

*Lifeline Medicine Dispenser and Reminder System*Mr.G.Ganesh Reddy¹, Ch.Sri Navya², P.Rupa³, P. Ashmitha³¹ Assistant Professor, ^{2,3,4} UG Students^{1,2,3,4} Department of Electronics and Communication Engineering, Vignan's Institute of Management and Technology for Women.

Abstract—The Lifeline Dispenser is an IoT-based medicine reminder and automated dispensing system designed to ensure timely medication intake. It integrates an STM32 microcontroller with RTC, GSM SIM900A module, IR sensors, and servo motors to provide alerts and automatic medicine dispensing. The system also sends notifications to caregivers in case of missed doses, improving adherence and enabling remote healthcare monitoring.

Keywords—IoT, Medicine Dispenser, STM32, GSM Module, Healthcare Automation, Smart Medication System.

I. INTRODUCTION

Medication adherence plays a vital role in effective health care management, particularly for elderly individuals and patients suffering from chronic diseases such as diabetes, hypertension, and cardiovascular disorders. Failure to follow prescribed medication schedules due to missed doses, incorrect timing, or improper intake can significantly reduce treatment effectiveness and may lead to serious health complications, hospitalizations, or life-threatening conditions. Despite its importance, maintaining strict adherence remains a major challenge worldwide due to factors such as forgetfulness, complex medication routines, cognitive decline in elderly patients, and lack of continuous supervision. Traditional methods, including manual reminders, pill organizers, and caregiver monitoring, are often unreliable and prone to human error, as they depend heavily on memory and availability. These limitations highlight the need for intelligent, automated solutions that can ensure timely and accurate medication intake while reducing dependency on manual intervention. With the rapid advancement of the Internet of Things (IoT), smart healthcare systems have emerged as an effective approach to address these challenges by enabling real-time monitoring, seamless communication, and automation, thereby improving overall healthcare outcomes.

In this context, this paper presents the design and implementation of the Lifeline Dispenser an IoT-based medicine reminder and automated dispensing system aimed at improving medication adherence

through automation and remote monitoring. The proposed system integrates an STM32 microcontroller as the core processing unit, along with a Real Time Clock (RTC) module for precise scheduling and a GSM SIM900A module for communication and alert notifications. Additional components such as infrared (IR) sensors, servo motors, LCD display, buzzer, and LED indicators are incorporated to provide an efficient and user-friendly interface. The system generates audio-visual alerts at scheduled times and automatically dispenses medication upon user interaction. In cases where doses are missed, real-time notifications are sent to caregivers, ensuring enhanced patient safety and accountability. Designed to be cost-effective, simple, and accessible, the system is particularly suitable for elderly users and home-based healthcare environments. Overall, the Lifeline Dispenser offers a reliable and scalable solution for smart medication management, reducing human error, improving treatment adherence, and supporting independent living, while also providing scope for future enhancements such as cloud integration and AI-based healthcare analytics.

II. PROBLEM STATEMENT

Medication adherence is a major issue, especially for elderly and chronically ill patients who often forget to take medicines on time. Existing systems only provide reminders but do not ensure whether the medicine is actually taken, leading to health risks. They also lack automation and caregiver communication. Therefore, a smart system is needed to provide reminders, automatic dispensing, intake detection, and alert

notifications to improve patient safety.

III. LITERATURE SURVEY

A. SMS Based Emergency Communication System for Health care

It is a simple yet effective solution designed to enhance patient safety through reliable communication using GSM technology. The system typically consists of a microcontroller interfaced with a GSM module, enabling it to send predefined SMS alerts to registered contacts such as caregivers, doctors, or family members during emergencies or scheduled medication times. It operates independently of internet connectivity, making it particularly suitable for rural or remote areas where network infrastructure is limited but cellular coverage is available. The device is generally triggered either manually through a button or automatically based on programmed conditions, ensuring timely communication in critical situations. Its low cost design, minimal hardware requirements, and ease of implementation make it accessible and practical for widespread use. However, the system is limited in functionality as it relies solely on SMS alerts without incorporating additional user interaction features such as LCD displays, audio alarms, or automated dispensing mechanisms. This lack of multi modal feedback reduces its usability for elderly or visually impaired patients and highlights the need for more advanced systems that integrate alerts, monitoring, and automation for comprehensive healthcare support.

B. Design of Embedded Health Safety Devices Using GSM & RTC

Focuses on developing a reliable healthcare support system by combining GSM communication with Real-Time Clock (RTC) scheduling to ensure timely alerts and efficient remote monitoring. The system typically uses a microcontroller integrated with an RTC module to maintain accurate timing for medication reminders or emergency alerts, while the GSM module enables sending notifications to caregivers or medical personnel when required. This combination ensures that patients receive alerts at

precise intervals, improving medication adherence and reducing the risk of missed doses. The system is particularly beneficial in home-based healthcare and rural settings, as it does not depend on internet connectivity and can function effectively with basic cellular networks. Its design is simple, cost-effective, and easy to implement, making it accessible for widespread adoption. However, the system mainly relies on basic sound alarms for user notification, which may not be sufficient for elderly or hearing-impaired patients. Additionally, limited display capabilities restrict user interaction and clarity of information, indicating the need for enhancements such as voice guidance, advanced user interfaces, and integration with modern IoT platforms for improved functionality and user experience.

C. IoT Enabled Patient Monitoring and Alert System

The system focuses on real-time health monitoring using sensors and cloud technology. It continuously tracks vital parameters such as heart rate and body temperature. The collected data is transmitted to cloud platforms for storage and analysis. Healthcare professionals can access this information remotely through online dashboards. This enables timely diagnosis and better decision-making. The system also generates alerts when abnormal conditions are detected. As a result, patient safety and emergency response are improved. However, the system depends heavily on internet connectivity for proper functioning. In areas with poor network coverage, performance may be affected. Additionally, it mainly focuses on monitoring and does not support medicine reminders or automated dispensing.

D. Assistive Technology for Alzheimer's Patients

It is designed to support individuals with memory loss by providing regular reminders for medication intake and daily activities. The system uses audio and visual cues to effectively capture the patient's attention and guide them through routine tasks. It helps improve independence and reduces the risk of missed medications or forgotten activities. The design focuses on enhancing memory support and ensuring patient safety in home environments. It is especially useful for elderly patients who require constant assistance. However, the system lacks communication

features to inform caregivers about missed doses. This limits its effectiveness in remote monitoring and supervision. Additionally, it does not include automated tracking or dispensing mechanisms. Therefore, further improvements are needed to enhance alert tracking, caregiver connectivity, and overall system automation.

E. IoT Medical Devices Interfaced with Mobile Networks

It focuses on large-scale healthcare monitoring by integrating IoT devices with mobile communication networks. The system enables real-time collection and transmission of patient health data, allowing doctors and healthcare providers to monitor multiple patients remotely. It is particularly useful in hospitals and telemedicine applications where continuous observation is required. The use of mobile networks ensures wider coverage and accessibility compared to traditional systems. This approach improves efficiency in managing patient data and supports faster medical decision-making. However, the system heavily depends on internet or mobile network connectivity, which can affect performance in areas with poor signal strength. Additionally, it lacks a dedicated mechanism for medication reminders or automated dispensing. Therefore, while it is effective for monitoring, it requires further enhancement for comprehensive medication management.

F. IoT-Based Smart Pill Reminder System for Elderly Care

It is designed to improve medication adherence by leveraging IoT connectivity and mobile applications. The system sends timely medication reminders to patients through smart phone notifications, making it convenient and easy to follow prescribed schedules. It allows caregivers to remotely monitor whether the patient has taken their medicine, enhancing supervision and accountability. By using Wi-Fi and cloud storage, medication data can be updated, stored, and accessed from anywhere, providing flexibility and real-time tracking. The system is particularly beneficial for elderly individuals who experience memory-related issues, helping them maintain dependence in daily healthcare routines. However, the system heavily depends on internet connectivity,

which can lead to unreliable performance in areas with poor network coverage. Additionally, it lacks voice alert features, which are important for visually impaired patients, indicating a need for further improvements in accessibility and reliability

IV. EXISTING METHOD

In existing methods, medication reminders are typically provided through alarms, mobile applications, or simple buzzer and LED systems. These systems only notify the user but do not ensure that the medicine is actually taken. Medicine dispensing is done manually, requiring the patient to remember the correct dosage and timing. Monitoring is limited, and there is no proper feedback mechanism to confirm medicine intake. Additionally, most systems do not provide communication with caregivers in case of missed doses. As a result, these methods are less reliable and highly dependent on the patient's memory and discipline, often leading to missed or incorrect medication intake.

V. PROPOSED METHOD

The proposed system introduces an IoT-based Lifeline Dispenser that ensures timely medication through automation and monitoring. It uses an STM32 microcontroller along with an RTC module to track real-time and compare it with preset medication schedules. When the scheduled time is reached, the system generates alerts using a buzzer, LEDs, and an LCD display to notify the user.

A servo motor is used to automatically dispense the correct medicine, while an IR sensor detects whether the medicine has been taken. If the user fails to take the medicine within the specified time, the GSM SIM900A module sends an SMS alert to caregivers. This method ensures accurate medication, real time monitoring, and improved patient safety with minimal human intervention.

VI. SYSTEM ARCHITECTURE AND COMPONENTS ***A. System Architecture***

The system architecture of the Lifeline Dispenser – IoT Based Medicine Reminder System is designed using a centralized embedded approach in which the STM32 microcontroller acts as the core processing

unit connecting all components. The system integrates input, processing, output, and communication modules to ensure accurate and timely medication delivery. The Real-Time Clock (RTC) module provides precise scheduling information to trigger medication reminders, while the IR sensor detects whether the user has taken the medicine. Based on these inputs, the microcontroller processes the data and controls various output devices such as servo motors, buzzer, LEDs, and LCD display. The servo motors are responsible for automatically dispensing the medicine at scheduled times, while the buzzer and LEDs provide audio-visual alerts to notify the user. The LCD display shows important information such as time, reminders, and system status, enhancing user interaction. For remote monitoring and communication, the system uses the GSM SIM900A module, which sends alert messages to caregivers if the medication is not taken within the specified time. This architecture ensures reliability, automation, and user-friendliness, making it suitable for smart healthcare applications and home-based patient monitoring.

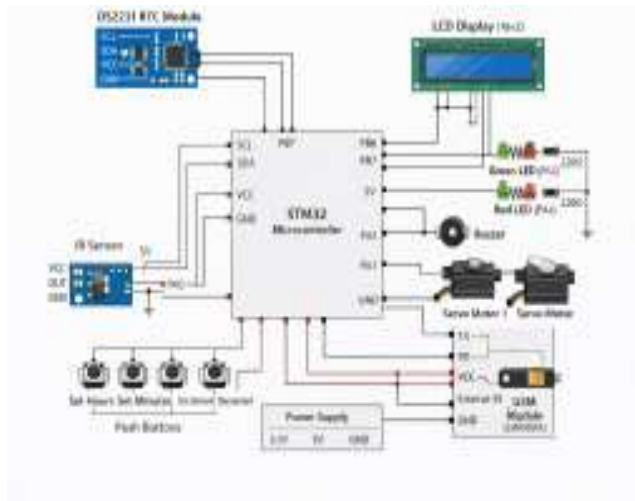


Fig. 1. Schematic diagram

Core Components

1.STM32 microcontroller (Controller Unit):

Embedded control data processing Acts as the brain of the system, processing inputs and controlling all components based on programmed logic.

2.RTC Module (Real-Time Clock):

Timekeeping using oscillator and counters Maintains accurate current time and triggers medication schedules at predefined intervals.

3.GSM SIM900A module (Communication Unit):

Cellular communication using GSM network Sends SMS alerts to caregivers when medicine is missed or for notifications.

4.IR Sensor (Infrared Sensor): Infrared reflection detection Detects whether the medicine has been taken by sensing object presence or movement.

5.Servo Motor (Actuator): Pulse Width Modulation (PWM) control Rotates to dispense medicine accurately at scheduled times.

6.LCD Display: Liquid crystal light modulation Displays time, alerts, and system status for user interaction.

7.Buzzer: Sound generation using electrical signals Produces audio alerts to notify the user about medication time.

8.LED Indicators: Electroluminescence Provides visual status:

Green → Medicine taken

Red → Medicine missed

VII. WORKING PRINCIPLE

1.Setup of the medication schedule: The user initially sets the drug timing and schedule using push buttons. These inputs are stored in the system and used for automated operation.

2.Real-Time Monitoring: The RTC module continuously maintains accurate current time and sends this data to the STM32 microcontroller for comparison with the preset schedule.

3.Time Matching Alert Activation: When the current time matches the programmed medication time, the microcontroller triggers the alert system,

activating the buzzer, LED indicators, and LCD display to notify the user.

4. User Notification Guidance: The LCD displays messages such as “Take Medicine Now,” while the buzzer provides an audible alert, ensuring that the user is clearly informed about medication timing.

5. Automatic Medicine Dispensing: After the alert, the microcontroller controls the servo motor using PWM signals, which rotates to dispense the correct amount of medicine at the right time.

6. Medicine Intake Detection: The IR sensor monitors user interaction by detecting whether the medicine has been taken, providing feedback to the system.

7. Successful Intake Confirmation: If the IR sensor detects that the medicine has been taken within the specified time, the system records it as a successful intake and may indicate it using a green LED.

8. Missed Dose Detection Notification: If no interaction is detected within the given time, the system considers it a missed dose and activates the GSM SIM900A module to send an SMS alert to caregivers or family members.

9. System Reset Continuous Operation: After completing the process, the system resets and continues monitoring time for the next scheduled dose, ensuring continuous and reliable operation.

10. Overall Functionality: The system integrates time-based automation, sensing, and communication to reduce human error, improve medication adherence, and enhance patient safety.

VIII. PROJECT IMPLEMENTATION

The project was initiated by identifying the problem of medication non-adherence among elderly and chronically ill patients. A solution was planned to automate reminders, dispensing, and monitoring using IoT technology. Suitable components such as the STM32 microcontroller, RTC module, GSM SIM900A module, sensors, and actuators were selected. A basic system design and workflow were

then developed before proceeding to hardware and software implementation.

In the initial stage, the problem of medication non-adherence among elderly and chronically ill patients is identified and analyzed. The system requirements are defined to include essential functionalities such as timely medication reminders, automatic dispensing, intake detection, and caregiver notification. Based on these requirements, suitable hardware components such as the STM32 microcontroller, RTC module, GSM SIM900A module, IR sensor, servo motors, LCD display, buzzer, LEDs, and push buttons are selected. A high-level system workflow and operational objectives are established to guide the development process.

In second stage, the overall system architecture is designed by categorizing components into input, processing, output, and communication units. The RTC module is incorporated for accurate timekeeping, while the GSM module is integrated to enable remote communication through SMS alerts. Sensors such as the IR sensor are used for detecting user interaction, and actuators like servo motors are included for automated medicine dispensing. The hardware layout is carefully planned to ensure proper voltage regulation, efficient interfacing, and reliable performance of all modules.

In third stage, a detailed circuit diagram is developed to establish pin-to-pin connections between the microcontroller and all peripherals. Standard communication protocols are implemented, including I2C for interfacing RTC and LCD modules, UART for GSM communication, GPIO for IR sensor, LEDs, buzzer, and push buttons, and PWM signals for controlling servo motors. Proper power supply distribution (3.3V and 5V) and common grounding techniques are ensured to maintain system stability and prevent hardware failures.

In the fourth stage, Embedded C programming is carried out to implement the complete system logic. The software includes modules for reading real-time data from the RTC, comparing it with predefined schedules, generating alerts, controlling servo motors for dispensing, detecting medicine intake through the

IR sensor, and sending SMS notifications via the GSM module using AT commands. The hardware and software components are then integrated to form a complete system, ensuring synchronization and real-time operation.

In final stage, the fully integrated system is tested under various operating conditions to evaluate its performance. Individual modules are verified for accuracy, followed by complete system testing to ensure proper alert generation, dispensing, detection, and communication. Debugging is performed to resolve issues such as timing mismatches or communication delays. The system is then deployed in real-time scenarios, and performance metrics such as reliability, response time, and user-friendliness are analyzed. Based on the evaluation, necessary optimizations are implemented to enhance overall system efficiency and effectiveness in healthcare applications.

IX. ADVANTAGES

1. Ensures patients take medicines on time, reducing missed doses and health risks.
2. Provides audio-visual notifications through buzzer, LEDs, and LCD display.
3. Eliminates dependency on memory and manual tracking, ensuring accuracy.
4. Simple interface makes it easy to use, especially for elderly patients.
5. The STM32 microcontroller and RTC ensure precise timing and stable performance.
6. Ideal for elderly care, chronic disease management, and independent living.
7. The system uses affordable and easily available components, making it suitable for widespread use in home healthcare.
8. The design can be easily upgraded with features like mobile apps, cloud storage, and AI-based monitoring for advanced healthcare solutions.

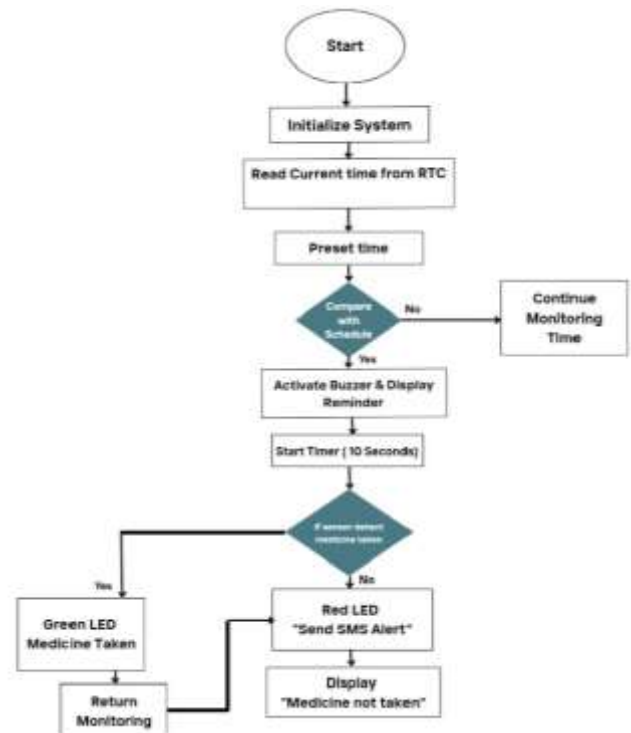


Fig.2 Flow chart

X. RESULT

After the successful implementation and operation of the Lifeline Dispenser – IoT Based Medicine Reminder System, the results demonstrate a significant improvement in medication adherence and patient safety. The system accurately triggers alerts at predefined times using the RTC module and effectively notifies users through buzzer, LED indicators, and LCD display. The automated dispensing mechanism controlled by the servo motor ensures that the correct medicine is delivered at the right time without manual intervention. The IR sensor reliably detects whether the medicine has been taken, providing real-time feedback to the system. In cases of missed doses, the integration of the GSM SIM900A module successfully sends SMS alerts to caregivers, enabling remote monitoring and timely action. Overall, the system operates efficiently with minimal errors, reduces dependency on human memory, and proves to be a cost-effective, reliable, and user-friendly solution for healthcare applications, especially for elderly patients and individuals requiring continuous medication management.



XI. FUTURE SCOPE

The Lifeline Dispenser system can be further enhanced by integrating advanced technologies to improve functionality, usability, and scalability. The Lifeline Dispenser can be enhanced by integrating a mobile application for real-time monitoring and schedule management. Adding cloud connectivity would enable data storage, remote access, and long-term tracking. Features like voice assistance can improve accessibility for elderly and visually impaired users.

Further improvements may include AI-based prediction of missed doses, integration with wearable health devices, and support for multiple medicines with secure access. These advancements can transform the system into a comprehensive smart healthcare solution.

XII. CONCLUSION

The Lifeline Dispenser – IoT Based Medicine Reminder and Automated Dispensing System provides an effective solution to improve medication adherence and patient safety. By integrating an STM32 microcontroller with RTC scheduling, automated dispensing using servo motors, and communication through the GSM SIM900A module, the system ensures timely reminders, accurate medicine delivery, and remote monitoring. The inclusion of sensors and alert mechanisms helps in confirming medicine intake and reducing human error. Overall, the system is cost-effective, user-friendly, and reliable, making it highly suitable for elderly patients and individuals requiring regular

medication. It successfully combines automation and IoT technology to enhance healthcare management and has strong potential for further improvements and real-world applications.

XIII. REFERENCES

- [1]. Patel, R., & Sharma, V. (2016). SMS-Based Emergency Communication System for Healthcare. Prototype and field-trial of GSM SMS alerts for remote patient emergencies.
- [2]. Rao, S., & Menon, A. (2017). Design of Embedded Health Safety Devices Using GSM & RTC. Prototype design and implementation report on timed SMS alerts and local alarms.
- [3]. Rahman, A., & Kulkarni, S. (2019). IoT Enabled Patient Monitoring and Alert System. Realtime cloud-based monitoring architecture with automated abnormal-condition alerting.
- [4]. Sharma, L., & Bennett, K. (2021). Assistive Technology for Alzheimer's Patients. Study on audio-visual reminder systems for daily activities and medication adherence.
- [5]. Prakash, V., & Lim, T. (2024). IoT Medical Devices Interfaced with Mobile Networks. Study on real-time patient monitoring using cellular IoT connectivity for large scale healthcare.
- [6]. Narayan, R., & Gupta, M. (2024). IoT-Based Smart Pill Reminder System for Elderly Care. Cloud-connected medication scheduling and remote caregiver tracking architecture.