Decision Support System in Diabetes Disease with Providing Health Care Services

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Abstract—Decision support System in diabetes to improve the life of patients who are suffering from diabetes disease. Disease improvement is one of the applications where Data Mining techniques are showing effective results. Data Mining techniques have been widely used to mine knowledgeable information from medical database. Most countries face high and extending rates of Diabetes Disease. Diabetes is the main reason behind death all around all through the world in the previous ten years. This thesis covers the different fields of decision support system for the diabetes patients. The objective of the study of health care system to explore new and emerging areas of data mining for the data mining techniques. Function performed and algorithms used in these tools have been analyzed. Disease diagnosis is one of the application where data mining tools are proving successful result. Computer based information along with advanced Data mining techniques are used for appropriate results. The system needs patients information and gives them advice according to their condition entered by them. It also provides adequate and detail information about the patient to the health-care providers that help them to take an optimal decision. Diabetes disease is the leading cause of death all over the world in the past ten years. Several researchers are using statistical and data mining tools to help health care professionals in the diagnosis of Diabetes disease.

Keywords: Data Mining; Decision Support System; Health care;Health records;

I. INTRODUCTION

Data mining is defined as the process of automatically discovering useful information in large data repository.Nowadays Computer system and automated system is used in all fields of life to make life easy whether you are at home or at office [1]. Advancement in technology is increase day by day to make life easy. computer technology in health care is an old thing but there is some area in which computer can help for better life. So our target is to those patients who are suffering from diabetes disease [2]. Diabetes is one of the dangerous disease, if the correct instruction is not followed then patients will suffer a lot. So best instruction and daily instruction is needed for diabetes patients [1].

Today most countries face high and increasing rates of Diabetes disease and it has become a leading cause of debilitation and death worldwide in men and women over age sixty-five and today in many countries Diabetes disease is viewed as a second epidemic replacing infectious diseases as the leading cause of death (Gale Nutrition Encyclopedia, 2011).

It is not possible for patients to visit hospital daily and get information from doctors about their sugar level and all information regarding their diseases [3]. On the other hand treating diabetes disease is very expensive and difficult because there are numerous things to record about the patients like blood sugar level,dietplan,exercise,diet taken and lots of other thing which are helpful to them [4]. So decision support system in diabetes is one of the solution so that it can help to the patients as well as doctors.Decision support system help patients and give advice about their life style.

So this kind of decision support system will reduce the unnecessary hospital visit of the patients and as well as the time. The objective of the study is the give 24 hours health care service to the patients so that we can improve the life of patients.

Data mining techniques can be used for data selection,finding patterns and generates the output of the diabetes using large data sets [3]. In health care management,data mining techniques are increasingly being used due to its inherent characteristic of finding hidden pattern. application of web technology to health care for remote patients are current topic of interested in future research and also useful for preventive medicine to improve health [5]. Web application server provides a data mining service and notifies user of important rules

concerning their health and life style. Data Mining is predicted to be one of the most revolutionary developments of the century, according to the online technology magazine ZDNET News.

Data mining can be a useful tool in the health sector and health care for improving the quality of life of patients [6]. Organizations that perform data mining are better positioned to meet their long-term needs, Some researchers argue that data can be a great asset to health care organizations, but they have to be first transformed into information. In recent years new research Avenues data mining techniques, has become a popular research tool for medical researchers who seek to identify and exploit patterns and relationships among large number of variables [7].

A. Definition

Nowadays, Health care industry contains huge amount of heath care data and these health care data contains hidden information. This hidden information is useful for making effective decisions using different Data Mining techniques. We can develop an efficient decision making for patients who will be suffering from disease and using this we can identify patient for improve their health.

B. Objective of Study

As shown in the Fig-1 identify the patients who will be suffering from disease using Data sets. To use these data sets find out the different techniques for better efficiency and accuracy and that will be used to reduce cost and best outcomes, to improve health in relation to Diabetes Diseases.

• To identify key patterns or features from the data set.

• To Identify and select attributes that are more relevant.
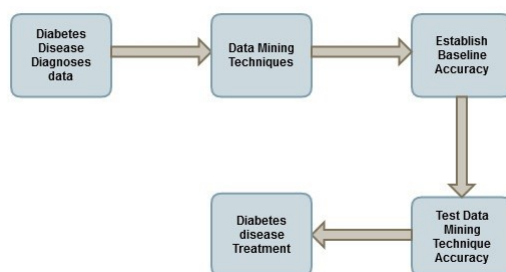

Fig. 1.   complete scenario of identify the Diabetes disease patients.

Motivated by the world-wide increasing mortality of diabetes disease patients each year and the availability of huge amount of patient's data from which to extract useful

knowledge, researchers have been using data mining techniques to help health care professionals in the diagnosis of diabetes disease [8]. Data mining applications will be used for better health policy making and prevention of hospital errors, prevention of diseases and improve health treatment [3].

C. Use of the database Information

• To reduce cost.

• best outcomes [9].

• Improve Health Treatment [3].

• Using Data mining techniques to improve efficiency and accuracy of the data.

II. LITERATURE SURVEY

Work done in patients identification using historical data sets using different algorithm and techniques are discussed below:

Diabetes remains the 7th leading cause of death in the United States in 2010, with 69,071 death certificates listing it as the underlying cause of death, and a total of 234,051 death certificates listing diabetes as an underlying or contributing cause of death [10].

The medicinal services industry gathers a lot of social insurance information and that need to be mined to find concealed data for compelling choice making. Propelled by the overall expanding mortality of diabetes disease patients every year and the accessibility of colossal measure of patient's information from which to concentrate valuable learning, analysts have been utilizing Data Mining strategies to help medicinal services experts in the determination of Diabetes disease [9] [11].

The vast majority of the papers have actualized a few information digging systems for determination of coronary illness, for example, Decision Tree, Naive Bayes, Neural System, portion thickness, consequently characterized gatherings, sacking calculation and help vector machine demonstrating diverse levels of correctness's on numerous databases of patients from around the globe.

Used the R-programming to investigate applying Naive Bayes and Decision Trees for the area of this disease.Utilized the pressing count as a piece of the R programming contraption and differentiated it and Decision Tree in the investigation of disease. In this paper discuss the grouping tree methods in Data Mining. The grouping tree calculations utilized Tree calculation. The goal of this examination was to analyze the results of the execution of diverse arrangement methods for a diabetes disease data set.

Many authors have specified different parameters and databases for testing the accuracy. In particular, researchers have been investigating the application of the

Decision Tree technique in the diagnosis of diabetes disease with considerable success. Sitair-Taut et al. used the weka tool to investigate applying Naive Bayes and J48 Decision Trees for the detection of diabetes disease. Tu et al. used the bagging algorithm in the weka tool and compared it with J4.8 Decision Tree in the diagnosis of diabetes disease. In the decision making process of diabetes disease is effectively diagnosed by Random forest algorithm.

III. PROPOSED FRAMEWORK

Decision Support system provides a communication plat form to the user for their daily outcome at home. This Decision Support system helps the patients for make decision in effective manner. This Support system will provide a diabetic patients a 24 hours medical facilities as well as the daily routine of the patients from anywhere at anytime. Patients get the best instruction of their (diet plan,exerciseetc) while staying at home and get the best instruction regarding their health while staying at home [3].

1) Patient Database: Patient database is data sets collected from Patients input and also form the UCI Repository.
2) Data Preprocessing: This phase includes extraction of data from the in a uniform format
3) Training the Models: Each of the these models has been trained using different methods.
4) Testing the Models: This type of model used to analyze data and discover patters in classification and regression analysis.
5) Comparison of Results: The results obtained after applying the rules will be analyzer on the basis of sensitivity, specificity, and accuracy.

As shown in Fig-2 ,based on the input given by the patients decision support system provides the output of their diet plan, exercise plan, doctor, therapist and medical prescription.

A. Problems and Goal

Diabetes diseases is one of the major diseases that can cause the health problem like visual impairment, heart diseases, failure of kidney weight reduction etc.

Diabetes patient have a shorter future than those without diabetes. So they require to keep their health maintain and they need extra care in their diet, medicine and food. If any of these things like diet, medicine and food gone wrong then it causes serious health problem. To improve their life patients should not depended on only doctors they also should take care themselves [12].

Most of all diabetes patients visit hospital on daily bases so our target is to reduce their visit and give them a better solution while staying at home. So better description is needed for all diabetes patients for better health [12].

Patients need extra care for their treatment for their better life.

It is not possible for patients to visit doctor everyday and visit to laboratory everyday for daily checkup and some day hospital are too much crowded so patients wait for too long for their turn so it is a waste of time as well as difficult for patients. So patients may be disturb for their daily life. Diabetes patients suffers from many type of illness so that they need special care by them selves as well as by doctors. If patients need any guidance at anytime to keep themselves update about their life then it is not possible to visit doctors at anytime [13].

These above problems contribute the important role in our study. By eliminating these issues, we can save many medical resources and a lot of precious time of medical staff, relatives and patients as well. The time can be utilized for other constructive activities by both patient and care providers. Patient can spend his/her more time in social activities instead of spending most of the time in depressed environment of hospital.

B. Challenges

There are many question how to improve the life of diabetes patients like:

1) How to increase the quality of life for diabetes patients by providing Decision Support System (DSS) in diabetes eHealth care for self care at any place and any time?
2) How technology can support the care providers and help the doctors in decision making about the patient diseases?

Diabetes disease is very chronic illness and diabetes patients need more care than others.They should be very careful in diet and exercise. Diabetes patients need regular check ups, medical test, laboratory test, exercise instruction etc . So these kind of instruction disturb the life of patients [14].

So according to our 1st question we will try to provide the solution for the same and so that patients life will be better and they can access from anywhere at anytime. Diabetes patients can take all the information like their diet and exercise etc while staying at home and improve their life without visiting hospital.

The Goal of our examination will take care of the diabetes patients and care suppliers by solid and accurate decision support system for improvement health awareness service at home. Reduce the unwanted visits of the patients to hospital or care providing centers through effective and easy communication between the care providers [14].

IV. METHODOLGY

In this section we include the methodology used to carried out some output. Methodology defines as a how to complete and accurate our work towards our goal.

Mixed technique explore in which the researcher utilizes subjective exploration ideal model for one stage and the quantitative research examination for an alternate period of the study.

This research will carried out at multiple phases. In the first phase we studied literature review to understand what is diabetes, diabetes types, problems and complications due diabetes in elders, eHealth, Decision support systems [15].

Today Diabetes mellitus is the one of the most frequent non-contiguous disease in the world. According to the international diabetes federation, today 5.1% of world population is suffering with diabetes mellitus and in 2025 it will increase the 6.3%. From the most recent couple of decades, the bio medical designing has been significant concentrate on the improvement of the disease, checking and treatment of diabetes people groups. The quick development and advancement in innovation give diverse application in mobile computing, Internet, computer incorporation and mobile Internet to get to the health service.

In this paper we present the decision support system, and this decision support system how it will work, what is the architecture, what is the framework and structure and its services for diabetes patients. This will give the on line administration to patients of diabetes and consideration suppliers.

V. DECISION SUPPORT SYSTEM IN EHEALTH SERVICE ON

DIABETES DIEASES

E-health solution includes all kind of information and health system for diabetic patients for improve their life-style for better health. This solution includes all the information like prevention of disease , medical treatment, daily life care and treatment for diabetic patients for better life. Main purpose of this solution is to give a diabetic patients a good service while staying at home or if they are away from hospital. The Prominent aspects of the success of eHealth are increasing the quality of medical information, effective user interaction, and professionalization of patient data according to need and requirement [16] [17].

Diabetes is one of the dangerous disease so diabetic patients need extra care than other diseases. Diabetic patients
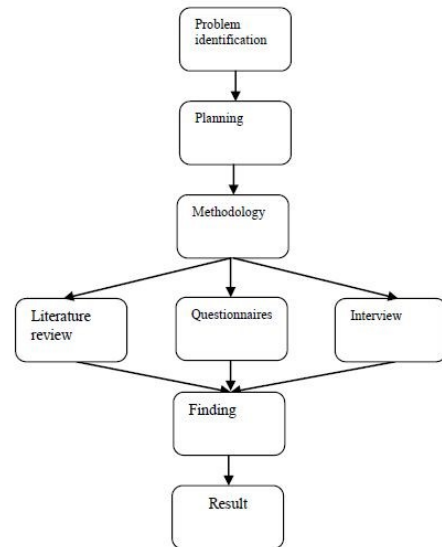

Fig. 2.   Flow of the Work

need care of body, take proper rest , take proper medicine, proper diet, proper treatment. If any one of that gone wrong than it cause a serious problem to them. So only patients can not depended only on doctors even patients can take care of them selves. There is one major problem is that good communication with doctors So decision support system provides better communication with doctors also [18].

In this one end is patients they can get information for their better life from decision support system. In this decision system first of all signs are given as input and its compare with our data sets if it is normal then give them a advice about their diet and exercise but if it is abnormal then the patients should contact their care providers. Decision Support System (DSS) use different data mining techniques to find out the most accurate and optimal output to the user [19].

Making diagnoses, detecting trends and react on it.

Decision support system is computer-based tools that are used to support complex decision-making and problem solving. Decision Support System (DSS) are computer based frameworks that used to help the human to settle on better choices of their health. In health-care, such frameworks improve the quality of health-care and improve the quality of life, with the likelihood of lessen expense without loss of quality. Effectively executed DSS takes out the human limits of thinking, complex assessments, retention and time to settle on an ideal choice and DSS is a general wording which can cover a wide range of frameworks in the field of health care [3].

This type of decision support system usually analyze the different data in short time and give us a accurate result. Numerous computer frameworks including decision support system, have been created to help the patients and to aid the other consideration suppliers 60-70% of them are viable and minimize the communication gape and amplify

the openness of data and assets . The decision support system in diabetes eHealth consideration will give a 24-hour medicinal encourages to patient and consideration suppliers at whatever time and anyplace. Patient would be able to update his/her health status at any time and can get essential directions (eating routine, activity) and remedies while staying at home [20] [21].

Because of this framework patent can stay in contact with care suppliers and get the fundamental direction in regards to his/her health at home.

DSS framework in diabetes eHealth consideration will acts like a specialist framework under the supervision of any prepared medical staff. Expert framework is a computer program that serves to take care of issues or settle on choices by a store of significant Information with the execution of artificial intelligence.
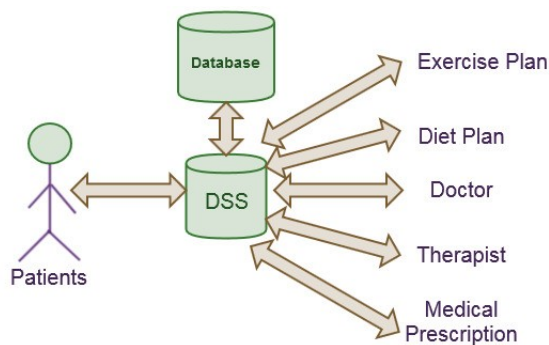

Fig. 3.   Overview of DSS in Diabetic eHealth Care [3]

The DSS will be adaptable as per the circumstance, patient needs .In proposed DSS, database contains diverse sort of very much built and joined data. It has detailed information about, Diabetes patient history, diabetes cases history, optimal solutions from different medical experts for different conditions, suitable exercises and diet plans according to the condition of patient, and record of relevant care-providers.

Concentrated database building design gives speedier and exact critical thinking procedure. Nature of choice relies on, amount, quality and structure of data put away into the database.

Decision support system is to analyze the results. System depends on the current information that will provided by the patients and its start matching with the past information of the patients. Then only it comes with the output which is most similar to the patients like (diet ,exerciseetc).

Presently the arrangement from master's supposition database is coordinated with the diabetes cases history database to discover, where the expert's arrangement had been connected ever? What were the states of patients? Furthermore, what was the yield of the arrangement? Each of the three arrangements (infection history, expert's

feeling, expert's opinion and Disease history) thought about and joined into one.

A. Importance of Decision Support System

Diabetic patients need a special care and special care is dependent on the condition of the patients. If diabetic patients
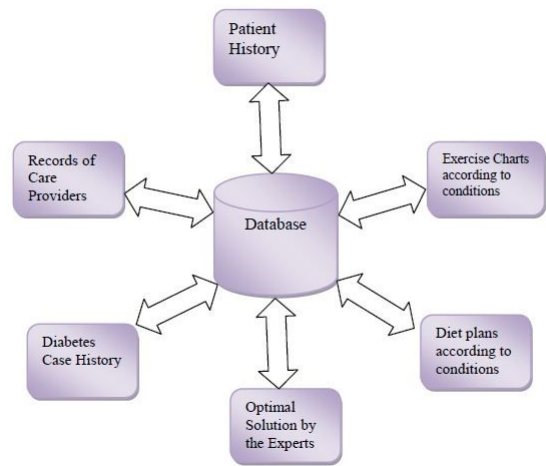

Fig. 4.   Entities of Database

is new than he should be learn about diabetic disease and regularly check their blood glucose level ex. 6-8 times a day. If sugar level is high then decision support system will provided how to slow down [22].
If patients is newly detected as a diabetic patients than he should visit the hospital 4-5 times as a week.so our target is to reduce that visit.
If patients is not new than he should be visit the hospital once in a month and he should be able to control his disease by staying at home about their diet,exercise ,medicine ,blood sugar etc [23].

If patients visit the hospital than doctors ask the following question to them like:

- Patients blood pressure.
- patients sugar level.
- patients diet.
- patients Exercise.
- patients working time. • patients sleeping time.
- medicine taken by patients.

So if these information is given to our decision support system then it will provide a complete guidance what doctors have to give them. It will give the complete guideline about the patients diet and exercise. Diabetic patients is always confuse about food which food they should take and which should not so our decision support

system provide information like which food they should take and which should not. For a diabetic patients exercise is more important to keep their sugar level at a normal [24].

patients truly admire the framework which helps them to settle on a choice and make a good decision about their health. Patients demonstrated their energy about the framework when they came to realize that the framework can lessen their visits to health awareness focuses and they can update their record and get instruction about their health being at home.

Framework makes the proposals as per their circumstances, if there any quick increment in their glucose level, then patients should go to their care providers immediately. Patients say that more often than not they went to the health care center just to tell the doctor about their bizarre change in the glucose level. So patients waste their time as well as the doctors time so using the Decision support system we can reduce that time [25].

Medicinal services suppliers would welcome the framework on the grounds that the framework will redesign the patient's record remotely and reveals to it in such helpful way that can help the medical caretakers or specialists to settle on a decent choice without squandering their time to peruse the patient's record and meeting the patients about his/her every day life of most recent couple of weeks or months. On the off chance that patients don't visit clinic then there is no requirement for doctors in the health centers.

B. TASK FLOW OF PATIENTS EHEALTH CARE

*1)   INPUTS :*Patient inputs his/her personal number, sugar level, blood pressure and taken diet using the web or mobile services. After the log in process, patient can enter the Blood Sugar, diet of the day, and time of meal taken, exercise and other description . By clicking Submit button request sends to the system.

*2)   PROCESSES :*Processes comprises on data mining of patient history, disease history, experts opinion, diet plan and exercise plan. Decision system will find out the best combination of diet plan and medicine according to the data enter by the patients. Decision support system work based on the data mining techniques that we applied for that and according to that it will give the output for the same.

3)   OUTPUTS: Outputs are instructions about diet and exercise. Accepted single report sends to the nutritionist, adviser and specialist at same time for final choice.

Framework saves the patients redesign in the patients history. Decision support system gives the output about the patients health, patients diet plan, exercise, patients condition, medical plan and if the consult a doctor immediately or not [26].

C. KEYS FEATURES OF DSS

1)   REDUCE   UNNECESSARY   VISITS   OF HOSPITAL: As diabetes is a very dangerous disease and patients of diabetes are suffering many issues or complications. One of them is communication issue between patients and care providers.

Patients can't visit the specialists consistently or can't get arrangement for laboratory test day by day, even no care suppliers can visit the patients day by day or in brief times of time to keep themselves update about the health of patients. DSS in Diabetic eHealth Care will lessen the pointless visits of patients to doctors. Presently with help of DSS in Diabetic eHealth Care, they can get the essential directions (eating routine and activities) at home. They can get to this framework from anyplace and whenever [3].

Health Care suppliers talk against about the unwanted visits of patients to the doctor's facility. Interviewees express that patients particularly get hyper when they realized that their glucose level is high. They surged toward the specialist doctors or care providers to help them out. Medical caretakers constantly recommend to patients attempt to learn yourself that, why it happened? Patients visit social insurance focuses to ask about their eating routine. Patient asks specialists via email and phone getting some information about every eating routine it is possible that they can devour or not [2].

2)   DATA UPDATION AND HELP IN DECISION MAK-ING: Diabetes Patients upgrades his/her status on every day bases to get the essential direction at home, these information will spare in database. Care suppliers e.g. specialists, medical caretakers can get to patient's information so as to audit the patient's conditions and can make proposal for him/her. This database will help the care suppliers to settle on choices about the health of patients and make a accurate decision about patients health.

3)   DIET PLAN: Choice Support System(DSS) in Diabetic eHealth Care, gives the eating routine arrangement to diabetes patients, they can get the direction in regards to their eating routine at homes as per their circumstances. It gives how to keep up the solid eating routine by and large and offers evidences to diabetes patients what eating routine is good for their health or what eating routine is horrible for their health? Diet Plan is an imperative part to control the diabetes and is arranged by patient weight, height, age, sex and sort of diabetes. The fundamental center is on type 2 diabetes that can be controlled by health eating routine [3] [27].

4)   EXERSIE PLAN: Exercise is very important for diabetes patients particularly for those patients who are suffering from it. An exercise with mix of eating routine and solution assume an imperative part to control the weight and glucose level of diabetes patients. Exercise serves to control the diabetes by, Help to lessening and control weight Help to control pulse Enhance the body to utilize insulin successfully [3] [27].

Reduce the most of the weight by burning the extra calories by exercise so that it can help to improves the insulin sensitivity and Getting muscles solid Strengthens. Reduce the cholesterol so that it can help to protect against heart disease . Increase body's energy level to upgrade work limit. Exercise plan for releasing stress,releasingtension,releasing pressure and nervousness.

VI. CONCLUSION

The main aim of this paper is to identify the problems of diabetes patients and propose an intelligent decision support system through which they can get to the basic guideline of diet routine and activity at home that enhances the quality of life.

how to improve their quality of life and what existing system are providing services to patients at home. It provides the basic service regarding diet and exercise at home and gives a communication channel between care providers and patients. It provides the decision support both to care providers and patients.

Because of this, some unnecessary visits to doctors may be reduced and this clearly decrease the communication problems of the diabetes patients about their health and So that we can reduce the cost of health care centers as well as patients cost.

It saves the valuable time of care suppliers and patients and saves many medical resources.

The patients can get the fundamental guidelines at home, there is no need to visits doctors over and over to get guideline about health. It decreases the unnecessary visits of patients and they can get to it anyplace and at whatever time. Because of this patient every day quality of life improves. Patients update their health status and it automatically saves in database. This patient's history is helpful to care providers to make decision about patients.

VII. FUTURE WORK

The technique can be improved further by experiments with more data set and using algorithms to improve the classification accuracy and to build a model that can give the perfect output.

This paper is a push to enhance the nature of day by day life of diabetes patients and give them such framework through which they can get to proper guidelines at home.

In order to show a good and accurate prediction system we can't adjust the prediction system and give instruction. We are presently examination the routines to improve utilization of this data.

We are at present examination the systems to improve utilization of this data.

Patients can upgrade their sugar level values in the record and can get the activity and eating regimen arrangement for each and every meal. Future exploration is obliged to quality of life of diabetes patients and give

simple and available communication channel between care suppliers and patients.

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