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IOT BASED VIRTUAL DOCTOR ROBOT

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Abstract: An IoT-based virtual doctor robot that is intended to improve healthcare administration is presented in this paper. The robot has capabilities including line-following, home automation, energy management, a medical box for supply management and a medical waste collection. A website is also being developed for online registration and data storage for patients. Using the unique identification on the website, patients can access their previous medical records. Using sensor measurements, online graphs of the body's temperature, pulse and other vital indicators are created. The measurement of sensors graphs supports the precise treatment that doctors provide. The proposed solution enhances patient care, and streamlines healthcare processes.

Keywords— *IoT (Internet of Things), Virtual doctor robot, Healthcare management, medical box management, Line-following robot, Data storage, Sensor-based monitoring*

1. INTRODUCTION

The healthcare sector is always changing and looking for new ways to enhance patient care and streamline healthcare administration procedures. The emergence of the IoT has created prospects for the integration of intelligent technologies into healthcare systems. The key issues in healthcare institutions that our proposed initiative seeks to address are effective supply management, the removal of medical waste, laundry collection, and patient data accessibility.

A virtual doctor robot for providing remote healthcare services by using the IoT technology and robotics is presented in [1]. [2] presents a system to collects real-time health data by using AI algorithms then provides diagnoses and medical advice. The under-standing of the technologies, challenges and opportunities associated with applying IoT in the context of smart healthcare in of key importance [3]. The waste management system implemented in universities using IoT technology and machine learning (ML). It aims is showcase the system's potential to optimize waste management processes, improve operational efficiency and contribute to a cleaner and greener university environment is discussed in [4]. M. Lucking and R. Manke successfully explained the decentralized patient-centric data management system that addresses the challenges of sharing IoT data streams. It aims to advocate for patient control, privacy and security in managing their health data and to provide a technical frame-work for implementing such a system [5]. The authors in [6] describe the development and application of a sensor-based system to monitor, analyze and visualize vital signs in the elder people. The authors designed IoT-based remote health monitoring system specifically for patients and elderly people. The system addresses the growing need for continuous monitoring and timely intervention in healthcare, especially for individuals who are unable to visit healthcare facilities regularly [7]. The potential benefits and applications of IoT technology is attracting the attention in enhancing the efficiency, accuracy and quality of healthcare monitoring [8]. The IoT-based system called "Corona Virus Disease (COVID)-safe" to automate health monitoring and surveillance in the post-pandemic life has positive impact on managing healthcare remotely [9]. Integration of IoT devices and sensors to capture critical patient data is a need of today [10].

This paper proposes an IOT based robot that incorporates a medical waste collection mechanism, automating the disposal of biomedical waste. By using this function, healthcare facilities can be made safer and more hygienic, reducing the risk of infections and improving the general wellbeing of both patients and employees. Furthermore, the project includes a laundry collection module that streamlines the collection. This feature boosts the effectiveness of laundry management and ensures that clean, easily accessible linens are provided for patient comfort and infection control. Also created a website that allows for online patient registration and data storage in order to improve patient involvement and easy smooth data management. Each patient is given a special identification that gives them access to their detailed medical records, which contain information on previous diagnoses, treatments, and test results. Additionally, the website offers live graphs of vital signs like temperature, and pulse.

2. SYSTEM DESIGN

The block diagram of proposed project shown in Figure 1 illustrates the overall architecture of the IoT-based virtual doctor robot system. The proposed block diagram displays the IoT-based virtual doctor robot's system architecture and component interactions. The project's hardware architecture is built to support the functioning and integration of numerous IoT-based virtual doctor robot components. The hardware parts make it possible for the system to run without interruption and effective healthcare management. The main components of the hardware architecture are as follows:

Pulse Sensor: The Pulse Sensor is a tool that captures a person's pulse and heart rate. It measures variations in blood volume in the earlobe or fingertip and provides real-time heart rate information.

Arduino Circuit: The brain this proposed work is a microcontroller platform called Arduino intended to program and manage various electronic parts. The interface and connectivity required for integrating and managing the many sensors and motors in the proposed work are provided by the Arduino circuit board.

A. Hardware architecture

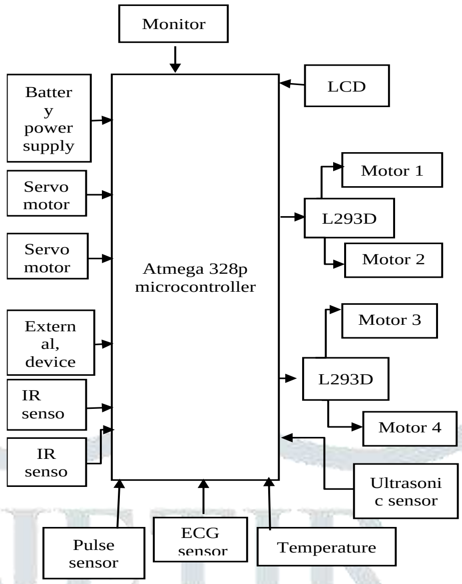

figure 1: Block diagram of the hardware architecture of a IOT based virtual doctor robot

Temperature Sensor: The MLX90614 ESF Sensor monitors the surface temperature of objects without making any physical contact with them. It employs infrared technology to measure thermal energy and transform it into electrical impulses so that project can monitor temperature.

IR sensor: The IR (Infrared) sensor is utilised for obstacle detection and proximity sensing. Its ability to generate and detect infrared signals enables the robot to recognise obstacles in its path and adjust its course accordingly.

Servo Motor: A servo motor is a specific kind of motor that enables exact control of an angle or linear position. It can rotate within a specific range of motion based on control signals received, making it ideal for controlling robotic limbs, grippers, or other mechanical components.

DC Motor: To provide rotational motion in robots, DC (Direct Current) motors are frequently utilised. They convert electrical energy into mechanical motion and can power wheels or other moving components on robot.

ECG Sensor: To track and document the electrical activity of the heart, an ECG (Electrocardiogram) Sensor is employed. It offers insightful data on the heart's rhythm and can be applied to identify irregularities or abnormalities.

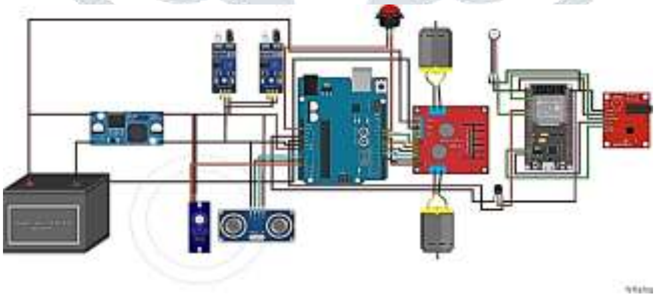

figure 2: Schematic diagram of the hardware architecture of a IOT based virtual doctor robot

Figure 2 displays the schematic diagram of the proposed doctor robot. The many parts and connections involved in an IoT-based virtual doctor robot are often depicted in a schematic diagram.

B. Software architecture.

The software part of proposed project involves use the Arduino IDE programming for the Arduino board. HTML for structuring the web pages. CSS for styling and enhancing the visual presentation of the web interface. Together, these software elements create a user-friendly online interface for patient registration and data display. Enable the control of hardware elements and guarantee smooth hardware and software integration for your IoT-based virtual doctor robot.

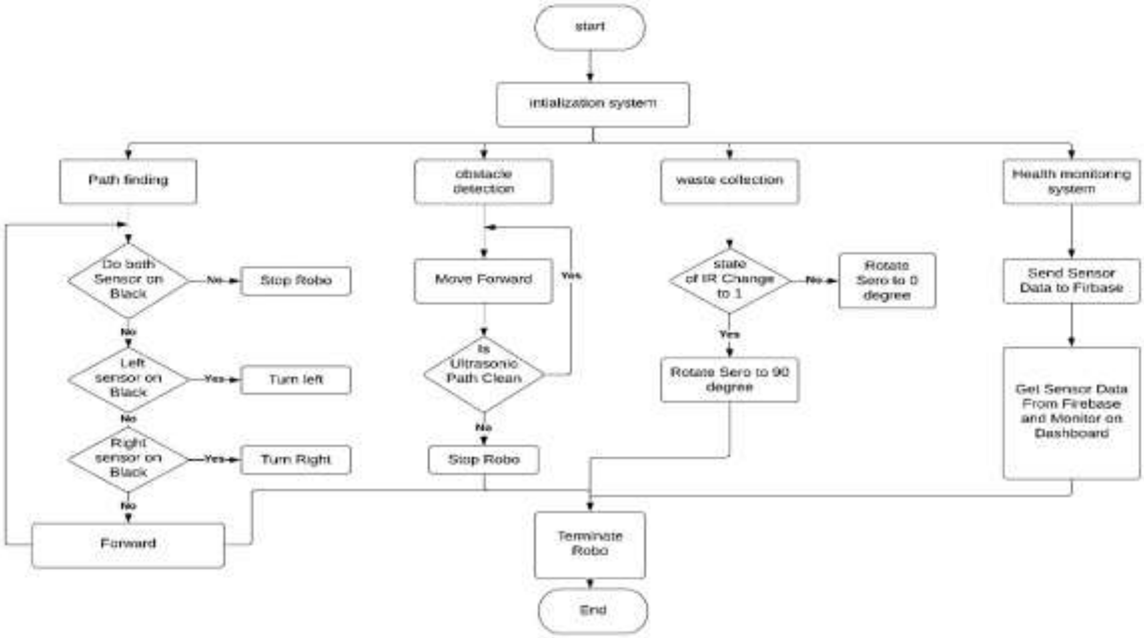

figure 3: flowchart of a IOT based virtual doctor robot

The IoT-based virtual doctor robot system's flow is shown in the Figure 3.

Start: The flow diagram begins with a start symbol, indicating the initiation of the hardware processes.

Sensor Data Acquisition: The first stage involves collecting data from the system's different sensors. This involves gathering information from the IR Sensor, MLX90614 ESF Sensor, ECG Sensor, and Pulse Sensor. Each sensor offers certain readings or values pertaining to body temperature, vital signs, and obstacle detection.

Data processing: The Arduino Circuit subsequently processes the collected sensor data. The Arduino Circuit makes use of its programming logic to collect and understand the relevant information from the sensor readings.

Patient Monitoring: The processed data is put to use for keeping track of patients. In order to evaluate the patient's health, this involves looking at vital signs like heart rate, pulse, and ECG readings. The temperature readings can also reveal information about the patient's body temperature.

Decision Making: The Arduino Circuit decides what to do next or starts the necessary activities based on the data that has been analysed. For instance, the system may generate notifications or alert medical personnel for immediate attention if the heart rate or temperature surpass predefined parameters.

Actuator Control: The Servo Motor and DC Motor receive control signals from the Arduino Circuit. In order to perform activities like collecting medical waste or interfacing with the medical box or laundry collection unit, the servo motor directs the movement of robotic arms or grippers. The robot may walk along a predetermined path or adhere to line marks because the DC Motor powers its wheels.

Feedback Loop: The system continuously monitors the environment and receives feedback from the IR Sensor, which detects obstacles or objects in the robot's path. This feedback allows the system to adapt its movement and avoid collisions.

End: The flow diagram closes, signifying that the hardware operations are finished.

Below figure 4 illustrating the body structure of the project (IOT based virtual doctor robot).

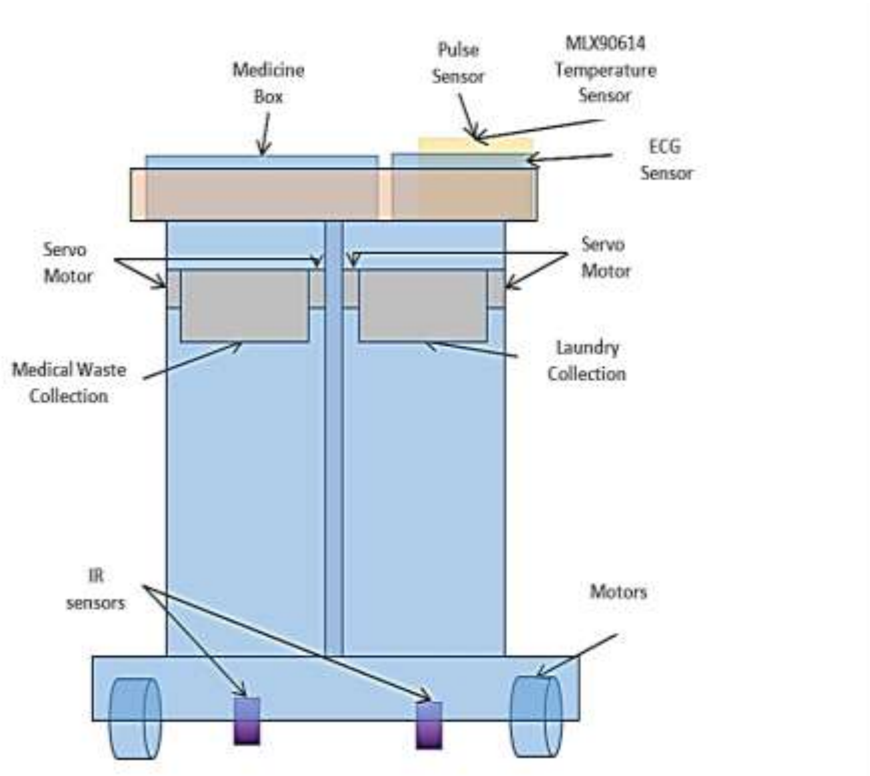

figure 4: Body structure of a IOT based virtual doctor robot

3. RESULT

In this section, proposed work offers the findings from our data analysis and experimentation, which were conducted to assess the performance and efficacy of our IoT-based virtual doctor robot. The proposed work goal was to create a comprehensive system that combines the capabilities of medical boxes, medical waste collection, laundry collection, and real-time sensor monitoring for patient health evaluation. We gained useful ideas and results through meticulous experimentation and analysis, which show the power and significance of our solution.

In order to gather information and evaluate the effectiveness of the virtual doctor robot, we carried out a number of carefully monitored tests in a hospital setting. To record vital signs and environmental characteristics, we equipped the robot with the essential sensors, such as the MLX90614 ESF Sensor, IR Sensor, ECG Sensor and Pulse Sensor. The Arduino Circuit acted as the main controller for the robot's actions and was programmed using the Arduino IDE. To capture a wide range of scenarios and patient conditions, we deployed the system for a considerable amount of time.

fig. 5 Home page.

Fig. 5 shows a screenshot of the home page for the AAS Hospital system. The service, contact and admin login pages are located on the home page. On those sites, users can obtain information about the hospital's services. A hospital schedule can be seen on the home page. It also has an emergency phone number.

fig. 6 Service Page

In Fig. 6, the Service Page is shown. Users can get information on this page about services like child care, personal care, CT scans, Alzheimer's illness, joint replacement and examination and diagnosis. This website contains more information about the hospital departments.

fig. 7 Login page.

The sign-in page is shown in Figure 7. This page allows users who have previously registered to log in. Otherwise, unregistered users can create their accounts by selecting the "Create a New Account" option. There is a lost password option in case a user forgets their password.

fig. 8 Registration Page

Fig. 8 shows the Registration Page. A new user can set up their own account on this website. The form will ask for the user's full name, address, phone number, email address and password. Make an account next. Then user's acknowledgment is shown.

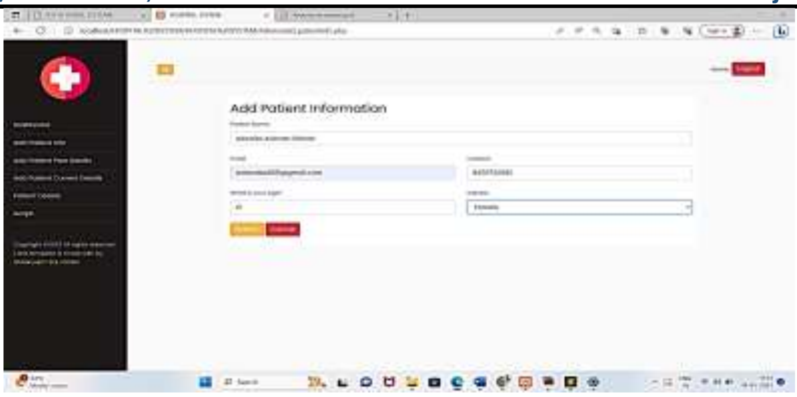

fig. 9 Tab to Add Patient Information page

Fig. 9 shows the page Tab to Add Patient Information. When a user logs in, this page loads. The user fills out the form's remaining fields like patient names, addresses, patient IDs, previous information and other data that users provide on this page. Then simply click the submit button.

fig.10 Graph page

The proposed project's graph page is depicted in Fig. 10. Users can view a graph of the three distinct sensors' tests on that page. The doctor will use that to capture environmental details and vital signs.

fig.11 Final Hardware of project

Fig. 11 shows the project's finished hardware. The overall Hardware layout of the "IOT based virtual doctor robot" is depicted in the picture. It is made up of numerous related parts and gadgets. Such as, sensors, DC motors, servo motors, batteries, Arduino circuit boards, and plywood.

CONCLUSION

A concept that has the potential to change healthcare is an IoT-based virtual doctor robot that offers patients effective and specialized medical care. The robot gathers patient vital sign data using IoT sensors and send it to the cloud for analysis. The robot offers a diagnosis, recommend additional testing, and recommend medicine.

By allowing the robot to undertake routine check-ups and consultations, this plan can significantly decrease the load for medical professionals, allowing them to concentrate on essential cases. Additionally, the robot can deliver medical care to disadvantaged and isolated locations where access to healthcare is poor.

The precision and dependability of the sensors and the confidentiality and security of the patient's data are just a few of the variables that will determine whether this project is a success or a failure.

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