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Smart Virtual Doctor Robot With Health Monitoring System

N. Dilip Kumar[1], J. Yamuna[2], G. Krishna Teja[3], G. Praveena[4], M. Jaya Chandra Reddy[5]
[1,2,3,4,5]*Department of ECE,Annamacharya Institute of Technology & Sciences, Tirupati.*

Abstract
Occasionally, doctors are required to work at every hospital and emergency room. Yet, it is not practical for every doctor to be accessible at all locations at all times. The Smart Virtual Doctor Robot's Health Monitoring System is an essential part since it continuously gathers and assesses a patient's vital indicators. Monitoring their heart rate, blood pressure, oxygen saturation, and other critical health indicators falls under this category. The information gathered by the Health Monitoring System is utilized to offer individuals individualized medical advice and to notify medical professionals of any alarming changes in their state of health. This makes it difficult for the doctor to freely move among hospital rooms or view patients in the operating room. We have created a virtual doctor robot to assist in resolving this problem. It enables a doctor to virtually move about and even communicate with people in remote locations as needed. For doctors, this robot offers a variety of benefits, including the freedom to walk about the patient, the ability to move around operating rooms with ease, the opportunity to view medical reports remotely via video chats, and the freedom to roam around other rooms as they choose. To facilitate navigation, the system employs a robotic vehicle with four wheels. The robot also has a controlling box for the electronics as well as a mounting for a tablet or phone. Live video calls are held on a mobile device or tablet. The robot can be controlled by the doctor via an IOT-based panel. The robot controller receives the control commands given online. The Wi-Fi internet is used by the robot controller. Real-time commands are sent, and the robot motors are activated to carry out the requested movement instructions.
Keywords: Virtual doctor Robot, patient Vital Signs, monitoring health indicators, ESP32 Cam, Bluetooth module, robot controller.

I. INTRODUCTION

A developing trend in medicine aims to reduce the necessity for hospitalization by transferring some medical processes from hospitals (hospital centric) to patients' homes (home-centric). This approach has received attention primarily because of its potential to increase patient welfare and therapeutic efficacy. The efficiency and costs ofthe global public health system, which have been challenged in the past ten years by the ageing of the population and the increase in chronic diseases, can also be decreased. The Internet of Things (IoT) offers the scalability required for continuous and accurate global health monitoring for this purpose. This approach is becoming an increasingly important technology in healthcare. In addition, new developments in low-power consumption, miniaturization, and biosensors have completely changed the way that monitoring is done and identifying health issues. Wearable and unobtrusive sensors were included in the platform first planned for patients' de-hospitalization. The Reference Architecture for IoT-based Healthcare Applications for a genuine intensive care unit (ICU) and the interoperability with currently available multi parametric monitors serve as the blueprint for the development of the program and its component parts. Finding doctors can be difficult, but they are always needed in hospitals and emergency rooms. Nevertheless, medical professionals are not always available where they are required. The disadvantage of video calling is that it requires a desk-based PC or laptop to establish a connection.

It restricts the movement inside the hospital or around the operating rooms when they need to visit patients or view them. To assist with the help of a robot we've created, a doctor may interact with patients online and even move around (PRN).

For clinicians, this robot offers a variety of choices, including the availability of doctors wherever and atany time. Doctors can easily roam around the patient, study medical data remotely through video conferences, and are unrestricted in their explorationof adjacent rooms. The concept makes use

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of a robotic vehicle with four-wheel drive for straightforward maneuveres. The robot has components that make it possible to hold live video chats, including a mounting for a phone or tablet and a controller box for circuits. The doctor can use an IOT-based control panel to have total control over the robot. The online control commands are delivered to the robot controller. The Wi-Fi internet is used by the robot controller. Real-time commandsthat indicate how to move the gadget cause the robotmotors to turn on. Moreover, the robot has a battery status indicator that alerts the doctor when recharging is necessary.

II. LITERATURE REVIEW

The author is Itamir De Morais Barroca, [2] IoT emerges as a promising paradigm because it offers the scalability necessary for this objective, facilitating ongoing and accurate global health monitoring. In this setting, an IoT-based Based on this backdrop, the authors' prior studies presented anIoT-based healthcare platform to offer remote monitoring for patients in a life-threatening condition. Seyed ShahimVedaei ,[3]The Internet of Things (IoT) can assist in providing a remote diagnosis before to hospitals for more effective treatment in a smart healthcare system. Continuous blood glucose monitoring is essential for diabetic patients, and wearable sensors or smartphones can send blood glucose data to medical professionals forthis purpose. create an IoT e-health platform. As of [4] Kashif Hameed The term "remote delivery of healthcare services" refers to telemedicine. Nonetheless, both citizens and policymakers are aware that there are some murky areas that are challenging to monitor. Over the coming ten years, the area will expand enormously, but there will be both technological and practical hurdles. Sumit Paul, Mohd. Hamim [5].IoT integration with health wearables can eliminate the requirement for patientsto visit hospitals for basic health issues. Also, patients' medical costs are much lower as a result of this. Also, by tracking a patient's health statistics over time via an application, doctors can prescribe appropriate drugs. To comprehend how the sensors function, a thorough study of the signals was collected with regard to fluctuations in physical and environmental activity. [6] Prajoona Valsalan This research presents a portable physiological monitoring system that can continuously monitor the patient's heart rate, room temperature, and other essential environmental data. We suggested a continuous monitoring and control tool to monitor patient condition and save patient data on a server using Wi-Fi Module-based remote communication. [7] Md. Anowar Hossain Most medical professionals wanted to use the internet to control their robot assistant. FASTele is the name of another paper. Every paramedic can use a Tele-Echography portable robot device for an emergency situation. The PMS (Patient Monitoring System), advanced healthcare, healthcare, digital thermometer, and non-contact infrared thermometer have all been used in some ways.

III.METHODOLOGY

The Arduino UNO controller is the main part of the robot and runs on a battery power supply that must be recharged after each use. Esp32 Camera, which is used to view the scene in real time, is part of it. The four-wheeled robot is controlled by commands so that it can move around the patients. The doctor controls the robot while keeping an eye on the screen via a Esp32 camera. Three voice commands are contained in the ARP voice module, which connects the speaker to the robot. When touched, a temperature sensor and a SPO2 (heartbeat and oxygen) sensor are present. 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.

IV.HARDWARE COMPONENTS

A. NodeMcu Esp8266

The required hardware components are: NODE MCU ESP8266 , 16X2 LCD display, Touch sensor, DC motor, ESP32 cam, pulse sensor, Bluetooth Sensor. The additional components required are rod, cardboard, transformer for charging the battery, PCB’s and soldering gun.

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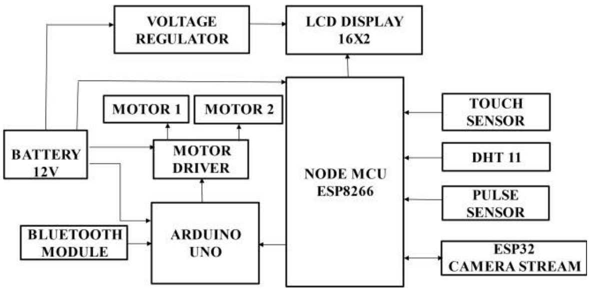

Fig.1:Block diagram of smart virtual doctor robot

Fig 4.1: NodeMcu Esp8266

The open-source Node MCU firmware anddevelopment board are designed specifically for Internet of Things (IoT) applications as shown in figure 4.1. It has hardware based on the ESP- 12 module and firmware that runs on the ESP8266 Wi- Fi SoC from Espress if Systems. It is perfect for IoT projects thanks to its high processing power, built-inWi-Fi and Bluetooth, and Deep Sleep Operating capabilities.

B. 16X2 LCD display

LCD (Liquid Crystal Display) is a type of flat panel display which uses liquid crystals in its primary form of operation. It is specific type ofelectronic display module that is utilised in a broad range of circuits and gadgets, including mobile phones, calculators, computers, TV sets, and other electronic equipment. It displays the digital format output on its screen. Which is as shown in figure 4.2.

Fig 4.2: 16X2 LCD display

C. TOUCH SENSOR

Electronic sensors that can recognize touch are called touch sensors. When touched, they act as a switch. These sensors are utilised in lighting, mobile touch screens, etc. The user interface provided by touch sensors is simple. Tactile sensors are another name for touch sensors. The five senses that make up the human body allow us to interact with the world around us. To interact with their surroundings, machines also require some sensing components. There are several types of touch sensors including capactive, resistive and surface acoustic wave sensors. The basic touch sensor which is utilized in many applications can be shown in the below figure which is Fi g 4.4.

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Fig 4.3: Touch Sensor

D. PULSE SENSOR

This sensor is also known as a heartbeat sensor or a heart rate sensor. Connecting this sensor from the human ear or fingertip to an Arduino board will enable it to function. such that it is simple to compute heart rate as shown in figure 4.4. This sensor creates a circuit using an uncomplicated optical pulse sensor, amplification, and noise cancellation.

Fig 4.4: Pulse Sensor

E. BLUETOOTH SENSOR

Bluetooth sensor is designed for creating wireless connectivity as shown in figure 4.5. An accelerometer that can collect vibration data andtransmit it to a receiver using the Bluetooth standard protocol is a Bluetooth vibration sensor. To create wireless connectivity, these sensors typically incorporate an accelerometer and a Bluetooth transmitter. having the capacity to connect through a mesh network or peer-to-peer technology.

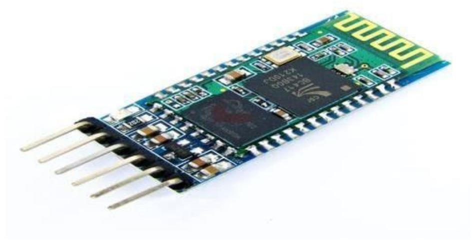

Fig 4.5: Bluetooth Sensor

F. DHT 11

DHT11 is a digital temperature and humidity sensor as shown in figure 4.6. The amount of water vapour in the air is measured as humidity. The amount of humidity in the air has an impact on a number of chemical, biological, and physical processes. Humidity can have an impact on staff health and safety, business costs associated with the products, and employee safety

Fig 4.6: DHT 11

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The amount of moisture in the gas which maybe a mixture of water vapour, nitrogen, argon, or pure gas, among other things is determined by the humidity measurement.

G. MOTOR DRIVER

An electronic device called a motor aids in the transformation of electrical energy into mechanical energy as shown in figure 4.7. Thus, a motor driver enables you to carry out automatic tasks utilising electricity. Electric motors come in a variety of varieties.

Fig 4.7: Motor Driver

These kinds include stepper motors, servo motors, and DC motors. These motors differ from one another in terms of their functioning theories and traits. It's crucial to get the right kind of motor driver so that your engine and microcontroller can communicate effectively as shown in figure 4.7.

H. DC Motor

A direct current motor is a type of electrical appliance that employs direct current (DC) to transform electrical energy into mechanical energy as shown in the figure 4.8. Any of a group of rotating electrical machines that transform direct current electrical power into mechanical power is known as a rotary DC motor.

Fig 4.8: DC Motor

I. ESP 32 CAM

ESP 32 CAM is designed for Many clever IoT applications, including WiFi image upload, QR identification, wireless video monitoring, and others, can make use of the ESP32-CAM as shown in figure 4.9.The ESP32-CAM is an ESP32-based, compact camera module with low power requirements. The OV2640 camera and the ESP32-CAM-MB micro USB to serial port converter are included. supports WiFi picture upload and WiFi video monitoring.

Fig 4.9: ESP 32 Cam

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V. SOFTWARE COMPONENT

J. UBIDOTS

Ubidots is a cloud-based platform that provides a simple and powerful way to store, analyze, and visualize data from connected devices. Integrating Ubidots into a smart virtual doctor robot with a health monitoring system can provide numerous benefits. One possible use case for Ubidots in a smart virtual doctor robot with a health monitoring system is to collect and store data from various sensors and devices that aremonitoring the patient's health. For example, the robot could be equipped with sensors that measure the patient's temperature, blood pressure, heart rate, and oxygen saturation levels. This data could then be transmitted to the Ubidots platform for storage and analysis.

VI. RESULTS

We have successfully designed and developeda Smart Virtual Doctor With Health Monitoring System that can be used to improve the accuracy of diagnoses and treatment recommendations, while the health monitoring system could allow for the early detection ofhealth problems and prevent medical errors. This has the potential to be a game-changer in the field of healthcare. By combining virtual technology with real- time health monitoring, this system could provide personalized healthcare to patients, regardless of their location. It is important to note that a smart virtual doctor robot with a health monitoring system should notreplace the human touch in healthcare entirely. There are some aspects of healthcare that require a personal connection between a patient and a healthcare provider.

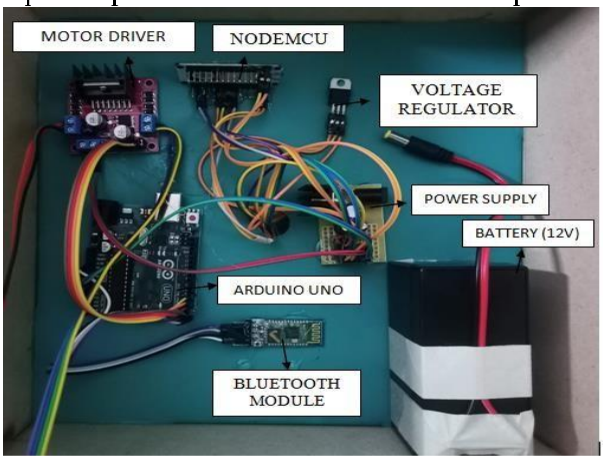

Fig 5(a)

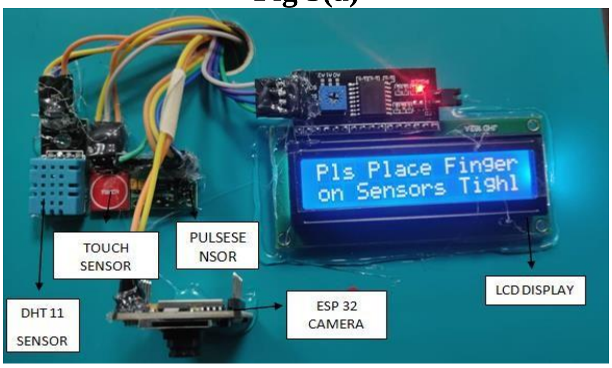

Fig 5(b)

Figures 5(a) & 5(b): Complete Setup of VirtualDoctor Robot

A Smart Virtual Doctor With HealthMonitoring System that can be used to improve theaccuracy of diagnoses and treatment recommendations, while the health monitoring system could allow for the early detection of health problems and prevent medical errors. The users data is sent to the cloud .As shown in below figures:

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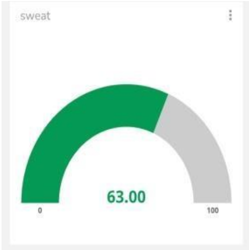
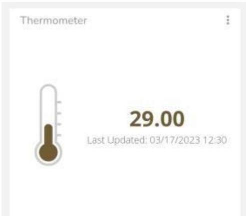


5(c) **5(d)**



5(e) 5(f)

The Figures 5(c), 5(d), 5(e) & 5(f) shows the pulse, sweat, Temperature and Spo2 of a patient.

VII. CONCLUSION

The workload of a doctor during their busy schedule can be lessened by IoT-based virtual doctor robots. Patients waiting times can be cut down. It is accomplished to provide primary patient care andaid with everyday tasks. We created the "Doctor robot" with a manual and autonomous control mechanism for user-friendliness. Via the IOT system, doctors from any location in the world will be able to converse via video chats with patients while viewing all of their data with out having to physically interact with them. We are confident that this robot will make a significant difference in addressing the global shortage of qualified doctors. vendors to focus on patients. Robots in the healthcare setting are transforming the manner that medical treatments. Clinical robots aid in medical procedures, simplify coordination processes at emergency clinics, and free up are carried out, streamlining supply conveyance and sanitization, and allowing suppliers to draw in with patients more quickly. In the forecasted period of 2022 to 2028, the clinical robot industries experience market growth.

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