



ADVANCED HEALTHCARE ASSISTANCE SYSTEM

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Abstract:

This project shows the detailed plan and creation of a smart healthcare system that helps monitor patients in real time and automatically gives out medicine. The system uses an ESP32 microcontroller and includes medical sensors like MLX90614 to check body temperature without touching the patient, and MAX30102 to track heart rate and oxygen levels. The system focuses on safety, automatic operation, and easy access by using a secure one-time password (OTP) system through a keypad. Based on the real-time health data, a servo motor helps give out tablets automatically. The system aims to solve problems in usual healthcare, like the need for manual checks, slow medicine delivery, and difficulty in reaching people in faraway places. By combining embedded systems with IoT ideas, the system offers constant monitoring, quick reactions, and better efficiency. The prototype is affordable, simple to use, and can be used in hospitals, rural clinics, pharmacies, and emergency medical stations.

Keywords: ESP32, MLX90614 IR Temperature Sensor, MAX30102, Heart Rate Monitoring, SpO₂ Measurement, Servo Motor, 4×4 Matrix Keypad, Automatic Tablet Vending Machine, Embedded Systems, IoT, Smart Medical Assistance.

I. Introduction

Healthcare is very important for keeping people healthy, and finding health problems early can help stop them from getting worse. Factors like body temperature, heart rate, and how much oxygen someone has in their blood can show a lot about their health. But in many places, especially



in rural and semi-urban areas, there is not always someone there to watch over patients or give them help right away because there are not enough resources or people working in healthcare. Older healthcare systems depend a lot on people doing things by hand for both checking on patients and giving them medicine.

This can lead to longer waiting times, mistakes, and problems when emergencies happen. Also, because of the recent focus on avoiding close contact, it's more important than ever to reduce physical interactions during healthcare procedures. Thanks to newer technologies like embedded systems and the Internet of Things, it's now possible to build smart tools that can check on people's health and act automatically. Microcontrollers such as the ESP32 are great for this because they are inexpensive, can connect to the internet easily, and work well with different sensors. These qualities make them good for building smart healthcare tools.

The system we are designing brings together health monitoring and medicine distribution into one tool.

It uses sensors that don't need touching to collect data, processes that data as it happens, and automatically gives out medicine when needed. To make sure only the right people get the medicine, the system uses a special kind of code called OTP, which adds a layer of safety and trust.

II. Literature Survey:

Patil et al. (2024) presented an IoT-based health monitoring system that utilizes temperature and pulse sensors for continuous data acquisition and cloud storage. Their approach enhances remote patient monitoring; however, it lacks automation in medicine delivery and does not include any secure authentication mechanism.

Sharma and Kulkarni (2023) developed a Raspberry Pi-based system capable of accurately measuring heart rate and SpO₂ levels with a graphical user interface. While the system ensures reliable data collection, it is limited to monitoring functionality and does not support automated healthcare response or security features.

Ahmed et al. (2022) proposed a contactless temperature monitoring system using infrared sensing technology, which is particularly useful in maintaining hygiene during health checks. However, the system is restricted to single-parameter monitoring and does not integrate multiple health parameters or decision-making capabilities.

Verma et al. (2025) introduced a smart medicine vending machine with automated dispensing and digital payment support. Although the system improves accessibility to medicines, it does not consider the patient's real-time health condition before dispensing.

Deshmukh et al. (2023) designed an automatic pill dispenser for elderly patients, focusing on scheduled dispensing and alert systems. While it enhances medication adherence, it lacks real-time health monitoring and secure access control mechanisms.



Khan and Sheikh (2021) analyzed wearable health monitoring systems that enable continuous tracking and wireless communication. These systems provide mobility and flexibility but involve higher complexity and increased cost.

Roy et al. (2022) reviewed various IoT-based healthcare systems with emphasis on cloud computing and data analytics. The study highlights the importance of connectivity but lacks practical hardware-level implementation.

Jadhav et al. (2024) developed a low-cost embedded prototype for health monitoring, suitable for educational purposes. However, the system has limited scalability and does not incorporate advanced features such as authentication or automated dispensing.

Gupta and Mehta (2023) proposed a multi-parameter health monitoring system using Arduino and IoT integration. The system effectively measures multiple vital signs, but it does not include any decision-making mechanism for treatment or medicine delivery.

Singh et al. (2022) developed a wireless health monitoring system using Bluetooth technology for short-range communication. While it ensures portability, it lacks long-distance communication and cloud integration features.

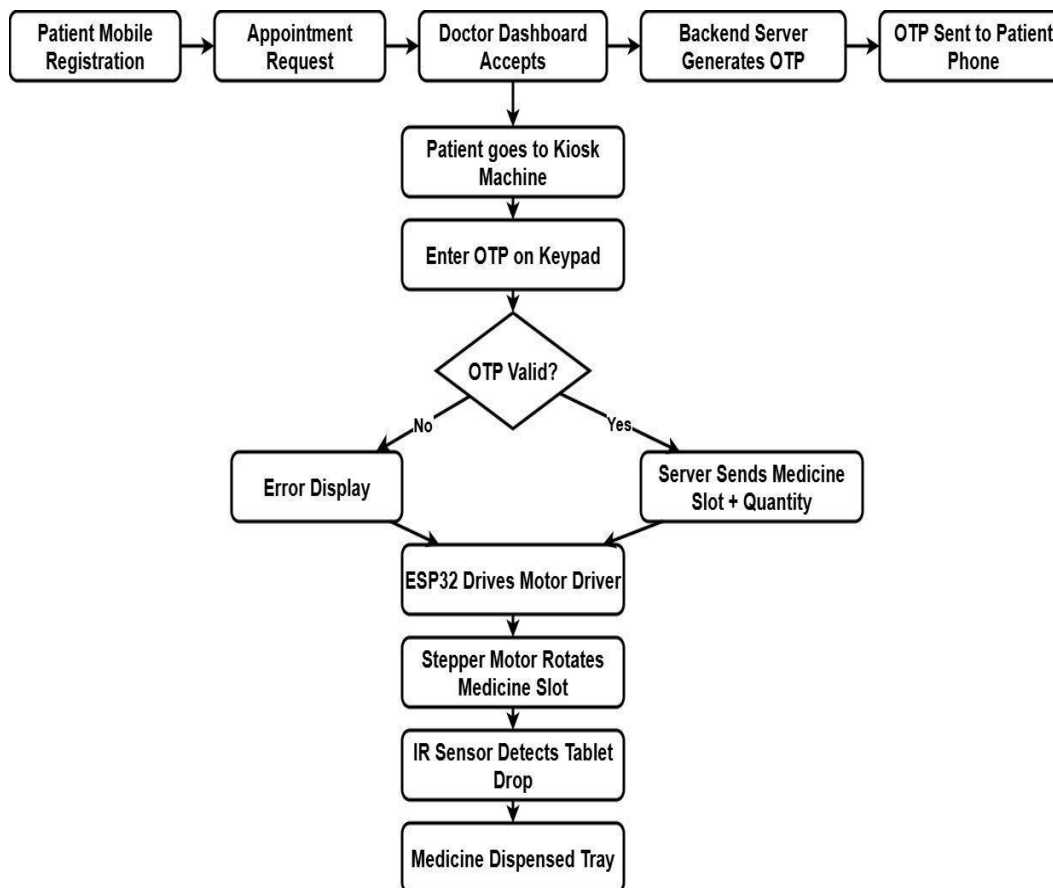
Reddy et al. (2024) introduced a smart healthcare system with mobile app integration for real-time monitoring. Although it improves user interaction, it does not include automated dispensing or secure verification mechanisms.

Joshi and Patwardhan (2023) designed a digital health kiosk for rural areas to measure basic health parameters. The system enhances accessibility but lacks real-time doctor interaction and automated response features.

Ali et al. (2021) proposed an IoT-enabled smart healthcare system focusing on data transmission and storage. However, the system does not incorporate physical output mechanisms such as medicine dispensing units.

More et al. (2024) developed a biometric-based authentication system for healthcare devices. While it improves security, it is not integrated with health monitoring or medicine delivery systems.

Pawar et al. (2025) introduced an automated healthcare assistance system combining sensor data and cloud processing. Although the system supports real-time monitoring, it lacks secure OTP-based verification and precise dispensing control.

Methodology:**Figure 1 Block Diagram of Advanced Healthcare Assistance System**

The system is designed in a clear way that includes sensing, processing, checking if someone is allowed to use it, and then taking action. First, a user signs up using a phone or computer, and their personal information is kept safely in a database. Once they log in, the system starts checking their health using special devices called sensors that are connected to the system.

In this setup, the MLX90614 sensor is used to check body temperature without touching the person, which helps keep things clean.

The MAX30102 sensor is used to check heart rate and oxygen levels in the blood. These sensors are connected to an ESP32, a small computer that handles the data right away.

The system checks the readings against set limits to see if anything is wrong.

The data is also sent to a central system where a doctor can look at it. If the doctor thinks the patient needs help, they create a request for a consultation.

The doctor then checks the request and sends a special code called an OTP to the user's phone.



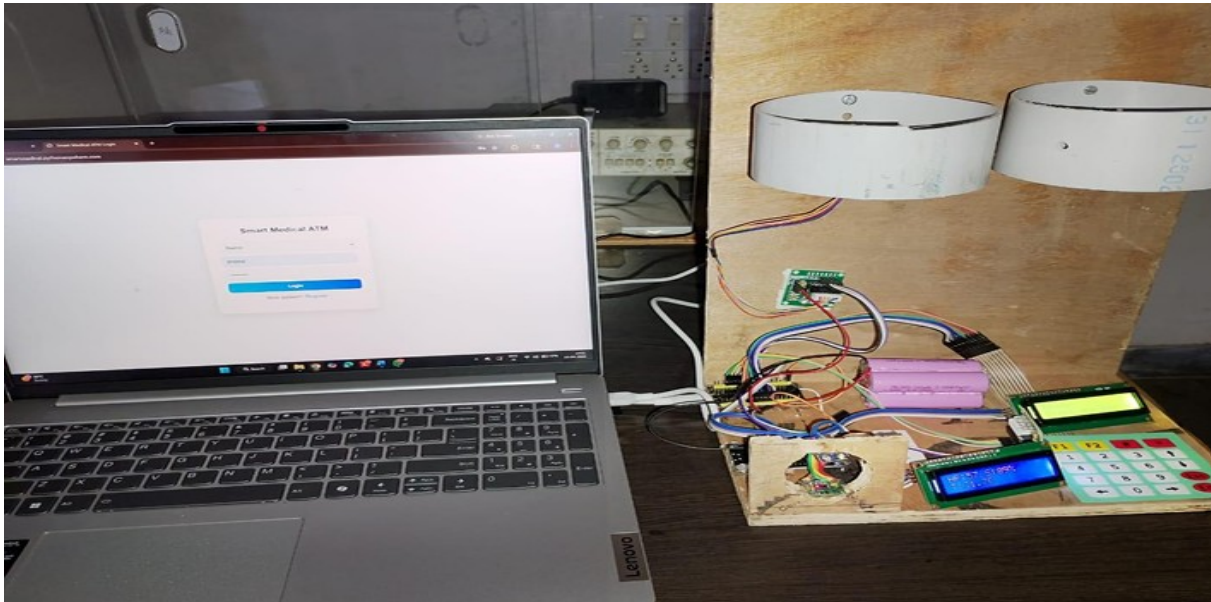
This code is used to confirm that the user is who they say they are. The user types this code into a keypad at a kiosk. The system checks if the code is correct. If it is, the ESP32 gets instructions to give the medicine that was prescribed. A motor-driven dispensing mechanism is then activated. The motor aligns with the correct medicine slot, and the tablet is released. An IR sensor confirms the successful dispensing process.

The Smart Medical Assistance System operates through an integrated workflow that connects patient input, doctor verification, and automated medicine dispensing. The process begins with patient mobile registration, where the user registers their details through a mobile interface. After registration, the patient sends an appointment request, which is received and reviewed by the doctor through a dedicated dashboard. Once the doctor accepts the request, the backend server generates and sends a One-Time Password (OTP) to the patient's registered mobile number for secure verification.

Following this, the patient physically visits the kiosk machine, which acts as the central unit of the system. The patient is required to enter the received OTP using a keypad. The system then verifies whether the entered OTP is valid. If the OTP is incorrect, an error message is displayed, and the process is halted until correct authentication is completed. This ensures security and prevents unauthorized access.

If the OTP is valid, the backend server transmits instructions regarding the medicine slot and required quantity to the system. The ESP32 microcontroller processes this data and controls the motor driver accordingly. A stepper motor is activated, which rotates the medicine dispensing mechanism to the appropriate slot containing the prescribed medicine.

Once the correct position is reached, the medicine is released, and an IR sensor detects the tablet drop, ensuring that the dispensing process has occurred successfully. The medicine is then collected in a dispensing tray, making it easily accessible to the patient.



1. RESULT:



Doctor Dashboard Logout

Patient Requests

Request ID: 76

Patient Details
 Name: Rajeshwari
 Phone: 7719074550
 Heart Rate: 214 BPM
 Alerts: High Heart Rate, Low Oxygen

Vitals
 Temperature: 31.4 C
 SpO2: 31 %

Prescription
 Paracetamol (Slot 1, 6 left)
 Quantity:
 Generate OTP

Appointment History

Request ID	Patient Name	Phone	Requested	Status	Prescription	Dispensed	Action
78	Rahul Chavan	9322790078	10 Apr 2026, 04:34 pm	Approved	Paracetamol x 1	11 Apr 2026, 12:04 pm	Dispensed
77	Rahul Chavan	9322790078	10 Apr 2026, 03:00 pm	Approved	Paracetamol x 1	10 Apr 2026, 03:01 pm	Dispensed
74	Rahul Chavan	9322790078	10 Apr 2026, 02:29 pm	Approved	Paracetamol x 2	10 Apr 2026, 02:35 pm	Dispensed
73	Rajeshwari	7719074550	10 Apr 2026, 02:18 pm	Approved	Paracetamol x 1		OTP Expired

Figure 1 Result 1 Set Up

Figure 2 Result 2 Website Interface

The system was tested in different situations to check how well it worked and stayed reliable. The MLX90614 sensor gave temperature readings that were very close to those from regular thermometers, with very little difference. The MAX30102 sensor started giving steady heart rate and SpO2 measurements once the signals were stable.

The OTP authentication system worked well, allowing only people with the right code to use the medicine dispenser.

The time it took to check the OTP was just a few seconds, making the process smooth for users. The dispenser, which used a servo motor, worked reliably, giving the right tablets every time in repeated tests.



Putting together the sensors, the controller, and the motor showed that they all worked well together, proving that the system is practical and can be used as intended.

The Smart Medical Assistance System is an IoT-based healthcare system designed to monitor a patient's basic health parameters and provide automated medical assistance. In this system, the user places their finger on the sensor for about 15 seconds, during which sensors measure important parameters such as body temperature, SpO₂ (oxygen level), and heart rate. The collected data is then processed by a microcontroller and displayed on an LED screen, allowing the user to instantly view their health status.

After this, the data is transmitted to the doctor's dashboard through the internet. For security and verification, the doctor sends an OTP to the patient, which is entered using a keypad. Once the OTP is successfully verified, the doctor analyzes the patient's data and prescribes the appropriate medicine. Based on this prescription, the system activates a dispensing unit, which rotates using a motor mechanism to deliver the required tablet to the patient. This system provides a fast, reliable, and automated healthcare solution, helping to save time and making medical services accessible even in remote areas. Smart Medical Assistance System is an IoT-based healthcare system designed to monitor a patient's basic health parameters and provide appropriate medical assistance automatically.

In this system, the user places their finger on the sensor for about 15 seconds, during which parameters such as body temperature, SpO₂ (oxygen level), and heart rate are measured. The collected data is processed by a microcontroller and displayed instantly on an LED screen, allowing the user to view their health status. This data is then transmitted to the doctor's dashboard through the internet. For security and verification, the doctor sends an OTP to the patient, which is entered using a keypad. After successful OTP verification, the doctor analyzes the patient's data and prescribes the required medicine.

Based on this prescription, the dispensing unit in the system is activated, which rotates using a motor mechanism to deliver the appropriate tablet to the patient. This system provides fast, reliable.

2. CONCLUSION:

This project offers a dependable and effective way to help with healthcare by combining real-time health tracking with automatic medicine delivery. By using embedded systems and IoT, the design is small and affordable, making it easy to use in real-world settings. The system cuts down on the need for people to do things manually and speeds up how quickly healthcare responses can happen. Adding secure login features makes the system more trustworthy and stops people from using it incorrectly. Looking ahead, the system could be improved by linking it to the cloud, adding mobile app support, and using AI to analyse health data, which would make it even better at helping with healthcare.



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