INTEGRATING DECISION SUPPORT SYSTEM (IDSS) IN DIABETES DIAGNOSIS USING SENSOR SYSTEM & WEB SERVICES

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ABSTRACT

In the contemporary human health problems, it is discovered that Diabetes Mellitus is causing blindness, renal failure, amputation, heart attacks and stroke. Even though other factors like working conditions& lack of physical activity are considered, the key factor found is change in the meal. It may cause unpredictable changes in blood sugar(BG) levels. To monitor a diabetes patient, any diagnosis system considers above factors. The scope of Data Mining (DM) techniques is considered to analyze the data and study relationships among those parameters. A solution with readings from sensors like gluco meter sensor, blood Pressure sensor and others is generated using data mining techniques for appropriate results to medical experts to take final decision. RFID(Radio Frequency Identification) is used to record the patient's data with corresponding electronic health record (EHR). A sensor system as a sub system is proposed to support existing IDSS (Integrated Decision Support System) with web services to update data and find appropriate solution. DM tool classifies and analyses the pattern for diagnosis. The internet technology enables web services with low cost global connectivity between the patient's personal device, his physician. The patient's web portal updates the personal details, drugs remainder and the blood sugar level. This paper proposes a quicker and more efficient technique of diagnosing the disease, leading to timely treatment of the patients using IDSS. If there is any abnormality, then sensor set reads it to update & inform it by a phone call or an SMS to physician for any action.

Index Terms— *BG(Blood Glucose), EHR(Electronic Health Record), IDSS, RFID, DM.*

INTRODUCTION

Diabetes mellitus is a metabolic disease which explains abnormality in fuel metabolism. Blood glucose is main source of energy and comes from the food taken. Body Organ Pancreas makes a hormone called as insulin which helps glucose from food to blood cells for energy. If human body doesn't make/use insulin, Glucose fails to reach blood& burn which can lead to it's accumulation. Over the time, it can cause health problems. Daily meditation and regular diet will keep the disease under control. The diabetes management web portal like Joint Asia Diabatic Evolution **(**JADE**)** and glycemic index database are included.

Because of ignorance, it is spreading under the carpet as cause of death in the world.

Diabetes mellitus is divided into

(i) Insulin – dependent diabetes mellitus (IDDM), and

(ii) Non-insulin dependent diabetes (NIDDM).

IDDM or type I : It occurs in 12-15 years age of children. The patients require insulin therapy.

NIDDM or type II: It occurs in adults (usually above 35 years) and is less severe than IDDM. The patients of NIDDM may have either normal or increased insulin levels due to over eating fat food & lack of physical exercise. For NIDDM, health advisors/physicians are made available through online to assist patients by viewing their health records to timely answer difficulties. SMS/E-mail services are added.

II. DIABETES PATIENT MONITORING SENSORS

The web service facilitates registration of new members, people with diabetes, their family members, or anyone else with an interest in the disease. The user has to fill the registration form with their private information and choose the account's username and password. Once the information is conformed and the registration is successful, the user can login and use the opportunities that other services offer.

Management of the user profile entered during the registration is mandatory .It is important to enroll their sensor reading automatically. EHR(Electronic Health Records) are generated accordingly.

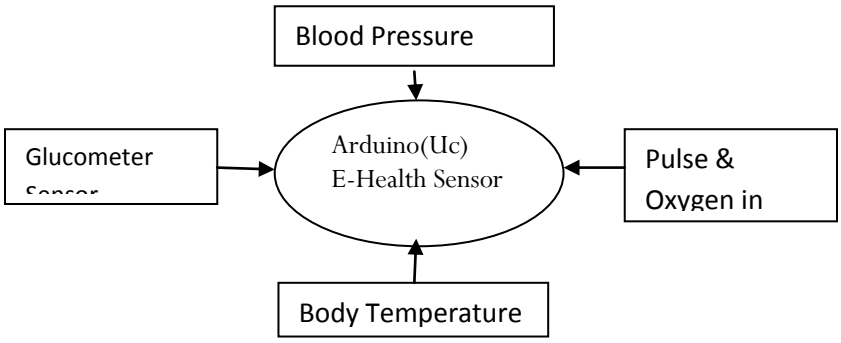

Fig 1: Deployment of Different Sensors on Diabetic Patient

1. Arduino – It is a microcontroller device which is used to make flexible things. It is available as open source to develop the multi-disciplinary projects in various fields.

2. E-health Sensor Platform – In this, Arduino performs biometric and medical applications to monitor body using different sensors.

3. Body Temperature Sensor- Used to measure the current temperature of the body

4. Pulse and Oxygen in Blood Sensor (SPO2) - Used to measure the pulse level and amount of oxygen content available in blood

5. Glucometer sensor- It measures approx concentration of glucose in blood. A small drop of blood is obtained by pricking the skin with a lancet, which is placed on a disposable test strip. The meter reads and uses to calculate the blood glucose level.

III. PROPOSED SENSOR SYSTEM

Here, a collective sensor platform is designed to integrate it to an IDSS. It is collection of Glucometer Sensor, Pulse &Oxygen Sensor, Body temperature sensor and Blood Pressure sensors. All are interconnected to E-health sensor (Micro Controller). It is connected to patient to note corresponding readings. RFID(Radio frequency Identification) tag verifies login id and password, whenever user logs in. Readings are updated automatically after measuring through body interface. It communicates accordingly to the concerned using web services with internet.

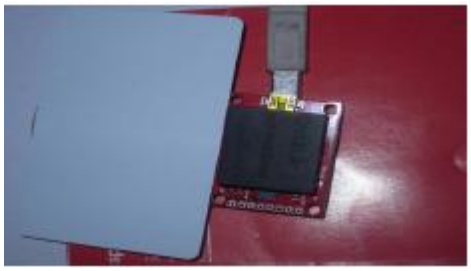

Fig 2: Use of RFID Tag in Smarter Kit.

A RFID smarter kit allows a user to get login into the web portal. The RFID tag ID number is entered in the database every time the user login to the web page the corresponding ID

valve available in the database will be verified and then allow them to login to the web portal for updation of sensor readings . In that the sensor are deployed in the diabetes patient by using the arduino and E-health sensor shield the measurements to be taken from the diabetes patient and then compared with the database finally the observed reading is normal then update it otherwise the sensor readings above the normal level then automatically it will send a message and the phone call to the personal doctor to the patient.

Figure 3.Welcome page with user login

Then the collected information is updated into the website for Diabetes patient management. If the glucose level increases, then automatically a message and mail are sent to the allocated personal doctor. Only in case of emergency, the mail and message are sent from the web portal.

Figure 4: Read RFID tag and login

IV. SUB SYSTEM ARCHITECTURE

The architecture diagram describes the overall process of the diabetes patient monitoring. Initially, sensors are deployed on the diabetes patient's body for monitoring. Measurements are taken to update into the database. These sensors record glucose level, pulse and oxygen in blood, blood pressure, body temperature, and ECG of the diabetes patients.

After two hours from taking a meal, the sensors are activated to take measurements. The RFID tag is read after login to the web service. The default normal measurements are provided for comparison. Then Calculation is carried accordingly. If the measured values are greater than default normal values, an automatic phone call or SMS(Short Message Service) and email are sent to physician. The Web Site contains the prescribed Drugs and general care about patients for physicians for reference only. Much information is provided to reduce time for decision making by experts.

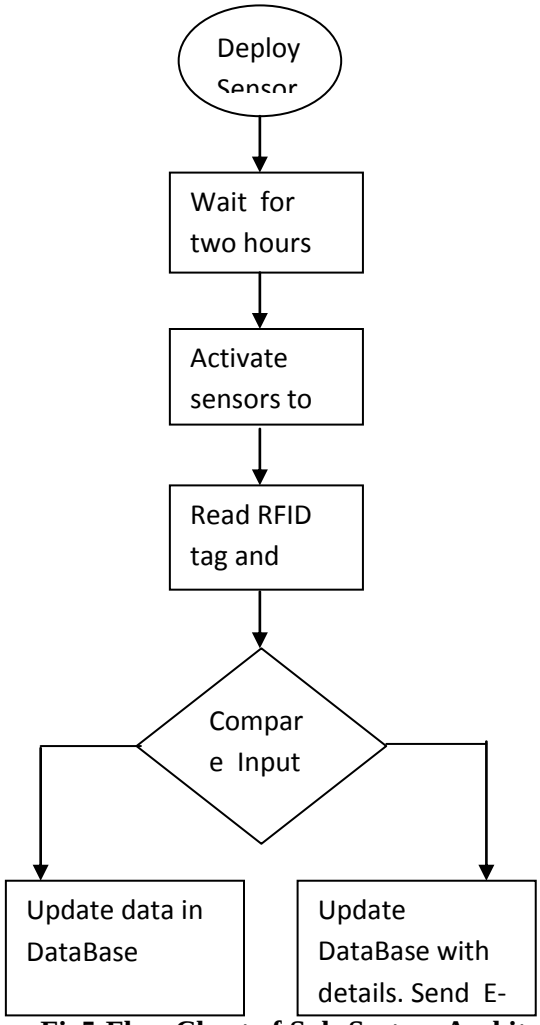

Fig5:Flow Chart of Sub-System Architecture

Glucose is primarily derived from glycogenesis between the meals. Depending on frequency of consumption of various food items at different times in a day, Glucose varies in day times(less active) and night times. Daily the patient details are updated. If the user forgets to take a meal, then a message will be sent to the particular user and it updates the sensor readings in the web portal at a particular time interval, also there is a discussion about their doubts and clarifications

V. DIABETES PARAMETERS

Diabetes is a disease where blood glucose levels are above normal, the Environmental factors, physical inactivity and genetic factors are the causes. A personal device has been developed to assist and Considered factors in the insulin therapy dosage calculation.

Table 1: Difference between type1 and Type 2 Character

Character	Type 1	Type2
Age at onset	Less than 20yrs	Above 30 yrs
Body weight	Normal or low	Obese
Prevalence	10-20% of diabetic population	80-90% of diabetic population
Duration of symptoms	Weeks	Months of years
Administration of insulin	Always required	Not necessary
Oral hypoglycaemic drugs	Not useful for treatment	Suitable for treatment
Diabetic complications at diagnosis	Rare	Found in 20% cases
Plasma insulin	Absent or decreased	Normal or increased

A wireless identifiable device which is used for diabetes monitoring steadily measures blood sugar levels. This is informed by the RFID tag, which is then added into the web service, when it is about to reach a critical status via a smart phone equipped with a built-in IOT communicator that allows it to connect to web service.

VI. CONCLUSION

This Sensor System is proposed as a concept to support & integrate it with existing IDSS. The solution is to support a patient's profile management based on personal RFID cards and provide global connectivity between the

patients and the web service. The security concept is the diabetes patients details are to be kept as secret. The drugs remainder and the discussion portion will be included in the future design session of IDSS.

FUTURE WORK

This work is to be improved in the security aspect in IDSS between the diabetes patients who access the same web portal for sharing and gathering information communicating in the wireless network interphone. Smart phone is used set as an immediate alarm. A phone call or an alert SMS is sent to the personal doctor and the GPS location of the patient in case of emergency. The nearest energy center is alerted and it dispatches an ambulance.

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