# Enhancing Healthcare Through Robotic Telemedicine: A Self-Controlled     Temperature-Monitoring Robot for Remote Doctor-Patient Interactions

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**Abstract:**

**Introduction:** Introduced by Kevin Ashton in 1999, the Internet of Things (IoT) refers to the connection of information on the Internet with a changing set of global services. The Internet of Things is the result of advanced research in information and communication technology. During an epidemic, due to the large number of patients, doctors are very busy interviewing all patients. Due to the epidemic, doctors have to see all patients, which complicates their work both because of time constraints and because doctors do not have free time. These robots can be used to reduce doctors' effort, saving transport time and reducing the possibility of infection. This can save lives because the disease can be detected in time.

A. *Overview:*    Our Robot is a self-controlled three-wheeled vehicle to reach the patient and initiate doctor-patient interaction. The system can control the patient's temperature, which can be seen by doctors to further diagnose the disease. An adjustable hydraulic lift makes it easy to see your patient clearly, whatever their height. Obstacles in the robot's path can be easily identified due to the presence of UV sensors to warn the operator. This robot doctor makes the life of doctors a little easier and can speed up the diagnosis process.

B. *Challenges:* Physicians now have difficulty in managing their time due to the increasing number of diseases and also have difficulty in satisfying all patients due to the increasing number of patients. Therefore, it is not possible to find all doctors everywhere and at all times. This problem has a solution for a phone call with the doctor, but the problem with the phone call is that the video call must be made from a pc or laptop on the table or apartment and the patient must be seen clearly. Failure to do so will limit doctors' ability to see patients. Also, if the number of patients increases, the nurses will not be able to take care of them regularly, which will be a big problem because every patient needs frequent care to maintain their health.

C. *Future directions:* The field of medical robotics is already evolving rapidly

1. *Accurate diagnosis*: Medical robots can be equipped with advanced sensors and have the ability to focus to help diagnose diseases accurately and efficiently. They can use artificial intelligence to analyze patient data, medical history and images to identify diseases or conditions at an early stage.

2.*Surgical assistance:* Robotic surgery machines such as the Da Vinci Surgical System have been in use for some time. Doctor robots of the future will evolve in precision, dexterity and autonomy. They are also more accessible and cheaper, allowing the use of a variety of medical procedures.

3. *Rehabilitation and Physical Therapy:* Doctor robots can assist patients in the rehabilitation process by providing exercises and treatments to help patients recover from injuries or mental disorders. These robots can be adjusted according to the progress and performance of the patient.

**Disadvantages of Existing System:**

1.Patients have to wait for the doctors for a very long duration.

2.Physicians now have difficulty in managing their time due to the increasing number of diseases and also have difficulty

in satisfying all patients due to the increasing number of patients. Therefore, it is not possible to find all doctors everywhere and at all times

3.Doctor robots can be expensive to acquire and maintain. The initial investment and ongoing maintenance costs may pose financial challenges for many healthcare facilities, especially smaller ones or those in resource-constrained regions

4.The technology behind doctor robots is complex, requiring specialized training for medical professionals who will operate and interact with them. Integrating robots into existing healthcare systems and workflows can be time-consuming and may require significant adjustments

5.Some doctor robots require significant power and energy resources to function, which can lead to higher energy costs and environmental impacts. Developing energy-efficient robotic systems is necessary to address these concerns.

**Proposed System:** To solve this problem, a virtual doctor can be created, allowing the doctor to move from the desired location and even talk to the person in the remote area when necessary. The architecture of the robot is to use IoT devices to record the necessary parameters and send them to the doctor for further examination. Thanks to this method of communication with the help of IoT network topology, we can manage and save a lot of time.

**Methodology:**

*Hardware:*

Some sensors, the wheels of the robot, the chassis of the car, the camera talking to the doctor, the node MCU module integrating the control of the sensors and the car, the motor and power for the power of the car, etc. are the necessary hardware to make a robot. NodeMCU is an open-source Lua based firmware and development board specifically targeted for IoT based Applications [2]. In This project NodeMCU is used to operate the vehicle and also to check the temperature of the patient. Node

MCU of model 8266 is used in our robot. Ultrasonic ranging module HC-SR04 provides 2cm-400cm non-contact measurement function, ranging accuracy can reach to 3mm [3]. This helps to find the obstacles on the way of the robot and alerts the operator. A Motor driver is used basically to control the motor. L298 motor driver is used to control 2 or 4 DC motors and helps to control their direction and speed. In our robot it is used to control the motors in the car. A temperature sensor is used to find the temperature of the patient in our case. We are using a temperature sensor of model MLX90614 which will be connected to the Node MCU board and the temperature sensed can be viewed by the doctor and also by the patient by a led display through an O'LED Display.

O'LED Display is used to display a specific content like sensor information etc., we are using this O'LED display to display the information sensed by the temperature sensor. This displayed information can be viewed by the patients and the attender/nurse who is attending the patient. DC motor in our robot is used to control the vehicle and also to move the hydraulic lift on which the phone has been mounted. In the vehicle, it is used to rotate the wheels whereas in the lift, it is used to adjust the size of the lift.The nine-volt battery, or 9-volt battery, is an electric battery that supplies a nominal voltage of 9 volts. Actual voltage measures 7.2 to 9.6 volts, depending on battery chemistry. In our robot it s used to run the vehicle.
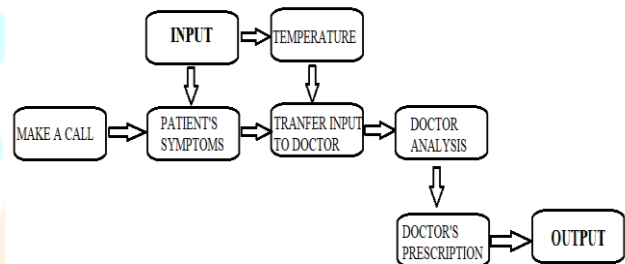
*Overall architecture:*
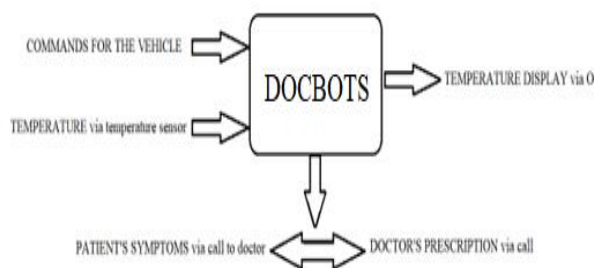


*Doctor side:*
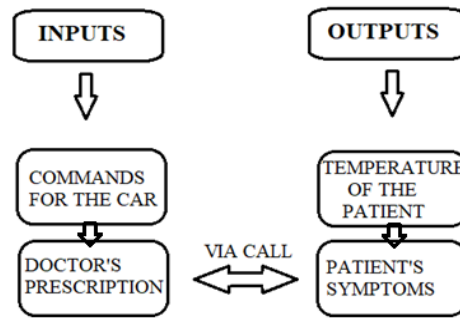


*Patient side:*



*Software:*

In Docbots, we use the Lua programming language to command the system from the Node MCU. The Node MCU board supports the Lua programming language, a lightweight, high-end, multilingual programming language. We use this message to provide the vehicle control code and use the Node MCU board to control the temperature. The Lua programming language has strong annotations based on integration and general expressions.

**Advantages Of Proposed System:**

They say that the robot doctor has many advantages for doctors, he can move anywhere at any time, he can move easily in the operating room, he can move around patients easily and he can move in other rooms as he wishes. It also saves doctors a lot of time. For patients, the system can easily communicate with doctors via phone calls, and patients can talk to doctors by appointment without long waiting times. Therefore, in many hospitals, we can use these robots to reduce the stress of doctors and the waiting time of patients.

**Objective:**

The purpose of the robot doctor is to improve medical care, improve patient outcomes, and support the work of doctors. Some of the main purposes of medical robots are as follows:

1. *Accurate diagnosis*: One of the main purposes of medical robots is to help diagnose diseases with high efficiency. Using advanced sensors, sensing capabilities and intelligence, robots can analyze patient data, medical history and symptoms to provide accurate and timely diagnosis.

2. *Telemedicine support*: Robotic doctors can expand medical services to underserved or remote areas through telemedicine. Its purpose is to provide telemedicine consultations, deliver medications, record vital signs, and provide appropriate treatment for patients unable to access essential medical facilities.

3. *Reduce workload and burnout:* Medical robots aim to reduce workload and prevent burnout by performing specific tasks and providing support to doctors. The goal is to allow doctors to focus directly on patient care and make difficult decisions.

4. *Increased efficiency*: Robots can work tirelessly without fatigue, which can improve the efficiency of medical tasks. They can assist medical professionals in various ways, such as preparing medications, managing medical records, and delivering supplies, allowing doctors and nurses to focus on more critical aspects of patient care

5. *Reduced infection risk:* Robots can be used in environments where there is a high risk of infection transmission, such as during the treatment of highly contagious diseases. Using robots in these scenarios helps protect medical personnel and prevents the spread of infections.

6. *Reduced healthcare costs:* By increasing efficiency and minimizing the need for certain human resources, doctor robots can potentially help in lowering healthcare costs. Shorter hospital stays, fewer medical errors, and improved patient outcomes can lead to cost savings for both patients and healthcare facilities

7. *Continuous monitoring:* Some doctor robots are designed to monitor patients continuously, gathering vital signs and other health-related data. This real-time monitoring can help detect changes in a patient's condition promptly, allowing medical professionals to intervene early and prevent complications.

**Limitations:** While the Doctor Robot Foundation has broad capabilities in healthcare, it has some limitations that need to be acknowledged and addressed. Some of the main limitations are: 1. *Cost and accessibility:* Medical robots can be very expensive to build and use, making them difficult to use in all medical facilities, especially in limited areas.

2. *Limited freedom:* Simple medical robots will need constant supervision and guidance from the surgeon, which will limit their independence and ability to do some work on their own.

3. *Maintenance and reliability:* The reliability and maintenance of medical robots are important.

**Conclusion:** In conclusion, the development of medical robots represents a breakthrough and revolution in healthcare. Our Doctor Robot project is a testament to the incredible potential of medical robots to shape the future of healthcare. We envision a world where these robots work hand-in-hand with intelligent medical teams, enhancing their capabilities and transforming patient care for the benefit of humans. With persistence and dedication, medical robots will greatly benefit healthcare and create a new era of efficiency, effectiveness and compassion.

**Future Enhancements:**

1. Future robots will also include blood pressure, ECG sensors, and oxygen sensors.

2. Robots can also be designed to control blood sugar.

3.The robot's tracking of the patient's position and automatically going to the patient without the help of a doctor simplifies the whole process.

4. These robots can be upgraded to virtual assistants that can remind patients to take their medication regularly and monitor them at all times.

5. Screening / laboratory tests can also be done on site and results can be sent directly to the doctor.

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