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Medication Reminder System Using IoT

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Abstract. In healthcare environments, particularly in hospital wards, the arrangement of medication by nurses for patients is essential to ensure the patient's health is considered. In some hospitals, nurses use a manual form to record the medication time for each patient in the ward, and they have to remember the exact time to give medicine to the patients. However, on some occasions, nurses might miss or delay medication to the patients when nurses are busy and manage multiple patients, especially during peak hours or shift transitions, which can lead to patients' risk. This project proposes an interface system for medication reminder using IoT that comprises Bluetooth technology and a mobile application. The objectives of the project are to develop a mobile app that provides personalised medication reminders and develop a Bluetooth-enabled device that allows nurses to use the mobile application to record and monitor messages in real time. Besides, nurses receive a notification on the mobile and LCD screen, which shows the room number and types of medication for the patient. The system is developed using Android for the mobile app and Arduino-based BLE modules for device integration. This project has been successfully tested and implemented as nurses are able to insert information on the mobile phone, and receive notifications on the mobile phone and on the LCD screen as well. This project is able to enhance patient health, reduce nurse response time, and improve overall healthcare service delivery through a user-friendly, accessible, and intelligent system.

Keywords: Bluetooth technology, mobile application, medication reminders, Android, LCD screen.

1. INTRODUCTION

In the digital era, the management in numerous industries has been developed with the Internet of Things (IoT) by seamlessly connecting devices and facilitating data exchange. Healthcare is one of the areas that has significantly benefited from technology[1]. Healthcare systems face increasing challenges in ensuring safe and effective patient care, particularly regarding medication management in hospital environments. Current hospital practices rely heavily on paper reminders, which are susceptible to human error[2]. This method lacks real-time updates or notifications for upcoming medication times. In addition, nurses may overlook or postpone medicine when caring for several patients at once, particularly during hectic times or shift changes[3][4]. This can negatively impact patient recovery and safety. These mistakes can compromise patient safety, result in additional healthcare costs, or even cause life-threatening complications.

The objectives for this project are to develop a mobile application integrated with Bluetooth technology, which allows nurses to insert patient medication schedules as reminders for medication administration and also to implement an IoT-based system that displays real-time medication alerts on an LCD (Liquid Crystal Display) screen. The system is specifically designed for use in hospital wards to assist nurses with managing medication schedules for multiple patients. The system utilises Arduino-based BLE (Bluetooth Low Energy) modules and mobile applications using MIT app. The notification will show on the mobile and LCD screen, including the patient's room number and the type of medication needed and a buzzer to alert nurses.

2. LITERATURE REVIEW

Currently, the administration of medication in hospitals is still performed manually. When nurses are busy or occupied with other responsibilities, they may unintentionally forget to administer medication, resulting in patients not receiving their treatment as scheduled. Such non-compliance with prescribed medication regimens disrupts effective medication management and can compromise patient health. It is well established that proper medication management plays a vital role in the treatment of chronic diseases. If patients with chronic conditions do not take their medication at the correct dosage and time, it may lead to serious complications and significantly reduce the overall effectiveness of the treatment.

To address these issues, previous studies have proposed the development of smart medication reminder systems to assist individuals, particularly those with memory challenges, in managing their medication schedules. These intelligent systems are designed to alert patients when it is time to take their medication and even allow them to set up personalised schedules based on recommendations from their healthcare providers.

Further research has introduced Smart Medication Reminder Systems and Automated Pill Dispensers, specifically targeting the elderly population, who are more prone to forgetfulness and medication errors. Medications are typically prescribed in written form by doctors, but elderly patients often struggle to follow these instructions accurately. As a result, they require assistance to ensure proper adherence. These devices serve as essential tools, reminding elderly individuals to take their medications correctly and punctually in accordance with the schedule provided by their physicians. [5]

In addition, researchers have also developed automatic medication reminder systems for the structured distribution and secure storage of medications. These systems can dispense controlled doses at predetermined times, significantly reducing the likelihood of human error in the medication process. Innovative technologies, such as microcontroller-based devices, offer a comprehensive approach to medication management by integrating sensory alerts and customizable reminders tailored to each patient's prescription. The primary objective of these systems is to minimise forgetfulness, enhance user awareness, and improve adherence to prescribed medications. The Real-Time Medication Reminder System aims to foster a culture of timely and consistent medication intake. In doing so, it supports healthier lifestyles and contributes to improved patient well-being. [6]

One notable advancement is the Embedded Reminder System, which combines Internet of Things (IoT) capabilities with automation technology. This system enhances the accuracy of medication intake and leads to better treatment outcomes. Medications are dispensed automatically according to a pre-configured schedule, and timely alerts ensure that no dose is missed. Additionally, email notifications are sent to caregivers or healthcare professionals as reminders and status updates regarding the patient’s medication adherence. This system helps mitigate the risk of missed or incorrect doses while promoting consistent and accurate medication intake. [7]

A medicine reminder system for nurses to monitor scheduled medicine using IoT technology and patient identification is secured and protected by using the RFID card. Besides, medical data of the patients, such as type of medicine, quantity etc., can be entered by prescribers through a web page. It is beneficial and economic for the patient. [8]

Apart from that, a device with twenty-one compartments is designed to keep and remind old people or patients in the hospital. It used an SD card shield to store the time schedule and audio file, the real clock time for reading time, a speaker to alert the patient and a reset button to stop the operation. On the device, some important information such as the time of taking medicine, quantity etc., is displayed on the LCD screen when it has reached the time that has been set. The device can ascertain the appropriate medicine dose and prevent of drug abuse among elderly people.[9]

A system of pill reminder comprised of Internet of Things (IoT) enabled pill compartment integrated with a mobile application for Android has been created. The mobile application is designed to keep the record of medicine details, for instance, medicine name, number of dosages, times of the day to take and reminder days of which all the information is saved in the database. Besides, the device can detect whether a patient has taken medicine or not by using an infrared (IR) sensor. [10]

Overall, this innovative solution demonstrates significant potential in applying modern technology to health management. It offers a practical and efficient approach to managing medication schedules while enhancing the quality of care in hospital settings.

The core objective of the system is to make it easier for patients to remain consistent and aware of their medication intake. At the same time, the application notifies nurses when it is time to administer medication to patients in hospitals—ensuring improved coordination, efficiency, and patient care

3. RESEARCH METHODOLOGY

This section outlines the methodology for developing a medication reminder system for nurses in a hospital ward. The approach includes hardware, software and testing procedures to ensure that the system meets the required performance.

3.1 Proposed system

This project implements a system for medicine reminder based on IoT technology. The proposed scheme was created for the Android platform. The reminder system alerts nurses when it is time to take medicine for the patient. Figure 1 shows the block diagram of the project.

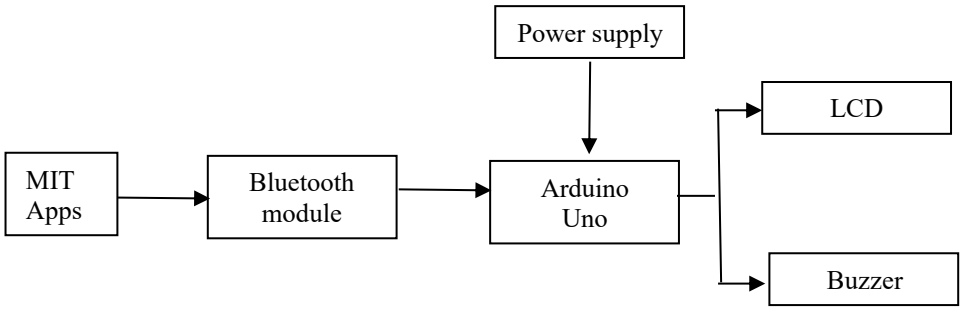

Figure 1: Block Diagram

3.2 Hardware

In the hardware component, the project has designed a prototype of a counter in the hospital ward. It comprises of microcontroller using Arduino Uno paired with a Bluetooth Module (HC-05). While the output devices are an LCD screen and a buzzer. Figure 2 shows the circuit used in the project.

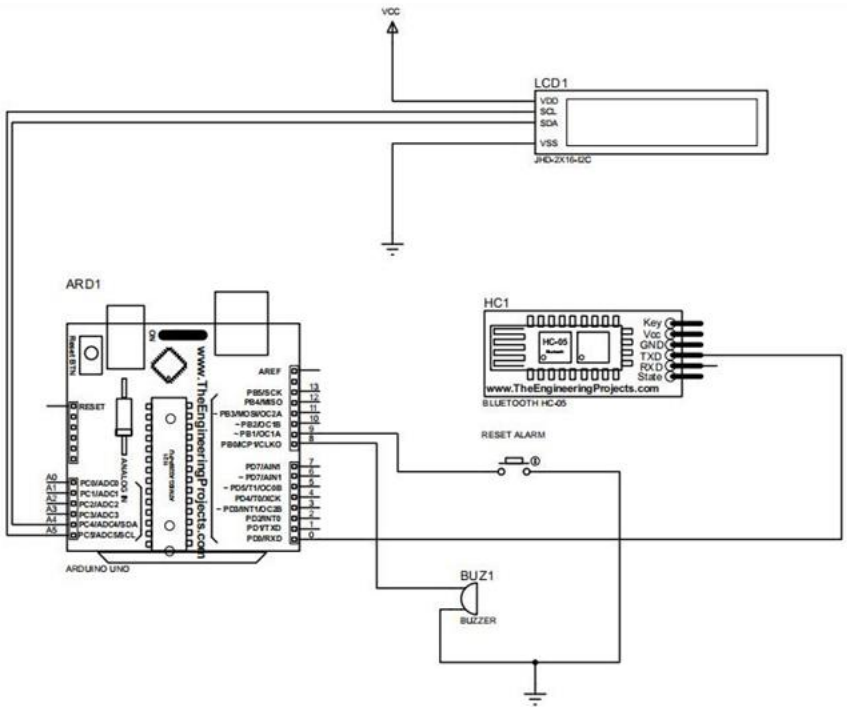

Figure 2: Circuit Diagram

Arduino Uno

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller as shown in Figure 3. Arduino Uno is used to program the Bluetooth Low Energy (BLE) module, manage LCD and buzzer outputs, and also handle communication protocols. It facilitates the integration of hardware-level functions such as data reception from the mobile app, display of medication details on the LCD, buzzer alert and real-time system responses.

Figure 3: Arduino Uno

Bluetooth Module (HC-05)

Bluetooth module (HC-05) is a Bluetooth module designed for wireless communication, short-range data transmission between microcontrollers and other Bluetooth-enabled devices, as shown in Figure 4. They are small, low-power modules that can be easily integrated into electronic projects and controlled using microcontrollers or other digital devices. The HC-05 can function in either Master or Slave mode, making it versatile for IoT applications like the Medication Reminder System, where it enables real-time wireless communication between an Arduino-based device and a mobile application. Technically, the module operates at a 3.3V logic level, though it can accept 5V power

input due to its onboard voltage regulator. It has a typical range of 10 meters (33 feet) in open space, making it suitable for hospital ward environments.

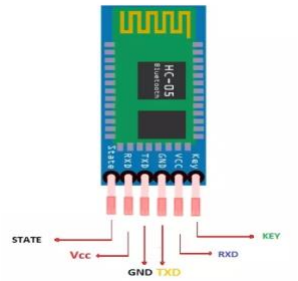

Figure 4: Bluetooth Module

Liquid Crystal Display (LCD)

An LCD screen is a type of electronic display module that creates a visible image using liquid crystal, as illustrated in Figure 5. The 16x2 LCD screen is a very simple device. The 16×2 translates a display of 16 characters per line into 2 such lines. It consumes 5 volts to operate.

Figure 5: LCD screen

Buzzer

A buzzer or beeper is a type of audio signalling device that can be mechanical, piezoelectric, or electromechanical. This is primarily used to transform an audio signal into sound. Typically, it is powered through DC voltage. It can generate different sounds like alarm, music, bell & siren. It consumes 6 volts to operate as shown in Figure 6.

Figure 6: Buzzer

3.2 Software

The Arduino IDE, as shown in Figure 7, is used to program the microcontroller to handle Bluetooth communication**,** LCD output**,** and buzzer control in a seamless workflow. Other than that, MIT App Inventor is used as shown in Figure 8. It is an open-source**,** cloud-based platform designed to enable rapid mobile app development, especially for Android devices, without requiring extensive coding knowledge. It uses a visual, block-based programming environment, allowing developers to design complex mobile apps by dragging and connecting logical components, making it ideal for prototyping healthcare IoT applications.

Figure 7: Arduino IDE software

Figure 8: MIT App Inventor

3.3 Principle of operation

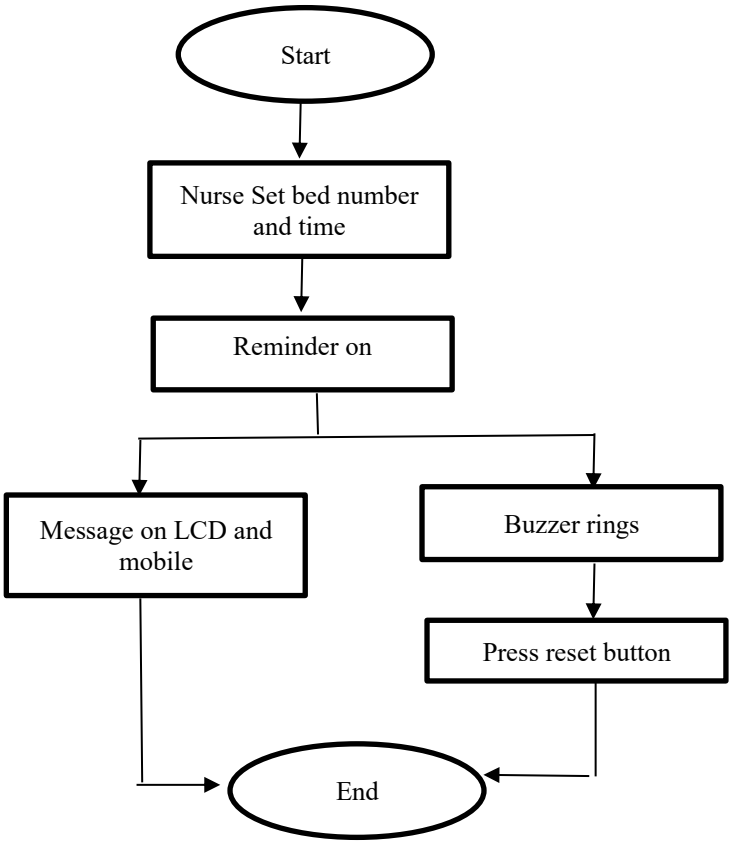

Figure 9: Flow chart project

Figure 9 shows the flow chart designed to assist in hospital settings. The process starts when a nurse inputs the patient's bed number and the scheduled medication time into the system via a mobile app. This information is transmitted via Bluetooth (HC-05 module) and stored temporarily in the Arduino's memory. Once the schedule is set, the reminder system is activated, and the Arduino Uno enters a waiting state, continuously checking the real-time clock (RTC) module against the programmed time.

When the preset time matches the RTC output, the system initiates three concurrent actions: it displays a message on the mobile and the 16x2 LCD screen, such as “Katil 2- Take Medicine”, and activates the buzzer to alert nearby staff or patients. This ensures both visual and auditory cues are provided, enhancing reliability. The buzzer continues to ring until a reset button connected to the Arduino digital input pin is pressed. Pressing the button sends a HIGH signal to the microcontroller, which then executes a predefined interrupt or conditional function to deactivate the buzzer and clear the display message. Finally, the system returns to its idle state, ready for the next cycle or updated instructions.

4. RESULTS AND FINDINGS

The development of the Medication Reminder System using IoT resulted in a functional prototype, as shown in Figure 10, that successfully integrates hardware and software components for real-time medication management in a hospital environment.

Figure 10: Prototype of a counter in the hospital ward

During the testing phase, the MIT App Inventor mobile application effectively allowed nurses to input critical patient information, including the patient’s room number**,** scheduled time and date for administration, as shown in Figure 11. The app’s interface was validated for usability, ensuring that even non-technical healthcare workers could operate it without confusion. Data transmission through Bluetooth HC-05 was stable, with a typical connection range of 10 to 15 meters, covering the required distance in a hospital ward. The system experienced no data loss during transmission, and the latency between the mobile app sending the command and the Arduino device receiving it was consistently below 2 seconds**,** indicating real-time capability.

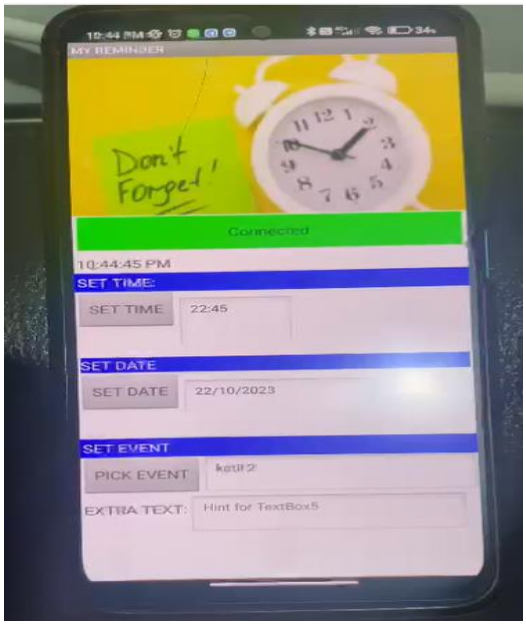

Figure 11 : Set time, date and event

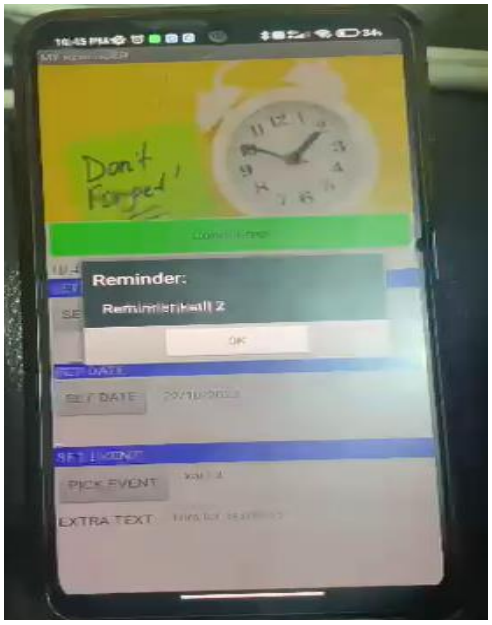

Figure 12: Notification on the mobile

Once the Arduino device received the data, the display output included clear and readable messages, such as the patient's room number, which helped nurses quickly identify the required action without referring to manual records, as shown in Figure 12 and 13. Simultaneously, the buzzer was activated. After alerting the nurse, the nurse can press the reset button to switch off the buzzer.

Figure 13: Message on the LCD

5. CONCLUSION

This project successfully developed a Medication Reminder System using IoT, integrating both hardware and software elements to enhance medication management in healthcare environments. The system addresses the critical issue of missed or delayed medication administration, particularly in hospital wards where nurses manage multiple patients and complex schedules. By combining a Bluetooth-enabled mobile application, an Arduino-based controller, a real-time LCD display, and an audio buzzer, the system ensures that nurses receive timely and accurate medication reminders.

The results confirm that the mobile application built using MIT App Inventor provided a useful platform for nurses to manage patient medication schedules. The HC-05 Bluetooth module reliably transmitted this data to the Arduino microcontroller, which successfully parsed the information and displayed relevant alerts on the LCD screen while activating a buzzer for immediate attention. System testing guarantees stable hardware operation, and high user satisfaction due to reduce manual recording and preventing the chance of human error.

For further improvement and research, the system can be extended by including additional health monitoring sensors (e.g., heart rate, blood pressure) to provide a more comprehensive patient care solution beyond medication reminders.

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