IoT Based Robot for Quarantine Hospitals (IRQH)

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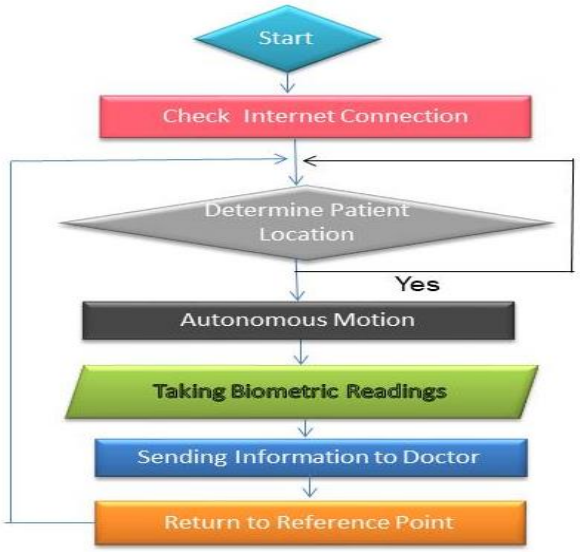
Abstract– ***IoT technology is used to make the connection between patient's details that have been reading from sensors and doctor's control unit. The robot goes to a specific room that is set to it by doctor's controller by using Line Track technique. Upon reaching the specified location, the robot takes the patient's vital readings and displays them on the patient's webpage in control room to modify and update the history database of this patient. Doctors make interaction with the patient through Video streaming connection and give command to the robot for opening dedicated drawers inside it which allow the patient to take the medicine intended for his condition without direct contact with doctors. In addition to the presence of self-sterilization to reduce the spread of the virus***

I. *Introduction*

Covid-19 is one of wide range of viruses that may cause disease to animals and humanity. It causes humans to die due to respiratory failure. Covid-19 was not unique but there were many of its family that appeared several years ago such as the Middle East Respiratory Syndromer Mers and severe acute respiratory syndrome (SARS) [1]. There was no knowledge of the presence and disease of this new virus before it began to spread in the city of Wuhan China in December 2019 for Covid-19 now has turned into a pandemic that effects on many countries of the world. The virus causes an accompanying set of complications such as fever, fatigue and dry cough [2]. Many medical crews and doctors are vulnerable to injury and lose their life because of Covid-19 phenomenon. an autonomous robot is the best solution to limit direct interaction between doctors and patients. So it reduces the Covid-19 infection probability for the medical team in quarantine hospitals. IoT technology is the only way to connect the robot with the main controller (the doctor). It is used to control the movement and direction position destination by the controller unit. It also used to connect the robot with different measuring devices as well as the doctor's control website. Also using line tracking technology to reach a specific point via GPS system and avoiding obstacles (Autonomously). In addition to using a built-in system to automatically operate and sterilize the robot. In this paper, fight the spread of the covid-19 Pandemic by using smart robot in quarantine hospitals are discussed. Section II discusses the proposed system flow chart and architecture. In section III and IV, algorithms used in the paper and the hardware components are introduced respectively. Finally, section V discusses the conclusion of this work.

II. *System-Flowchart and architecture*



The project consists of two mainly systems one of them is autonomous system which is responsible for the movement of the robot from the starting point to the patient's room. It consists of three main techniques: Line tracking, Navigation system, and Mapping. The other system is medical service which consists of: Wi-Fi-module, PIC controller unit, reading sensors and using Web-page. Many programming languages are used such as HTML, C-language, CSS Java-script and Proteus.

III. *Algorithm for Autonomous system*

Line tracking is a very important technique in the world of robotics as it gives to the robot movement autonomously and ease implement navigation scheme [3]. As you can see in figure (1), a line sensor is composed of a number of cells. Each cell is composed of a sender and a receiver. The particularity of this sender/receiver pair, is that it sends light that shall be reflected by the line to be detected but not by the eventually opaque background surrounding this line. Any sender/receiver pair that is able to make a difference between a line and the rest of ground (of a different colour) can be used in a line sensor.

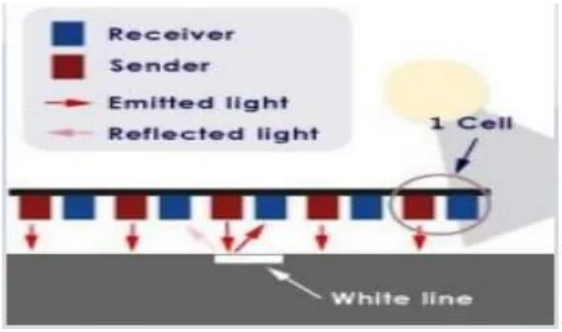


Fig.1 Line Tracking Sensor Algorithm

Fig.2 Line Tracking Sensor

Line Tracking uses IR sensors to locate robot position in environment (Map) [4]. The line tracking sensor works by detecting reflected light coming from its own infrared LED and by measuring the amount of reflected infrared light, it can detect transitions from light to dark (lines) or even objects directly in front it. For line sensing operation, IR sensors are the one which are widely used for the development of a line follower robot. These robots usually use an array of IR (infrared) sensors shown in figure (2) in order to calculate the reflectance of the surface beneath them. The basic criteria are that the black line has a lesser reflectance value (black absorbs light) than the lighter surface around it as shown in figure (3). Figure 4 shows automatically adjusted of the movement in the event of deviation from the map, through the IR sensor.

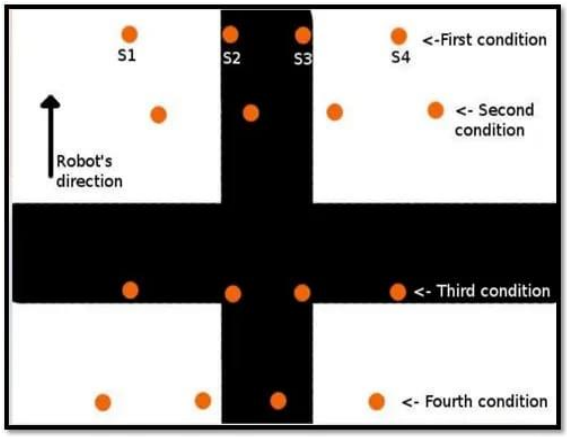


Fig.3 Sensor detection lighter surface

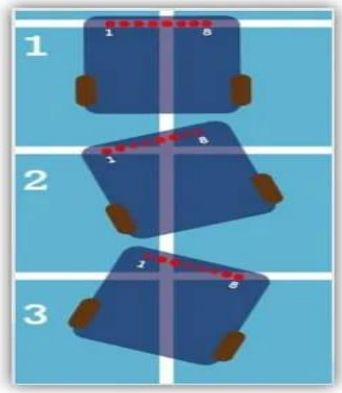


Fig.4 Movement adjustable technique.

The graph of the robot is either continuous or discrete. The nail in which the robot sends the site in the environment (map) every second or less, but the discrete sends its position every longer time period (minute spectrum) in this robot the Discrete graph was used where it sends its site every minute to update its position on the map constantly [5]. In this method, we use the intersection points to determine where the robot in the arena by line following sensor kit, through the numbering of intersection points (X, Y) as shown in figure (5).

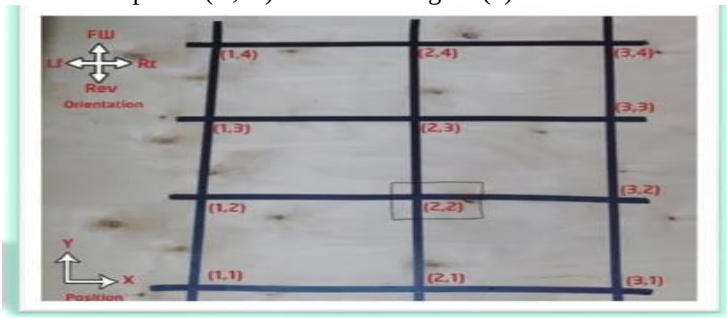


Fig.5 Mapping points intersection

All cases that robot will move on its environment (the hospital) and Identified his motion are studied in every case. They are eight just cases that can robot move based them. We noticed some basics in robot movements to perform these cases in best X and Y are points in the environment (Hospital) that represent every single point X, Y is a Room.

IV. *Algorithm for Medical system*

The second part of our project is Medical system. The doctor has specified for specified position and takes the biometric readings from the patient and reaches the doctor via the internet using Database [6]. The medical system consists of three main units: (Wi-Fi-module, PIC connection and Web server). The programming languages are used: C-language, PHP and My soul. The robot is supported by a set of sensors used to read the patient's condition, such as temperature, heart rate and pressure of the patient. The temperature sensor shown in figure (6) operating voltage equals 5 volts, take data as Analog signal and detected by Analog to digital converter ADC.

Fig.6 Temperature Sensor

Fig.7 Pulse Rate Sensor

Pulse Rate Sensor is also used to measure the patient's heart rate as shown in figure (7). It's operating voltage at 5 volts and current 4mA with digital Input signal and digital Output [7][8]. All data detection from reading sensors is sent through the controller (pic) to the esb server. Data send at from pic by using UART module TX pin and waiting for ESP response using RX pin if Wi-Fi send data which pic make interrupt and save this data is array which can save 800 char and check if this data in WIFI response then pic can send anther WIFI command and so on. finally, ESP will be configuration as ap and switch now we can send data to PhP page shown in figure (8) to store this data my SQL table xampp and create another Web page shown in figure (8) to access on xampp data base this page will show value of medical sensors each 10 second.

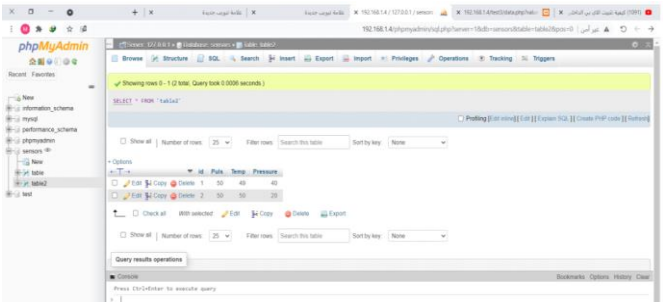


Fig.7 PhP- page.

Fig.8 Web- page.

After taking the various readings, the doctor diagnoses the patient's condition, and from here the tray designated for the medication necessary for his condition is opened [9]. And after each use, there is a feature inside the robot, which is self-sterilization to limit the spread of the virus. The robot is equipped with a video streaming ESP32 camera shown in figure (9) to allow the doctor to follow the patient's condition and contact the doctor, in addition to photographing the robot's movement path the module solid work shape of our robot is shown in figure (10). All circuits have been applied on PCB board shown in figure (11).

Fig.8 ESP32 Camera

Fig.10 Solid work

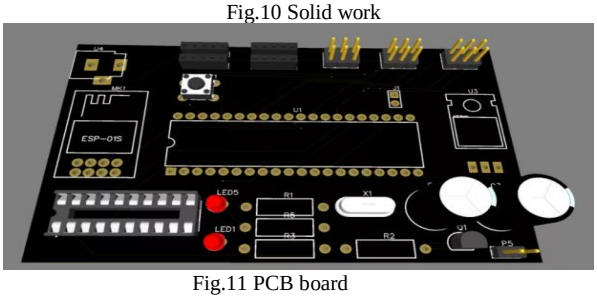


Fig.11 PCB board

V. *CONCLUSION*

Our project able to reduce the infection probability for the medical team in quarantine Hospitals. It can also limit direct interaction with doctors and patients, by implementing autonomous robot to provide medical care for patients by transporting medicines and food to rooms. The robot provides continuous measurement and follow up of vital rates such as; temperature, blood pressure, oxygen percentage in blood, and heart rate to enable the medical stuff to communicate with patients through video streaming technology.

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