

Smart Medicine Pill Box Reminder

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Abstract: With the increasing of elderly and young people who are diagnosed with diseases, the proper and correct medicines taken need to become the first priority to being healthy. However, among this people, 40-60% are having an issue of forgetting to take medicine on right time. The main objective of this project is to design a system that will alert the patients to take the medicines and also create an application that will alert the caretakers if their patients have taken the medicines by detecting the weight of the pill box. The system consists of a box where the patients will be able to keep their medicines and will alert the patients to take their medicines visually and audibly. The Blynk application will send notification to notify the caretaker if the patients have taken their medicines. This system has a feature that uses a weight sensor to detect the remaining medicines that are present in the box. The caretaker will be notified if the status of the pill box is less than 50% of the total weight of the medicines through this application. By using the Blynk application the caretaker can get a notification about the status of the pill box hence knowing if their patients have taken their medicines in the following week. It can be seen that in order to reach 50% of the total weight of the medicines the patients have to take their medicines four times. This gives an indication to the caretakers that their patients have taken their medicines for four days. Some improvements that can be made are, by changing the working system of the load cell in order to detect the changes in weights of the medicines in the pill box for each day of the week.

Keywords: Medicine, Load Cell, Blynk

1. Introduction

Lately medicine consumption has been skyrocketed, and it is now a frequent occurrence among all people. Therefore, a reminder must be made for the timely consumption of the medicines. Reminding medication at the prescribed time and the proper medicine intake is a must for a patient [1]-[3]. For most of the patients they will have to take the medicines for one or more times a day and they will sometimes forget to take the medicines. This often occurs to some elderly people and also young people. This means that if there are any delays or ignorance of forgetting to take the medications or even taking them on the wrong time may raise some potential problem to the patient's health.

With the increasing of elderly and young people who are diagnosed with diseases, the proper and correct medicines taken need to become the first priority to being healthy. For patients who are at home, they must take the right doses of medication in the appropriate time. If they fail to do so, this may cause the period to recover from the disease to prolong. Therefore, it is important for the patients to take the medicines in the precise time and quantity. This project focuses on to help these people to get their medicines on time so that their health is not at risk and that they can stay healthy for a long period of time. Hence, the objectives of this project are to design a system that will alert the patients to take the medicines and also to create an application that will alert the caretakers if their patients have taken the medicines.

One of the similar projects that consist of a LDR sensor, a magnetic reed sensor, motor and a buzzer which are connected to the heart of the system which is the NodeMCU microcontroller [4]. The function of the LDR sensor is to detect whether the patient have completed the proper medication or not. While the magnetic reed sensor is used as a security purpose that acts as a switch for the LDR sensor and also the motor that operates the lid of the box. The buzzer is used to alert the patient about their medication in a given time. Other than that, a project which uses a servo motor that will only unlock the medicine box in the right time and will stay locked even if the patient wants to take the medicine early [5]. This means that the patient may only have access to the medicine in the given time which seems helpful but may still have issue. The issue is that if the patient is in an emergency situation where the patient has to take the medicine earlier than the given time of the medicine box, then the patient may face some problem to access their medicines. Furthermore, other projects include the use of pill dispenser that uses android application to control the whole system [6]. The application will store the information about the patient's details on the cloud and performs synchronization upon login. To dispense the pills by using the stepper motor, the phone will connect with the Arduino microcontroller via Bluetooth and starts sending commands indicating which container and stepper motor should be rotated.

2. Materials and Methods

Arduino Uno is used to serve as a microcontroller for this project and the ESP8266 WiFi module is used as WiFi module to connect to the Blynk application so that the caretakers can receive the notifications through their phones. The alerting system that will alert the patients to take their medicines will be triggered by the LED and buzzer. Load cell is also used to measure the weight of the medicines contained in the pill box. Real Time Clock (RTC) DS3231 is used to keep track of the time so that the patients can set their desired alarm. Pushbuttons are used for navigating through the LCD display to set the date and time and also the alarm.

2.1 Hardware Development

Specifications and properties of materials, equipment, and other resources used in this project are described in this section. As shown in Figure 1, the RTC DS3231 manages all the timekeeping functions of this project where it will maintain the date and time that has been calibrated by the user. It also contains a backup battery of 3V where it will maintain the information of the date and time even if there is a power disconnection. The 1kg load cell is used to convert a force into an electrical signal that can be measured where the electrical signal changes proportionally to the force applied. Therefore, for this project it is used to measure the weight of the medicines that are in the pill box. Other than that, the ESP8266 WiFi module is used to send notifications to the caretaker by alerting them about the status of the pill box. The caretaker will be notified if the status of the pill box is less than 50% of the total weight of the medicines through the Blynk application. Arduino Uno will act as the heart of the system where all the functions of the devices will be calibrated and adjusted in this microcontroller. All the input and output devices will be connected to the proper pins of the Arduino so that each device can function properly as intended. The output of the system will consist of LED, buzzer and LCD. The LCD will display the time and date information and also where the patients can set their alarm while the LED and buzzer are the alerting system which will be activated when the alarm is triggered.

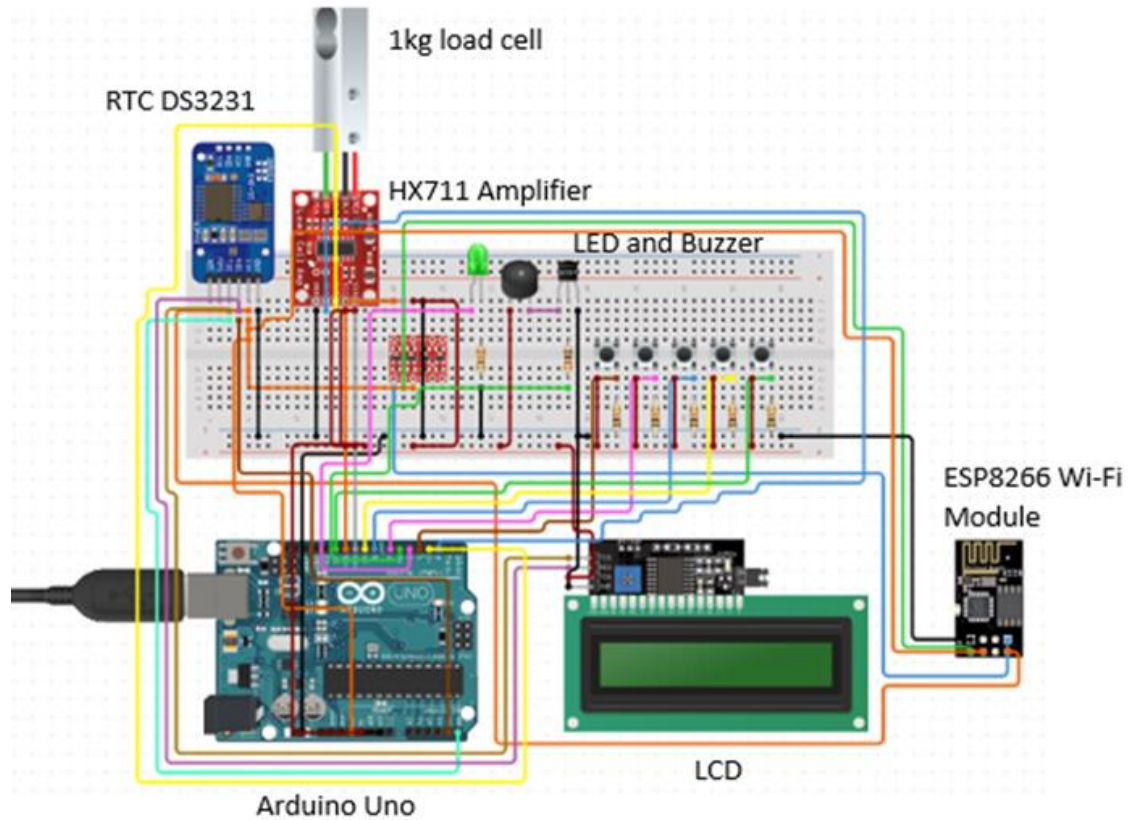


Figure 1: Schematic diagram of the system

Figure 2 shows the flowchart of the system which consists of the date and time setup where the patients are able to set the correct date and time in the system. After that, the patients can set their desired alarm to the system so that when the alarm is triggered, they are able to take their medicines. Calibration of the load cell will be done by the caretaker to make sure that the load cell weight sensors are functioning precisely in measuring the total weight of medicines present in the pill box. Next, the data from the load cell will be sent to the Blynk application where the caretaker will be able to receive a notification and also monitor the weight of the medicines in the pill box. Lastly, if the load cell detects that the total weight of the medicines is less than 50%, the caretaker will be notified that their patients have taken the medicines.

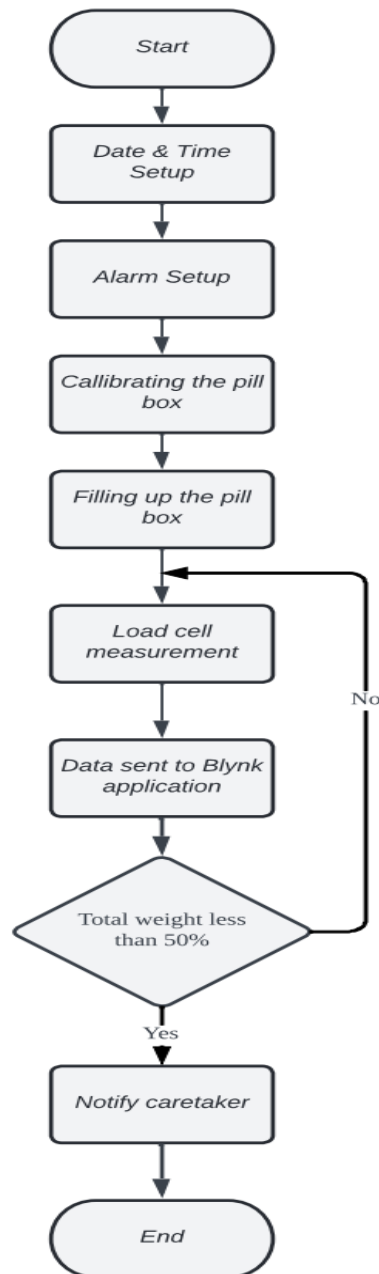
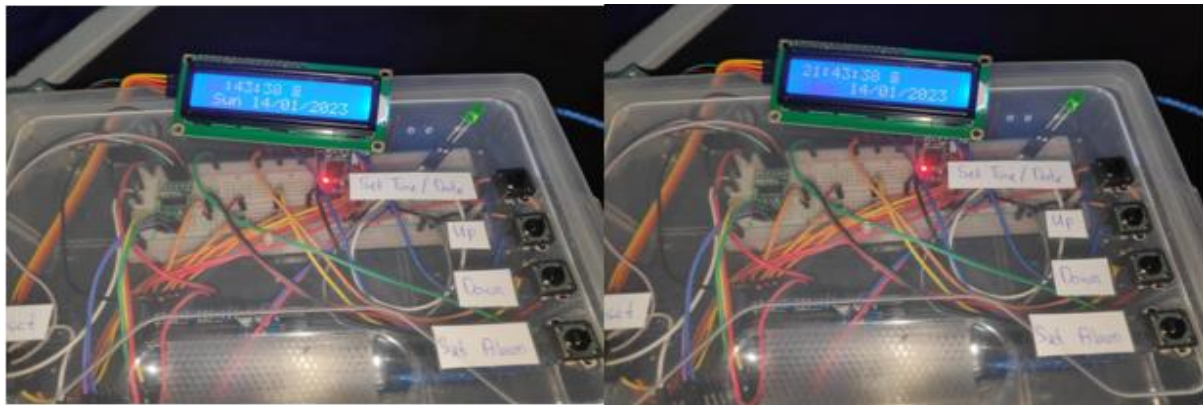


Figure 2: Flowchart of the system

2.2 Time and date setup

Patients can set their time and date on the RTC DS3231 by navigating through the pushbutton indicating at the “Set Time / Date” button. By pressing this button, the LCD will display a blinking effect on the screen which the patients can choose to set the time and date. To set the time and date the patient can press the “Up” and “Down” button to increase or decrease the value of the date and time. Each time the patients is pressing the “Set Time / Date” button the blinking effect will move to the hour section, minute section and second section of the time. If the patients want to set the correct hour of the time, they would have to press the “Set Time / Date” button until the blinking effect of the LCD reaches the hour section as shown in Figure 3(a). The same procedure goes if the patients want to set the date as shown in Figure 3(b).



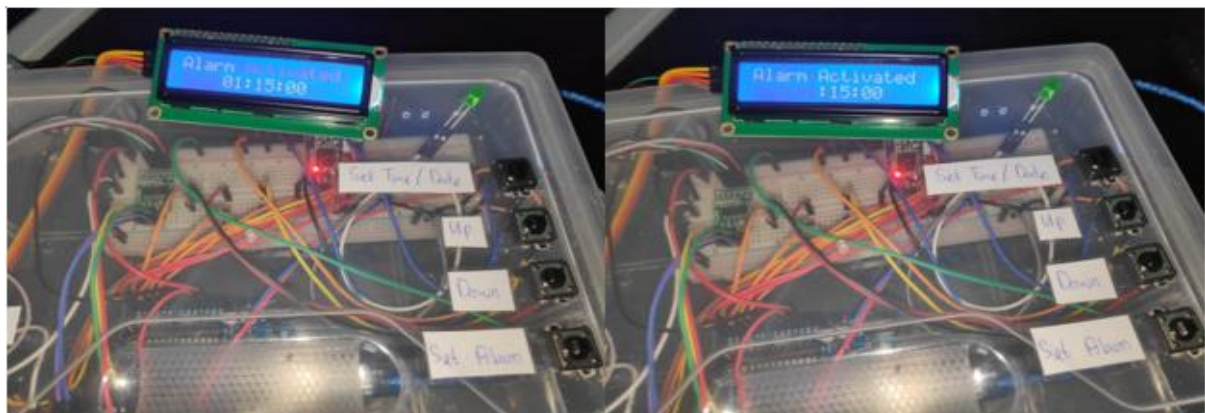
(a)

(b)

Figure 3: (a) Blinking effect appears on the hour section of the time**(b) Blinking effect appears on the day section of the date**

2.3 Setting up the alarm

The patients can set up their desired alarm by pressing the “Set Alarm” button. As shown in Figure 4(a) by pressing the button the LCD will display a new layout in the screen that enables the patients to activate or deactivate their alarm. After choosing whether to activate or deactivate the alarm, pressing the “Set Alarm” button again will display a blinking effect to the LCD which will move to the hour section of the alarm. Each time the patients is pressing the “Set Alarm” button the blinking effect of the LCD will move starting from the hour section to the minute section and lastly the second section. The blinking effect of the LCD is to indicate which section does the patients want to set their alarm.



(a)

(b)

Figure 4: (a) Alarm is activated (b) Blinking effect on the hour section

3. Results and Discussion

For this section the output of the system will be determine by the system alerting the patients to take their medicines and also the caretakers getting a notification about their patients taking the medicines.

3.1 Alerting system for the patients

The alerting system for the Smart Medicine Pill Box Reminder consists of a LED and a buzzer that will only be activated when the alarm has been triggered. Based on Figure 5 when the alarm is triggered the green LED will light up and the buzzer inside the box will emits a pulsating sound for one minute respectively. This will alert the patients to remind them to take their medicines.



(a) (b)

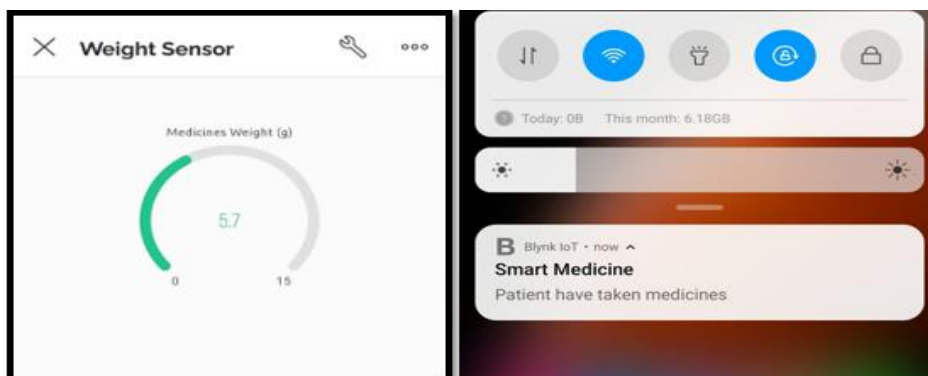
Figure 5: (a) Before alarm is triggered (b) After alarm is triggered

3.2 Blynk notification to caretaker

A total of 13.8g of medicines are filled in the pill box as shown in Figure 6. The caretaker will only be notified through the Blynk application when the total weight of the medicines reaches below 50%. This means that when the total weight of the medicines reaches below 6.9g, the caretaker will get a notification through their phone indicating that their patients has taken their medicine as shown in Figure 7.



Figure 6: Total weight of medicines in pill box



(a) (b)

**Figure 7: (a) Load cell reaches below 50% of total weight of the medicines
(b) Notification sent to the caretakers via the Blynk application**

From these results, it can be seen that in order to reach 50% of the total weight of the medicines the patients will have to take their medicines four times. This will give an indication to the caretakers that their patients have taken their medicines for four days. From this project it can also be seen that there is a limitation on the size of the pill box. This means that the pill box can only accommodate medicines that have the same shape and size.

4. Conclusion

The Smart Medicine Pill Box Reminder is designed so that it is able to alert the patients in taking their medicines on time and also notify their caretakers that their patients have taken their medicines. Therefore, the objectives of this project have been achieved and analyzed with the obtained results. By using the Blynk application the caretaker can get a notification about the status of the pill box hence knowing if their patients have taken their medicines in the following week. The caretaker will be notified if the status of the pill box is less than 50% of the total weight of the medicines through the Blynk application. Besides that, the Smart Medicine Pill Box Reminder also has an alerting system for the patients by emitting an LED light and also the sound of the buzzer. This happens when the patients have set their alarm. If the alarm is triggered the LED and buzzer will be activated, hence alerting the patients that they have to take their medicine today

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