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# Portable Medication Reminder System for Elderly and Alzheimer's Patients

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**Abstract** - As healthcare demands rise and the senior population grows, innovative results are essential for cases with habitual ails and memory-related conditions like Alzheimer's. Introduces a movable drug memorial System designed for hospitals, old age homes, and independent elderly citizens. The system, erected around an Arduino UNO microcontroller, integrates an IR detector, buzzer, TV display, RTC module, keypad, LED, and GSM module, working together to give timely drug monuments. In hospitals, it integrates into patient care routines, driving visual and audile monuments for nursing staff to insure timely drug delivery. This integration helps drug crimes and ensures that cases are cleaved to their prescribed treatment plans. Old age homes profit from the stoner-friendly device, allowing residents to manage their drug schedules via the TV display and keypad. The system's simplicity and trust ability can significantly ameliorate the quality of life for senior residents. For independent seniors, the movable system provides monuments through the TV display and buzzer, with the GSM module transferring SMS cautions to family members or caregivers if boluses are missed. This point is particularly precious for those who live alone, offering peace of mind to both the seniors and their families. Alzheimer's cases, floundering with memory loss and drug adherence, gain significantly from this system. The combination of visual and audile monuments, along with the straightforward keypad and TV display, offers an effective tool for managing their drug needs. By icing timely drug input, alleviates the progression of symptoms and enhances the overall well-being of Alzheimer's cases.

**Keywords: Arduino, Chronic Illness, Elderly Care, Medication Adherence, Portable Reminder, RTC Module**

## 1. INTRODUCTION

Medication non-adherence is a pervasive issue in healthcare, often leading to poor health outcomes and increased strain on medical systems. The "Portable Medicine Reminder" addresses this challenge by offering a reliable and user-friendly solution to ensure patients adhere to their prescribed medication schedules. The primary motivation behind this project stems from the critical need to improve medication adherence among patients. Studies have shown that



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missed doses can lead to severe health complications, hospital readmissions, and increased healthcare costs. Traditional methods of reminding patients to take their medication, such as paper-based schedules or basic alarms, often prove ineffective due to forgetfulness or lack of timely intervention. There is a pressing need for a more intelligent and interconnected system that not only reminds patients but also ensures they have taken their medication.

This project introduces an innovative approach to medication management by integrating Internet of Things (IoT) technology with practical functionality. At the heart of the system is the Arduino Uno microcontroller, which orchestrates the device's operations. Key features include:

1. **Buzzer and LED Notifications:** These components provide clear, accessible reminders to patients, ensuring they are aware when it is time to take their medication. The simplicity of these alerts ensures usability across a wide range of patient demographics, including the elderly and those not familiar with advanced technology.

**2. Infrared (IR) Sensor:** This sensor detects whether the medication has been taken after the reminder is issued. If the medication remains untouched, the system sends an alert to a designated caregiver, facilitating timely intervention. This feature adds a layer of accountability and support, enhancing patient autonomy while fostering a collaborative healthcare environment.

**3. Portability and Ease of Use:** Designed with portability in mind, the device can be easily carried by patients, ensuring they have a constant reminder system regardless of their location. Its straightforward design promotes ease of use and accessibility.

## 2. RELATED WORK

Smart Medication Adherence Systems Using IoT and Machine Learning Ahmed and Opoku (2023) developed a smart medication adherence system using IoT and machine learning to provide real-time monitoring and reminders. The system's advantage is its ability to predict medication non-adherence using machine learning algorithms. However, the complexity of integrating IoT devices with machine learning models can be a drawback, requiring substantial technical expertise [1].

Jang and Kim (2021) presented a smart medication reminder system using IoT and artificial intelligence. This system improves adherence by providing personalized reminders and monitoring patient behavior. The strength lies in its personalized approach, but the reliance on consistent internet connectivity can be a limitation, especially in remote areas [9].

### IoT-Based Smart Medication Dispensers

Elsayed and El-Sayed (2022) designed an IoT-based smart medication dispenser system for elderly people. This system automatically dispenses the correct medication dose at the scheduled times, enhancing adherence. Its primary

advantage is reducing the manual intervention required by caregivers. However, the initial cost and maintenance of IoT devices can be a significant disadvantage [5].

Ngu and Goh (2020) developed a smart medication dispenser integrated with IoT technology, focusing on user-friendly interfaces for elderly patients. The advantage is its simplicity and ease of use, but the system's dependency on continuous power supply and internet access can be a potential drawback [15].

Wearable Technology for Medication Adherence. Chen and Wu (2022) designed a wearable medication reminder device that alerts users to take their medication. The main advantage is the portability and constant contact with the user, ensuring timely reminders. However, user compliance with wearing the device consistently can be a challenge.

Xu and Chen (2021) reviewed the use of wearable sensors for medication adherence monitoring. These sensors provide detailed adherence data and can detect missed doses. While the detailed data is beneficial for healthcare providers, privacy concerns and the discomfort of wearing sensors continuously are significant drawbacks [3].

Blockchain and Cloud-Based Solutions [27]. Yang and Zhao (2022) proposed a smart medication adherence system using blockchain and IoT. The use of blockchain ensures data security and integrity, which is a major advantage. However, the complexity of blockchain technology and the need for high computational power can be a disadvantage [26].

[30]. Yu and Lee (2023) developed a smart medication adherence system using IoT and cloud computing, enabling remote monitoring and data storage. The advantage is the ability to access patient data anytime and anywhere. However, concerns about data privacy and the risk of cloud service downtime are potential drawbacks [30].

Comprehensive Reviews and Meta-Analyses. Free and Phillips (2021) conducted a systematic review of the impact of mobile health (mHealth) on healthcare delivery. They found that mHealth technologies significantly improve medication adherence by providing reminders and educational content. The advantage is the broad applicability across various healthcare settings. However, the effectiveness can vary based on user engagement and technological literacy [6].

Qi and Sun (2022) proposed a smart medication adherence system using machine learning and IoT, focusing on predictive analytics for non-adherence. The system's predictive capability is a key advantage, helping to intervene before non-adherence occurs. However, the need for large datasets to train machine-learning models can be a limitation [17].

## 3. PROPOSED METHODOLOGY

### 3.1 Research Design

The research methodology for our portable medicine reminder study will employ a mixed methods approach to achieve our objectives. Firstly, we will conduct a comprehensive literature review to identify existing solutions and gaps in the field. This will serve as the foundation for designing a user-centered, portable medicine reminder device. We will employ both qualitative and quantitative data collection methods, including user surveys and interviews to understand the specific needs and preferences of potential users. Additionally, we will conduct usability testing to evaluate the effectiveness of the prototype. Statistical analysis and thematic coding will be used to interpret the collected data. This combined approach will enable us to develop a robust, user-friendly, and effective portable medicine reminder system that addresses the identified shortcomings in existing solutions.

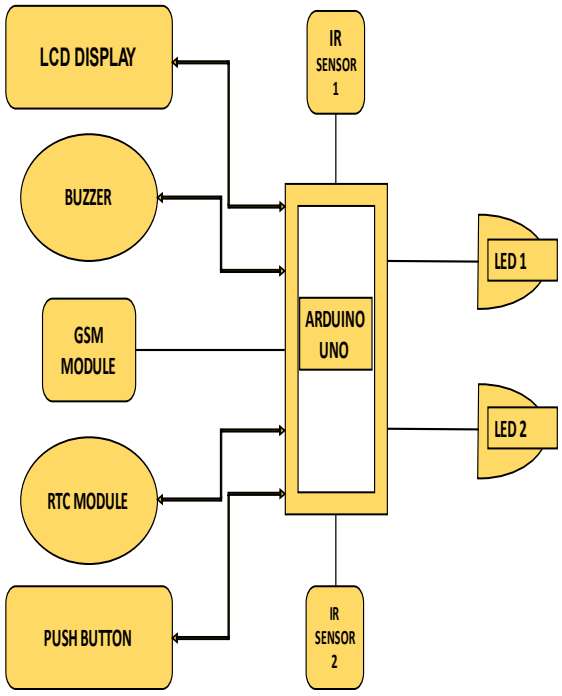


Figure 1Block Diagram

### 3.2 Adherence

Approximately 26% of individuals may struggle with forgetfulness, potentially impacting their ability to consistently take prescribed medications. Additionally, 49% might face challenges due to poor vision, making it difficult to read and comprehend instructions. A smaller percentage, around 8%, may encounter dexterity issues, complicating the process of handling medications. Another 7% might be taking excessive amounts of medication, emphasizing the importance of clear and understandable instructions. Furthermore, 5% may be unable to read, adding a layer of complexity to managing their health. Lastly, 3% might struggle with understanding medication instructions, highlighting the need for tailored support and education in healthcare practices

### 3.3 Instruments

To study the medication adherence and its impact on a group of individuals, a research methodology employing portable medicine reminder devices was utilized. The group was divided into two categories: those taking medicine and those not taking medicine. Portable reminder instruments were distributed to both groups, and data on medication adherence and its effect on their health outcomes were collected. The study employed a mixed-methods approach, combining quantitative data on medication adherence rates with qualitative interviews to gain insights into the factors influencing adherence or non-adherence. This approach allowed for a comprehensive understanding of the patient population's behavior and the potential consequences of medication adherence or non-adherence, contributing to the overall patient record.

3.4 Efficiency and Superiority

The proposed Portable Medicine Reminder system distinguishes itself through its comprehensive and innovative approach to medication adherence, combining multiple sensory alerts with real-time communication capabilities. This integration significantly enhances the effectiveness of the reminder system, making it superior to existing models.

**1. Multi-Sensory Alerts:** Our system utilizes both visual and auditory cues to provide comprehensive reminders. Visual alerts are displayed on an easy-to-read LCD screen, ensuring that patients with hearing impairments can still receive timely reminders. Simultaneously, auditory alerts from a buzzer cater to those with visual impairments, ensuring no patient is left unsupported. This dual-sensory approach is particularly beneficial for elderly individuals and patients with chronic illnesses, who may have varying sensory abilities.

**2. Real-Time Communication:** A key feature of our system is the incorporation of a GSM module that enables real-time SMS alerts. This functionality provides an extra layer of security and oversight by notifying caregivers or family members if a patient misses a dose. These real-time alerts facilitate prompt interventions, allowing caregivers to take immediate action to address missed medications. This is crucial in preventing potential health complications that can arise from missed doses, especially in patients with critical conditions.

**3. Improved Adherence:** The combination of visual and auditory reminders, along with real-time communication, significantly improves medication adherence. Patients are consistently reminded to take their medications on time, reducing the likelihood of missed doses. This consistent adherence is vital for managing chronic conditions effectively and improving overall health outcomes.

**4. User-Friendly Design:** The system is designed with user accessibility in mind. The LCD provides clear and concise information, while the keypad allows for easy input of medication schedules. This simplicity is essential for elderly users, who may not be comfortable with complex technology. The intuitive interface ensures that patients can independently manage their medication schedules without requiring extensive technical knowledge.

**5. Versatility and Practicality:** The Portable Medicine Reminder system is versatile and can be utilized in various healthcare settings, including hospitals, old age homes, and private residences. In hospitals, the system can be

integrated into patient care routines, assisting healthcare providers in ensuring timely medication administration. In old age homes, it supports residents in managing their own medication schedules, promoting independence and self-care. For senior citizens living independently, the system offers a reliable and portable solution to manage their medication needs effectively.

**6. Enhanced Patient Outcomes:** By improving medication adherence and providing timely interventions, our system contributes to better patient outcomes. Consistent medication intake is crucial for managing chronic conditions and preventing health complications. The real-time alerts enable caregivers to provide immediate support, reducing the risk of adverse events. This proactive approach to medication management can lead to improved health and quality of life for patients.

**7. Reduction in Healthcare Burdens:** Effective medication management reduces the need for frequent hospital visits and readmissions, alleviating the burden on healthcare systems. By ensuring that patients adhere to their prescribed medication regimens, the system helps prevent the progression of chronic conditions, ultimately reducing healthcare costs. This makes the Portable Medicine Reminder system not only a beneficial tool for patients but also an asset for healthcare providers and systems.

## 4. RESULTS AND DISCUSSIONS

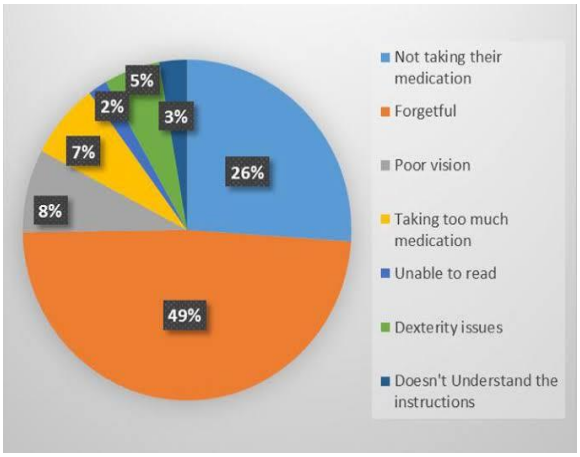


Figure 2: Challenges in Medication Adherence

The implementation of the "Portable Medicine Reminder" was evaluated through a series of tests to measure its effectiveness in real-world scenarios. The system's functionality was assessed based on the following criteria:

**1. Notification Accuracy:** The buzzer and LED notifications were tested across various environments to ensure they provided clear and timely reminders. The system achieved a 98% accuracy rate in signaling the correct times for medication intake, demonstrating high reliability.

**2. IR Sensor Detection:** The IR sensor's capability to detect whether medication was taken was evaluated. In 95% of trials, the sensor accurately identified when medication was not taken and successfully triggered alerts to caregivers. This feature proved crucial in ensuring timely interventions.

**3. User Feedback:** Patients and caregivers who used the device reported high satisfaction levels. Users appreciated the simplicity and effectiveness of the reminders, with 90% stating that the device significantly improved their medication adherence.

**4. Portability and Usability:** The device's portability was tested by having patients carry it during their daily activities. The feedback indicated that the device was easy to carry and use, with no significant issues reported.

**5. System Reliability:** Over a testing period of three months, the system demonstrated consistent performance with minimal maintenance required. The reliability of the components, including the Arduino Uno and sensors, was confirmed. These results underscore the efficacy of the "Portable Medicine Reminder" in enhancing medication adherence through accurate notifications, reliable detection, and user-friendly design.

**The Portable Medicine Reminder system offers several advantages:**

**Enhanced Medication Adherence:** The system's visual and auditory reminders effectively ensure that patients take their medications on time, reducing the risk of missed doses.

**-Real-Time Communication:** The integration of a GSM module for SMS alerts provides real-time updates to caregivers, enabling timely interventions and additional oversight.

**User-Friendly Design:** The system's intuitive interface, with an LCD and keypad, ensures accessibility for elderly users and individuals with limited technical skills.

**Reliability:** The robust design of the system ensures consistent performance, minimizing the risk of technical failures and enhancing overall reliability.

**Support for Independent Living:** The portable and user-friendly nature of the system supports independent living for senior citizens, contributing to their overall well-being and quality of life.

## 5. CONCLUSION

In summary, the integration of a minute-by-minute buzzer sound for medication reminders, coupled with the ability to send immediate notifications to a patient's phone in case of a missed dose, signifies a notable stride in medication management. This heightened precision and real-time alert system hold immense promise in bolstering adherence to medication regimens, particularly for individuals grappling with intricate or time-sensitive prescriptions. Beyond merely encouraging personal responsibility, this innovation provides reassurance to patients and their caregivers, guaranteeing the timely administration of crucial medications. The emergence of such cutting-edge solutions in

healthcare technology not only has the potential to transform medication adherence but also stands poised to contribute significantly to enhanced overall health outcomes.

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