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SMART PILL DISPENSER

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Abstract
This paper presents a smart medicine dispenser prototype. The main purpose of the system is to help the patients, primarily seniors take their medicines on time in an easy way without any possibility of missing pills, also reducing the risk of over or under dosage accidentally. Not taking medicines correctly can have a serious consequence such as delayed recovery, illness and even death. The smart medicine dispenser could solve such problems by informing and alerting the patients to take appropriate dosage at the correct time. In addition, it provide the direct communication between the patients and the caretakers as it will immediately notify the caretaker in case the patient missed their pill. In addition, Smart Pill Dispenser provides the user with a touch interface available as an application on their smartphone, which will allow them to remotely manage and control pill schedules and usage data.

Index Terms-- Android application, Interface, Pill box, Pill schedules, Remote, Smart Phone, Smart medicine dispenser

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INTRODUCTION

Medical dispensers have transfigured the medication management sector over past few years. These automated tools are used to manage medical prescriptions for the patients. These devices are used to remind the scheduled time of dosage to patients and provide right amount of medicine at the right time.

As people grow older, they need to completely depend upon the support from others for their health monitoring and medical care. The current healthcare in recent society is widely considered as inadequate to meet the needs of an elder population.

Most patients need to take medicine for a long period to stabilize their health conditions. To assure that, the patients need to consume the right medicine at the exact time to avoid critical situation.

To accomplish this, the product is implemented using a simple microcontroller and simple x and y-axis movement setup of two motors to manage the pill's dispersal. In addition, a buzzer is given to alert the user to take pills and also notify their caretaker when pills have not been taken.

ABOUT PROJECT

Introduction

As discussed earlier, this project is to reduce medication error using a simple microcontroller and motor setup. The smart pill dispenser (SPD) contains medicine strips in each tray.

The trays are numbered for identification. The prescription along with tray number is uploaded to the SPD using mobile application. According to the time mentioned in the prescription, the alarm rings and when push button is pressed respective trays are opened.

A display shows medicine names along with the number of pills to be taken. A voice guide for visually impaired people is also provided.

When patient fails to take the medicine from the compartment, notification will be sent to the caretakers and patients mobile through a Wireless Fidelity (Wi-Fi) module.

Block Diagram

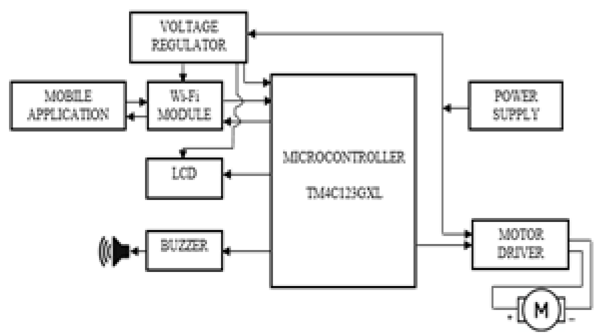

Figure 2.1. Block diagram

The fig.2.1 shows the block diagram of the prototype. The block diagram consists of a microcontroller which controls the system. A Wi-Fi module is used to transfer data from the user's mobile to microcontroller.

The microcontroller continuously monitors the present time and the prescription time. The Liquid Crystal Display shows the tablet name, tray number and dosage to be taken.

A 12V power supply is used along with voltage regulators to power the system. Buzzer is used to alert the user to take medication in time. An android application is for caretaker to monitor the patient's medical routine.

Flow Chart

The working of the project is well explained with the help of flow chart given below shown in fig 2.2.

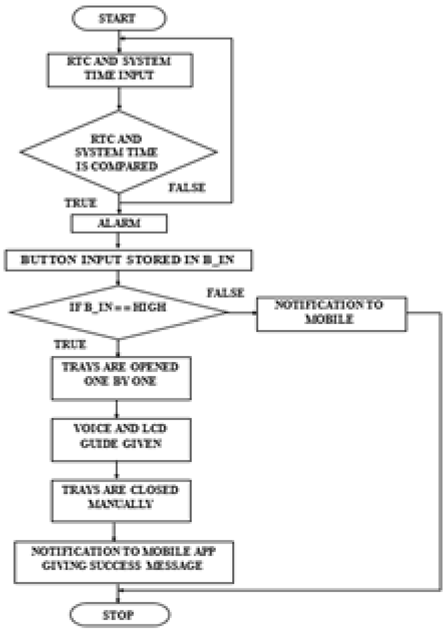

Figure 2.2. Flow chart

Step by step procedure of the working of the project is as follows:

- STEP 1: Start
- STEP 2: Given time input is compared with the Real Time Clock if it returns true goes to step 3 else step 2
- STEP 3: Buzzer sound is given as remainder
- STEP 4: If the button is pressed then goes to step 5 else messages are sent for every 30 minutes for 6 time to the mobile
- STEP 5: Trays are opened based on the time one by one
- STEP 6: Tablets are taken and the trays are closed indicating the completion of the process
- STEP 7: Notification is sent to the mobile indicating that tablets are taken
- STEP 8: Stop

HARDWARE DESCRIPTIONS

Microcontroller

In this, EK-TMC123GXL microcontroller shown in fig.3.1 is used. It is a 32 bit arm cortex M4 based microcontroller with 256-kbflash memory, 32-kb Static Random Access Memory (SRAM) and 80 MHZ. This microcontroller is used to control the system and also used to store the uploaded prescription as data. The microcontroller gets the prescribed data from the application through the Wi-Fi module. The ARM processor has the larger battery life and low power consumption.

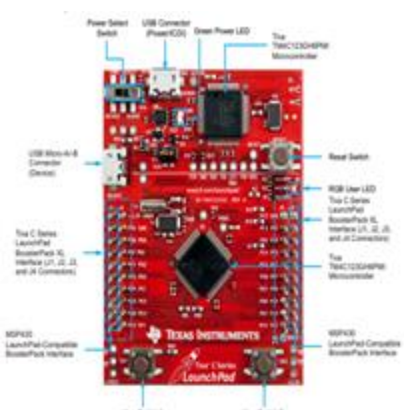

Figure 3.1. Microcontroller TM4C123GXL

There are two on-chip buses that are connected to core and to the peripherals. Processor performance is 100 DMIPS and its combined performance with interrupt handling is fast. The processor has high performance interrupt handling.

USB Connectivity

The controller is capable of USB embedded and On-The-Go (OTG) functions. The functions of OTG are enabled by R25 and R29. The General Purpose Input/Output pin and PD4 and PD5 are used to connect the USB. These are self-powered and providing power when acting as a host. The user can select the power source by power select switch like switch 3(SW3) to the device.

Power Supplies

The microcontroller has two power sources. One is on-board ICDI USB cable, and it is default and debug. Another power supply is USB device cable. Select the power select SW3 only one at a time.

Wireless Module

Wireless module is used to transmit the data wirelessly. In this project, a WIFI-ESP8266 module is used and shown in fig.3.2. This module is interfaced with the microcontroller. It is easy to integrate Wi-Fi functionality in the mobile computing devices. This ESP8266 module is efficient and cheaper as compared to the other module. The module TX and RX is connected to microcontrollers RX and TX i.e. PB0 and PB1 respectively.

Figure 3.2. WIFI ESP8266

Motor Drive

The A4988 is a micro stepping driver and is used to control bipolar stepper motor for easy operation. The driver operates with a supply voltage (3 – 5.5) V and is connected across V_{DD} and GND pins. The motor requires a supply voltage (8 – 35) V is connected across to VMOT and GND. The A4988 has a maximum current rating of 2A per coil. Two motor drivers are used. The step pin and dir pin are connected to microcontrollers PWM pins PB3, PF3, PF2 and PC4. PC4 and PF3 are step pin. PB3 and PF2 aredir pin. Fig.3.3 shows A4988 motor driver used in system.

Figure 3.3. A4988 bipolar stepper motor driver with heat sink

Stepper Motor

The NEMA 17 stepper motor can use for bipolar or unipolar stepping motor. The winding needs to reverse the magnetic pole, so they especially built in H-bridge arrangement. The Voltage rating (4V) and Current rating (1.2 A). The threaded rod output shaft present in motor converts rotation into linear motion. It has

200 steps per revolution in which per revolution 1.8 degree. Two motor are used. Fig.3.4 shows bipolar stepper motor used in the kit.

Figure 3.4. Stepper Motor

LCD Display

The fig.3.5 shows the structure of LCD is shown. It is a 7- segment display as in a digital clock. It is available display arbitrary images or fixed images. Large number of small pixels are used to make the arbitrary images. It can work in both 8-bit mode and 4-bit mode. It is operating voltage is 4.7 to 3.5V. Data pin 4, 5, 6, and 7 are connected to PA2, PA3, PA4 and PB6. Other data pins are grounded. RS, EN are connected to PC6 and PB6 respectively. LED+ and LED- are given to positive 5V and grounded.

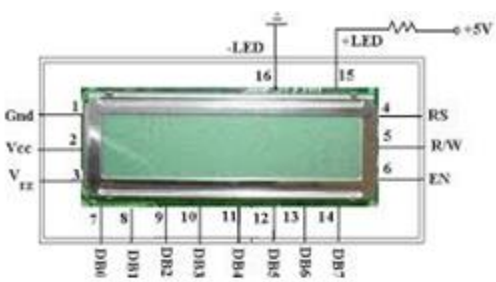

Figure 3.5. LCD Pin Diagram

Buzzer

A buzzer is audio signaling device. There are two pins one pin attached to ground and another pin attach to power. The resonant frequency is 2300 Hz. PD2 GPIO pin is connected to buzzer positive end and negative is grounded. Fig.3.6 shows the buzzer used for alarm in the kit.

Figure 3.6. Buzzer

SOFTWARE DESCRIPTIONS

The TIVA C Series Launchpad uses ENERGIA software and it is used to control the peripheral devices. On-chip peripherals are operated by using TIVA C Series peripheral Driver Library. ENERGIA is an open source prototyping platform. It has C/C++ programming / Arduino Programming and library files which simplifies many tasks. It also has easy-to-use functional APIs, and also libraries for programming a microcontroller. Higher level libraries are also available, such as Wi-Fi, Ethernet and Sensors etc. Operating system that supports ENERGIA are Mac OS X, Linux and Windows.

AN ANDROID APPLICATION OVERVIEW

The proposed prototype system methodology consists of the Smart Pill Dispenser design and its external peripheral. In this model, an Android Application that is responsible for uploading the prescription to the microcontroller. It's the primary way of interacting with the system; the application uploads the data to the microcontroller through the Wi-Fi module. Fig.5.1 shows the communication is in between the user and system.

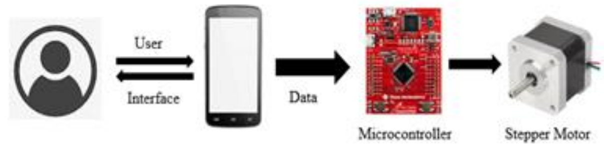

Figure 5.1. Communication between Devices

RESULTS AND DISCUSSION

The input is given to the smart pill dispenser kit through an android application. An android application is a used for sending information to the microcontroller through a Wi-Fi module. The prescription details are entered and it is shown in the below fig.6.1. The screen shown is for one tablet. Similarly, as many as tablets as prescribed can be entered and stored.

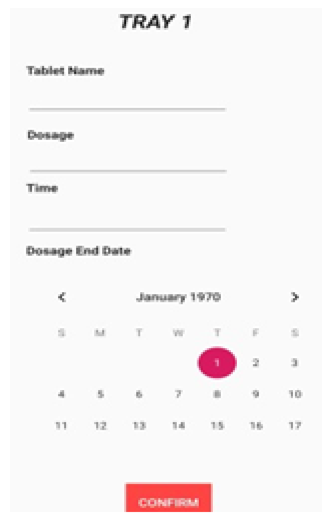

Figure 6.1. View of Mobile application

The motor driver circuit is shown in the fig. 6.2 is used to drive the motor and make x and y-axis movement using A4988 motor driver. Fig.6.3 shows the motor set up along with the trays for the tablet to be stored.

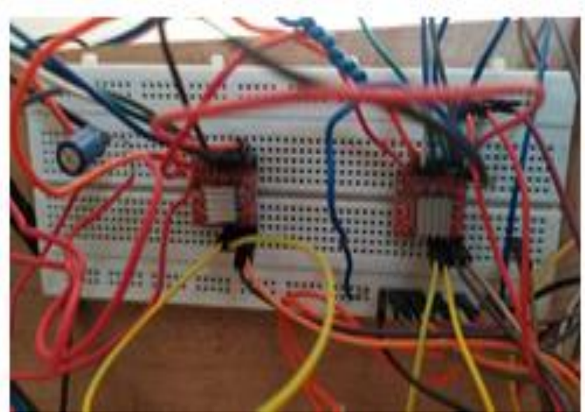

Figure 6.2. Motor driver circuit

Figure 6.3. Motor Setup along with the trays

When the prescribed time and RTC time matches, an alarm rings. If the button provided to open the trays are opened, a display shows tray number, medication names along with the number of pills to be taken. The fig. 6.4 and 6.5 shows tray details and Dosage prescribed.

Figure 6.4. Opened Trays

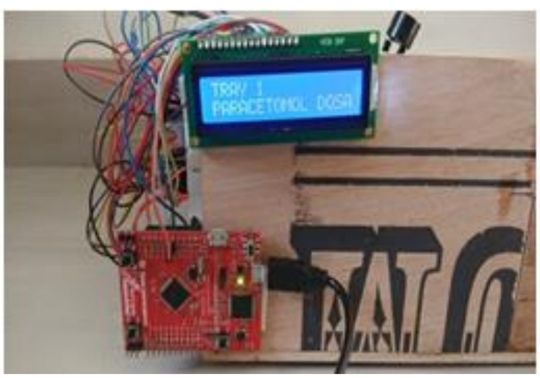

Figure 6.5. Display to display the dosage and the tablet name

CONCLUSION

The proposed system is made ease and helpful for the old age patient especially who used to forget to take medicines on time or they couldn't recognize name of the medicines. It has the facility to send remainder. In case patient do not take medicines even after alarms, system sends a message to the care taker's number given in the application. It is possible to change the prescription of the medicines as per requirement.

As the world is moving towards digitalization this kit can be further developed to a complete IOT based product, which in turn can be used to track health of any person anywhere at any time. And can be developed for hospitals in large scale to help nurses to keep track of the prescriptions of many patients.

REFERENCES

1. Wissam Anton, Ali Abdo and Suleiman Al- Yaman, "Smart Medicine Dispenser", IEEE 4th Middle East Conference on Biomedical Engineering (MECBME),Vol. 6, Page No: 20-23, Year: 2018
2. A.Jabeena, Animesh Kumar Sahu , N. Sardar Basha and Rohit Roy , "Automatic Pill Reminder For Easy Supervision", International Conference on Intelligent Sustainable Systems (ICISS 2017), Vol. 3, Page No : 98-102, Year :2017
3. Kartheek.K and Saddam Hussain SK, "Medical Dispense System Using Iot", International Conference on Vision towards Emerging Trends in Communication and Networking (ViTECoN), Page No: 1-3, Year - 2019
4. PK NijiyaJabin Najeeb ; Aysha Rimna ; KP Safa ; M Silvana ; TK Adarsh , "Pill Care-The Smart Pill Box With Remind, Authenticate And Confirmation Function",2018 International Conference on Emerging Trends and Innovations In Engineering And Technological Research (ICETIETR) , Page No : ,Year -2018
5. Mrityunjaya D , H Kartik J Uttarkar, Teja , Kotresh Hiremath , "Automatic Pill Dispenser", International Journal of Advanced Research in Computer and Communication Engineering Vol. 5, Issue 7, July 2016,Page NO 1-3
6. Jayesh Patil, Sameer Khairmode, Rishikesh Lokhande, Omkar Shinde, "The Autonomous Pill Dispenser With Alarm And Mobile Notifications", International Journal for Research in Applied Science & Engineering Technology (IJRASET), Volume 7 ,Issue IV, Apr 2019, Page No 2503-2507
7. Shaantam Chawla, "The Autonomous Pill Dispenser: Mechanizing The Delivery Of Tablet Medication", 2016 IEEE 7th Annual Ubiquitous Computing, Electronics & Mobile Communication Conference (UEMCON), 12 December 2016, Page No 2-4.
8. Chris Lee Eric, Groeteke Jayan Hewaparakrama, "Automated Pill Dispenser", Research gate, 04 May 2016, Page No 3-10