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# Patient and Health Monitoring Robot

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**ABSTRACT:** Main objective of this paper is to reduce the physical interaction between doctors and patients in the time of pandemics and to increase the doctors ability to be at anyplace anytime. Since covid is highly infectious it is very important to quarantine covid patients but at the same time doctors need to monitor health of covid patients too. Due to the increasing number of COVID-19 cases, there is a remarkable demand for robots, especially in the clinical sector. Hence to overcome this we implemented a robot which can monitor and assist the patient. In our patient and health monitoring robot, we are monitoring pulse rate, oxygen level and temperature of the patient by using respective sensors for temperature measurement and oxygen level measurement and also with the help of camera, we are capturing live image or video of the patient so that the patient can be monitored continuously. The results obtained from this project reveal that introduction of robotics into the healthcare field has a substantial effect in controlling the spread of SARS-CoV-2, and many other communicable diseases as it blocks the virus propagation between patients and healthcare workers. Proper sanitation of hospitals can also be done and cleanliness of hospitals can also be check at regular interval.

**KEYWORDS:** Doctor robot, Temperature sensor, Atmega328, MAX30102, DS18B20, Pandemic health measurement

## I. INTRODUCTION

As the technology is improving day by day, life span of people is also increasing gradually which leads to the population increase, it became a necessity to monitor the health conditions of people for their healthy lifestyle. A global emergency (COVID-19) was declared by the World Health Organization (WHO) due to the outbreak of the novel coronavirus SARS-CoV-2 on January 30, 2020. The first signs of this pandemic were initially witnessed in Wuhan city, China, in December 2019. Frontline health workers have a higher risk of getting infected, as they are in close contact with patients. This situation has motivated many researchers to develop robotic solutions for healthcare personnel in order to serve patients effectively without getting infected. Without quality monitoring it is impossible to monitor the conditions of patients, though there are millions of medical centers across the world, it is difficult there to provide attention to each and every patient, especially patients who are suffering from communicable diseases like Covid-19, Hepatitis B, it is practically very difficult to monitor the conditions of those patients because of the fear of infection. The current method of providing assistance and monitoring patient is not satisfied. Recently, the patient monitoring systems is one of the major advancements because of its advanced technology. In the traditional approach they need to visit the patients ward for checking necessary parameters. Robots are serving various tasks in the health and social care sectors. Patient and Health monitoring robot offers a lot of benefits to people life as we need daily observations in case of communicable diseases. The purpose of this device is to support physicians who are unable to visit patients in person. This could be because of distance, location (such as for those in remote areas), patient immobility (due to illness or access to transportation), and/or costs. A virtual doctor's visit can also sometimes be more cost-effective, allowing healthcare access to more people.

## II. METHODOLOGY

The purpose of our project is to reduce the interaction between the patient and the doctor in the time of pandemic. In this project, a robot will go to the patient and takes the necessary parameters of health such as heart rate, temperature, oxygen level. Robot can move according to the controller so it can also go to the different patients one by one where we can see the patient through ESP32 cam which is mounted on the robot. Aside from camera a 16\*2 liquid crystal display is also there, so that patient can also see his health parameters by himself and we can talk to the patient through audio by using HC-05 Bluetooth module. Bluetooth module is also used for controlling the motion of the robot. 9 volts dc motors with 12 volts battery are used in this robot. Now talking about the sensors, there are two sensors in this robot first is MAX30102 High-Sensitivity Pulse Oximeter and Heart-Rate Sensor for Wearable Health and DS18B20 for sensing temperature of the patient.

Following are the main components of the project.

### 2.1 USB TO SERIAL CHIP 340

CH340 is a USB bus convert chip and it can realize USB convert to serial interface ,USB convert to IrDA infrared or USB convert to printer interface. In serial interface mode, CH340 supplies common MODEM liaison signal, used to enlarge asynchronous serial interface of computer or upgrade the common serial device to USB bus directly. In infrared mode, add infrared transceiver to CH340 can compose USB infrared adapter, realize SIR infrared communication.



Fig 2.1 USB to Serial CHIP 340

### 2.2 CRYSTAL OSCILLATOR

The 16 MHz Crystal Oscillator module is designed to handle off-chip crystals that have a frequency of 4-16 MHz. The crystal oscillators output is fed to the system PLL as the input reference. The oscillator design generates low frequency and phase jitter, which is recommended for USB operation.



Fig 2.2 Crystal Oscillator

### 2.3 DS18B20

The DS18B20 digital thermometer provides 9-bit to 12-bit Celsius temperature measurements and has an alarm function with nonvolatile user-programmable upper and lower trigger points. The DS18B20 communicates over a 1-Wire bus that by definition requires only one data line (and ground) for communication with a central microprocessor. In addition, the DS18B20 can derive power directly from the data line ("parasite power"), eliminating the need for an external power supply. Each DS18B20 has a unique 64-bit serial code, which allows multiple DS18B20s to function on the same 1-Wire bus. Thus, it is simple to use one microprocessor to control many DS18B20s distributed over a large area. Applications that can benefit from this feature include HVAC environmental controls, temperature monitoring systems inside buildings, equipment, or machinery, and process monitoring and control systems.



Fig 2.3 DS18B20

## 2.4 ESP-32 CAM

ESP32-CAM is a low-cost ESP32-based development board with onboard camera, small in size. It is an ideal solution for IOT application, prototypes constructions and DIY projects. 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. Fully compliant with WiFi 802.11b/g/n/e/i and Bluetooth 4.2 standards, it can be used as a master mode to build an independent network controller, or as a slave to other host MCUs to add networking capabilities to existing devices .



Fig 2.4 ESP-32 CAM

## 2.5 ESP8266EX

Espressif's ESP8266EX delivers highly integrated Wi-Fi SoC solution to meet users' continuous demands for efficient power usage, compact design and reliable performance in the Internet of Things industry. With the complete and self-contained Wi-Fi networking capabilities, ESP8266EX can perform either as a standalone application or as the slave to a host MCU. When ESP8266EX hosts the application, it promptly boots up from the flash. The integrated high speed cache helps to increase the system performance and optimize the system memory. Also, ESP8266EX can be applied to any micro controller design as a Wi-Fi adaptor through SPI/SDIO or UART interfaces. ESP8266EX integrates antenna switches, RF balun, power amplifier, low noise receive amplifier, filters and power management modules. The compact design minimizes the PCB size and requires minimal external circuitries.





Fig 2.5 ESP8266EX

## 2.6 HC-05 BLUETOOTH TO SERIAL PORT MODULE

HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Bluecore 04-External single chip Bluetooth system with CMOS technology and with AFH(Adaptive Frequency Hopping Feature). It has the footprint as small as 12.7mmx27mm. Hope it will simplify your overall design/development cycle.

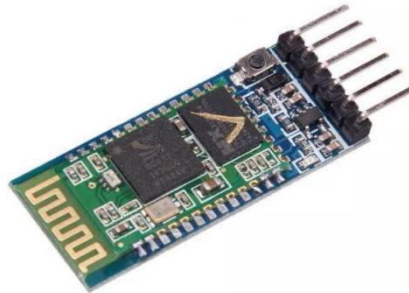


Fig 2.6 Bluetooth to serial port module

## 2.7 L293x QUADRUPLE HALF-H DRIVERS

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 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. Both devices are redesigned to drive inductive loads such as relays, solenoids, DC and bipolar stepping motors, as well as other high-current/high-voltage loads in positive supply applications. Each output is a complete totem-pole drive circuit with a Darlington transistor sink and a pseudo Darlington source. Drivers are enabled in pairs, with drivers 1 and 2 enabled by 1,2EN and drivers 3 and 4 enabled by 3,4EN. The L293 and L293D are characterized for operation from 0°C to 70°C.

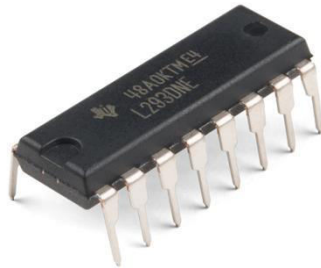


Fig 2.7 Quadruple Half-H Drivers

## 2.8 LCD MODULE

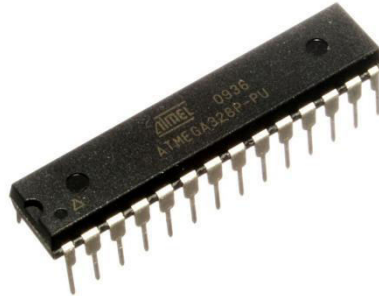
An LCD is an electronic display module which uses liquid crystal to produce a visible image. The 16×2 LCD display is a very basic module commonly used in DIYs and circuits. The 16×2 means it displays 16 characters per line in 2 such lines. In this LCD each character is displayed in a 5×7 pixel matrix.



Fig 2.7 LCD MODULE

## 2.7 ATMEGA 328P

The ATmega328P is a single-chip microcontroller created by Atmel in the megaAVR family (later Microchip Technology acquired Atmel in 2016). It has a modified Harvard architecture 8-bit RISC processor core. The Atmel 8-bit AVR RISC-based microcontroller combines 32 KB ISP flash memory with read-while-write capabilities, 1 KB EEPROM, 2 KB SRAM, 23 general-purpose I/O lines, 32 general-purpose working registers, 3 flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8 channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and 5 software-selectable power-saving modes. The device operates between 1.8 and 5.5 volts. The device achieves throughput approaching 1 MIPS/MHz.



**Fig 2.8 ATMEGA 328P**

### **2.8 LM117**

The LM117 is a low dropout voltage regulator with a dropout of 1.2 V at 800 MA of load current. The LM117 is available in an adjustable version, which can set the output voltage from 1.25 to 13.8 V with only two external resistors. In addition, it is available in five fixed voltages, 1.8 V, 2.5 V, 3.3 V, and 5 V. The LM117 offers current limiting and thermal shutdown. Its circuit includes a zener trimmed bandgap reference to assure output voltage accuracy to within  $\pm 1\%$ . A minimum of 10- $\mu$ F tantalum capacitor is required at the output to improve the transient response and stability.



**Fig 2.9 LM117**

### **2.9 MAX30102**

The MAX30102 is an integrated pulse oximetry and heart-rate monitor module. It includes internal LEDs, photodetectors, optical elements, and low-noise electronics with ambient light rejection. The MAX30102 provides a complete system solution to ease the design-in process for mobile and wearable devices. The MAX30102 operates on a single 1.8V power supply and a separate 3.3V power supply for the internal LEDs. Communication is through a standard I2C-compatible interface. The module can be shut down through software with zero standby current, allowing the power rails to remain powered at all times.

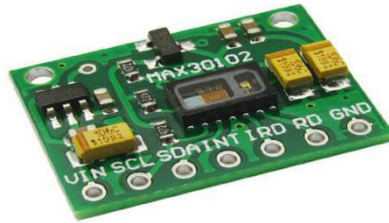


Fig 2.10 MAX30102

### Iii. Working

Firstly, in this project we use HC-05 Bluetooth module which will help in controlling the robot and transferring data. This robot can be controlled by a smartphone or computer/laptop which has Bluetooth in it. We use 9-volt dc motors through which this project can move in whatever direction we want. Aside from getting information on mobile devices a patient can also see his heartbeat temperature and oxygen level on 16\*2 led which is mounted on the robot.05 we use ATMEGA328p microcontroller which is also known as Arduino. For doctor to see the patient we have installed an ESP32 cam for transmitting a video of the patient to the doctor. After getting information from the robot through the sensors doctor prescribe medication to patient. This way we can say both patient and doctor are saved.

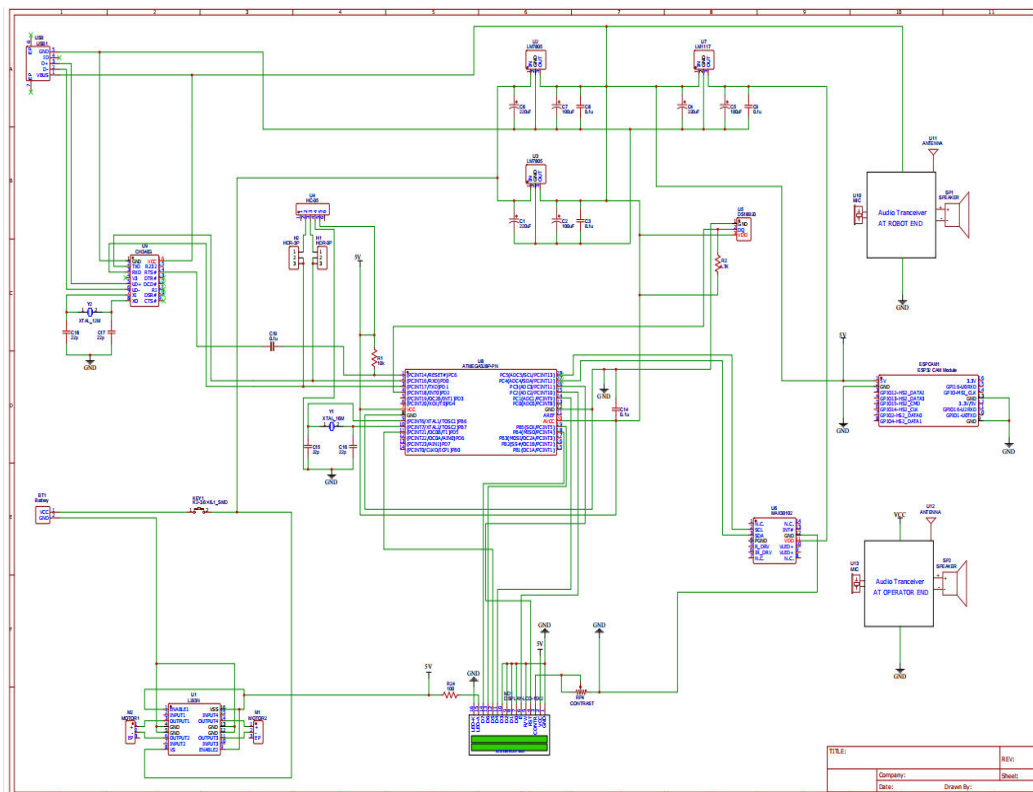


Fig CIRCUIT DIAGRAM



### 3.1 BLOCK DIAGRAM

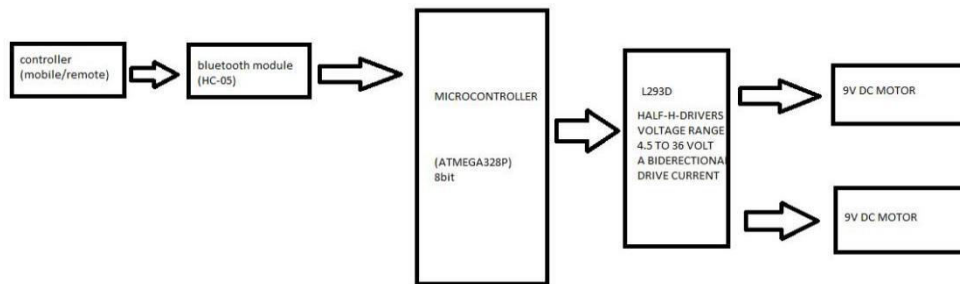


Fig 3.1 Block Diagram

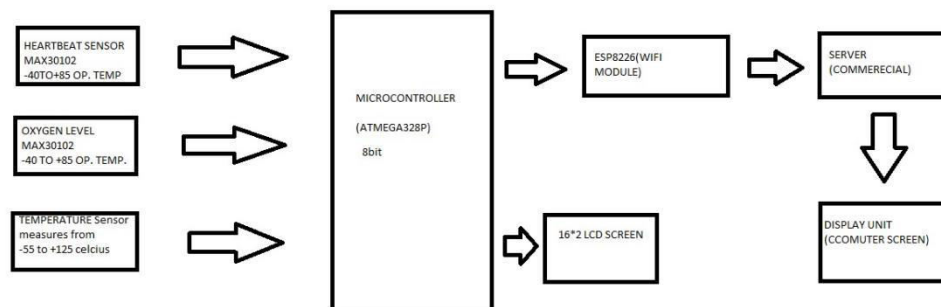
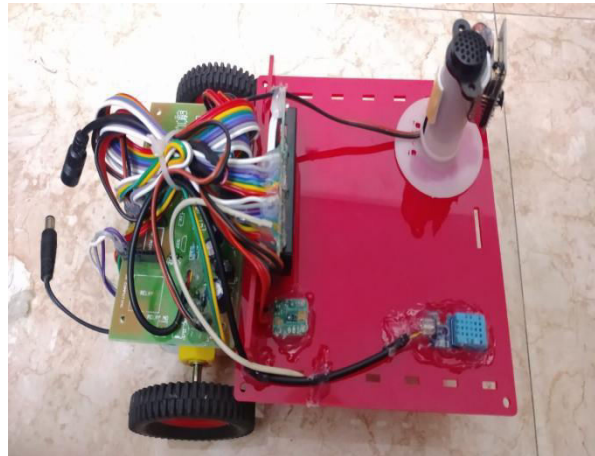


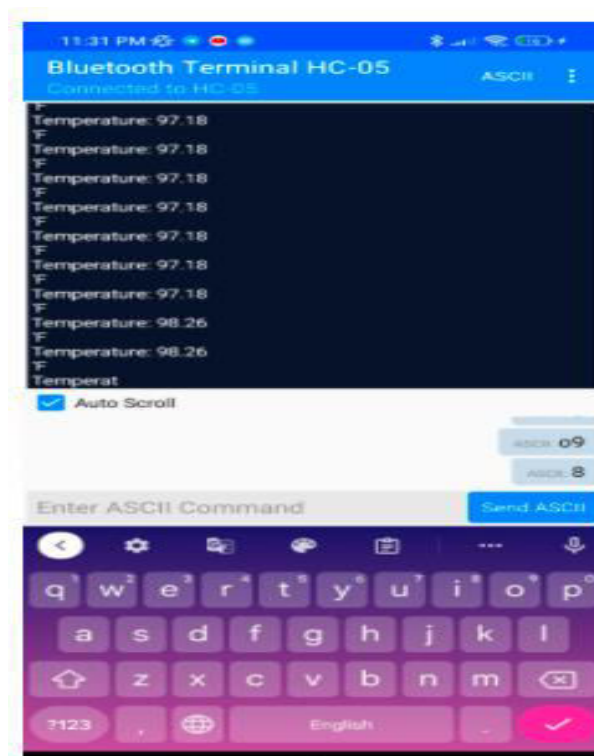
Fig 3.1.1 Block Diagram

### 3.2 PROTOTYPE

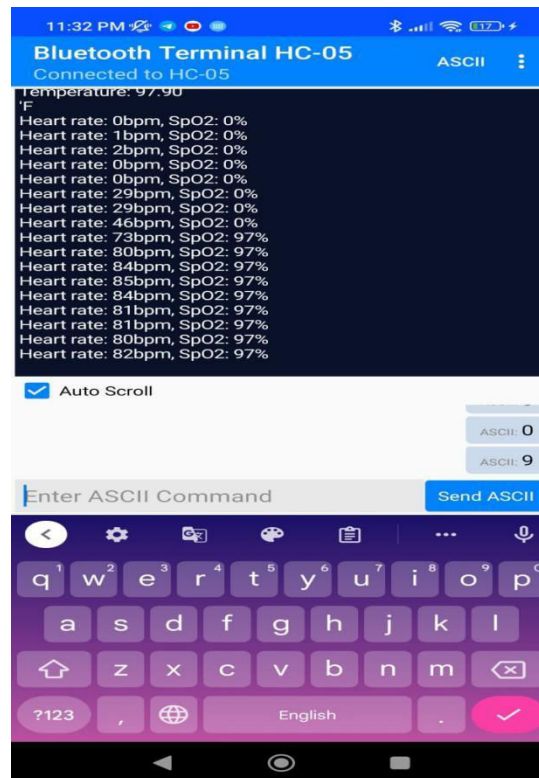




#### IV. RESULT



#### TEMPERATURE MEASUREMENTS



**PULSE RATE AND OXYGEN LEVEL MEASUREMENTS**



**TRANSMITTED VIDEO**



## V. CONCLUSION

The project HEALTH AID AND MONITORING ROBOT FOR VARIOUS PURPOSES system is designed using wireless technology. This project is basically designed for providing health care facilities in hospitals. The measurements of various health parameters taken by the robot are stored on cloud. The future of this project is very bright, as we can add more and more sensors and devices as per the needs, so that it can widely measure patient's health. This project will become very advance if we merge this with AI (Artificial Intelligence), this robot will be capable of doing multitasks.

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