

Smart Drug Administration System using IoT-driven RTC Timer for Medication Management in Chronic Patients

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ABSTRACT

The primary objective of this project is to develop a Smart Medicine Box tailored for users with regular medication needs, especially those with lengthy prescription regimens that can be challenging to remember. Elderly patients, in particular, often encounter difficulties adhering to their pill schedules, leading to health issues for those with chronic conditions such as diabetes, hypertension, respiratory problems, heart ailments, and cancer. Our inspiration for this initiative stemmed from observations in hospitals and among individuals grappling with these health challenges. To address these issues, we have devised a Smart Medicine Box that addresses the problem by establishing a timetable for prescribed medications outlined in the prescription. When it's time to take the medicine, the system activates a buzzer, illuminates specific pill boxes with a bright light, and opens the corresponding compartment. This way, the patient can easily identify the designated boxes for their medication. All pill boxes are pre-loaded into the system, aligning with the scheduled times for medication intake. To enhance user convenience, we have incorporated features allowing the user to set the time and input medicine descriptions through an IOT Telnet application on a mobile phone. Subsequent voice alerts serve as reminders at specified intervals. The project's status can be conveniently monitored on a 16*2 LCD module, displaying relevant information. The proposed system is ingeniously designed using an ARDUINO microcontroller programmed with the Arduino IDE software. A 5V regulated power supply is employed to regulate the ARDUINO microcontroller, ensuring seamless control and functionality. Finally, this innovative system aims to contribute to the prompt and effective management of patient health by offering a user-friendly solution to medication adherence challenges.

Keywords: Smart pill box, health monitoring, medication management, Internet of Things, RTC timer.

1. INTRODUCTION

Currently, worldwide aging and regularity of persistent diseases are flatter a broad concern. Numerous countries are undergoing hospital restructuring by reducing number of hospital beds and escalating home healthcare, which is envisioned to perk up health care quality, has fascinated wide-ranging attention. In order to track the physical status of the elderly and, in the meanwhile, to keep them healthy, the proposed idea will be helpful. IoT expands the Internet into our everyday lives by wirelessly connecting various smart objects, and will bring significant changes in the way we live and interact with smart devices. Internet of Things (IOT) is a network where many of the objects that surround us will be networked in one form or another. In this process of encryption the schedule data or doctor's prescription are sent to pill box through mobile app. The LEDs are placed for indication and buzzer for alarm alerts and reset button is used to count for medicine in cloud platform.

The main step in the treatment of any disease is not just prescribing medication but also for the right administration of the drugs. Thus this machine automatically gives the right pills at the right time and also sounds an alarm to remind the patient about the medication time. Once a voice feedback is received from the patient, the pills are ejected. The proposed model makes it easy especially for the

elderly people who has one or more chronic condition or those who have to take multiple medications. This device mainly assists people with chronic disease or those suffering from heart diseases, osteoporosis, diabetes or cancer.

2. LITERATURE SURVEY

Several medical treatment systems have been built using different approaches and platforms. With the growing popularity of remote healthcare and medical apps, a lot of researches in these fields have been evolved. As part of that, several medication reminder systems have been introduced. In [1], the researchers proposed a prototype of an in-home medication management and healthcare system based on intelligent and interactive packaging and intelligent medicine box. Similar system is proposed in [2], where a medicine reminder app that manages prescription schedules and alerts for reminding patients about the type and time of the medication according to the prescribed medicine schedule. A typical design for smart medicine box introduced in [3] where a time table of prescribed medicines through push buttons as given in prescription. Another medication reminder system in [4] is proposed where it transmits open mobile alliance (OMA) data synchronization (DS) based messages which contain the patient's prescription and the device data to a remote medical staff. While in [5] researchers proposed an intelligent home monitoring system using ZigBee wireless sensors network that monitors the elderly who are living alone. We used the Medication management concept to propose a medication reminder system where pharmacists or patients can set the schedule time and the number of pills of up to eight medical doses. Based on an RTC (Real Time Clock) interfaced to the microcontroller, [6] the programmed time and number of pills for a medicine is displayed on the LCD along with a buzzer sound to alert the patient about taking the appropriate medicine. If patient doesn't press done button, he will receive a reminder about the medicine he has to take via SMS on his/her cell phone, by using GSM modem. Ikko et al [4] proposed Ubi PILL A Medicine Dose Controller of Ubiquitous Home Environment (2009), Home automation and wireless sensor network which have enhancing the quality of life by providing security, information and comfort.

Kliem et al [5] proposed Security and communication architecture for networked medical devices in mobility-aware eHealth environments (2012), Telemedicine concept is cost efficient and location autonomous monitoring system, the suitable and secured medical data can be transferred with different devices with attention towards security and privacy issue. Emergency situations need on the flutter network integration and data transmission fluctuating from domains like patients home, medical practices, ambulances and, hospitals, where each domain may parallel to a different authority so, mobility aware approach allowing out of the box medical device integration and authentication, and simultaneously fulfilling the typical security and privacy requirements of e-health environments. Parida [8] et al [3] proposed Application of RFID Technology for In-House Drug Management System (2012), RFID based technology have used to make drug management system, in this tracking of medicine can be done including emergency or regular medicine with or without RFID tag. The HF tag have assigning the user and by employing RFID reader along with camera and web based system to track the user. This system can be beneficial for the old age, less educated people. Clifton et al [2] A Self-powering Wireless Environment Monitoring System Using Soil Energy, proposed A large-scale clinical validation of an integrated monitoring system in the emergency department (2013), [9] In the integrated patient monitoring which include electronic patient data which generally have more amount challenges to acquire cope with artefact data with the help of algorithm, analyzing and communicating the resultant data for reporting to clinician, here in this demonstrated the machine learning technology embedded within healthcare information system which provide clinical benefits for improving patient outcomes in busy environments. [10] Hamida et al [6] proposed towards efficient and secure in-home wearable insomnia monitoring and diagnosis system (2013), Due to the evolution

in technology it is now possible to specific timing monitoring here delivers an experimental estimation of communication and security protocols that can be used in in-home sleep monitoring and health care and highlights the most proper protocol in terms of security and overhead. Design Procedures are then derived for the distribution of effective in-home patients monitoring systems Ray et al7 proposed Home Health Hub Internet of Things (H3IoT)(2014) , Health is vital part of life and it is quite necessary to give priority health related issue in which digitization helpful by using number of devices through the concept of IOT but due to heterogeneity and interoperability the concept of digitization for health care is neglected, here in this the best focus given to architecture framework for human health hub which have envision of usage of real life implementation technology(2014), Vital sign monitor can be implemented with IOT technology which is embedded with sensor, the transmitter will include the application oriented smart phone enable with 3G or IEEE 802.11 i.e. wi fi based transmission. The data from transmitter will be sending to cloud for centralized monitoring takes place; the expert in remote place can view all patient data and in case of emergency can take appropriate action.

3. EXISTING SYSTEM

Medisafe-an android application, which performs an automatic alarm ringing system. The alarm are often set for multiple medicines and timings together with date, time and medication description. The system only reminds the timing for a particular medicine and gives alarm at given specific time. Smart medicine Reminder for old people-usually old people forgets to take medications, which leads to health deterioration. This system aims to reduce this downside by reminding patients regarding their medications.

4. PROPOSED SYSTEM

The proposed medicine drug admin system is integrated of both hardware and software. This system used IOT android based RTC time, buzzer and Arduino model microprocessor, regulated power supply section for sign conversion system using python programming. When the set time is match with controller data base time then automatically medicine box will open to consume medicine pill.

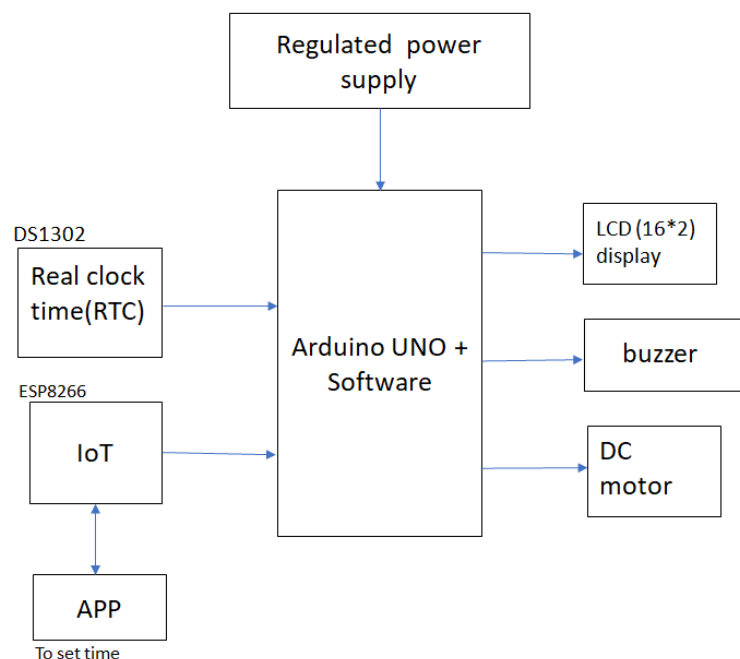


Fig. 1: Block diagram

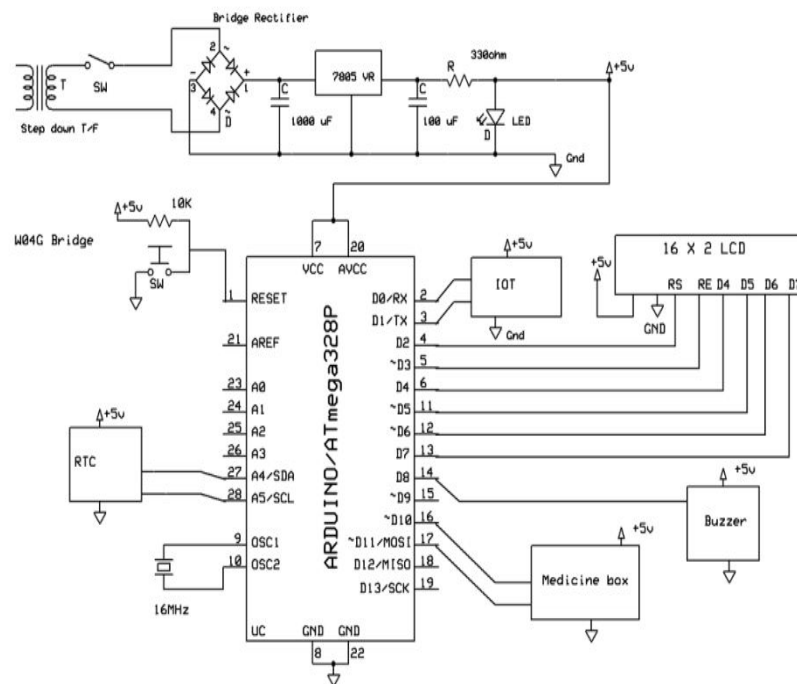


Fig. 2: Schematic diagram

- In this project we are using Atmega328p Microcontroller. It has total 28 pins. In these 28 pins we are using only 20 pins. D0-D13 are the Digital pins(14) and A0-A5 are the Analog pins(6).
- Here the D0,D1 are connected to the BLUETOOTH, for transmitting and Receiving the data. D2-D7 pins are connected to 16*2 LCD display.
- D10,D11 pins are connected to Medicine pill box Module gives the Medicine. A4-A5 pins are connected to RTC timer which can use to counts the time.
- The 230v Ac is converted into 5V of DC and that is given to the circuit through pin7. Reset is given to the pin 1 which is used to reset the circuit for connecting to the IOT module.
- The oscillator is connected to the pin9 and pin10, the GND is connected to the pin8 and pin2

Arduino sketch that functions as a medicine drug admin system using an Arduino board, a Real-Time Clock (RTC) module, a Liquid Crystal Display (LCD) module. The system is designed to remind users to take their medication at specific times by displaying messages on the LCD and dc motor opens the medicine box. The proposed system designed to configure and manage medication reminder times, display the current date and time on an LCD, and trigger dc motor box to remind users to take their medication. It uses an RTC module to keep track of time and EEPROM memory to store configuration data.

Logic explanation

Header Inclusions: The code starts by including the necessary libraries for various modules and functions used throughout the sketch. **Global Variables:** Various global variables are declared to store information such as medication times, current time, and configuration values. These variables are used throughout the sketch to control the behavior of the system.

Setup Function: The setup() function is where the initial setup of the system occurs. This includes setting up pins, initializing the LCD, initializing the Real-Time Clock (RTC) module, and configuring the IOT module for communication. It also initializes variables and clears the LCD screen.

In this code snippet, the setup initializes the necessary components including Serial communication, Software Serial, pins for motors and buzzers, and the LCD. It also initializes the RTC module and WiFi using the wifiiinit() function. The loop function reads the current date and time from the RTC module and displays it on the LCD. Additionally, it checks if it's time to trigger medication reminders based on the configured times (hourv1, hourv2, etc.) and performs actions accordingly. Please note that the complete medication reminder logic is not provided in the code snippet, but it's expected to be implemented in the loop() function. The serial Event() function handles serial communication for configuring medication reminder times. The wifiiinit() function initializes WiFi communication with certain configurations.

Overall, the code appears to manage medication reminders, display the current date and time, handle serial communication for configuration, and establish WiFi communication. If you have specific questions about any part of the code or require further assistance, feel free to ask. Top of Form WiFi Initialization Function (Unused): The wifiiinit() function is not used in the provided code. It seems to have been intended to set up a WiFi connection.

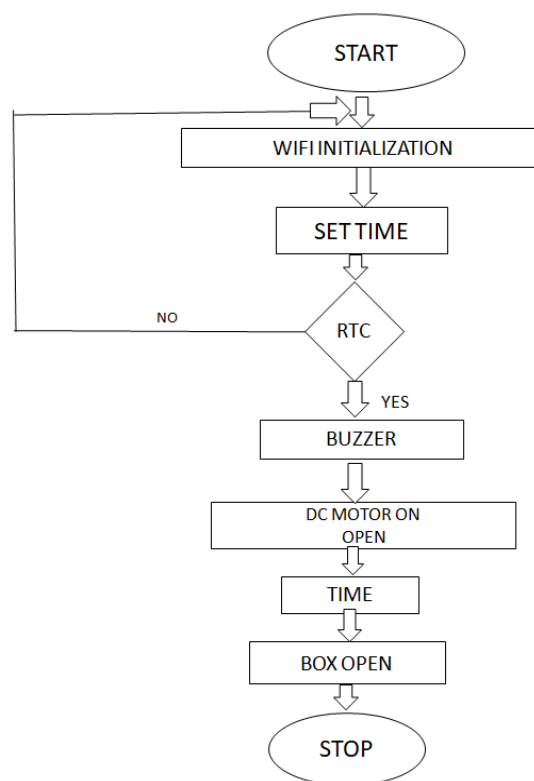


Fig. 3: Flow diagram

WORKING

The RPS module converts the 230 ac volts into 5v of dc. The 5v of power supply goes to all components in the system. The input of the project is RTC and IOT module. The RTC has CMOS battery and RTC circuit and it counts the time and opens the medicine box. The IOT server can send the data and display the data in the IOT server app. The output has LCD, Buzzer alarm and dc motor. In the Arduino microcontroller contains the software programming code Embedded C. The main

purpose of the microcontroller is the data can be control by the microcontroller. Once we should ON the kit first Reset the kit because to connect wifi to IOT server. The kit is reset the LCD displays the Medicine Remainder. After we configure to IOT server by using an TCP Telnet Terminal app. By using our mobile phone we can connect the wifi to IOT server. Once the wifi is ON the mobile data should be OFF. By using the IP address 192.168.4.1 and port:23 connect the IOT server. Once it is connected the LCD displays the present Date and Time.

Next we can the set the time for reminding the Medicine we can use the command like @HH:MM:SS#. We can give the Eight commands first we can save and then send the LCD displays the configurations of reminders. The first two commands are getting the same voice and similarly the next six commands also. The next command is for the reminding purpose. Not only giving the voice we can also see the name of the medicine on the LCD and at the same time IOT app.

In real time once we can set the commands it working on 24/7 until the power is OFF. Suppose the power is OFF we can again set the commands.

6. HARDWARE IMPLEMENTATION

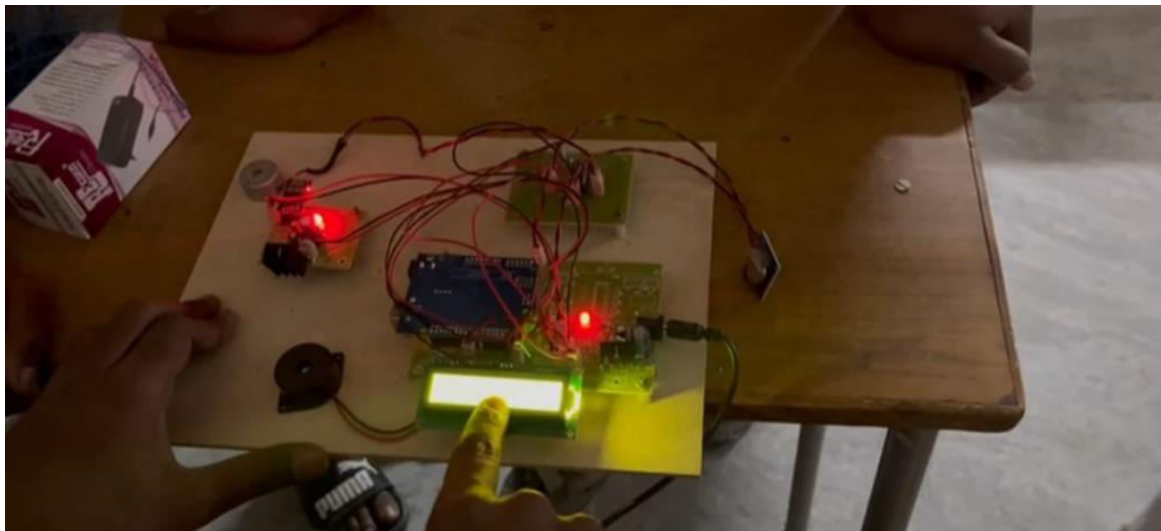


Fig. 4: Smart pill box model.



Fig. 5: Lcd displaying time and date

After giving the power supply and Wi-Fi LCD displayed current day, date and time.

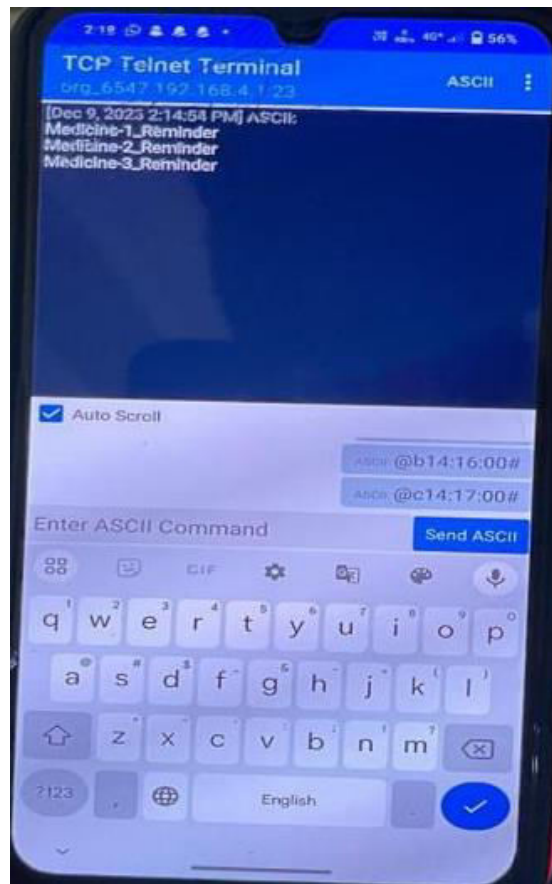


Fig. 6: Mobile application

By using IoT app we have given three commands at a time in the format (@atime(hh:mm:ss)#) with certain time interval. The time is given in 24 hours format. At particular time the buzzer rang and pill box came out all the three times.

6. CONCLUSION

Overview of the project is “IOT RTC based smart drug admin gives the medicine box automatically open and close for easy consumption of medicine at correct time.” the main aim of the project reminding the medicine for the people who are having the health problems Mentally elderly and physically. In this project we are using the RTC timer and IOT module transmitting the data. And the data can be controlled by Microcontroller. By using the wifi connect the IOT server. The data can display on the LCD display and at the same time IOT server. The medicine box will be open through the dc motor module.

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