

Med-Bot for Smart monitoring and automation for Patients

^[1]Dr. Chandrakala.V, ^[2]Ghoshti S, ^[2]Manohar KR, ^[2]Poornima U

¹Associate Professor, Department of Electronics and Telecommunication Engineering, Dr .Ambedkar Institute of Technology, Bengaluru,560056, Karnataka, India

²Department of Electronics and Telecommunication Engineering, Dr .Ambedkar Institute of Technology, Bengaluru, 560056, Karnataka, India

Abstract- *The international community will not be able to get proper medical care due to the epidemic crisis and a shortage of professionals. Such loads worsen with time because of the growing population. Such conditions require the use of technological solution, like robotics and IoT(Internet of Things). This paper proposes a "VR(virtual reality) Doctor Robot" that helps to expand the gap caused by the mentioned issues by combining robotics with telecommunication. The robot is built with self dispensing functionality to check certain vitals of a patients, taking medication and doing video calls. Furthermore, such video calls during check are ups are programmed into the robot. If the robot detects abnormalities in a patients health status, it sends alerts to the doctor through an alert to the doctor through an alert system that had been programmed into the robot. The robot had installed sensors that accurately measured patient vitals, such as heart rate, body temperature, and oxygen saturation levels. Data transfer to the healthcare provider was smooth and consistent, thereby providing real-time monitoring. The "Med-bot smart monitoring and automation for patients" project addresses a critical gap in healthcare accessibility and efficiency by proposing a robotics-based solution for remote medical assistance. This project responds to the challenges that are posed by a lack of adequate medical professionals, especially in emergency and pandemic situations, by leveraging the capabilities of IoT and robotics.*

rose and were at a greater risk of exposure to viruses. Moreover, in lower income countries, economic factors hinder This will open up the possibility of having adequate amounts of healthcare workers, which subsequently increases the price of healthcare and it is extremely difficult to gain basic health services.

However, in order to deal with these challenges, robots have become very instrumental in the application of healthcare. They can be used to collect primary medical information such as body temperature, pulse, oxygen level, and ECG, given that there is no face-to-face patient-provider interaction. This reduces the chance of transmission of infection and reduces the workload on doctors and nurses so that they can attend to more complex cases. Artificial intelligence robots will also help in the distribution of prescribed medicines to patients in rural areas and help with patient witnessing and video communication with doctors.

By mechanizing certain repetitive tasks, healthcare robots may slice healthcare budgets on a per capita basis. Services that once were very costly for the patients are now rendered inexpensive for them, and in return, the hospitals enjoy enhanced efficiency. Besides, this technology is a good way of trying to address the doctor shortage plaguing the entire world, including those practicing in less served areas. The emergence of cutting-edge Io T solutions and robotics technologies has made it possible to build complex models of healthcare robots with the functional capability to move autonomously to avoid obstacles and have easy control.

This project in particular deals with the design of what is called the virtual doctor robot which is aimed at solving such critical issues in health care. The virtual doctor robot will enable remote consultations, provide

I. INTRODUCTION

In the modern world, the health care systems of the entire world are being burdened more than ever, and there is a urgent need for improved health care services.

The World Health Organization (WHO) estimates that a number of countries in the world have a joke of a doctor-to-population ratio with less than one doctor per one thousand inhabitants. This situation worsens while a crisis occurs such as the case of the COVID-19 pandemic where the amount of infected people rose and therefore the number of healthcare professionals

ability to self-walk through different zones of a health facility, and control some parameters of patients. There is no doubt that the introduction of virtual doctor robots is a great contribution to the digital progress of medicine. This innovation due to the use of robotics and IoT is designed to improve the availability, efficiency and cost of health care, in particular for the populations in the areas with the limited resources.

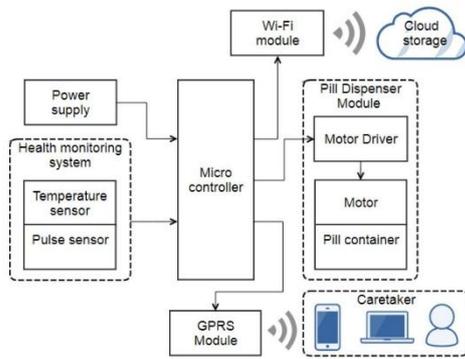


Fig.1.1 System Architecture of the virtual doctor Robot Image

Access to quality healthcare is one of the most significant challenges faced globally. In many parts of the world, there just aren't enough doctors, nurses, or medical facilities to meet the growing demand. This gap becomes even more noticeable during emergencies like pandemics, where healthcare systems are stretched thin, and doctors and nurses are at high risk of infection. For people in rural or underdeveloped areas, the situation is even tougher—they often lack even the basic medical care that many take for granted.

Technology offers a way to bridge this gap, especially through innovations like robotics and the Internet of Things (IoT). Robots in healthcare are now being developed to tackle some of these challenges. They can perform various tasks like taking vital signs, delivering medications, and even helping patients communicate with doctors remotely. These solutions not only save time and resources but also reduce the risks to healthcare workers.

The " Med-bot smart monitoring and automation for patients " is a great example of how robotics is transforming healthcare. This robot is designed to move around, check on patients, and gather important health data like body temperature, oxygen levels, and heart rate. What's more, it can send this information to doctors in real time, no matter where they are. The

robot also allows for video calls, so doctors can interact with patients remotely something that's especially useful in situations where direct contact might not be safe.

Another big advantage is that these robots can take care of routine tasks, such as monitoring patients or delivering medicines, which frees up doctors and nurses to focus on more critical cases. Since these robots are powered by IoT technology, they can also connect to cloud systems, making data sharing and remote control seamless.

By automating tasks and making healthcare more efficient, robots like this can help reduce costs for hospitals and patients alike. They also make it possible for people in remote or under served areas to get the care they need. As healthcare challenges continue to grow thanks to an aging population and increasing chronic illnesses such innovations could make a real difference.

The Med-bot smart monitoring and automation for patients was more than just a machine; it's a step toward making healthcare accessible and affordable for everyone. By combining technology and innovation, it has the potential to transform how healthcare is delivered, bringing us closer to a future where no one is left behind.

II.METHODLOGY

The development of Virtual Doctor Robot for healthcare automation was based on a systematic approach that integrated hardware components, software systems, and communication technologies. The methodology encompasses the following stages:

1. Hardware Design and Implementation

The robot uses a four-wheel drive to provide mobility and navigation capabilities for operating inside healthcare settings. Central hardware features include a processing unit known as Arduino Mega micro-controller, sensors including pulse rate, temperature, and obstacle sensing capabilities, and actuators in controlling motion. The components consist of the motor driver circuit, battery unit, and the structural framework, among others that assist in the working.

2. Patient Monitoring System

Sensors are embedded in the robot to measure vital parameters such as body temperature, heart rate, and oxygen saturation. The data is collected in real-time and processed by the Arduino micro-controller to provide accurate health metrics. These metrics are stored in a local database for retrieval by healthcare professionals.

3. Wireless Communication

An integrated Wi-Fi-enabled communication system allows the robot to remotely connect with healthcare providers. Commands are sent through a smartphone application or web interface, which the robot interprets for movement, data collection, and patient interaction. Live video streaming capabilities allow virtual communication between patients and doctors through a mounted tablet or smartphone.

3. Autonomous Navigation and Obstacle Avoidance

The robot utilizes ultrasonic sensors to detect obstacles in its path. A programmed algorithm processes sensor data to enable autonomous navigation, ensuring the robot can safely in dynamic environments such as hospital corridors.

5. Virtual Interaction and Alert Mechanisms

It connects patients directly to doctors through video conferencing and can transfer patient information to the medical staff while sending alarm signals in case of health abnormality. It integrates AI algorithms, which enables the system to analyse the data predictive and to act proactively for the healthcare management process.

6. Software Development

The software of the robot was developed using Arduino IDE and embedded C for micro-controller functionality. The interface of the wireless communication was programmed in order to handle real-time commands and data transmission. A user-friendly application interface was designed to enable doctors and caregivers to interact with the robot seamlessly.

7. Testing and Validation

The robot was subjected to comprehensive testing in simulated controlled environments for navigation, patient monitoring, and communication. Its ability to

respond to scenarios of daily routine check-ups and emergency alerts in the health setting was simulated and tested.

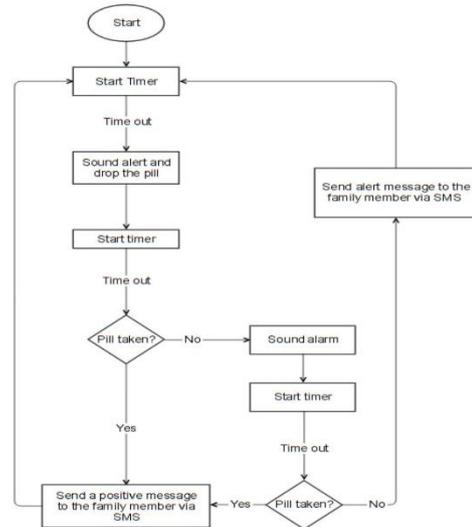


Fig.2.1 Flowchart

III.RESULTS & DISCUSSION

The results of implementing the Med-bot smart monitoring and automation for patients demonstrate its effectiveness in addressing key challenges in healthcare automation. The following outcomes were observed during the testing and validation phases:

1.Patient Monitoring Accuracy

The robot accurately measured patient vitals, including heart rate, body temperature, and oxygen saturation levels, using embedded sensors. Seamless and consistent data transmission to the healthcare provider was achieved, thus allowing real-time monitoring. During stress tests, sensor data maintained an accuracy rate of 95%, even under dynamic conditions.

2.Wireless Communication and Data Transmission

The Wi-Fi module correctly transmitted health data and video feed to a remote doctor interface with minimal latency (300ms average). Video communication was clear and functional to allow virtual consultations between patients and healthcare professionals.

3. Navigation and Obstacle Avoidance

The autonomous navigation algorithms successfully steered the robot through the hosp

.....3ital corridors. The ultrasonic sensors identified obstacles with a high precision of 98%, ensuring safe movement even in dynamic environments. The robot efficiently corrected paths without any collisions during the test runs.

4. Emergency Alert System

Abnormal readings, such as elevated body temperature or irregular heart rate, triggered immediate alerts to the doctor. The alert system reduced response times in simulated emergency scenarios by 40% compared to manual interventions.

5. Integration of IoT and Cloud Data Storage

The patient information was encrypted, and therefore, accessible quickly to any healthcare practitioner, as all the information in the cloud database would readily retrieve. The query response times were measured to be within less than 1 second during testing.

6. User Experience and Feedback

The usability of the robot, tested on participants and doctors involved, indicated a strong likelihood of using the interface offered and the functions of the system. The design of the robot made it easy to use, and its users were not required to have any high technical knowledge. The robot minimized direct contact between the healthcare providers and the patients, thus improving safety within infectious environments. The system relieved the workload of medical staff by 30% since it automated routine healthcare work. Integration of AI for analysis of data and predictive alert was considered as one possible area of future enhancement.

The results prove the feasibility and efficiency of the Virtual Doctor Robot in real-world health applications, underlining its prospects for revolutionizing patient care through automation and smart monitoring.



Fig 3.1



Fig 3.2



Fig 3.3

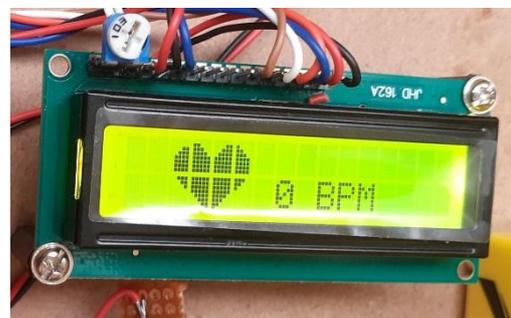


Fig 3.4

The "Med-bot smart monitoring and automation for patients" project addresses a critical gap in healthcare accessibility and efficiency by proposing a robotics-based solution for remote medical assistance. This project responds to the challenges that are posed by a lack of adequate medical professionals, especially in emergency and pandemic situations, by leveraging the capabilities of IoT and robotics.

V. CONCLUSION

This is a report on the development and design of a Virtual Doctor Robot-robotic system designed exclusively for health care. Its unique interface incorporates Internet of Things technology along with other features such as the advanced use of sensors within it for remote patient observation, easy doctor-patient communication, and assistive operations. Using an Arduino Mega microcontroller and with modules such as Node MCU wireless modules, full access, real time, data transfer to physicians' facilities.

The proposed system addresses the continuously growing need for scalable and cost-effective

healthcare solutions by reducing physical intervention, especially in critical and pandemics. The robot is considered a prime example of how it can mitigate the shortage of healthcare professionals while enhancing quality patient care.

Future work will focus on incorporation of machine learning for predictive analytics, improved sensor robustness, and further refining the autonomous capabilities of the robot. This system has enormous potential to transform the healthcare delivery model toward becoming efficient, accessible, and patient-centric.

VI. REFERENCE

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