International Journal of Emerging Engineering and Technology (IJEET)
ISSN (e): 2958-3764
Volume: 2, Number: 2, Pages: 7- 12, Year: 2022

The Development of IOT Based Virtual Doctor Robot

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Received: 11/09/2022, Revised: 14/11/2022, Accepted: 23/12/2022

***Abstract*- Recently, COVID-19 affected millions of people worldwide, so healthcare and routine checkups have become impossible for hospital doctors. The doctor Robot is comfortable for hospitals and has become necessary for all hospitals in emergency and viral infectious diseases. In Virtual Doctor Robot Project, a 2 to 3 feet Robot will be designed by using Arduino. We will design it in 5 steps. First, the line following the Robot base will be designed, and we will ensure the robot moves towards 3 to 4 virtual beds. An Android App will be designed by which the user can command the robot to follow which line and to reach which virtual bed station. Then in the second step, we will design the robot's frame. The third step is to design and code the sensors to detect if anything blocks the robot's path, and then the buzzer will turn on. Forth step is to design, code and manufacture the medical checkup instruments, which will be directly inserted into the robot. The doctor will command the robot what medical Report he wants by using Android App. The fifth step is to design and code RFID for Reports to scan patient cards to verify patients. The doctor will use a panel mainly based on IOT to manage the mechanism. Overall, the base has other functions and the battery status, which reacts to the battery charging prompt in good time.**

***Index Terms*—Doctor robot, air-insulated switchgear, core stability current transformers.**

I. INTRODUCTION

The Internet of Robotic Things is being created by the IoT and robotics groups (IoT) [1-4]. According to the IoT idea, intelligent devices may observe events around them, combine the data from many sensors, utilize both local and distributed intelligence to decide on the best course of action, and then act to modify or control physical things [5-9].

A mechanical doctor, controlled by a character's counterpart many miles away, prepares for action (see Fig. 1). Robots are currently used not solely within or however additionally aid staff and a way vary to assist scale back exposure to scientists throughout the scenarios of pandemic, e.g., COVID-19 pandemic [10-12].

Figure 1: Assessing patient remotely.

II. PROBLEM STATEMENT

Occasionally, doctors are required to work at every hospital and emergency room. However, it is not practical for each doctor to be accessible at all locations. The issue with video calling is that it must be done from a PC, laptop, or smartphone that is on a desk. This restricts the doctor's ability to freely travel among hospital rooms, see patients, or even be in the operating room as needed. For inflectional diseases like Covid-19, it is very difficult for doctors to exam his/her patients so many times in one day. In that case, the patient needs much health care and regular checkup. Doctors can also be infected by that disease very easily. In the case of massive accidents where so many people get injured and not so many hospitals in that area, it becomes difficult for healthcare staff to provide first aid to all patients.

III. TASKS OF ROBOT

The robots will perform the following tasks.

- IoT (Internet of Things) modification by Using a Bluetooth Module through an Android App.

- Ultrasound Sensor for detecting objects which block the robot's path.
- Line following robot for moving from one path to its destination.
- RFID will identify its destination.
- Pulse Rate Sensor for checking the Heartbeat rate of patients.
- The temperature sensor monitors body temperature and sends data to the doctor's device.

The block diagram of the project is shown in Fig. 2.

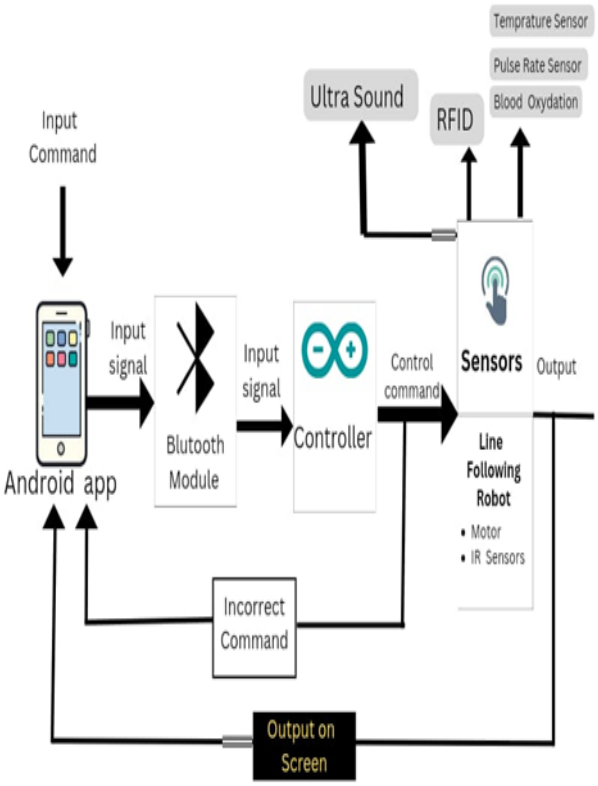

Figure 2: Block diagram of the project.

IV. HARDWARE DESIGN AND IMPLEMENTATION

The robot's frame is designed on AutoCAD software. The bottom part is the moving part, and the sensors are assembled on the top surface.

The frame shown in Fig. 3 is made of steel and good quality crystal white plastic material, with all the components, battery supply and sensors assembled.

We used the microcontroller, Arduino Mega, to control the Movement of the Robot. We also connected the Bluetooth module to connect with the android application RFID and Buzzer with it. The Arduino Mega 2560 shown in Fig. 4 is made for your most ambitious projects that need extra memory and pins. All the sensors for health monitoring are connected with Arduino.

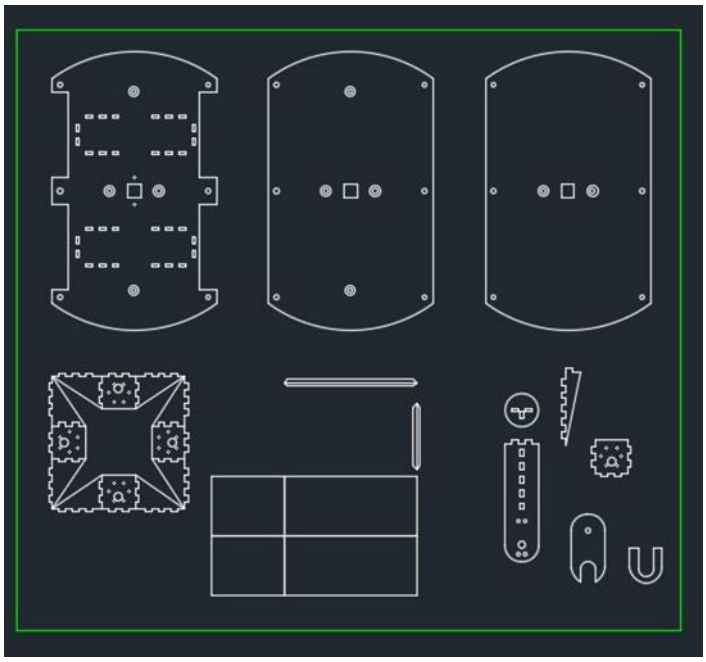

Figure 3: Block diagram of frame.

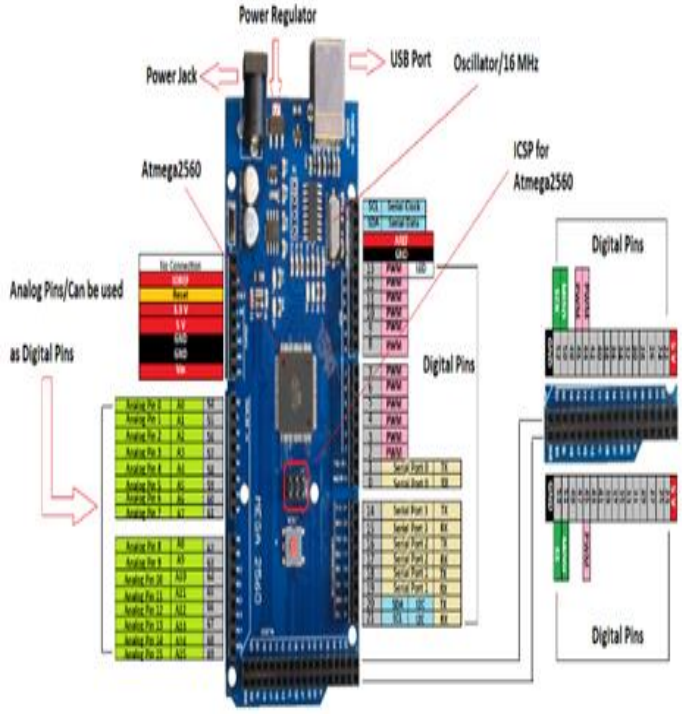

Figure 4: Arduino board.

We used LED Display to show the results of checkup. So that the patient will be aware of his/her health condition. Relays act as electrical switches, and their primary job is to change weaker electrical input into stronger output. This conversion is crucial for the devices and is employed in many manufacturing unit control components.

Temperature Sensor is used to monitor the temperature of patients. Accurate non-contact temperature measurement in medical applications is made possible by infrared (IR) temperature sensors. The most typical uses for this kind of temperature sensor shown in Fig. 5 are for monitoring skin, forehead, or ear temperatures.

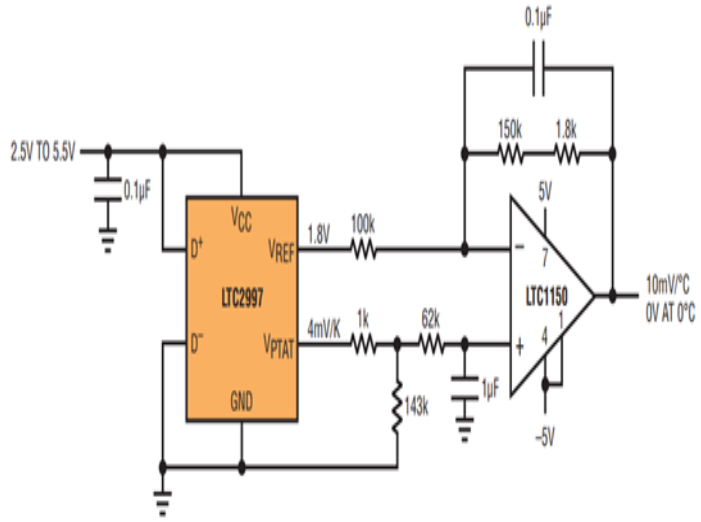

Figure 5: Circuit diagram of the temperature sensor.

The ability to carefully construct gear assemblies to improve torque is one of the main advantages of employing DC gear motors shown in Fig. 6 in the Virtual Doctor Robot. Additionally, gear operations may be altered to lower the speed to almost any desired result, providing remarkable control for various applications.

Figure 6: DC gear motor.

To move the robot on its path smoothly we used Robotic Wheels. We used Jumper wires to connect the circuit, sensors, pins, or Arduino. We used rechargeable Lithium batteries for supply purposes. To give supply all the sensors, motors and microcontroller. We used a battery holder to hold the battery and keep it safe from damage. We used RFID for destination identification, shown in Fig. 7. It is used in our project so that we can communicate remotely.

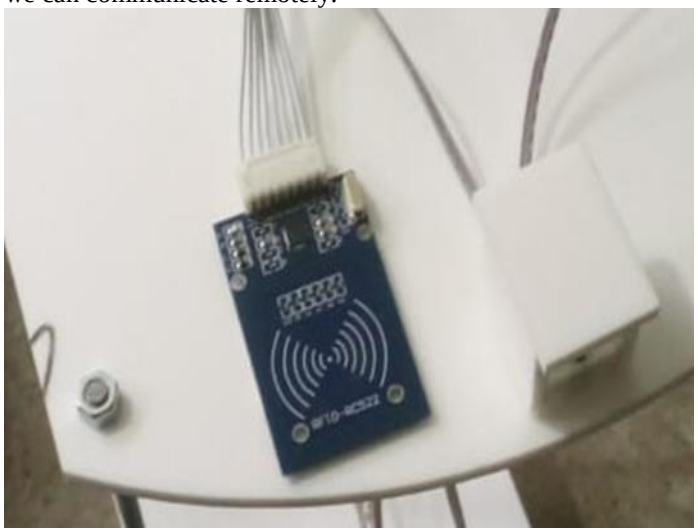

Figure 7: RFID chip.

It turns on when any object blocks its path. It is the main task of our project to check the heartbeat. For that purpose, we used a heart rate sensor. Our project's main task was to check the pulse rate, so we used a pulse oximeter. We used a printed circuit board (PCB) shown in Fig. 8 to make the permanent connections in our project.

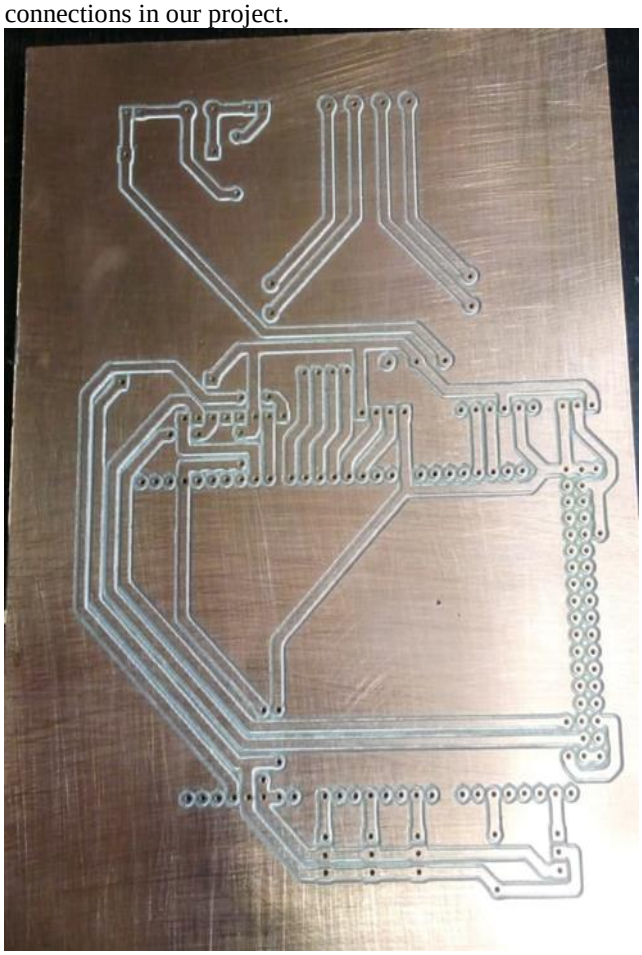

Figure 8: Printed circuit board.

V. SOFTWARE IMPLEMENTATION

A. PCB DESIGN ON PROTEUS

Lab Center Electronics formed the Proteus simulation and electronic design development tool. It is a very helpful tool since it confirms that the firmware code or circuit design is practical formerly you start physically working on it, as shown in Fig. 9.

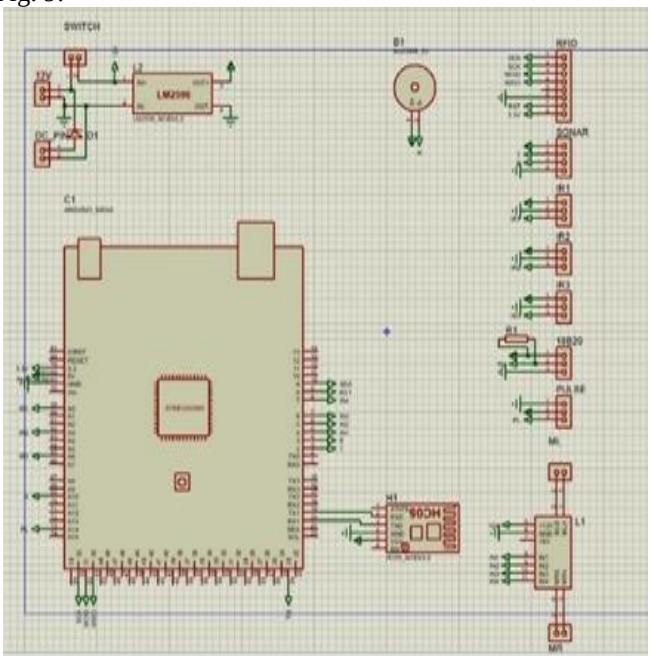

Figure 9: Circuit implementation using LabVIEW.

Its library comprises a sizable quantity of constituents that may be utilized to produce your circuit virtually. Your ideas may be quickly assembled and debugged using Proteus' virtual oscilloscope, voltmeter, and ammeter, among other tools, as shown in Fig. 10.

B. *ANDROID APPLICATION*

We will need to install Bluetooth Terminal Android Application on your phone after successfully pairing the Bluetooth module with your smartphone before you may manually operate the robot using the following code.

The software serial library has been used in this code to set up a connection between the Arduino and the HC-05 Bluetooth modules. Additionally, we are instructing the Arduino to use this software as shown in Fig. 11. Following steps are followed to develop the software design;

1. Serial.print(str); data = mySerial.readStringUntil('n');
2. Serial.print ("BlueTooth Value"), Serial.println(btVal), btVal=(data.toInt());
3. Case 1: To Forward = Serial.println("Forward");
4. Case 2: To reverse= Serial.println("Reverse");

Moving Forward: In this scenario, the robot should move forward when both sensors are on a white surface, and the line is between the two sensors. To do this, both motors must rotate so that the robot moves in the forward direction. However, due to the placement of the motors in our setup, both motors should rotate in the opposite direction. But for ease of use, we'll refer to the motors as spinning forward.

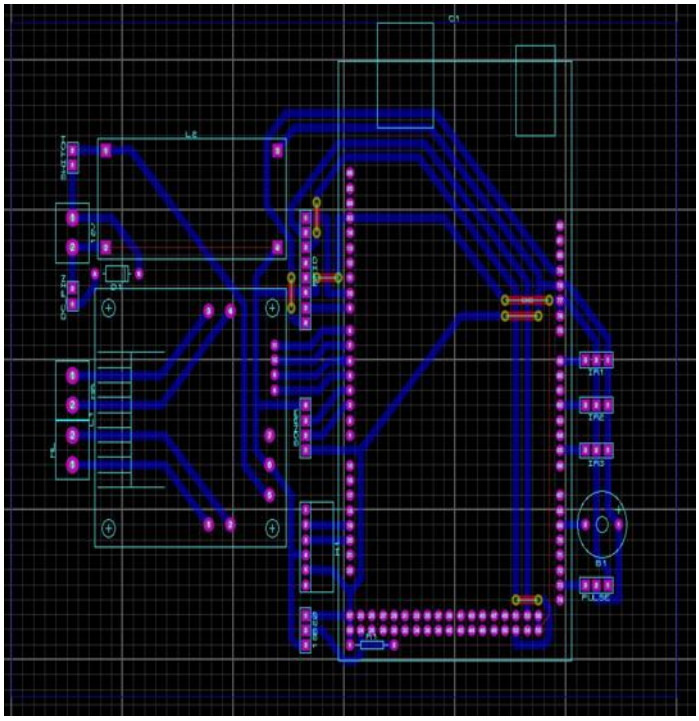

Figure 10: PCB layout.

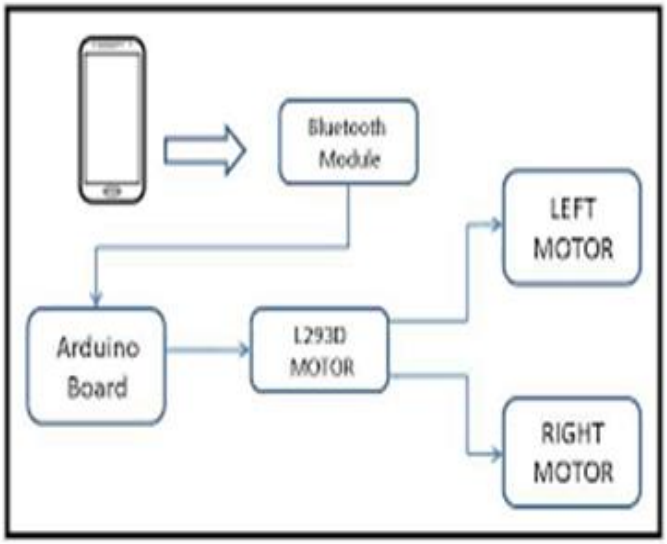

Figure 11: Flowchart implementation.

Turning Left: The left sensor, in this instance, detects the black line and sends a signal to the microcontroller since it is on top of the dark line, whereas the right sensor is on the white portion. The robot should turn left since the left sensor sends a signal. As

a result, the right motor rotates forward while the left rotates backward. The robot then pivots to the left.

Turning Right: Although this condition is identical to the left example in that just the right sensor is present, the robot should turn to the right in this instance. The left motor rotates forward to turn the robot in the correct direction, while the right motor rotates backward to turn the robot in the right way.

To Stop: The microcontroller is instructed to see this circumstance as a reason to halt the procedure since both sensors are on top of the line and can simultaneously detect the black line. As a result, both motors are turned off, which stops the robot from moving.

C. RFID LOGIC DIAGRAM

For testing, we'll utilize the Serial Monitor feature of the Arduino IDE. The UID sequence will be sent to Serial Monitor if the reading is successful and Arduino can analyze the data. If the HC05 Bluetooth module is attached, it also broadcasts the SE simultaneously (See Fig. 12).

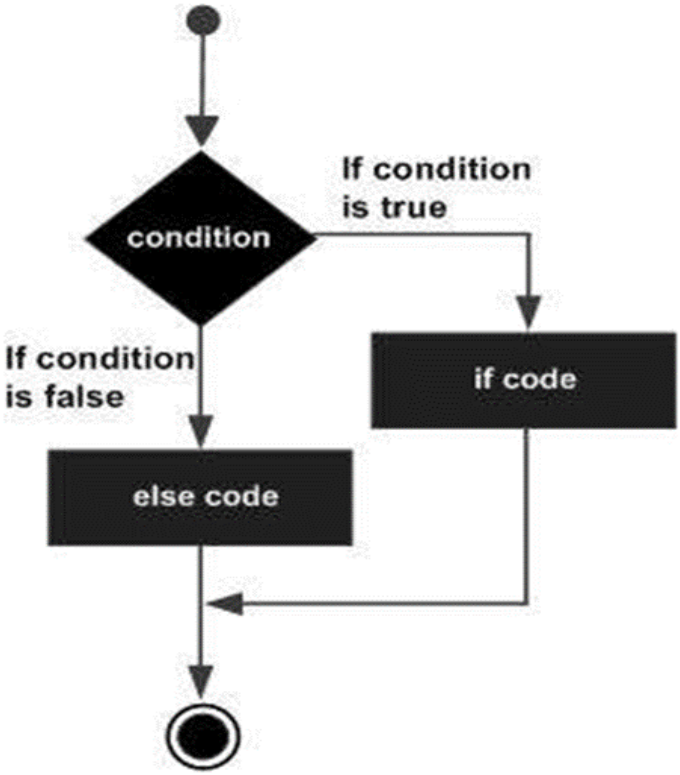

Figure 12: RFID logic diagram.

D. PULSE RATE SENSOR AND TEMPERATURE SENSORS WITH BLUETOOTH

The earth of the Bluetooth module is linked to the Arduino's ground, and the +5volt or VCC pin of the HC-05 Bluetooth module is connected to the Arduino's 5 volts. Rx of the Bluetooth module should be connected to Arduino PIN 1, and Tx should be connected to Arduino PIN 0. Pins 1, 5, and 16 are all linked to the ground. The center pin of the variable resistor or potentiometer, PIN 15, is linked to PIN 3 of the LCD, while the 5v from the Arduino is attached to PIN 2. The ground and 5 volts are connected to the other two pins. The pins D7 to D4 of the LCD are linked to the Arduino's pins 4 to 7.

The ground pin is linked to pins 1, 5, and 16. Pins 2 and 15 are wired to the Arduino's 5V supply. The third lcd pin from the LCD is linked to the middle pin of the variable resistor or potentiometer. The ground and 5 volts are connected to the other two pins. The lcd's pins D7 to D4 are linked to the Arduino's pins 4 to 7.

The enable pin of the LCD is linked to PIN 8 on the Arduino.

The RS pin of the LCD is linked to arduino PIN 9. The pulse sensor's vcc pin is linked to 5 volts, but it may alternatively be connected to 3.3 volts.

Figure 13: Code for the movement of robot.

VI. CONCLUSION

To control the mechanism, the doctor will utilize a panel mostly based on IOT. The robot controller receives control commands transmitted online. The Bluetooth Local Area Network is used by the robot controller. Real-time orders are sent, and the robot motors are also turned on to carry out the necessary movement commands. Overall, the base offers other features besides the battery status indicator, which promptly responds to the battery charging prompt. Modifying the Internet of Things (IoT) using an android app and a Bluetooth module. An ultrasonic sensor for locating obstacles in the route of the robot. Line continuation RFID will determine its destination as the robot moves along

one way to get there. A pulse rate sensor for monitoring patients' heart rates. A temperature sensor will track body temperature and provide information to medical equipment. This robot is very beneficial as we know that in COVID-19, which recently infected millions of individuals worldwide, physicians found it difficult to provide medical treatment and conduct basic examinations in hospitals. The doctor robot is not just a convenience for hospitals; it is now a must for all hospitals in cases of emergency and contagious viral diseases.

FUNDING STATEMENT

The authors declare they have no conflicts of interest to report regarding the present study.

CONFLICT OF INTEREST

The Authors declare that they have no conflicts of interest to report regarding the present study.

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