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MEDICATION REMINDER AND MONITORING USING IOT

Pallavi Prakash Ghogare[1], Mrs. V. S. Jahagirdar[2]

[1]M-tech in Electronics Design and Technology, National Institute of Electronics Design and Technology, Aurangabad, Maharashtra, India
[2] Senior Technical Officer, National Institute of Electronics Design and Technology, Aurangabad, Maharashtra, India

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Abstract - *The idea of digital world where different types of sensors and local processing connected to share information is used in many industries nowadays. There are various products which are developed based on these ideas. Healthcare industry is one where lot of improvements is taking place. Medicines play important role for prevention and cure for most of the diseases. Many Harmful and risky diseases can be cured through proper medication. The proposed system consists of an IoT enabled medication reminder system and it gives timely alerts for the patients about their medication time. It alerts the patient to take medicines at proper time by providing audio-visual alert. The system helps to monitor whether patient has taken the medicine and it's healthcare data.*

Key Words: Internet of Things; Medical reminder system; Arduino Module;

1. INTRODUCTION

Poor medication adherence still remains a major challenge facing most industrialized countries including the United States, leading to worsening disease severity and increased costs associated with higher hospital admission rates [1]. According to the American Heart Association, more than half of all Americans with chronic disease do not follow their physician's medication and lifestyle guidance, and nine out of ten make mistakes taking their medication [2]. In the U.S. alone, non-adherence to medications causes 125,000 deaths annually and accounts for 10% to 25% of hospital and nursing home admissions, with the annual direct and indirect cost of non-adherence estimated to be over $177 billion [3]. Recent literature show that, despite extensive research into interventions for assisting with adherence, rates of adherence have not changed over the past three decades [4,5].

Previous research found that forgetfulness is one of the most common factors contributing to poor adherence, along with the complexity of the regimen and disruption of daily routines [6,7]. Other studies have shown that medications are taken at various locations and in various contexts within the home; therefore, home computers are of marginal utility in this space since few people take their medications near them [8,9]. All of these results suggest that automated medication reminders through multiple devices within the home might be helpful technology interventions for improving adherence.

To support in-home health care activities, As part of an initiative investigating technology solutions we created several concepts of a multi-device, home-centered system that would use television (TV) along with set-top box (STB), mobile phones and other in-home devices as a means to set and deliver medication reminders. To assess the value of these concepts, we conducted a focus group study with the following goals: 1) to understand the current practices and challenges faced by our potential users (Le., middle aged and senior adults living independently) in managing their medications, 2) to assess the potential value of TV (& STB), mobile phones and other in- home devices for delivering medication reminders, and 3) to identify additional user needs to support home-centered medication management activities.

2. PRODUCT PERSPECTIVE

The major functionalities of the system are:

The IoT enabled system will generate an alert so that the patient can take required medicine at proper time.

There is one confirmation key provided in the system, by pressing that key caretaker of the patient will came to know that the medicine has taken, otherwise SMS to the caretaker of the patient will be send.

There are three sensors for Heartbeat measurement, temperature measurement and sweating measurement. If the values which are given by the sensors increases beyond the reference values then alert will be given to the caretaker of the patient.

3. HARDWARE INTERFACES

3.1 Arduino Mega 2560

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560 with 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller and simply connect it to a computer with a USB or power it with an AC-to-DC adapter or battery to get started.

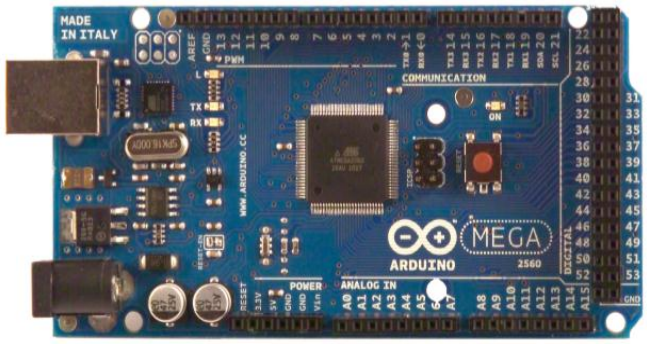

Fig -1: Arduino Module

3.2 Memory

There are three types of memory systems.

SRAM: This is called as static Random Access Memory where the sketch creates and implemented when it runs. It is a volatile memory and 8KB SRAM is available in the microcontroller board.

EEPROM: It is non-volatile memory and long-term information can be stored in this memory space. 4KB of EEPROM is available on microcontroller board.

Flash memory: This memory stores arduino sketch and is non-volatile. Microcontroller has 256 KB of flash memory for storing code (of which 8 KB is used for the boot-loader).

3.3 ESP8266 Wi-Fi wireless Transceiver

ESP8266 is a Wi-Fi module for adding Wi-Fi functionality to an existing microcontroller via a Universal Asynchronous Receiver/Transmitter serial connection. The ESP8266 highly integrated chip, including antenna switch balun, power management converter, so with minimal external circuitry, and includes front-end module, including the entire solution designed to minimize the space occupied by PCB. Microcontroller can access the Wi-Fi network by using the TCP/IP protocol stack. ESP8266 requires 3.3V power and can be pre-programmed so we can hook this up to Arduino device.

3.4 GSM Module

GSM (Global system for mobile)/GPRS(General Packet Radio Service) isSIM900 Quad-band GSM/GPRS device, works on frequencies 850MHz, 900MHz, 1800 MHz and 1900MHz. it is very compact in size and easy to use as plug in GSM modem. The modem is designed with 3V3 and 5V DC TTL interfacing circuitry which allows user to directly interface with 5V controllers (PIC, AVR, 8051, Arduino, etc.) and 3V3 controllers (ARM, ARM Cortex XX, etc.). The modem can be interfaced with a microcontroller using USART (Universal Synchronous Asynchronous Receiver and Transmitter) feature (Serial communication).

3.5 RTC Module

RTC (Real Time Clock) DS307 is 8-pin device which uses I2C (Inter Integrated Circuit) interface. It has automatic power-fail detect and switching circuitry. It has 56 byte of non-volatile RAM memory for data storage.

3.6 Temperature Sensor

LM35 is used as the temperature sensor which gives output gives output voltage which is linearly proportional to Celsius temperature. It gives low output impedance as well as low self heating.

3.7 Heartbeat Sensor

Heartbeat sensor provides a simple way to study the function of the heart which can be measured based on the principle of psycho-physiological signal used as a stimulus for the virtual- reality system. The amount of the blood in the finger changes with respect to time. It provides a direct output digital signal for connecting to a microcontroller. It possesses compact Size.

3.8 Breadboard

The breadboard has many holes into which circuit components like ICs and resistors can be inserted for constructing and testing circuits quickly before finalizing any circuit design. The holes which are on top and bottom side are connected horizontally while remaining holes are connected vertically. Board has strips of metal which run underneath by connecting the holes on the top of the board.

3.9 LCD Display

LCD (Liquid Crystal Display) is an image displaying technology used in many electronic devices. It has built in controller which works on 5V supply.

3.10 JUMPER WIRES

These wires are used to transmit electricity between two points in a circuit. Mainly jumper wires are used to analyze defects within the circuit or used to updating the circuits.

4. SOFTWARE INTERFACES

4.1 Arduino Software (IDE)

Arduino Software has text editor for writing code and the programs, called as sketches. These sketches along with the extension '.ino' are stored in a standard place called sketchbook. Once the sketch is written that can be uploaded to the arduino board. The Arduino IDE software will display a message if the upload is successful or it will display an error.

5. PROPOSED SYSTEM DESIGN

The Medicine reminder system consist of pill box provided with a set of compartments. It is designed in such a way that

normal people can use it easily for their medication. The control system of pill box consists of LEDs for giving the visual alerts to the patient for medicine. There is buzzer in the system which alerts the patient in audio form. It will buzz for particular time, within that time only the person have to press the key by taking the medicine, otherwise the alert will be given in the form of SMS to the caretaker of the patient by GSM that patient has not taken the medicine at the time prescribed by the doctor. The buzzer and LEDs are giving the alerts at the proper time set by the caretaker.

The block diagram of proposed system is given below:

There are three sensor fixed in the system for monitoring patient's health. They are Sweating Probe, Temperature sensor and Heartbeat sensor for measuring sweat, temperature of the patient and heartbeat respectively. Temperature sensor LM35 and sweating probe will provide the output in the Analog form which is given to the microcontroller and values are displayed on website designed for monitoring purpose. Heartbeat sensor will generate the output in digital form and it will also be given to the microcontroller and value of heartbeat will be displayed on website designed. If the value crosses the reference values given in the program then alert will be given to the caretaker of the patient in the form of SMS by the GSM that Patient's health is not good.

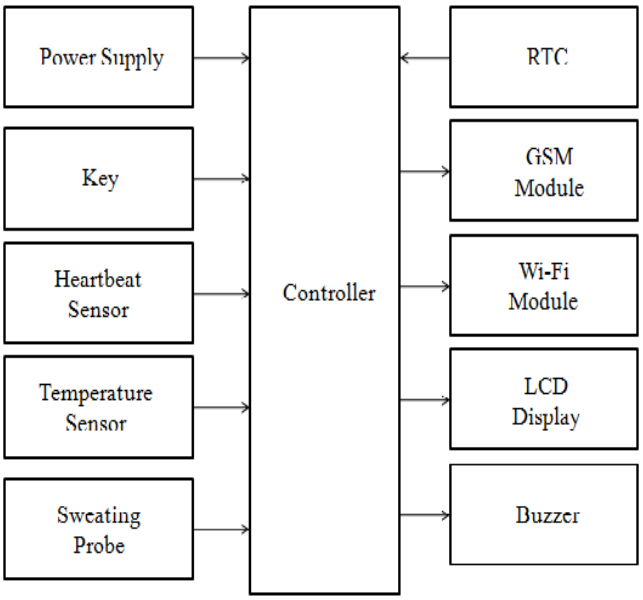

Fig -2: Block diagram of proposed system

RTC DS307 is interfaced with arduino by I2C interface which keeps the track of timings for medicine. If the power fails due to some reason then it has capability of automatic switching. LCD in the system will display medicine name to the patient. Confirmation key interfaced to the microcontroller will provide digital output and can be pressed by the patient when the medicine is taken.

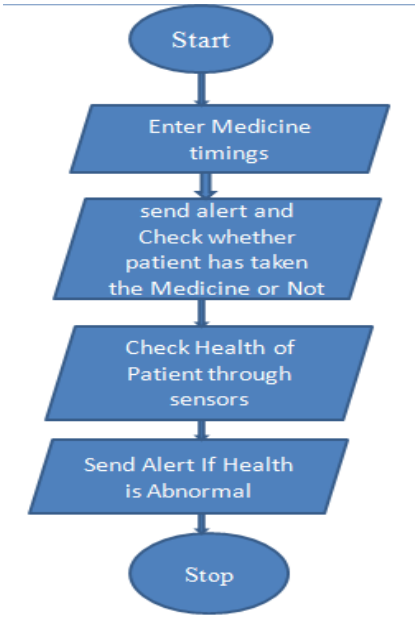

Fig -3: Flowchart for the System

Wi-Fi module ESP8266 is for giving Wi-Fi functionality to the device for sending the data of the patient monitored by the sensors. It is interfaced with arduino by using UART (Universal Asynchronous Transmitter and Receiver). GSM is also interfaced with controller by using serial interface.

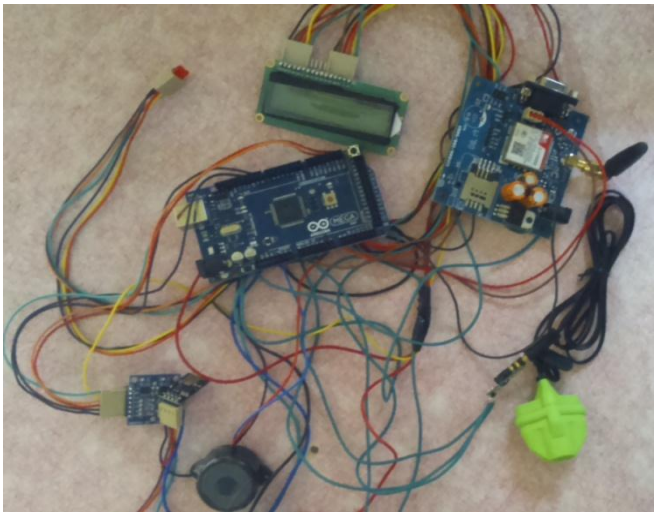

Fig -4: Prototype of Medication Reminder System

6. CONCLUSION

This system prevents wrong dosage of the patient and also safe to the patient. It will reduce the effort of patient as well as the caretaker of the patient in remembering medicine and patient will get alert of medication along with medicine name at appropriate time.

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