A proposed approach for personalized health assistance

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Abstract—**The advent of state-of-the-art smartphones has made great significant improvements in health tracking and ailment detecting mobile applications. With our busy schedule, regular check-up in a hospital is strenuous and also in current scenarios it is non-viable. Our application's purpose is to keep track of the user's physical as well as mental conditions which will be recorded regularly and will be modified in real-time based on the user's responses. All users are permitted to add their trustworthy verified family doctor. The user's health report will be generated based on the regular responses to the questions asked by the application and according to the user's Body Mass Index. These questions will be specific and well defined to analyze a person's physical health (factors like blood pressure, sugar level, comorbidities, flu and cold symptoms) and a person's mental health (factors like emotional, psychological, and social well-being). Based on this report, a patient that can have severe symptoms for a particular disease (influenza, COVID-19, stress etc) his/her family doctor will be notified. The doctor gets access to the patient's entire previous report and will proceed accordingly. The app will also be recommending general health improvement tips(yoga) and medication reminders will be given. In case of an emergency, the patient can immediately notify their family doctor. The patient's treatment expenditures will be recorded. This app will be able to efficiently assist the user to manage his/her health.**

Keywords—mHealth, healthcare, health monitoring system, symptom analysis, Covid-19, Influenza H1N1, Influenza H3N2, stress management, Artificial Intelligence, Machine Learning, Machine Learning Classifier.

I. INTRODUCTION

Health defines the ability of the body to function well. Being healthy not only includes our physicality but also concerns emotional, mental and social health. Mobile health is an emerging field nowadays. The reason behind the development of such systems is the very busy life of the people and very less time is given to health. Sometimes due to hectic schedule and mental stress, a person requires physical as well as mental support which are provided by mHealth applications.

Due to COVID-19, patients have isolated themselves, which led to massive decrease in outpatient visits. Doctors recommend regular health check-ups to keep track of one's health. Regular health check-up is needed to ensure one is getting screened for diseases and identify problems at an early stage. However, due to our busy schedule and also due to current scenarios regular health check-up is non-viable.

Various studies have shown that there is an increase in the amount of research of AI related healthcare systems in the past few years. In the era of pandemic(Covid-19), mhealth apps are used on a large scale by multiple nations for disease diagnosis. These apps can priorly inform you about the chances of being affected by the disease. The key objective is to design a smartphone-based health monitoring system that track's a patient's physical health as well as psychological state in real-time, regardless of their health status. The main aim is to bridge the gap between doctor & patient. The objectives of the project includes:

1. Provide assistance to the doctor.
2. Connect the doctor and patient.
3. Monitor and improve the health of the patient.

This project is for the development of a health monitoring Android-based application for patients. The scope of the project includes:

1. Separate interface for the doctor and the patient.
2. The doctor can accept/reject a patient's connection request.
3. View the patient's report and assessment history.
4. Schedule an appointment with the patient.
5. Take health assessments to analyze whether the patient is suffering from Covid-19, Influenza(H1N1 & H3N2) and stress.
6. View health report and assessment history.
7. View/edit health profile.
8. Set medication reminders.
9. Send an emergency notification to the family doctor.

10. Request an appointment with the doctor.

11. Save health expenditure details for future reference.

12. Send a connection request to the family doctor.

13. Recommend yoga asanas.

II. LITERATURE REVIEWS

As we aim to create a personalized health assistance system because circumstances now are way distinct from preceding years due to COVID-19 situation, everything is getting digitised and many states and cities are still under lockdown, so our motive is to bridge the gap between doctors and patients through this app. To aid our purpose in the survey we reviewed multiple applications and research papers, among all we have narrowed down to these five research papers mentioned below out of which first three papers are our base papers.

1. A Smartphone based Application to Improve the Health Care System of Bangladesh.-(2016)

The application they have built is an Online cabin booking system which includes suggestions of hospitals based on cost and quality and information about facilities of hospitals and their locations. Assistance to the user to make an emergency call for an ambulance or health care service and it also has an alert system to take medicines in a fixed time. The system also offers the users with a novel option to make an appointment with a doctor of his locality. A user can search for a doctor by mentioning his urgency. After finding a doctor, he can make an appointment with the doctor. The application will provide him the location of the chamber of the doctor.

2. Digital Medicine: An android based application for health care system.-(2017)

The proposed application is deployed on android based mobile phones connecting to the server managed by healthcare professionals and uses GPS and GSM network for communication.The system provides an emergency alarm,appointment scheduling with the doctor and further communication of doctor and patient, a secure channel for transferring medical reports between patients and doctors.The system provides the facility of online prescription for giving an urgent medication to the patients. The application is also able to give the information of nearest hospitals to the patients.

3. A Design of Mobile Health for Android Applications - (2014)

The system takes user details such as height,weight,gender,etc and by using this calculates BMI(Body Mass Index).On the basis of indices of BMI exercise recommendation is done and also application provides food tips and recommendation for different categories of people who are underweight,overweight or obese. Application also generates a dairy report and makes it more informative by representing it in Pie-charts so that

users can understand its health information very much easily.

4.Predicting influenza-like symptoms using human mobility behaviors.-(2017)

This application understands and models people's mobility behaviours for predicting flu and flu-like diseases (fever,cough, shortness of breath, headache, muscle pain, malaise, sore throat and cold). System traces behavioural patterns of a person using different sources of information on social media sites and on the smartphone. System also detects happiness and emotional levels, stress levels and predicts physical health conditions of the person by asking certain kinds of questions, tracing mobile activities and GPRS locations.

5. Android-Based Health Care Management System.-(2016)

Application is integrated with different modules for targeting and detecting heart rate, calorie level, blood volume and diabetes. Report is generated in each module based on users input and answers given to daily questionnaires, input data and figure gets compared with a fit person's health report and generates results for the users by using different AI algorithms. Users receive a health report on a weekly and monthly basis and the system notify the user if it detects any symptoms and release and alter if anything severe. Application also assists users to track down their diet, weight and calorie burn with the purpose to help them in maintaining and constantly improving their health.

III. IMPLEMENTED SYSTEM

The proposed system architecture contains the advantages of the existing system and eliminates the disadvantages of it. The new modules introduced to overcome the disadvantages of the existing system are:

1. Doctor's Interface

2. Treatment Expenditure Record

3. Symptom Analysis

The proposed system will assist the doctor to have fruitful communications with the patient and not replace the doctor. The system consists of two interfaces, one for the patient and other for the doctor.
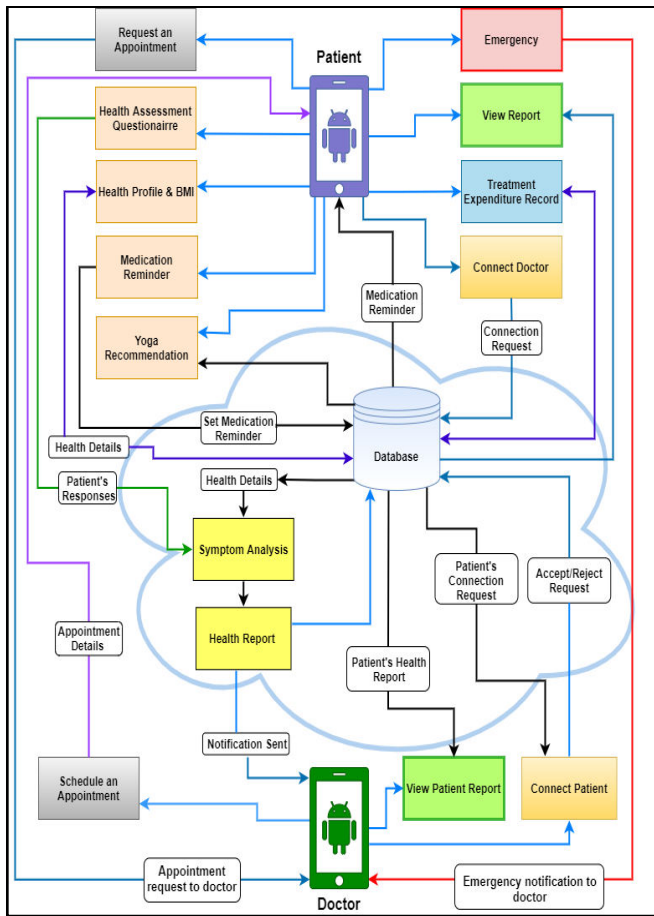
Fig. 1: Implemented System Architecture

Patient's interface:-

● *Health Profile & BMI*:- This module will provide an interface to the patient to view and edit health details(Height, Weight, Blood Pressure, Blood Sugar, etc). On the basis of health details, BMI(Body Mass Index) will be calculated for the patient. The patient can also set medication reminders in this module.

● *Treatment Expenditure Record*:- In the existing system, previous medical expenses could not be tracked. So, this module is included to keep a track of a patient's previous health expenditure.

● *Health Assessment Questionnaire*:- There will be some sets of questions for identification of specific diseases(Influenza, Covid19, etc) and stress.

● *Symptom Analysis*: The responses of the assessment as well as the health details of the patient will be sent to this module stored on cloud. The input will then be analyzed using Classification algorithms(SVM, Naive Bayes,Neural Network,etc).

● *Health Report*:- Based on the results of the Symptom Analysis module a report will be generated and the doctor will be notified.

● *Yoga Recommendation*:- Yoga asanas will be recommended based on the current health of the patient for health improvement.
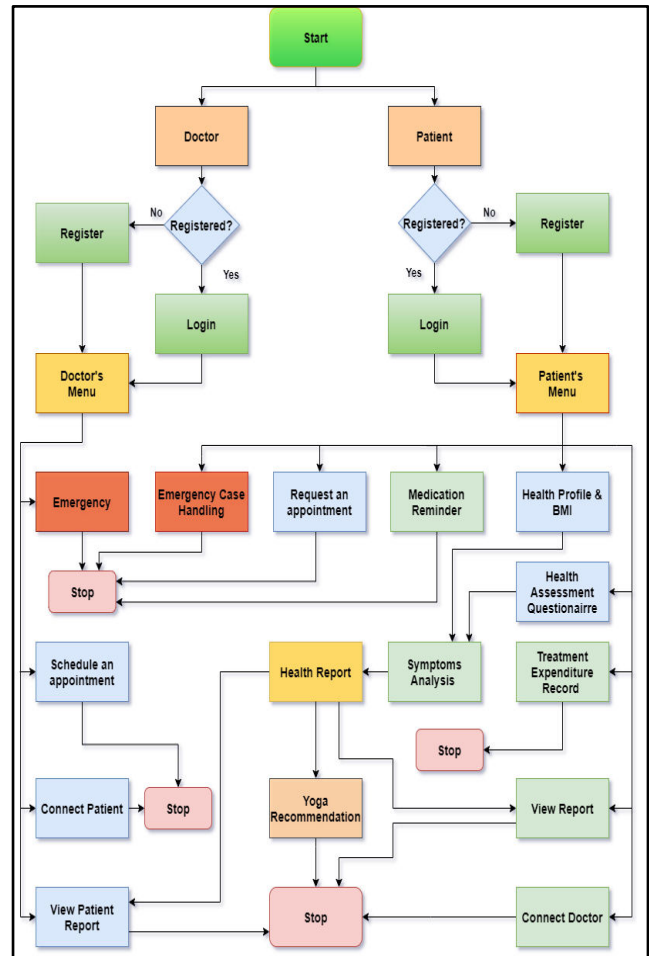

Fig. 2: Implemented System Flowchart

● *View Report*:- Patients can view their health report and assessment history.

● *Emergency*:- In case of emergency, the doctor will be sent an email and an sms.

● *Request an appointment*:- An email will be sent to the doctor about the patient's appointment request.

● *Connect Doctor*:- A connection request will be sent to the doctor.

Doctor's Interface:- As no doctor was participating actively in the system, the system is unreliable. To overcome this, the proposed system has a separate interface for the doctor.

● *View Patient Report*:- View the patient's health report and assessment history

● *Connect Patient*:- Accept/reject a patient's connection request.

● *Schedule an Appointment*:- Handle patient's appointment request or initiate an appointment without the patient's request.

IV. EXPERIMENTAL RESULTS

A. Standard Datasets Used

The proposed system uses classification algorithms for three different ailments i.e. Influenza(H1N1 & H3N2), Covid-19 and Stress. Three datasets were used and were taken from multiple sources. The Influenza dataset was taken from the Influenza Research Database(IRD) and it consists of human clinical data from across the world. The Covid-19 dataset was obtained from Kaggle and was made based on WHO guidelines containing the possible symptoms of Covid-19. The Stress dataset was obtained from Data World which was created by a research group. This group analyzed various input features provided by domain expertise.

Table 1:Standard Datasets Used

Dataset	Source	No. of Training Examples	No. of Features	No. of Output Variables	Type
Influenza	Influenza Research Database	1,306	11	3	Excel Sheet
Covid-19	Kaggle	5,434	17	2	Excel Sheet
Stress	Data World	16,384	7	4	Excel Sheet

B. Performance Evaluation

In order to select the best algorithm and evaluate the proposed system algorithms such as Support Vector Machines, Random Forest, Decision Trees, Naive Baye and Artificial Neural Networks were evaluated using Accuracy, Precision, Recall, F1-Score on the test set and the algorithm with the best performance was selected. The results of the analysis are given below:

Table 2:Result analysis of the three Datasets

Algorithm	Class	Precision	Recall	F1 Score	Accuracy
Influenza Dataset: Random Forest	No Influenza	0.98	0.98	0.98	80
	Influenza H1N1	0.75	0.76	0.76	
	Influenza H3N2	0.67	0.65	0.66	
Covid-19 Dataset:	Covid-19 Negative	0.94	0.98	0.96	98
Artificial Neural Networks	Covid-19 Positive	0.99	0.98	0.99	
Stress Dataset: Support Vector Machine	No Stress	1.00	0.40	0.57	96
	Mild Stress	0.98	1.00	0.99	
	Moderate Stress	0.95	1.00	0.97	
	Severe Stress	1.00	0.42	0.59	

C. Screenshots
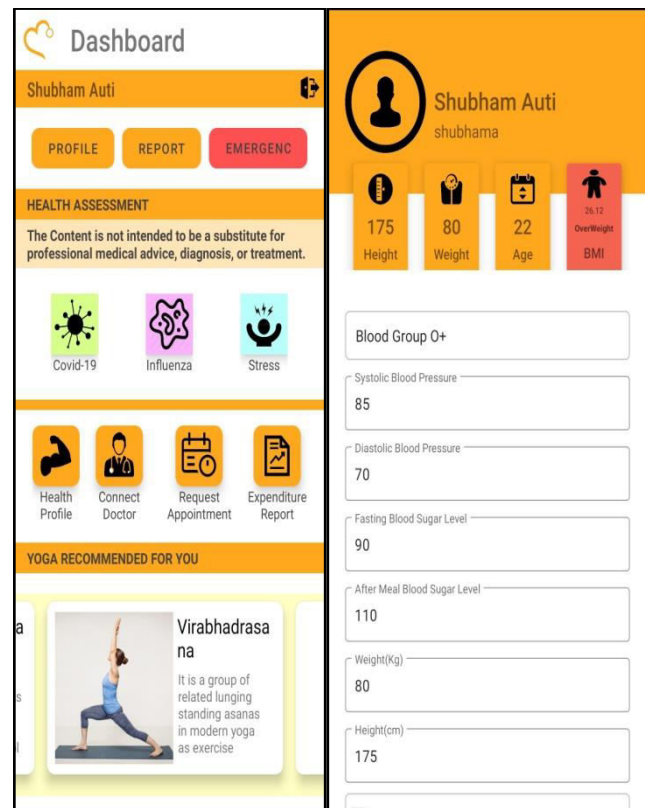
Fig. 3:Patient's Dashboard and Health Profile

Fig. 4:Covid-19 and Influenza Assessment

Fig. 5:Stress Assessment and Health Report

Fig. 6:Medication Reminder and Patient connecting with Doctor

Fig. 7:Doctor's Dashboard and Doctor connecting with Patient

V. CONCLUSION AND FUTURE SCOPE

In this paper, we commenced with the introduction of the domain by explaining its fundamental terms, a brief introduction to our system and its objectives. We got an opportunity to look closely into the problem that people are facing in the current environment. We analysed all existing architectures of our base papers and by understanding their working we have discovered some flaws in the currently existing system. We have kept all the prime features of existing systems and tried to eliminate their disadvantages by implementing new modules such as doctor's interface, symptom analysis and yoga recommendation in the proposed system. The classification algorithms used in the project are explained. Standard statistics of the dataset and the screen shots of the project are given. Different

evaluation parameters like precision, recall, f1 score and accuracy are mentioned. The algorithms were evaluated based on the evaluation parameters and then the algorithms were chosen. We are truly aware of the problems that all are facing in general and we are determined to provide them the optimum solution.

The future scope of our project includes:-

1. Automation of Doctor's Verification: As verification of doctor currently happens through the admin by manually verifying doctor's registration number approved by the NATIONAL MEDICAL COMMISION (NMI). So for implementing it on a larger scale, we can associate with NMI and hence system automated direct verification can be done through NMI Records.

2. Enhancement in Health Assessment Module: As of now Health Assessment Module provides the symptoms analysis for Covid-19, Influenza and Stress. With more resources we can implement symptom analysis for multiple other diseases.

3. Updation in Yoga Recommendation: Based on the patient's BMI and health reports different Yoga Asanas are recommended to them from a fixed data repository of Yogas, this data can get updated in real time with the innovations in Yoga around the world and new Yoga Asanas may also be recommended to the patient.

4. Payment Gateway Implementation: In the Treatment Expenditure Module a Payment Gateway can be integrated in order to transfer Doctor's fee for the appointment directly through the App and for the bill payment for medical expenses.

5. Storing lab reports: For the future reference of the doctor and the patient, the laboratory generated reports can be stored in the Health Profile module. Storing lab reports online will act as a backup if the hardcopy of the lab report is damaged. With the help of lab reports available online, the doctor can easily check in the patient's profile whether there is improvement in the health of the patient.

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REFERENCES

[1] Ahmed Imteaj and Muhammad Kamrul Hossain, "A Smartphone based Application to Improve the Health Care System of Bangladesh", IEEE, 2016.
https://ieeexplore.ieee.org/document/7835358

[2] Prof.D.V.Chandran , Sayali Adarkar , Apurva Joshi, Preeti Kajbaje, "Digital Medicine: An android based application for health care system", International Research Journal of Engineering and Technology (IRJET), 2017.
https://www.irjet.net/archives/V4/i4/IRJET-V4I4584.pdf

[3] Dr. Vuda Sreenivasa Rao & Dr. T. Murali Krishna, "A Design of Mobile Health for Android Applications", American Journal of Engineering Research (AJER), 2014.
http://www.ajer.org/papers/v3(6)/D0362029.pdf

[4] Gianni Barlacchi, Christos Perentis, Abhinav Mehrotra, Mirco Musolesi & Bruno Lepri, "Predicting influenza-like symptoms using human mobility behaviors", EPJ Data Science Journal, 2017.
https://epjdatascience.springeropen.com/articles/10.1140/epjds/s13688-017-0124-6

[5] Anam Habib Ammara & Fazal Masud Kundi, "Android-Based Health Care Management System", ICIT, 2016.
https://www.researchgate.net/publication/306379073_Android-Based_Health_Care_Management_System

[6] Stress Analysis
https://data.world/dataorg1/stress-analysis

[7] Influenza Research Database
https://www.fludb.org/brc/staticContent.spg?decorator=influenza&type=FluInfo&subtype=Mission

[8] Symptoms and COVID Presence
https://www.kaggle.com/hemanthhari/symptoms-and-covid-presence