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Design and Fabrication of Medicine Delivery Robots for Hospitals

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ABSTRACT: This paper presents a designing and fabrication of drug delivery robots for hospitals. Automation is a field which is spearing its branches almost in all service-oriented fields which is now extended in the field of medicine. This paper aims at designing a robot for delivering the pile in order to alternate the nursing service. Our nursing robot find the path using line following method which identifies the track with the help of two infrared proximity sensor and using RFID cards identifies the room number of the patient and it uses a ultrasonic sensor for identifying the locked rooms and uses a voice play back kit that can be used to speak to patients about the medicine. It can also monitor the pressure and temperature levels of the patient and record it in the hospital patient database by incorporating a pressure and temperature sensor in it which is an added advantage in this model. This objective is achieved by designing and developing a Bluetooth controlled robot car built using the Arduino Uno microcontroller and equipped with a spare smartphone whose camera will be used to provide live feed to the application developed using MIT App Inventor. The robot is equipped with tray that allows the medicines to be delivered with an ease to the patients from a safe distance.

I.INTRODUCTION

With the ever-increasing rise in the number of daily covid-19 positive cases in India, which is more than to 1,00,000 as of 10-06-2021, there is a need to control the spreading of the virus especially among the doctors and the medical staff because they are our life saviours. This bot will prevent the virus from spreading from the infected patients to the nurses or doctors when they must visit the patient just for delivering medicines as it is a fully contactless system. The main aim of the project is to develop and design a Bluetooth controlled robot car which can be controlled from a distance of at least 50 feet which the help of an application running on a smartphone [1]. The basic idea is to develop an unmanned robot car using Arduino Uno Microcontroller which has an onboard ATMega328P integrated circuit (IC) which has a medicine tray attached on top of it and is equipped with a camera so that it can be controlled very easily from a distance of at least 50 feet away using a mobile application. The bot also has an ultrasonic distance sensor which sends the real-time distance to the same mobile application which makes the operator aware of the dynamic obstacles around it. This project can be further extended by connecting it to the internet and adding artificial intelligence to it. This can be done by running algorithms on a Raspberry Pi or other microprocessor.

Robotics is a technology which is wide spreading these days almost in all the fields starting from the complex rocket technology to monitoring the crop in the field of agriculture. In this paper we use the technology robotics in finding the alternative for the human resource for doing simple services in hospitals such as robots for intimating the patients to take medicine of to take their food properly in proper interval and to deliver the pills based on the doctor's recommendation to the patient. Nowadays hospitals are overcrowded due to increase in lots of new disease. Shortage of the human resource is a notable bottle neck.

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Delivering pills to the patient of one ward in a daily basis would take around half to one hour. But delivering a pill is not a big task which can be automated. This was the motivation behind for developing this paper. But hospital is a composite environment which is composed of various activities such as Laboratories, scan centre, emergency ward, outpatient ward and general ward. Hence designing a robot is a tough task in order to operate in that complex environment. Here the movement and finding the path to the patient's location is done through a line follower concept and with a RF id Tag, similarly to identify the obstacles a module based on ultrasonic sensor is employed. Here we us an audio playback system module which will give a voice intimation to the patient for alerting about the medicines. As an added advantage we have incorporated two sensors one is the pressure sensor and the other one is temperature sensor which monitors the patient's body parameters and and will be recorded in the hospital patient database through IoT. Thus our paper limits the difficulties and drawbacks in the hospital environment and increases its functional efficiency through our design with hardware development and sensor integration. The rest of the paper is organized as follows, in discusses about the existing methods available in hospitals and their drawbacks, the proposed system with hardware architecture and sensor interfacing are introduced. And in the end results and discussions with future enhancement.

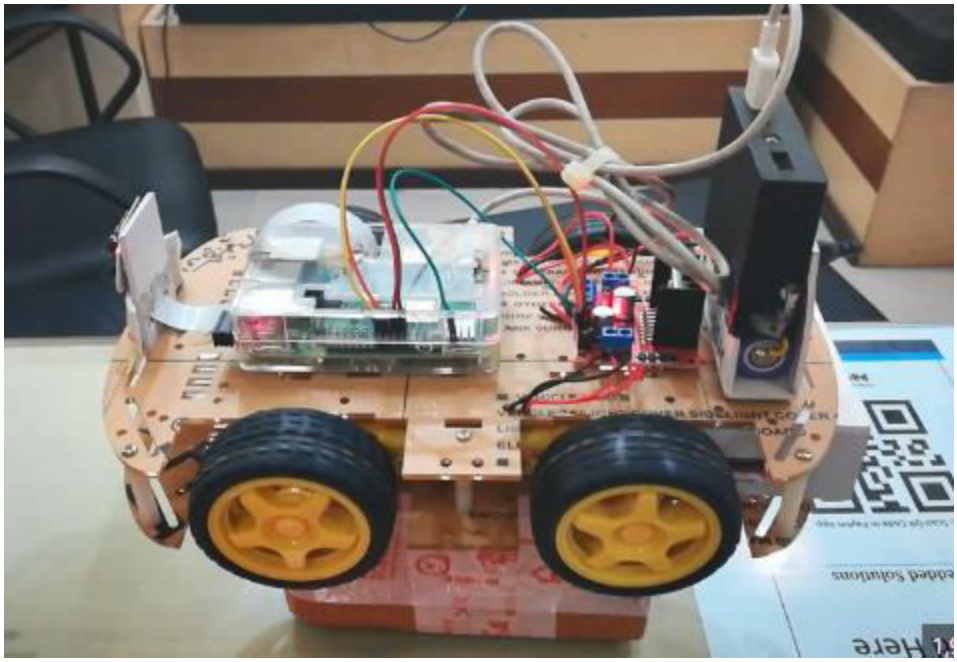

Figure 1: Raspberry Pi Surveillance Robot

II.LITERATURE REVIEW

KavitaSatale, et.al.,[1] Proposed a design & implementation of Nursing Robot, the components used are ATmeg2560microcontroller, L298N, DC motor. The system is able to efficiently and accurately picking and placing of medicines at correct patients using suitable path planning algorithm. As we know that robotics is an emerging technology it need more research and development.

Miran Lee, et.al.,[2] To investigate the necessity and feasibility of care training assistant robots in care education, uses Dynamixel XM-430-W350- R, servo motors. Two 6-axis force sensors PFS303YA301, the reducing human errors, reducing costs associated with labor, and improving output efficiency has led to adoption of robotics in assembly lines, agriculture, packaging, and recently health care.

Xi Vincent Wang, et.al.,[3]Proposed the robots are expected to be progressively more autonomous, flexible, and cooperative in the post-pandemic world. Regarding future research trends, the technologies underneath are suggested to enhance robotics research in the intra- and post-pandemic era.

ShuoTian, et.al.,[4] Proposed the Smart healthcare that can facilitate better health self-management, uses IoT, mobile Internet, cloud computing, big data, 5G, microelectronics, and artificial intelligence, Currently, smart healthcare lacks macro guidance and programmatic documents, which leads to unclear development goals and ultimately a waste of resources.

Erwin Loh, et.al.,[5] Proposed the different medical specialties, and discusses the current strengths as well as challenges, AI has now been shown to be as effective as humans in the diagnosis of various medical conditions, and in some cases, more effective. AI researchers are already developing AI algorithms that are able to learn, grow and mature like human beings do, through self-reflection.

Leo Louis, et.al.,[6] Proposed the Exploring the working principle and applications of an Arduino board, uses Arduino, Microcontroller, Hardware, Software, Open-source platform, VLSI, Sensors. Arduino is an open source microcontroller which can be easily programmed, erased and reprogrammed at any instant of time, though it is an open source microcontroller, easily programmed, it is used for limited applications.

Krishna ChaitanyaKodur, et.al.,[7] Proposed the Robotic nursing aid, it uses 7-DoFs robotic arm equipped with a 2-finger gripper, Intel RealSense D435i camera, laser. Robot system that is capable of assisting users with walking and is tele operated in an easy and intuitive manner. An impedance control strategy in conjunction with model predictive control to ensure an optimal control strategy that keeps the robot within a strict distance and matched velocity to the patient.

Amit Kumar Pandey, et.al.,[8] To create a social robot, it uses motor/sensor board and the internal computer, and communications device Class-Ethernet control model is used on a universal serial bus cable between the tablet and the CPU, we can transfer a program or a module from one robot to the other. To achieve future success for such general-purpose sociable robots, there is still a long way to go. Such machines must behave in a socially accepted and expected manner.

Meir Nitzan, et.al.,[9] To estimate the oxygen saturation of the blood and the pulse rate. Uses pulse oximetry, photo plethysmography, Monitoring oxygen saturation over time, Alerting to dangerously low oxygen levels, particularly in newborns. Low peripheral perfusion due to low cardiac output or vasoconstriction interfere with accurate detection of arterial pulsations.

Maria Kyrarini, et.al.,[10] The open challenges healthcare robots face to be integrated into our society, healthcare; robotics; care robots; nursing robots; hospital robots; assistive robots, It helps elderly or disable people. commercially available robots are expensive and the cost does not allow the ubiquitous use of robots.

III.METHODOLOGY OF PROPOSED

Robotics is a field which is a combination of electronics and mechanical Engineering. This field was invented to substitute the human and to replicate their actions. Involving robots in various environments are very common these days. Here we propose an efficient and cost effective method of involving robotics as a substitute of nurse in hospital environment which is the basic requirement for a good hospital. For designing a robot we need motors, controllers, driver circuits for running a motor.

Line tracing robot follows a line either a black or white line. The line follower robot that can able to detect colored line drawn on the floor with the help of IR proximity sensor. Here we have designed an Atmega 2560 based line tracing robot. The main principle is to detect the non reflective colored line on the floor and move along that line. Robot senses a non reflective colored line by using Infrared sensors and sends a signal to Atmega 2560. Then L293D motor driver, drives the motor according to sensors output. In this research there are two IR proximity sensors are which are placed in front in left and right side of the chassis when both left and right sensor faces a reflective colored surface robot move forward.

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After building and making all the connections, the robot is loaded with medicines and is controlled from a safe distance of 50 feet at the minimum.The live feed from the camera on the bot is transmitted wirelessly to the application running on the mobile phone [13]. The ultrasonic sensor measures the distance of the dynamic objects at the back of the bot and sends the distance to the applications so that the LED or the buzzer could be activated to alert the people.

The application is built using an open-source platform called "MIT App Inventor". It is a graphic programming environment which allows the user to create an application using drag and drop method. The application is then coded using coding blocks which makes it very easy to use for beginners as well as children.

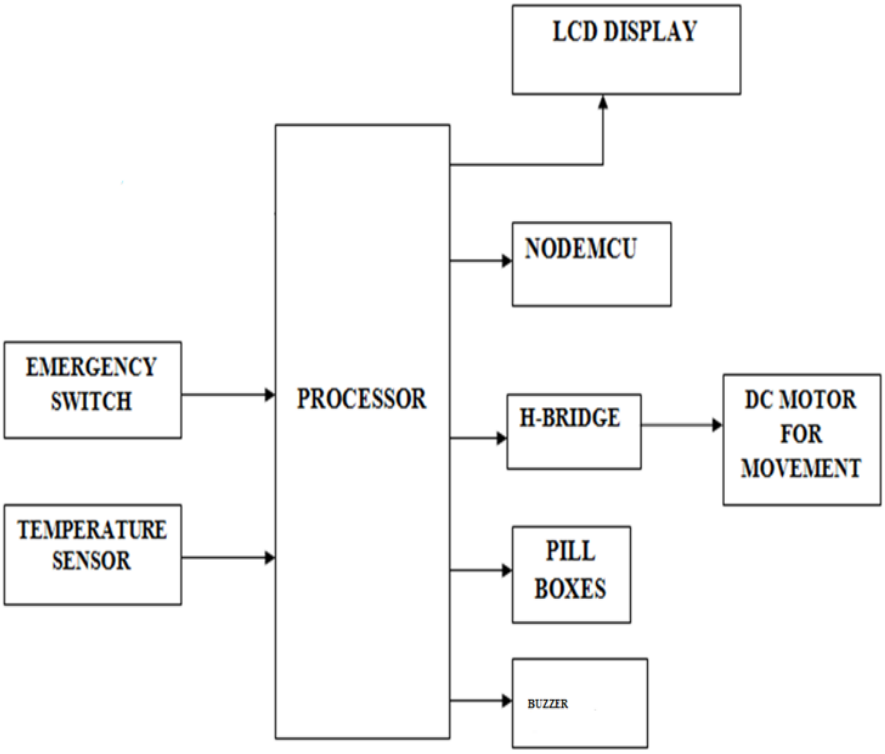

Figure 2:BlockDesign and Fabrication of Medicine Delivery Robots

IV.RESULTS AND DISCUSSION

As it is obvious, robots do not require masks, can work for long periods of time without sacrificing productivity, are easily disinfect able, and do not become ill. As a result, and other similar robots can be employed on every hospital floor or ward to reduce unwanted contact with isolated patients. This will limit the number of cases of covid19 among doctors and medical personnel, who require the most protection to save lives. As a result, medical robots like these can save and protect people's lives. With the use of rechargeable batteries, the robot can serve up to 12 hours a day and 2-hour recharge time.

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There will be multiple trays available in robot each for particular time and for particular patient which will be controlled by a IR sensor after picking the tablet the IR sensor place in the concern tray detects the activity only then the robot moves back to its original position for the next activity. A L293D motor driver module and relays are used to control the wheel directions. As an added advantage the model consists of a temperature and heart rate sensor attached to the robot through an ESP8266 module the recorded parameters will be stored in the patient database for doctors reference.

Figure 3: Results of the hardware implementation

V.CONCLUSION AND FUTURE SCOPE

The Nursing Robot will help the patient to take the medicine at the correct time. Based on timing, the robot will move from one place to another place. It tracks the path by an IR sensor and detects each room by RFID. Since DC motor is used for movement of the robot, so it can move in four directions without any constraints. If any obstacle is there it can recognize easily by the Obstacle IR sensors. It moves to the next room by the line follower concept. Our proposed system is interfaced with sensors which enhance the patient caring level in the hospital with the help of IoT technology. We can implement this caring robot in the hospital for remaining the patients about their medicines without human interventions. Various health organizations throughout the world according to Microsoft, have produced many artificial intelligence (AI) chatbots and self-assessment bots, reaching out to over 18 million people and sending over 160 million messages. Similarly, robots like MedBuddy may be able to save patients as well as medical personnel from this fatal sickness. Sales of these robots and AI-assisted bots have exploded, and analysts predict that this trend will continue in the future.

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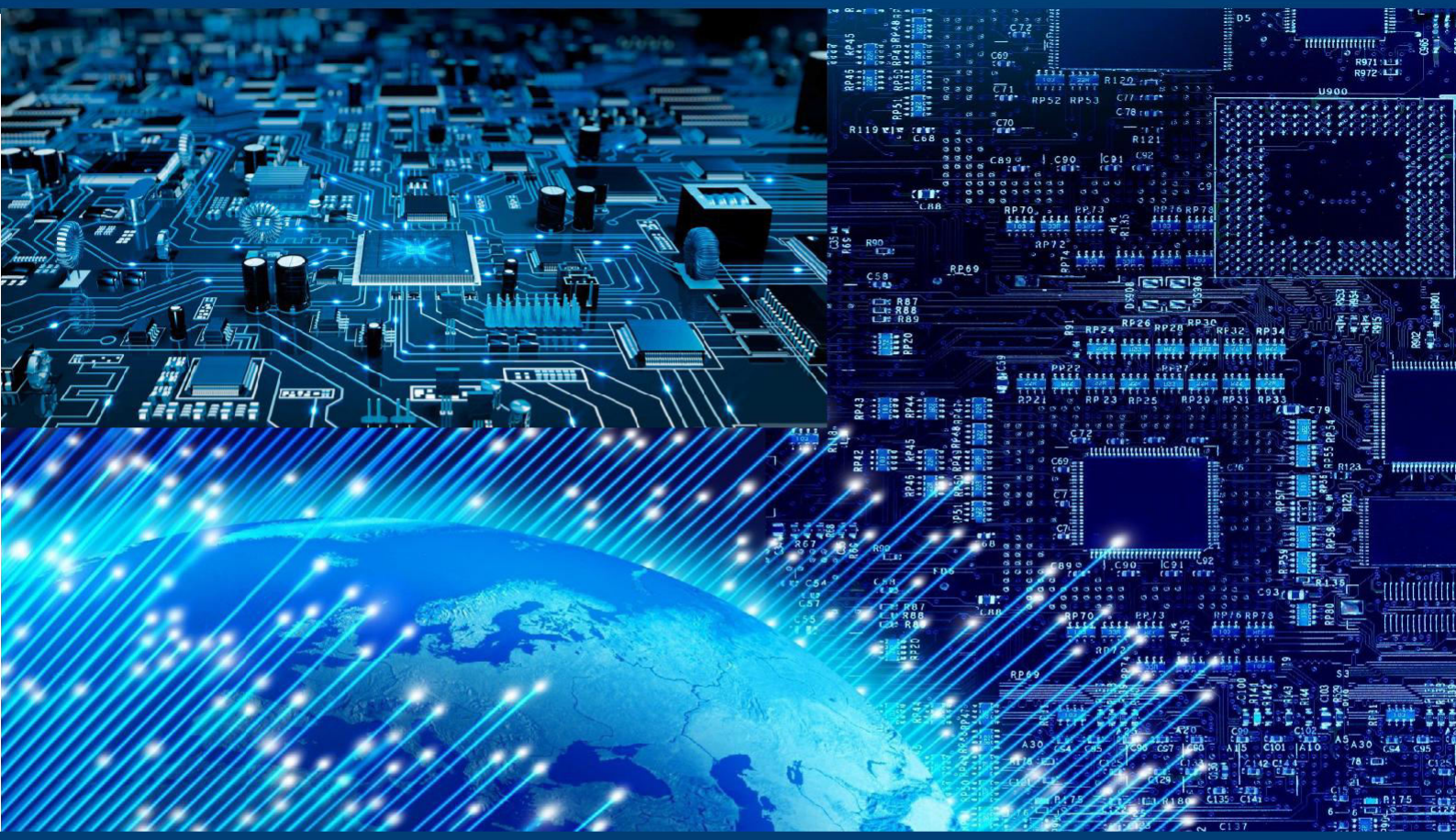

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