International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 06 | June 2021 www.irjet.net p-ISSN: 2395-0072

Medi-Insight: A Smart Health Prediction System

Yashaswi G Sagar[1], Sahana Gajanana Acharya[2], Vishal S Chincholi[3], Riyal Vivek A[4], Swetha P M[5]

[1-4]*Student, Bachelor of Engineering in Computer Science, JSS Science and Technology University, Mysore, India*
[5]*Assistant Professor, Computer Science and Engineering, JSS Science and Technology University, Mysore, India*

Abstract - *Machine learning is a powerful technique which can increase the efficiency and accuracy in disease prediction. In current scenario there is a need for efficient machine learning models that can be used in healthcare system to predict the specific diseases by monitoring the patient's symptoms over a period. But there exist very few studies pertaining to algorithms that can be used to predict a general set of diseases, not restricted to one field of medicine. Also, rise in the field of machine learning technology is widely used in various fields. Now it has various applications in the field of health industry. It works as a helping hand in the field of healthcare by analyzing the healthcare records and patient data. The aim of this study is to produce an effective application of machine learning algorithm for health prediction that can eventually shape a suitable health prediction system for patients. This project hopes to implement a system which not only predicts the disease but also provides the suitable methodologies to cure them and give information regarding those methodologies and the doctors who can treat that disease. So we are implementing Medi-Insight: A smart health prediction system with the help of Naive Bayes algorithm for disease prediction which helps to make the better medical decisions and also for rise in the accuracy. As accurate analysis of the prediction of disease helps in the patient care and the society services. Disease prediction can be easier with the help of various tools, algorithms and framework provided by the machine learning. Thus this study proposes a framework that enables clients to get suitable direction on their medical problems through a smart health prediction system*.

***Key Words*: Machine learning, Naive Bayes algorithm, Disease Prediction, Symptoms, Health Industry**

1. INTRODUCTION

Health is one of the most important assets of our life which directly reflects in any form of progress or development. At present, when a person suffers from a disease, then that person has to visit the doctor which is time consuming and costly too. It might also happen that someone needs doctor's supervision immediately but they are not available due to some reason or sometimes it happens that patients cannot find the correct doctor for the treatment. Many medical complications stem from the misdiagnosis or delayed diagnosis of a medical condition, illness, or injury. When a doctor's diagnosis error or delay in diagnosis leads to incorrect treatment, delayed treatment, or no treatment at all, a patient's condition can be made much worse, and they may even die. This signifies the severity and influence of the point at issue, the point being why using machine learning algorithms are critical to making sure misdiagnosis is reduced. Also the patients are not aware of the various methods of treatment available and their effectiveness. Due to the problem in the difficulty of identifying a disease until its later stages, both patients and medical service providers are facing inappropriate activities and operations daily that leads to a decrease in efficiency of identifying the disease.

This project proposes a solution for identifying diseases based on symptoms Information technologies are being increasingly implemented in healthcare organizations. A system that can predict a person's lifetime diseases will be able to warn the person to have early medical services or to manage and prevent exceptional situations in life. It will help to reduce the number of patients with long term diseases and also helps patients to save their time and money. It will stop unexpected diseases from growing up the level of disease without medical services needed in the early stages. Also, when people identify their future diseases as a warning to prepare for a solution for the disease, they can prepare for treatments or applying insurance for the disease identified. Also providing guidance regarding the various methodologies of treatment helps the patients in many ways. Instead of diagnosis, if a disease prediction is implemented using certain machine learning algorithms, then medical care can be made smart. Few cases may occur when an early diagnosis of a disease is not within reach. That's where the Smart Health Prediction steps in and is of first hand help to diagnose a patient and suggest health remedies. Hence implementing an application that can eventually shape a suitable health prediction system can provide instant guidance to patients and be helpful in preventing diseases to get into later stages. The timely analysis of data and gaining accuracy in disease prediction can save many lives.

2. LITERATURE SURVEY

Health is the most vital thing in our lives. At times, people need doctor's supervision immediately but they are not available on spot due to some reason. To deal with this issue, we came up with Smart Health Prediction application that provides patients with a better way to deal with such scenarios. Developing a model that can predict diseases based on patient symptoms and provide information about various methodologies of treatment is helpful in getting quick and proper medical amenities. Several researches have been conducted on disease prediction using machine learning.

The author "Keshan Fernando" proposed a system for Disease Prediction Using Machine Learning in which he describes the difficulty of people in terms of finances for medicine. He comes up with a model that can predict a person's lifetime diseases and also will be able to warn the person to have early medical services or to manage and prevent exceptional situations in life.[1]

The author "Akash C. Jamgade and Prof. S. D. Zade" proposed a model for Disease Prediction Using Machine Learning. This paper mainly focuses on the development of a system which would incorporate the symptoms collected from multisensory devices and other medical data and store them into a healthcare dataset. This dataset would then be analyzed using K-mean machine learning algorithms to deliver results with maximum accuracy.[2]

The authors "Ambiga R. Hariraman S and Anantharaj B" developed an expert system called Smart Health Prediction system, which is used to overcome the drawback of the existing system and simplify the task of doctors. The system checks a patient at the initial level and suggests the possible diseases. It starts with asking about symptoms to the patient, if the system can identify the appropriate disease then it suggests a doctor available to the patient in the nearest possible area.If the system is not sure, it asks some queries to the patients, still, if the system is not sure then it will display some tests to the patient.[3]

The authors "Pinky Saikia Dutta, Shrabani Medhi, Sunayana Dutta, Tridisha Das and Sweety Buragohain" proposed a data mining application in the healthcare system to develop an automated tool for identifying and disseminating relevant healthcare information. They presented a web-based application for predicting diseases based on user input symptoms. It predicts probable diseases by mining data sets and provides remedial solutions for effective treatment. [4]

The authors "Prof. Krishna Kumar Tripathi, Shubham Jawadwar, Siddhesh Murudkar and Prince Mishra" proposed a model which makes use of Artificial Intelligence, machine learning and database management techniques to extract new patterns from large data sets and the knowledge associated with these patterns. By using this technique data can be extracted automatically or semi-automatically. The different parameters included in data mining are clustering, forecasting, path analysis and predictive analysis.[5]

The authors "G.Pooja reddy, M.Trinath Basu, K.Vasanthi, K.Bala Sita Ramireddy and Ravi Kumar Tenali" presented the techniques and applications of data mining in medicinal and instructive parts of Clinical Predictions. The main aim of this paper is to assess the techniques of data processing in the fields of clinical and health care to develop correct choices.[6]

3. METHODOLOGY

Medi-insight is a smart health prediction application, which predicts the disease based on input symptoms and also provides instant guidance to patients. At present, when a person suffers from a disease, then that person has to visit the doctor which is time consuming and costly too. This is a replacement product which lowers the need of general physician by predicting the disease based on symptoms. It also renders the available methods of cure like Homeopathy, Allopathy and Ayurveda along with their side effects and effectiveness in curing that particular disease. A successful implementation of this user interface will above all provide faster guidance to the patients in case of emergencies and helps them to choose the best form of medicine considering all the available options.

3.1 Dataset

The dataset is made up of various symptoms and the corresponding diseases. This dataset includes 133 total columns, 132 of them being symptoms experienced by patients and the last column contains the disease for those symptoms. It consists of 41 different diseases.

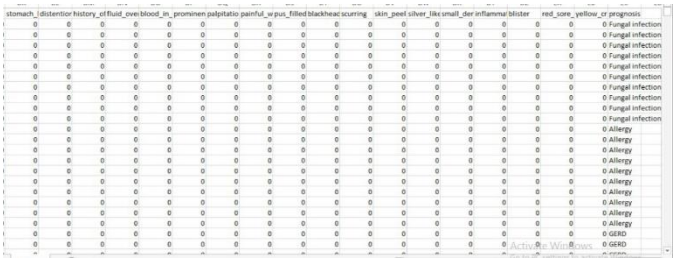

Fig -1: Dataset

3.2 Proposed System

The proposed system is designed to overcome the existing system's flaws and provide instance guidance to patients. The pandemic situation has led to the shortage of doctors. Also there are numerous other situations like late night emergencies, curfews, etc. Also many forms of medicine are not considered by patients due to lack of knowledge about them. The main objective of our application is to provide timely guidance to patients in such situations and help them in availing the best possible treatment.

In our system the diseases are predicted automatically by the system using our model which is trained on the medical dataset. This system also shows the confidence score of the prediction. After getting the anticipated disease, the system will list the various methods of treatment available for the disease. It also suggests the doctors associated with that disease.

The disease prediction system has 3 users such as doctor, patient and admin. Each user of the system is authenticated by the system. The system allows the patient to give symptoms and according to those symptoms the system will predict a disease with an accuracy score. Then it lists the methods of treatment available for that particular disease along with its effectiveness, side effects, etc. It also suggests doctors treating that disease and provide an option to consult the doctor. Then the patient can consult a doctor anytime at his convenience.

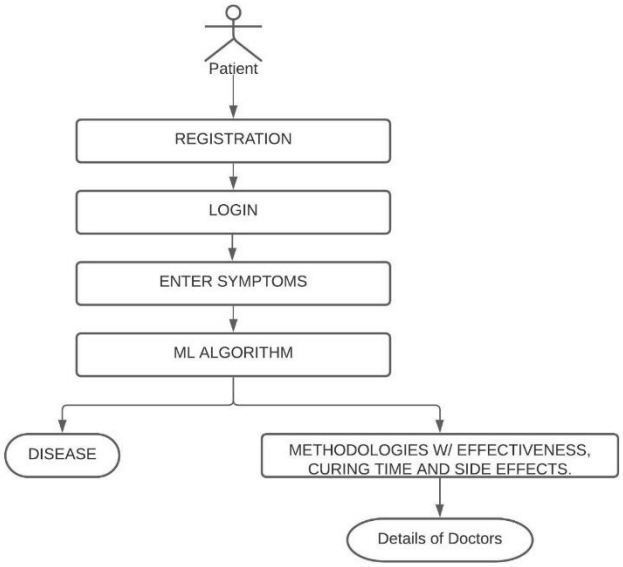

Fig -2: Flow diagram of MEDI-INSIGHT

3.3 Algorithm:

Naive Bayes classifiers are a collection of classification algorithms based on Bayes' Theorem. It is not a single algorithm but a family of algorithms where all of them share a common principle, i.e. every pair of features being classified is independent of each other.

We have used Multinomial Naive Bayes, a variant of Naive Bayes algorithm to implement our disease prediction model. Multinomial naive Bayes assumes to have feature vector where each element represents the number of times it appears (or, very often, its frequency). This technique is very efficient in natural language processing or whenever the samples are composed starting from a common dictionary.

If the feature vectors have n elements and each of them can assume k different values with probability pk, then:

$$P(X_1 = x_1 \cap X_2 = x_2 \cap \ldots \cap X_k = x_k) = \frac{n!}{\prod_i x_i!} \prod_i {p_i}^{x_i}$$

The conditional probabilities P(xi—y) are computed with a frequency count (which corresponds to applying a maximum likelihood approach), but in this case, it's important to consider the alpha parameter (called Laplace smoothing factor) which default value is 1.0 and prevents the model from setting null probabilities when the frequency is zero. It's possible to assign all non-negative values, however, larger values will assign higher probabilities to the missing features and this choice could alter the stability of the model.

3.4 Architecture

Medi-insight predicts the disease based on the input symptoms given by the user. It also renders the available methods of cure like Homeopathy, Allopathy and Ayurveda along with their side effects and effectiveness in curing that particular disease. It provides the patients an option to consult the doctor who can cure the disease.

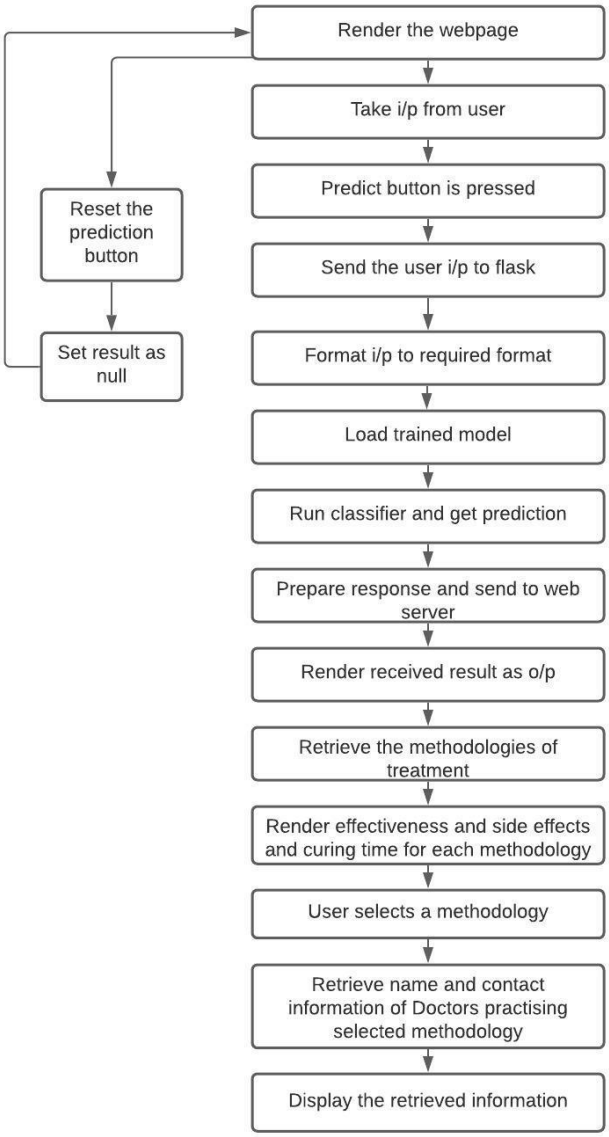

Fig -3: Architecture diagram of MEDI-INSIGHT

4. RESULT ANALYSIS

4.1 Registration and Authentication:

As Medi-Insight is a health prediction application, it is necessary to make sure that the user's personal data is kept confidential. So in order to access this website, the users must have registered with our website providing all the necessary information such as Name, age, gender, etc. The users must set a password of at least six characters

while registering. Our system has two classes of users, Doctors and patients. The patients can register by providing their personal information. The doctors, in addition to the necessary information mentioned above must also provide their field of specialization.

Fig -4: Doctor's Registration

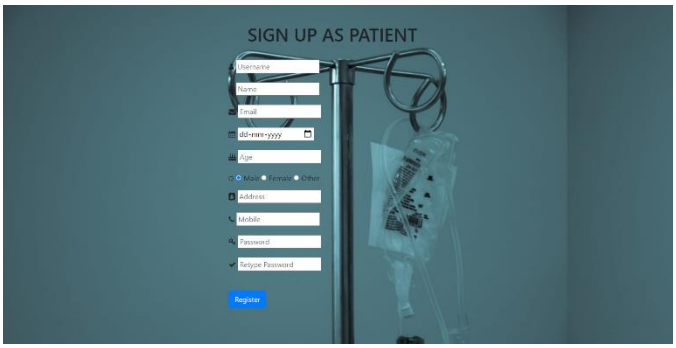

Fig -5: Patient's Registration

4.2 Login:

The registered users can login to our website using their Usernames and Passwords. Only authenticated users will be allowed to access the website. The user who has registered as patient can only login as patient and not as doctor and vice-versa.

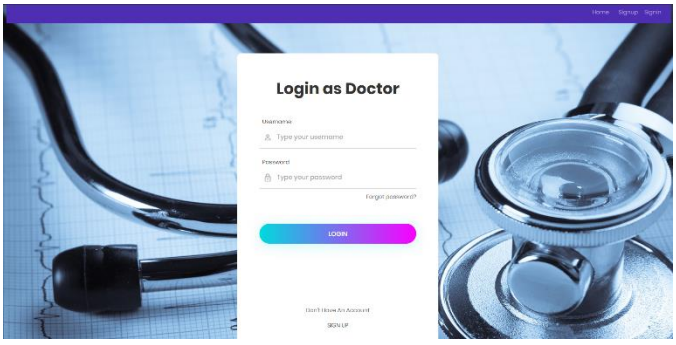

Fig -6: Login-Doctor

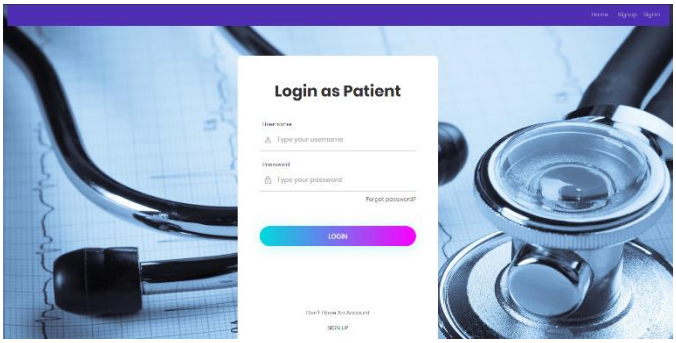

Fig -7: Login-Patient

4.3 User Profiles:

Once the patient gets logged in, the User Interface looks as follows.

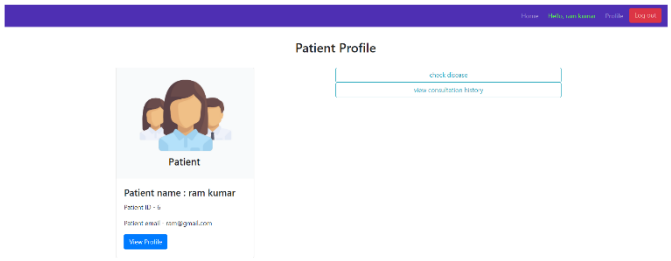

Fig -8: Patient's profile

Once the doctor gets logged in, the User Interface looks as follows.

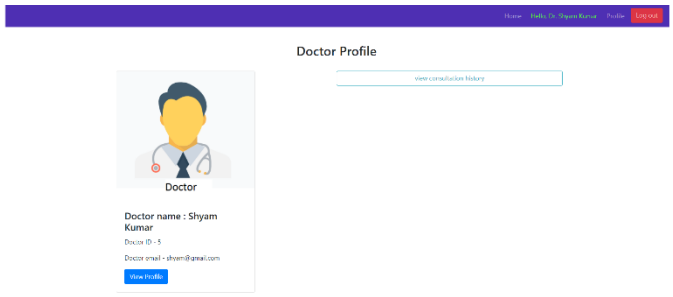

Fig -9: Doctor's profile

4.4 Disease Prediction:

The patient can select the symptoms from the given list. Based on the symptoms the algorithm predicts the disease and displays it along with the confidence score.

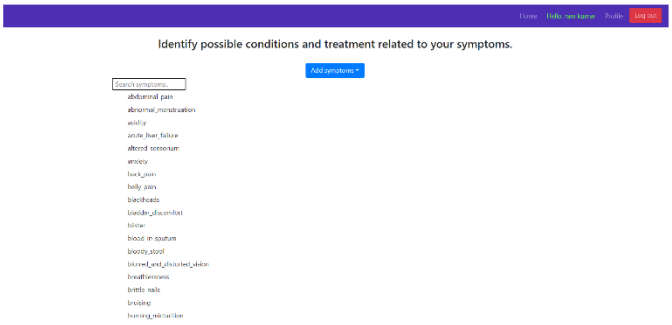

Fig -10: Disease prediction

The set of symptoms given were
1) Cold hands and feet
2) Continuous Sneezing
3) Shivering

Two of the given symptoms corresponded to the disease Allergy and the disease predicted was Allergy with a confidence score of 100%.

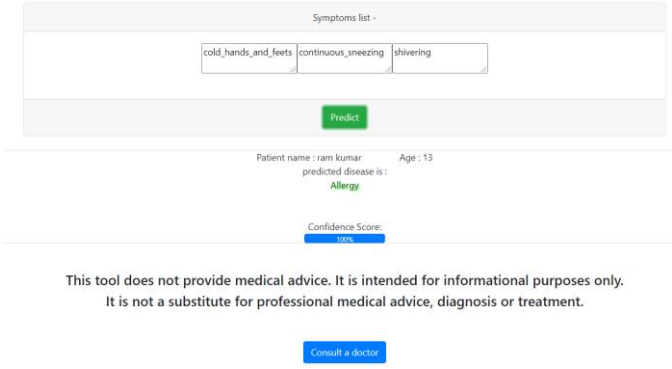

Fig -11: Disease prediction

4.5 Consultation:

Once the disease is predicted the patients are provided with a list of doctors who can treat that disease. The patients can choose one of the Doctors and consult them through the chat window provided.

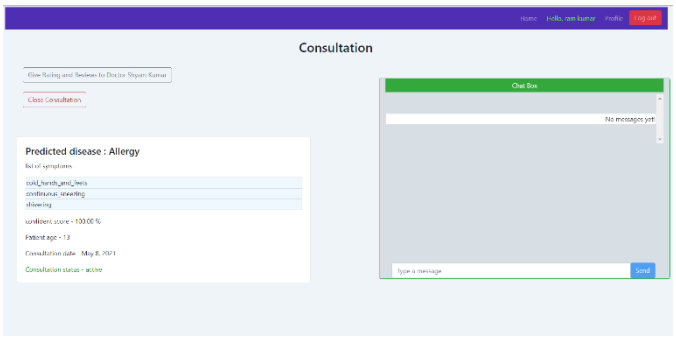

Fig -12: Consultation

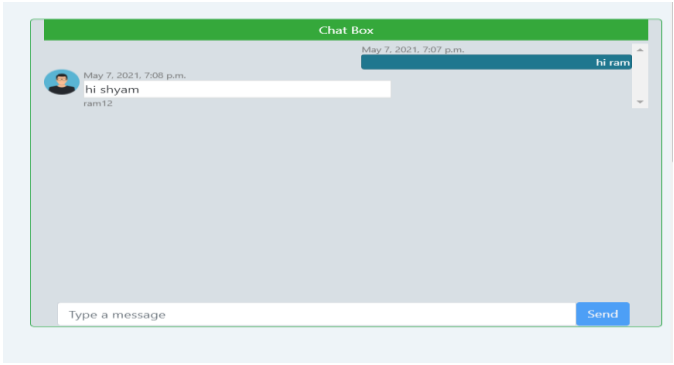

Fig -13: Chat with doctor

Both the patients and doctors can also check the consultation history.

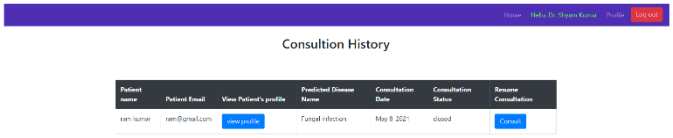

Fig -14: Patient's consultation history

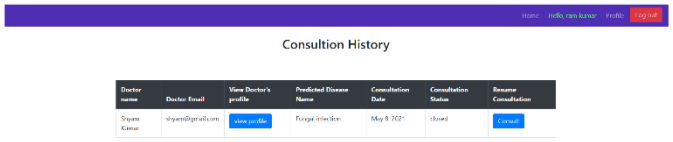

Fig -15: Doctor's consultation history

4.5 Methodologies of treatment:

Once the disease is predicted the Method button can be clicked which displays different methods of treatment available for the predicted disease along with their respective effectiveness, number of days required to cure and side effects if any.

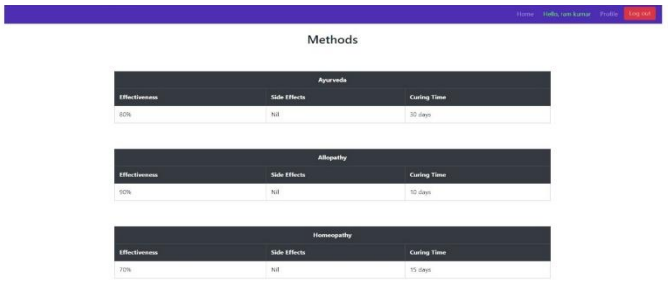

Fig -16: Information about methodologies of treatment

5. CONCLUSIONS

The project addresses the topic of disease prediction using symptoms and providing instance guidance to patients. In the process of implementing the project, the several steps needed to materialize it into an application are realized methodically. The project is designed in such a way that the system takes symptoms from the user as input and predicts disease as an output. Also our system displays the various methodologies available for treating the disease, along with the effectiveness, side effects if any, and number of days required to cure the disease for each methodology. Because of our system, Patients won't have to wait for Doctors appointments, due to our system patients save their money and time. After getting the anticipated disease and information regarding methodologies, the system will suggest doctors associated with that disease and therefore the patient can consult the doctor online.

The proposed system acts as a decision support system and will prove to be an aid for the physicians with the diagnosis. It helps the patients to get immediate help in case of emergencies.

ACKNOWLEDGEMENT

An endeavour is successful only when it is carried out under proper guidance and blessings. So, we would like to express our gratitude to people who helped us in carrying this work by lending invaluable assistance and support. We hereby extend our special thanks to Dr. S. B. Kivade, Honourable Principal of JSS STU, Mysuru, and Dr. M. P. Pushpalatha, Professor and Head, Department of Computer Science and Engineering, JSS STU, Mysuru who gave us a platform to showcase our work. It is our foremost duty to thank our guide Prof. Swetha P M, Assistant Professor, Department of Computer Science and Engineering, for her constant encouragement, effective guidance and valuable suggestions. We also extend our gratitude to all the teaching and non-teaching staff of the Department of Computer Science and Engineering who are helping us during the course of project.

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