WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Design and Development of Smart Medicine Dispenser IoT

[1]Mallikarjun K, *[2]Rajathreddy S, *****[3]Syed Maaz, ******[4]Tanish S, *******[5]Dr. Prasanna Kumar**

[1,2,3,4,5] R V College of Engineering, Bangalore, Karnataka

ABSTRACT-

Indian population is expected to exceed 1.5 billion by 2031, according to a recent census. By 2031, there will be 132 million senior citizens and disabled people, up significantly from 77 million in 2011. Such people depend on opportune drug to keep them sound. Additionally, there appear to be more overdose-related deaths, according to reports. By extrapolating the current data, which indicate a little more than 2.5 million deaths, it can be predicted that there will be approximately 5.5 million deaths by 2031. We propose a Smart Medicine Dispenser to address these societal issues. The proposed unit is a microcontroller-based plan that gives an open prescription agreement and circulation framework for older people or patients at standard time stretches as recommended by the specialist. The dispenser is driven by a mechanical system that includes push buttons and specialized servo motors. Various kinds of pills are put away in various canisters and an iterative system is utilized to administer various pills of a similar sort. The framework utilizes an onscreen regulatory entryway to allow the guardian safely to enter or change the remedy for the patient. This information is stored on the Google's Firebase database. This system uses a real-time clock to provide the device with the current time because timely medication is crucial. In addition, a Twilio has been added that, in the event of an emergency, can provide the patient with a supply of particular medications. Additionally, a Twilio API has been utilized to notify authorized medical personnel or caregivers of such emergencies. When the SOS feature is turned on, an SMS is sent. The Smart Medicine Dispenser was put into use with success, and the results were in line with the theoretical framework. The fact that the gadget makes it seen apportioned the expected medicine at the set time, according to the remedy. The proposed design was followed by the Twilio as well. Overall, the system was found to be extremely accurate and dependable, as well as safe for elderly and disabled users.

Introduction

As technology progresses, it has led to the discovery of many drugs that can actively cure a large number of diseases. These drugs would be even more beneficial for the general public. Administration errors, or errors that occur due to the patient's or caregiver's failure to comply with directions provided by a licensed medical professional, are the most common. Such errors are preventable and the Automatic Medication Dispensation and Alerting Unit described in this report is designed for this purpose. It is primarily for the growing population of users who are elderly or have chronic conditions but are well enough to live independently. Apart from being threatening to patients, such medication errors cost hospitals dearly. In 2013, The Institute of Medicine in the United States of America surveyed hospitals across the nation and released a report which said that for each patient admitted to the hospital on account of a medication error, hospital costs increase by at least 5,857. This leads to a total of 3.5 billion every year. These are the shocking statistics for a country as largely developed as the United States of America. For a developing country like India, the numbers will be much higher. Mis-medication is the most common form of elderly abuse in India. With the number of senior citizens and disabled individuals expected to cross 120 million by the year 2031, and an increasing number of deaths caused by drug overdose, there arises a need to introduce a safe and affordable system that can provide accurate and timely medication. Another major issue faced in hospitals is pilferage due to which they incur heavy losses. This calls for automated systems that can track the usage of different medicines and keep a check on the number of pills being used per patient. An automated medicine dispenser is ideal for such situations. With the number of people volunteering to take up careers as hospital staff diminishing every year, it become extremely important for patients to be provided with devices that can reduce or even replace the need for such caregivers. Design and Development of Smart Medical Dispenser using IOT Department of Electronics and Instrumentation 2022-23. Existing methods of medicine dispensation fall into two categories: • Manual: This includes self-service and service provided by a caregiver. These methods, however, involve a large percentage of human error. The risk of taking incorrect amounts or doses and missing schedules is also high. • Automated: Medicine stations and premixed medicine dispensers are two of the existing automated systems. Such systems are expensive and very often not for individual purchase. In today's fast-paced and interconnected world, the smart medicine dispenser emerges as a beacon of innovation in the field of healthcare. With the increasing complexity of medication regimens and the challenges of medication adherence, this cutting-edge device has arrived to simplify and optimize the way we take our medications. The smart medicine dispenser is not just an ordinary pill organizer; it is a comprehensive solution that seamlessly integrates technology, intelligence, and convenience. Designed with the user's well-being in mind, it addresses the common pitfalls of medication management and empowers individuals to take control of their health journey.

Literature Survey

1. Bhagya Shree S.R et al [1] presented a model that presets the scheduled medication time as prescribed by the doctor. This was achieved by comparing the preset time with the time indicated by a real time clock. If for some reason the patient fails to take his/her medicines, a message is sent to the caregiver informing about the failure. This model was proposed keeping the elderly, illiterate and bed ridden patients in mind, so that timely medication is available to all. Time and dose control are two important factors that have been proved to be extremely effective in illness management, especially for the elderly.
2. Mohammed M.N.A et al proposed a Dose Reminder System which was designed for home use. They aimed to find a low-cost solution that had increased accuracy and reduced the need for caregivers. Upon testing, it was seen that device was able to achieve an accuracy of approximately 90%. The authors however failed to implement quality control methods and advanced digital prototyping is necessary.
3. Krasinski P et al proposed a device that had the advantage of in- built safety features like a GSM module. This feature ensures that a patient has taken the medication on time and in case of failure provides an alarm to a supervisor or caregiver. A system to avoid therapy errors was also incorporated.
4. Ermisoglu E et al proposed an automated medication tracker called “Mobile Treatment Monitoring System”. The design established a remote link between the patient and doctor and is extremely beneficial as it does not rely on the patient’s memory. Since approximately 50 to 75% of patients fall prey to mis-medication due to forgetfulness and busy schedule, such a design has great value.
5. PHARMA 2.0 is a system designed by Iadanza E et al . The authors looked at reducing Adverse Drug Events (ADEs) by making use of a telematics integrated system. The proposed system was grounded on three sub-systems: a CPOE (Computerized Prescription Order Entry), an RFID-based drug container, and a dispenser and a middleware system. Administration of the drug on the basis of the prescription was handled through a web application designed to comply with international usability regulation.
6. MedMate is a pill dispenser created for home use by Jit Chee et al . The authors first conducted a study by developing a paper prototype of MedMate, to get feedback from users early in the development cycle. The study consisted of a questionnaire followed by an interview to gain in-depth understanding of the users’ perceived acceptance and their concerns regarding MedMate. The results showed that the design was acceptable. However, participants were concerned about affordability, portability, reliability, safety, efficiency of reminder, accessibility and capability in handling different forms of medication. The design was well received but the authors failed to address all the concerns raised.

Methodology

The methodology of the prototype involves two major parts: (1) Software and (2) Hardware. The two major parts can be further divided into (1) Android Interface, (2) Firebase Data-Base, (3) Microcontroller and (4) Servo Motor along with 3D printed parts and (5)Twilio.

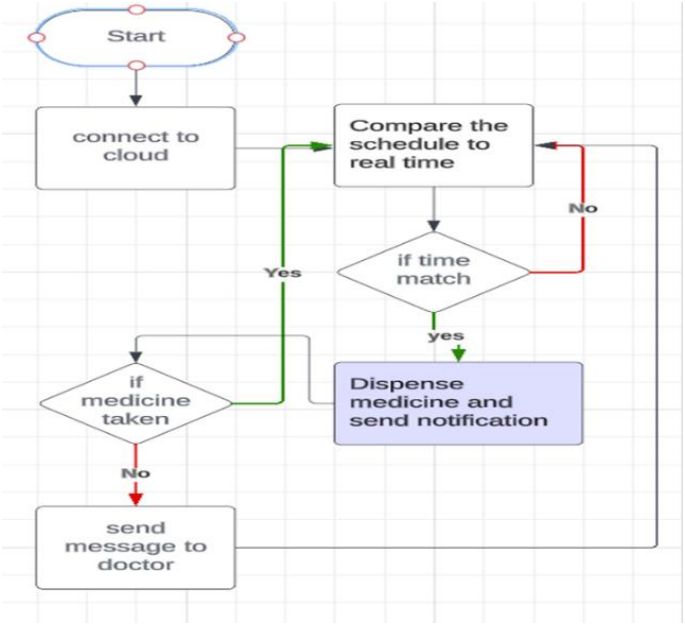

Fig. 1. Data Flow Diagram

Android Interface

Android application has become an important part in communication between the user and the project. Since an Android smart phone is being used for every day task like setting reminders, messages, IOT, browsing etc.

The medicine dispenser prototype uses the Application as interface. The application is designed mainly to set the schedule for the tablets that need to be taken. The application consists main menu and setting the number of days and if the tablets needs to be taken morning or evening.

Fig. 2 shows the application main menu.

Fig. 3 shows the schedule page for tablet A.

Fig. 2. Main Menu

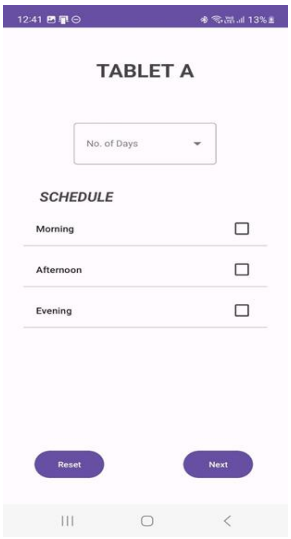

Fig. 3 Schedule setting

Firebase DataBase

Firebase provides NoSQL and Real-time Database, which is available on cloud. This is very suitable for Internet-of-Things Applications, since

• it allows for real-time sync of json data

• can collaborate among multiple devices

• supports offline use and syncs data when online

• data is secured.

The Firebase realtime database has been used to set and store the pill details entered from Android Application. This information inturn is fetched from the microcontroller and is made to dispense the tablet accordingly.

Fig. 4 shows the storing of the data in realtime

Fig. 4 Firebase data storage

ESP32

The ESP32 is a microcontroller based on Arduino core, which has in-built WiFi and Bluetooth module. This microcontroller is mainly used to fetch data from the firebase as it has a wifi and makes it easier to connect to cloud as it has libraries specially made for it. Without cloud connectivity it is hard to connect the microcontroller to android application.

A ntc clock server is being used to dispense the tablet at the particular time set but the user through application.

Servo Motor and 3d Printed parts

Servo Motor holds the 3d Printed container of medicine which has slots on it. The servo rotates the container when it receives the instruction the ESP32. The container is a star shaped as shown in the Fig. 5 and the prototypes use slots, which can be extended in future to any number of slots as per the requirements.

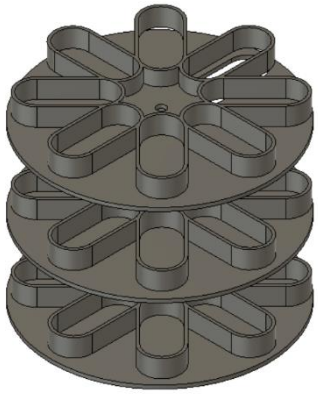

Fig. 5. 3D Design

The prototype consists of 3 servo motor attached to 3 containers. All 3 servo motors are connected to a push button for on-demand supply of medicine. In order to make the functioning of on-demand supply of medicine hardware interrupts are used in order to pause the running code and make the on-demand functionality.

Twilio

Twilio is a communication tool which is used for making and receiving phone calls, sending and receiving text messages. The prototype uses twilio to mainly send user the message as notification whenever the tablet is dispensed. The sample messages have been shown in the figure 6.

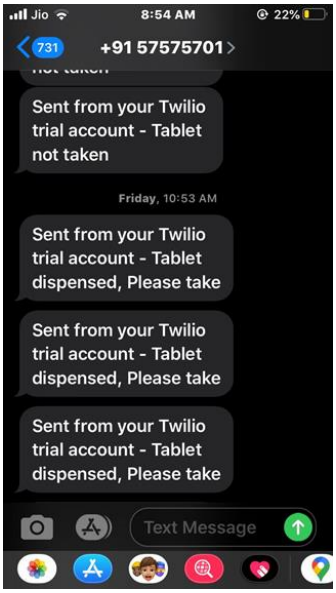

Fig. 6. Twilio messages

Pseudocode

Step 1. Connect both Android application and ESP32 to the internet.

Step 2. Connect the microcontroller and application to firebase.

Step 3. Update the information on firebase through android application.

Step 4. The data is then obtained from firebase through microcontroller.

Step 5. The microcontroller then processed the data and instructs the servo motor to rotate the container.

Step 6. Create hardware interrupts for push button so that it supplies medicine on-demand.

Step 7. Sending notification from twilio whenever the tablet is dispensed.

Conclusion

In conclusion, the development of a medicine dispenser that dispenses tablets on a timely basis holds great potential for improving medication adherence and patient health outcomes. Throughout this report, we have explored the importance of medication adherence, the challenges associated with it, and the potential benefits offered by a timed medicine dispenser. Medication non-adherence is a significant issue that affects a large number of individuals worldwide. It leads to negative consequences such as poor disease management, increased healthcare costs, and a higher risk of complications. Recognizing the need for innovative solutions to enhance medication adherence, the concept of a medicine dispenser that delivers tablets at specific times has emerged as a promising intervention. The implementation of a timed medicine dispenser offers several advantages. Firstly, it provides a convenient and user-friendly solution for patients, as they no longer need to rely solely on their memory or manual organization of medication schedules. The dispenser can be programmed to dispense the right medication at the right time, ensuring consistency and accuracy. This greatly reduces the chances of missed doses or incorrect administration. Furthermore, a timed medicine dispenser has the potential to improve medication adherence by incorporating reminder features. Many dispensers can be equipped with alarms, visual cues, or even connectivity to mobile devices to send reminders to patients. These reminders serve as prompts for individuals to take their medication, reinforcing adherence behavior and reducing the likelihood of forgetfulness. Design and Development of Smart Medical Dispenser using IOT Department of Electronics and Instrumentation 2022-23 Page 50 Another crucial aspect of a medicine dispenser is its ability to enhance safety. With programmable features, it can prevent medication errors by ensuring the correct dosage is dispensed at the specified time. Additionally, some dispensers offer childproof mechanisms, protecting young children from accessing medication that may be harmful to them

Reference

1) Smart medicine dispenser"[b J Feslina[4] and Teena Rajan[5] Department of Electronics and Communication Engineering, Mar Baselios College of Engineering and Technology, Trivandrum]

2) "Smart pill dispenser using iot"[Kartik Arora , Ujjwal Singh, 0, Smart pill Dispenser using Internet of Things, INTERNATIONAL JOURNAL OF ENGINEERING RESEARCH & TECHNOLOGY (IJERT) Volume 07, Issue 07 (July 2018)]

3) "Automatic Medicine Dispenser using iot" [Jyothis Philip, Feba Mary Abraham, Ken Kurian Giboy, B J Feslina and Teena Rajan Department of Electronics and Communication Engineering, Mar Baselios College of Engineering and Technology, Trivandrum]

4) "Construction of a Smart Medication Dispenser with High degree of scalability and remote manageability".[Jyothis Philip, Feba Mary Abraham, Ken Kurian Giboy]

5) Pei-Hsuan Tsai, Tsung-Yen Chen, Chi-Ren Yu, Chi-Sheng Shih, Jane W. S. Liu, "Smart Medication Dispenser: Design, Architecture and Implementation", IEEE Systems Journal, Vol. 5, No. 1, March 2011, pp. 99-110

6) Insight- How Servo Motors Work – Ashok Sharma, Retrieved from internet resource located at: www.engineersgarage.com/articles/how-servo-motors-work

7) Bhagya Shree S.R, Chandra Shekar P, Arjun A, Manoj G.R, "Automated Medication Dispensation System", IEEE Eleventh International Conference on Wireless and Optical Communications Networks (WOCN), 11-13 September 2014, pp. 1-6