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VIRTUAL DOCTOR ROBOT

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ABSTRACT

The foundation of health systems and the forces that promote universal health coverage and global health safety by health workers and caregivers. Everyone can see their dedication and professionalism throughout the epidemic: special people doing the show extraordinary quality work However, too many of them have become ill, sick, or died as a result. COVID-19. According to the WHO, between 80,000 and 180,000 health care workers and caregivers may be affected. COVID-19-related deaths occurred between January 2020 and May 2021, with the highest rate in January 2020 and shipwreck in May 2021. These deaths are a terrible tragedy. And they are one of a kind. Gap in dealing with a global epidemic. To assist tackle this problem, we created a virtual doctor robot that allows a doctor to roam around at whim in a remote location and even talk to people there if necessary.

This robot offers a number of benefits to doctors, including: ability of a doctor to be at anywhere, at any moment Doctors are free to walk around in operating rooms. Doctors have the freedom to travel about the hospital. Doctors can view the medical reports through video conversations from distance. At the hospital, I made direct contact with the patients of COVID-19.Health. To navigate easily, the system employs a robotic vehicle with four wheels that can be controlled. A controller box for circuits such as a patient health monitoring system and a mounting to hold a mobile phone or tablet are also included in the robot. Live video calls can be made using a smartphone or tablet. The robot controller receives the control commands transmitted over the internet. The robot controller connects to the internet through Wi-Fi. The commands are received in real time, and the robot motors are activated to carry out the movement commands.

Index Terms *- Node Mcu ESP8266, MAX3010 Pulse oximeter Heart rate sensor, MLX90614 Temperature sensor, Servo motor, Mobile/Tab, L298N Motor Driver, DC Motors, Power Supply*

1. INTRODUCTION

The pandemic of coronavirus disease 2019 (COVID-19) has altered how clinicians interact with patients. To protect health care workers, personal protective equipment, social distancing, and triage facilities to screen symptomatic individuals have been established. Professionals prevent the transmission of the corona virus that causes severe acute respiratory syndrome (SARSCoV-2). Despite all these precautions, health-care workers are still at high amount of risk of contracting COVID.19; according to one study, health-care workers in Italy account for up to 20% of all infections. Clinicians who contract COVID-19 are not being able to provide direct patient care, resulting in some amount reduction in patient care. The availability of a critical workforce in the event of a pandemic, during the evolution of the development of pharmacotherapies and vaccinations to combat COVID-19 is still progressing, according to several health care professionals from famous medical institutions.

With the goal improving, tele-health, systems have expanded their capabilities and capacities. Clinicians can use these technologies to give care electronically, identify the need for more testing, and do follow-up visits without having to make contact. Many existing tele-health platforms are relying on patient-controlled tablet computers or cellphones that usually remain stationary. The usage of clinician-controlled mobile robotic telemedicine devices can help with a dynamic evaluation process in the hospital context. These tele-health systems that are depended on robotic chassis can let doctors evaluate patients in various locations.

Within a hospital setting, robotic systems represent a mobile telepresence that can be used to travel between patients, rooms, or wards. The implementation of an agile robotic system in field hospitals created to manage the influx of COVID- 19 patients could eliminate the requirement for temporary static infrastructure.

2. BLOCK DIAGRAM AND EXPLANATION

2.1 BLOCK DIAGRAM

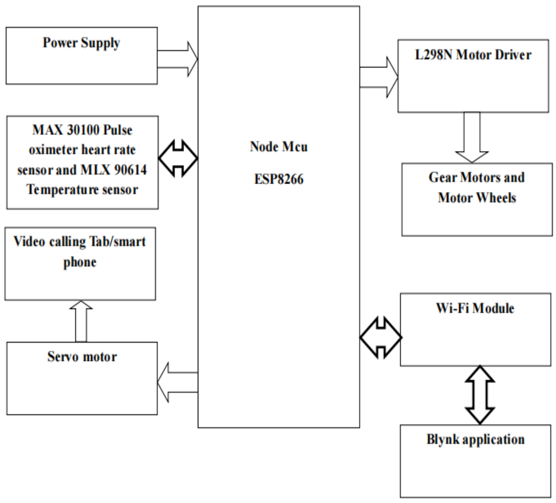


Fig. 1 Block Diagram

2.2 EXPLANATION

2.2.1 Power Supply

A power supply is a device that generates electric energy. A power supply, usually known as a PSU, is a device or system that supplies electric and other kinds of energy to supply terminals or sets of loads. Electrical energy sources are the most commonly used, with kinetic energy sources being used less regularly and others being used extremely infrequently.

This power distribution component is used to transform an Ac supply to a Dc link by simply reducing the signal's volume. Although the power supplies output signal is 230V/50Hz, which would be a reference voltage, Voltage output (lower frequencies) with frequency and magnitude of 5 volts and +12V is required for different kinds of applications.

2.2.2 MLX90614 Temperature Sensor:

The MLX90614 is made up of two Melexis-developed and-manufactured chips. The MLX81101 infrared thermopile detector. The signal conditioning ASSP MLX90302 was created especially for processing the output of an IR sensor. The gadget comes in a TO-39 packaging, which is widely used in the industry. The thermometer's accuracy and resolution are improved because to the MLX90302's low noise amplifier, high resolution 17-bit ADC, and powerful DSP unit.

The measured and observed object and ambient temperatures are stored in the MLX90302's RAM with a 0.01 C resolution. They can be accessed via the device's 10-bit PWM (Pulse Width Modulated) output or a two-wire serial SMBus compliant interface (0.02°C resolution).The MLX90614 is factory calibrated in a wide temperature range: -40 to 125 degrees Celsius for the ambient temperature and -70 to 382.2 degrees Celsius for the operating temperature.

2.2.3 ESP8266 NodeMCU:

Open-source prototyping board designs are available for NodeMCU, an open-source firmware. The name "NodeMCU" is a perfect mixture "node" and "MCU" (micro-controller unit). The word "NodeMCU" refers to the firmware, not the development kits that go with it. The designs for the firmware and prototyping board are both open source. The Lua scripting language is used in the firmware. The ESP-12E module, which contains the ESP8266 chip with Tensilica Xtensa 32-bit LX106 RISC microprocessor, is included with the NodeMCU ESP8266 development board.

This microprocessor is RTOS compatible and has a clock frequency range of 80MHz to 160MHz. To store data and programmes, the NodeMCU contains 128 KB of RAM and 4MB of Flash memory. It's suitable for IoT projects because of its high processing power, built-in Wi-Fi / Bluetooth, and Deep Sleep Operating capabilities. Open-source prototyping board designs are available for NodeMCU, which is an open-source firmware. The name "NodeMCU" is a homogenous mixture "node" and "MCU" (micro-controller unit). The word "NodeMCU" refers to the microcontroller rather than the development kits that go with it.

The firmware as well as the prototyping board designs are free and open source. The Nodemcu ESP8266 and ESP32 are becoming increasingly popular, with over 50% of IoT projects using them today. Lua, a scripting language, is used in the firmware. The firmware is written using the Espressif Non-OS SDK for ESP8266 and is based on the eLua project.

2.2.4 MAX3010 Pulse oximeter Heart rate sensor:

MAX30100 is a sensor for measuring heart rate. This sensor is made up of two Light Emitting Diodes (LEDs) (one emits infrared light and the other emits red light), modifiable optics, and a low-noise signal processor which detects heart rhythm. The output data is kept in sixteen FIFOs on this module, which can be adjusted using software registers. The I2C interface connects this sensor to the other microcontroller. Ambient light cancellation, a sixteen-bit ADC, and a temporal filter are included in this module's pulse measurement system. It communicates with a host microcontroller via an I2C digital interface. Ambient light cancellation, a sixteen-bit ADC, and a temporal filter are all features of the MAX30100.

This module has a low power consumption, making it suitable for battery-powered systems. It works with a voltage range of 1.8 to 3.3 volts. It has two Light Emitting Diodes, one of which emits red light with a wavelength of (650nm) and the other of which emits infrared light with a wavelength of (650nm) (950nm). Because this gadget is used to measure heart rate and blood oxygen levels, place it on your finger or earlobe for these measurements. It can also be placed on any area of the body that is not too thick. Respectively infrared and red light pass through into the tissues of a finger, and the absorption of these lights could be measured by a photodiode when it is worn on your finger for measurement.

2.2.5 L298N Motor Driver:

The L298N is a dual H-Bridge motor driver that allows for simultaneous speed and direction control of two DC motors. The module can power DC motors with voltages ranging from 5 to 35V and peak currents of up to 2A. This L298N Motor Driver Module is a high speed driver for DC and Stepper Motors.

An L298 motor driver IC and a 78M05 5V regulator make up this module. Up to four DC motors, or two DC motors with directional and speed control, can be controlled by the L298N Module. In an integrated circuit, the L298N Motor Driver module contains an L298 Motor Driver IC, a 78M05 Voltagem Regulator, resistors, capacitors, a Power LED, and a 5V jumper. Only when the jumper is inserted will the 78M05 Voltage Regulator be enabled.

The inner circuitry is powered by the rectifier circuit when the power source is less than or equal to 12V, and the 5V pin can be utilised as an output pin to power the microcontroller when the power supply is less than or equal to 12V. When the power supply is greater than 12V, the jumper should be removed and a separate 5V should be provided through the 5V connector to power the internal circuitry. The ENA and ENB pins regulate the speed of Motor A and Motor B, respectively, whereas the IN1 and IN2 and IN3 and IN4 pins control the direction of Motor A and Motor B.

2.2.6 Double Shaft DC Motors:

Only when the jumper is inserted will the 78M05 Voltage Regulator be enabled. The inner circuitry is powered by the rectifier circuit when the power source is less than or equal to 12 volts, and the 5V pin can be utilised as an output pin to power the microcontroller because when power supply is less than or equivalent to 12 volts When the power supply is greater than 12V, the jumper should be removed and a separate 5V supplied to the internal circuitry via the 5V connector.

The ENA and ENB pins regulate the speed of Motor A and Motor B, respectively, whereas the IN1 and IN2 and IN3 and IN4 pins control the direction of Motor A and Motor B. advantage of these motors. Small shaft with matching wheels gives an optimized design for your application or robot. Mounting holes on the body & light weight makes it suitable for in-circuit placement.

The 300 RPM Dual Shaft BO Motor Plastic Gear Motor - The major advantage of these motors is that they provide good torque and rpm at lower operating voltages. The combination of a small shaft and matching wheels results in a design that is tailored for your application or robot. It is suitable for in-circuit implantation due to mounting holes on the body and its small weight.

2.2.7 DC Servo Motor:

A closed-loop control system includes a control circuit, a servo motor, a shaft, a potentiometer, a driving gear, an amplifier, and either an encoder or a resolver, among other components. A servomotor is a self-contained electrical device that efficiently and precisely rotates elements of a machine. This motor's output shaft can be changed to a certain angle, location, and velocity that a regular motor cannot. A conventional motor is used in the servo motor, which is coupled with a sensor for position feedback.

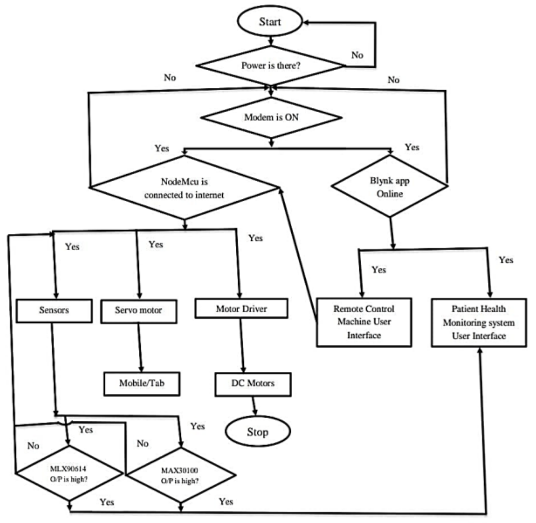
The controller is the most significant component of the servo motor, which was created specifically for this application. The servo motor is a closed-loop system that uses position feedback to regulate rotational or linear speed and position. The motor is controlled by an analogue or digital electrical signal that determines the amount of movement that indicates the shaft's final commanded position. Encoders are a sort of sensor that provides feedback on speed and location. This circuit is incorporated right into the motor casing, which usually includes a gear system..

2.2.8 Wi-Fi Module:

To set the system on, a 12V power source is attached to it. Then, considering our project is IoT-based, we'll need an internet connection to get the system up and running. After that, we'll use the Blynk software to construct a user interface. We may construct remote control machine and patient health monitoring system pages in the Blynk app. We can make labels for sensor outputs, a scrollbar for speed and servo motor control, and a switch for remote control on these pages.

When it comes to hardware, the NodeMcu acts as a bridge between components and the Internet. The instructions are sent to the NodeMcu through the Internet based on the instructions we supply in the Blynk app. The output of the sensors is sent through the Internet to the patient health monitoring system page in the Blynk app using NodeMcu. So we can use the Blynk app to get the readings. The mobile/tab is rotated by a servo motor.

3. DESIGN FLOW



4. WORKING PRINCIPLE

SCL, SDA, VIN, GND, and a few additional pins are available on the NodeMcu ESP8266. Ports ENA, ENB, IN1, IN2, IN3, IN4, 5V, and GND help compensate the L298N Motor Driver. SCL, SDA, INT, VIN, and GND pins are on the MAX 30100 Pulse oximeter heart rate sensor. SCL, SDA, VIN, and GND pins are present on the MLX 90614 Temperature Sensor. The SCL and SDA pins of the MAX 30100 Pulse oximeter heart rate sensor and the MLX 90614 Temperature Sensor are now linked to the SCL and SDA pins of the NodeMcu ESP8266, so they are functioning. These sensors' VIN and GND pins are wired to the same NodeMcu pins. Motor Driver pins ENA→D0, IN1→D3, IN2→D4, IN3→D5, IN4→D6, ENB→D6, VIN12→V, GND→GND to NodeMcu. Servo motor pins 5v→VIN, GND→GND, and ControlD8 to NodeMcu.

To switch the system on, a 12V power source is attached to it. Then, because our project is IoT-based, we'll need an internet connection to get the system up and running. After that, we'll use the Blynk software to construct a user interface. We may construct remote control machine and patient health monitoring system pages in the Blynk app. We can make labels for sensor outputs, a scrollbar for speed and servo motor control, and a switch for remote control on these pages.

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5. HARDWARE AND SOFTWARE REQUIREMENTS

5.1 Hardware Requirements

1. Power supply
2. MLX90614 Temperature Sensor
3. ESP8266 NodeMCU
4. MAX3010 Pulse-oximeter Heart rate sensor
5. L298N Motor Driver
6. Double Shaft DC motors
7. DC Servo Motor

5.2 Software Requirements

1. Arduino IDE

2. Blynk Application
3. Embedded C language

6. FIGURES AND TABLES

6.1 Figure

Fig 1: Schematic representation of Virtual Doctor Robot

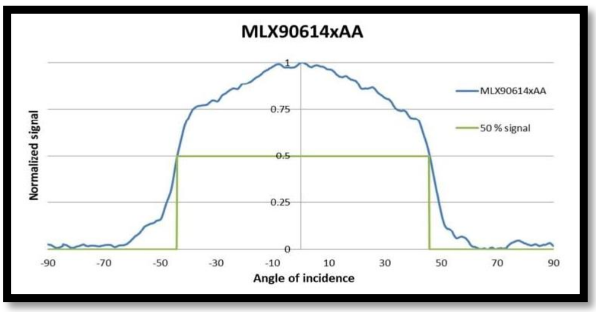

Fig.2 Typical FOV of MLX90614xAA

The graphical illustration of the MLX90614 Temperature sensor above indicates the standard vicinity of view in which the temperature may be detected.

6.2 Table

S.No	Name of the patient	Temperature(°F)	Heart beat (rpm)	SPO2 (%)
1	Charan Teja	98.0	70	95
2	Geethika	98.9	73	93
3	Hema	99.0	78	95
4	Keerthi	98.6	71	96
5	Wagdevi	98.9	85	87
6	Rishitha	98.6	72	95
7	Supriya	98.7	70	94
8	Haritha	102	60	78
9	Rahul Roy	103	71	93

The above table represents the data collected from different patients from the Virtual Doctor Robot. These values can be obtained through the Blynk application that is connected to the Virtual Doctor Robot through WiFi-Module.

7. END SECTIONS

7.1 Appendix A

The Arduino IDE source code is included in Appendix A, which is written in the C programming language and uses the Microsoft environment to construct the software. The code must be entered into that software, then uploaded, and the results verified.

7.2 Appendix B

Appendix B includes references, as well as research papers from which we derived the foundational research for this project.

7.3 Acknowledgments

I'd like to take this time to thank the individuals listed below for their invaluable contributions and support with this project. Initially, I would like to thank my project supervisor, **Mr. CH. Lakshmana, M. Tech** for his guidance and support, especially for his valuable ideas and knowledge provided throughout the Project. His expertise and experience in **Communication and signal processing** makes valuable comments and suggestions have been very useful in solving problems encountered during the Project.

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Finally, I want to express my gratitude to my family for their unwavering support and assistance during my academic career, as well as their ongoing support and encouragement for this project.

8. RESULT

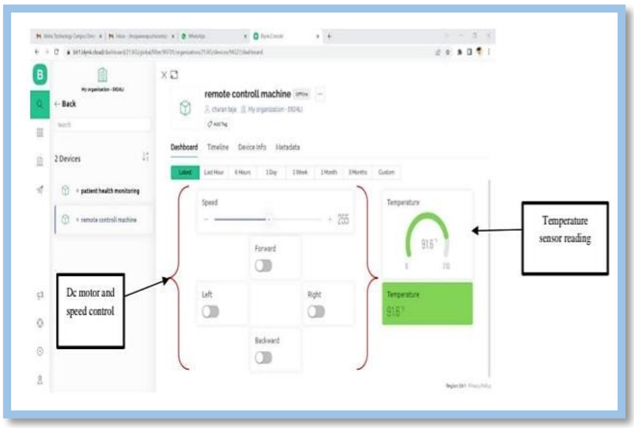

Fig.3 Prototype

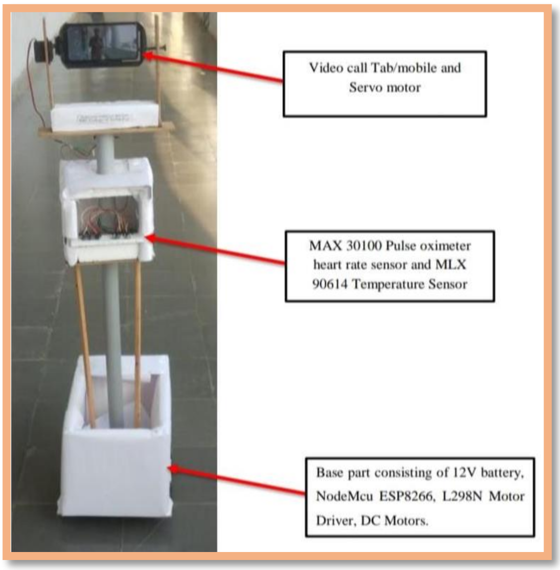

Fig.4 Remote Control Machine

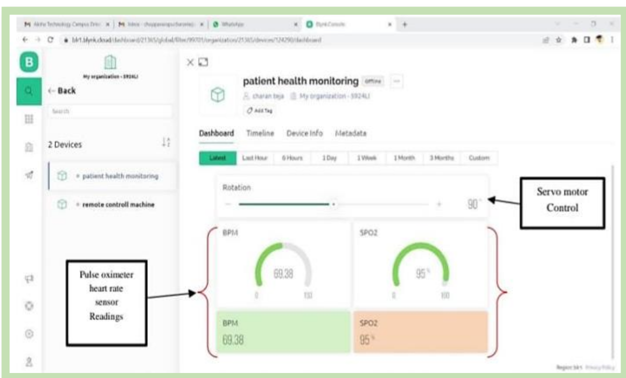

Fig 5: Patient Health Monitoring System

9. CONCLUSION

The goal of offering this IoT-based virtual doctor robot is to allow a doctor to virtually walk around at whim in a faraway place and even talk to people there if wanted. This robot offers a number of benefits to doctors, including the possibility for doctors to be anywhere at any time. Doctors are free to walk around in operating rooms. Doctors can easily move about the patient. Doctors can view medical reports via video conversations from afar. The goal of the Virtual Doctor Robot is for it to be able to move around virtually in almost any location, including hospitals, health centers, and operating theatres, keeping doctors safe from contagious diseases like COVID-19. A patient health monitoring system is included in the IoT-based Virtual Doctor Robot. As a result, the readings aren't very accurate. We can get reliable readings by putting some efficient sensors in place and using a 12V rechargeable battery. Because the battery is quickly depleted, we can use a solar panel to replenish it. We must be concerned about internet connectivty.

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