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AUTOMATIC MEDICAL DISPATCHER WITH DYNAMIC TELEMONITORING USING IOT

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Abstract— The project “Automatic Medical Dispatcher with Dynamic Telemonitoring using IOT” is designed to enhance healthcare delivery through automation and remote monitoring. Central to the system is a Raspberry Pi microcontroller that coordinates various functions, including real-time telemonitoring and automatic medicine dispensing. An LCD displays vital information, while a DC motor, controlled by the Raspberry Pi, automatically dispenses prescribed medicines. The system integrates an Arduino Nano to manage multiple sensors: a heartbeat sensor for monitoring heart rate, a temperature sensor for tracking body temperature, an ultrasonic sensor for measuring patient height, and a load cell for determining weight. Additionally, an IP camera is incorporated to facilitate live video communication between patients and healthcare professionals, allowing remote consultations. This comprehensive system provides an efficient solution for remote health monitoring and medication management, ensuring timely intervention and improved patient care.

Keywords : Telemonitoring, Raspberry Pi, IoT Healthcare, Automated Medical Dispatcher, Remote Monitoring.

1. INTRODUCTION

The "Automatic Medical Dispatcher with Dynamic Telemonitoring Using Raspberry Pi" project aims to revolutionize healthcare delivery by integrating automation and telemonitoring into a cohesive system. In a world where timely medical intervention is critical, this project leverages the power of Raspberry Pi and Arduino Nano to continuously monitor a patient's vital signs and manage medication dispensing automatically. By utilizing sensors for heart rate, temperature, height, and weight, alongside an IP camera for live communication with healthcare providers, the system offers a comprehensive remote healthcare solution. This approach minimizes the need for in-person visits, reduces human error in medication management, and provides immediate access to medical advice, making healthcare more accessible and efficient, particularly for patients in remote or underserved areas.

In rural and remote areas, access to immediate medical assistance remains a significant challenge due to a lack of healthcare infrastructure, medical professionals, and efficient emergency response systems. Traditional emergency medical services (EMS) often face delays, leading to increased mortality rates in critical situations such as heart attacks, strokes, or accidents. The integration of Internet of Things (IoT) technology in healthcare has opened new possibilities for real-time patient monitoring and automated emergency response.

The increasing prevalence of chronic diseases, coupled with inadequate emergency healthcare services in rural regions, necessitates an intelligent and automated solution. A system that can continuously monitor vital health parameters, detect medical emergencies, and dispatch appropriate medical assistance can significantly reduce response times and save lives. The proposed Automatic Medical Dispatcher with Integrated Telemonitoring System leverages IoT sensors and communication networks to enable real-time patient monitoring and automatic emergency alerts.

One of the standout features of this project is the integration of an IP camera, which allows for live communication between the patient and healthcare providers. This feature enables remote consultations, immediate medical advice, and real-time health assessment, significantly reducing the need for in-person visits. By providing

2. LITERATURE SURVEY

Overview of IoT in Healthcare:

The Internet of Things (IoT) has revolutionized the healthcare industry by enabling real-time monitoring, data analytics, and automated decision-making. IoT-based healthcare systems utilize wearable sensors, cloud computing, and wireless communication technologies to collect, transmit, and analyze patient health data remotely. Several studies have highlighted the advantages of IoT in reducing hospital readmissions, enhancing patient care, and improving emergency response times.

[1]. Telemedicine and Remote Monitoring in Healthcare

Recent studies highlight the growing adoption of telemedicine to provide healthcare services remotely, especially for patients in rural or underserved areas. Research emphasizes how telemonitoring improves accessibility, allowing continuous tracking of patient health data and reducing hospital visits. The integration of sensors for vital sign monitoring in telemedicine systems has shown potential in enhancing patient outcomes and lowering healthcare costs. This aligns with the proposed system, which integrates real-time health monitoring and remote consultations via video communication.

[2]. Automatic Medication Dispensing Systems

Research into automated medication dispensing systems has demonstrated their effectiveness in reducing medication errors and improving adherence. Automated systems have been shown to significantly decrease the chances of missed or incorrect doses by providing a controlled and timely release of medications. The Raspberry Pi-based dispenser in the proposed system follows the

principles, ensuring accurate and reliable medication management for patients

[3].Remote Health Monitoring Using Raspberry Pi

Several studies have explored the use of Raspberry Pi in healthcare systems for its flexibility and cost-effectiveness in implementing real-time health monitoring. Research demonstrates how Raspberry Pi, when integrated with sensors and communication devices, can be used to build efficient and low-cost telemonitoring systems that support real-time health tracking and alert systems. The proposed system builds on this approach, using Raspberry Pi as a central hub for managing sensors, dispensing medicine, and facilitating remote communication.

[4].Real-Time Patient Monitoring with IoT Devices

Research on IoT devices in healthcare has shown their effectiveness in collecting and transmitting real-time patient data for continuous monitoring. A study by Islam et al. (2015) explores how IoT-based healthcare systems can gather and process health data efficiently, offering timely interventions. The proposed system follows a similar approach by utilizing sensors connected to Arduino Nano for real-time monitoring of vitals such as heart rate, temperature, and weight, ensuring prompt responses to any changes in patient health.

[5].Smart Medication Adherence Systems

Several studies have highlighted the importance of smart medication systems to ensure patient adherence to prescribed treatment plans. According to research by Vimalanathan and Dwivedi (2019), automated medicine dispensers improve medication compliance, especially for elderly patients or those with chronic illnesses. The Raspberry Pi-based medication dispensing system proposed in this project addresses these concerns by automatically administering the correct dose at the right time, reducing the chances of non-adherence or missed doses.

3. EXISTINGWORK

Existing methods for medical dispatching and telemonitoring primarily rely on manual processes, leading to inefficiencies in patient care:

Manual Processes: Traditional healthcare systems require manual intervention for dispatching medical assistance, leading to delays in emergency response.

Fragmented Systems: Many telemonitoring and dispatching solutions operate in isolation, lacking seamless integration between health monitoring, medication management, and emergency services.

Inconvenience for Patients: Patients often need to visit healthcare facilities for routine monitoring of vital signs such as heart rate, temperature, and weight, which is challenging for individuals with mobility issues or those in remote areas.

Manual Medication Management: Medication dispensing is commonly managed manually, increasing the risks of:

- Human errors in dosage administration
- Missed doses leading to ineffective treatment
- Improper medication management affecting patient safety

3[1]. Limitations of Existing Systems

Despite advancements, existing telehealth and emergency medical dispatch systems face several limitations:

Lack of Integrated Real-Time Monitoring: Many systems do not support real-time data collection and dynamic health monitoring, reducing their effectiveness in detecting urgent health issues.

Inefficient Communication Channels: Limited interoperability between telemonitoring systems and healthcare providers results in delayed responses to emergencies.

Reduced Effectiveness in Patient Monitoring: Due to poor synchronization between patient data, medication management, and emergency response, the overall efficiency of healthcare delivery is compromised.

These limitations highlight the need for an b that:

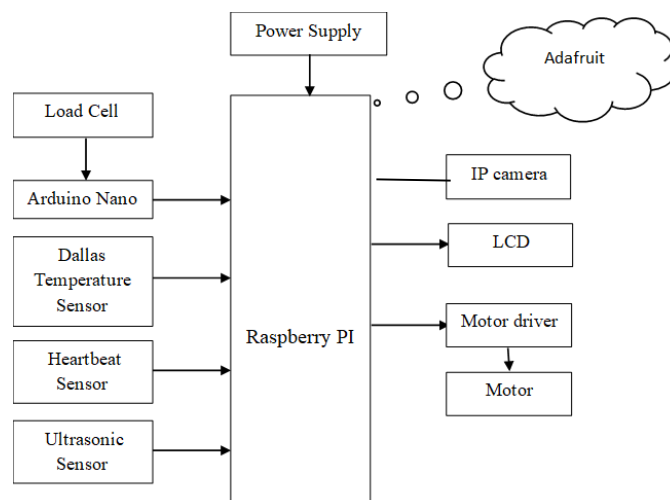
- Enables continuous health monitoring through IoT-based devices.
- Provides efficient medication management to reduce errors and improve adherence.
- Ensures dynamic communication between patients and healthcare professionals for faster medical response and

better accessibility.

4.METHODOLOGY

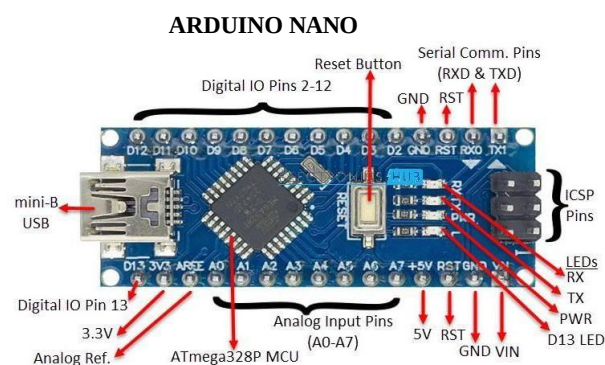
The proposed system introduces an automated medical dispatching and dynamic telemonitoring system using Raspberry Pi and Arduino Nano to address the limitations of traditional healthcare systems.

Block Diagram



The proposed Automatic Medical Dispatcher with Integrated Telemonitoring System is designed using Raspberry Pi as the central processing unit, interfacing with various sensors and output devices to ensure real-time health monitoring and automated emergency response. The system is powered by a dedicated power supply, which ensures uninterrupted operation. The Arduino Nano is responsible for managing multiple sensors, including the Dallas Temperature Sensor for body temperature monitoring, a heartbeat sensor for tracking pulse rate, an ultrasonic sensor for measuring patient height, and a load cell for determining weight. The collected health data is processed by the Raspberry Pi and displayed on an LCD screen for easy access.

For medication management, the system incorporates a motor driver and motor, controlled by the Raspberry Pi, to automate medicine dispensing, reducing human intervention and ensuring accurate dosage administration. The system also includes an IP camera to facilitate live video communication between patients and healthcare providers, enhancing remote consultations. Additionally, the system leverages Adafruit IoT services for cloud-based data storage and remote monitoring, enabling healthcare professionals to access real-time patient data from any location. This integrated approach ensures continuous health tracking, automated emergency response, and improved accessibility to medical services, particularly for individuals in rural and underserved areas.



The Arduino Nano plays a crucial role in the Automatic Medical Dispatcher with Integrated Telemonitoring, serving as the main microcontroller for processing and controlling the system's operations. Due to its compact size, low power consumption, and sufficient processing capabilities, it is ideal for embedded medical applications.

In this system, the Arduino Nano is responsible for receiving sensor data from IoT-enabled health monitoring devices, such as temperature sensors, pulse sensors, or other biomedical sensors that track patient vitals.

The Arduino Nano primarily handles sensor data collection and motor control, while the Raspberry Pi acts as a gateway to process and transmit data to the Adafruit cloud platform for remote access.

Raspberry Pi



In the Automatic Medical Dispatcher with Integrated Telemonitoring System, the Raspberry Pi acts as the central processing unit, coordinating all sensor inputs, data processing, and system operations. It plays a crucial role in ensuring real-time health monitoring, automated medication dispensing, and remote patient communication.

Data Acquisition & Processing

The Raspberry Pi collects health data from multiple sensors, including:

- Heartbeat Sensor – Tracks pulse rate to monitor cardiovascular health.
- Dallas Temperature Sensor – Measures body temperature for fever detection.
- Ultrasonic Sensor – Determines patient height.
- Load Cell – Measures body weight for BMI calculation.

Automated Medication Dispensing

The Raspberry Pi controls a **motor driver and motor** to automate the dispensing of medicines. Based on the patient's health condition and prescribed schedule, the system ensures:

- Accurate dosage delivery
- Reduced human intervention and errors
- Timely medication reminders and dispensing

Remote Communication & Emergency Response

To enhance telemonitoring and emergency dispatch, the Raspberry Pi integrates:

- IP Camera – Enables live video consultation between patients and healthcare professionals for remote diagnosis.
- Adafruit IoT Services – Facilitates cloud-based data storage and remote **access** for healthcare providers, allowing them to monitor patient health from anywhere.

System Integration & Connectivity

The Raspberry Pi acts as a communication bridge between the Arduino Nano, sensors, motor drivers, LCD, and cloud services. It ensures seamless data transmission and efficient operation, making the system highly responsive and reliable for real-time healthcare applications.

DS18B20 Temperature Sensor

The digital temperature sensor like DS18B20 follows single wire protocol and it can be used to measure temperature in the range of -67°F to +257°F or -55°C to +125°C with +5% accuracy. The range of received data from the 1-wire can range from 9-bit to 12-bit. Because, this sensor follows the single wire protocol, and the controlling of this can be done through an only pin of Microcontroller. This is an advanced level protocol, where each sensor can be set with a 64-bit serial code which aids to control numerous sensors using a single pin of the microcontroller.

No:	Pin Name	Description
1	Ground	Connect to the ground of the circuit
2	Vcc	Powers the Sensor, can be 3.3V or 5V
3	Data	This pin gives output the temperature value which can be read using 1-wire method

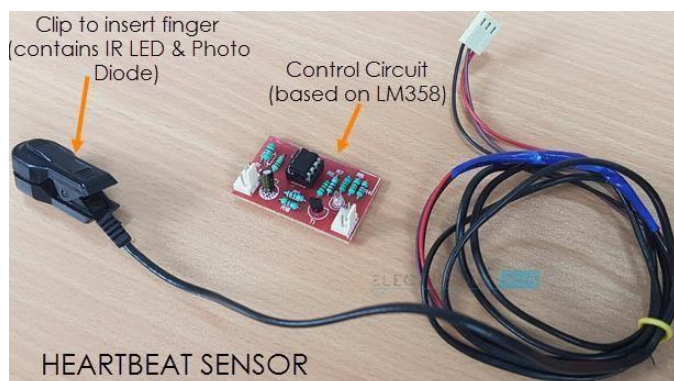


Working Principle

The working principle of this DS18B20 temperature sensor is like a temperature sensor. The resolution of this sensor ranges from 9-bits to 12-bits. But the default resolution which is used to power-up is 12-bit. This sensor gets power within a low-power inactive condition. The temperature measurement, as well as the conversion of A-to-D, can be done with a convert-T command. The resulting temperature information can be stored within the 2-byte register in the sensor, and after that, this sensor returns to its inactive state.

Heartbeat Sensor

Heartbeat Sensor is an electronic device that is used to measure the heart rate i.e. speed of the heartbeat. Monitoring body temperature, heart rate and blood pressure are the basic things that we do in order to keep us healthy.



The principle behind the working of the Heartbeat Sensor is Photoplethysmograph. According to this principle, the changes in the volume of blood in an organ is measured by the changes in the intensity of the light passing through that organ.

Usually, the source of light in a heartbeat sensor would be an IR LED and the detector would be any Photo Detector like a Photo Diode, an LDR (Light Dependent Resistor) or a Photo Transistor.

With these two i.e. a light source and a detector, we can arrange them in two ways: A Transmissive Sensor and a Reflective Sensor.

IP CAMERA

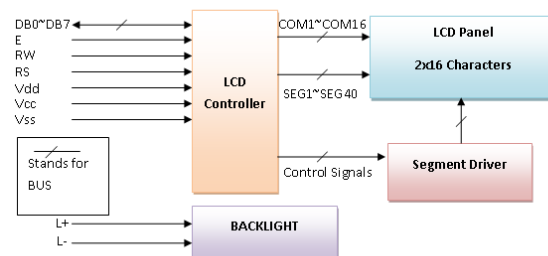


An IP camera is a video camera that is networked over a Fast Ethernet connection. The IP camera sends its signals to the main server or computer screen via an Internet or network link. It is mostly used in IP surveillance, closed-circuit television (CCTV) and digital videography. IP cameras are widely replacing analog cameras due to their digital zoom and remote surveillance options over the Internet.

IP cameras tend to capture better quality images, which is especially helpful in the case of moving targets, as frame rates can be adjusted according to the bandwidth provided. They support two-way communication and hence can send customized alert signals in case of suspicious activity or other predefined occurrences. Hundreds of gigabytes of video and image data can be stored in video servers, which can be retrieved at any time

LCD

LCD (Liquid Crystal Display)



The LCD (Liquid Crystal Display) plays a crucial role in the Automatic Medical Dispatcher with Integrated Telemonitoring, providing a real-time user interface for displaying important information about the system's operation. It allows patients, caregivers, or healthcare professionals to interact with the device and monitor medicine dispensing status of medical dispatcher

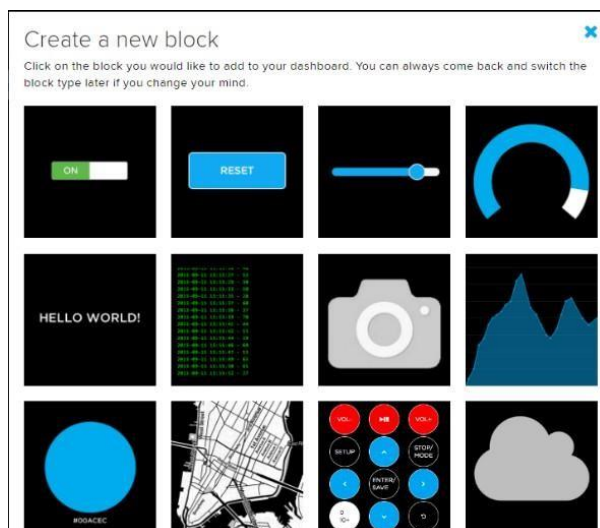


User-friendly interface for patients and caregivers. Real-time feedback for medicine dispensing and system monitoring. Low power consumption, making it ideal for embedded systems. Enhances automation and reliability by providing instant alerts.

Pin No	Function	Name
1	Ground (0V)	Ground
2	Supply voltage; 5V (4.7V – 5.3V)	Vcc
3	Contrast adjustment; through a variable resistor	V _{EE}
4	Selects command register when low; and data register when high	Register Select
5	Low to write to the register; High to read from the register	Read/write
6	Sends data to data pins when a high to low pulse is given	Enable
7	8-bit data pins	DB0
8		DB1
9		DB2
10		DB3
11		DB4
12		DB5
13		DB6
14		DB7
15	Backlight V _{CC} (5V)	Led+
16	Backlight Ground (0V)	Led-

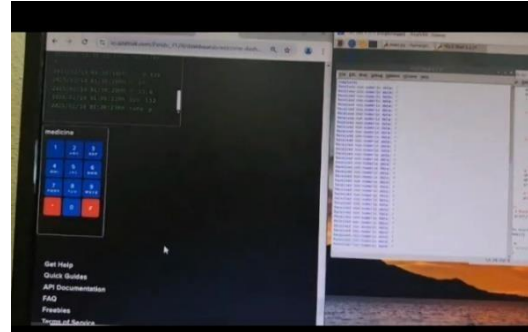
Adafruit

Adafruit IO serves as a cloud-based platform for storing patient data



from connected sensors, ensuring real-time monitoring. A DC motor is used to dispense the prescribed medicine, with the platform displaying the exact number of pills being released. Doctors can access and modify

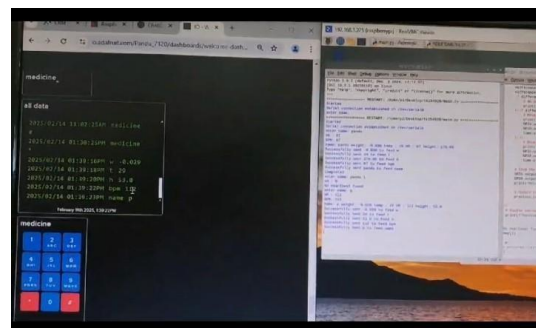
this information through the Adafruit dashboard, allowing for remote adjustments to prescriptions. The integration of hardware and cloud storage ensures accurate medication management, reduces human error, and enables efficient remote healthcare monitoring.



RESULT

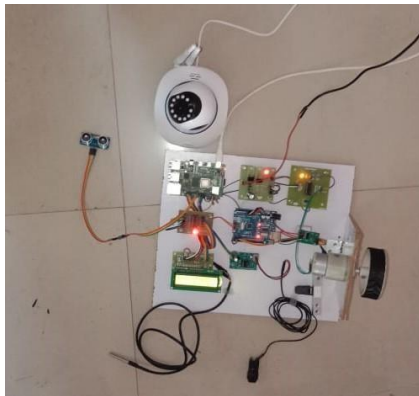
The system collects data from sensors, which is then logged into the Adafruit platform and stored in the cloud. This data includes vital information such as patient health parameters, or any other relevant metrics required for the system's operation. Adafruit's feed acts as a central hub where the processed data is made available for further actions. One of the key pieces of information received from Adafruit is the medicine number, which determines which specific medicine needs to be dispatched.

Once the medicine number is identified, the system activates a DC motor, which is controlled by a motor driver. The motor rotates to a predefined position corresponding to the specified medicine. It stops precisely at the designated number, ensuring accurate dispensing of the medicine. This automated process minimizes human intervention and ensures efficient and error-free medicine dispatch based on the real-time data received from Adafruit



and enabling medicine configuration. Through this system, doctors can prescribe medications remotely, while automated hardware components dispense the prescribed medicine accordingly. The process begins with logging into Adafruit IO and setting up feeds to store sensor readings, such as heart rate and temperature, as well as medicine dispatch information. These feeds automatically receive patient data

Once the medicine number is identified, the system activates a DC motor, which is controlled by a motor driver. The motor rotates to a predefined position corresponding to the specified medicine. It stops precisely at the designated number, ensuring accurate dispensing of the medicine. This automated process minimizes human intervention and ensures efficient and error-free medicine dispatch based on the real-time data received from Adafruit.



FUTURE SCOPE

The future scope of the Automatic Medical Dispatcher with Dynamic Telemonitoring Using IOT is vast. To improve accessibility, the system can be integrated with a mobile app and voice commands, allowing users to control medicine dispensing remotely. This feature would be especially beneficial for elderly and visually impaired patients. The system could also include smart medication scheduling with automated reminders via SMS, email, or app notifications to alert users of missed doses or abnormal health readings. Additionally, an emergency alert system can be integrated to notify doctors or emergency services in case of critical health conditions, with GPS-enabled emergency medicine dispatch.

Finally, ensuring regulatory compliance and medical certifications such as FDA, CE, and ISO standards would be essential for the system's credibility. Collaborating with healthcare providers and pharmaceutical industries can help validate its accuracy and reliability, making it a trusted solution for modern medical dispensing and telemonitoring. With these advancements, the system can revolutionize healthcare by providing efficient, automated, and data-driven medication management while enhancing patient safety and accessibility.

CONCLUSION

The Automatic Medical Dispatcher with Integrated Telemonitoring is a significant step toward improving healthcare accessibility, accuracy, and efficiency. By automating medicine dispensing and integrating real-time health monitoring, the system minimizes human intervention, reduces medication errors, and ensures timely delivery of prescribed medicines. The use of IoT, AI, and cloud-based technologies enhances its functionality, allowing seamless communication between patients, healthcare providers, and pharmacies.

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