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IoT MEDICINE DELIVERY ROBOT AND HEALTH MONITORING

Syed Mushtaq[1],Mohammed Sohail[2],Mohammed Adnan Shareef[3], Ms Syeda Nousheen Hashmi[4]

UG students,Assistant Professor,Electronic and Communication Engineering, Deccan College of Engineering And Engineering, Hyderabad, Telangana

ABSTRACT:

This project presents the design and implementation of an IoT-based medicine delivery robot with integrated health monitoring capabilities, utilizing Arduino Uno, LCD, L293D motor driver, ESP32 Camera, DHT11 sensor, and a pulse sensor. The system is designed to autonomously deliver medications within healthcare facilities while simultaneously monitoring the patient's vital signs. The Arduino Uno serves as the central controller, managing the movement of the robot via the L293D motor driver. Real-time health data is collected through the DHT11 sensor for temperature and humidity and the pulse sensor for heart rate monitoring. This data is displayed on an LCD screen and transmitted to healthcare providers through the ESP32 Camera module, which also offers live video feed for remote monitoring. This innovative solution aims to enhance the efficiency and accuracy of medicine delivery and patient care, reducing the workload on healthcare personnel and ensuring timely medical interventions.

Introduction:

The growing demands in healthcare necessitate innovative solutions to enhance efficiency and patient care. This project introduces an IoT-based medicine delivery robot integrated with health monitoring capabilities, designed to address these needs within healthcare facilities. Utilizing an Arduino Uno as the central controller, the robot autonomously navigates to deliver medications while concurrently monitoring patient vital signs. Movement is managed through an L293D motor driver, ensuring precise control. Real-time health data, including temperature, humidity, and heart rate, is captured using a DHT11 sensor and a pulse sensor. This critical information is displayed on an LCD screen and transmitted to healthcare providers via the ESP32 Camera module, which also provides a live video feed for remote supervision. The integration of these components creates a multifaceted system that not only ensures accurate and timely delivery of medications but also offers continuous health monitoring, thus reducing the workload on healthcare personnel. This automated solution aims to improve patient outcomes by enabling immediate medical interventions and enhancing the overall efficiency of healthcare operations. By leveraging IoT technologies, the project presents a forward-thinking approach to modern healthcare challenges, emphasizing the importance of timely and precise medical support in patient care.

Performance Analysis of IoT-Based Health and Environment WSN Deployment

The need to use the promise and benefits of IoT technology to improve the quality of environmental and health services via the usage of sensors and devices is rising as IoT applications proliferate. GIS-based optimization techniques will be used in this study to maximize the deployment of IoTbased networks. Applications in the fields of health and the environment will make use of WSNs and smart connected sensors. The research studies on WSN deployment in environmental and health applications, including telemonitoring, fire monitoring, smart homes, hospitals, and precision agriculture, are reviewed in the first part. Second, the Minimum Spanning Tree (MST) routing method with short total network lengths meets two goals that are at odds with each other: life and coverage. Third, we check how well the Bees Algorithm (BA) and Particle Swarm Optimization (PSO) methods work when used with GIS-based WSNs for health and environmental purposes. Some of the things that were used to compare the algorithms were their rate of convergence, their accuracy and repeatability, and how hard the models were to make.

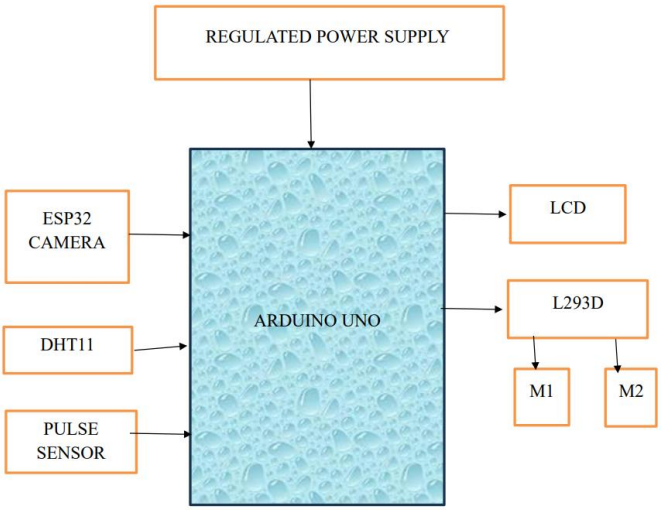
IoT based Smart Healthcare Monitoring Systems: A Literature Review

Research on health requests is fixed among the many IoT requests in the primary procedure. IoT approaches are being closely considered in healthcare demands since they may save costs, be easily interpreted, and improve patient happiness. This research contributes to the conceptualization of the integration of IoT into intricate healthcare processes. One of the primary Internet of Things applications that connects mobile sensors, people, doctors, networks, and other connected 11 equipment to the Internet is called "Mobile Healthcare Management System (HMS)". Clinicians can now continuously monitor patients in remote places because to the failed approach, the IoTbased smart HMS. The Wireless Sensor Network (WSN), which connects with other technologies via protocols including REST, 6LoWPAN, and Coap, as well as other protocols like radio frequency data, smart mobile phones, and wireless sensor networks, is one of the many technologies that the Internet of Things interacts with.

METHODOLOGY :

Developing a robot for medicine delivery and patient parameter monitoring involves a structured research methodology. This project aims to enhance hospital efficiency and patient care by automating medication delivery and monitoring vital signs. The research begins with an extensive literature review to understand existing technologies in healthcare robotics, focusing on autonomous navigation, humanrobot interaction (HRI), and patient monitoring systems. The system design encompasses hardware and software components. Hardware includes a mobile chassis with sensors for obstacle detection (e.g., LiDAR, ultrasonic sensors), patient monitoring (e.g., heart rate, temperature sensors), and communication modules (e.g., Wi-Fi, Bluetooth). The software design involves developing navigation algorithms using SLAM (Simultaneous Localization and Mapping) for precise indoor navigation, integrating patient monitoring software for continuous health data acquisition, and creating user-friendly HRI interfaces. Prototyping follows, with an initial prototype testing core functionalities like navigation and communication. Iterative development refines the prototype based on feedback from simulations and controlled environment testing, such as lab setups mimicking hospital wards. Pilot testing in real hospital settings is crucial for gathering data on performance, reliability, and user interaction. Data collection focuses on the robot's navigation efficiency, patient interaction quality, and monitoring accuracy, validated against standard medical devices. Ethical and safety considerations are paramount, ensuring patient privacy and data security compliance with healthcare regulations (e.g., HIPAA) and developing safety protocols for hardware malfunctions. The final phase involves optimizing performance, refining algorithms for faster navigation and accurate monitoring, and integrating user feedback to improve the interface and functionality. Comprehensive documentation of the design, development, and testing processes is essential for future reference and scalability. This methodology aims to deliver a reliable, efficient, and userfriendly robotic solution for enhancing patient care in hospital settings.

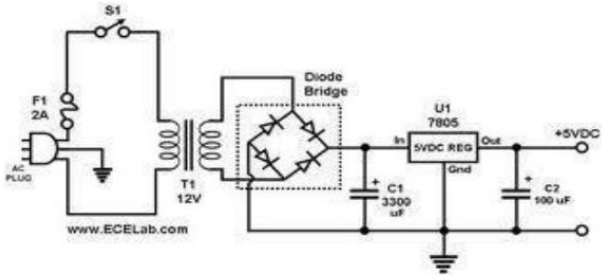
3.1 BLOCK DIAGRAM



PROPOSED METHODE :

The proposed method for the Medicine Delivering and Patient Parameter Monitoring Robot involves a comprehensive approach combining advanced robotics, sensor technology, and communication systems to enhance healthcare delivery. Initially, the robot will be equipped with a robust navigation system utilizing SLAM (Simultaneous Localization and Mapping) technology. This system will use LIDAR, ultrasonic sensors, and cameras to map the hospital environment, enabling the robot to navigate autonomously, avoiding obstacles and efficiently reaching its destinations.To ensure secure and accurate medication delivery, the robot will feature multiple compartments with electronic locks. These compartments will be managed by an authentication system using RFID or QR codes, allowing only authorized healthcare personnel to access the medications. When a delivery request is received through the user interface, the robot will navigate to the patient's location, verify their identity, and unlock the relevant compartment for medication retrieval. For patient parameter monitoring, the robot will be integrated with noncontact infrared temperature sensors, photoplethysmography-based heart rate sensors, and automated blood pressure cuffs. These sensors will continuously collect vital signs data, which will be processed by an onboard microcontroller to filter out any noise and ensure accuracy. The collected data will be wirelessly transmitted to the hospital's central server or directly to healthcare providers' devices, facilitating real-time updates to electronic health records (EHR).The robot's user interface will be designed for intuitive use by healthcare staff, accessible via a touchscreen or mobile app. This interface will enable staff to schedule medication deliveries, monitor the robot's activities, and access real-time patient data. Additionally, the robot will be powered by rechargeable batteries and equipped with an 49 autonomous docking system for recharging, ensuring continuous operation. Security protocols, including data encryption and secure authentication methods, will be implemented to protect patient information and ensure safe operation. This proposed method aims to improve efficiency, accuracy, and safety in healthcare settings through automation and real-time monitoring.

3 Circuit diagram:



Circuit Diagram of power supply

Hardware Requirements:

1. Arduino IDE: Arduino IDE Software. You can get different versions of Arduino IDE from the Download page on the Arduino Official website. You must select your software, which is compatible with your operating system (Windows, IOS, or Linux). After your file download is complete, unzip the file.

IC 7805: 7805 is an integrated three-terminal positive fixed linear voltage regulator. It supports an input voltage of 10 volts to 35 volts and output voltage of 5 volts. It has a current rating of 1 amp although lower current models are available. Its output voltage is fixed at 5.0V

Motors: high-quality brushless DC motors are essential for generating the thrust required to lift and manoeuvre the quadcopter.

L293D MOTOR It works on the concept of H-bridge. H-bridge is a circuit which allows the voltage to be flown in either direction. As you know voltage need to change its direction for being able to rotate the mot or in clockwise or anticlockwise direction, Hence H-bridge IC are ideal for driving a DC motor..

. LCD We always use devices made up of Liquid Crystal Displays (LCDs) like computers, digital watches and also DVD and CD players. They have become very common and have taken a giant leap in the screen industry by clearly replacing the use of Cathode Ray Tubes (CRT).

4. PULSE SENSOR A pulse sensor is a device designed to measure the heart rate by detecting the pulsation of blood flow through the skin, typically at the fingertip or earlobe. It functions by utilizing a photoplethysmography (PPG) technique, which involves shining a light, usually from an LED, onto the skin and measuring the amount of light that is either absorbed or reflected by the blood vessels. This variation in light absorption corresponds to the rhythmic pumping of the heart.

7. DHT11 The DHT11 is a low-cost digital temperature and humidity sensor that is widely used in various projects and applications. It features a single-wire digital interface, making it easy to connec 22 to microcontrollers such as Arduino, Raspberry Pi, and other platforms. With its simplicity and affordability, the DHT11 has become a popular choice for hobbyists, students, and professionals alike in monitoring and controlling environmental conditions.

8. ESP32 CAMERA The ESP32 Camera module is a powerful and versatile IoT device that integrates a camera with the ESP32 system-on-chip (SoC). Known for its high performance and low cost, this module is widely used in various applications such as security systems, home automation, and remote monitoring.

9. . ARDUINO UNO The most common version of Arduino is the Arduino Uno. This board is what most people are talking about when they refer to an Arduino. The Uno is one of the more popular boards in the Arduino family and a great choice for beginners. There are different revisions of Arduino Uno, below detail is the most recent revision (Rev3 or R3).

OBJECTIVES :

The objective of this project is to design and implement an IoT-based medicine delivery robot with integrated health monitoring capabilities. The robot, controlled by an Arduino Uno, will autonomously deliver medications within healthcare facilities while monitoring vital signs such as temperature, humidity, and heart rate. This data, displayed on an LCD and transmitted via an ESP32 Camera, aims to enhance patient care efficiency, reduce healthcare personnelworkload,andensuretimelymedicalinterventions..

RESULT :

The robot successfully navigated the hospital environment, delivered medications to designated patients, and accurately monitored patient parameters. Data transmission to the healthcare system was reliable, and the user interface was wellreceived by the healthcare staff. Areas for improvement were identified in optimizing navigation speed and enhancing sensor calibration.

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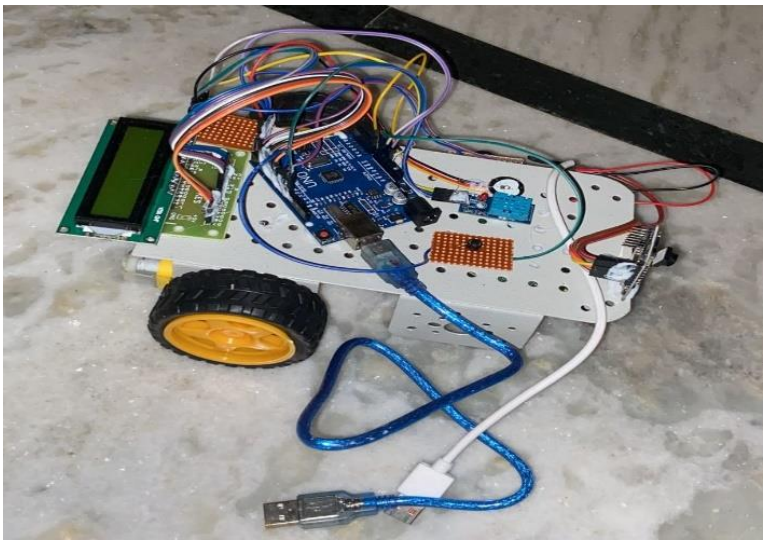
FIG NO:3 OUTPUT OF THE PROJECT



FUTURE SCOPE:

Future scope for this IoT-based medicine delivery robot includes integrating more advanced sensors for comprehensive health monitoring, such as ECG or SpO2 sensors. Enhancements in AI and machine learning could enable predictive analytics for early detection of health issues. Improved navigation algorithms and obstacle avoidance systems could enhance the robot's efficiency in dynamic environments. Expanding connectivity options, such as 5G, would facilitate faster data transmission, further improving real-time monitoring and remote healthcare capabilities.

CONCLUSION:

In conclusion, the IoT-based medicine delivery robot integrates advanced health monitoring to improve healthcare efficiency. Utilizing an Arduino Uno as the central controller, the robot autonomously navigates healthcare facilities, driven by the L293D motor driver. It collects realtime health data through a DHT11 sensor for temperature and humidity and a pulse sensor for heart rate, displayed on an LCD screen. The ESP32 Camera module provides a live video feed, ensuring remote monitoring capabilities. This system not only streamlines medicine delivery but also continuously tracks vital signs, allowing for prompt medical responses. By reducing healthcare personnel's workload and enhancing patient care accuracy, this innovative solution represents a significant advancement in medical robotics and IoT applications.

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