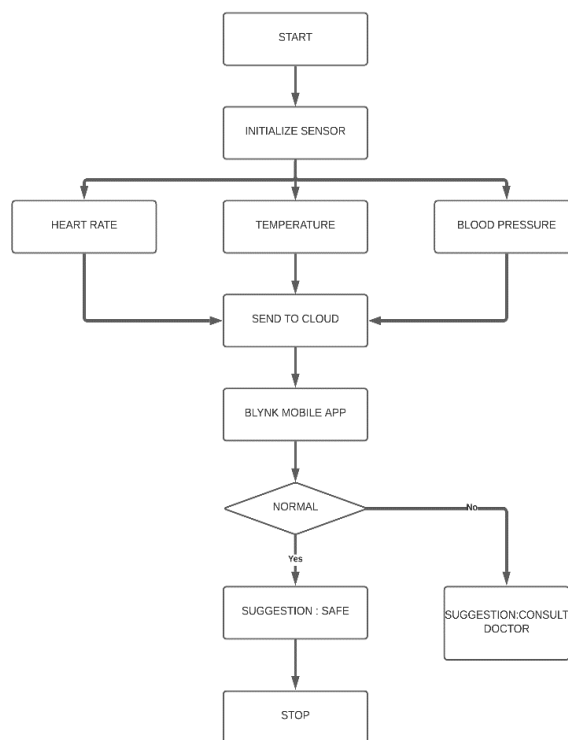


Fig. 3. Proposed Idea

The proposed concept is shown in Fig. 3. With a smart patient health monitoring system, the most fundamental physical parameters of the patient are measured and sent to the cloud for further analysis. A system for tracking the measured data in real time. Any disparities between the observed values and those established by the doctors as the standard of care will be communicated to the patients and their loved ones. A

direct effect of this is that the patient will be able to obtain prompt first aid without having to wait for or engage with the doctors personally.

The suggested system adds additional sensors to the physical layer, resulting in a significant shift in the healthcare paradigm, and analysis. Sensors are attached to the patient's body in various locations and wirelessly linked to the microcontroller. Heart Beat Sensor: Pulse waves, or changes in the volume of a blood artery caused by the heart pumping blood, are measured by an optical heart rate sensor. The range of heart rate for humans is shown in the table: 1. An optical sensor and a green LED are used to detect pulse waves by monitoring volume changes. To mitigate the influences of ambient light such as visible and infrared rays, the detector block utilizes an optic filter calibrated for pulse wave recognition. This facilitates the gathering of high-quality pulse impulses even in wide spaces. Furthermore, by leveraging optic sensor systems that had been developed over a long period, ROHM was capable of increasing the sensitivities of the sensing panel.

TABLE I. HEART BEAT SENSOR

Sl. No.	Age	Heart Rate
1	Less than 1 month	120-60
2	1-12 months	80-140
3	1-2 years	80-130
4	2-6 years	75-120
5	6-12 years	75-110
6	>12 years	60-100

#### A. Temperature Sensor

A temperature sensor is a device that employs an electrical signal to produce temperature measurement in a readable form, often a thermocouple or a resistance temperature detector. A thermometer is the most standard form of the temperature gauge, and it is used to detect exactly cold or hot something that is. Temperature meters are used in the geotechnical profession to monitor structural changes induced by seasonal oscillations in concrete, buildings, soil, water, bridges, and other structures. A temperature sensor is a gadget that senses an item's degree of warmth or coolness. How effectively a temperature meter works is determined by the voltage across the diode. The resistivity of the diodes varies in direct proportion to the temperature change. Whenever the temp drops, so does the resistance, and vice versa.

#### B. Pressure Sensor

The Blood Pressure Sensor is a non-invasive blood pressure monitor for people. Systolic, diastolic, and mean arterial pressure are all measured using the oscillometric approach. The pulse rate is also properly considered. Blood pressure is one of the most important essential indicators (BP). Moving blood exerts pressure on the vascular walls. Blood pressure is defined as the ratio of systolic to diastolic pressure. A mercury sphygmomanometer is used to check blood pressure. In this procedure, blood pressure is calculated using the height of the mercury column. The oscillometric method has been used for automated blood pressure monitoring since 1981. As technology progresses, devices for non-invasive oscillometric blood pressure monitoring are being developed. As technology progresses, devices for non-invasive oscillometric blood pressure monitoring are being developed. Such a gadget is the Blood Pressure Sensor: The diastolic and systolic pressure is monitored via oscillometric sensing and the disparity capacitive or variable piezo resistance concept,

respectively. Fig. 4 depicts a normal human Systolic vs. Diastolic blood pressure chart which is taken from [bloodpressureuk.org](http://bloodpressureuk.org).

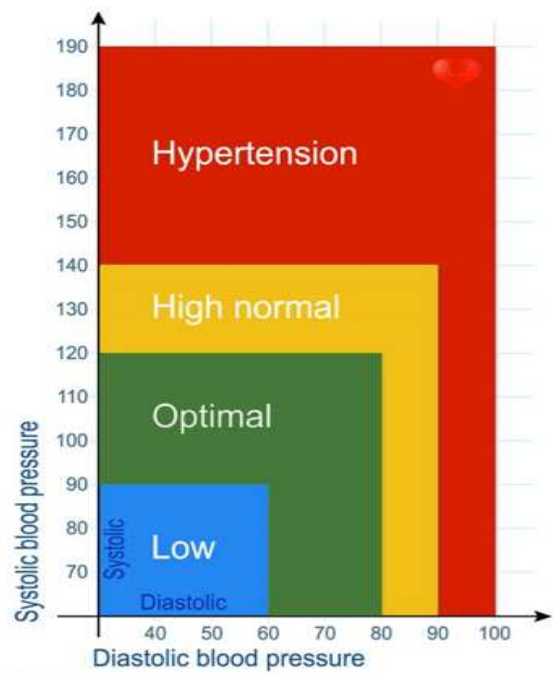


Fig. 4. Blood pressure range.

#### C. Node-MCU

Node MCU is an open-source IoT platform that includes both software and hardware. It performs the function of as like as the microcontrollers like Arduino and many. It is based on the ESP8266 microcontroller. It may be connected to the computer by USB connection, and programs can be installed onto it. A Wi-Fi module is included. The Node MCU is linked to a variety of health monitoring sensors, and data is gathered. These data are transferred to the cloud with the aid of the Wi-Fi module. It may be viewed from anywhere using e-mail from the cloud.

### IV. RESULTS AND DISCUSSION

Sensors in the proposed system measure and communicate all body variables in real time to the cloud, which is powered by an Internet of Things platform. It displays the heart rate at any given point in time during the day. Wearers of wearable devices can enjoy more comfort as a result of this feature. This method captures data that is more exact and accurate. If you compare it to the manual techniques, it saves you valuable time. Because data is collected on a constant basis, the burden on doctors is reduced as a result of these statistics. It is possible that the other specialist will also receive these numbers by email. The health status of a patient, for example, can be recognized and compared to established parameters defined by his or her family, and major health alarms can be triggered depending on the detected data. The temperature from the temperature sensor is monitored regularly, and the data in the Blynk app are updated regularly. The temperature measured graph is shown in Fig. 5, Fig. 6. The wearable blood pressure sensor measures both systolic and diastolic blood pressure. The systolic blood pressure is shown in Fig. 7, Fig. 8 and the diastolic blood pressure is shown in Fig. 9, Fig. 10. The heartbeat sensor is used to determine the heart rate. The heartbeat rate graph of the patient is shown in Fig. 11, Fig. 12.

Application software is designed to show the output status of the patient's body condition. Through this, uneducated people could also get to know their health condition with the help of a sensor is attached to the body. This particular sensor measures four important parameters. The detectable four parameters incorporated here are temperature, systolic, diastolic, and heart rate. As shown in Fig. 5 and Fig. 6. the temperature monitor is abnormal and normal respectively. Normally, a human's average temperature would be 98.6 degrees Fahrenheit. This tested output denotes us through the alert symbol accompanied with an alert beep. If the temperature is above the normal state, then the alert symbol and a beep sound will get initiated. From this Doctor, a visit has to be done by the patient for checking if any abnormality is noticed. The graph is depicted for legible understanding to uneducated people at the moment after testing. In Fig. 5, since the temperature exceeds the normal temperature, an alert beep is noticed. In 15 minutes, 1 hour, 6 hours, 1 day the temperature is noticed as 130 degrees, 120 degrees, 125 degrees, 124 degrees respectively. In Fig. 6, since the temperature doesn't exceed the normal temperature, an alert beep is not noticed. So that the patient could take self-care by him or herself. In the output, one of the patient's outputs is 140 degrees, so the alert is shown due to its abnormality. While another one is 101 degrees, so the alert is not shown due to its normality.

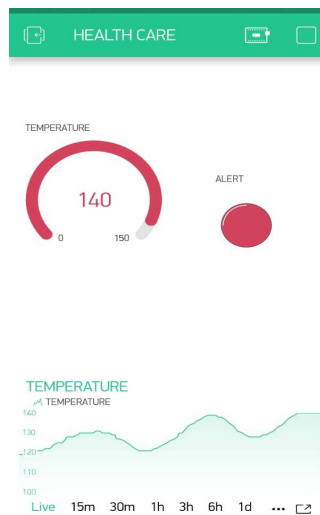


Fig. 5. Temperature monitor - abnormal

As shown in Fig. 7 and Fig. 8. the systolic monitor is abnormal and normal respectively. Normally, a human's average systolic pressure would be 80 to 120 mm Hg. This tested output denotes us through the alert symbol accompanied with an alert beep. If the systolic pressure is above the normal state, then the alert symbol and a beep sound will get initiated. From this Doctor, the visit has to be done by the patient for checking, if any abnormality is noticed. The graph is depicted for legible understanding to uneducated people at the moment after testing. In Fig. 7, since the systolic pressure exceeds the normal state, the alert beep is noticed. In 15 minutes, 1 hour, 6 hours, 1 day the systolic pressure is noticed as 120 mm Hg, 135 mm Hg, 140 mm Hg, 132 mm Hg respectively. In Fig. 8 since the systolic pressure doesn't exceed the normal state, an alert beep is not noticed. So that the patient could take self-care by him or herself without visiting the doctor. In the output, one of the patient's outputs is 134 mm Hg, so the alert is shown due to its abnormality.

While another one is 120 mm Hg, so the alert is not shown due to its normality.

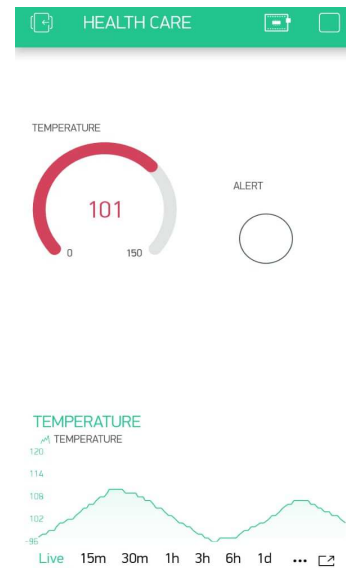


Fig. 6. Temperature monitor - normal



Fig. 7. Sysyolic monitor. – abnormal

As shown in Fig. 9 and Fig. 10. the diastolic monitor is abnormal and normal respectively. Normally, a human's average diastolic pressure would be 60 to 80 mm Hg. This tested output denotes us through the alert symbol accompanied with an alert beep. If the diastolic pressure is above the normal state, then the alert symbol and a beep sound will get initiated. From this Doctor, the visit has to be done by the patient for checking, if any abnormality is noticed. The graph is depicted for legible understanding to uneducated people at the moment after testing. In Fig. 9, since the diastolic pressure exceeds the normal state, an alert beep is noticed. In 15 minutes, 1 hour, 6 hours, 1 day the diastolic pressure is noticed as 82 mm Hg, 78 mm Hg, 90 mm Hg, 92 mm Hg respectively. In Fig. 10, since the diastolic pressure doesn't exceed the normal state, an alert beep is not noticed. So that the patient could take a self-care by him or herself without visiting the doctor. In the output, one of the patient's outputs is 99 mm Hg, so the alert is shown due to its abnormality. While another one is 73 mm Hg, so the alert is not shown due to its normality.



Fig. 8. Systolic monitor. - normal

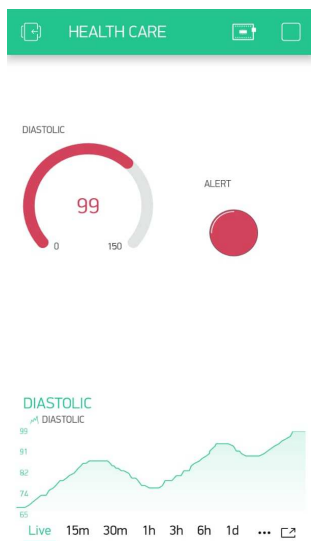


Fig. 9. Diastolic monitor. - abnormal



Fig. 10. Diastolic monitor. - normal

As shown in Fig. 11 and Fig. 12. the Heart rate monitor is abnormal and normal respectively. Normally, a human's average Heart rate would be 60 to 100 beats per minute. This tested output denotes us through the alert symbol

accompanied with an alert beep. If the diastolic pressure is above the normal state, then the alert symbol and a beep sound will get initiated. From this Doctor, the visit has to be done by the patient for checking, if any abnormality is noticed. The graph is depicted for legible understanding to uneducated people at the moment after testing. In Fig. 11, since the heart rate exceeds the normal state, an alert beep is noticed. In 15 minutes, 1 hour, 6 hours, 1 day the heart rate is noticed as 78 beats per minute, 82 beats per minute, 97 beats per minute, 95 beats per minute respectively. In Fig. 12, since the heart rate doesn't exceed the normal state, an alert beep is not noticed. So that the patient could take self-care by him or herself without visiting the doctor. In the output, one of the patient's output is 98 beats per minute, so the alert is shown due to its abnormality. While another one is 68 beats per minute, so the alert is not shown due to its normality.



Fig. 11. Heart rate monitor abnormal

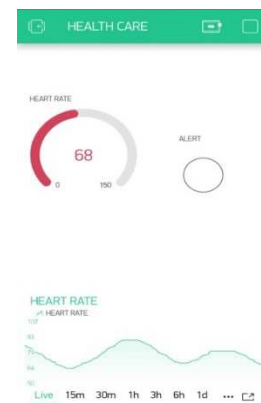


Fig. 12. Heart rate monitor - normal

The sensor's data is fed to the controller, which subsequently sends it to the IoT device. These values are uploaded in the Blynk app so that we can able to monitor them easily. The usual body temperature for a healthy person is between 97- and 99-degrees Fahrenheit. A healthy person's heart rate ranges from 60 to 100 beats per minute. The human body's typical systolic and diastolic rates are fewer than 120 and 80, respectively. If any of these numbers are abnormal, the controller will notify the patients, their families, and their physicians, who will administer emergency first aid.

## V. CONCLUSION

A low-cost, simple-to-implement health monitoring system is provided, which solves the shortcomings of the existing method of measuring the health parameters by

making it a more effective technique of monitoring patients' health parameters. It offers the advantages of being less expensive, taking less time, and using less power. The accurate measurement of a patient's heart rate and other health data is achievable, and it plays an important part in the medical monitoring system. IoT allows sensors to relay data wirelessly to a server. Basic physical characteristics are monitored regularly. It is more comfortable for the patient to utilize these wearable gadgets. This approach records values that are more exact and accurate. It saves time compared to the manual way. The doctors' workload is decreased since these values are continually recorded. In the future, machine learning and artificial intelligence algorithms will be used to analyze a component of the design. Automated diagnosis, prescription, and report analysis the system will be supplemented by the generator.

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# IoT Based Mobile App for Continuous Health Monitoring of the Person

Indira Priyadarsini<sup>1,a)</sup>, I.S. Chakrapani<sup>2,b)</sup>, S.Manochitra<sup>3,c)</sup>,  
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**Abstract.** In the sphere of medicine, IOT is meant to keep people safe and healthy plays a crucial part in communicating with doctors and patients through the use of health monitoring equipment and lowering healthcare costs in the future years. The internet of things (IoT) is making the world a smarter and more efficient village by allowing a variety of sensors and smart gadgets to gather and analyse data for a variety of reasons. As a result of these smart things, the healthcare system is growing wiser. When basic health facilities lack comprehensive medical care infrastructure, emerging countries gain. However, there is currently no specialized architecture for smart health units that can allow for this gathering and transferring patient health information to headquarters hospitals where live patient assistance is offered. Here, a smart IoT-based healthcare system is proposed, which includes a smart medical kit linked to sensors and a server for frequent health tracking. This smart medical kit is associated with sensors to measure the health parameters like body temperature, blood pressure, and heart rate for the effective function of the body. The proposed idea can alert the patient and their relatives in case of any abnormalities in their health parameters and also get suggestions from the doctor without physical contact with the doctor.

**Keywords:** Heart rate, Temperature, Blood Pressure, IoT, Blynk

## INTRODUCTION

The Internet of Things (IoT) has become a globally acknowledged network technology and heavily researched area. Sensors are employed in practically every product today, from ordinary items to Sensor-based exhaustive medical systems, and industry surveillance systems are now booming. [1]. The Internet of Things (IoT) makes our lives smarter, efficient, and productive. The prototype device [2] uses a mobile phone as the data transferring platform to deliver user-friendly speech recognition and alert functionality. Because of insufficient and ineffective healthcare services to satisfy the expanding demands of a growing population with chronic conditions, health care is becoming ever more difficult to manage. Many smart or medical sensors have emerged as a result of technological advancements, which continually assess individual patient behavior and properly forecast a problem. Data collected by such sensors may be utilized for a variety of reasons by a variety of actors, including physicians, patients, family, and healthcare facilities. Reports that explain the patient's health state are created by combining analytics and sensor data. This platform may also include data from a variety of sensors to provide mechanisms for monitoring, processing, visualizing, storing, and sending notifications about a patient's status and vital signs in real-time through Internet standards. Different types of sensing devices are employed in healthcare, depending on their qualities, usefulness, and efficiency. The growth of the IoT in the field of medicine is shown in figure 1 and the statistics taken from the [grandviewresearch.com](http://www.grandviewresearch.com) website.

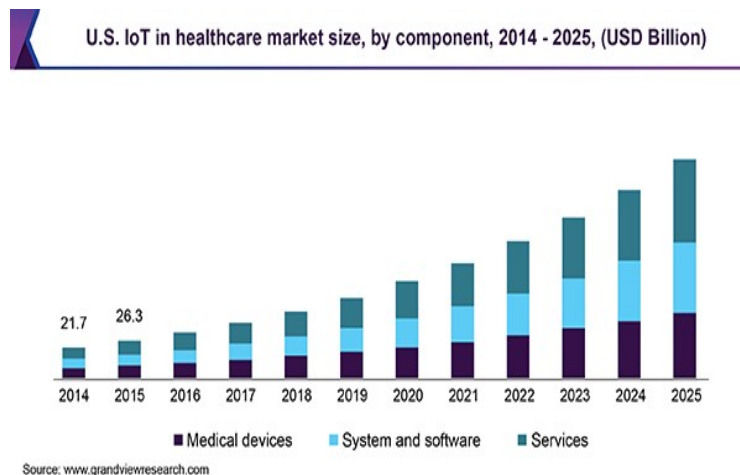
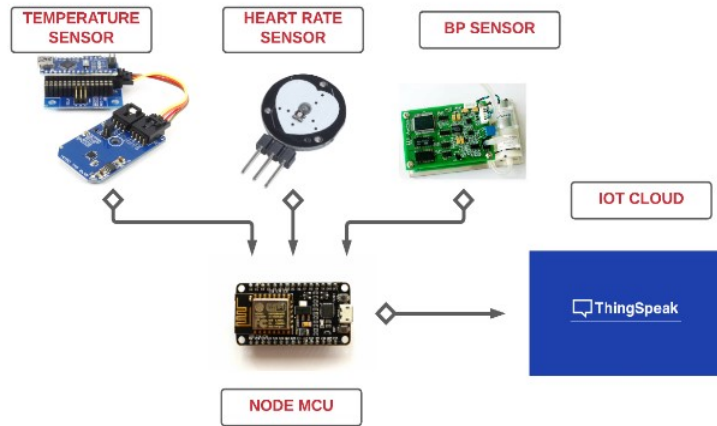


FIGURE 1. IoT in health care

These networked IoT devices produce massive amounts of data that suppliers must handle well, which might be a big burden. The Internet of Things Analytics (Particle) process is used to address the difficulty of storing and analyzing large amounts of data. Using approaches such as information extraction and information analytics, the raw data is transformed into meaningful and therapeutically significant information. It is expected that by 2020, more than 50-55 % of raw data analysis approaches would be able to better handle the stream of data created by instrumented devices and applications. Mobile phone-based health assessing solutions are growing increasingly mostly as the information and technology revolution continues. These technologies can gather significant health data and deliver comments to doctors and patients [3]. Enabling everyone to assess their health to seek emergency treatment in the case of any unconditional emergency can save a person's life. In the long term, the adoption of such process moves may save the government money on medical expenditures [4]. Integrating cellular data with a healthcare system based on an open-source Android architecture has become fairly straightforward as a result of the high accessibility of mobile internet access. [5].



**FIGURE 2.** Block diagram

The implementation of IoT in health monitoring systems has provided us with significant growth in the improvement of contemporary medical treatment [6]. Sensors have gotten smaller as a result of advancements in VLSI technology, allowing for the creation of wearable solutions. Devices are getting more effective and powerful as a result of persistent internet access. IoT-based health monitoring gadgets keep an eye on a patient 24 hours a day, seven days a week. The gadgets create essential signals by assessing statistical data at every critical point [7]. Patients may be remotely monitored and appropriate actions are taken in the event of an emergency since IoT-based gadgets are always linked to the internet. Health tracking systems and IoT-based health tracking systems have considerable distinctions. IoT integration in health monitoring systems is a difficult challenge [8]. The following are some of the difficulties: The majority of IoT efforts have yet to be deployed successfully. The Internet of Things produces a massive amount of data, which necessitates the use of specialized big data for proper management. For IoT systems, security is a major concern. In the case of flawed or obsolete security systems, hackers might readily get sensitive private data from users. Because it is not up to date with current security measures, obsolete infrastructure might cause difficulties. Figure 2 shows the overall block diagram of the proposed idea

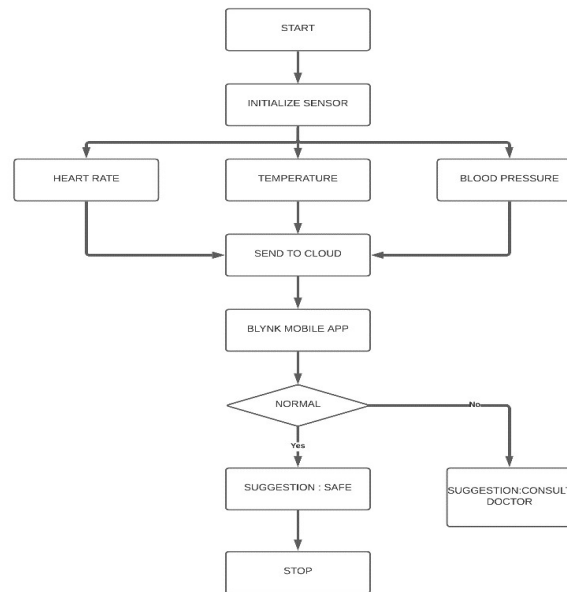
## LITERATURE SURVEY

Pang and his team demonstrated a monitoring approach using an Android smartphone. The system may capture and process data on the server and send it to the smartphone terminal through a socket, allowing it to monitor the target location from anywhere within the range of a wireless network. Sensor data is collected from temperature, humidity, infrared, and CO2 sensors. A pervasive health system [9] using mobile phones was created to help chronic patients manage their diseases while out and about. This system includes patient health monitoring, diaries for various illnesses or symptoms, and social sharing of recorded information. Analyzes IoT-based patient monitoring. Chronically ill patients can benefit from an IoT-based patient monitoring system [10]. This method's goal is to improve patients' quality of life by giving them more control over their diet and exercise habits. Instructions to obtain measurements through sensors and recommendations and exercises are equally effective in improving patients' eating habits as the created model for the system [11]. Current human health monitoring systems have some flaws, such as a rising number of users and submitted data, no user assurance, poor real-time performance, and low data usage. This project develops an IoT-based health monitoring system [12]. The device can continually monitor heart rate, blood pressure, pulse, body temperature, and other vital indications. In this project, wireless sensors save data for health monitoring. The data is integrated using the Internet of Things to enable real-time monitoring (IoT). The proposed approach improved the current health monitoring platform's accuracy and stability [13-14]. The author in suggests a smart monitoring system based on IoMT. This study describes a full health paradigm that includes a

remote health-monitoring system. It gathers critical patient information and sends it to the physicians. This technique saves time for both the patients and the doctors. In the event of an emergency, the physicians will be able to assist the patient right away [15]. Many scholarly publications discuss IoT-enabled versus non-enabled health monitoring systems, both in terms of functionality and cost. R. Ali Khan et al. explain the system design of a wireless body area sensor network for health monitoring purposes [16-17]. Authors in proposed a mobile phone accessory-based wireless health monitoring system [18]. The patient's heart rate is communicated utilizing a smartphone with this method. It is made up of a single microcontroller chip. This type is the least but it has the benefit of extending the battery life.

## PROPOSED SYSTEM

A smart health assessment system checks body temperature, blood pressure, and heart rate using a variety of sensors, with the values being relayed using an ESP8266 with the support of an IoT platform to provide a comprehensive picture of one's health.



**FIGURE 3.** Proposed Idea

The proposed concept is shown in Figure 3. With a smart patient health monitoring system, the most fundamental physical parameters of the patient are measured and sent to the cloud for further analysis. A system for tracking the measured data in real time. Any disparities between the observed values and those established by the doctors as the standard of care will be communicated to the patients and their loved ones. A direct effect of this is that the patient will be able to obtain prompt first aid without having to wait for or engage with the doctors personally.

The suggested system adds additional sensors to the physical layer, resulting in a significant shift in the healthcare paradigm, and analysis. Sensors are attached to the patient's body in various locations and wirelessly linked to the microcontroller. Heart Beat Sensor: Pulse waves, or changes in the volume of a blood artery caused by the heart pumping blood, are measured by an optical heart rate sensor. The range of heart rate for humans is shown in the table: 1. An optical sensor and a green LED are used to detect pulse waves by monitoring volume changes. To mitigate the influences of ambient light such as visible and infrared rays, the detector block utilizes an optic filter

calibrated for pulse wave recognition. This facilitates the gathering of high-quality pulse impulses even in wide spaces. Furthermore, by leveraging optic sensor systems that had been developed over a long period, ROHM was capable of increasing the sensitivities of the sensing panel.

**TABLE 1.** Heart Beat Sensor

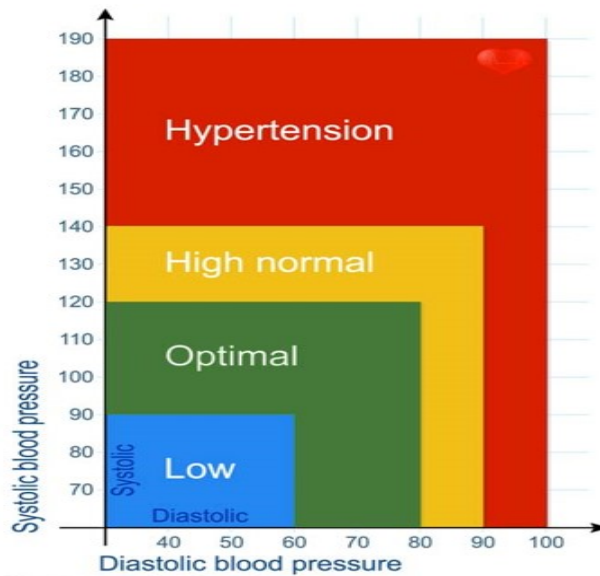
<b>Sl.No</b>	<b>Age</b>	<b>Heart Rate</b>
1	Less than 1 month	120-60
2	1-12 months	80-140
3	1-2 years	80-130
4	2-6 years	75-120
5	6-12 years	75-110
6	>12 years	60-100

### **Temperature Sensor**

A temperature sensor is a device that employs an electrical signal to produce temperature measurement in a readable form, often a thermocouple or a resistance temperature detector. A thermometer is the most standard form of the temperature gauge, and it is used to detect exactly cold or hot something that is. Temperature metres are used in the geotechnical profession to monitor structural changes induced by seasonal oscillations in concrete, buildings, soil, water, bridges, and other structures. A temperature sensor is a gadget that senses an item's degree of warmth or coolness. How effectively a temperature meter works is determined by the voltage across the diode. The resistivity of the diodes varies in direct proportion to the temperature change. Whenever the temp drops, so does the resistance, and vice versa.

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**FIGURE 4.** Blood pressure range.

### Node-MCU

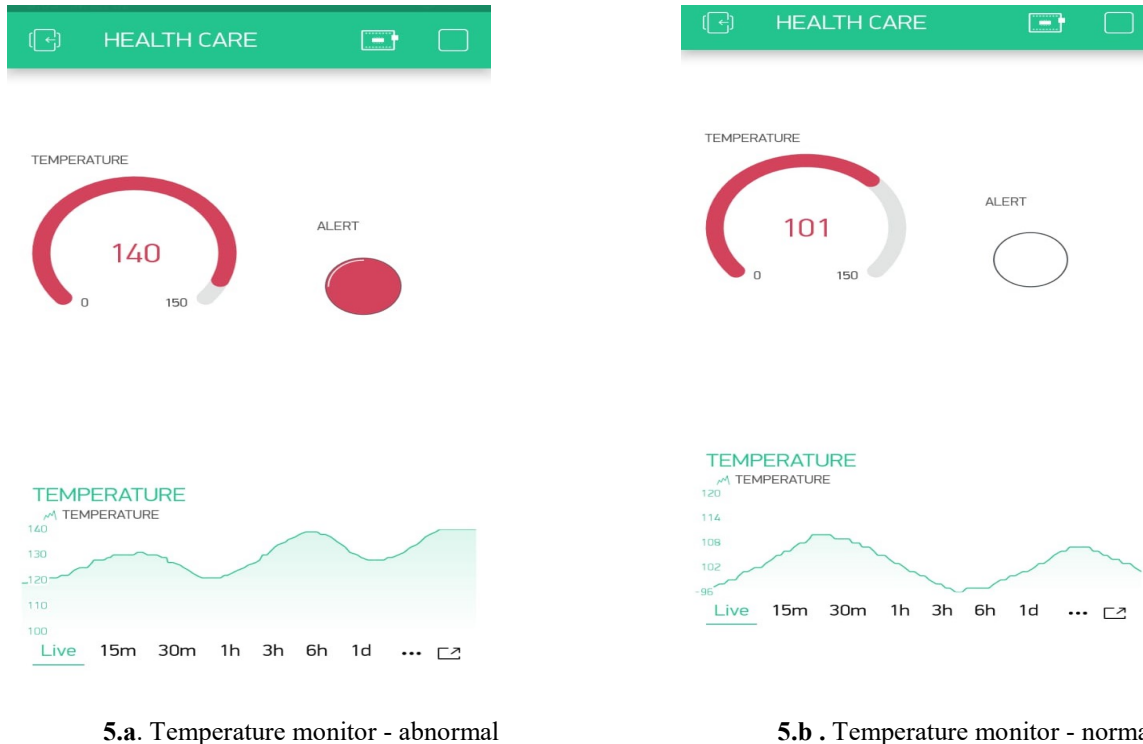
Node MCU is an open-source IoT platform that includes both software and hardware. It performs the function of as like as the microcontrollers like Arduino and many. It is based on the ESP8266 microcontroller. It may be connected to the computer by USB connection, and programs can be installed onto it. A Wi-Fi module is included. The Node MCU is linked to a variety of health monitoring sensors, and data is gathered. These data are transferred to the cloud with the aid of the Wi-Fi module. It may be viewed from anywhere using e-mail from the cloud.

### RESULTS AND DISCUSSION

Sensors in the proposed system measure and communicate all body variables in real time to the cloud, which is powered by an Internet of Things platform. It displays the heart rate at any given point in time during the day. Wearers of wearable devices can enjoy more comfort as a result of this feature. This method captures data that is more exact and accurate. If you compare it to the manual techniques, it saves you valuable time. Because data is collected on a constant basis, the burden on doctors is reduced as a result of these statistics. It is possible that the other specialist will also receive these numbers by email. The health status of a patient, for example, can be recognized and compared to established parameters defined by his or her family, and major health alarms can be triggered depending on the detected data. The temperature from the temperature sensor is monitored regularly, and the data in the Blynk app are updated regularly. The temperature measured graph is shown in figure 5. The wearable blood pressure sensor measures both systolic and diastolic blood pressure. The systolic blood pressure is shown in figure 6 and the diastolic blood pressure is shown in figure 7. The heartbeat sensor is used to determine the heart rate. The heartbeat rate graph of the patient is shown in figure 8.

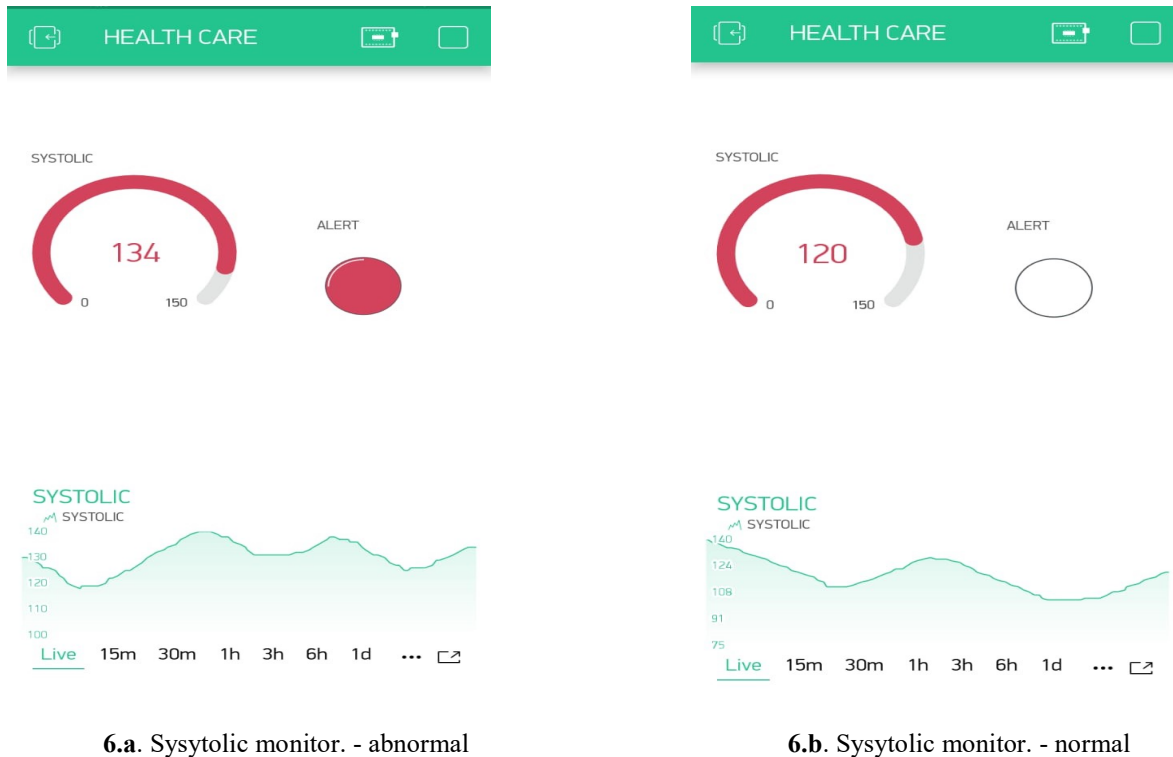
Application software is designed to show the output status of the patient's body condition. Through this, uneducated people could also get to know their health condition with the help of a sensor is attached to the body. This particular sensor measures four important parameters. The detectable four parameters incorporated here are temperature, systolic, diastolic, and heart rate. As shown in Figures 5. a and 5. b. the temperature monitor is abnormal and normal respectively. Normally, a human's average temperature would be 98.6 degrees Fahrenheit. This tested output denotes us through the alert symbol accompanied with an alert beep. If the temperature is above the normal state,

then the alert symbol and a beep sound will get initiated. From this Doctor, a visit has to be done by the patient for checking if any abnormality is noticed. The graph is depicted for legible understanding to uneducated people at the moment after testing. In figure 5. a, since the temperature exceeds the normal temperature, an alert beep is noticed. In 15 minutes, 1 hour, 6 hours, 1 day the temperature is noticed as 130 degrees, 120 degrees, 125 degrees, 124 degrees respectively. In figure 5. b, since the temperature doesn't exceed the normal temperature, an alert beep is not noticed. So that the patient could take self-care by him or herself. In the output, one of the patient's outputs is 140 degrees, so the alert is shown due to its abnormality. While another one is 101 degrees, so the alert is not shown due to its normality.



**FIGURE 5.** Temperature monitor through mobile

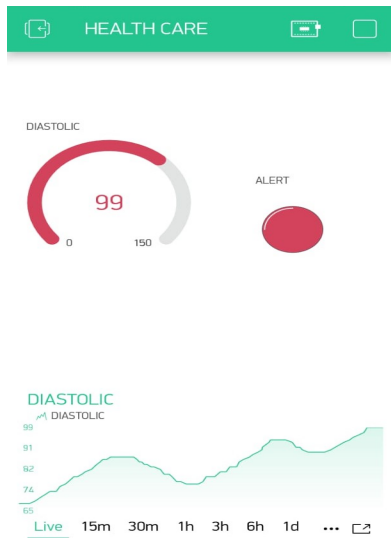
As shown in Figures 6. a and 6. b. the systolic monitor is abnormal and normal respectively. Normally, a human's average systolic pressure would be 80 to 120 mm Hg. This tested output denotes us through the alert symbol accompanied with an alert beep. If the systolic pressure is above the normal state, then the alert symbol and a beep sound will get initiated. From this Doctor, the visit has to be done by the patient for checking, if any abnormality is noticed. The graph is depicted for legible understanding to uneducated people at the moment after testing. In figure 6. a, since the systolic pressure exceeds the normal state, the alert beep is noticed. In 15 minutes, 1 hour, 6 hours, 1 day the systolic pressure is noticed as 120 mm Hg, 135 mm Hg, 140 mm Hg, 132 mm Hg respectively. In figure 6. b, since the systolic pressure doesn't exceed the normal state, an alert beep is not noticed. So that the patient could take self-care by him or herself without visiting the doctor. In the output, one of the patient's outputs is 134 mm Hg, so the alert is shown due to its abnormality. While another one is 120 mm Hg, so the alert is not shown due to its normality.



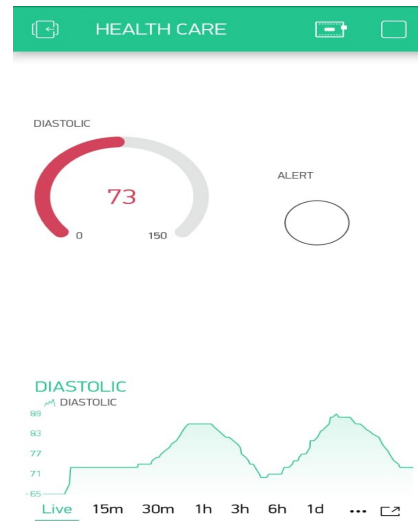
**FIGURE 6.** Systolic monitor through mobile

As shown in Figures 7. a and 7. b. the diastolic monitor is abnormal and normal respectively. Normally, a human's average diastolic pressure would be 60 to 80 mm Hg. This tested output denotes us through the alert symbol accompanied with an alert beep. If the diastolic pressure is above the normal state, then the alert symbol and a beep sound will get initiated. From this Doctor, the visit has to be done by the patient for checking, if any abnormality is noticed. The graph is depicted for legible understanding to uneducated people at the moment after testing. In figure 7. a, since the diastolic pressure exceeds the normal state, an alert beep is noticed. In 15 minutes, 1 hour, 6 hours, 1 day the diastolic pressure is noticed as 82 mm Hg, 78 mm Hg, 90 mm Hg, 92 mm Hg respectively. In figure 7. b, since the diastolic pressure doesn't exceed the normal state, an alert beep is not noticed. So that the patient could take a self-care by him or herself without visiting the doctor. . In the output, one of the patient's outputs is 99 mm Hg, so the alert is shown due to its abnormality. While another one is 73 mm Hg, so the alert is not shown due to its normality.

As shown in Figures 8. a and 8. b. the Heart rate monitor is abnormal and normal respectively. Normally, a human's average Heart rate would be 60 to 100 beats per minute. This tested output denotes us through the alert symbol accompanied with an alert beep. If the diastolic pressure is above the normal state, then the alert symbol and a beep sound will get initiated. From this Doctor, the visit has to be done by the patient for checking, if any abnormality is noticed. The graph is depicted for legible understanding to uneducated people at the moment after testing. In figure 8. a, since the heart rate exceeds the normal state, an alert beep is noticed. In 15 minutes, 1 hour, 6 hours, 1 day the heart rate is noticed as 78 beats per minute, 82 beats per minute, 97 beats per minute, 95 beats per minute respectively. In figure 8. b, since the heart rate doesn't exceed the normal state, an alert beep is not noticed. So that the patient could take self-care by him or herself without visiting the doctor. . In the output, one of the patient's output is 98 beats per minute, so the alert is shown due to its abnormality. While another one is 68 beats per minute, so the alert is not shown due to its normality.



7.a. Diastolic monitor. - abnormal

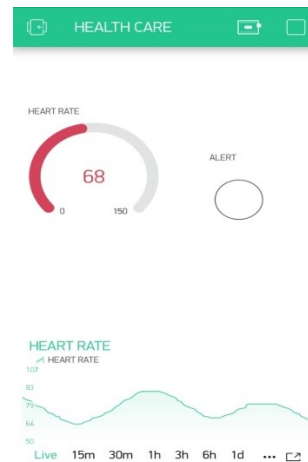


7.b. Diastolic monitor. - normal

FIGURE 7. Diastolic monitor through mobile



8.a. Heart rate monitor abnormal



8.b. Heart rate monitor - normal

FIGURE 8. Heart rate monitor through mobile

The sensor's data is fed to the controller, which subsequently sends it to the IoT device. These values are uploaded in the Blynk app so that we can able to monitor them easily. The usual body temperature for a healthy person is between 97- and 99-degrees Fahrenheit. A healthy person's heart rate ranges from 60 to 100 beats per minute. The human body's typical systolic and diastolic rates are fewer than 120 and 80, respectively. If any of these numbers are abnormal, the controller will notify the patients, their families, and their physicians, who will administer emergency first aid.

## CONCLUSION

A low-cost, simple-to-implement health monitoring system is provided, which solves the shortcomings of the existing method of measuring the health parameters by making it a more effective technique of monitoring patients' health parameters. It offers the advantages of being less expensive, taking less time, and using less power. The accurate measurement of a patient's heart rate and other health data is achievable, and it plays an important part in the medical monitoring system. IoT allows sensors to relay data wirelessly to a server. Basic physical characteristics are monitored regularly. It is more comfortable for the patient to utilize these wearable gadgets. This approach records values that are more exact and accurate. It saves time compared to the manual way. The doctors' workload is decreased since these values are continually recorded. In the future, machine learning and artificial intelligence algorithms will be used to analyze a component of the design. Automated diagnosis, prescription, and report analysis the system will be supplemented by the generator.

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# Analyzing the Occurrence of Stroke using Machine Learning-A comparative Study on Supervised Learning Models

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**Abstract**—Stroke is blood coagulation or bleed in the brain which could cause permanent damage and affects mobility, intelligence, vision, and communication. Stroke is considered a health-related crisis circumstance and can cause long-term neurological damage, complication, and often death. Most of the stroke is classified as ischemic and haemorrhagic. Stroke has been observed to have abnormal ECG signals. Therefore, if the individuals have their bio-signals monitored in real-time, they can get proper treatment rapidly. Most stroke diagnosis forecast systems are based on image processing tools namely CT and MRI, which are costly and hard to use in clinical practices. Stroke is the consequent driving cause for death around the world and quite possibly the most dangerous infection for persons over the age of 65. It causes ill-effects to the cerebrum like "coronary failure" which causes ill-effects to the heart. When a stroke sickness occurs, it causes enormous clinical care and permanent disability, yet in some cases, it also results in death. Like clockwork, someone dies of a stroke every 4 minutes, yet up to 80% of stroke could be averted if the medical specialist could forecast the incidence of stroke in initial phases. In this project, we have designed an ML model for predicting stroke utilizing the KNN algorithm, SVM algorithm, and NB algorithm. Followed by comparing KNN, SVM, and NB algorithms utilizing error and accuracy. Among KNN, SVM, and NB algorithms, the Support Vector Machine algorithm has the highest accuracy of 96.66%. This project hence helps in predicting the stroke effects and provides a customized warning. Therefore, it urges clinical patients to fortify the inspiration of wellbeing prosperity and brief changes in their medical care practices.

**Keywords**—ECG signal, Stroke, MRI, CT, Machine Learning.

## I. INTRODUCTION

The first paragraph after a heading is not indented (Body text style). The World Health Organization(WHO) interpreted Stroke—"Fast-growing clinical indications of severe disruption of brain activity, having indications persisting 24 hours or greater or resulting in death, without reason apart from vascular origin"[1]. A stroke occurs when the blood dispense to some portion of the brain is hindered, preventing cerebrum tissue from obtaining oxygen and nutrients. A stroke is a health crisis and prompt treatment is vital. Early treatment can lessen the brain damage and other consequences. Stroke is one of the main dangers to general wellbeing throughout the world [15].

With the enhancements in medical services, more individuals endure stroke yet many need to adapt to the physical, mental, social environment, bringing about expanded individual and public expenses. The socio-economic effect of stroke is extensive around the world [16].

It is estimated that 4.5 million people die of stroke a year around the world and more than 9 million stroke survivors. Nearly one of every four males and almost one of five females over the age of 45 can expect to have the illeffects of stroke in case they live to the age of 85. Recurrence of stroke expands the level of inability and demise of patients [14].

Stroke is the leading cause of death in the United States, as per the Centers for Disease Control and Prevention. It is a non-communicable infection that accounts for more than 11% of all deaths worldwide [12]. Constantly, more than 795,000 persons in the US have experienced the health impacts of stroke. It is the fourth remarkable inducement for demise in India [2]. The worldwide lifetime threat for stroke in 2016 for people beginning at the age of 25 was 24.9%. The most noteworthy worldwide lifetime threat for stroke was identified in East Asia (38.8%) followed by Europe (31.7%). The most reduced stroke threat was identified in eastern sub-Saharan Africa with a percentage of 11.8.

With the enhancement of innovation in the healthcare sector, foreseeing the circumstance of stroke can be modeled by utilizing ML [11]. The algorithms in ML are valuable in creating precise predictions and providing the right examination. The obstruction with this model is that it is being prepared on literary information and not on clinical cerebrum scans [10], [18].

The dataset is selected from Kaggle with different characteristics as its features. Initially, the dataset is Pre-processed (i.e.) cleaning and preparing for the ML model to recognize. Following that Label Encoding is executed to transform the string to integer data type. Then the dataset is parted as learn and validation data. Subsequently, a model is created utilizing this new data through three supervised ML techniques. Accuracy is determined for these various techniques and analyzed to become the finest prepared model for the forecast. Succeeding legitimate examination, the paper concludes with the most appropriate algorithm for stroke analysis.

## II. LITERATURE SURVEY

To get the required knowledge about different ideas related to the stroke analysis, existing literature was taken into account. The research paper on “Computer methods and programs in Biomedicine, provides the computational analysis of stroke prediction over 10 years and classifies the patient’s stroke probability occurrence into five different categorizations [3]. The research paper [22] determines a model condition for stroke pre-analysis algorithm with dormant modifiable ill effects. The paper [23] utilizes a Decision tree algorithm to extract the attributes, a principal component analysis algorithm to lessen the dimension and the adopted back propagation neural network classification algorithm is used to establish a classification model. In the paper [24] principle component analysis algorithm is used for decreasing the dimensions and picks up the most involved features for stroke prediction. The research paper [4] suggests the forecast of thromboembolic stroke disorder by utilizing Artificial Neural Networks. Though this model has an accuracy of over 85%, neural Networks require higher processing time and to train. The research work [21] utilized the random forest algorithm to predict the ill effects of the patient suffering from a stroke. This specific work cannot be utilized on any further new stroke types later on. The article [25] provides the application interface for clinical information perception and the board for nervous system specialists in stroke grouping and expectation framework called Stroke MD. The research work [26] proposes the utilization of three various calculations to foresee the chance of stroke and inferred that the Decision tree has the most noteworthy exactness (about 75%). In any case, this model couldn't suit this present reality model.

Other paragraphs are indented (Body text Indented style). According to the journal article [27], the algorithm for stroke detection was developed using Random Forest, Decision Tree, and Multilayer Perceptron. The accuracy rates achieved for the 3 strategies were fairly similar, with just minor variations. Decision Tree had a measured efficiency of 74.31 percent, Random Forest had a determined efficiency of 74.53 percent, and multi-layer perceptron had a determined efficiency of 75.02 percent. [28] Demonstrates the application of a supervised learning method to evaluate cardiac stroke. They built the model using several machine learning approaches such as Naive Bayes, Decision Tree, and SVM and then compared their results. The methods they utilized had the highest accuracy of 60%, which is rather low. The researchers of [29] utilized several data categorization algorithms to forecast the stroke risk. The dataset was obtained first from the Region of Saudi Arabia's Hospitals. C4.5, Jrip, and MLP were the three classifiers' methods utilized (MLP). The algorithm achieved an accuracy of about 95% using these techniques. Despite the article's claim of 95 percent accuracy, the duration required for training and prediction is longer since the scientists utilized a mix of sophisticated algorithms.

According to a study published in [30], three distinct algorithms may be used to forecast the risk of a stroke. Decision Trees, Nave Bayes, and Artificial Neural networks are implemented. This study revealed the Decision tree had a maximum accuracy of 75 percent. However, depending on the outcomes derived from the confusion matrix, this concept could not be applied to real-world instances. The investigators in [31] used the Cardiovascular Study database to forecast strokes. They developed a unique

automated feature selection method that picks resilient feature extraction methods on a cautious mean that presented. For more effectiveness, they coupled this technique with the SVM Classifier. However, this enabled the production of a lot of variables that gradually decrease the effectiveness of the algorithm. The article [31] suggests employing Neural Networks to forecast stroke illness. The Back-propagation technique was employed for estimation. This model obtained an accuracy of about 89 percent. However, due to the complicated design and growing neurons, NN consumes a long time to educate and even more processing time.

The article can be interpreted in the following manner: Section II goes into detail about the literature review. Section III describes the research's purpose. Section IV describes the study materials and methods. Section V explains in detail how the three machine learning techniques KNN, SVM, and NB, works. Section VI goes through the project's execution. Section VII examines the results in terms of accuracy, precision, and recall. Section VIII suggests the best approach for predicting strokes.

## III. OBJECTIVE OF THIS RESEARCH

Stroke stays as significant wellbeing trouble both for the people and for the public medical care system [17]. The objective of this study is to apply the fundamentals of ML on huge data to viably analyze the occurrence of stroke dependent on conceivably modifiable risk factors.

## IV. MATERIALS AND METHODOLOGY

This section briefly explains the Dataset, Algorithms, and Train and test datasets.

### A. Dataset Description

The dataset is collected from Kaggle and it is the documentation of around 5000 people’s information on their health status. The dataset contains 10 attributes and the labelled response.

- 1) *Age*: This attribute is numerical data and it is the age of the patient.
- 2) *Gender*: It is categorical data about the patient’s gender.
- 3) *Hypertension*: It is numerical data about whether the patient is hypertensive or not.
- 4) *heart\_disease*: It is numerical data on whether the patient had any previous cardiac issues.
- 5) *ever\_married*: It is categorical data about the patient’s marital status.
- 6) *work\_type*: It is categorical data on a patient’s employment status.
- 7) *residence\_type*: This is categorical data on the patient’s occupancy scenario.
- 8) *avg\_glucose\_level*: This is numerical data on the patient’s body glucose level.
- 9) *BMI*: It is the ratio of mass to the square of the person’s height and it is numerical data.
- 10) *smoking\_status*: It is categorical data on whether the patient smokes or not and how often he/she smokes.
- 11) *Stroke*: It is the numerical data on the stroke attacks. This is the decision:making attribute.

### B. Algorithm

The occurrence of stroke can be predicted by employing three Machine Learning algorithms namely (1) Support Vector Machine (SVM) (2) K Nearest Neighbour (KNN), (3) Naïve Bayes (NB) algorithm. The motivation behind using these algorithms is that these algorithms are very notable in modeling accurate predictors and have been utilized in few comparative research works. These models are assessed by comparing the confusion matrices [6].

### C. Data Splitting

Parting the data into various sets is a procedure usually utilized in ML. The data is generally parted into a learning and validation dataset to prepare and track down the model parameters and to evaluate the model prediction with the parameters such as accuracy or error [5]. The training dataset was utilized to fit the model and testing dataset for the evaluation.

## V. PREDICTIVE TECHNOLOGY

For predicting the stroke based on the given attributes three machine learning algorithms are used includes KNN, SVM, NB. The KNN is the laziest algorithm that predicts the stroke occurrence based on the nearest sample. The SVM predicts the stroke based on the hyper plane drawn in the plotted data. Finally, the Naïve Bayes predict the stroke by the Bayesian formula. All three algorithms used in this work are detailed with a flow chart in the upcoming sections.

### A. K Nearest Neighbor Algorithm

KNN is the least complex ML algorithm dependent on supervised learning. The KNN was first proposed by Cover and Hart in 1968 [7]. KNN algorithm deduces the analogy between new data with available datasets and places the new data into the most suitable category. KNN algorithm is commonly used in Classification problems and for Regression problems.

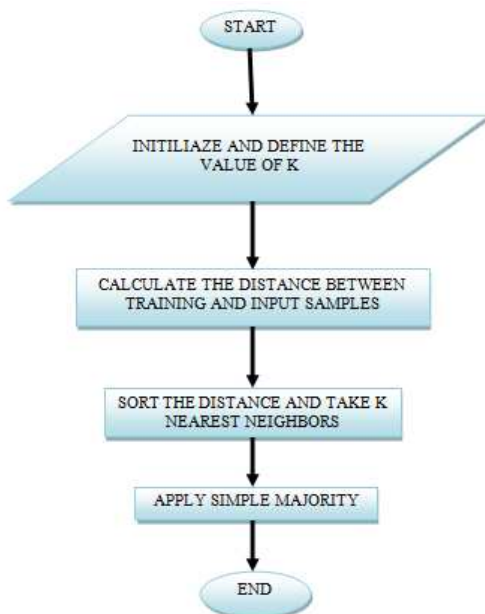


Fig. 1. Block diagram of KNN algorithm

KNN algorithm is shown in the Fig. 1, which is a non-parametric algorithm as it doesn't make any presumption on the available data. The K value is chosen to reduce the training

and validation error. The K value is the number of neighbour data available for classification. Predominantly, an odd number is chosen as the K: value. KNN algorithm has the advantage of being simple and less complex. There's no compelling reason to build a model, tune parameters and make extra assumptions. The disadvantage of the KNN algorithm is it comparatively gets slower as the number of independent variables increases. In the Fig. 2, the classification of KNN algorithm is explained.

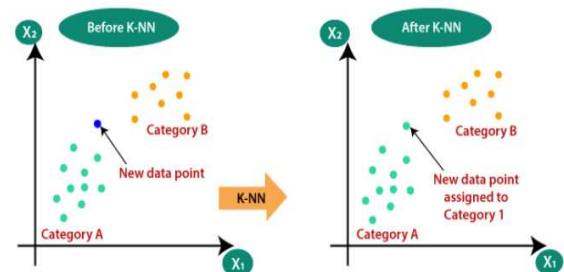


Fig. 2. Classification of KNN algorithm.

(Source: <https://www.javatpoint.com/k-nearest-neighbor-algorithm-for-machine-learning>).

### B. Support Vector Machine Algorithm

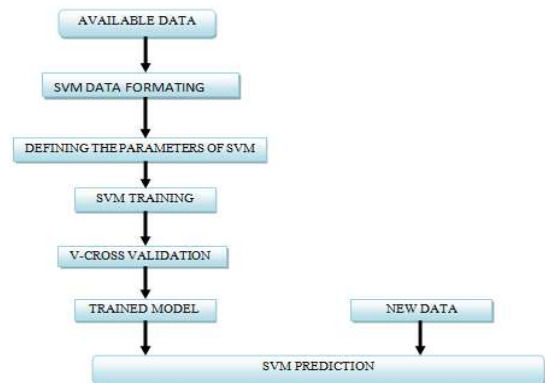


Fig. 3. Block diagram of SVM algorithm

Fig. 3 describes the SVM which is an ML algorithm based on Supervised Learning and is most commonly used for Classification and Regression problems. In 1963, the SVM algorithm was initially developed by Vladimir N. Vapnik and Alexey Ya. Chervonenkis. The target data is plotted in the  $n$  dimensional plane, where 'n' indicates the number of attributes available in the dataset [8]. After plotting, the hyper plane is being drawn. The ideal hyperplane will be the one with the greatest margin, since bigger margin guarantees, slight deviations in the data points will not influence the result of the model. The performance of SVM completely depends on the kernel selection. Yet, the ideal selection of kernel for some problems is not found. The advantage is that it functions admirably with a clear margin of partition. It is viable in high level dimensional planes furthermore in situations in which the quantity of measurement is more than samples. Fig. 4, shows the classification of SVM Algorithm. The disadvantage is that it doesn't perform well when the data has more noise and with an enormous dataset since the training time is more.

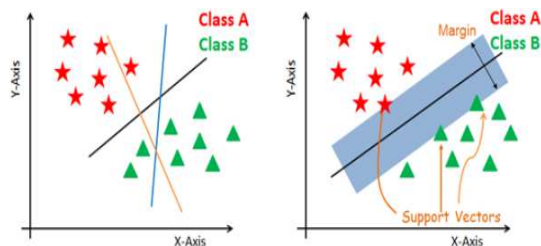


Fig. 4. Classification of SVM algorithm.

(Source:

<https://heartbeat.fritz.ai/understanding-the-mathematics-behind-support-vector-machines-5e20243d64d5>).

### C. Naïve Bayes Algorithm

Naïve Bayes based on Bayes theorem is an ML algorithm dependent on supervised learning and most commonly utilized for classification problems. It is mostly utilized in text characterization that incorporates a high dimensional training dataset. It helps in building quick ML models that can make a speedy prediction. It is a probabilistic classifier. The advantage of the NB algorithm is that it is one of the less complex and quick algorithms which is used for text classification [9]. It executes well in multi class predictions than other algorithms. The disadvantage is that it cannot learn the relationship between features as it assumes all features are independent. The types of NB algorithm are Gaussian, Multinomial and Bernoulli. It's a gathering of computations that contains an average guideline as no attribute depends on the other. NB is shown in the Fig. 5. Bayes theorem is expressed as (1):

$$P\left(\frac{A}{B}\right) = \frac{P\left(\frac{B}{A}\right)P(A)}{P(B)} \quad (1)$$

Where,  $P(A) \rightarrow$  Prior probability,  $P(B) \rightarrow$  Marginal probability,  $P(A/B) \rightarrow$  Posterior probability,  $P(B/A) \rightarrow$  Likelihood probability.

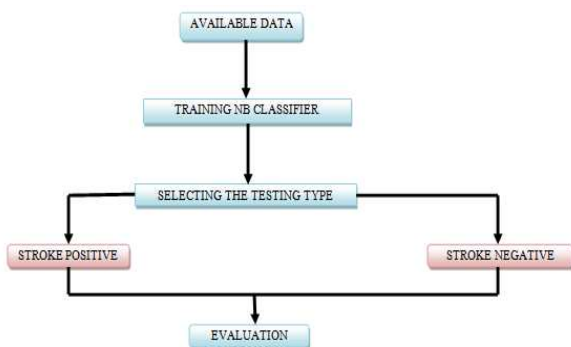


Fig. 5. Block diagram of NB algorithm

## VI. IMPLEMENTATION OF THE PROJECT

To complete this project, basic Python programming, Matplotlib, and Sklearn libraries are employed. The block diagram is depicted in Fig. 6

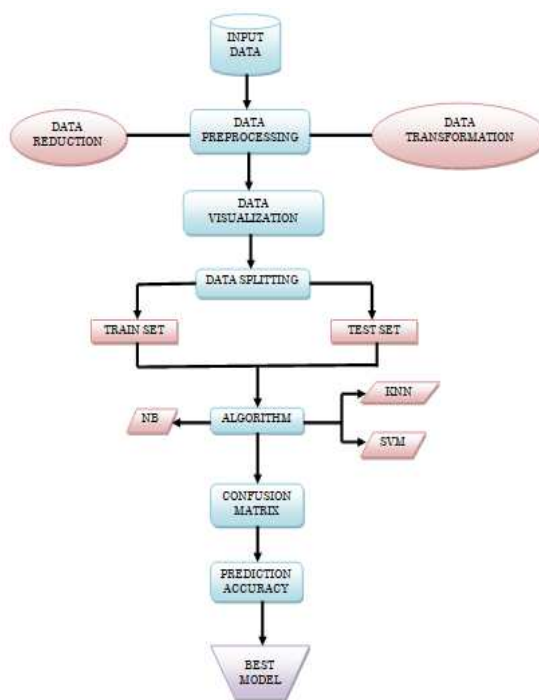


Fig. 6. Block Diagram to analyze the stroke prediction

1) *Input Data*: The data of around 5000 people have been collected from Kaggle. It contains risk factors like a lifetime, gender, hypertension, cardiac issue, marital status, employment type, habitation, Blood sugar level, BMI, and Smoking status.

2) *Data Pre:processing*: Data pre:processing is done to check the duplicate and missing values in the dataset. Followed by Label encoding, a type of data transformation is performed to convert categorical data to numerical data in the columns 'marital status', 'employment type', 'residence type', and 'smoking status. Data reduction is performed to balance the stroke positive and negative cases. Finally, the standardized data is acquired to proceed with further ML processing.

3) *Data Visualization*: Data visualization is performed to obtain a clear view of the dataset. Data visualization is the graphical representation of data.

4) *Data Splitting*: The final dataset is separated into features and labels and further into training and testing dataset in the ratio of 7:3 using Scikit learn library.

5) *Algorithm*: Three algorithms namely KNN, SVM, and NB have been utilized to train the set and to validate the dataset to predict the most appropriate model.

6) *Confusion matrix*: Confusion matrix is employed to estimate the value of Accuracy, Precision, and Recall.

7) *Best model*: The level of accuracy of the three ML models is identified and the best model for stroke prediction is obtained.

## VII. RESULT AND DISCUSSION

The dataset which is collected from Kaggle contains 10 attributes and around 5000 samples. The data is parted into two categories as training dataset and testing dataset in the ratio of 7:3. For analyzing the stroke prediction, three ML algorithms have been utilized namely KNN, SVM, and NB to develop an appropriate model. Confusion matrix elements like

True Negative, False Positive, True Positive, and False Negative have been utilized to analyze the model using performance metrics namely Precision, Recall, and Accuracy.

1) *True Positive (TP)*: The patient is affected by stroke in real:time and the model also predicts the same.

2) *False Positive (FP)*: Though, the patient is not affected by stroke in real:time the model predicts that the patient is affected by stroke.

3) *True Negative (TN)* : The patient is not affected by stroke in real:time the model predicts the same.

4) *False Negative (FN)* : Though, the patient is affected by stroke in real:time the model predicts that the patient was not affected by stroke [13].

5) *Precision*: It is the small portion of suitable illustration among the recovered illustrations [19].

6) *Recall*: Also known as Sensitivity that is the small portion of suitable illustrations that are recovered [20].

7) *Accuracy*: It is used to decide the best model. It is the percentage of correct prediction in the test.

Table I gives the formula for performance metrics employed in the machine learning algorithms like KNN, SVM, and NB. Table II compares the performance analysis of the ML algorithms.

TABLE. I. FORMULA OF PERFORMANCE METRICS

Performance Metrics	Formula
True Positive rate	TP/Actual positive
True Negative rate	TN/Actual negative
False Positive rate	FP/Actual negative
False Negative rate	FN/Actual positive
Precision	TP/(TP+FP)
Recall	TP/(TP+FN)
Accuracy.	(TP+TN)/(TP+TN+FP+FN)

The accuracy of the three algorithms is taken to analyze the best method to predict the stroke. The accuracy of the three ML algorithms is plotted in Fig. 7. The accuracy value of Naïve Bayes is 95.33%, Support Vector Machine is 96.66% and finally, the accuracy of K Nearest Neighbour is 94.0%. From this, it is identified as the accuracy is very high for the Support Vector Machine algorithm and the accuracy value is very less in the K Nearest Neighbour method. For the best model, the accuracy value should be high. The model is designed for predicting stroke. So the model accuracy is very important. From this comparison, the Support Vector Machine is found to be good.

TABLE. II. PERFORMANCE SURVEY OF THE MACHINE LEARNING ALGORITHMS

Algorithm	Accuracy	Precision	Recall
Naïve Bayes	95.3333	93.58974	97.3333
Support Vector Machine	96.66667	97.36842	96.1039
K:Nearest neighbor	94.0	93.50649	94.7368

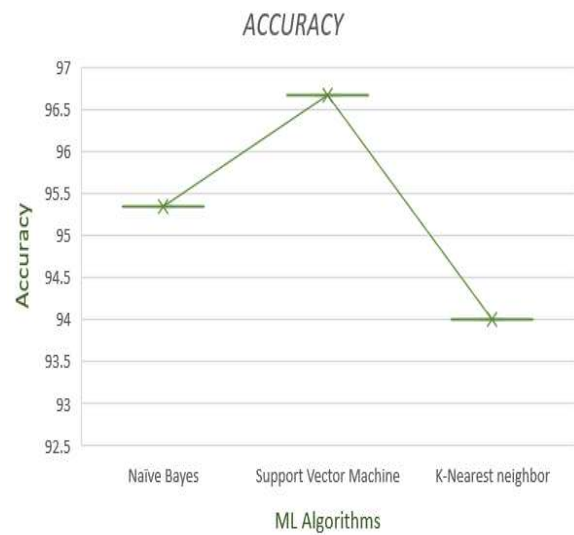


Fig. 7. Comparison of 3 ML algorithms based on accuracy.

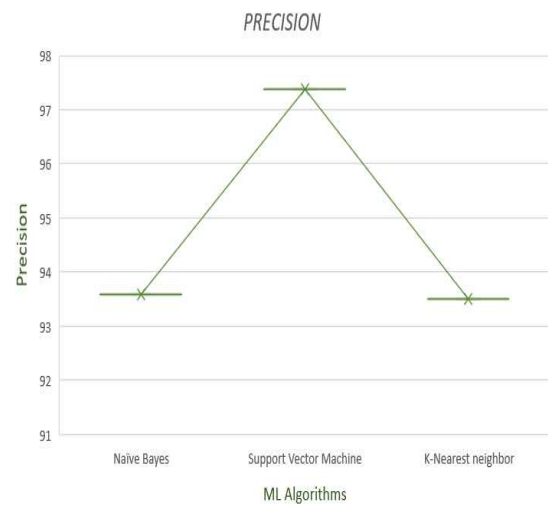


Fig. 8. Comparison of 3 ML algorithms based on precision

The precision of the three algorithms is taken to analyze the best method to predict the stroke. The precision of the three ML algorithms is plotted in Fig. 8. The precision value of Naïve Bayes is 93.58%, Support Vector Machine is 97.36% and finally, the precision of K Nearest Neighbour is 93.50%. From this, it is identified as the precision is very high for the Support Vector Machine algorithm and the precision value is very less in the K Nearest Neighbour method.

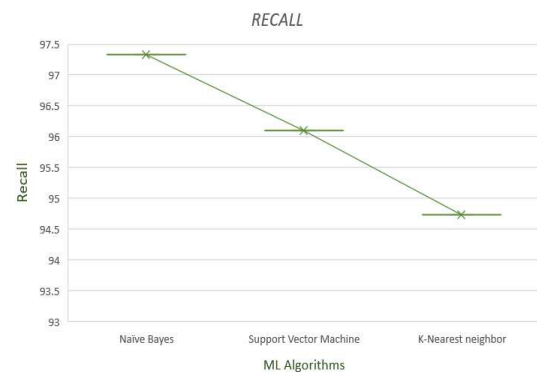


Fig. 9. Comparison of 3 ML algorithms based on recall.

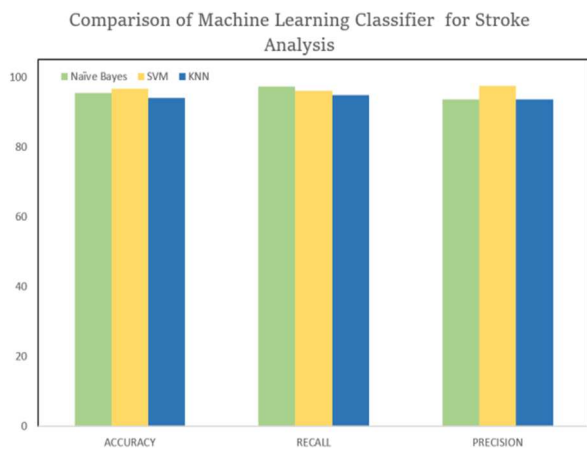


Fig. 10. Bar graph for analyzing the performance of Machine learning Algorithms.

The recall of the three algorithms is taken to analyze the best method to predict the stroke. The recall of three ML algorithms is plotted in Fig. 9. The recall value of Naïve Bayes is 97.33%, Support Vector Machine is 96.10% and finally, the accuracy of K Nearest Neighbour is 94.73%. From this, it is identified as the recall is very high for the Naïve Bayes algorithm and the recall value is very less in the K Nearest Neighbour method. Fig. 10 shows the Bar graph for analyzing the performance of Machine Learning Algorithms.

#### VIII. CONCLUSION

This project can be anticipated to develop a mobile application to give a customized message based on every patient's degree of effects from stroke and a lifestyle remedy message on the hazard factors of stroke. Further advancements in this research can incorporate foreseeing different infections separated from a stroke. This model completely predicts the occurrence of stroke and might have been used in guiding patients and their families for planning clinical preliminaries. This methodology gives a steady advantage beyond current clinical practice that can convert into significant advantages for populace wellbeing and work with the adoption of ML based danger predictors in clinical practice.

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# ఆంధ్ర సాహిత్య

(తెలుగు భాష, సాహిత్య, సాంస్కృతిక అధ్యయనం)

ఏడవ సంఖ్య

త్రైమాసిక పత్రిక

మార్చి 2023



## తెలుగు శాఖ

ఆంధ్ర విశ్వకళా పరిషత్  
విశాఖపట్నం

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## అభ్యుదయకవిత 'నయాగారా'

డా॥ గణేపవరం వీరప్పిర్యం

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శిలా శాసనం / పడగొట్టను

పరిగిన నా నిప్పుల కంఠం

పలికిన విప్లవ గీతం అని మొదలెట్టిన రామదాసు స్థిరతరంగమై ఉన్న జగత్తును తన కవితాగానంతో ఉరకలెత్తే ఉత్తుంగ తరంగంగా మార్చాలని ఆవేశపడి, నిప్పుల కత్తెరలను సృష్టించి జగత్తుకు జలప్రళయం తెచ్చి సరహంతకులకు తలకొరివి పెట్టారు. నడవండంటూ జనులకు నవలోకం ఆవిష్కరించారు.

'ఈరోజు' అన్న శీర్షికలో గానుగలో

సున్నంలాగా రైలు కింద

పట్టాల్లాగా / చెప్పుకింద

చీమల్లాగా / నలిగిన మానవులారా

పగిలిన గుండెల్లారా

తరిగిన కండల్లారా అని పిలిచి సమాజంలో ఉన్న ప్రజల దుస్థితిగతులను వారికి తెలియజెప్పి నవలోకంలో బంగారు భవిష్యత్తు రారమ్మని పిలుస్తోంది. మీ మెళ్లీ పూల మాల వేసి, మీ కళ్యాణానికి రణ ధనుస్సు విరిచింది లెండి ఇప్పటి దుస్థితికి చరమ గీతం పాడి నవనవోన్మేషంతో రణరంగంలో విజయ కేతనం ఎగరవేయండి అంటూ ప్రజలను ఉద్బోధించారు.

ఇక కథానాయకుడు కుందుర్తి ఆంజనేయులు ..

తన ముందుమాటలో ఆ రోజుల్లో కుండపోతగా ఆవేశం కుమ్మరించడమే కవిత్వమనే వాదం మాది.. దీనికి తోడు ఎర్రజెండా నాయకత్వాన యీ సమాజ వ్యవస్థ మారాలని మా కవితలో ఉందే సందేశం.... అని దృక్పథంతో ఉన్న కుందుర్తి పెద్దదయినా, చిన్నదైనా ఉద్యమం ఉద్యమమే ఆ ఉద్యమమే ప్రజా జీవితాలను మార్చి వారికి వెలుగునిస్తుందని హృదయపూర్వకంగా నమ్మిన వాడు కనక మానవత్వానికి పెద్ద పీట వేసే తత్వం కూడా ఉన్న మనిషి కనక 'మన్యంలో' అన్న వచనకవితలో

మన్యంలో

తిరుగుబాటు

ప్రభుత్వం విరగబాటు అణిచేసిన

గొడ్డలి పెట్టు అనే ఆరంభించారు. తాను ఎందుకీ కవితాత్మను వెలుగులోకి తీసుకొస్తున్నారో చెప్పడంలోనే

పూర్వ కవులందరూ కవితాన్ని రసానందానికి, హృదయానందానికి మాత్రమే ఎక్కువగా ఉపయోగించారు. అప్పటి సమాజాన్ని వారు వారి రచనల్లో ప్రస్ఫుటించినా ఎక్కువభాగం అభూత కల్పనలకే ఎక్కువగా చోటిచ్చారు. రాజులు మెచ్చాలని వ్రాసిన కవులు, భగవంతుడు మెచ్చాలని వ్రాసిన కవులు లేదా వారి ప్రేమోదంతాన్ని చెప్పే రచనలే సంప్రదాయ కవిత్వంలో ఎక్కువగా చోటు చేసుకున్నాయి. బహుశా కలియుగంలో కనిపించే రాధాంత సిద్ధాంతాలు ఆనాడు లేవేమో. ! లేకపోతే ఉన్నా వాటిని కవులు పట్టించుకోలేదేమో తెలియదు.

ఇప్పుడు అలా కాదు సంప్రదాయవాదులు ఉన్నా అభ్యుదయం పేరిట సమాజోన్నతి పేరిట కవిత్వం అనేక ఒరిపిడులను రాసుకుంటూ తోసుకుంటూ మున్ముందుకు వచ్చి అత్యున్నత శిఖరోరహణం చేసింది. ఆ దారిలోనే బెల్లంకొండ రామదాసు, కుందుర్తి ఆంజనేయులు, ఏలూరి సుబ్రహ్మణ్యం గార్లు శ్రీశ్రీ మొదలెట్టిన కవితారంగంలో ఎగిసి దుమికారు. ప్రజా చైతన్యాన్ని ఆజ్యం పోశారు. వారి ఆవేశం, ఆవేదన, ఆసక్తి చూసి సంప్రదాయవాదులు సైతం నివ్వెరపడి నిల్చుండిపోయారు. వారి చేత అభ్యుదయ కలం పట్టించారు.

వీరు కాలం తీరిన కథలు కాక కాలంతో పాటు రగిలిపోతున్న నేపథ్యాలనే సమాజానికి అప్పటికప్పుడు కావాల్సిన చైతన్యాన్ని పోగుచేయడానికి తమ తమ కలాలకు ప్రజల వెతలనే సిరా పేసి అక్షరాలనే ఆయుధాలు చేసి అభ్యుదయం పేరిట పరిష్కార మార్గాలను సూచించారు.

అందుకే ప్రజలు సైతం అభ్యుదయ కవితానికే నీరాజనాలు అందించారు. కొద్దో గొప్పో చదువుకున్న వారికి మాత్రమే తన కవిత్వపు ధోరణి అర్థమవుతుందేమో అనుకున్న కుందుర్తి ఆలోచనలకు విఘాతం కలిగిస్తూ అతి సామాన్య మానవుడు కూడా ఆ మన్యం వీరుడికిచ్చిన బలం లాంటిదే ఈ మన్యం వీరునికి పలికే వీరగాధకూ వీరతిలకం దిద్దారు.

నయాగారా ముగ్గురు అభ్యుదయ కవుల కలాలలోంచి వెలువడిన కవితా సంపుటి

మొదటిదిగా బెల్లంకొండ రామదాసు...

మానవ మేధస్సుకు / సంకెళ్ళను

తగిలించిన / గత సాంఘిక

అభ్యుదయానికి నాందివాచకం పలికారు.

కేవలం జనజీవన స్రవంతిలో అభ్యుదయం  
తేవాలనే ఆలోచనతో అభ్యుదయకవిత్వం వెలార్చిన కవి  
కుందుర్తి కనుక

రాచరికపు బాటల్లో  
రాజుకున్న కారుచిచ్చు  
మన్ను తిన్న పాముల్లాంటి  
మన్యం వీరుల గుండెల్లో  
రేగినై ప్రళయ ప్రళయంగా

తుఫాను సహస్రాలు అన్నారు... 'మన్ను తిన్న  
పాముల్లాంటి మన్యం వీరుల... ' ఇక్కడే సాత్విక  
జీవనులైన మన్యం జనుల్లో కూడా ప్రళయాగ్ని  
పుట్టించడం ఆ బడబాగ్ని సెగలు ఎంతగా  
ప్రజ్వలిస్తున్నాయో ఊహించకోవడం కష్టం.

ఆ కారిచిచ్చు బెల్లంకొండలో చెప్పిన గంటల  
గణగణలో నినదించిన కంఠాలే నిప్పుల రణ శంఖాలై  
పగిలినవీ రోజున... పాతాళం బ్రద్దలుగా పగిలినదీ రోజున  
అన్న కవితాపలుకులకు తోడుగా నిలిచాయి అని చెప్పవచ్చు.  
ఇది ముగ్గురు వ్రాసిన కవితా సంపుటి అయినా ఒకదానికొకటి  
తోడుగా నిలిచే రైలు బోగీల్లా కనిపిస్తాయి. బెల్లంకొండ  
వెలిగించిన ఎర్రని జెండాలు కుందుర్తి కవితావేశంలో  
చింతనిప్పులయ్యాయి. ఆ నిప్పులు -వీల్చారి సుబ్రహ్మణ్యం  
కవితలో రూక్షోజ్వల రుధిర దీప్తి పొంది

అరి భయంకర ఆహవ శక్తి  
నవజీవన ప్రభాత భేరీ  
అభిగామియై శుభదాయకమై  
సౌదామిని నిగనిగలై / ధగధగలై వొస్తున్నది  
మహాశక్తి ప్రజాశక్తి  
సోమరులను పామరులను / నరనరములు

కదిలించే

నరులందర నడిపించే / విప్లవకర మంగళ కర  
మహాశక్తి వొస్తుంది  
జీవశక్తి ప్రజాశక్తిగా మారింది.

ముగ్గురు కవులు ఒక్కటై ఒక్క గొంతుకై నినదించిన  
ఎర్రజెండా వినువీధుల్లో వివంచయై వల్లవించింది  
అభ్యుదయం ప్రతి వీధిలోను ప్రతి మనిషిలోను రగిల్చింది  
అని చెప్పడంలో -ఎవరికీ ఏ సంశయాన్ని  
కలిగించలేకపోయింది.

అందుకే కుందుర్తి తన జయిస్తుంది అన్న కవితా  
ఖండికలో

గడిచిన చరిత్ర / యుగ సందుల్లో  
కలకాలం కలలుగన్న / మానవజాతికి  
విముక్తి నేడే అని మొదలెట్టారు.  
త్యాగానికి / త్యాగం నేర్పే యోగుల్లారా  
ఇరుగు పొరుగు జాతుల కొరకై

విరామమే యెరుగని / పురోగామి సైనికులారా  
సకలం తెగించి పోరే / సమరంలో జయించి  
మీరే నిర్మాతలు నవ జీవన / నిర్ణేతలు

అంటూ అంతకుముందు ఎవరివిజయ పథం  
కోసమో విశ్రమించక పోరాడిని వీరుల వీరత్వాన్ని తనకై  
తాను ఇప్పుడు ప్రదర్శించమని చెప్తారు. మృత్యువు ఎదురుగా  
వచ్చినా -మడిమ తిప్పని అరివీర భయంకర వీరుల్లారా  
ఇప్పుడు చేసే సమరంలో మీకోసమే. మీరే ఈ సమరానికి  
సైనికులు, విజేతలూ మీరే అని సైనికుల్లో ఉత్సాహాన్ని ఉ  
రకలెత్తించారు.

విప్లవమంటేనే రక్తపాతం అని చెప్పే చచ్చుపుచ్చు  
మాటలు వినకుండా మారే జగతికి మరో జగత్తుకు చేరే  
మార్గం ఇదే అని చెవిలో శంఖం ఊది మరీ చెప్పారు.

నేటి ఈ వీరులు చేసే యుద్ధం  
సిరిలో  
పొర్లాడిన  
శ్రీమంతులకూ  
ఆకలితో  
మోకరిల్లిన  
అసువులు విడిచిన  
దిక్కులేని  
దీనులకూ  
చోటు లేని లోకాన్నే  
విప్లవ సైన్యం కోరింది  
గతకాలపు మతాలకూ  
శ్రుతి కలవని కులాలకూ  
తరతరాలు పీడించిన  
పరిపాలన పద్ధతికీ వీలు లేని లోకాన్నే విప్లవ  
సైన్యం చూసింది

....

నా చేతి కలంలాగా  
ననా ననా ననా ననా  
నడిచే  
విప్లవ సైన్యం

జయిస్తుంది జయిస్తుంది తప్పక విజయం  
సిద్ధిస్తుంది. అనాదిగా జరిగే అన్యాయాలకు తిలోదకాలు ఇచ్చి  
అభ్యుదయ బాటలో అరివిరిసిన మందారంలాంటి ఎర్రటి  
సూరీడు స్వచ్ఛంగా స్వేచ్ఛగా కనపడుతాడు వెలిగిపోతాడు  
వీరులకే కాదు దీనులకూ, అల్పులకూ అర్భకులకూ తన  
వేడిమిని అందిస్తాడు. 'జయిస్తుంది' అన్న కవితాఖండికలో  
అందరిలో చైతన్యపు క్రాంతిని వెల్లివిరియజేస్తాడు అనే ధ్వనిని  
వినిపింపచేసాడు.

వీల్చారి సుబ్రహ్మణ్యం గారు 'విజయ ముద్ర' అనే  
కవితా ఖండికలో అప్పటి దాకా చరిత్రలో మగ్గిపోయిన  
అణగారిన జీవుల ఆక్రందనలు మోగి మోగి చివరకు ఏమి

మిగులుస్తాయో అణిచేసే అడుగులు పాదాలను ఎలా కబళిస్తాయో చెప్పక చెప్పారు. ఏచరిత్ర చూసిన ఏమున్నది గర్వకారణం అనే శ్రీశ్రీ మాటలను మణిపూసల్లా గ్రహించిన సుబ్రహ్మణ్యం తన విజయముద్రను ఎలా ఆవిష్కరించారో ఒక్క సారి చూద్దాం

ఆకలో  
ఆకలోయని  
గోడు గోడుగ  
రోదించి  
పీక్కుపోయి  
కణికెడు కూటికి  
ఘూర్లిల్లిరి ...

... అటువంటి వారు ఆక్రందనలు

శిఖరారోహణం చేస్తే

ఏమౌతుంది? ఒక్కసారి ఒక్కసారి వెనుతిరిగి చూసుకునేందుకు కూడా సమయం చాలక ఆగర్భశ్రీమంతులు ఆక్రందనలకు కూడా చోటులేక అందులోన కూరుకుపోతారు అనే నిజాన్ని చెప్పడానికి

పరుగెత్తి పరుగెత్తి / కాలు విరిగి / సడి తప్పగ / బరువెక్కిన

కనురెప్పలు / మూతల పడి  
సోలిపోయి / కుప్పై కూలిరి  
బిచ్చగాళ్లు  
కూలిన జీవుల / లోహపాదముల  
కసకస / తొక్కుచు  
విలయముగా / జ్వలియించెను  
బిచ్చగాళ్లు  
ఒక్కటై / ఒక కేక పెట్టిరి  
మెరుపును మింగిరి  
...

చల్లారని ఆకలి / చల్లారని చిచ్చుకు  
శాంతి శాంతి / పిడుగులు పిడుగులు

....

పైకి చిందిన / పచ్చి రక్తం  
పురిటి వాకిట / పేద జీవుల  
విజయముద్రగ / ఎగురుచున్నది  
ఎర్రజెండా... అని నినదించారు. చరిత్రలో

రాబోయే రోజుల్లో కనిపించే సజీవ శిల్పాన్ని తన కవితాత్మలో ఆవిష్కరించారు.

అట్లానే ఆంజనేయులు కూడా  
చాలీ చాలని / కూలి జీవనం  
కండల తరుగూ / మండే ప్రేవులు తెలియని

అజ్ఞానంలో చిమ్మీ దీపం చీకటిలో

నిరాశలో / నిద్రించిన జీవులు!  
..... ఇవన్నీ కూడా శతాబ్దాల

క్రితం రాజన్యల ముఖ చిత్రాలు కానీ కాలం మారి తీరుతుంది. ఎర్రజెండా పట్టుకున్న నేతలు ప్రజల మూతుల్లో విజయపు చిరునవ్వులను పూయిస్తారు. దానికోసమే

....

ప్రజా విజయ  
చైతన్యం  
ప్రబలిన మానవ హృదయం  
అగ్ని పర్వతం బ్రద్దలయింది  
కాలం / చీకటి  
మార్గాలను కబళించిన / తేజస్వాలీ!  
స్వార్థ పరత్వం తెచ్చిన జగడం/ ఈర్ష్యా సూయల  
రగిలిన పోరూ / రణరంగం  
చెప్పిన తీర్మా/ ఒకజాతికి  
నెత్తిన కళ్ళూ / మరో వర్గపు మహావమానం  
ఏదో వ్యవస్థ / సంఘానికి

కొత్త స్వరూపం / వస్తుండటం అంటూ ఊరటనిస్తారు.

ఆ ఊరటే ప్రజల చైతన్యానికి బీజాలు వేస్తుంది. ఎర్రజెండా ఆ బీజాలను నీరు పోసి వటవృక్షాలను పెంచుతుందనేది కుందుర్తి ఆశ. ఆశయం. దీన్నే 'తరువాత' అన్న కవితా ఖండికలో ఆవిష్కరించేశారు.

బెల్లంకొండ రామదాసు తన 'చెరసాల' అన్న శీర్షికలో అప్పటి వరకూ ఉన్నసమాజాన్ని ఇన్నాళ్లూ సమాజం ఒక సంకెళ్ళ చెరసాల / హత్యలు జరిగిన చెరసాల నెత్తురు పారిన చెరసాల దుర్మార్గులు కట్టిన చెరసాల

ఒక పెద్ద చెరసాల అంటూ అభివర్ణించారు

ఆ చెరసాలలో పుణ్యం పేరిట ఇచ్చిన బలులు, సామాజ్యోన్నతి, చక్రవర్తిత్వం కోసం సమరభూమికి అర్పించిన వీరుల ప్రాణాల గుట్టలు, తమ ప్రాపకం కోసం, తమ అధికార దాహం కోసం మతాధినేతలు వ్రాసిన దుర్మార్గపు శాస్త్ర శాసనాలలో తగిలించిన నియమ శృంఖలాలకు బలైన అమాయకులు ఇవన్నీ గతకాలపు సమాజచిహ్నాలుగా వర్ణిస్తారు. అటువంటి సమాజంలోంచి పుట్టిన ఎర్రజెండా అభ్యుదయ కవిత్యపు ఎజెండా మనుష్యుల్లో మార్పు ను తీసుకొచ్చి ... అణగారిన

ప్రపంచ దీనులారా !

మీకై / ఈనాడొక / అగ్ని పర్వతం  
పగులుతోంది చూశారా! అని అడుగుతూ ....

మీకై  
ఈనాడొక

నవజగత్తు  
ప్రభవిస్తున్నది చూచారా!

.... నంద నవన వసంత మందారం /

కుసుమించెను చూచారా!

మీకై / ఈనాడొక / రణభేరి / పగిలింది

విన్నారా! అంటూ అణగారిపోయి ఉన్న దీనార్తుల హృదయాల్లో చైతన్య దీప్తిని రగిలిస్తారు. వారిలో ఆనందాబ్ధికోసం అర్రులు చాచే ఆసక్తిని కలిగిస్తారు.

ఈ చెరసాలకు విముక్తిని ప్రసాదించే లాగు కుందుర్తి తన జయిస్తుంది అనే కవితా శీర్షికలో గడిచిన చరిత్ర యుగసంధుల్లో కలకాలం కలలు గన్న మా సరజాతికి విముక్తి నేడు నంటారు. అంతేకాదు దారి లేని / తెన్ను లేని/ జగతి నడత నిరసించను శాశ్వత శాంతికి / మార్గం సాధించే యీ సైన్యం/ గొడ్రాలికి పుత్రభిక్ష మా పాలిటి కల్పతరువు గబగబగబ గబ/ నయాగారా జలపాతంలా/ నడిచే విప్లవ సైన్యం జయిస్తుంది జయిస్తుంది అని నినదిస్తారు. ఉదరంలో రగిలిన క్షుధాజ్వాల సెగలు రగిలి యెగిసిన మంటలై భుగ భుగ మంటలు

బోగిమంటలై తారతమ్యతల / ఫలితంగా / ఈనాటికి పతితులకూ పీడితులకు కార్మికులకూ కర్షకులకూ కలిగిన / చైతన్యపు మంటలకు తోడు మంటలై వీర వరుల / విప్లవ సైన్యం వేసే అగ్ని విహారం చేసే తుఫానులై శతఘ్నులూ పరువెత్తే / నరహంతల/విప్లవ సైన్యం

జయిస్తుంది జయిస్తుంది అన్నారు. దీనికి ఒక్క అడుగు కలిపిన ఏల్చారి వారు గగనంలో వేగుచుక్క జగమంతా జగచ్చక్తి తమస గర్భ దళసహేతి బానిసత్వ విచ్ఛేదక ప్రబల విజయ ప్రజాశక్తి వొస్తున్నది ప్రజాశక్తి

.....  
ప్రకృతి కుసుమించిన సర్వం / ప్రతి వ్యక్తి సుఖియించెను కాదా! అని ప్రశ్నించి జనుల్లో

విప్లవ శంఖాన్ని ఊదే శక్తికి ఊపిర్లందించారు. ఆ జనులే విప్లవ జెండా పట్టి విజయ కేతనం ఎగురవేసి ప్రజాస్వామ్యంలో స్వాతంత్ర్యపు గాలులను పీల్చుకున్నారు. కానీ మళ్లీ ఎక్కడో ఒకచోట మసి మసకబారిన వైనం కన్పించి హృదయావేదనకు నిప్పు రాజేస్తునే ఉంది.

అందుకే తన మలి ముద్రణలో కుందుర్తి వారు “అభ్యుదయకవిత్వం నయాగారా రోజుల నుండి ఎన్నో మలుపులు తిరిగి మజిలీలు దాటి, ఎంతో దూరం ప్రయాణం చేసింది. ఇప్పటి విప్లవ కవుల వీరావేశాన్ని చూస్తుంటే అది ఒక ఋజు రేఖలో కాకుండా ఒక వలయాకార పరిధి మీద తిరుగుతూ మళ్లీ అదే స్థానానికి వచ్చిందా అనిపిస్తుంది” అని అన్నారు.

బెల్లంకొండ రామదాసు, కుందుర్తి ఆంజనేయులు, ఏల్చారి సుబ్రహ్మణ్యం గారలు ముగ్గురు కలిసి - ఒక్కొక్కరూ మూడేసి ఖండకావ్యాల చొప్పున - సంకలనంచేసి ప్రచురించిన ‘నయాగరా’ నాకు త్రేతాగ్నిలా అనిపించింది. ఈ సంపుటి అభ్యుదయ కవితా ప్రస్థానంలో ఒక మజిలీ - ప్రసిద్ధ సాహిత్య విమర్శకుడు అవయిన జి.వి.సుబ్రహ్మణ్యంగారు అభిప్రాయ పడ్డారు. శ్రీశ్రీ కల్పించింది వాతావరణం మట్టుకే కాగా నయాగరా కల్పించింది ఆ వాతావరణం లోని స్థూల రేఖలు - ప్రసిద్ధ సాహిత్య విమర్శకుడు, రచయిత అయిన కె. వి. రమణారెడ్డిగారు అభిప్రాయం వ్యక్తం చేశారు.

ఆనాడే కాదు నేడూ కార్పొరేట్ సంస్కృతిలో నలిగిపోయే బడుగు జీవుల (శ్రీమంతులమని చెప్పుకోవడానికి చేసే అప్పుల ఊబిలో కూరుకుని పోతున్న యువత) కోసం మళ్లీ నయాగారా జలపాతం రావాల్సిందే అనడంలో ఏమాత్రం సంకోచం కలగడం లేదు.

**ఆధార గ్రంథాలు**

- గుర్రం జాషువా గబ్బిలం
- సినారె - మంటలూ మానవుడూ, విశ్వంబర
- దాశరథి కృష్ణమాచార్యులు - తెలంగాణ కోటి రతనాల వీణ
- ఆరుద్ర త్వమేవాహం
- ఆవంత్య సోమసుందర్ - వజ్రాయుధం

# జానపద నాంపు

(వ్యాస సంకలనం)



ఆచార్య విం. రామనాథం నాయుడు  
కర్ణాటక రాష్ట్ర సాంస్కృతిక విశ్వవిద్యాలయం,  
మైసూరు.

జానపద సౌంపు (వ్యాస సంకలనం)

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X-X-X-X-X

# నెల్లూరు రొట్టెల పండుగ - చారిత్రక వితిహాసం

డా॥ గోపవరం పద్మప్రియ

తెలుగు అధ్యాపకురాలు

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మొహరం పర్వదినాల్లో హిందూ, ముస్లింలు కలసి మెలసి నెల్లూరు నగరంలోని బారాషాహిద్ దర్గా సమీపంలో గల స్వర్ణాల చెరువు వద్ద వివిధ కోర్కెలు కోరుతూ, నెరవేరిన కోర్కెలకు మొక్కులు తీర్చుకుంటూ వాయనంలా రొట్టెలు ఇచ్చు, పుచ్చుకునే పండుగే "రొట్టెల పండుగ". ఈ పండుగకు ఒక ప్రత్యేకత ఉంది. మత వ్యాప్తికోసం జరిగిన పోరాటం, దాని ఆనవాళ్లు - నేడు మత సామరస్యానికి ప్రతీకగా ఈ పండుగ ప్రఖ్యాతి చెందినది. భారతీయ ప్రజలు సంప్రదాయాలకు, ఆచారాలకు, విశ్వాసాలకు విలువనిస్తారు. వారికి ఒక ఆచారంపై గాని, విశ్వాసంపై గాని గురి కుదిరిందంటే కుల, మతాలకు అతీతంగా వాటిని ఆచరిస్తారు, ఆరాధిస్తారు. అలాంటి నమ్మకానికి, విశ్వాసాలకు నెలవైనదే బారాషాహిద్ దర్గా, దానికి అనుసంధానమైనగే రొట్టెల పండుగ. అలా దేశం నలుమూలల నుంచి అనేకమంది ప్రజలు మొహరం నెలలో సందర్శించే ప్రాంతమే బారాషాహిద్ దర్గా. వారు ఆచరించే సంప్రదాయమే రొట్టెల పండుగ. ఈ పండగ శతాబ్దాల చరిత్రతో భక్తుల కొంగు బంగారంగా, 2017 నుంచి రాష్ట్ర పండుగగా విరాజిల్లుతుంది.

## చారిత్రక నేపథ్యం :-

భారతదేశంలో విదేశీయులు వ్యాపార విస్తరణతోపాటు సామ్రాజ్య విస్తరణ, మత వ్యాప్తిగావించారు. ఆ మతవ్యాప్తిలో ముస్లిం మత వ్యాప్తి కూడా ప్రధానమైనది. దానిలో భాగంగా 12 మంది వీరులు భారతదేశానికి వచ్చారు. వీరు వచ్చిన ప్రాతం టర్కీ నుంచి అని కొందరూ, సౌదీ అరేబియా నుంచి అని కొందరు భిన్నాభిప్రాయాలు తెలుపుతున్నారు.. వీరు ముందు మైసూరు నవాబు అయిన హైదర్ అలీని దర్శించుకుని మత ప్రచారం చేస్తూ నెల్లూరు ప్రాంతానికి వచ్చారు. ప్రచారంలో భాగంగా వారు నెల్లూరుకు సమీపంలో గండవరంను చేరారు. వారిని అక్కడ స్థానికులు అడ్డగించి పోరాడారు. ఆ పోరాటం (యుద్ధం)లో 12 మంది తలలు తెగిపడ్డాయి. వారి తలలు అక్కడే పడిపోగా, మొండాలను తీసుకొని గుర్రాలు భయంతో నెల్లూరు వైపు పరిగెత్తారు. అలా వచ్చిన గుర్రాలు ఆ పన్నెండు మొండాలను నెల్లూరు పట్టణంలోని స్వర్ణాల చెరువు దగ్గర పడవేశాయి. ఆ 12 మంది వీరుల మొండాలపై నిర్మించిన సమాధులపై చిన్న భేదాలలో విభిన్న కథనాలు వినిపిస్తున్నాయి.

గుర్రాలు తెచ్చిన మొండాలను స్వర్ణాల చెరువు వద్ద పడవేయగా అది మట్టిలో కలిసిపోగా, వాటిపై స్థానికులే సమాధులు నిర్మించారన్నది ఒక కథ.

ఈ సంఘటన 1751 ప్రాంతంలో జరిగింది. అప్పుడు నెల్లూరు, తమిళ ప్రాంతాలను ఆర్కాటు నవాబు మహమ్మద్ అలీఖాన్ పల్లాజి పాలిస్తున్నాడు. ఈ 12 మంది వీరుల మొండాలు పడిపోయిన రాత్రి నవాబు భార్య కలలోకి వీరులు వచ్చి తమ మొండాలు నెల్లూరులోని స్వర్ణాల చెరువు దగ్గర పడి ఉన్నాయని వాటికి సమాధిని

నిర్మించమని తెలపగా ఈ విషయం భర్తకు తెలపగా సవాబు భార్యతో అక్కడికి వచ్చి వారికి సమాధులను నిర్మించాడు.

మరొక ఐతిహ్యం ఆ మొండాలు స్వర్ణాల చెరువు వద్ద బట్టలు ఉతుక్కుని సాయంత్రం బయలుదేరి వెళ్ళు న్న ఒక రజకుడి కంట బడడంతో అతడు భయంతో పరుగుతీసి స్థానికులకు తెలపగా వారు వచ్చి వారిని సమాధిని చేయడం జరిగింది. ఇదే సమయంలో ఆర్కాలు సవాబు భార్య దీర్ఘకాలంగా అనారోగ్యంతో బాధపడుతూ ఉంది. ఆమెకు వీళ్ళు కలలో కన్పించి దర్గాను నిర్మించినట్లయితే నీ ఆరోగ్యం బాగుచేస్తానని చెప్పడంతో సవాబు విశ్వాసంతో దర్గాను నిర్మించాడు. అనూహ్యంగా ఆమె ఆరోగ్యం కుదుటపడింది. దానితో వారు ప్రతి సంవత్సరం మొహరం నెల పదకొండవ రోజున రొట్టెలను పంచేవారు. అదే కాలక్రమంగా రొట్టెల పండుగగా ప్రసిద్ధికెక్కింది. వారు ఆ సమాధులపై నిర్మించినదే బారాషహీద్ దర్గా బారహ్ అంటే 12 అని అర్థం షాహిద్ అంటే అమరత్వం అని అర్థం.

**విశేషాంశం - బారాషహీద్ దర్గాను పులి శుభ్రపరచుట:**

పూర్వం ఈ ప్రాంతం నెల్లూరు పట్టణానికి దూరంగా వుండటం వలన అడవి లాగా వుండేది. జనసంచారం ఉండకపోయేది. ప్రతి రోజు ఒక పులి దర్గాలోకి వచ్చి రాత్రివేళల్లో దర్గాలో వుండి ఉదయం వేళకు తన తోకతో దర్గా మొత్తం శుభ్రం చేసి వెళ్ళేదని ఒక కథ ప్రచారంలో వుంది ఇది దర్గా మహత్వం అని భక్తులకు నమ్మకం పెరగడంతో భక్తుల రద్దీ ప్రతి సంవత్సరం పెరుగుతూనే వుంది. కుల మతాలకు అతీతంగా ఈ పండుగ భక్తి శ్రద్ధలతో జరుపుకుంటూనే వున్నారు.

**పండుగ జరుగు విధానం:**

మొదటి రోజుల్లో ఈ పండుగ ఒక్క రోజే జరిపేవారు. అది మొహరం నెలలో 12వ రోజున చేసేవాళ్ళు అంటే మొహరం పండుగ వెళ్ళి రెండవ రోజు జరిపేవారు. కాలక్రమముగా రెండు రోజులు, తరువాత మూడు రోజులు, ఇప్పుడు నాలుగురోజులు చేస్తున్నారు.

మొహరం నెల మొదటి రోజు నెలవంక కనిపించిన రోజు జెండాలను (నిషాన్లు) ఈ దర్గాలో కడతారు.

**మొదటి రోజు:**

మొదటి రోజును 'షహదత్' అంటారు. ఇంది మొహరం నెలలోని 10వ రోజు. ఈ రోజు నుండి రొట్టెల పండుగ ఉత్సవం మొదలవుతుంది. ఈ రోజున దర్గాను శుభ్రం చేస్తారు. అదే విధంగా పన్నెండు మంది అమరవీరుల సమాధులను పన్నీరుతో శుభ్రం చేస్తారు. నూతన వస్త్రాలను వాటిమీద పరుస్తాడు. మహ్మదీయ పెద్దలు, పండితులు వచ్చి ఖురాన్ చదువుతారు.

**రెండవ రాజు:**

ఈ రోజును 'సాండల్ ముబారక్' అంటారు. ఈ రోజు కడప పీఠాధిపతి దర్గాకు వస్తారు అతను పూజలు నిర్వహిస్తారు. రెండవ రోజున గంధంను సమాధులకు పూస్తారు. అందువలన దీనిని గంధ మహోత్సవం అంటారు. తరువాత భక్తులకు గంధాన్ని పంచిపెడతారు.

**గంధమహోత్సవం నిర్వహించే విధానం:**

నెల్లూరు కోటమిట్టలోని జమీన మసీదు నందు మహ్మదీయ పెద్దలు, పండితులు ఈ రోజున హాజరౌవుతారు.

సమాజు చేసి ఖురాన్ పఠిస్తారు. ఆ తర్వాత అందరు కలిసి పన్నీరు, పూలు, గంధం కలిపి పన్నెండు బిందెలను పన్నెండు గుర్రాల మీద తీసుకొని వచ్చేవారు. కాని ఇప్పుడు ఒక గుర్రం మీద ఒక బిందె పెట్టుకొని మిగతా పదకొండు బిందెలను మోటారు బండిలో తీసుకుని రావడం జరుగుతుంది. అయితే ఈ బిందెలను అమీనా మసీదు నుండి ఊరేగింపుగా ఖురాన్ చదువుతూ మేళతాళాలతో తీసుకొని వస్తారు. ఈ ఊరేగింపుక ముందు నిషాన్ (జెండా) పట్టుకొని ఒకరు తర్వాత ముర్షద్లు మంత్రాలు (ఖురన్) చదువుతూ పుండగా గుర్రం మీద గంధం బిందెతో అనుకరిస్తారు. వారి తర్వాత మహమ్మదీయ పెద్దలు, పండితులు వస్తారు. గంధంను తీసుకొని వచ్చి ఒక్కో బిందెలోని గంధాన్ని ఒక్కో సమాధికి పూస్తారు. అన్ని బిందెలను ఒక చోట చేర్చి కడప పీఠాధిపతి వచ్చి సమాజు చేసిన తర్వాతనే ఈ గంధం సమాధులకు పూడం జరుగుతుంది. సమాధులకు పూయడం జరుగుతుంది. మిగిలిన గంధాన్ని భక్తులకు పంచిపెడతాడు. దీనితో రెండవ రోజు నిర్వహించే గంధ మహోత్సవం ముగుస్తుంది.

**మూడవ రోజు:**

ఈ రోజును 'జహరత్' అంటారు. అదే అసలైన రొట్టెల పండుగ. ఆ రోజే భక్తులు రొట్టెలు మార్చుకుంటారు. అంతకు ముందు సంవత్సరం తమ కోరికలు తీరాలని మ్రొక్కుకున్నవారు. తమ కోరికలు తీరినట్లయితే మ్రొక్కు తీర్చుకోవడానికి వస్తారు. అలా కోరిక తీరినవారు రెండు రొట్టెలు తీసుకొని వస్తారు. నెల్లూరుకి దగ్గర ప్రవేశం వారైతే ఇంట్లోనే రొట్టెలు తయారు చేసుకుని వస్తారు. దూరప్రాంతం నుండి వచ్చే భక్తుల కోసం దర్గా దగ్గర రొట్టెలు తయారుచేసి అమ్మేవారు వుంటారు. ఆ రొట్టెలను కూడా భక్తులు ఉపయోగించుకుంటారు. భక్తులు తెచ్చిన రెండు రొట్టెలతో ఒకటి సమాధుల వద్ద సమర్పించి కృతజ్ఞతలు తెలుపుకుంటారు. రెండవ రొట్టెను తమలాంటి కోరిక కోరుకునే వారికి ఇస్తారు. అలా కోరుకునే వారు ఆ రొట్టెను తీసుకుని వెళ్తారు. కోరిక కోరుకునే వారు ప్రత్యక్షం ఇక్కడ లేకపోయినా వారి తరపున ఎవరైన రొట్టెను గ్రహించి వారికి పంపించవచ్చు. అలా తమ కోరిక తీరిన మరుసటి సంవత్సరం వీరు కూడా రెండు రొట్టెలను తయారుచేసుకుని వస్తారు. మరలా అదే కోరికను కోరిన వారికి ఇస్తారు. ఇలా నిరతరంగా ప్రతి సంవత్సరం జరుగుతునే వుంటుంది. ఈ రొట్టెల పండుగలో ప్రధానంగా కోరుకునే కోరికలు - పెండ్లి కాని వారు పెండ్లి కావాలని పెండ్లి రొట్టె, చదువు బాగా సాగాలని చదువు రొట్టె, వ్యాపారం వృద్ధిలోకి రావాలని వ్యాపారం రొట్టె సంతానం లేని వారు సంతానం కోసం సంతాన రొట్టె, ఉద్యోగం లేనివారు ఉద్యోగం కోసం ఉద్యోగ రొట్టె విదేశీయానం కోరుకునే వారు విదేశీయాన రొట్టె, ఈ మధ్య బదిలీల రొట్టె కూడా కొంత మంది భక్తులు అడుగుచున్నారు.

**రొట్టె మార్పిడి విధానం:**

ఈ రొట్టెలను మార్చుకునే విధానం సాంప్రదాయకంగా వుంటుంది. కోరిక తీరిన వారు కోరిక కోరేవారు మంగళస్నానం ఇంటి వద్దనే ఆచరించి శుభ్రమైన వస్త్రాలు ధరించి రొట్టెలను తయారు చేసుకొని స్వర్ణాల చెరువు వద్దకు వచ్చే ముందుగా దర్గా సమాధులను దర్శించుకొని ఒక రొట్టెను సమాధుల వద్ద సమర్పించి చెరువు వద్దకు చేరుకుంటారు, ఇది ఆడవారు మాత్రమే నిర్వహిస్తారు. రొట్టెలు పంచుకోవడానికి మగవారు నిషేధం కేవలం ఆడవారు మాత్రమే ఈ రొట్టెల మార్పిడి చేసుకుంటారు. తాము తీసుకువచ్చిన రొట్టెను రెండు చేతులు దోసిలిగా చేసిన రొట్టెను ఆ దోసిలిలో పెట్టుకుని స్వర్ణాల చెరువులోకి దిగితారు దోసిలి అడుగుభాగానికి నీళ్ళుతాకే విధంగా రొట్టె పట్టుకొని అదే కోరికతో వచ్చిన వారికి వాయనం లాగా ఇస్తారు. ఇది ఇచ్చేవారు, తీసుకునే వారు ఒకసారి భగవంతుడిని స్మరించుకుని రొట్టెను ఇవ్వడం గాని, తీసుకోవడం గాని చేస్తారు. ఆ రొట్టెను గ్రహించినవారు



ఎవరికోసమైతే గ్రహిస్తారో వారిచేత తినిపిస్తారు. కోరిక తీరినవారు తక్కువగా వుండి కోరిక కోరేవారు ఎక్కువగా వుంటే ఆ రొట్టెను ముక్కలుగా చేసి పంచుకుంటారు పూర్వం భక్తులు తక్కువగా వుండటం వలన కోరిక తీరిన వారు తమ దగ్గర వున్న రొట్టె ఏమిటో ఎదుట వారికి చెప్పి అదే కోరిక గల వారిని వెతుక్కునే వారు. ఇప్పుడు భక్తులు అధిక సంఖ్యలో హాజరవడం వలన ప్లెక్సీలు ఏర్పాటు చేసి పెండ్లి రొట్టె, చదువు రొట్టె ఇలా అన్ని రొట్టెలు దొరికే స్థలాన్ని సూచిస్తున్నారు. ఒకే రకమైన కోరిక కలవారు దొరకనపుడు ఆ రొట్టెను నేరుగా నీళ్ళలో పదిలిచేస్తారు. దాదాపుగా ఇటువంటి సంఘటన జరిగి వుండదు. కారణం భక్తులు ఈ రొట్టెల కోసం అధిక సంఖ్య గాల్సిస్తుంటారు.

**నాల్గవ రోజు :**

దీనిని 'తహాలీల్ ఫాతియా' అంటారు. అంటే ముగింపు అని అర్థం. ఈ రోజుతో ఈ రొట్టెల పండుగ ముగుస్తుంది. ఇంతకు ముందు ఈ పండుగను మూడు రోజులు మాత్రమే నిర్వహించేవారు. కాని భక్తుల శాశ్వత పెరగడం వలన నాల్గవరోజున కూడా నిర్వహిస్తున్నారు. ఈ రోజు కూడా రొట్టెల మార్పిడి జరుగుతుంది.

ఈ పండుగ ప్రాసస్త్యం పెరగడంతో వచ్చే భక్తులకు అన్నదానం నిర్వహిస్తారు. చాలా స్వచ్ఛంద సంస్థలు ఇక్కడ అన్నదాన కార్యక్రమాలు నిర్వహిస్తాయి. ఈ నాల్గరోజులు తిరునాళ్ళు జరుగుతాయి. అనేక రకాలైన తిను బండారాల దుకాణాలు, పిల్లల ఆటవస్తువులు మొదలైన దుకాణాలు ఈ తిరునాళ్ళలో పెట్టడం జరుగుతుంది. నెల్లూరు పట్టణమంతా చాలా సందడిగా, రద్దీ వుంటుంది. చాలా షహీదు 'ముజావర్' అయినటువంటి ఎమ్.డి. రఫిగారు పదనాల్గు సంవత్సరముల నుండి ఈ దర్గాలో ముజావర్ గా నియమింపబడినారని పదునాల్గు సంవత్సరముల క్రింత మూడు లక్షల మంది భక్తులు వచ్చేవారని అది ఇప్పుడు ఇరవై లక్షలకు పెరిగినట్లు చెప్పారు. అంతే కాకుండా పండుగ దినాల్లోనే కాక సాధారణ దినాల్లో కూడా భక్తులు ఈ దర్గాను అనునిత్యం సందర్శించుకుంటూనే వుంటారని మహ్మద్ రఫిగారు తెలిపారు.

**ముగింపు:**

280 సం॥ల పైబడ్డ చరిత్ర కలిగి మతసామరస్యానికి నిలయమైన భక్తుల కోరికలు తీరుస్తూ కుల, మత, వర్గ భేదం లేకుండా లౌకికత్వాన్ని పాటిస్తూ ప్రతినిత్యం వర్గ కలహాలతో పోట్లాడుకునే వారికి ఇది కనువిప్పు కలిగించే విధంగా వుండి మనమంతా భారతీయులమై, మనమంతా సహోదరులమే అనే భావాన్ని అనువణవున కలిపించేటటువంటి ఈ రొట్టెల పండుగను రాష్ట్ర పండుగగా ప్రకటించడం గర్వకారణమే. అయినప్పటికీ దానికి సరిపడినంతగా ప్రగతి కార్యక్రమాలు ప్రభుత్వం తీసుకోవడం లేదు. బారా షహీద్ ను పర్యాటక రంగం పరంగా అభివృద్ధి పరచాలంటే కొన్ని మౌళిక వసతులైనటువంటి సత్రాలు, ఉచిత ప్రయాణ సౌకర్యం, భోజన, మంచినీరు, మరుగుదొడ్డి సౌకర్యాలు కల్పించి రాష్ట్ర ప్రభుత్వం తగిన చర్యలు తీసుకున్నట్లయితే ఇంకా భక్తులు పెరగడమే కాక పర్యాటక రంగంలో బారాషహీద్ దర్గా ప్రపంచ దృష్టిని ఆకర్షిస్తుంది అనడంలో ఎటువంటి సందేహం లేదు.

X-X-X-X-X



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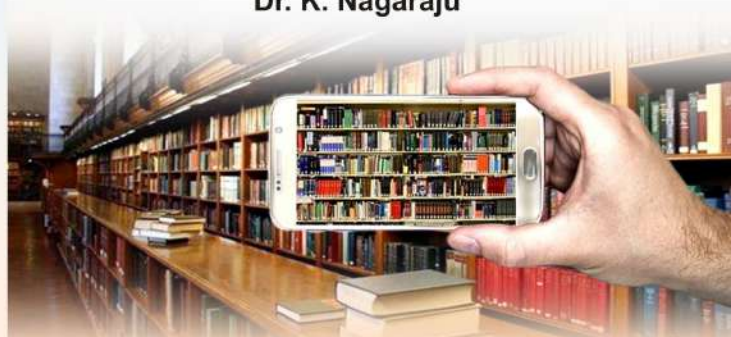


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Centers through Digital Technology  
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**Dr. Y. Sudha Rani  
Dr. K. Nagaraju**



University Library  
Vikrama Simhapuri University  
Nellore-524324, Andhra Pradesh

# **ICSSR SPONSORED NATIONAL SEMINAR**

**on**

**The Transformation of Academic Libraries into Skill  
Development Centers through Digital Technology**

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**Dr. K Nagaraju**

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Vikrama Simhapuri University  
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## Use of Library & Information Resources in Government Degree Colleges in SPSR Nellore District, A.P.: A Study

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Dr. E. Kiran Kumar

Librarian, PRR&VS Government Degree College, Vidavalur, SPSR Nellore

### Abstract

*In this paper I studied use of library and information resources of in Government Degree Colleges in SPSR Nellore District in Andhra Pradesh, distributed 1050 questionnaires in colleges and collected 936 questionnaires. I found in this study the library information resources, services (electronic & print), and library expressed their opinion about library working hours, physical facility, library information resources and services excellent and good.*

**Keywords:** *Academic libraries, Government Degree Colleges, Library and Information resources, facilities and Students.*

### Introduction

Resources Center or Library is a place where books, records, documents and nonprint materials are available to refer and borrow. It is recognized as an significant social institution in the society where every individual can seek any kind of knowledge particularly. An academic library, is a very important education tool in a school or a college or a university in the process of making an academic community, that helps to change or develop ones ideas. A library

attached to an educational institution is known as academic library. A college library of an institute acts as an auxiliary unit to represent its objectives effectively. It is an intellectual resource of a academic community , that helps them in their self-intellectual development which enables to fulfill their curriculum requirements and to promote knowledge. Therefore, education and library have become extremely intervened that one cannot exist without the other. They always go hand in hand.

## **Role of Library in Education**

Teaching is a co-operative enterprise. Teachers must have the necessary tools for teaching purposes in the shape of Librarians and laboratories. A library is a heart of an educational institution. Library plays vital role in Teaching, learning and research activities of the college. For this, it builds up collection in the form of print as well as non-print media and provides periodical access to online databases. The teachers are main feeders of transmitting knowledge to the students. Library keeps the teachers updated regarding the progress and development taking place in their respective fields. It helps and promotes research activities that are being carried out in a respective institution by providing pin pointed and relevant information.

## **Categories Information sources**

- **Primary:** Primary publications are those in which the author for the first-time supplies evidence, describes a discovery, drives a new proposition and brings forward new evidence about earlier proposition.
- **Secondary:** A document that concerns a particular subject of inquiry that is or based on a study and analysis of a primary information source is called secondary source of information.
- **Tertiary:** a Report information appears last and usually doesn't contain. It is designed to provide information about information and also acts as a guide to the primary and secondary sources of information.
- **Current approach:** It helps the user to keep abreast of current developments in his/her areas of interest.
- **Everyday approach:** It originates from the user's frequent information needs in the course of his/her study or investigation.
- **Exhaustive approach:** It is the user's demand for almost all relevant documents on a subject within the area of interest.

- **Catching - up approach:** It is the user requirement for a brief but on a complete picture of recent developments on a particular subject outside the area of his/her main interest.

## Role of College Libraries

The library occupies a place of central importance in a college; it touches the academic work of students and staff at every point. Libraries are regarded as means of universal and perpetual self education by an individual. Keeping this in view, reading habit has to be developed and encouraged among the people in their early life. It should commence with the school library, be continued by the college, university libraries and sustained by the public libraries.

- Seeking and cultivating new ideas
- Inculcation of leadership qualities and development of mental powers;
- Training in all useful faculties and profession;
- Promotion of equality and social justice;
- Fostering a sense of nationalism and internationalism;
- Greater socialization and participation;
- Develop the capacity of individual for interpretation, critical evaluation.

## Nature of Degree College Library

- **Library user:** The user community of degree colleges consists of students (under-graduates) faculty and non-teaching staff. Undergraduate student's requirements include literature which provides basic knowledge of the subject of their study in the class. They need basic text books, reference books, journals and some reference tools, Faculty along with non-teaching staff who plays a dual role of teaching and administrative practice. Hence, they require reference books, journals, indexing and abstracting periodicals, reports of meetings, conference proceedings, materials related to interdisciplinary aspects of teaching, changes in curriculum, organisation of courses etc.
- **Library Resources:** Degree Colleges Libraries contains collection of general books, reference books, textbooks, competitive exam books, book bank, back volumes of journals, current journals/ magazines/ newspapers, CDs/DVDs, etc. Also, the library

subscribed DELNET database and N-LIST E-resources and necessary.

- **Library Services:** The services provided through conventional or unconventional means generally include provision of physical access to resources, document delivery service with the help of effective internal and inter library lending services supported by photocopying, internet services, reference service, current awareness service by generating in house general alerting services and specialist SDI services and the user instruction service. In recent times, the changes in information environment led many of the libraries to switch over mechanized information retrieval and online searching.

## Objectives of the Study

The following are the specific objectives of the study.

- To know the frequency of visits, time spent, and purpose of visit by the users of Degree College Libraries.
- To know the Awareness and Use of Information resources and services in Degree College Libraries.
- To identify the purpose of using information resources and services in the Government Degree Colleges of Nellore district.
- To identify the user satisfaction about the library collection, services and information access facilities available in Degree College Libraries.
- To find out the problems of the users in utilizing various resources and services in the Degree College Libraries.

## Methodology

The basic research method adopted in the current study is a survey method. As there are many methods used in survey methods to collect data like observation, interview and questionnaire, the present study is based on survey method to collect data from the Government Colleges Libraries located in Nellore District. Two comprehensive and structured questionnaires were developed by the researcher in consultation with the research supervisor for the purpose of this study. The first questionnaire was to collect the data from the librarians of degree college libraries and the second questionnaire was intended to collect data from the users of library.

## Data analysis and Interpretation

**Table 1:** Gender-wise distribution of students

S. No.	Gender	Frequency	Percentage
1.	Male	417	44.55
2.	Female	519	55.45
	Total	936	100

It is obvious from Table-1. Out of the total 936 respondents, (55.45%) are female respondents and the remaining 7(44.55%) are female. The proportion of the female respondents was much higher than that of the male.

**Table 2:** Branch wise distribution:

S.No.	Branch wise	Frequency	Percentage
1.	BA	209	22.32
2.	BCOM	323	34.51
3.	BSC	404	43.16
	Total	936	100

The above table it can be observed that samples of(43.16%) users are selected BSC students, (34.51%) users are B.Com., students and the remaining (22.32%) users are B.A. students.

**Table 3:** Classification of respondents-Age Group (years)

Age Group	B.A N=209	B.Com N=323	BSc N=404	Total
Below 18	26 (2.7)	38 (4.05)	50 (5.34)	88 (9.4)
18-19	68 (7.26)	84 (8.97)	154 (16.45)	306 (32.69)
20-21	72 (7.69)	136 (14.53)	138 (14.74)	346 (36.96)
Above 21	43 (4.59)	65 (6.94)	62 (6.62)	170 (18.16)

It is evident from Table - 3 that the age group of the respondents is are categorized into four groups. A majority of the respondents (students) i.e.346(36.96%)belong to the age group 20-21 years, whereas 306(32.69%) respondents are in the 18-19 years age group, 88(9.4%) are students above 21 years and the remaining 170(18.16%)

respondents are below 18 years. Hence, it can be concluded that majority of the respondents are below 20-21 years age group.

### Classification of Respondents-location Wise

Background	Rural area	Urban area	Semi urban	Total
DKW	132 (14.1)	104 (11.11)	92 (9.82)	328 (35.04)
Gudur	18 (1.92)	12 (1.28)	10 (1.06)	40 (4.27)
Naidupet	32 (3.14)	16 (1.7)	28 (1.99)	66 (7.05)
Vidavalur	36 (3.18)	15 (1.6)	17 (1.81)	68 (7.26)
Rapur	22 (2.35)	08 (0.85)	15 (1.6)	45 (4.8)
Venkatagiri	42 (4.48)	10 (1.06)	21 (2.24)	73 (7.79)
Udayagiri	58 (6.19)	14 (1.49)	24 (2.26)	96 (10.25)
Kovur	38 (4.05)	16 (1.7)	18 (1.92)	72 (7.69)
Sullurpet	72 (7.69)	20 (2.13)	46 (4.91)	138 (14.74)
Total	450 (48.07)	215 (22.97)	271 (28.95)	936 (100)

The above table 4 depicts the user's geographical background. It depicts the user's geographical background. It reveals that 450(48.07%) respondents belong to Rural area, whereas 271(28.95%) respondents belong to semi-urban area and the remaining respondents are 271(28.95%) urban areas. It can be concluded that majority of the respondents 450(48.07%) respondents belong to Rural areas.

**Table 5:** Frequency of visit to the Library

Visit the library	B.A N=209	B.Com N=323	BSc N=404	Total N=936
Daily	18 (1.92)	36 (3.84)	86 (9.18)	140 (14.95)
Once in a week	35 (3.73)	92 (9.82)	104 (11.11)	231 (24.67)

<b>Visit the library</b>	<b>B.A N=209</b>	<b>B.Com N=323</b>	<b>BSc N=404</b>	<b>Total N=936</b>
Twice in a week	42 (4.48)	78 (8.33)	118 (12.6)	238 (25.42)
Once in a fortnight	24 (2.6)	63 (6.73)	60 (6.41)	147 (15.7)
Once in month	58 (6.19)	30 (3.2)	20 (2.13)	108 (11.53)
Occasionally	32 (3.41)	14 (1.49)	16 (1.71)	62 (6.62)

It can be observed from the Table -5 shows that 238(25.42)visiting the library twice in a week, followed by 231(24.67)are visiting once in a week, 147(15.7)visiting the library Once in a fortnight, 140 (14.95) users who are visiting the library daily and remaining 108(11.53)of the users visiting the library once in a month.

**Table 6:** Time spent in the library

<b>Time spent</b>	<b>B.A N=209</b>	<b>B.Com N=323</b>	<b>BSc N=404</b>	<b>Total N=936</b>
less than 1 hour	42 (4.48)	46 (4.91)	86 (9.18)	174 (18.58)
1 to 2 hours	76 (8.11)	132 (14.1)	154 (16.45)	362 (38.67)
2 to 3 hours	54 (5.76)	84 (8.97)	112 (11.96)	250 (26.7)
3 to 4 hours	25 (267)	43 (4.59)	28 (2.99)	96 (10.25)
More than 4 hours	12 (1.28)	18 (1.92)	24 (2.56)	54 (5.76)

The duration of visit is taken as less than one hour, 1 to 2 hours, 2 to 3 hours, more than 3 hours. From the above Table – 6 shows that 362(38.67%) of respondents spent time 1 to 2 hours per day in the library, followed by 250(26.7%) spent time 2 to 3 hours in the library, 174 (18.58%) spent time less than 1 hour, 96(10.25%) spent time 3to 4 hours and the remaining 54(5.76%)spent time more than 4 hours in the library.

From the Table-7 it is seen that the maximum number 294 (31.41%) of respondents were borrow/return books purpose, followed by 218(23.29%) of respondents purpose of read Newspaper/ magazines, 128(13.67%) of respondents are collect subject specific

information, 75(8.01%) respondents are prepare for Assignments, 86(9.18%) respondents are to use Electronic resources, 88(9.4%) respondents are use Internet, 25(2.67%) respondents are To take Photocopies (Xerox).

**Table 7:** Purpose of visiting the library

<b>Purpose of visit to library</b>	<b>B.A N=209</b>	<b>B.Com N=323</b>	<b>BSc N=404</b>	<b>Total N=936</b>
To borrow/return books	72 (7.69)	98 (10.47)	124 (13.24)	294 (31.41)
To read Newspaper/ magazines	34 (3.63)	82 (8.76)	102 (10.89)	218 (23.29)
To collect subject specific information	26 (2.77)	46 (4.91)	56 (5.98)	128 (13.67)
To use Electronic resources	18 (1.92)	32 (3.41)	36 (3.84)	86 (9.18)
To use Internet	20 (2.13)	28 (199)	40 (4.27)	88 (9.4)
To prepare for Assignments	21 (2.24)	24 (2.56)	30 (3.2)	75 (8.01)
To take Photocopies (Xerox)	12 (1.28)	05 (0.26)	08 (0.85)	25 (2.67)
Any other (pi. Specify)	06 (0.3)	08 (0.85)	08 (0.85)	22 (2.67)

**Table 8:** Level of satisfaction on application of Information Technology in your library

<b>Levels of satisfaction</b>	<b>B.A N=209</b>	<b>B.Com N=323</b>	<b>BSc N=404</b>	<b>Total N=936</b>
Fully Satisfied	54 (5.76)	82 (8.76)	78 (8.33)	214 (22.86)
Satisfied	58 (6.19)	98 (10.47)	132 (14.1)	288 (30.76)
Uncertain	43 (4.59)	74 (7.9)	74 (7.9)	191 (20.4)
Dissatisfied	34 (3.63)	50 (5.34)	62 (6.62)	146 (15.59)
Highly Dissatisfied	20 (2.13)	19 (2.02)	58 (6.19)	97 (10.36)

Table-8 shows 288(30.76%) of respondents stated satisfied with the available library information resources and 214 (22.86%) of respondents are Fully Satisfied with the availability of library and information services. The remaining 191(20.4%) of respondents are Uncertain, 146(15.59%) of respondents are dissatisfied, and 97(10.36%) of respondents are Highly Dissatisfied.

**Table 9:** Problems while using Library

<b>Problems while using Library</b>	<b>B.A N=209</b>	<b>B.Com N=323</b>	<b>BSc N=404</b>	<b>Total N=936</b>
Lack of prescribed text books	46 (2.47)	54 (2.9)	68 (3.65)	168 (17.94)
Low speed of internet	52 (2.79)	72 (3.86)	102 (5.47)	226 (24.14)
Lack of indexing / abstracting services	32 (1.71)	84 (4.51)	58 (3.11)	174 (18.58)
Lack of computer terminals in digital library	34 (1.82)	46 (2.47)	54 (2.9)	134 (14.31)
Lack of OPAC facility Computerized Catalogue	18 (0.96)	44 (2.36)	70 (3.75)	132 (14.1)
Lack of assistance from the library staff	12 (0.64)	13 (0.69)	16 (0.86)	41 (4.38)
Lack of seating capacity	15 (0.81)	10 (0.53)	36 (1.93)	61 (6.51)

The above table-9 It is evident that majority 226(24.14) of the respondents facing lack of Low speed of internet problem, followed by 174(18.58)Lack of indexing /abstracting services, 168 (17.94)Lack of prescribed text books ,132(14.1)Lack of OPAC facility Computerized Catalogue,134(14.31)Lack of computer terminals in digital library, 61(6.51)Lack of seating capacity ,and the remaining 41(4.38)are Lack of assistance from the library staff .

## Findings

- Majority of the users 519(55.45%) are female respondents and the remaining 417(45.55%) are male. The proportion of the female respondents was much higher than that of the male.
- Majority of the (43.16%) users are BSC students, (34.51%) users are B.Com., students and the remaining (22.32%) users are B.A. students

- A majority of the respondents 346(36.96%) belong to the age group 20-21 years, whereas 306(32.69%) respondents are in the 18-19 years age group.
- Majority of the respondents 450(48.07%) respondents belong to Rural areas.
- Majority of the users 238(25.42) visiting the library twice in a week, followed by 231(24.67) are visiting once in a week.
- Majority of the users 294 (31.41%) of respondents were borrow/return books purpose, followed by 218(23.29%) of respondents purpose of read Newspaper/magazines, Majority
- Majority of 288(30.76%) of respondents stated satisfied with the available library information resources and 214 (22.86%) of respondents are Fully Satisfied with the availability of library and information services.
- Majority of the respondents majority 226(24.14) of the respondents facing lack of Low speed of internet problem, followed by 174(18.58)Lack of indexing /abstracting services

## **Suggestions**

Training the User for necessary digital literacy skills can bring about knowledge in the use of ICT.

Develop IT communication in library, Increase computers with high band width and more computers.

Better to have a digital library, Give training classes to students, Improve facilities of study oriented programs, Must improve IT in library and speed internet

## **Conclusion**

The survey highlighted availability and use of the library information resources and services of the selected degree college libraries in Nellore district, Andhra Pradesh, India and what will be somewhat helpful to the students in communicate realistic education to their present generation for a better tomorrow. In this study majority of library users satisfied on library resources and services of degree college libraries. It provides access to various e-journals, full-text databases, bibliographic databases, etc to the colleges. These resources will provide information in many disciplines for learning, teaching and research in the educational institutions. The following are recommended based on the results of the study.

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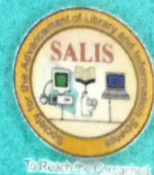
# Transformation of Learning Resource Centres in the Digital Era

## Editors

Dr.A.M.Venkatachalam  
Dr.K.Karunai Raghavan  
Dr.M.Mandhirasalam  
Dr.T.Magudeeswaran



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Society for the Advancement of  
Library and Information Science (SALIS)

**SALIS 2022**

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2022

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Department of Library, K.S.Rangasamy College of Technology (KSRCT)  
&  
Society for the Advancement of Library and Information Science (SALIS)

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# Awareness and Usage of E-Shodhsindhu Consortium by Faculty and Research Scholars of Nagarjuna University: A Study

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## Abstract

The term "virtual library" refers to a library without walls where customers can access any sort of knowledge in electronic format without restriction. A digital library is a great resource for academic communities since it allows them to access electronic journals, databases, and e-books. The e-ShodhSindhu is that the Consortium for educational e-resources merging three consortia, i.e. UGC-INFONET Digital Library Consortium, INDEST-AICTE Consortium and N-LIST in December 2015. The e-ShodhSindhu is supposed to provide current and depository access to E-Resources i.e. e-books, e-journals, e-journal archives, on-line databases to its member establishments at a negotiated rate of subscription. The main purpose of this paper is to find out user awareness and usage of e-ShodhSindhu Consortium by Faculty Members and Research Scholars of AcharyaNagarjuna University (AU), in Andhra Pradesh.

**Keywords:** Virtual Library, e-ShodhSindhu, Digital Library, e-Resources

## Introduction

The significance of the name Acharya Nagarjuna University comes from the fact that it was established by the great Buddhist preceptor and philosopher Acharya Nagarjuna on the banks of the Krishna River many years ago. He turned it into a great centre of learning that drew many teachers and students from all over the world. The University was established by Act 43 of 1976 of the A.P. State Legislature and Governed by Act 4 of 1991 covering 6 Universities in the State.

The present Acharya Nagarjuna University is not very far from the haloed spot, as it derives its moral and intellectual sustenance from Acharya Nagarjuna in which context the University has been renamed Acharya Nagarjuna University through the A.P. Universities (Amendment) Ordinance, 2004, promulgated by the Governor of Andhra Pradesh. The aspirations of the southern coastal districts of Andhra Pradesh to pursue Post-Graduate education nearer their homes resulted in the establishment of Acharya Nagarjuna University.

## Dr.B.R.Ambedkar Memorial Library

The library building's plinth area is roughly 3,000 square feet in total. The Circulation, Periodicals, Reference, Acquisition, Binding, and Technical Sections, in addition to the Administrative and Computers Sections, perform the majority of the library's functions. The Dr. B.R.A.M. Library is open from 8 a.m. to 8 p.m. on all working days and from 8 a.m. to 1 p.m. on the first Saturday and Sunday of each month. For seating and reading purposes, the library mostly uses wooden chairs and tables. Steel book racks that meet specific criteria are utilized for shelving. For the year 2016, a total of Rs. 57,72,079 was spent on 270 publications, including daily newspapers, general magazines, and foreign and Indian periodicals.

### Objectives of the Library

- To inspire and encourage all who would seek knowledge through higher education and research.
- To provide quality instruction and research for the advancement of science and technology.
- To promote teaching and research studies in disciplines of societal relevance.
- To bridge the gap between theory and practice of the principles of higher education.
- To develop the human talent necessary for the industry.

**Table 1: Dr.B.R.Ambedkar Memorial Library Collection**

Sl.No.	ResourceName	Description of Resource/URL	Total
<b>1. Print and Non-Print Resources</b>			
1.1	Books	TextBooks	1,35,796
1.2	ForeignJournals(Print)	AllSubjects	49
1.3	IndianJournals(Print)	AllSubjects	162
1.4	GeneralMagazines	English, Telugu, etc	28
1.5	Newspapers	English, Telugu, etc	15
1.6	BackVolumes	AllSubjects	2766
1.7	CD-ROMs	MagazinesandSubjectRelated	471
<b>2. University subscribed e-Resources</b>			
2.1	E-ShodhSindhu	<a href="http://www.inflibnet.ac.in/ess/eres.php?memID=93">http://www.inflibnet.ac.in/ess/eres.php?memID=93</a>	-
2.2	DELNET	<a href="http://www.delnet.nic.in/">http://www.delnet.nic.in/</a>	-
<b>3. e-Journals subscribed for the year 2021 through E-ShodhSindhu</b>			
3.1	AmericanChemical Society	<a href="https://pubs.acs.org/">https://pubs.acs.org/</a>	51
3.2	AnnualReviews	<a href="https://www.annualreviews.org/">https://www.annualreviews.org/</a>	43
3.3	EconomicandPolitical Weekly	<a href="https://www.epw.in/">https://www.epw.in/</a>	1
3.4	JSTOR	<a href="https://www.jstor.org/">https://www.jstor.org/</a>	3165
3.5	SpringerLink	<a href="https://link.springer.com/">https://link.springer.com/</a>	1725
3.6	Taylor&Francis	<a href="http://www.tandfonline.com/">http://www.tandfonline.com/</a>	1078
<b>4. Databases subscribed for the year 2021 through E-ShodhSindhu</b>			
4.1	WebofScience	<a href="http://webofknowledge.com/">http://webofknowledge.com/</a>	-
4.2	InstituteofStudiesin Industrialdevelopment	<a href="http://isid.org.in/">http://isid.org.in/</a>	-
4.3	J-gatePlus	<a href="https://jgateplus.com/search/">https://jgateplus.com/search/</a>	-

The variables used for this study are broadly divided into two, namely classificatory variables and study variables. The variables are selected by the literature reviewed for the purpose.

- University
- Gender of the respondent
- Age of the respondent
- Academic position of the respondent
- The academic area of the respondent

### Objectives of the Study

The proposed work considered Science and Social Science Research's magnitude in Nagarjuna universities for E-ShodhSindhu effects. Before deciding the research priorities for this study, previous research studies were utilized. An analysis of prior results has been undertaken, and some differences in the past research were identified. Based on the identified variations, the following research objectives are formulated by the researcher:

- To know the users' awareness about E-ShodhSindhu resources available in Nagarjuna university
- To know the usage pattern of the E-ShodhSindhu
- To identify the intent of accessing E-ShodhSindhu electronic resources.
- To evaluate the impact of E-ShodhSindhu electronic resources on the academic community of higher education.
- To find out the strategies adopted by user store cooperate data through E-ShodhSindhu electronic resources.
- To determine the user's challenges and problems while using the E-ShodhSindhu electronic resources.
- To find out the required training programs to improve the usage of E-ShodhSindhu electronic resources.
- To analyse the satisfactory level the users while using E-ShodhSindhu electronic resources
- To study the infrastructural facilities provided by the University Libraries associated with the E-ShodhSindhu electronic resources.

### Population of the Study

The research excludes PG students and administrative employees. This population is not having much awareness and usage of E-Shodh Sindhu. To obtain samples from both classes, the investigator divided the users into two categories based on their academic status and picked preventative sample from each category to perform the analysis. As a result, the following groups have been formed.

**Faculty** – Comprised faculty members from the relevant university departments.

**Research Scholars** – Includes those pursuing Ph.D. and M.Phil. Degrees in university departments

**Table 2: Total Population in the Study Area**

Variables		Status of the Respondents	ANU	% of Total Population
Position of Respondents	Faculty	Professors	28	4.32
		Associate Professors	41	2.34
		Assistant Professors	34	10.65
		Research Scholars	1238	82.69
		<b>Total</b>	<b>1341</b>	<b>100</b>
Gender		Male	863	51.52
		Female	478	48.48
		<b>Total</b>	<b>1341</b>	<b>100</b>
Academic area		Science	686	47.18
		Social Sciences	655	52.82
		<b>Total</b>	<b>1341</b>	<b>100</b>
<b>Grand Total of Population</b>			<b>1341</b>	

From the above table we understood that the total population of ANU is 1341 and faculty are 103 and scholars are 1238.

**Table 3: Distribution of Respondents based on Subject of Study and Universities**

Subject		Acharya Nagarjuna University (ANU)	
Science	N	104	
	%	45.81	
Social Sciences	N	123	
	%	54.19	
Total	N	227	
	%	100.00	

**Table 4: Source of Information the Respondents Generally Consult**

Source of Information		Academic Status		Universities
		Faculty	Research Scholars	ANU
University Library	N	38	153	42
	%	21.71	21.34	18.50
Internet	N	71	308	107
	%	40.57	42.96	47.14
Interaction with Friends / Colleagues	N	31	86	21
	%	17.71	11.99	9.25
Interaction with Teachers	N	25	118	44
	%	14.29	16.46	19.38
Family Members	N	4	36	5
	%	2.29	5.02	2.20
Personal Book Collection	N	6	16	8
	%	3.43	2.23	3.52
Total	N	175	717	227
	%	100	100	100

**Table 5: Availability of Library Consortium Facility based on Academic Status, Subject of Study and University**

Available Library consortium		Academic Status		Subject of Study		University
		Faculty	Research Scholars	Science	Social Sciences	ANU
E-Shodh Sindhu	N	68	322	181	209	158
	%	38.86	44.91	41.14	46.24	69.60
DELNET	N	37	161	96	102	34
	%	21.14	22.45	21.82	22.57	14.98
Any Other	N	70	234	163	141	35
	%	40.00	32.64	37.05	31.19	15.42

**Table 6: Frequency of Visiting E-ShodhSindhu Resources**

Frequency of Visit		Academic Status		Subject of Study		ANU
		Faculty	Research Scholars	Science	Social Sciences	
Daily	N	23	54	53	24	17
	%	13.14	7.53	12.05	5.31	7.05
Once in a week	N	46	27	27	46	20
	%	26.29	3.77	6.14	10.18	8.81
2-3 times in a week	N	43	241	152	132	114
	%	24.57	33.61	34.55	29.20	50.22
2-3 times in a month	N	39	223	106	156	52
	%	22.29	31.10	24.09	34.51	22.91
Occasionally	N	24	172	102	94	24
	%	13.17	23.99	23.18	20.80	10.54

**Table 7: Respondents spending time on E-ShodhSindhu Resources**

Time spent in E-Shodh Sindhu		Academic Status		Subject of Study		SPMU
		Faculty	Research Scholars	Science	Social Sciences	
Less than One hour	N	47	296	188	155	47
	%	26.86	41.28	42.73	34.29	35.61
1-2 hours	N	79	246	142	183	64
	%	45.14	34.31	32.27	40.49	48.48
2-3 hours	N	27	142	85	84	16
	%	15.43	19.80	19.32	18.58	12.12
More than 3 hours	N	22	33	25	30	5
	%	12.57	4.60	5.68	6.64	3.79
Total	N	175	717	440	452	132
	%	100.00	100.00	100.00	100.00	100.00

**Table 8: Usage of E-Journals based on Academic Status of Acharya Nagarjuna University**

Usage of E-Journals		Academic Status											WS	WAM Score	Rank					
		Faculty (N=36)					WS	WAM Score	Rank	Research Scholars (N=192)						WS	WAM Score	Rank		
		1	2	3	4	5				1	2	3							4	5
American Chemical Society	N	9	10	6	5	5	92	2.63	4	22	44	41	61	24	597	3.11	5			
	%	25.71	28.57	17.14	14.29	14.29				11.46	22.92	21.35	31.77	12.50						
Annual Reviews	N	17	5	7	3	3	75	2.14	6	42	10	26	65	49	645	3.36	3			
	%	48.57	14.29	20.00	8.57	8.57				21.88	5.21	13.54	33.85	25.52						
Economic and Political Weekly	N	10	12	4	3	6	88	2.51	5	21	16	69	30	56	660	3.44	1			
	%	28.57	34.29	11.43	8.57	17.14				10.94	8.33	35.94	15.63	29.17						
JSTOR	N	7	6	6	7	9	110	3.14	1	35	24	22	61	50	643	3.35	4			
	%	20.00	17.14	17.14	20.00	25.71				18.23	12.50	11.46	31.77	26.04						
Springer Link	N	7	6	11	4	7	103	2.94	2	48	18	47	43	36	577	3.01	6			
	%	20.00	17.14	31.43	11.43	20.00				25.00	9.38	24.48	22.40	18.75						
Taylor and Francis	N	10	6	6	4	9	101	2.89	3	20	31	31	74	36	651	3.39	2			
	%	28.57	17.14	17.14	11.43	25.71				10.42	16.15	16.15	38.54	18.75						

Table depicts the usage of E-Journals from E-ShodhSindhu by the Faculty and Research Scholars of Acharya Nagarjuna University. Based on the weighted arithmetic mean the purposes are ranked.

### **Major Findings**

It is evident from the table that all the faculty members have completely preferred and gave first rank for JSTOR followed by Springer Link (2<sup>nd</sup> rank), Taylor and Francis (3<sup>rd</sup> rank), American Chemical Society (4<sup>th</sup> rank), Economic and Political Weekly (5<sup>th</sup> rank) and Annual Reviews (6<sup>th</sup> rank). That means majority of the faculty preferred the usage of E-Journal 'JSTOR'.

The table analyses that all Research scholars have completely preferred and gave first rank to Economic and Political Weekly followed by Taylor and Francis (2<sup>nd</sup> rank), Annual Reviews (3<sup>rd</sup> rank), JSTOR (4<sup>th</sup> rank), American Chemical Society (5<sup>th</sup> rank) and Springer Link (6<sup>th</sup> rank). This means that majority of the research scholars from Acharya Nagarjuna University preferred the usage of E-Journal 'Economic and Political Weekly'.

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