Smart Medicine Reminder Kit With Mobile Phone Calls And Some Health Monitoring Features For Senior Citizens

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Peer Review Information	Abstract
	The advancement of medical technology has created a demand for systems that improve healthcare by ensuring timely medication intake. Elderly and illiterate patients often miss or take the wrong medicine due to memory loss, multiple prescriptions, or difficulty reading labels, which can lead to serious health risks and reduced treatment success. Missed or incorrect medication intake contributes to non-adherence, reducing the effectiveness of treatment and posing serious health concerns. To address this problem, a smart medication reminder system is needed, especially for elderly and illiterate patients, to ensure they follow their prescribed drug plans accurately and safely. We propose a portable multifunctional medicine reminder kit with phone call alerts to help patients manage their medication effectively. In addition to reminders, the system offers intelligent features such as real-time display of time. date and day of room temperature and humidity, as well as patient health tracking including heartbeat rate, body temperature, and oxygen saturation levels.

Introduction

Due to the prevalence of many diseases among the people of Bangladesh, a huge number of them are forced to take medicine regularly. The affection rate also increases daily. Though some diseases may not cause severe suffering, some are fatal. Some diseases can be controlled by taking medicine regularly and on time. The lifespan of human beings is affected by those diseases. We need to take many medicines regularly for survival [1]. Common illnesses such as blood pressure, diabetes, gastritis, and hypocalcemia demand frequent medication to maintain normal quality of life [2].

In order to eliminate the aforementioned risks as well as mitigate the requirement of continuous observation to take the scheduled dose, we are motivated to search for an easy, user-friendly, and effective approach. Some types of medicine kits have already been proposed by some researchers, but most of them are not user-friendly for senior citizens. Some of them are not portable due to their larger size. Nowadays, human errors in many sensitive sectors have been reduced by using modern programmable wireless tech nologies. The use of modern automotive technologies enhances accuracy, so if we merge the concept of programmable modern wireless technology with the medicine reminder kit, then it will be able to provide great features, including reducing size. Different types of medical systems have been previously proposed

upon different platforms and concepts, for example: an automated reminder medicine box [3].

Our proposed system combines hardware and software to deliver a smart, user-friendly kit with alarms, LED indicators, GSM call alerts, and ESP32-based scheduling. Advanced features like reinforcement learning and AI-driven support are considered for future improvements, enabling personalized reminders and error prevention. Other assistive systems based on ambient intelligence and home sensors help reduce errors, but our design extends these ideas by adding health monitoring features[9].The ESP32 microcontroller with SPIFFS memory stores medicine schedules received from a mobile app. With the help of the RTC module, it checks scheduled time against current time to trigger reminders [10]. LED indicators and a speaker alarm provide instant alerts when medicine time arrives, ensuring the patient's attention. A sensor (reed switch) detects whether the medicine box is opened. If it remains closed, the system makes a phone call to remind the patient [12]. The device also monitors vital signs such as heart rate, oxygen saturation (SpO_2), and body temperature using the MAX30100 sensor . Environmental parameters like room temperature, humidity, and smoke levels are tracked to provide complete safety monitoring [14]. The system works in two modes: default mode (reminders, time, date, smoke, room conditions) and medical checkup mode (heart rate, SpO_2, body temperature) . In medical checkup mode, the patient simply places a finger on the sensor to get readings, making the system simple and convenient [16]. The LCD display shows all reminders and health readings clearly, avoiding the complexity of larger monitoring devices . The combination of medicine reminders with health monitoring ensures better care for senior citizens and patients with chronic illnesses . The design promotes preventive healthcare by reducing missed doses and identifying abnormal health conditions in real time Overall, this smart medicine reminder kit provides an efficient, reliable, and accessible healthcare solution for elderly and chronically ill patients .

Literature Survey

Smart healthcare systems have gained significant attention in recent years, particularly in the area of medication adherence and patient monitoring.

Studies show that between 40% and 75% of adults fail to take their prescribed medications on time, which can lead to reduced treatment effectiveness, complications, and even life-threatening situations [1]. Traditional reminder methods such as alarms, mobile notifications, or pill organizers provide some assistance but often fall short for elderly and illiterate users who struggle with complex schedules [2].Earlier approaches include automated pill dispensers and medicine reminder applications. Systems based on real-time clock (RTC) modules and microcontrollers were designed to trigger audio-visual alarms to remind patients [3]. overcome these challenges, researchers introduced IoT-based and AI-assisted medication systems, integrating wireless modules, sensors, intelligent decision-making algorithms. For example, reinforcement learning–based systems provided personalized reminders and warnings to prevent incorrect drug intake [5]. Ambient intelligence and smart home sensors have also been proposed to enhance patient safety [6] Despite their advancements, these systems often suffer from high cost, limited portability, or lack of integrated health monitoring features. Recent developments emphasize the importance of multi-functional systems that go beyond simple reminders. Some prototypes incorporated basic health monitoring, such as heart rate or temperature tracking, but most lacked complete integration with environmental monitoring or escalation mechanisms like GSM-based phone call alerts [7].

Proposed Methodology

The proposed Smart Medicine Reminder Kit addresses limitations of existing systems by integrating GSM phone call alerts for missed doses and using ESP32 microcontrollers for automated scheduling and LED-guided medicine box unlocking. It provides real-time health monitoring (heart rate, SpO_2, body temperature) and environmental monitoring (temperature, gas, humidity) [15]. Unlike prior solutions, it is low-cost, portable, and senior-friendly, making it suitable for both home and hospital use. In conclusion, while previous systems improved medication adherence, they often lacked usability, scalability, and integrated monitoring. The proposed system combines medication management, patient safety, and environmental monitoring into a single, reliable, healthcare management system.
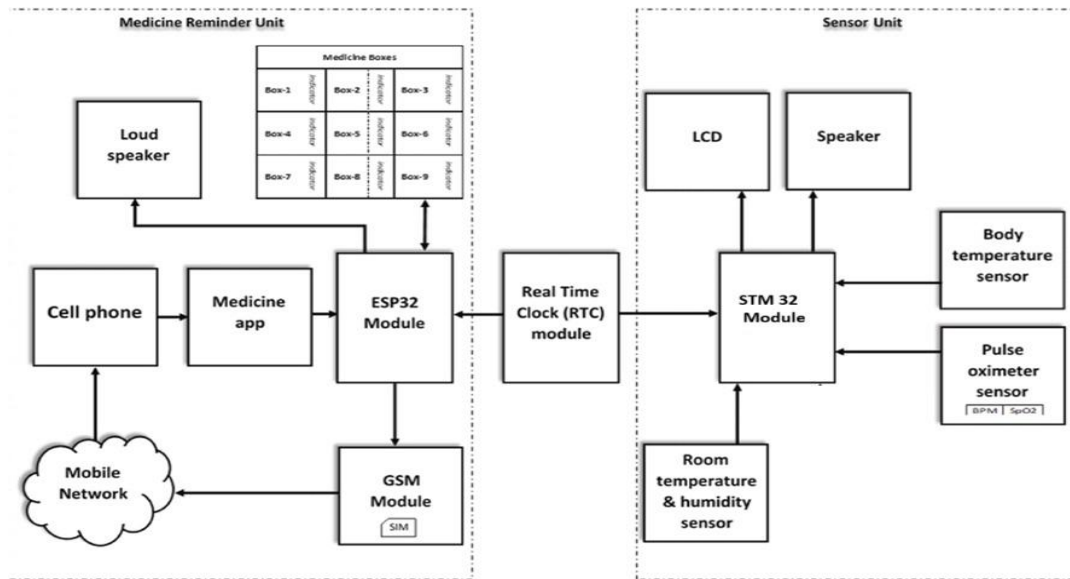
Fig 1: Block Diagram of Smart medicine reminder kit with mobile phone calls and some health monitoring features for senior citizens

The workflow of the block diagram represents the step-by-step operation of the proposed system. It shows how input signals are received, processed by the controller, decisions are made, and the final output is delivered to the user. This ensures a clear understanding of the complete working of the system.

System Overview
The proposed system integrates medicine scheduling, reminder alerts, and health monitoring using IoT and embedded controllers. It reduces the chances of missing doses, ensures timely medication, and provides real-time health monitoring for patients, especially elderly or chronically ill individuals.
The system consists of the following main components:
- Mobile App: Allows the user or caregiver to set medicine schedules and reminder notifications.
- ESP32 Module: Acts as the central controller for the medicine reminder unit, communicating with the mobile app.
- GSM Module: Sends SMS or call alerts to patients or caregivers if a dose is missed.
- Medicine Box Indicators & Loudspeaker: Indicate which medicine to take at a given time and provide audible reminders.
- STM32 Module: Handles the health monitoring sensors and displays data.
- Sensors: Measure body temperature, heart rate (BPM), oxygen level (SpO_2), room temperature and humidity.
- RTC (Real-Time Clock): Ensures accurate timing for medicine reminders and health data logging.

- LCD & Speaker: Display health readings and give audio alerts for abnormal conditions.

1. Medicine Reminder Process
- Medicine Scheduling: The user sets dose timings through the mobile app.
- Control & Alerts: The ESP32 activates the respective medicine box (Box-1 to Box-9) using indicator LEDs.
- Audible Reminder: A loudspeaker announces reminders at scheduled times.
- GSM Notification: If the user misses a dose, the GSM module sends alerts to the registered caregiver's phone.

2. Health Monitoring Process
- Sensor Data Collection: The STM32 continuously collects readings from body temperature, pulse oximeter, and environmental sensors.
- Real-Time Display: Health readings are displayed on the LCD screen.
- Audio Alerts: If abnormal values are detected (e.g., high fever, low oxygen), the speaker provides immediate alerts.
- RTC Logging: All sensor data is time-stamped using the RTC module for accurate monitoring.

3. Data Logging and Communication
- Automatic Logs: The system stores medicine intake history and Health readings in local memory.
- Wireless Alerts: GSM sends reminders or emergency alerts via SMS or calls.
- Remote Monitoring: Caregivers can track patient compliance and health status through notifications.

4. Security and Privacy

To ensure safety of health and medicine data:

- Authorized Access: Only registered users and caregivers can configure the system.
- Data Protection: Sensitive health information is restricted to the user and caregivers.

5. Scalability

The system is modular and can be scaled for:

- More Medicine Compartments: Additional medicine boxes can be integrated.
- Multiple Patients: Can be adapted for clinics or elderly care centers.
- Cloud Expansion: Future integration with cloud platforms for storing and analyzing patient data remotely.

6. User Interaction and Alerts

- Friendly Interaction: Speaker guides patients by announcing which medicine to take.
- Missed Dose Alerts: GSM module notifies caregivers if the patient fails to take medicine on time.
- Emergency Alerts: If sensors detect abnormal health conditions, the system immediately informs caregivers.

Applications

1. Medication Adherence Support

- Personal Care: The system helps patients take medicines on time by providing LED indicators and audible reminders. This ensures proper adherence to prescribed schedules, reducing missed doses, especially for elderly or chronically ill patients, and minimizing associated health risks.

2. Real-Time Health Monitoring

- Continuous Monitoring: The system continuously tracks vital parameters such as body temperature, pulse rate (BPM), oxygen saturation (SpO_2), room temperature and humidity.
- Alerts and Feedback: Abnormal readings trigger immediate audio alerts and notifications to caregivers, enabling timely interventions and proactive health management.

3. Remote Notifications and Caregiver Alerts

- GSM Alerts: Using the GSM module, the system automatically sends SMS or call notifications to caregivers if a dose is missed or abnormal health conditions are detected.
- Emergency Response: This feature allows caregivers or medical professionals to respond quickly without being physically present, improving patient safety and reducing critical delays.

4. Data Logging and Reporting

- Record Maintenance: The system logs medicine intake and sensor readings with accurate timestamps via the RTC module.
- Remote Access: Optional cloud integration allows caregivers and healthcare providers to access data in real-time, generate reports, and track patient compliance and health trends efficiently.

5. Scalability and Flexibility

- Modular Design: The system can integrate additional medicine compartments or sensors to support multiple patients.
- Adaptability: It can be deployed in homes, clinics, elderly care centers, and hospitals, with the option for future expansion such as cloud-based analytics or AI-driven predictions.

6. User-Friendly Interface

- Mobile App Interaction: The intuitive mobile app allows users to set medicine schedules and receive notifications.
- Ease of Use: Medicine box indicators and audible alerts guide patients effectively, improving engagement and reducing reliance on manual tracking or caregiver intervention.

7. Enhanced Healthcare Accessibility

- Remote Monitoring: Caregivers and healthcare providers can monitor patients from a distance.
- Preventive Care: Real-time data supports timely interventions, ensuring structured and reliable patient health management in personal and clinical environments.
- Improved Patient Independence: By reducing the need for frequent hospital visits, elderly individuals can manage their health more comfortably at home.

Conclusion

In this project, Our aim is to develop a Smart Medicine Reminder Kit and Health Monitoring System for senior citizens. The system will provide timely reminders for taking medicines through a mobile app, GSM notifications, and audio alerts via a loudspeaker. Indicators will be assigned to individual medicine boxes, ensuring that the correct medicine is taken at the right time.

Additionally, the project will integrate various sensors (such as body temperature sensor, pulse oximeter, humidity and smoke sensors) to continuously monitor the health conditions of elderly individuals in real time. The collected information will be displayed on an LCD screen, and alerts will be generated whenever necessary.

Thus, through this project, we will attempt to design an affordable, user-friendly, and effective solution to support medicine management and health monitoring for senior citizens.

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