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Arduino Fire Fighting Robot with SMS & Call Alert

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ABSTRACT: Fire incidents are disasters that can potentially lead to the loss of life and property. It can also lead to a temporal or permanent disability for the affected victim. The primary duty of fire-fighters is to handle fire incidents, which often exposed them to high risks when carrying out the task of extinguishing fire, especially in the hazardous area. This study presents the development of a fire extinguishing robot with SMS & Call alert feature that can raise an alarm to notify occupants of the building, send an alert SMS message & a Call to a registered phone number, and also proceed to extinguish the fire unattended. It is designed to be compact to ease movement into narrow spaces. The robot is equipped with an ultrasonic sensor to avoid collision with any obstacle and objects in the surrounding, while the flame sensor alongside a smoke sensor, was used to detect the fire. This developed autonomous system demonstrates capabilities of identifying fire locations automatically and extinguishing the fire using the stored mixture in the container placed on it.

KEYWORDS: Arduino UNO, Fire Fighting Robot, SMS, Call Alert, Flame sensor, Smoke sensor, etc.

I. INTRODUCTION

Robots with different features, which are facilitated by different sensors that detect before the fire is out, every day, aims to develop microcontroller-based firefighting robot, nowadays the robot industry becomes visible as a model that is produced as an alternative to the human element in a new branch. Flying robots, wheeled robots, legged robots, humanoid robots, and underwater robots are some kinds of them. The growing world population is bringing involuntary problems together. Among all the problems Fires most important. The robotic industry has a lot of work in this area. Some of these are fixed mobile fire search and rescue equipment, mobile locating robots used for fire detection, and fire extinguishing robots in many different models designed to help firefighters in the fire. During the design and development of the mechanical system; draft drawings, measurements, computer-aided design, and solid modeling programs. The robot designed in the study was able to detect fire sources randomly placed in random obstacle areas and extinguished with determined fire extinguishing systems, randomly placed in random obstacle areas and extinguished with determined fire extinguishing systems.

II. RELATED WORK

According to National Crime Records Bureau (NCRB), it is estimated that more than 1.2 lakh deaths have been caused because of fire accidents in India from 2010-2014. Even though there are a lot of precautions taken for Fire accidents, these natural/man-made disasters do occur now and then. In the event of a fire breakout, to rescue people and put out the fire we are forced to use human resources which are not safe. With the advancement of technology especially in robotics it is very much possible to replace humans with robots for fighting the fire. This would improve the efficiency of firefighters and would also prevent them from risking human lives.



A fire outbreak is a hazardous activity that leads to numerous consequences. Detecting a fire at an early stage and extinguishing it can aid in the prevention of various accidents. Till now we rely on human resources. 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 extinguishes the fire by using sprinklers on triggering the pump. This robot uses flame sensors for accurate fire detection. This proposed model of a Fire Extinguishing Robot using Arduino is used to detect the presence of fire and extinguish it automatically without any human interference. It contains gear motors and motor drivers to control the movement of the 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 moved in the required direction using a servo motor. The whole operation is controlled by an Arduino UNO.

Firefighting is an important but dangerous occupation. A firefighter must be able to reach the situation quickly and safely extinguish the fire, preventing further damage and reducing fatalities. Technology has come to rescue this issue, firefighters and machines are now having more efficient and effective methods of firefighting. This gives you the design idea of a fire-fighting robot using autonomous operation. The robotic vehicle is loaded with a fire extinguisher and a water pump which is controlled over the solenoid valve to throw water. An Arduino UNO is used for the desired operation. A water tank and fire extinguisher set up along with a water pump are mounted on the robot body and its operation is carried out from the output through the appropriate signal from the sensor. The whole operation is controlled by an Arduino UNO.

III. METHODOLOGY

The main brain of this project is Arduino, but to sense fire we use the fire sensor module (flame sensor). When fire burns it emits a small amount of Infrared light, this light will be received by the IR receiver on the sensor module. So, we place three such sensors in the direction of the robot to sense in 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 L293 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 & 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.

TABLE 1. COMPONENTS OF PROJECT

Equipment	Quantity
Arduino UNO	1
Sim 800L	1
Flame sensor	1
MQ2 sensor	1
L293 motor driver	1
Relay module	1
LM 2596 buck converter	1
Servo sg 90	1
Mini water pump (5V)	1
BO motor wheel	4
18650 battery	3
Mini breadboard	1
Jumper wires	As required

Fig.1. show the block diagram for the implementation of the robot which has been followed through this whole capstone project journey.



FIG- 1. BLOCK DIAGRAM

IV. EXPERIMENTAL RESULTS

In this project, we will learn how to build a simple robot using Arduino that could move towards the fire and pump out water around it to put down the fire. It is a very simple robot that would teach us the underlying concept of robotics; you would be able to build more sophisticated robots once you understand the following basics. So let's get started. 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-traveling vehicles, firefighters are constantly at 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, and safeguard lives of our heroes, our system comes to the rescue.

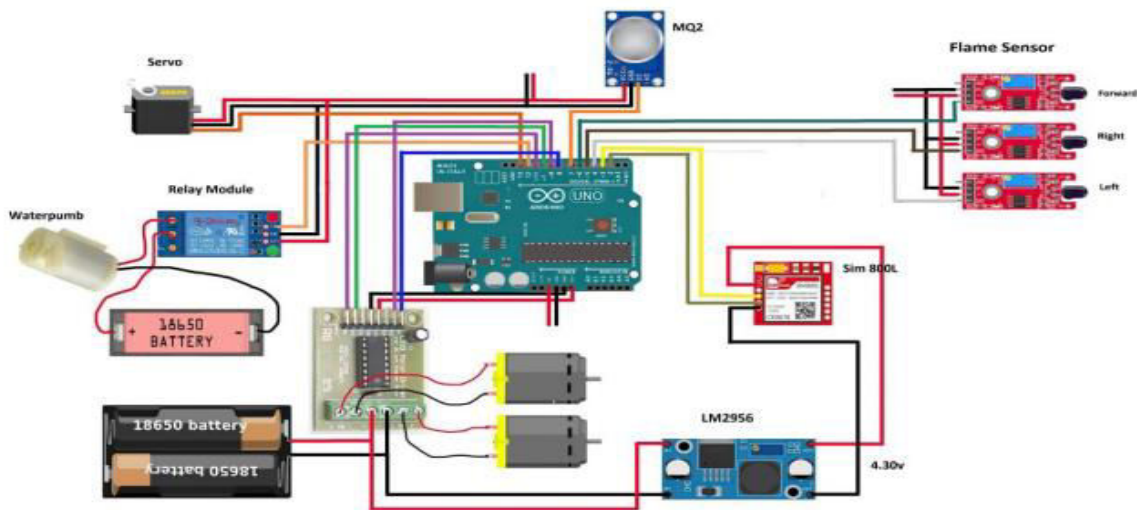
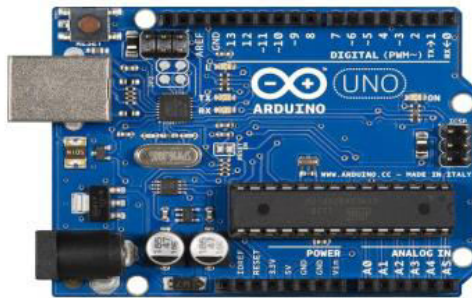


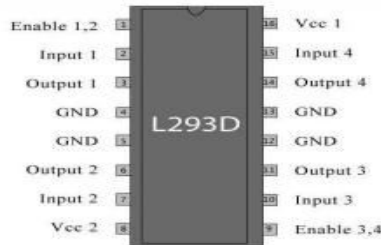
Fig 2. System Architecture

In this section, we briefly review the related work on Arduino firefighting robots and their different components.

Arduino: Arduino is a hardware & Software Company that designs & manufactures single-board micro-controllers. The Arduino language is merely a set of C/C++ functions that can be called from your code



L293D motor driver IC: A motor driver is an integrated circuit chip that is usually used to control motors in autonomous robots. The motor driver acts as an interface between Arduino & the motors. These ICs are designed to control 2 DC motors simultaneously.



Smoke Detector Unit: The smoke detector used in this design is the MQ2 gas sensor, they are used in detecting leakage of gas such as LPG, natural gas, town gas, cooking fumes, and cigarette in homes and industries.



Infrared (IR) flame sensor: IR sensors like all other photos - sensor works on the principle that a photon of sufficient energy can knock out electrons leading to a change in the resistance of the circuit. The flame sensor, shown in Figure 5, can be used to detect fire sources or other light sources of the wavelength in the range of 760 nm - 1100 nm.



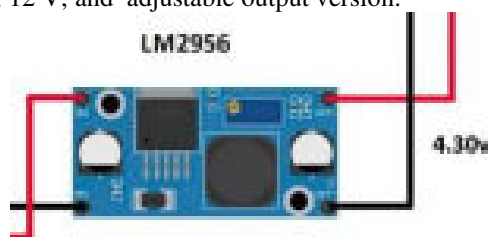
Servo motor (SG90): A servo motor is an electrical device that can push or rotate an object with great precision. If we want to rotate an object at some specific angles or distance, then we use a servo motor. It is made up of a simple motor that runs through a servo mechanism. The position of a servo motor is decided by an electrical pulse and its circuitry is placed beside the motor. Servo Motors are used in applications where very high precision motion is required like assembly robots, computer numeric controls, etc. Servo can rotate approximately 180 degrees.



Relay module: A power relay module is an electrical switch that is operated by an electromagnet. The electromagnet is activated by a separate low-power signal from a microcontroller. When activated, the electromagnet pulls to either open or close an electrical circuit.



LM 2596 buck converter: DC-DC Buck converter step-down module LM2596 power supply is a step-down (buck) switching regulator, capable of driving a 3-A load with excellent line & load regulation. These devices are available in fixed output voltages of 3.3 V, 5 V, 12 V, and adjustable output version.



GSM Module: SIM800L Module is a small GSM/GPRS Module and ideal for small ideal projects. The module supports a quad-band GSM/GPRS network, available for SMS and GPRS message data remote transmission. SIM800L is more advanced than its previous SIM900 modules. This module is responsible for sending the SMS alert to a predefined mobile number.



V. CONCLUSION

The development of an autonomous firefighting system with SMS & Call alert feature has been developed and implemented. This study has therefore provided a solution to the problem of a sudden fire outbreak by developing an extinguishing robot for a fire outbreak. The sensors used in this design can sense both gas leakages and fire with high sensitivity. In the case of a fire outbreak, the system is designed to work for three hours provided the lithium-ion battery is fully charged.

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