MEDICINE DELIVERING AND PATIENT PARAMETERS MONITORING ROBOT

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ABSTRACT

Our planned Med Robot can administer medication and monitor the patient's vital signs (heart rate and temperature) as part of this project. As things stand, less face-to-face interaction between patients and healthcare providers is essential in hospitals. Robots that administer medications are changing their function in an effort to reduce the risk of the Corona virus infecting medical professionals. The idea of wireless technology allows us to accomplish the robot's locomotion process, which is utilized to regulate the robot's movement and other activities. The goal of the obstacle avoidance approach is to find potential roadblocks by using ultrasonic sensor technology. Patients are able to receive their medication thanks to the servo motor. The LCD panel will show all the measured parameters. Instructions given to patients verbally on the administration of medication and the identification of potential obstacles. The robot's operator can see the patient's condition in real time thanks to a wireless camera module that streams video in real time. The robot also has a record and playback module so they can give specific commands, and a text display mechanism so they can remotely give commands that are shown on the LCD screen.

Keywords: Medication, Real Time Monitor, Vital Signs Monitoring, Obstacle Avoidance, Wireless Technology.

1. INTRODUCTION

In today's world, robotics is permeating nearly every industry, including healthcare. Surgery, caregiving, mobility, and pharmaceutical robots are some of the healthcare applications that use IoT robots. The capabilities of humans to perceive, interact with, manipulate, and recreate our physical environment have been greatly enhanced by robotic systems. When it comes to the diagnosis, treatment, and prevention of illness, medical robotic devices are engineered for totally distinct settings and tasks. Because of the large influx of new patients brought on by this devastating epidemic of novel coronavirus, or COVID-19, hospitals are at capacity. This highlights the critical need for technological assistance for healthcare personnel. Therefore, robotic healthcare discovers the optimal technique to assist them by delivering their excellent work and assisting them in avoiding direct contact with patients who tested positive for the coronavirus. Caring for assigned patients, which includes administering medications at the correct times and keeping track of vital signs, is a nurse's primary responsibility .It would take around half an hour to an hour every day to provide medication and monitor vital signs (heart rate, blood pressure, temperature, and oxygen saturation) in one ward. The automation of pharmaceutical dispensing and parameter monitoring can thereby alleviate some of the burden on medical professionals. This served as the impetus for creating this project. An aging population is likely to result from a combination of factors, including a longer life expectancy and technological advancements that make people live longer. Accurate health monitoring becomes a need for a healthy existence as one ages. It is extremely unlikely that a patient would make a full recovery without access to high-quality treatment. For a long time, this has been a major issue in healthcare.

1.1 Objective

Creating a healthcare robot, Med Robot, to reduce the need for human interaction in healthcare facilities is the main goal of this project. The purpose of the Med Robot is to monitor a patient's temperature and heart rate in addition to delivering medication to them autonomously. To make sure it can navigate safely throughout the hospital, it uses ultrasonic sensors to avoid obstacles. Through the use of speech announcements and Wifi technology, medical personnel are able to remotely manage the robot's functions, allowing for supervision and interaction with patients. Further, the ability to transmit live video allows for the real-time monitoring of patient status, which improves the safety and efficiency of healthcare delivery while decreasing the need for direct interaction.

2. LITERATURE SURVEY

Medical robots play a crucial role in healthcare, offering assistance to patients and healthcare workers in various settings. In recent research, Marcin Zukowski et al. developed a humanoid medical assistant and companion robot specifically tailored for children's hospitals. This robot, known as 'Bobot,' expresses emotions and interacts with children by recognizing faces and using visual aids such as pictures and text. It autonomously navigates hospital rooms and performs basic medical tests, providing live video feed to doctors and nurses.

Furthermore, Zukowski et al. implemented a patients' temperature measurement system for the medical robotic assistant. Through experimentation with infrared thermometers and thermal cameras, they found that a hybrid system combining both technologies provided more accurate results for detecting human presence and measuring temperatures.

Kaveh Bakhtiyari, Nils Beckmann, and Jürgen Ziegler proposed a non-invasive contactless heart rate variability (HRV) measurement method with respiratory sinus arrhythmia (RSA) correction. This method utilizes infrared and RGB cameras, along with a 3D depth sensor, to capture heart rate and respiratory signals, enabling accurate HRV calculations.

Sachit Mahajan and Prof. Vidhyapathi C.M designed a medical assistant robot capable of assisting patients by carrying necessary medical equipment. Using sensors such as Pixy image recognition and ultrasonic obstacle avoidance, this robot provides support to patients by following them and ensuring their safety.

Azeta Joseph et al. provided an overview of humanoid robotics applications in healthcare, emphasizing characteristics required for humanoid robots in healthcare settings, including vision systems, sensing behavior, mobility, and dexterity.

Additionally, Swaroop et al. developed an IoT-based real-time health monitoring system using Raspberry Pi 3. This system enables the creation, acquisition, processing, and communication of health data, offering accurate and low-latency monitoring of vital signs such as heart rate, body temperature, and blood pressure.

Finally, Haider, K. B. Khan et al. proposed a hospital assistance system to aid patients and hospital workers during emergencies, particularly relevant during the COVID-19 pandemic. This system, approved by health authorities, utilizes direct device-to-device communication technology and follows predetermined paths to ensure safety and efficiency without contributing to health hazards or pollution.These research findings collectively highlight the diverse applications of medical robots in healthcare, addressing challenges and advancing patient care and assistance in various contexts.

3. BLOCK DIAGRAM

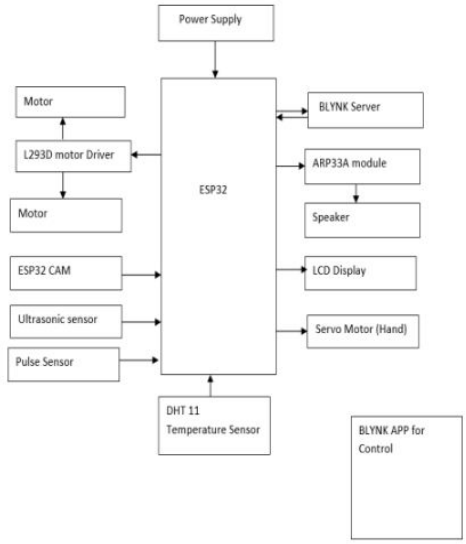

Fig 3.1 Block Diagram

3.1 ESP32 Module

Our first thought when considering a microcontroller for a project is typically an Arduino. It's cheap, user-friendly, and packed with digital I/O ports plus a few of analog inputs. Despite its many advantages, the Arduino is deficient in certain respects. One is speed; the widely used Arduino AVR boards operate at 16 MHz. While that may be quick enough to construct hundreds of apps, it becomes a stumbling block for others. The Arduino's digital inputs and outputs are more than enough to meet most needs, and the analog inputs are handy as well. On the other hand, you'll need to buy extra parts to add features like Bluetooth and WiFi. The Arduino, come on! It's been around since 2005. In technological terms, that's one hundred and fifty years. Espress if Systems of Shanghai really manufactures a set of microcontroller chips known as the ESP32. It comes in a variety of affordable packages. The ESP-WROOM-32 module, which houses a 32-bit LX6 microprocessor with Tensilica Xtensa® Dual-Core technology, is equipped with the development board. This processor is somewhat similar to the ESP8266, except it runs at a clock frequency of 80 to 240 MHz, has two independently controllable CPU cores, and can achieve a maximum performance of 600 DMIPS.

Fig 3.2 ESP32 Module

3.2 L293D Motor Driver

An easy-to-use and user-friendly interface for embedded applications is provided by the L293D motor driver. The L293D motor driver is attached to a high-quality, one-sided, non-PTH printed circuit board. To facilitate access to the pin functionalities of the L293D motor driver IC, the IC's pins are attached to connectors. With a supply voltage of up to 24V, the L293D, a dual full bridge driver, can drive up to 1Amp per bridge. One or more DC motors, relays, solenoids, etc., can be driven by it. You may use it with any TTL sensor. If you want to make its current capacity 2 Amp, you may connect two L293D H bridges in parallel.

Fig 3.3 L293D Motor driver.

3.3 Ultrasonic Sensor

One kind of acoustic sensor is the ultrasonic sensor. There is a single receiver and one transmitter in this. Both the transmitter and the receiver work together to transform electrical impulses into ultrasound. Ultrasonic sensors are employed in systems that assess objects by analyzing the reflected signals, much like radar and sonar. One way to determine an object's distance is to timing the transmission and reception of an echo.

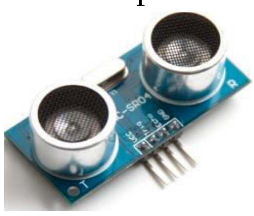

Fig 3.4 Ultrasonic Sensor

3.4 DHT11 Temperature Sensor

With the ability to measure both temperature and humidity, this DHT11 sensor offers a calibrated digital signal output. It has an 8-bit microprocessor built in for maximum performance. The exceptional long-term stability and great dependability are guaranteed by its technology .A wet NTC temperature sensor and a resistive element make up this sensor. With its high performance, anti-interference capability, quick reaction time, and superb quality, it is hard to beat. An exceptionally precise humidity calibration chamber is a characteristic of every DHT11 sensor. We should refer to the calibration coefficients saved in the OTP program memory when the process's internal sensors pick up signals. The integration of the single-wire serial interface technology makes it straightforward and fast. Compact, energy-efficient, and capable of transmitting signals up to 20 meters, it can handle even the most demanding applications with ease.

This item comes in a 4-pin, one-row pin package. Users may tailor their packages to meet their specific needs, and the connection is convenient.

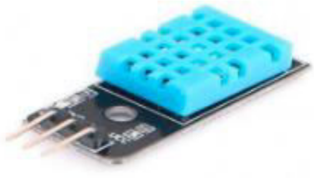

Fig 3.5 DHT11 Temperature Sensor

3.5 Servo Motor

A little, light server motor with a big punch is the Micro Servo Motor SG90. Servos function similarly to the regular types, but they are smaller and have a rotational range of around 180 degrees (90 degrees in each direction).These servos are compatible with any servo code, hardware, or library. Its compact size makes it ideal for first-timers who are interested in controlling objects without the need to construct a motor controller, feedback, and gear box. Hardware and three horns (arms) are included.

Fig 3.6 Servo Motor

3.6 ESP32 Cam

A highly competitive small-size camera module, the ESP32 CAM WiFi Module Bluetooth with OV2640 Camera Module 2MP For Face Recognition has a footprint of just 40 x 27 mm, a deep sleep current of up to 6mA, and finds widespread usage in various IoT applications. Internet of Things (IoT) uses such as wireless monitoring, smart home gadgets, and industrial wireless control are a good fit. The module's high-reliability connection mode and DIP packaging make it ideal for use in a wide range of Internet of Things (IoT) hardware terminals, and the module's ability to be immediately placed into the backplane speeds up product manufacturing. ESP incorporates WiFi, conventional Bluetooth, and BLE Beacon, and it has a 7-stage pipeline design and 2 powerful 32-bit LX6 CPUs. It features a temperature sensor, on-chip sensor, Hall sensor, and an adjustable main frequency range of 80 MHz to 240 MHz, among other features.

Fig 3.7 ESP32 Cam

4. SCHEMATIC DIAGRAM

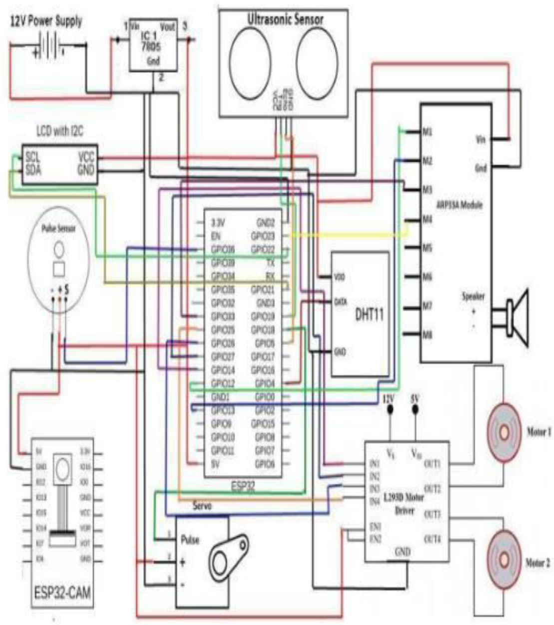

Fig 4.1 Schematic Diagram

5. FLOW CHART

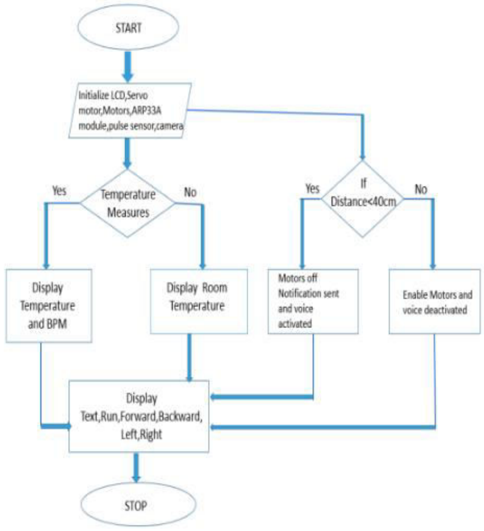

Fig 5.1 Flow Chart

6. RESULTS AND DISCUSSION

Administration of Medication and Tracking of Vital Signs The robot project is running smoothly and according to plan, with all the necessary hardware and software in place to meet our original goals. With its innovative concept and well-thought-out design, this project offers boundless possibilities. Presented below is a concrete illustration of an experimental board.

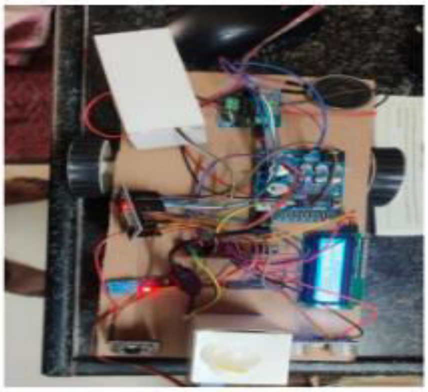

Fig 6.1 Top View of the Med Robot

After initialization, the robot begins to move in a 360-degree circle with the help of motors and a castor wheel. It then uses a servo motor to mimic a human hand and delivers the medicine to the patient, all while the Blynk app shows the command "PLZ take Medicine" on the LCD.

Fig 6.2 LCD Displaying Command to Take the Medicine

Fig 6.3 Camera Monitoring

After one minute of pressing the right thumb on the DTH11's temperature and pulse sensors, the device will display the patient's temperature and pulse rate on the LCD in Fahrenheit and beats per minute, respectively. In the event that an obstacle blocks the robot's path on its way to the patient, it will halt its progress, send a message to the email, display the message "Object Detected Please Move" on the LCD, and use the ARP33A module to generate pre-recorded voice commands.

Fig 6.4 LCD Displaying Temperature and Pulse

Fig 6.5 LCD Displaying of Obstacle Detection.

The Blynk app, which has widgets for controlling the robot's 360-degree movement, showing the patient's temperature and pulse, and moving the robot's hand to them. There's also a text box where you can write commands to show on the LCD, and the app can generate voice commands based on the robot's functions.

Fig 6.6 Mail When Obstacle is Detected

Fig 6.7 Mobile Blynk App

7. CONCLUSION

By dispensing medication and checking vital signs like heart rate and temperature, the Med Robot aims to reduce the need for human interaction in healthcare settings.For controlling its movements and avoiding obstacles, it employs Wi-Fi technology and ultrasonic sensors. Not to mention the LCD screen that shows patient characteristics and the servo motors that distribute the medication are also fantastic features. Another ingenious method of remote monitoring is the live streaming capability of the ESP32 CAM module. An additional useful feature is the ARP33A module, which can record and play back voice instructions. In sum, medical personnel really benefit from using Med Robot.

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