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Medicine Dispenser with Alarm and Alert Message using GSM

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Abstract: Nowadays, taking medicine is a regular part of our daily routine, helping to improve our health, treat diseases, maintain the immune system, cure infections, and relieve pain. However, improper medication, either through under-medication or over-medication can lead to unnecessary, unwanted and unexpected health risks. One significant factor contributing to this issue is that elderly people often forget to take their medicines as directed. To address this problem, this work utilizes an Arduino MEGA and a real-time clock module that serves as a timekeeper, providing accurate time for creating a medication dispenser and reminder system. The system includes a servo motor that controls the output of the medicine and dispenses it from the drawer. The ultimate goal is to develop a functional prototype that effectively addresses the problem of medication adherence among elderly individuals.

Keywords: Medicine Dispenser, Alarm System, Automatic Pill Dispenser

1. Introduction

Medicine is crucial for the health and well-being of individual especially aged people as it helps alleviate symptoms, treat illnesses and manage chronic conditions. However, not everyone responds to medication in the same way due to factors such as the unique physiology of older bodies and their specific health conditions. When prescribing medicine for the elderly, doctors take into account various factors including their medical history, age-related changes and potential interactions with other medications. Proper medication management is particularly crucial for aged individuals who may face additional challenges in adhering to complex medication regimens. It is important to ensure that older adults receive the necessary support and resources to effectively manage their medications and maintain their health [1].

Besides, living alone adds to the complexity as there may be no one to remind them about their medication schedule [2]. This situation increases the risk of medication errors and non-adherence, potentially leading to adverse health outcomes. A recent time during Covid19, risk to death increased and it more effected on aged people [3]. Moreover, a significant number of elderly individuals in this country experience health problems such as diabetes, hypertension (high blood pressure) and

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hypercholesterolemia, increasing their risk of heart disease and cardiovascular issues [4].As digital technologies continue to expand and enhance different aspects of our lives including healthcare [1], they are increasingly employed to enhance medicine management. Nevertheless, the rapid growth of technology can present challenges for older individuals, who often struggle to keep up with its pace. In such situations, GSM technology can play a crucial role by providing communication solutions and facilitating better connectivity with family members, as discussed in [5].

Based on previous researches, there are various methods were used. The smart medicine in [6] by Manjunath *et al.* addresses the important of having database to monitor the aged people medication and also provide cooling system to store medicine [6]. Kajal Shahane *et al*. in [7] demonstrated a pill dispenser box that use vibration motor to control the lid that hold the pill from came out. In [8], Jyothis Philip *et al.* set an IOT and have liquid medicine and pill medicine by using mini submersible pump to pump the liquid medicine [8]. Whilst, Bharat Bhushan Singh *et al.* use motor driver L293D to created dispenser box and came up with GSM system where the system initiated after five hours of pre-set time [9].

2. Materials and Methods

In this section, the specifications and properties of the materials, equipment and other resources used in the current study are described. This work aims to developed a medicine dispenser system that help aged people to monitor and improve their medication status. The subsequent sections will cover the diagram outlining the overall implementation process of the proposed work.

2.1 Block diagram

Figure 1 shows the block diagram of the system. The system includes various components and operates based on three main parts: input, processing unit and output. The input section consists of a power supply, real-time clock (RTC) and an infrared (IR) sensor. The processing unit is the Arduino MEGA microcontroller itself, responsible for receiving input data and generating the desired output. The output section includes a GSM module for sending alerts and miscalls, an LCD display for showing medicine information, a buzzer for alarms, LED lights for indicating the correct medicine and a servo motor for dispensing medicine.

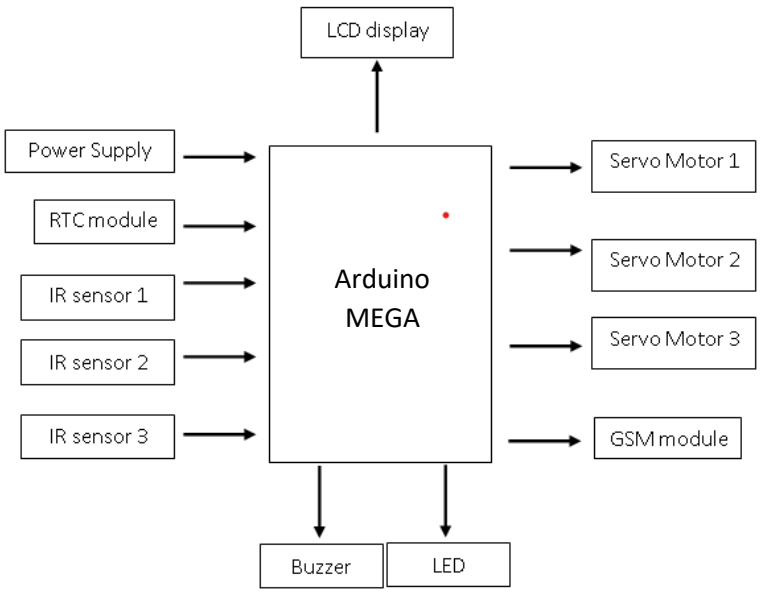


Figure 1: Block diagram

Additionally, the system allows the user to set up reminders for different types of medicine, dosage and specific times. The dispenser accommodates medicine for high blood pressure, diabetes and heart disease. When it's time to take the medicine, an alarm sounds and the user can access the medicine by pressing the stop button then take from the drawer.

2.2 System operation

Figure 2 shows the flowchart system operation for the proposed work. The flowchart illustrates the flow of data and processes, starting with input to set medicine, dosage, medicine timing and finally dispensing of the medication to the user. The dispense mechanism control by lid and servo motor and dispense to the drawer. GSM module are operated when there is no action from stop button within 5 minutes to upward and turn off the system after GSM module sending miscall.

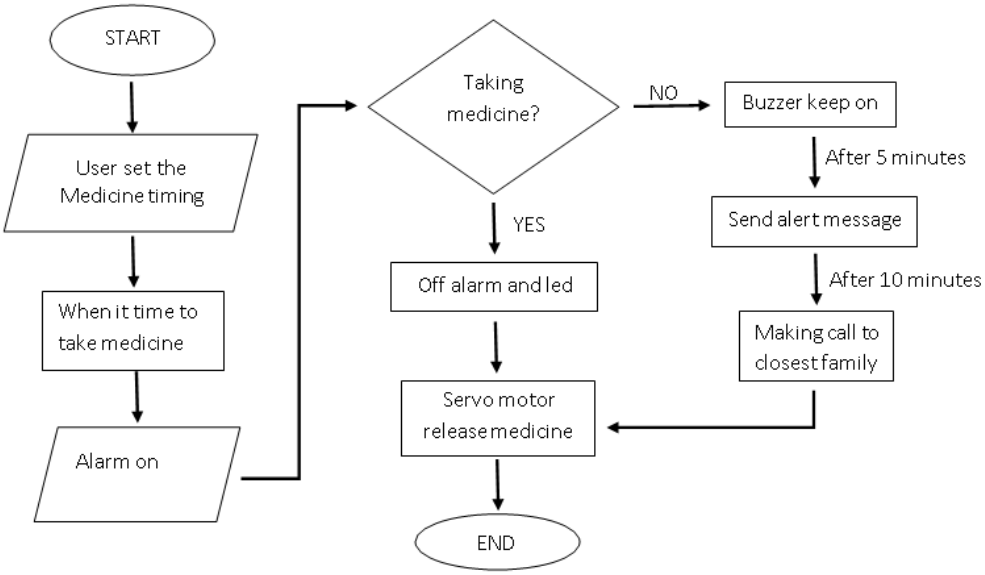


Figure 2: System flowchart

3. Results and Discussion

The procedure of implementing a method, design or model according to user specifications is known as execution. To ascertain the main objective of the system, several testing methodologies were employed. The outcomes of the system testing are deliberated.

Figure 3: The prototype of medicine dispenser

The hardware prototype utilized acrylic sheets of 2mm and 3mm thickness which are highly durable and capable of long-term use. Figure 3 shows the prototype of medicine dispenser. The medicine came

out from medicine container to the drawer. Output of medicine were control by lid under the medicine and servo motor to pull out.

3.1 Medicine alarm operation

The system has an alarm or reminder feature that can be customize to the individual medication schedule. It could be a visual alert and alarm buzzing. Users can enter their medication schedules into the system. This information includes the medication name, dosage and administration schedule. Medicine alarm system allow user to manage multiple medications simultaneously. The system is capable of sending notifications and reminders at the predetermined times. The alarm tracks the saved data from user and when current time meet the saved time and it buzz the alarm. When alarm turn on, it displays on which alarm data are operate. Below are Figure 4 that show the display when alarm 1 turn on which is the first saved data and user take the medicine by push the stop button. If there is no interruption from stop button, the display hanging on first picture in Figure 4.

Figure 4: Display when alarm turn on

3.2 GSM operation

The alert message system using GSM technology is a reliable way to send important message during emergencies. The GSM module operate when there is no interruption from the user by push the stop button. To improve reliability, it is important to consider using different mobile network providers or boosting the signal in weak areas. Figure 5 shows the operation of GSM sending alert message to caretakers. Based on figure below, the system not detect an interruption of stop button once the alarm turns on for 5 minute and sending alert message. Before stop the alarm, GSM will send miscall as an indication for other family members.

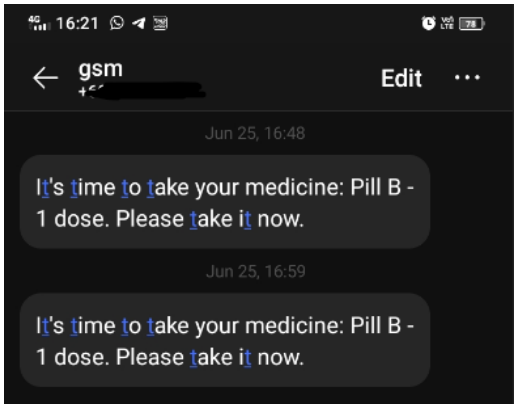
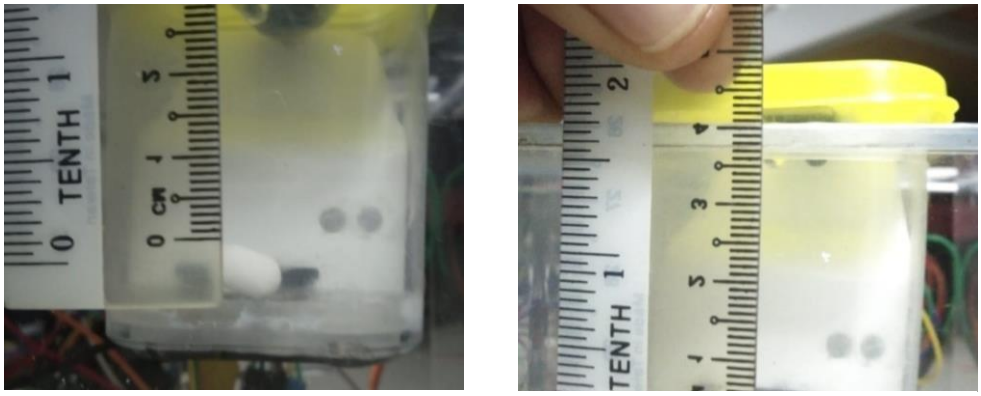


Figure 5: Alert message

3.3 IR operation

To analyze the low level of medicine using IR parameters, several steps are involved. First, a representative sample of the medicine is 7.5mm width. Next, the prepared sample is placed in the medicine container. A measurement needs to calculate to obtain the data for the low level of medicine. Figure 6 (a) shows the measurement from the top of the medicine inside the container. This method keeps a row of medicine in the container as a low-level status. Figure 6 (b) shows the measurement of the distance on IR sensor from the IR led inside the container. The distance calculates to obtain the constant distance to analyze the wavelength. The length obtain are 35mm for sample size 7.5mm width.



(a) (b)

Figure 6: (a) Measurement from medicine inside container (b) Distance measurement to IR sensor

Then, the infrared radiation interacts with the medicine and detected the specific wavelengths that are absorbed. This interaction creates a unique pattern called an IR spectrum which shows peaks and patterns that correspond to the different components in the medicine. For this work, the distance between the IR sensor and the medicine is set to 35mm and after that consider a low level of medicine at 35mm. By analyzing the IR spectrum, we can gain insights into the composition and concentration of the medicine at this low level. Table 1 shows the parameter for IR sensor.

Table 1: IR analysis

Medicine Width (mm)	Distance from IR to Medicine (mm)	Threshold value IR sensor in Arduino
6.5 (standard medicine size)	34	1200
7.0 (standard medicine size)	34.5	1150
7.5 (standard medicine size)	35	1100
8.0 (large medicine size)	35.5	1050
8.5 (large medicine size)	36	1000
9.0 (large medicine size)	36.5	950

The IR sensor has a threshold value that determines the minimum intensity required to detect the presence of the medicine. The threshold value of the IR sensor is sampling value by Arduino in decimal format, ranging from 0 to 1023 which corresponds to a voltage range of 0 to 5 volts from the IR sensor. The threshold value of the IR sensor decreases as the distance between the IR sensor and the medicine decreases. The threshold value also decreases as the width of the medicine increases. The standard medicine size has widths of 6.5mm, 7.0mm, and 7.5mm, while the large medicine size has widths of 8.0mm, 8.5mm, and 9.0mm. The threshold values range from 1500 for the standard medicine size with a distance of 45mm to 500 for the large medicine size with a distance of 20mm. Figure 7 shows a bar graph for IR parameter analysis on distance between IR to medicine, difference type of medicine and threshold value of IR sensor.

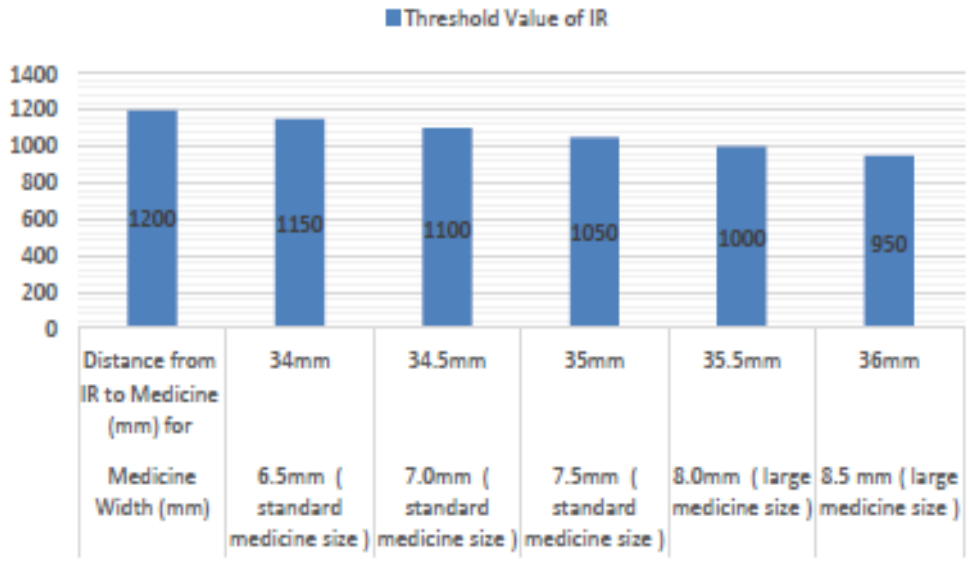


Figure 7: IR parameter analysis

By analyzing the IR spectrum, insights can be gained into the composition and concentration of the medicine which at low levels. The peaks and patterns in the spectrum help identify and characteristics these components. The parameter values in the table provide specific information for the IR sensor that used in the analysis. The width of the medicine along with the distance between the IR sensor and the medicine are considered to determine the appropriate threshold value for detection. Lower threshold value indicates a higher sensitivity to detecting the presence of the medicine. Thus, the table assists in setting up the IR sensor for effectively analyzing low level of medicine based on various parameters.

4. Conclusion

In conclusion, this study has successfully implemented a medicine dispenser system with customizable alarm features, GSM communication for emergency alerts and precise low-level medicine analysis using IR parameters. The hardware prototype constructed with durable materials and able to dispenses medicine to the drawer. The alarm system aids medication adherence and the IR analysis provides valuable insights into medicine composition and concentration at low levels. These results offer significant advancements in healthcare technology for medication management and monitoring. Further investigations may explore optimization and customization of the system to cater to varying medication needs and preferences.

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