

Health Monitoring Android Application and Diabetes Prediction using Data Mining Techniques

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Abstract— With the advancement in technology, there has been a tremendous growth in the medical industry all over the world. But even though the health care facilities have improved to a great extent, there has been an increase in the number of health problems. The main reason for this is hectic life of the people. The busy schedules of people have degraded the quality of life and has resulted in neglect towards health issues. In such an environment, where people are constantly using their phones, creating a personal health care android application can be very beneficial. This project seeks to apply the current knowledge and information and to create an android application which can be used by patients for management of their health care issues and would hence enable them to lead a better life. The applications also seeks to create a system for predicting whether a person has a risk of developing the disease diabetes in the next 10 years.

Key words: Health Monitoring Android Application, Data Mining Techniques

I. INTRODUCTION

In the recent years there have been plenty of applications and websites that have been created for the healthcare domain. The field of healthcare has always been a dubious one because it is concerned with the lives of people. Yet the development of healthcare based applications started much later than it should have. Although many applications were developed, they were mostly hardware based and hence very costly. As a result these applications were not widely used by the people. Our application is a solution to the above problem since it is software based.

A. Problem Definition

The busy lives of people have affected their health adversely. Due to the busy schedule, there has been a neglect towards health care. Hence, an android based application can be very beneficial in such a situation as most of the people today have android phones. Research has shown that that hospital readmission rates have been cut by 92 percent while emergency room visits dropped by 87 percent with the use of mobile health apps and greater communication. The use of mobile communication tools has also allowed for greater patient engagement, which means more individuals are focused on improving their health and wellness such as sticking to a healthy, physician-recommended diet, continuing exercise routines, and adhering to their medication schedule along with follow-up appointments. Most of the health monitoring applications are usually hardware based and are only for the use of critical patients. A simple health application will be preferred by many people. The application would help maintain day to day records for patients suffering from chronic diseases. A reminder facility for diet can help the patients maintain a good diet and the medication reminder can be helpful as the patient does not need to remember his doses as he will get constant reminders at the specified

timings. An automated message facility is implemented which can help the patients during emergencies. The application also seeks to predict whether a patient would acquire diabetes in the near future using various data mining algorithms.

B. Scope

- 1) The system will be Android-based.
- 2) SQLite will be used as the database for the system.
- 3) The security system will protect the user from outsiders with password verifications when needed.
- 4) The system will notify the user/others through email/text when user does not follow medication after several system notifications.
- 5) The system will save medical, diet, and vital signs information for the user as well as save extra information using a separate storage.
- 6) The system must verify user password before allowing users to edit medical information.
- 7) The monitoring system will monitor the user's medication time and notify user at the correct time.
- 8) The system will allow user to edit user account information.
- 9) The system can predict whether a certain patient will suffer from diabetes in the near future and can also predict the related complications using a set of questionnaires and a few data mining algorithms.

C. Applications

- 1) **Reminder functionality:** The system will provide a reminder through an alarm to the user on his/her dosage timings. The user will have to set the alarm manually in his/her device.
- 2) **Automated message functionality:** If the user of the application fails to snooze the alarm more than three times then an automated text message will be sent to an emergency contact as provide by the user.
- 3) **Diabetes specific functionality:** The application will predict if the user will develop diabetes in the near future. The app will also predict the other health related complications a diabetic person may face.
- 4) **Vital Signs functionality:** The system will be provide all vital signs of the patients. If the vital sign is alarming, the patient will be notified. Then the signs will be recorded there after
- 5) **Diet Functionality:** The system will allow the user to make diets and ask for daily data from the user in order to record the diet's process.

II. LITERATURE SURVEY

A. Research Papers Survey

- 1) The author Deepti Ameta and Kalpana Mudaliar describe an android based application in the research paper in which an automatic alarm ringing system is

implemented. It focuses on doctor and patient interaction. The patients can set an alarm on their dosage timings. The patients can search the doctor's area wise. Articles relating to various medical fields and health care tips are also provided. There is no external hardware device unlike other health monitoring systems which makes the app economical.

- 2) The research paper published by author Dr. Eirik Arsand primarily focuses as to how a diabetic person can keep his condition under check by continuous self-monitoring. Self-management is critical to achieving diabetes treatment goals. Mobile phones and Bluetooth can support self-management and lifestyle changes for chronic diseases such as diabetes. A mobile health (mHealth) research platform—the Few Touch Application (FTA)—is a tool designed to support the self-management of diabetes. The FTA consists of a mobile phone-based diabetes diary, which can be updated both manually from user input and automatically by wireless data transfer, and which provides personalized decision support for the achievement of personal health goals.
- 3) The research paper published by Veena Vijayan and Awasthy Ravikumar describes various prediction algorithms which can be used to predict if a person is likely to suffer from diabetes in future. Diabetes mellitus or simply diabetes is a disease caused due to the increase level of blood glucose. Various available traditional methods for diagnosing diabetes are based on physical and chemical tests. These methods can have errors due to different uncertainties. A number of Data mining algorithms were designed to overcome these uncertainties. Among these algorithms, amalgam KNN and ANFIS provides higher classification accuracy than the existing approaches. The main data mining algorithms discussed in this paper are EM algorithm, KNN algorithm, K-means algorithm, amalgam KNN algorithm and ANFIS algorithm.

B. Similar Existing Projects Comparison

1) Medication reminder and healthcare-an android application

In the above application an automatic alarm ringing system is implemented. The patients can set the alarm depending on their medicine dosage timings. Area wise doctor searching is possible healthcare tips and various informative medical articles are provided.

2) BG Monitor

BG Monitor is an android application which focuses on diabetes management. The various body parameters relating to diabetes such as blood glucose levels, daily insulin intake, an everyday diet plan can be stored with the help of the application. It has convenient features, like insulin bolus calculation and blood glucose targets that make it incredibly easy to record entries. The elegantly designed interface exposes all the information you need, allowing you to quickly find what you're looking for. Statistics provide insight on your blood glucose levels so you always know how you're doing.

3) Apollo Diabetes Predictor

It is an android application which can predict if a person is likely to develop diabetes in the near future. Although the

predictions are not a hundred percent accurate the app serves as good tool to estimate the advent of diabetes. The application has a questionnaire which the user has to answer based on which it is predicted that whether the user will or will not suffer from diabetes.

III. PROPOSED SYSTEM

The field of healthcare management has seen many varied applications being developed. Almost all of them have tried to better the features of the previous ones. The application that we are intending to make primarily focuses on personal healthcare management and also will try to predict if a person will be developing diabetes in the near future. The complications that can occur along with diabetes also will be predicted. The proposed system will work towards the following goals:

- 1) Providing easy and cost efficient healthcare management.
- 2) Creating awareness about diabetes and other complications arising because of diabetes.

A. Proposed Methodology

As the application being developed here focuses on healthcare management the first and foremost thing that needed to be done was extensive research about the field. The diabetes specific features also made it necessary to get an in depth knowledge of diabetes before starting with the actual development of the application. The application will be made by using android studio and the RDBMS software used is SQLite. The data mining algorithm that will be used to predict diabetes will be Naïve Bayes Classifier. The programming language used is Java.

B. Diabetes Prediction Module

The application uses Naïve Bayes Classifier algorithm. Commonly used in Machine Learning, Naïve Bayes is a collection of classification algorithms based on Bayes Theorem. In this application, we seek to find out the “chances”, that is, the probability of a person to develop the disease in the near future. Since Naïve Bayes Classifier is one of the simplest as well as an efficient algorithm for the prediction of probability decisions, it has been used in the implementation process.

	GENDER	EXERCISE	SMOKING	BODY TYPE	ALCOHOL	PREDIABETES	FAMILY HI	DECISION
1	male	yes	no	under weight	yes	no	no	very low risk
2	male	yes	no	under weight	no	no	yes	low risk
3	female	YES	NO	over weight	no	no	yes	very low risk
4	female	no	yes	under weight	yes	yes	yes	high risk
5	male	no	yes	normal weight	yes	no	yes	low risk
6	male	yes	no	over weight	no	yes	no	low risk
7	female	yes	yes	under weight	yes	no	no	low risk
8	female	yes	no	over weight	yes	yes	yes	high risk
9	male	no	yes	normal weight	no	yes	no	very low risk

Fig. 1: Training Dataset for Diabetes Prediction

In the application, the prediction process is carried out as follows:

- 1) The user has to answer all the questions in the questionnaire.
- 2) On answering the questions, the answers will be stored in the database.

3) Based on the training dataset and the questions answered by the user, the diabetes prediction will be done. The training dataset is as follows:

C. Naive Bayes Classifier

We can consider the following sample:

<Male, Exercise=no, Smoking=yes, Body type=underweight, Alcohol=yes, Prediabetes=yes, Family history=No>

The calculations are done by using the following formula:

$$P(\text{user}|\text{high}).P(\text{high})=P(\text{male}|\text{high}) * P(\text{no}|\text{high}) * P(\text{yes}|\text{high}) * P(\text{underweight}|\text{high}) * P(\text{yes}|\text{high}) * P(\text{yes}|\text{high}) * P(\text{no}|\text{high}) * P(\text{high}).$$

$$P(\text{user}|\text{low}).P(\text{low})=P(\text{male}|\text{low}) * P(\text{no}|\text{low}) * P(\text{yes}|\text{low}) * P(\text{underweight}|\text{low}) * P(\text{yes}|\text{low}) * P(\text{yes}|\text{low}) * P(\text{no}|\text{low}) * P(\text{low}).$$

$$P(\text{user}|\text{very low}).P(\text{very low})=P(\text{male}|\text{very low}) * P(\text{no}|\text{very low}) * P(\text{yes}|\text{very low}) * P(\text{underweight}|\text{very low}) * P(\text{yes}|\text{very low}) * P(\text{yes}|\text{very low}) * P(\text{no}|\text{very low}) * P(\text{very low}).$$

1) Example

The values obtained by using the above formulas are:

$$P(\text{user}|\text{high}).P(\text{high})=0.57$$

$$P(\text{user}|\text{low}).P(\text{low})=0.32$$

$$P(\text{user}|\text{very low}).P(\text{very low})=0.11$$

Hence, the probability is highest $P(\text{user}|\text{high})$, we can say that The person has a high risk of developing diabetes in the next year.

IV. IMPLEMENTATION

A. Login Module

Here the user will login to the application by using registered username and password.

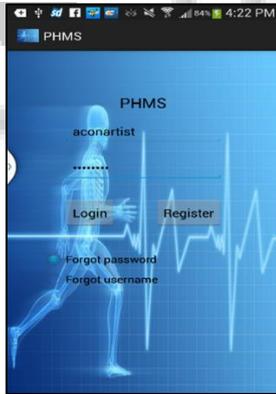


Fig. 2: Login Screen

B. Home Screen



Fig. 3: Home Screen

Once the user has username and password then he/she can login into the system by clicking on login button. The user will be directed to the home page of the application shown below.

C. Medication Screen

Here the user will be able to store the doses of his everyday medicines and he can also set up an alarm to remind him to take the same.

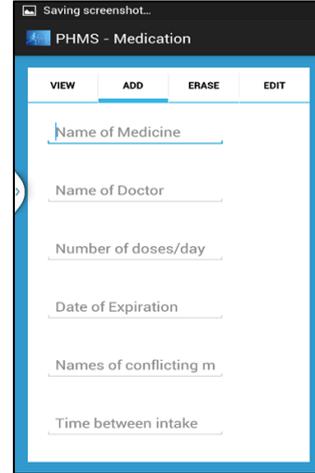


Fig. 4: Medication Screen

D. Diabetes Prediction

1) Questionnaire

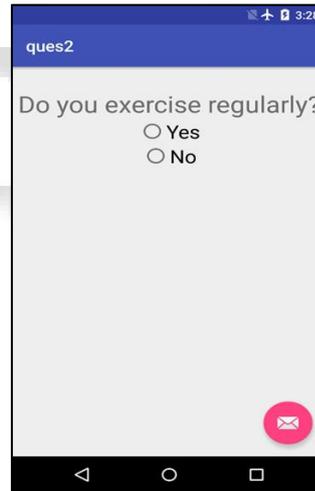


Fig. 5: Exercise related Question

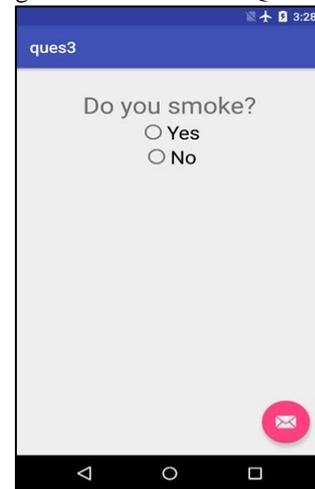


Fig. 6: Unhealthy habits related questions

2) Decision

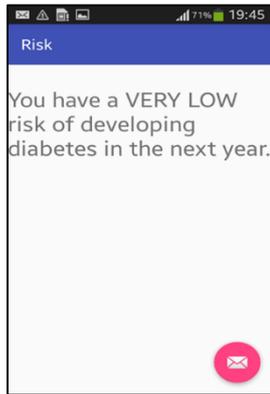


Fig 7: Prediction of Risk

V. FUTURE SCOPE

We have implemented various features in the applications like Electronic storage, Reminder Facilities and Diabetes Prediction. New Functionalities that can be added to this application are as follows:

A. Prediction of Complications related to Diabetes

The application built predicted the probability of a person having the risk of developing diabetes in the near future. The complications associated with it can also be predicted based on a set of questions.

B. Recommendation of Diet

The user of the application can also be provided with a proper diet plan based on parameters like calorie requirements, height and weight of the patient, Current medical history of the patient etc.

C. Area wise searching of Hospitals

One more feature that can be added is the user would have to enter his own location and would accordingly get a list of hospitals and clinics around the specific location along with the information of the doctors.

VI. CONCLUSION

The application is software specific, hence it is cost effective and can be widely used. The proposed system will make the process of health care management quite easy and systematic. Also the user of the system will be able to find out if he is likely to develop diabetes in the next 10 years and other complications that may arise because of diabetes. By proper use of the application the user will be able to manage his health without giving any extra time for the same. So staying healthy is made a lot easier by the application.

REFERENCES

- [1] Deepti Ameta, Kalpana Mudaliar, "Medication reminder and healthcare – an android application." International journal of managing public sector information and communication Technologies (IJMP ICT), Vol 6, NO.2, June 2015.
- [2] Dr. Eirik Arsand, Dr. Gunnar Hartvigsen, "Mobile health application to assist patients with diabetes: Lessons learnt and design implementations." Journal of diabetes science and technology volume 6, issue 5, September 2015.

- [3] Veena Vijayan, Awasthy Ravikumar, "Study of data mining algorithms for prediction and diagnosis of diabetes mellitus." International journal of computer applications, vol.95, june2014.
- [4] Daniel Lowd, Pedro Domingos, "Naïve Bayes Models for Probability Estimation." <http://homes.cs.washington.edu/~pedrod/papers/mlc05b.pdf>
- [5] G.M. Nasira, C.Kalaiselvi, "Prediction of Heart Disease using data mining techniques." International Journal of Science and Technology, vol8(14), july 2015.