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AUTONOMOUS FIRE EXTINGUISHER

¹Rutika Kamthe, ²Shivani Khadtar, ³Ganesh Pawade, ⁴Omkar Kudale
UG Students, Computer Science, P K Technical Campus, Pune, India
Prof. S. R. Bhujbal
Professor, Computer Science, P K Technical Campus, Pune, India

Abstract: The most common causes of fire incidents are misbehaving and carelessness in handling fire implemented tools, things as well as some electronic devices and gadgets. Gas cylinders are the most average cause of Fire in India. Fire Fighting is an important job but it is a very dangerous occupation. Due to this, our project is designed to find a fire and control it before it rages out of control. This project is about automatic fire extinguishing techniques. This robot has features like object detection, flames detection, a fire extinguishing system and, an advanced live monitoring and notification sending system. This fire extinguisher must run automatically, avoiding obstacles and at the same time find and track flames and extinguish them. For object detection ultrasonic sensor is used and for flame detection flame sensor is used. A water pump is used to sprinkle the water on fire.

Keywords: IoT, Fire Extinguisher, Object detection, Autonomous robot, Flame Detection, Robotics.

I. INTRODUCTION

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 to 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. The robot is defined as a mechanical design that is capable of performing human tasks or behaving in a human-like manner. This would improve the efficiency of firefighters and would also prevent them from risking human lives. So, we implement an Autonomous Fire Extinguisher robot using Arduino, which will automatically sense the fire and start the water pump.

Due to this robot, the operation of firefighters is done very easily and effectively. It could be used to work with firefighters to reduce the risk of injury to victims. The development is consisting of three elements which are hardware, software, and programming. We aim to design a robot capable of detecting and suppressing fires. By designing and implementing an autonomous robot capable of detecting and extinguishing flames, disasters can be avoided with minimal risk to human life. In this paper, we illustrate an autonomous robot capable of detecting flames indoors and take an action towards the flame to extinguish it with the help of a water tank. To achieve the best performance with effective implementation, we have taken a modular design strategy, where the robot is divided into several logical modules based on functionality.

This robot has 2 DC Motors for Driving System, a Fire sensor for flame detection, an ultrasonic sensor for object detection, and a water tank with a pump to extinguish the fire. For the live video streaming, we use a camera module and for notification, we used a wi-fi microchip. For the programming part, C and C++ languages are used to determine the robot action gain from the sensor's input.

The microcontroller used is ATmega328. A motor driver is used to control two DC motors. This motor driver acts as an interface between Arduino and the motors. These ICs are designed to control these DC motors simultaneously. The servo can rotate approximately 180 degrees (90 degrees in each direction). An ultrasonic sensor uses a single ultrasonic element for both emission and reception. As mentioned above, this is the overall hardware representation of the model.

According to the National Fire Protection Association, there were 29,130 injuries reported while fighting the fire in 2015. These injuries are also coupled with 68 on-duty deaths. Injuries and casualties are the reason why safety professionals, the government, and high-tech companies have come together to create firefighting robots that can perform tasks too risky for people[9].

II. LITERATURE SURVEY

Several pieces of work exist on the quantification of the environmental impact of fire, but there is a need to pull this information together and to identify the technical gaps that still exist [1]. Fire outbursts affect the environment very dangerously and hazardously and it takes a very long time to recover. It damages the overall healthy environment. The effects of fire disasters include many deaths of plants, animals, and human beings. There is also a very powerful impact of fire accidents on the economy of a particular country. It causes the emission of toxic gases and pollutants into the environment and makes it polluted. Everyone has to understand and determine what are the hazardous impacts of fire disasters and aware of them.

To avoid large-scale fire disasters a lot of factors must be taken into account in regards to general safety. However, fire accidents are not so easy to take down quickly. The difference in environment and difficulty in solving the accident leads to volatility, uncertainty, and ambiguity of information available. So, parts such as fire prevention, quality of works, the quickness of firefighters, the safety and time taken to make decisions. Also, the effectiveness and safety of the workers is the most vital

task which can be improvised by safety and making the decision quickly. The authors give the layout of the complexity of the situation for firefighters at the work in an emergency.

Artificial intelligence can play an important role in managing fire outbursts. AI has been achieving various goals in many industries [3]. AI machines are developed in such a way that they can reduce human interaction in many activities. That's why AI is now becoming very essential for future development industries. The service of firefighters is very difficult and challenging as they have to rescue many people from massive fires. AI helps to minimize the difficulties of firefighters during rescue operations. Various AI machines are designed to help firefighters to extinguish massive fires and rescue people.

The mobile robot is designed to navigate and carry out tasks with the intervention of human beings [4]. But automatic fire fighting robots work independently without the help of humans. The benefit of the automated robot is that once we give all needed commands to the automated robot further, we don't have to control it at every single move. In opposite, in the mobile robot, we have to guide it in every single operation. Our proposed system is fully automated. It sends an alert notification before the extinguishing process start and again sends a notification of completion of the operation. During this operation, the human guide is not needed.

Modular design based on proximity, vision, and IR sensors has been incorporated into a firefighting mode [5]. This fire extinguisher system is one of the autonomous applications in the future. These IR sensors detect the flame and they can extinguish the fire with the help of the water pump. Sensors detect fire because radiation comes through the firelight. Through the testing, it is already to run in everywhere of computer era world, to detect and extinguish the fire. We can use carbon dioxide to prevent future misuse of water.

Arduino is an open-source microcontroller that can be easily programmed, erased, and reprogrammed at any instant of time [6]. Arduino was introduced in 2005. It is a simple microcontroller board that is an open-source programming platform. It is widely used in IoT projects. It acts as a mini-computer. Like the computer, it can also able to send information over the internet through other Arduino components. We are using an Arduino Uno ATmega328P microcontroller. It is the main processor of our model which operates the robot.

Radio Detection and Ranging (RADAR), a device that can be used to monitor a distinct area continuously [7]. Ultrasonic sensors are used as radar of a submarine or a ship. Submarines use ultrasonic sensors to detect an object under the sea. An ultrasonic sensor sends sound waves in the forward direction. If the sensor receives an echo of these sound waves, then it is confirmed that some object is present in front of the submarine. This sensor also detects the distance between the submarine and the object. This is why we are using this sensor in our model to detect an object to avoid it and move forward.

The L293D is a 16-pin Motor Driver IC that can control a set of two DC motors simultaneously in any direction [8]. A direct current (DC) motor is supposed to be operated at an accurate and constant speed even if the load on the system is increased or decreased. We are using two DC motors to perform the move forward operation of the robot. These motors change their direction to the left side after an object is detected according to code. Commands are given to the L293D motor driver by Arduino and further DC motors are commanded by the motor driver to perform move forward operation. We also add an operation to slightly move backward before DC motors change their direction to the left side after object detection.

III. PROPOSED SYSTEM

Our proposed system has the following components:

- Object detection
- Fire detection and extinguishing
- Live monitoring
- Notification sending system

The main brain of this project is the Arduino Uno R3 with ATmega328P. It is a microcontroller that controls all the operations in this model. All the programming part for the operations is implemented using C/C++ language.

When the robot is powered on, the motors of the robot will run normally and the robot moves forward. During this time, the ultrasonic sensor continuously calculates the distance between the robot and the reflective surface. This information is processed by the Arduino, If the distance between the robot and the obstacle is less than 40cm, the robot stops and scans in left and right directions for new distance using a servo motor and ultrasonic sensor. If the distance towards the left side is more than that of the right side, the robot will prepare for a left turn. But first, it backs up a little bit and then activates the left wheel is reversed in direction.

To sense fire, we use the fire sensor module (flame sensor) that detects firelight in a range of 760 nm – 1100 nm wavelength. 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 three directions of the robot to sense in which direction the fire is burning.

When we detect the direction of the fire, we use the motors to move near the fire by driving DC motors through the L293D module.

When the robot is near the fire, we have to extinguish it using water using a small container in which we can carry water, a 5V pump is also placed in the container and the whole container is placed on the top of a servo motor so that we can control the direction in which the water has to be sprayed.

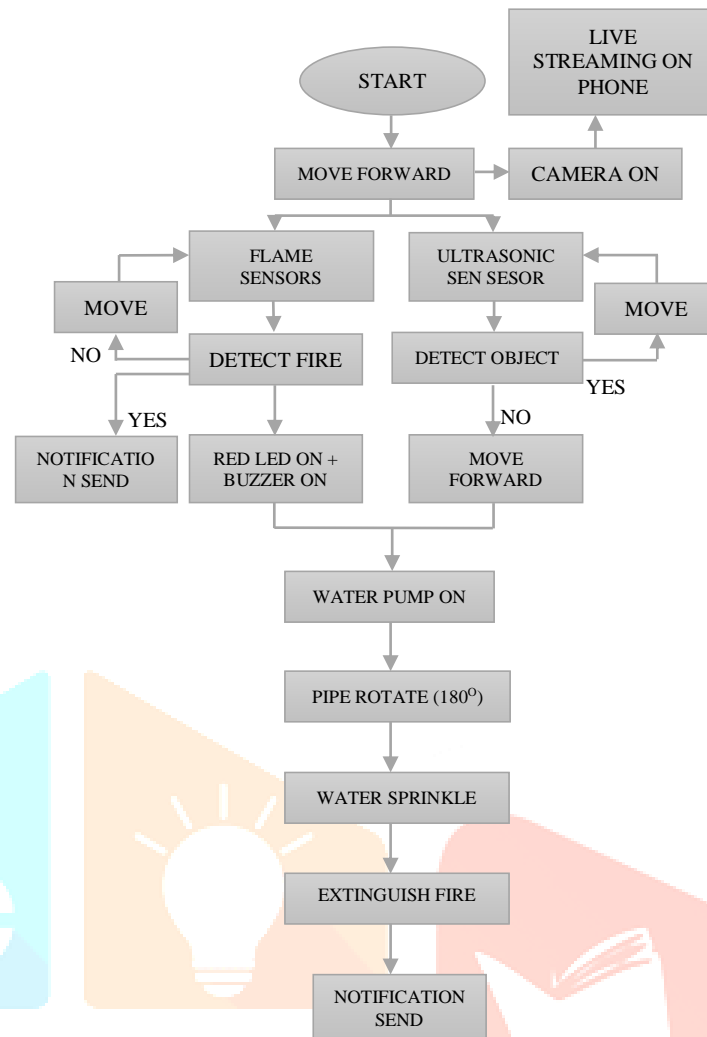


Figure 1 Working of Robot

IV. RESULT

We design the fire detection system using a flame sensor that is capable of sensing the flame. The robot can operate in an environment that is out of human reach in a very short time. The robot accurately and efficiently finds the fire and within minimum time after the fire is detected, it is extinguished.

V. CONCLUSION

This project has been motivated by the desire to design a system that can detect fires and interventions. This robot can detect the fire on its own and extinguish it. It can be extended to a real fire extinguisher by replacing the water tank with a carbon dioxide carrier and by making it extinguish the fire. This fire extinguisher will play an important role in helping firefighters. Due to the use of this fire extinguishing robot, we can decrease the health injury of firefighters during the operation of extinguishing the fire. In conclusion, we implemented a fire extinguishing robot that can be used in real-life applications.

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