

DEVELOPMENT OF FIRE FIGHTING ROBOT (QROB)

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ABSTRACT : Fire incident is a disaster that can potentially cause the loss of life, property damage and permanent disability to the affected victim. They can also suffer from prolonged psychological and trauma. Fire fighters are primarily tasked to handle fire incidents, but they are often exposed to higher risks when extinguishing fire, especially in hazardous environments such as in nuclear power plants, petroleum refineries and gas tanks. They are also faced with other difficulties, particularly if fire occurs in narrow and restricted places, as it is necessary to explore the ruins of buildings and obstacles to extinguish the fire and save the victim. With high barriers and risks in fire extinguishment operations, technological innovations can be utilized to assist firefighting. QRob is programmed to find the fire location and stop at maximum distance from the fire. A human operator can monitor the robot by using a camera which connects to a smartphone or remote devices.

(keywords:Aurdino UNO, Motor driver, Camera, Buzzer)

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INTRODUCTION

A robot is an automated device which performs functions usually attributed to humans or machines tasked with a repetitive or flexible set of actions. Numerous studies have shown that robots can be beneficial in medicine rehabilitation, rescue operation and industry. Over the years, robotics has been introduced in various industries. The industrial robots are multi-function manipulators designed for more specialized materials, divisions, gadgets or devices through various programmatic movements to perform various tasks. In line with the Fourth Industrial Revolution, there is demand for a one system that can control, communicate and integrate different robots regardless of their types and specifications. Machine learning has also heated up interest in robotics, although only a portion of recent development in robotics can be associated with machine learning. Recent robotic development project has embedded machine learning algorithms to increase the intelligence in robots. This will increase the productivity in industry while reducing the cost and electronic waste in a long run. Studies on the use of humanoid robots are actively carried out to minimize firefighters' injuries and deaths as well as increasing productivity, safety, efficiency and quality of the task given Robot can be divided into several groups such as Tele-robots, Telepresence robots, Mobile robots, Autonomous robots and Androids robots. Tele presence robots are similar to a tele-robot with the main difference of providing feedback from video, sound and other data. Hence, tele-presence robots are widely used in many fields requiring monitoring capability, such as in child nursery and education, and in improving older adult's social and daily activities. Mobile robots are designed to navigate and carry out tasks with the intervention of human beings. Meanwhile, autonomous robots can perform the task independently and receive the power from the environment, as opposed to android robots which are built to mimic humans.

HARDWARE CONNECTIONS

The electronic part is one of the vital parts in the development of Q Rob. It includes several types of sensors, microcontroller, DC motor with wheel, Transmitter and Remote control and Water pump. The figure shows the block diagram of the Q Rob operation which consists of a flame sensor and ultrasonic sensor as input pins will detect exact wavelength of different light.

Flame Sensor Connection

- ✓ The Q Rob will not react when the sensor not activates and the Q Rob will react when the sensor activates as well.
- ✓ This sensor is connecting with DC motor.
- ✓ This sensor OFF when fire was not detected and DC motor and Ultrasonic Sensor ON.
- ✓ This sensor ON when fire is detected, then DC motor and Ultrasonic Sensor will automatically OFF. When Flame Sensor = 1; DC Motor = 0, Ultrasonic Sensor = 0. When Flame Sensor = 0;

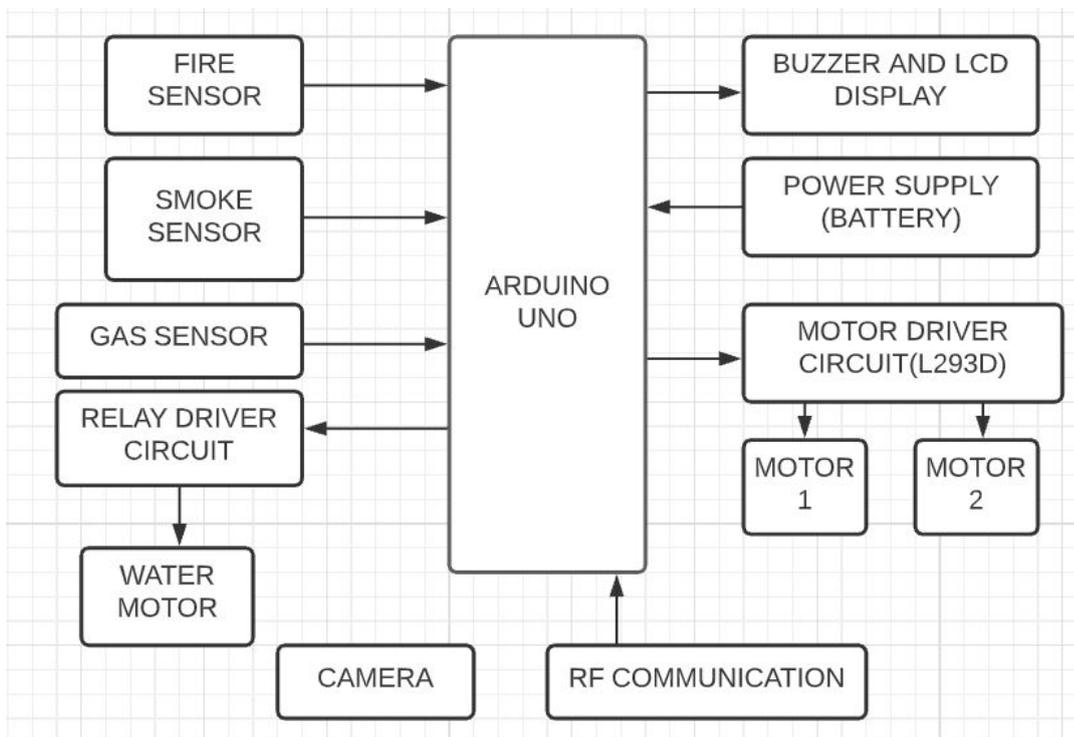


Fig.1. Block diagram of Fire Fighting Robot (Q ROB)

The transmitting frequency is 315 MHz / 433MHz. By utilizing the transmitter and remote control, Q Rob can be controlled from distant places where the operator who controls it will be in a safe place while the robot will enter into a dangerous fire area.

METHODOLOGY

Ultrasonic sensor: One of the most crucial aspects in inventing an autonomous target detection robot is a barrier and obstacle avoidance. A sensor must be compact, low cost, simple to produce and functional on a larger scale. Moreover, it should be able to sense things with enough limits to let robots react and travel appropriately.

DC motor with wheel: DC geared motor with rubber wheel is suitable material for this project. This DC motor is suitable to replace 2 WD and 4 WD car chassis. The working voltage for the DC motor is around 5V to 10 V DC. While the ratio of the gear is 48:1. Suitable current for this motor is 73.2 mA. DC motor is used to move the robot to the fire location.

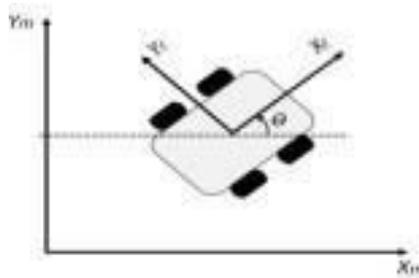


Fig.2.Relationship between Q Rob coordinate plane with main surface plane.

RESULT

Firefighting robot (Q Rob) has been developed to find the location of fire and extinguish it.

Q Rob has an ability to find the location by using flame sensor and ultrasonic sensor. The flame sensor is functioning to sense the location of fire while ultrasonic sensor is functioning to detect the presence of object around the Q Rob. Both sensors are connected to Arduino Uno, which controlled the movement of DC motor. When flame sensor found the fire, the DC motor will stop at 40 cm from the fire. The operator will be extinguishing the fire using remote control from the distance. The operator also can monitor the Q Rob by using camera that connects to a smartphone.

CONCLUSION

Overall, a fire-fighting robot that can be controlled from some distance has been successfully developed. It has advantageous features such as the ability to detect location of fire automatically besides having a compact body and lightweight structure. Q Rob also has the ability to avoid hitting any obstacle or surrounding objects due to its provision of an ultrasonic sensor. The Q Rob robot can be used at a place that has a small entrance or in small spaces because it has a compact structure. The operator is able to extinguish fire using remote control from a longer distance. Operators can also monitor the environmental conditions during the process of firefighting by using the camera that is connected to the smartphone. From the experimental results, the robot can sense smoke and fire accurately in a short time. As a conclusion, the project entitled “Development of Fire Fighting Robot (Q Rob)” has achieved its aim and objective successfully.

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