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Smart Medi Friend: An Automated Healthcare System, Implementation and Results

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Abstract*: In the current era, one of the greatest concerns in healthcare is global aging and prevalence of chronic diseases A smart medi-friend is an all-inclusive healthcare application consisting android devices, cloud server and medi-box(NFC). This system works as an assistance application for healthcare and also as a medicine remainder, eliminating the possibility of taking wrong medicine. One of the five main modules, Admin, will manage doctors' and patients' info stored in database through server. Doctors will be able to give prescription, update prescription and timing, view report and history of patient from patient list. Patients will be able to identify medicines using NFCs, upload reports and view latest prescription. Patient's app will generate an alert according to the medicine time uploaded by the doctor. ANN algorithm will predict the highest probable disease when symptoms are given as input. This project will reduce the burden on hospital resources, save time and money of patients and will act as a perfect assistance tool in healthcare services.

***Index Terms*: NFC, ANN, JDBC, J2SE.**

I. INTRODUCTION

In-home health-care service is a need of today's healthcare industry. Lots of resources get wasted because of lack of digitalization. It has a great business potential but a comprehensive platform was missing. It is urgent in near future to develops advance and practical healthcare technologies and services by applying them directly in home environment [2]. Therefore, we have designed a project 'Smart Medi friend' keeping in mind the need of moving routine medical checks and other healthcare services from hospital centric to home-centric environment [1] so that patients will be able to get seamless healthcare at any time and by remote treatments. The core objective of this system is to work as a assistance application for healthcare and medicine remainder, eliminating the possibility of taking wrong medicine as some people are not able to read medicine. By implementing this project, we can reduce Society's financial burden and burden on hospital resources also the paper usages which was being used in reports and multiple prescriptions.

This paper presents the new economical solution by an implemented home automated healthcare system. A smart medi friend project is a smart medicine assistance application which uses android platform, cloud server and medibox (NFC). This project contents five modules patient, doctor, admin, server and database. Glassfish server is used to perform various services and MySQL use for database design. Connectivity is given through JDBC. Admin will register and manage patients and doctors and also will apply prediction algorithm on patients' symptoms. There is an android application installed on patients and doctors NFC enabled devices. Doctor's android application has features like view patients list, give prescription, view history, give medicine with time and give medicine with NFC code. Patient's android application has features like login, view prescription, view medicine timetable, upload report to doctor, alert on medicine time, and identify medicines with NFC tags. The algorithm used i.e. ANN (Artificial Neural Network) is a prediction algorithm which takes patients symptoms as input and gives most probable disease as output. The main aim is to provide user comfort and a comprehensive platform for home healthcare.

II. SYSTEM IMPLEMENTATION

There are five main modules in proposed system that are Patient's application, Doctor's Application, Admin, Server and Database. Admin module is responsible for registering and managing patients and doctors and also for applying prediction algorithm. Both the android application installed on patient's and doctor's devices are responsible to give all the functionalities like NFC, alarm, prescription. Server communicates with the admin and both the android application using Wi-Fi or internet. Database stores the added data in the form of different tables.

For implementation purpose of the core project, we have used Java J2SE and JDK J2SE (Java 2 Standard Edition). Java is the language for development of the project. JDK is the development kit used to compile java programs. We have implemented Android application module in the eclipse platform and the server module is implemented in NetBeans platform. The Glassfish server is designed using various web services. Admin GUI and prediction algorithm is designed using NetBeans IDE. MySQL is used for designing database for ANN algorithm. Hardware NFC coding is done in both the android applications. Modules are connected using JDBC.

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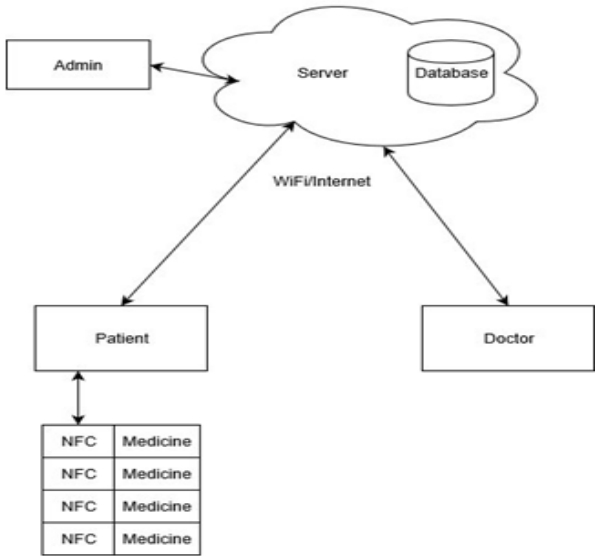

Fig.1 Block Diagram

Implementation of all the GUIs are shown below:

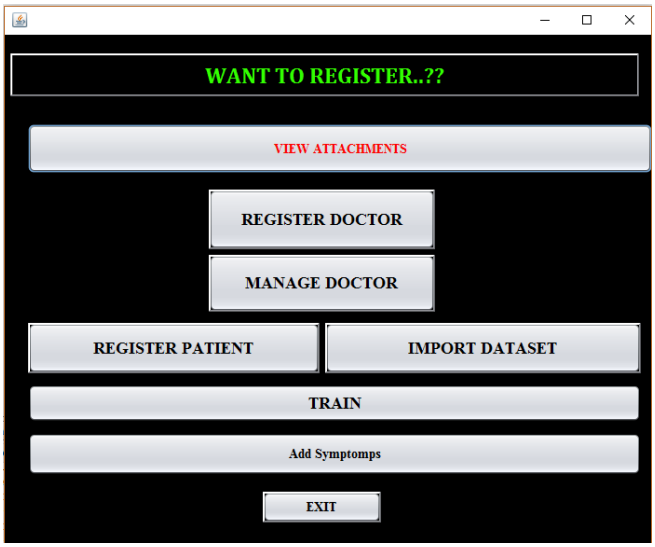

Fig.2 Admin GUI

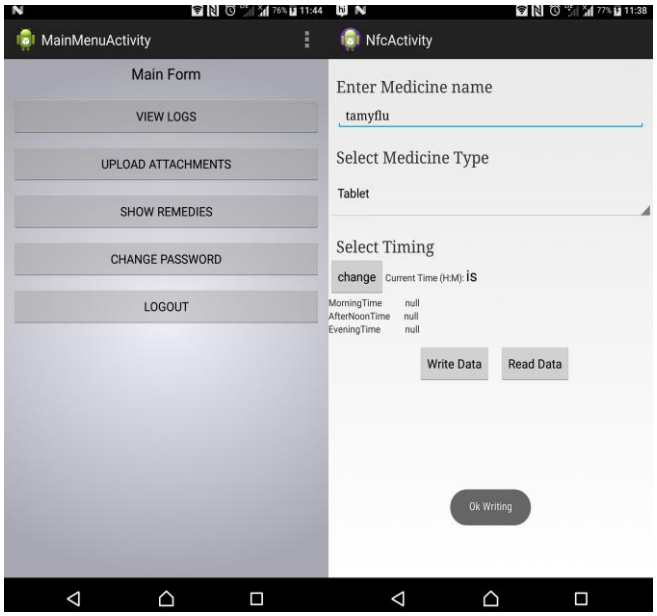

Fig.3 Doctor (right) and Patient (left) GUI

III. ALGORITHM

ANN is useful tool to assist doctors in the analysis and in interpretation of the complicated clinical data in medicinal surgery fields. The basic idea of ANN is that it works similar to the way in which system of human brain neurons works. ANN has capability and capacity to learn and adapt the things which is achieved by weight system. Each connection in the network is assigned a weight which is a numeric value that controls a signal between two neurons. If a positive output is generated, the weights assigned remain unchanged and in case of negative output generation, system adopts by changing weights until a positive output is achieved [5].

ANN uses training dataset to initially set the weights. In our project the training dataset includes list of patients who suffered with different diseases. The various symptoms of many patients for particular diseases are reduced. Symptoms will act as input nodes and diseases will act as output nodes.

According to the symptoms shown by patients ANN will assign weights to the connections. If there is a variation in symptoms shown by patients suffering with some disease, ANN algorithm does the suitable changes in the particular connection weight by backtracking method and so the algorithm will get trained to produce most accurate disease.

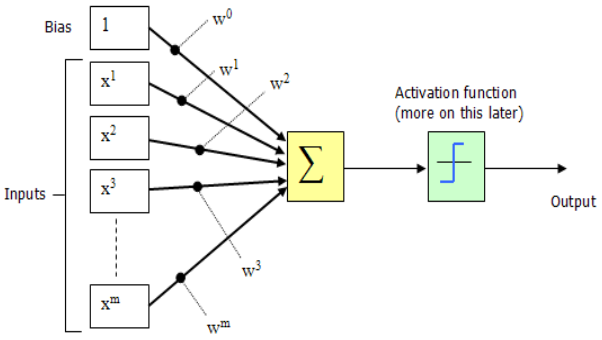

Fig.4 ANN Network

The inputs (x_1, x_2, x_3 ... x_m) and connection weights (w_1, w_2, w_3 ... w_m) in figure 4 are typically real values, both positive (+) and negative (-). If the feature of some x_i tends to cause the perceptron to fire, the weight w_i will be positive; if the feature x_i inhibits the perceptron, the weight w_i will be negative.

$$A = \sum_{n=1}^{N+1} Wm * Xm$$

The bias can be thought of as the propensity (a tendency towards a particular way of behaving) of the perceptron to fire irrespective of its inputs. The perceptron configuration network shown in figure 5 fires if the weighted sum > 0,

$$\sum_{i=1}^{m} bias + (w^i x^i)$$

Where w_i is the weight (i), and I_i is the input (i) value and n+1 is a bias. Backtracking allows you to use this error at output, to adjust the weights arriving at the output layer, but then also allows you to calculate the effective error s_1.

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layer back, and use this to adjust the weights arriving there, and so on, back-propagating errors through any number of layers. By using sigmoid as the non-linear transfer function.

$$y = g(x) = \frac{1}{1+e^{-x}}$$

It is by using this calculation that the weight changes can be applied back through the network.

IV. RESULT AND DISCUSSION

There are five main modules in proposed system. During patient's first visit, admin will add patient's info, symptoms and history to the database through server.

Admin module is used to add/manage patients' and doctors' entries. Apply Data mining using ANN for generating disease prediction using patient's history and symptoms. Admin is able to view report uploaded by the patient. That report can be forwarded to the doctor. Server module manages the database through request sent or received. Authentication process is done through server. The server used in this system will be home server.

Database module is used to store patients' information such as name, address, medical history, etc. Store the doctors' information such as name, contact, specialty, etc. Doctor's application module enables doctor to view patient or patient information. Doctor's application has facility to give prescription and timing to any patient irrespective of the location. Doctor is able to see reports sent by admin. Doctor gives NFCs for specific medicine. Doctor is able to change/update the medicine or the prescription timings.

By patient's application module, patient is able to view prescription given by doctor. Alert is generated according to prescription timings for specific medicine. Application identifies NFC tags on medicine and patient recognizes the correct medicine by alert message generated on patient's application. Patient can upload reports to server using application. NFC tags are used to identify the medicines. When a NFC enabled phone makes contact with NFC tag, it reads the NFC tag. NFC tag are assigned with unique ids according to particular medicine.

All the modules in the implemented project work fine and smooth and are error-free. Running of the project is shown below:

1. Output of ANN algorithm i.e. selection of symptoms and generation of most probable disease:

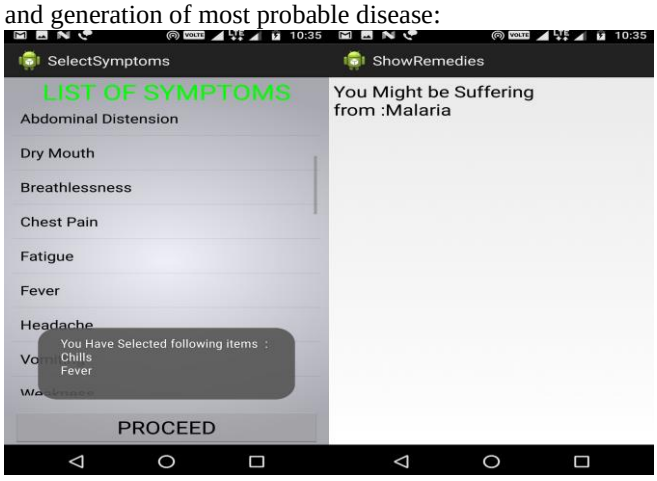

Fig.5 Disease Prediction

2. NFC tags identifying the medicine:

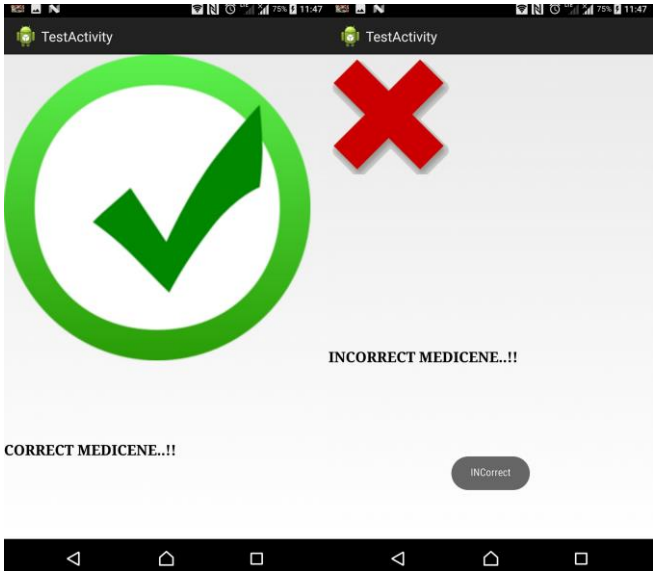

Fig.8 NFC identifying correct and wrong medicine

V. FUTURE SCOPE

In the near future, we can implement this project for multiple hospitals connecting them under single server so that hospitals can communicate and share healthcare resources. The facility of checking availability of doctors, taking appointment and paying fees through application can also be added. Furthermore, a facility of video calling and chatting can be implemented. For emergency cases, a facility of locating nearest healthcare service can be added in the application.

VI. CONCLUSION

This application mainly works as assistant application for healthcare and medicine remainder, eliminating the possibility of wrong medicine. This application is for the people who are too busy to remember the medicine timings and also for the old people who can't remember the timings. This project comes under EHR which reduces paper usage in great extent. Main objective of this project is to increase digitalization. By implementing this project, we reduce burden on hospital resources. Society's financial burden will also be reduced. Time and money will be saved which were previously being consumed due to transportation (multiple visits). This project reduces the possibility of losing hardcopy of the records by saving the history on database.

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Prachi Patil currently pursuing bachelor of Engineering in computer science from Sinhgad college of Engineering, Pune of Savitribai Phule Pune University. She has recently proposed the idea of 'Smart Medi Friend' and published a paper under a title “Smart Medi Friend: A Smart Medicine Assistance Application Using Cloud, Android and ANN”. Android and Artificial intelligence are her areas of interest and she is currently working on a project 'Smart Medi Friend' which needs knowledge of both of the fields.

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