International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 09 Issue: 07 | July 2022 www.irjet.net p-ISSN: 2395-0072

IOT Virtual Doctor Robot for Online Doctor Consultation of Patient Healthcare & Telemedicine

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Abstract - *Doctors are usually needed to work at every hospital and emergency center every now and then. But it is not feasible for every doctor to be available at every place at desired time. The problem with video calling is that video calls need to be done from a PC or laptop on a desk. This limits the doctor's capacity to view patient or around operation theatre at will or even move through hospital rooms as needed. To help solve this issue we here develop a virtual doctor robot that allows a doctor to virtually move around at a remote location at will and even talk to people at remote location as desired. This robot provides a whole lot of advantages for doctors: Doctors' ability to be at anyplace anytime, Doctors can move around in operation theatres, Doctors can move around the patient with ease, Doctors can see medical reports remotely via video calls, Doctors can move around in other rooms at will. The system makes use of a robotic vehicle with 4-wheel drive for easy navigation. The robot also includes a controller box for circuitry and a mounting to hold a mobile phone or tablet. The mobile or tablet is used to hold live video calls. The doctor can use an IOT based panel to control the robot. The control commands sent online are received by the robot controller. The robot controller operates over Wi-Fi internet. The received commands are received in real time and the robot motors are operated to achieve the desired movement commands.*

Key Words: **Robotic vehicle, Easy navigation, controller box, IOT based panel, robotic motors.**

1. INTRODUCTION

There is a growing trend in the medical field to minimize the need for hospitalization, moving several health care procedures from hospitals (hospital centric) to patient's homes (home-centric). This strategy has been raised mainly due to its possibility for improving patient's wellness and treatment effectiveness. It can also reduce the costs of the public health system worldwide and its efficiency, which in the last decade has been challenged by the population aging and the rise of chronic diseases.

For this purpose, Internet of Things (IoT) provides the scalability which supports continuous and reliable health monitoring on a global scale. This paradigm is increasingly becoming a vital technology in healthcare. Furthermore, the recent progress in low-power consumption, miniaturization, and biosensors has revolutionized the process of monitoring and diagnosing health conditions.

For patients' de-hospitalization the platform proposed initially were designed, by including wearable and unobtrusive sensors. The software is developed and the components are guided by the Reference Architecture for IoT-based Healthcare Applications for a real intensive care unit (ICU) and the interoperability with existing multiparametric monitors.

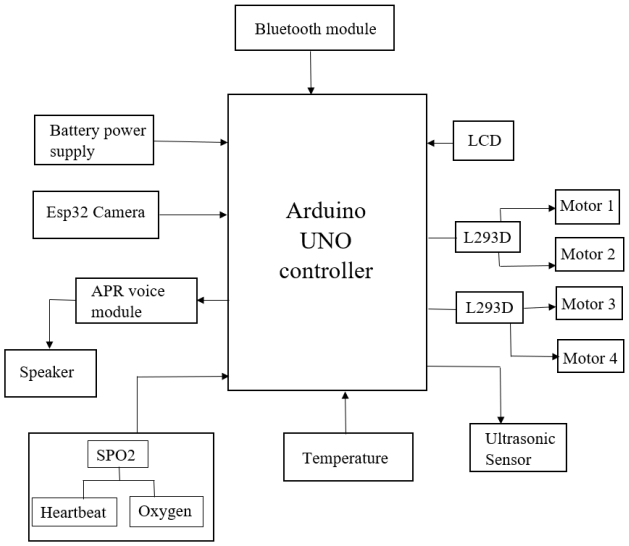

Fig1: Virtual Doctor Modelling

1.1 THEORITICAL MODELLING

The major component of the Robot is Arduino UNO controller which runs on battery power supply, that as to be charged, whenever it gets discharge. It consists of Esp32 Camera which is used to see the real time situation. The robot having four wheels is controlled using commands by which it can move around the patients, robot is controlled by doctor by monitoring on the screen using Esp32 camera. It consists of ARP voice module through which speaker is connected to the robot, it consists of three voice commands. It consists of SPO2 (heartbeat & Oxygen) sensor ad temperature sensor when touched the values are sensed ad displayed on LCD. The four wheels are controlled using motors which are connected

to the controller via L239D module. Ultrasonic sensor is used to detect the obstacle, whenever it detects obstacle the robot stops, again commands should be given to start the robot.

1.2 Hardware components

The required hardware components are: Arduino Uno, 16X2 LCD display, APR9600, DC motor, ESP32 cam, ESP8266, L293D, LM35, LM7085, MAX30100, Ultrasonic sensor

The additional components required are rod, cardboard, transformer for charging the battery, PCB's and soldering gun.

Arduino Uno

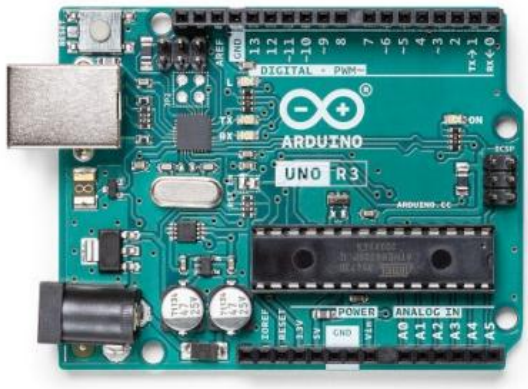

Fig2: Arduino Uno

The Arduino UNO R3 is the perfect board to get familiar with electronics and coding. This versatile microcontroller is equipped with the well-known ATmega328P and the ATMega 16U2 Processor.

16X2 LCD display

Fig3: 16X2 LCD display

The term LCD stands for liquid crystal display. It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly preferred for multi-segment light-emitting diodes and seven segments.

APR9600

Fig4: APR9600

The APR9600 device offers true single-chip voice recording, non-volatile storage, and playback capability for 40 to 60 seconds. The device supports both random and sequential access of multiple messages.

DC Motor

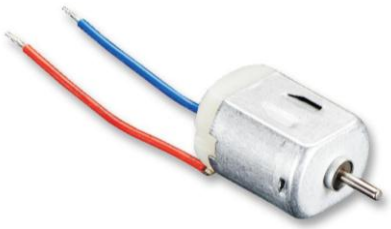

Fig5: DC Motor

A DC motor is any of a class of rotary electrical machines that converts direct current electrical power into mechanical power.

ESP32-CAM

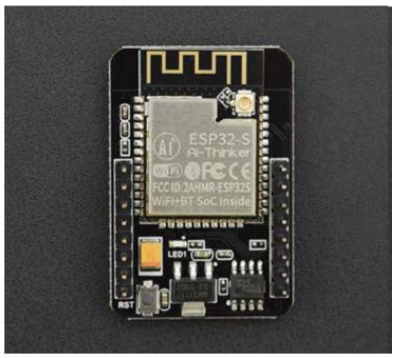

FIG6: ESP32-CAM

ESP32-CAM is a low-cost ESP32-based development board with onboard camera, small insize. The board integrates WiFi, traditional Bluetooth and low power BLE , with 2 high-performance 32-bit LX6 CPUs. It adopts 7-stage pipeline architecture, on-chip sensor,Hall sensor, temperature sensor and so on, and its main frequency adjustment ranges from 80MHz to 240MHz.

ESP8266

Fig7: ESP8266

NodeMCU is an open-source Lua based firmware and **development board** specially targeted for IoT based Applications. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module.

L293d

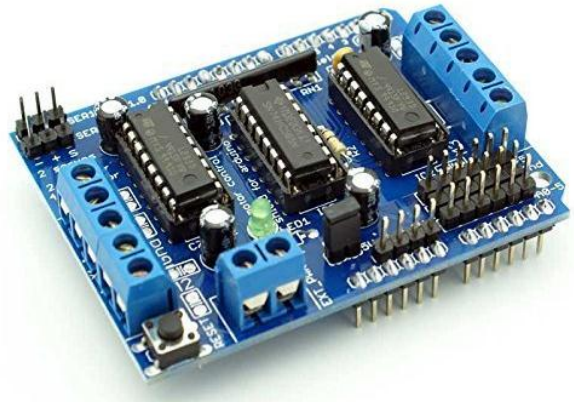

Fig8: L293d

The L293 and L293D devices are quadruple high current half-H drivers. The L293 is designed to provide

bidirectional drive currents of up to 1 A at voltages from 4.5 V to 36 V. The L293D is designed to provide

bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V.

LM35 Precision Centigrade Temperature Sensor

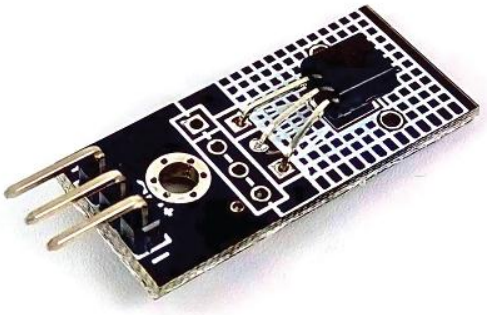

Fig9: LM35 Precision Centigrade Temperature

The LM35 series are precision integrated-circuittemperature devices with an output voltage linearly- proportional to the Centigrade temperature.

LM7805

Fig10: LM7805

The LM7805 is a voltage regulator that outputs +5 volts.

MAX30100

Fig11: MAX30100

The MAX30100 is an integrated pulse oximetry and heart-rate monitor sensor solution. It combines two LEDs, a photodetector, optimized optics, and low-noise analogsignal processing to detect pulse oximetry and heart-rate signals.

Ultrasonic Sensor

Fig12: Ultrasonic Sensor

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit.

2. Results and Discussion

I. Connect the power supply to the Arduino to start the robot

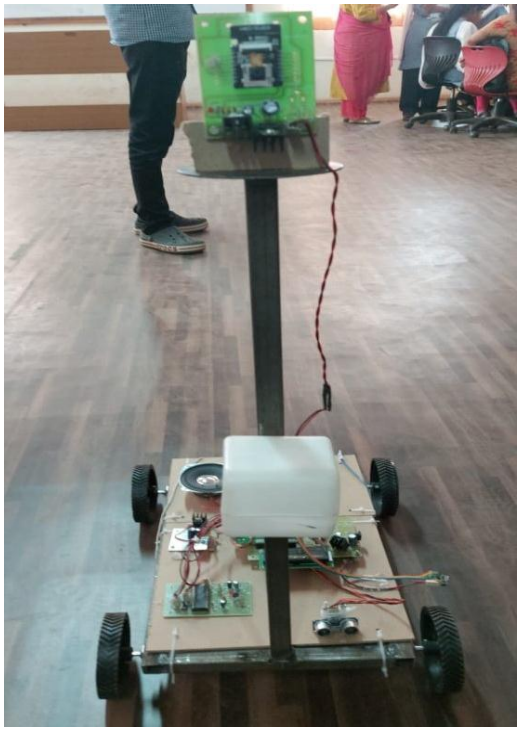

Fig13: Virtual doctor robot Model

II. On the mobile Wi-Fi/router connection such that the cam module will connect to the internet and its IP address is founded by using Network scanner IP scanner app, by finding is vendor name as espress if Inc. note its IP address.

Fig14: Network scanner IP scanner app

then open the IP address in the internet browser and see the live streaming.

Fig15: Camera Display in web browser

III. ESP8266 Wi-Fi Module is connected to the telnet app, type the Remote Host Name or Ip and then we can give the commands to the robot movement i.e left(*l#), right(*r#), front(*f#), back(*b#) and voice commands such as (*1#.) Placing finger, (*2#.) Take tablet, (*3#.) All ok, Take rest.

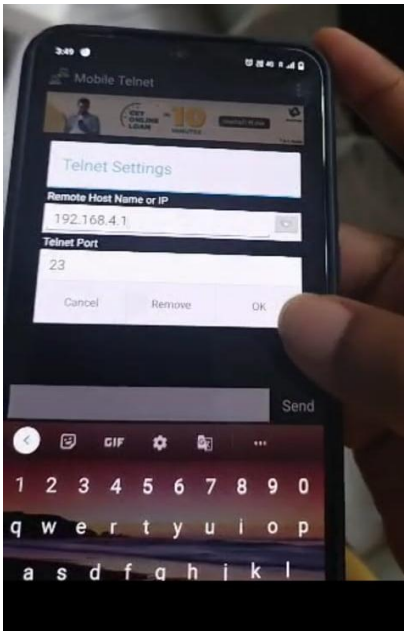

Fig 16: Telnet app

IV. After placing fingers on sensors we get the output on LCD display as well as on the mobile screen which is visible to the doctor.

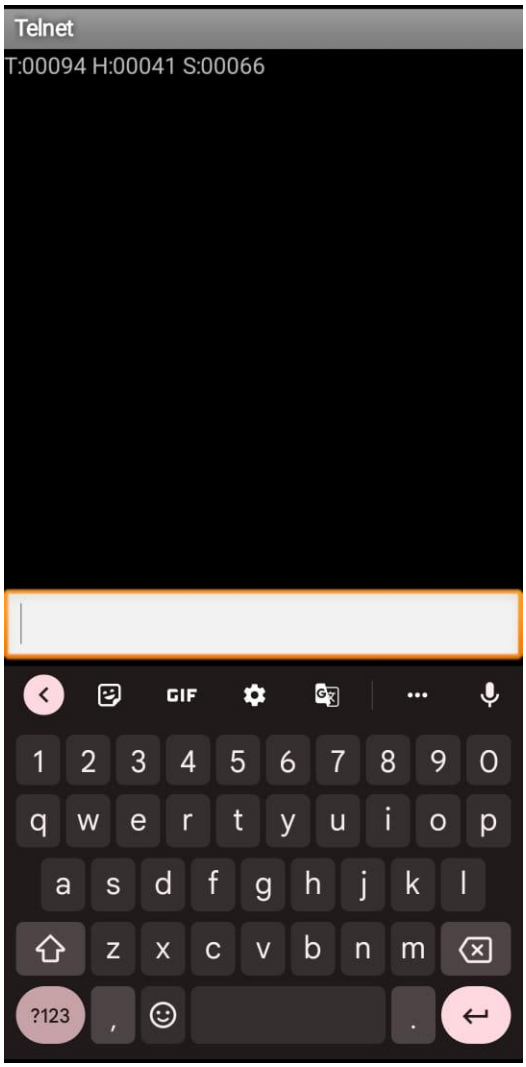

Fig17: Telnet app display

Fig18: LCD display

3. Conclusion

Using IoT based virtual doctor robot, the burden of a doctor can be reduced during the busy schedule. The waiting time of the patients can be reduced. Primary patient monitoring and patient caring assistance with daily activities is achieved. For user friendly, we designed "Doctor robot" with manual and autonomous control system. Doctors from anywhere in the world will be able to show the all-patient data without touching the patient through the IOT system and make communicate video calls with the patient. We believe this robot will go a long way in alleviating the lack of adequate doctors in medical services around the world.

Clinical robots help with a medical procedure, smooth out emergency clinic coordinated factors, and empower suppliers to concentrate on patients. Robots in the clinical field are changing the way that medical procedures are performed, smoothing out supply conveyance and sanitization, and saving time for suppliers to draw in with patients. Clinical robot market is relied upon to acquire market development in the figure time of 2022 to 2028.

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