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Robotic Assembly for Healthcare

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Abstract – *In the current scenario the communicable diseases are spreading at an alarming rate, the health workers and nurses are exposed to a risky atmosphere due to frequent exposure with patients and thereby getting infected. Due to the alarming situation nursers are supposed to work beyond their work shift thereby increasing work load and strain. Also, those patients who have undergone bone marrow transplantation should be kept in isolation for three months and the chance of getting infected is higher. Therefore, the robot plays an important role in overcoming these healthcare issues.*

The project consists of three units – Robot, Pass box and a temperature sensing unit. The robot picks the food, medicine etc. from pass box with the help of gripper and delivers it to the patient. Thus, with the help of the robot, a safe communication can be established between the patients and health workers.

Keywords: **Ultraviolet (UV), NodeMicroControllerUnit (NodeMCU), Light Emitting Diode (LED).**

1.INTRODUCTION

The communicable diseases such as COVID-19 has led to a global pandemic and the health of doctors, nurses as well as the patients are at very high risk. The patients who have undergone bone marrow transplantation are also at higher risk of getting infected. The robot aims at transfer of medicines food etc to patients who are suffering from communicable diseases and undergoing bone marrow transplant. By using the robot, we can reduce the interaction between the patient and the nurses thereby reducing spread of communicable diseases. It helps reduce the workload of nurses, doctors etc thereby making it easy to handle each patient safely. This also ensures a protection for patients who are prone to infections.

The robotic system consists of three units – Robot, Pass box and a temperature sensing unit. The pass box consists of a doctors' door unit and a patient's door unit. The food or medicine is placed in the pass box by the doctor through doctors' door and after UV sterilization the robot picks either the food or medicine from patient's door according to the command of the patient. The temperature sensing unit is used to monitor the patient's temperature and if the temperature exceeds, he normal value, the doctor is alerted with the help of push bullet.

This paper is organized as follows. In section 2, we explain the methodology of the healthcare robotic system focusing on the block diagram of the system. In section 3, we present the results and discussions consisting of hardware implementation. Finally, we conclude this paper on section 4.

2. METHODOLOGY

2.1 Passbox

The pass box is provided on the wall of the patient's room with two doors , one on the patient side and other outside on the patient's room . The medication or food to be transported to the patient is given to one end of the pass box (doctors' door) , then the path is sanitized by UV light and is passed to the other end of the pass box (patient's door) . The sterilization will continue for sometime which is indicated by the LED and after sterilization the robot picks food and medicine from the pass box and deliver it to the patient .

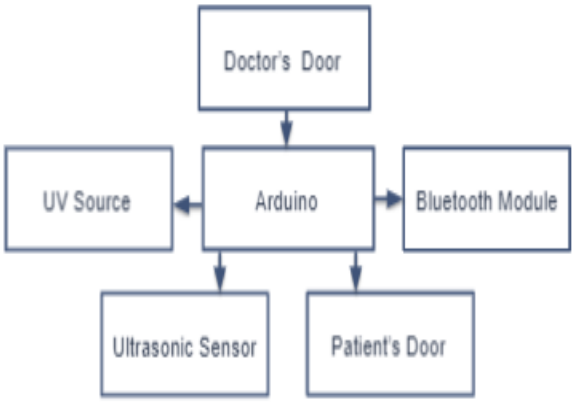

Fig: 2. 1 Block diagram of Pass box

2.2 Robot

The robot is controlled using raspberry pie and the movement of the robot is through motor wheel arrangement. Machine learning is used to determine the path of the robot using Tensor flow lite algorithm. The ultrasonic sensor is used to detect the obstacles in front of the robot during its movement and it takes another path to avoid the obstacle. Camera and mic are used for image processing in order to identify whether the collected object from pass box is food or medicine. The gripper is used to pick the object from

passbox and place it on the patient's table. The robot is powered by 12V DC supply

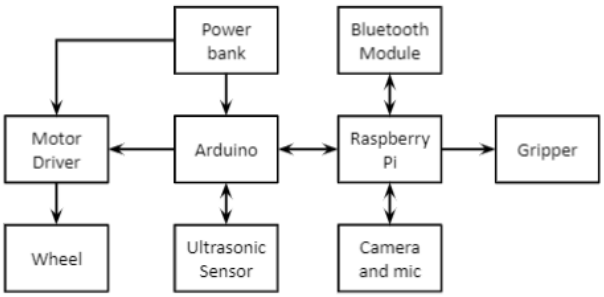

Fig:2. 2 Block diagram of Robot

2.3 Temperature Sensing Unit

The temperature sensing unit monitors the temperature of the patient through temperature sensor. If the temperature measured exceeds the normal level, it sends an alert to the doctor with the help of push bullet service. ESP8266(NodeMCU) is used as the microcontroller of the temperature sensing unit which is powered by an external power supply.

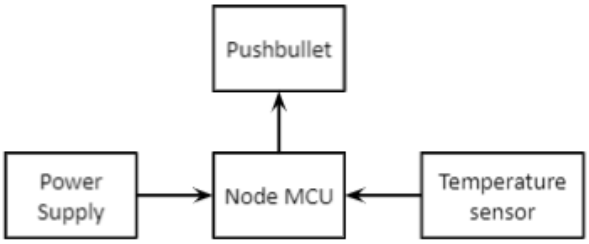

Fig:2. 3 Block diagram of temperature sensing unit

3. RESULTS AND DISCUSSIONS

3.1 Hardware implementation

The hardware implementation started with the framework of pass box as shown in **Fig:3.1.1** . Here the bottom portion acts as the platform for placing the medicines , food etc which is build using GI sheet . The structure is constructed using steel rods .

Fig:3.1. 1 Framework of Pass box

The temperature sensing unit has a simple arrangement consisting of a NodeMCU and temperature sensor. The temperature sensing unit is powered by an external power supply. The temperature sensing unit is shown in **Fig:3.1.2** The temperature sensor comes in contact with the patient's skin in order to measure the temperature of the patient. The patient alone can measure their own temperature whenever necessary.

Fig:3.1. 2 Temperature Sensing Unit

The robot chassis has been assembled using various components . The motor wheel arrangement has been provided for the movement of the robot . Ultrasonic sensors have been placed for the obstacle detection **. Fig :3.1.3** shows the robot chassis .

Fig: 3.1. 3 Robot chassis

3.2 Push Bullet Notification

Here we use Push Bullet service in emergency situations where temperature of the patient exceeds the normal temperature. Immediately a notification is sent to the doctors' phone in order to alert them and thus necessary help can be provided to the patient. The **Fig:3.2.1** shows the Push Bullet service app when the temperature is below 37°C that is no notification will be sent to the doctors' phone. The **Fig:3.2.2** shows the Push Bullet service app when the temperature is above 37°C that is the notifications will be sent to the doctor's phone along with the temperature readings.

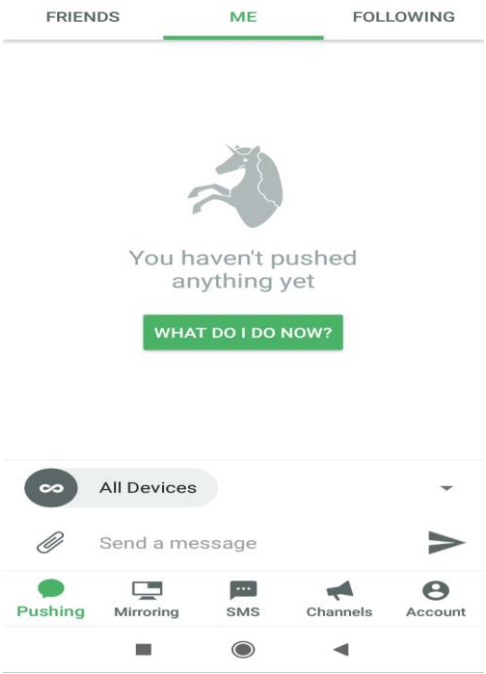

Fig:3.2. 1 Temperature below 37°C

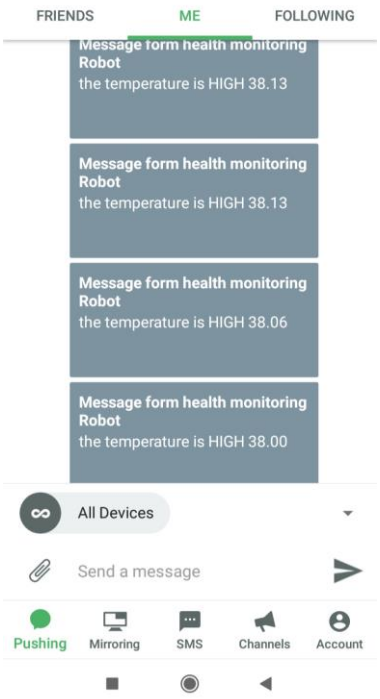

Fig: 3.2. 2 Temperature above 37°C

4. CONCLUSIONS

We developed a healthcare robot system for healthcare environments to save time and reduce the workload of medical staffs. In this pandemic, the healthcare robot is of great importance to the medical field. The robotic system is simple to build and implement and also reduces the cost with future advancements. Further modifications can be made on the system for future purposes such as displaying patients details as well as their medical requirements on a screen mounted on the system. So, this will be beneficial socially and economically for the society of the present and future.

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