
IOT-BASED TELE-MONITORING SYSTEM INTEGRATED WITH SMART MEDICAL DISPENSER

Dr. KVBL Deepthi, Nallella Madhumith, Veldandi Shivamani, Kadarla Harshitha

Department of ECE, MVSR Engineering College (MVSREC), Hyderabad, India.

Abstract

Access to basic healthcare services is still a challenge in many places, especially where immediate medical support is not easily available. This project presents a smart and user-friendly system that helps people monitor their health and obtain necessary medicines in a simple and automated way. The system keeps track of important health conditions and gives instant information so users can understand their current status without needing expert assistance.

Along with health monitoring, the system allows users to easily select and receive medicines through a secure and controlled process. This reduces dependency on manual support and helps avoid errors in medicine delivery. It also keeps users informed by sharing essential details and allows remote supervision, making the system more reliable and transparent.

Overall, the proposed solution makes healthcare more accessible, faster, and easier to use. It is especially useful in public places and remote areas, where it can support people with quick health checks and immediate access to basic medical needs.

Keywords: Internet of Things (IoT), Telemonitoring, Smart Medical Dispenser, ESP32 Microcontroller, Healthcare Automation, Biomedical Sensors, Remote Monitoring, GSM Communication, Automated Medicine Dispensing, Smart Healthcare Systems

I. Introduction

Connected technologies have reshaped multiple industries, with healthcare being one of the most impacted domains. Systems capable of collecting and transmitting medical data without requiring constant physical supervision are becoming increasingly relevant. Among these, remote health observation systems play a key role in minimizing dependency on in-person consultations.

In many real-world settings—such as campuses, rural communities, and transit hubs—immediate access to both health assessment and medication remain limited. Existing solutions often treat monitoring and dispensing as separate processes, which reduces efficiency and increases operational complexity.

The system described in this work addresses this gap by combining health data acquisition with an automated dispensing unit. Sensors capture essential physiological signals, which are then processed and made visible locally while also being available for remote access. The inclusion of a user-driven selection interface allows individuals to choose medication directly from the system.

A transaction validation step ensures controlled access to medicines, after which a mechanical unit handles precise delivery. Communication modules further extend the system's reach by sharing updates with both users and administrators. This integrated approach creates a compact, self-sufficient healthcare solution suited for decentralized environments.

1.1 Background

Healthcare delivery has traditionally relied on direct interaction between patients and professionals, which can be inefficient in high-demand or geographically constrained scenarios. The introduction of embedded electronics and networked communication has enabled the development of systems that reduce this dependency.

Remote monitoring technologies allow continuous observation of key health indicators without requiring physical presence. This approach is particularly valuable for early detection of irregularities and for supporting individuals who require frequent monitoring. At the same time, automation in service delivery—such as medicine distribution—helps reduce human error and operational delays.

While automated dispensers exist in various forms, their integration with real-time health assessment remains limited. Bridging these two functionalities creates a more responsive and intelligent system. Communication technologies further enhance this integration by enabling seamless data exchange between devices and stakeholders.

Such convergence of monitoring, automation, and connectivity forms the foundation for next-generation healthcare systems that are both scalable and user-centric.

1.2 Objectives

The system is designed with the following intentions:

- Develop a connected platform for monitoring physiological conditions
- Capture and process parameters such as temperature, pulse rate, and oxygen saturation
- Present health information through an on-device display
- Build a self-operating medicine dispensing mechanism
- Enable user interaction via a matrix keypad interface
- Control dispensing using a motorized actuation system
- Incorporate a transaction validation step before medicine release
- Deliver user-specific updates through mobile communication
- Provide administrative monitoring through an online messaging platform
- Ensure the system remains practical, reliable, and easy to operate

II. Literature Survey

Recent developments in the Internet of Things (IoT) have made it possible to monitor patient health continuously and from a distance. C. H. Patil (2021) [1][2] proposed an IoT-based smart medicine dispenser to help patients, especially the elderly, take medicines on time. The system provides alerts and reduces the chances of missing or incorrect dosage. It also supports basic communication with caregivers for better monitoring. However, the system mainly focuses on scheduled dispensing and does not include real-time health monitoring or advanced automation.

S.C. [2] proposed an IoT-based healthcare system for remote monitoring and communication. It enables real-time data sharing and improves accessibility, but does not include automated medicine dispensing or a complete integrated solution.

R. Nikhitha [3][3] proposed an IoT-based automatic medical dispatcher system that enables continuous health monitoring and remote communication between patients and healthcare providers. The system improves emergency response and reduces the need for frequent hospital visits by providing real-time updates and support. However, the approach mainly focuses on monitoring and communication, and does not include an integrated automated medicine dispensing mechanism.

Similarly, K. S. Venkatesh [4][6] developed a system to monitor basic health parameters and send data remotely. While useful, it does not include any method for providing medicines automatically. More recently, R. Kumar [5][7] introduced a system that sends health updates through mobile applications. Although it improves communication, it depends on the internet and does not support automatic medicine dispensing.

From these studies, it is clear that most systems focus only on monitoring or dispensing, but not both together. To overcome this, the proposed system combines health monitoring, automatic medicine dispensing, secure payment, and communication in one solution. This makes it more practical and useful for real-world healthcare applications like smart kiosks and remote support systems.

III. Proposed System

3.1 Methodology

The operation begins with continuous acquisition of physiological signals through dedicated sensors. These signals are transmitted to the ESP32 controller, where they are interpreted and formatted for display. The processed values are shown on a screen, allowing immediate user awareness.

User input is handled through a keypad arranged in a matrix configuration. Each key corresponds to a specific medicine compartment. Once a selection is made, the system initiates a payment validation process using a scanning interface.

After confirmation, control signals are issued to a driver module, which regulates the movement of a stepper motor. The motor rotates to align with the selected compartment and releases the required medicine.

Following this action, the system requests a contact number from the user. A communication module then sends a summary containing health readings and transaction details. In parallel, system activity is forwarded to an administrator through an online messaging service, enabling remote supervision.

All functional blocks operate in coordination under the control of the central microcontroller, ensuring synchronized execution of sensing, decision-making, and actuation.

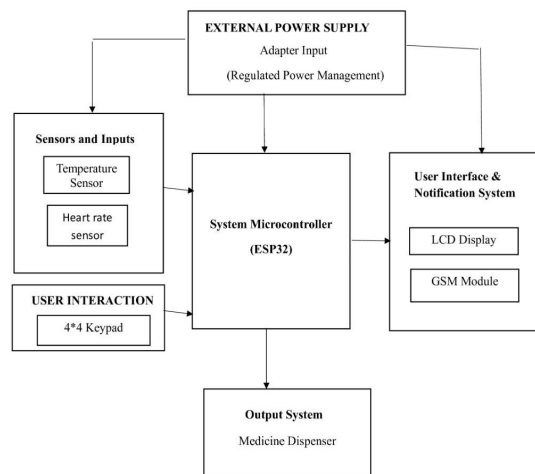
3.2 Implementation

The hardware setup is centred around the ESP32, which serves as the control and communication hub. Sensors connected to the controller capture real-time physiological data, which is processed and displayed locally.

A keypad provides an intuitive interface for selecting medicines stored in multiple compartments. Each compartment is mechanically linked to a motor-driven system controlled via a driver circuit. When a valid selection and payment are confirmed, the corresponding mechanism is activated to dispense the item.

The system also includes a communication unit that sends messages to users containing relevant details. Administrative monitoring is achieved through integration with an online messaging platform, allowing remote tracking of system usage. Careful integration of hardware and software components ensures smooth operation. The design emphasizes reliability, ease of interaction, and adaptability to different deployment scenarios.

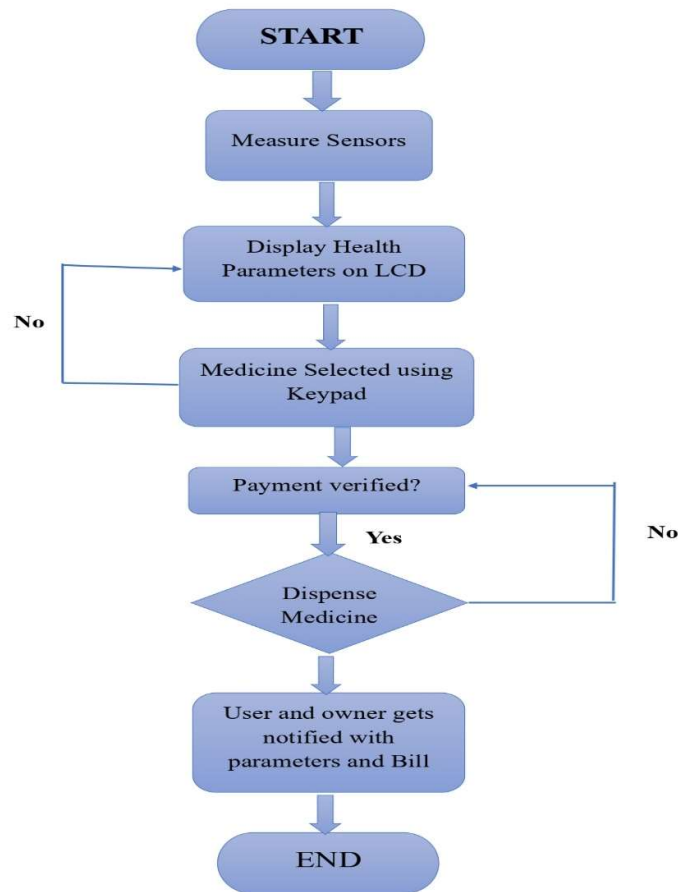
3.3 Block Diagram



The proposed system is an IoT-based tele-monitoring and automated medicine dispensing unit centred around the ESP32 microcontroller, which acts as the main processing and control unit. The system is powered by an external regulated power supply that ensures stable operation of all components. Physiological parameters such as body temperature and heart rate are continuously captured through sensors and forwarded to the microcontroller for real-time analysis. A 4×4 keypad enables user interaction, allowing caregivers or patients to input data such as medication schedules and system settings. The processed information is displayed on an LCD screen, providing real-time feedback, while a GSM module facilitates remote communication by sending alerts or notifications in case of

abnormal health conditions or missed medication timings. Based on predefined logic and sensor inputs, the microcontroller controls the output system, which is an automated medicine dispenser that releases the required dosage at the correct time, thereby reducing manual intervention and improving medication adherence. Overall, the system integrates sensing, processing, communication, and actuation into a unified framework for efficient and reliable remote healthcare monitoring.

3.4 Flow Chart



The flowchart illustrates the operational sequence of the automated health monitoring and medicine dispensing system. The process begins with system initialization, after which the sensors measure vital parameters such as temperature and heart rate. These readings are then displayed on the LCD for user awareness. The user proceeds to select the required medicine using the keypad interface; if no selection is made, the system continues to update and display health data. Once a medicine is chosen, the system checks whether the payment has been successfully verified. If the verification fails, the process loops back until a valid transaction is confirmed. Upon successful verification, the system activates the dispensing mechanism to release the selected medicine. Following this, notifications containing the patient’s health parameters and billing details are sent to both the user and the system owner. The process then concludes, ensuring a controlled, secure, and user-interactive workflow.

3.5 Hardware Components

ESP32 Microcontroller

The ESP32 acts as the central processing unit, coordinating sensor data acquisition, decision-making, and control of all system modules.

TFT Display

The TFT display provides a clear graphical interface to show real-time health parameters and system information to the user.

MAX30102 Sensor

The MAX30102 sensor measures heart rate and blood oxygen saturation (SpO₂) using optical sensing techniques.

Temperature Sensor

The temperature sensor detects and monitors the body temperature, ensuring continuous health tracking.

Buck Converter

The buck converter regulates and steps down the input voltage to a safe and stable level for circuit operation.

Stepper Motor

The stepper motor enables precise and step-wise movement, ensuring accurate positioning during medicine dispensing.

Servo Motor

The servo motor provides controlled angular motion to operate the opening and closing mechanism of the dispenser.

PCA9685 PWM Driver

The PCA9685 is a 16-channel PWM controller that uses I²C communication to precisely control multiple devices like servo motors, reducing the processing load on the microcontroller.

GSM 900A Module

The GSM 900A enables wireless communication by sending SMS alerts and notifications to users or caregivers, ensuring remote monitoring and timely updates.

3.6 Software Components**Arduino IDE**

The Arduino IDE is used to write, compile, and upload embedded C/C++ code to the microcontroller, enabling easy development and debugging of the system

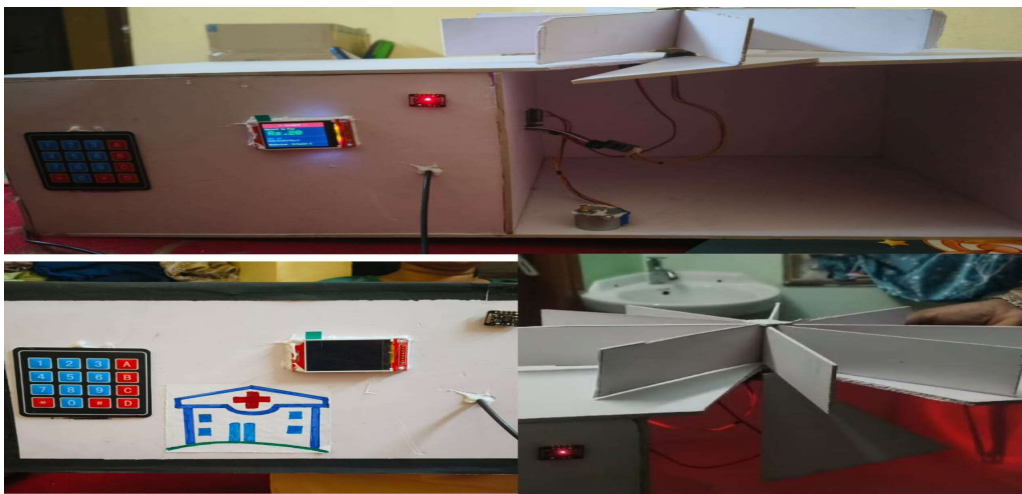
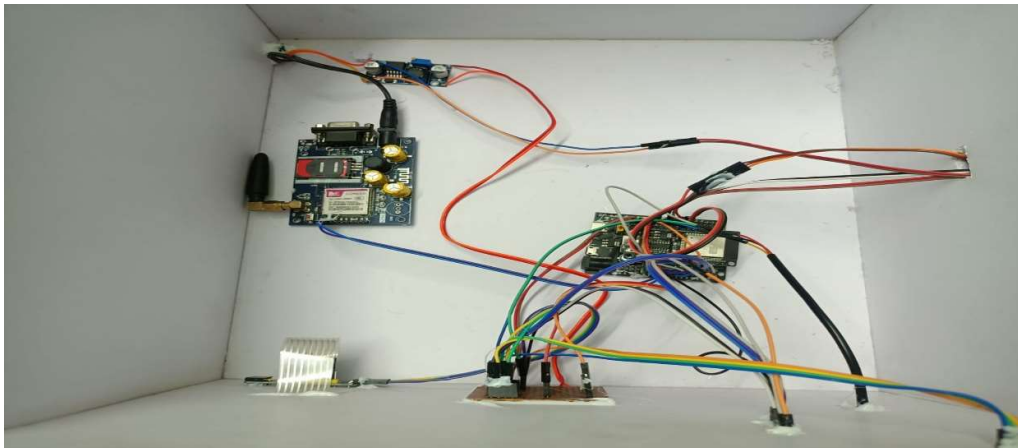
IV. Results and Analysis

The developed system performed as expected and demonstrated smooth overall operation. The LCD screen displayed the patient's temperature and heart rate clearly. Based on these readings, the system automatically suggested the required medicine according to predefined threshold values, making the process intelligent and user-friendly.

Once the appropriate medicine was identified, the user proceeded with the payment step using the keypad. After successful payment, the dispensing mechanism was activated. The stepper motor rotated precisely to the correct slot containing the required tablet, ensuring accurate medicine delivery. The user was then able to collect the medicine easily from the dispenser.

In addition to this, the system also provided a communication feature. After dispensing the medicine, a notification message was sent to both the owner and the customer, confirming the transaction and improving system transparency.

Overall, the system showed reliable performance with proper coordination between sensing, decision-making, payment processing, and medicine dispensing. This confirms that the proposed model is effective for smart healthcare applications with automated medicine delivery.



V. Conclusion

This system shows how different technologies can be combined to create a practical healthcare solution. By integrating health monitoring, automatic medicine dispensing, and communication features, it reduces manual effort and improves access to basic medical services.

The system delivers medicines accurately and keeps both users and administrators informed through timely updates. It works reliably and is simple to use, making it suitable for everyday use.

Overall, this project demonstrates how smart and connected systems can support healthcare, especially in remote or underserved areas where medical facilities are limited.

VI. References

- [1] Bassi, M. Bauer, M. Fiedler, T. Kramp, R. Van Kranenburg, S. Lange, and S. Meissner, *Enabling Things to Talk: Designing IoT Solutions with the IoT Architectural Reference Model*. Berlin, Germany: Springer, 2013.
- [2] C. H. Patil, N. Lightwala, M. Sherdiwala, A. D. Vibhute, S. M. Mali, and S. A. Naik, "IoT-Based Smart Medicine Dispenser for Medication Adherence," *International Journal of Innovative Technology and Exploring Engineering (IJITEE)*, 2021
- [3] R. Nikhitha, H. Muppanapalli, R. Sekhar, and et al., "Automatic Medical Dispatcher with Dynamic Telemonitoring using IoT," *International Journal of Scientific & Technology Research*, vol. XX, no. XX, pp. XX–XX, 2022.



- [4]H. Karl and A. Willig, *Protocols and Architectures for Wireless Sensor Networks*. Chichester, U.K.: Wiley, 2005.
- [5]S. Pandey, P. Singh, and R. Kumar, “Smart medicine dispensing system using IoT,” *International Journal of Engineering Research and Technology (IJERT)*, vol. 7, no. 5, pp. 1–5, 2018.
- [6]K. S. Venkatesh and M. Ramesh, “IoT-based health monitoring system using biomedical sensors,” *International Journal of Innovative Technology and Exploring Engineering (IJITEE)*, vol. 9, no. 2, pp. 1200–1204, 2020.
- [7]R. Kumar, A. Sharma, and P. Gupta, “Cloud-based smart healthcare monitoring system using IoT,” *International Journal of Advanced Computer Science and Applications (IJACSA)*, vol. 13, no. 4, pp. 250–256, 2022.