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Enhancing A Medbox for Health Precautions Using IOT

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Abstract: The ignorant nature and routine non-adherence towards medications have always caused immense imminence in terms of public health, also resulting in a significant amount of finance going run through. In-home healthcare services based on the Internet-of-Things (IoT) have great business potential; however, a comprehensive platform is still missing. This system shows how a Medbox can be used intellectually and effectively.

Keywords: Buzzer, Temperature and Blood pressure sensor, IR Sensor,GPRS Module

1. Introduction

Pervasive healthcare has been recognized to be the next generation form of healthcare, and distributed, patient-centric and self-managed care is emphasized as an alternative to the traditional hospitalized, staff-centric and professional-managed care. Pervasive healthcare based on the emerging technologies of the Internet-of-Things (IoT), as so-called Health-IoT, is highlighted as one of the killer applications of the IoT. It has been proven that, for the 4 most drug-spending chronic conditions (diabetes, hypertension, hypercholesterolemia, and congestive heart failure), hospitalization rates are significantly lower for patients with higher medication compliance. To address the medication noncompliance problem, one solution from traditional packaging industry is the One Dose Packaging which packetizes the tablets or capsules of one dosage into one small box of bag. It just makes medication more convenient for patients, but neither improves the compliance nor prevents from noncompliance. Noncompliance detecting and recording capability is offered by the Smart Medical Refrigerator, the microchip powered tablet package in and the Smart Dose Reminder in. But these are mainly afterward checking measure instead of preventive measure, and the operations of these solutions are so complicated that they are only usable for trained caregivers instead of the elderly, disabled, and patients.

At the same time, the increasing demands of daily monitoring prompt the Health-IoT solution to integrate more sensing and data processing capacities especially for on-site diagnosis and prognosis. For example, tri-axis accelerometer, electrocardiogram (ECG), blood pressure, blood oxygen saturation (SpO2), respiration oxygen saturation, blood sugar concentration, body temperature can be monitored on 24/7 basis [10-14]. So a powerful in-home terminal is needed not only to address the medication noncompliance but also to be used as a generic in-home healthcare station (IHHS) in everyone’s home. In this paper, extending our previous works in [16-21], an in-home medication management and healthcare system is proposed based on intelligent and interactive packaging (I2Pack) and intelligent medicine box (iMedBox). Preventive medication management is enabled by the intelligent pharmaceutical packaging which is sealed by Controlled Delamination Material (CDM) and controlled by wireless communication.

2. LITERATURE SURVEY

Ming Li et al [1]. proposed a Personal Health record which is patient-centric model of health information exchange.To achieve fine-grained and scalable data access control for PHRs, we leverage attribute based encryption (ABE) techniques to encrypt each patient's PHR file. Few experimental results show the security, scalability and efficiency of our proposed scheme. The framework addresses the unique challenges brought by multiple PHR owners and users.The system thus greatly reduces the complexity of key management while enhancing the privacy and also guarantees efficiency compared to the previous works.

Moeen Hassanalieragh et al [2]. Created a Networked sensor tha tcan be either worn on the body or embedded in our living environment, making the accumulation of rich information indicative of our physical and mental health.In particular, the availability of data at hitherto unimagined scales and temporal longitudes coupled with a new generation of intelligent processing algorithms helps in the betterment of facilitating evolution in the practice of medicine, enabling personalization of treatment and management ,and helping to reduce the cost of healthcare while simultaneously improving outcomes. There are several challenges in sensing, analytics, and visualization that need to be addressed before systems can be designed for seamless integration into clinical practice.

B. Sobhan Babu et al [3]. The Internet of Things(IoT) is the network of physical objects or things embedded with electronics, software, sensors, and network connectivity, which enables objects to collect and exchange data.This adopts the use of smart sensors that collaborate directly without human involvement to deliver a new class of applications.It thus assists the generally medically unaware mass to check their health status pretty much easily. Especially for health care system,Thus it ameliorates the identification of early signs of prevalent health ailments in an individual.

Mrinmoy Barua et al [4]. propose an efficient and secure patient-centric access control (PEACE) scheme for the emerging electronic healthcare (eHealth) system. The PEACE scheme can guarantee PHI integrity and confidentiality by adopting digital signature and pseudo-identity techniques and that the PEACE scheme is able to achieve desired security requirements at the cost of an acceptable communication delay. Through detailed security and performance analyses, it has been demonstrated that the proposed scheme is highly efficient to resist various possible attacks and malicious behavior.

3. BASIC ARCHITECTURE

A. MEDICINE BOX

The medicine box is built with a real time clock, a buzzer and LED lights to have an effective reminder system to the patient. It is also incorporated with a temperature and a Blood Pressure wireless sensors which prove efficient in detecting any abnormalities in the functioning of the patient. This is deemed as an emergency and an update is given to the physician for adopting a suitable action that is immediate. An IR sensor is used to detect if the medications are taken by the patient. The kit also involves a GPRS Module with a SIM slot to instantly update the web portal.Figure 1 shows the whole perspective of the underlying circuit of the medicine box.

B. TEMPERATURE SENSORS

General Description

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±1⁄4°C at room temperature and ±3⁄4°C over a full −55 to +150°C temperature range(Figure 1). Low cost is assured by trimming and calibration at the wafer level. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies. As it draws only 60 µA from its supply, it has very low self-heating, less than 0.1°C in still air. The LM35 is rated to operate over a −55° to +150°C temperature range, while the LM35C is rated for a −40° to +110°C range (−10° with improved accuracy). The LM35 series is available packaged in hermetic TO-46 transistor packages, while the LM35C, LM35CA, and LM35D are also available in the plastic TO-92 transistor package. The LM35D is also available in an 8-lead surface mount small outline package and a plastic

TO-220 package.

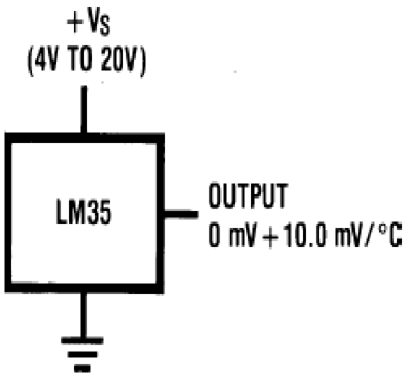

Figure 1. Basic Centigrade Temperature Sensor

C. IR SENSOR

Infrared radiation is the portion of electromagnetic spectrum having wavelengths longer than visible light wavelengths, but smaller than microwaves, i.e., the region roughly from 0.75µm to 1000 µm is the infrared region. Infrared waves are invisible to human eyes. The wavelength region(Figure 2) of 0.75µm to 3 µm is called near infrared, the region from 3 µm to 6 µm is called mid infrared and the region higher than 6 µm is called far infrared. (The demarcations are not rigid; regions are defined differently by many).

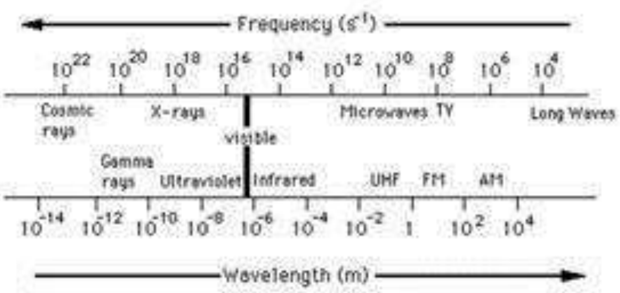

Figure 2. Wavelength Re**gion**

D. BLOOD PRESSURE SENSOR:

Blood Pressure & Pulse reading are shown on display with serial out for external projects of embedded circuit processing and display. Shows Systolic, Diastolic and Pulse Readings. Compact design fits over your wrist like a watch. Easy to use wrist style eliminates pumping.

Outcome of the sensor:

Each reading consists of **15 bytes** at 9600 baud rate. The reading packet's last byte is always the enter key character(0x0A in hex and 10 in decimal) which zllows you to view each reading on a new line. Also this character can be used to sync the microcontroller being used after reach readings.The output reading is a 8 bit value in ASCII format with fixed digits, from 000 to 255.

E. GPRS

General Packet Radio Service (GPRS) is a packet oriented mobile data service on the 2G and 3G cellular communication system's global system for mobile communications (GSM). GPRS was originally standardized by European Telecommunications Standards Institute (ETSI) in response to the earlier CDPD and i-mode packet-switched cellular technologies. It is now maintained by the 3rd Generation Partnership Project (3GPP).

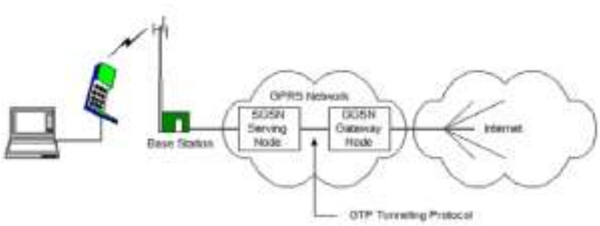

Figure 3. GPRS Network

4. WORKING /OPERATION

The system will work with a Real time clock by default. The registers are then loaded to the RAM of the LCD and hence displayed on the Screen. When the Set button is pressed, the display is cleared and message for setting the time is displayed. When the adjust button is pressed the time registers are updated and new value is displayed. The components can be changed by pressing again the Set button. The register is updated by incrementing the operation. Similarly, the Medicine frequency can be set for an at most 3 of times a day. Based on this an individual alarm can also be set by the same operation.

The kit also involves functionalities for an emergency situation for patients diagnosed with abnormalities in Blood pressure and body temperature.An alert for the patient to take medications to alleviate the emergency is generated and an update is given to the physician via the GPRS module.

The GPRS module acts as the transmitting agent for any sort of updates regarding the patient.The physician as well as the patient get to use a password encrypted web portal that holds

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records of the prescription and also details about the pills consumed on time and the pills missed.Thus the details of the patient and the prescription can be updated easily at any time.

5. PERFORMANCE ANALYSIS

The performance analysis demonstrated the efficiency of the function whereby a reminder was provided by means of an alarm from the wireless electronic pillbox to the smartphone when the patient forgot to take his/her medication.

Ten patients, who were taking oral medication every day, were recruited for this study. Patients who were under 20 years of age or over 75 years of age were excluded.Before starting the study, both medication prescription data and the scheduled medication time were entered into the portal by the researchers. Patients started using the web interface and the pillbox for taking their medication. The two important factors of concern were the timely reminders and the emergency action functionality.With the help of the Wireless temperature sensor and the blood pressure sensor ,any abnormal data immediately created an alert to the patient to take the required emergency medications and also let the physician know of the abnormality with ease.

6. CONCLUSION AND FUTURE ENHANCEMENTS

While the obstacles are substantial, new Embedded technologies are required to achieve precision medicine. Continued financial support for technical advancement of novel assays, clear guidance on regulatory pathways, and backing from strategic partners with broad distribution networks will facilitate the commercialization of these devices. As better information on individual health becomes available, utility of currently available therapies may be expanded, patient adherence may be improved, and more targeted therapies may be developed. New point-of-care technologies will play a critical role in this promising transformation in healthcare.

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Ms. D. Jennifer is currently working as Assistant Professor in the Department of Computer science & Engineering in Panimalar Engineering College, Chennai having an experience of 8 years. This college has been affiliated to Anna University, Tamil Nadu, and India. B.E with department first rank and M.E Degree is awarded to her by the St Peter's University during December 2012. Area of interest includes Data Mining, Theoretical Computer Science.