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Autonomous Fire Fighting Robot Using Arduino

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Abstract: *A fire outbreak is a hazardous act that leads to numerous consequences. Detecting a fire at an early stage and extinguishing it can aid in prevention of various accidents. Till now we rely on human resource. This often leads to risking the life of that person. Therefore, fire security becomes an important aspect to save human lives. In this a fire extinguishing robot has been proposed and designed which detects the fire location and extinguish fire by using sprinklers on triggering the pump. This robot uses flame sensors for accurate fire detection. This proposed model of Fire Extinguishing Robot using Arduino used to detect presence of fire and extinguishing it automatically without any human interference. It contains gear motors and motor driver to control the movement of robot when it detects any presence of fire and will automatically start the water pump to extinguish that fire breakout. This model robot has a water ejector which is capable of ejecting water at the fire breakout place. The water ejector pipe can be move towards the required direction using servo motor. The whole operation is controlled by an Arduino UNO. Fire-fighting is an important but dangerous occupation. A fire-fighter must be able to reach the situation quickly and safely extinguish the fire, preventing further damage and reduce fatalities. Technology has come to rescue this issue, fire-fighters and machines are now having more efficient and effective method of fire fighting. This is gives you the design idea of fire fighting robot using autonomous operation. The robotic vehicle is loaded with fire extinguisher and a water pump which is controlled over solenoid valve to throw water. An Arduino UNO is a is used for the desired operation. A water tank and fire extinguisher setup along with water pump is mounted on the robot body and its operation is carried out from the output through appropriate signal from the sensor. The whole operation is controlled by an Arduino UNO.*

Keywords: Fire Fighting Robot

I. INTRODUCTION

This advanced firefighting robotic system independently detects and extinguishes fire. In the age of technology, the world is slowly turning towards the automated system and self-travelling vehicles, fire fighters are constantly at a risk of losing their life.

Fire spreads rapidly if it is not controlled. In case of a gas leakage there even may be an explosion. So, in order to overcome this issue, safe guard live of our hero, our system comes to the rescue.

This firefighting robotic system is powered by Arduino Uno development board it consists of the HC-SR04 ultra-sonic sensor mounted on a servo motor for obstacles detection and free path navigation, it is also equipped with the FIRE, flame sensor for detecting and approaching fire it also makes use of water tank and spray mechanism for extinguishing the fire. Water spraying nozzle is mounted on servo motor to cover maximum area.

It will automatically detect the fire with the help of flame sensors. Once it detects the fire breakout location, it navigates itself accordingly to reach the fire source and extinguishes the fire by using built-in fire extinguishing system.

For fire detection it is using flame sensors. First one for the left direction, second one for the forward direction and third one for the right direction. Fire extinguishing system will get activated when fire detection system detects fire. It then reaches the breakout point and water pump will start ejecting the water when it detects fire. The key features of this system is to provide surveillance of fire so that major fire accidents can be prevented and loss of human lives gets minimized

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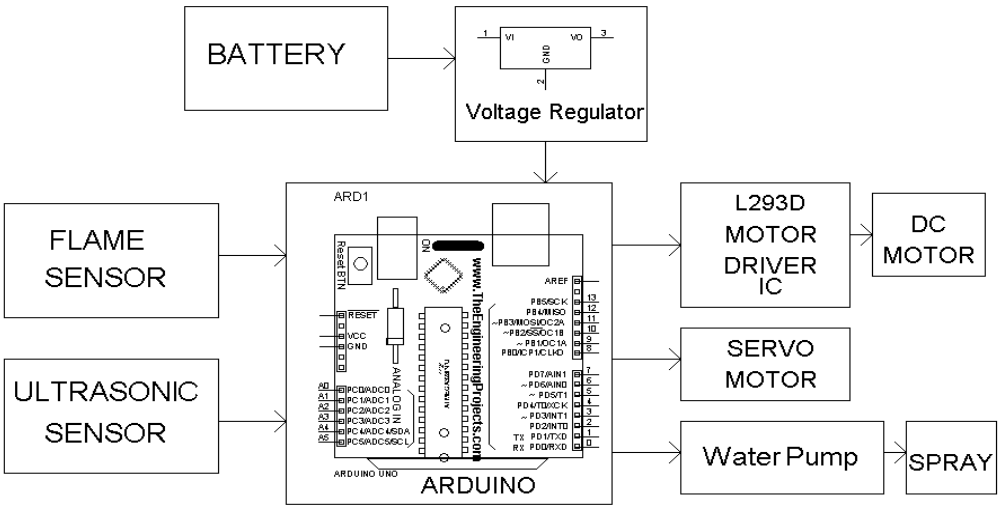
II. APPARATUS REQUIRED

SL.NO	APPARATUS	QUANTITY	TYPE	RATING
1	Arduino	01		
2	Voltage Regulator	01		5V
3	L293D Motor Driver IC	01	Switching Device	
4	DC Motor	01		9V 5V-3A
5	Ultrasonic Sensor	01		
6	Servo Motor	01		180 degrees
7	Water Pump	01		3V-6V
8	Battery	01		
9	Spray	01		
10	Arduino UNO	01		
11	Eagle	01		

III. BLOCK DIAGRAM



IV. METHODOLOGY

This fire fighting robotic system is powered by Arduino Uno development board it consists of the ultra-sonic sensor mounted on a servo motor for obstacles detection and free path navigation, it is also equipped with the fire flame sensor for detecting and approaching fire it also makes use of water tank and spray mechanism for extinguishing the fire. Water spraying nozzle is mounted on servo motor to cover maximum area. Water is pumped from the main water tank to the water nozzle with the help of 12V pump. This water pump needs driver circuit as it consumes a lot of current, much more than the controller provides. As you can see these sensors have an IR Receiver (Photodiode) which is used to detect the fire. How is this possible? When fire burns it emits a small amount of Infra-red light, this light will be received by the IR receiver on the sensor module. Then we use an Op-Amp to check for change in voltage across the IR Receiver, so that if a fire is detected the output pin (DO) will give 0V(LOW) and if the is no fire the output pin will be 5V(HIGH). So, we place three such sensors in three directions of the robot to sense on which direction the fire is burning. We detect the direction of the fire we can use the motors to move near the fire by driving our motors through the L293D module. When near a fire we have to put it out using water. Using a small container we can carry water, a 5V pump is also placed in the container and the whole container is placed on top of a servo motor so that we can control the direction in which the water has to be sprayed.

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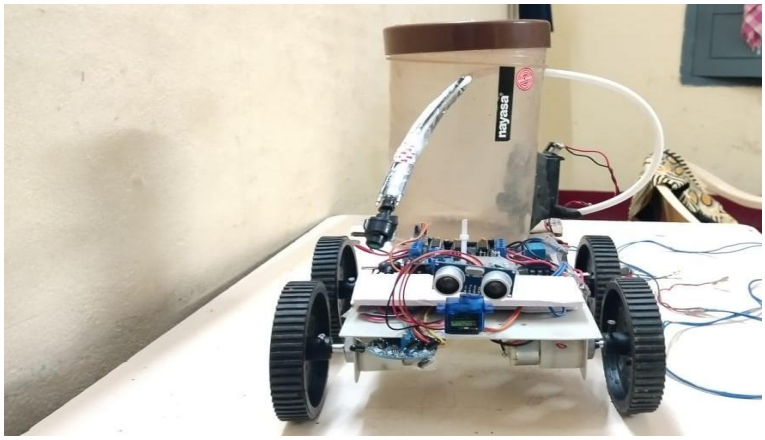

Fig 2. Image displaying

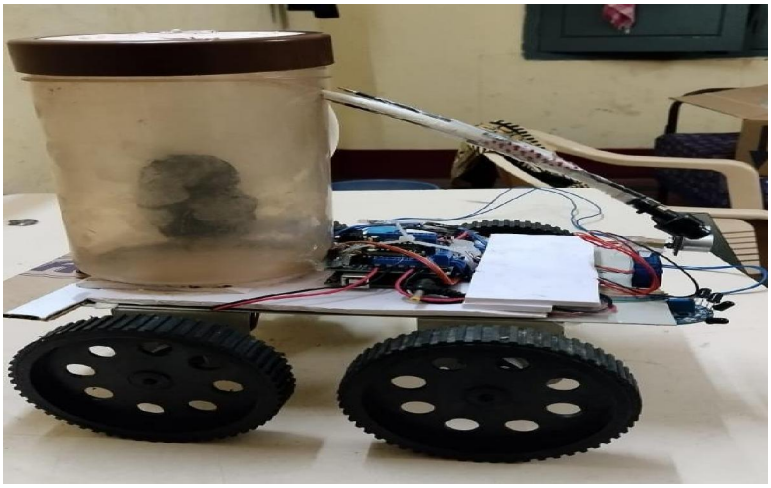

Fig 3. Figure displaying analyses result

IV. ADVANTAGES

- This firefighting robotic system is powered by Arduino Uno.
- Development board it consists of the HC-SR04 ultra-sonic sensor.
- Mounted on a servo motor for obstacles detection and free path navigation, it is also equipped with the fire flame sensor for detecting and approaching fire it also makes use of water tank

V. APPLICATIONS

- It is used in hazardous places.
- Useful in controlling fire at extreme places where human being cannot reach

VI. CONCLUSION

The Robot when detects fire, it moves on its own. Arduino will control the motor through the motor driver circuit. To rotate to either right or left direction, one motor will remain off and other one will move, thus resulting in rotation of the body. If Arduino flame sensor will detect the fire then the robot will move forward to the fire slowly. Here, algorithm is written such that it makes a slow approach of the robot towards fire. As soon as it detects fire, robot needs to stop at a certain limit and should not run over the fire. If it sensor output is greater than threshold value, it stops and moves back slightly to accommodate extinguishing. Then centrifugal pump throws water at fire to put it out. Fire extinguisher is also provided to put out fire

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