

The 9th International Convention on Vocational Student's Innovation Project (ICVSIP2024)

Chiangmai Grandview Hotel & Convention Center, Chiangmai, Thailand

27-30, August 2024

Alerting Medicine Cabinet by Using IoT and Web Application

Introduction

The elderly population is disproportionately burdened by chronic diseases, such as hypertension, diabetes, and hyperlipidemia. Consequently, medication adherence is often a cornerstone of their healthcare management. However, age-related physiological changes and the concomitant use of multiple medications can increase the risk of adverse drug events in this vulnerable population.

A recent study conducted by the nursing department of Siriraj Hospital revealed significant differences in medication adherence between chronically ill patients with and without caretakers. Patients without caretakers were more likely to experience medication non-adherence, characterized by missed doses or incorrect timing. Interestingly, both groups demonstrated a common practice of polypharmacy, with many patients taking 3-5 medications per meal.

In response to the identified challenges in Alerting Medicine Cabinet by Using IoT and Web Application, researchers have designed Alerting Medicine Cabinet by Using IoT and Web Application for oral medications, aiming to enhance patient quality of life

Objectives

- 1) To design and create Alerting Medicine Cabinet by Using IoT and Web Application
- 2) To test a working of Alerting Medicine Cabinet by Using IoT and Web Application
- 3) To evaluate a satisfaction of the users' Alerting Medicine Cabinet by Using IoT and Web Application.

Materials

- | | |
|---------------------------|----------------------|
| 1. A Medicine cabinet box | 5. An LCD Display |
| 2. An ESP32 | 6. An Acrylic sheets |
| 3. A Piezo Buzzer | 7. Circuit wires |
| 4. LED Alarms | |

Methods

The process of developing Alerting Medicine Cabinet by Using IoT and Web Application includes the following steps:

1) Analyze various problems associated with forgetting to take medication or taking an overdose. It can occur in patients of all ages, especially the elders. This can have adverse effects on health. Therefore, researchers have developed a concept for Alerting Medicine Cabinet by Using IoT and Web Application to address these issues and their consequences.

2) Design and develop our innovation.

2.1) Alerting Medicine Cabinet operates on a two-tier architecture: software and hardware. A web application serves as the user interface, enabling users to schedule medication reminders. Upon reaching the scheduled time, the system activates auditory and visual alerts at the specific compartment. Concurrently, a push notification is sent to the user's LINE application. The system's alerting function persists until the user acknowledges the reminder by opening the designated compartment. This interaction signals the system to cease the alerts.

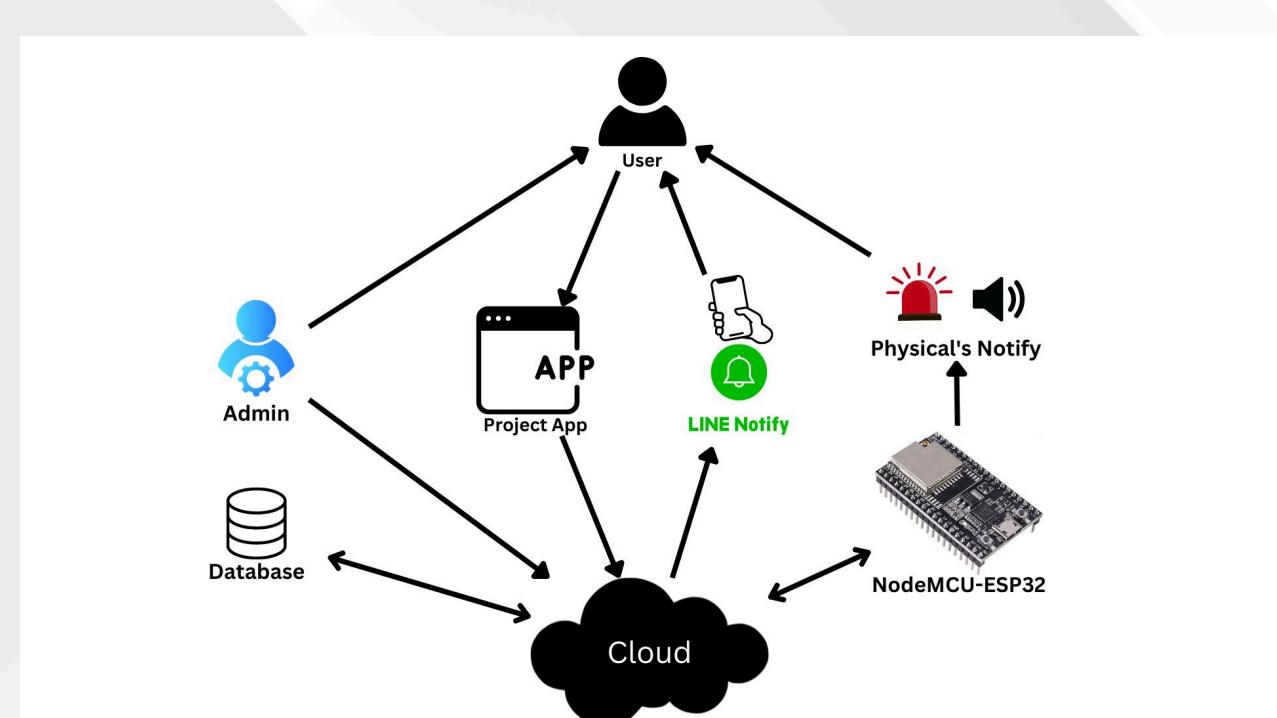


Figure 1: Design Our System

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2.2) The pill dispenser is designed with a single-compartment alert system. It allows for seven-day continuous reminders through light, sound, and LINE application. The dispenser has 28 compartments and 49 channels to accommodate before and after meal medications for four daily doses: breakfast, lunch, dinner, and bedtime.

3) The security booth will undergo a 7-day functional test, followed by adjustments and bug fixes.

The primary testing principle is the accuracy of notifications. The measured value is "Precision". It measures the accuracy of notifications. The calculation formula is as follows:

$$\text{Precision} = \frac{\text{Number of times the notification was correctly received.}}{\text{Total number of notifications}}$$

4) Implementation & Satisfaction Evaluation

Results

1. Working of Alerting Medicine Cabinet by Using IoT and Web Application (7 Days)

Day	Working Details							Accuracy (%)	Error
	T1	T2	T3	T4	T5	T6	T7		
1	✓	✗	✓	✓	✓	✓	✓	85.71	T2: It didn't notify with led
2	✓	✓	✓	✓	✓	✓	✓	100.00	-
3	✓	✓	✓	✓	✗	✓	✓	85.71	T5: It didn't notify with sound
4	✗	✓	✓	✓	✓	✓	✓	85.71	T1: It didn't notify with led
5	✓	✓	✓	✗	✓	✓	✓	85.71	T4: It didn't notify with led
6	✓	✓	✓	✓	✓	✓	✓	100.00	-
7	✓	✓	✓	✓	✓	✓	✓	100.00	-
Total Average							91.84	-	

The experiment aimed to evaluate the precision of notifications in relation to scheduled times. The average of accuracy was 91. 84%.

2. The results of satisfaction among a sample group of 15 individuals, comprising patients, caretakers, and the elders, revealed an average satisfaction rating of 4.48 at high level.

Discussion and Conclusion

Alerting Medicine Cabinet by Using IoT and Web Application dispenser was developed to address medication non-adherence, particularly among the elders. The device is constructed using electronic components such as a NodeMCU-ESP32 microcontroller, a piezo buzzer, and LED indicators. The system is divided into three primary modules: a server for web applications and databases, a device control module, and a notification module. A 7-day trial was conducted to evaluate the device's performance.

The performance evaluation of the medication reminder system revealed an average notification accuracy of 91.81% across visual, auditory, and mobile app-based alerts, along with system operational controls. Minor hardware malfunctions were observed in some LED lights and piezo buzzers due to lose fittings.

Testing and user satisfaction evaluation revealed that Alerting Medicine Cabinet performed according to specifications, providing accurate notifications through visual, auditory, and mobile app-based alerts.

References

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