

Fire Fighting Robot

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Abstract. Robotic has gained popularity due to the advancement of many technologies of computing and nano technologies. So, we have decided to design something that can make humans life easier and comfortable. Here my interest of review is to make a fully automated firefighting robot which can help in dealing with many fire problems in households and small scale industries. The aims of this project are to design and build a firefighting robot which can quickly extinguish fire. This project using autonomous robot that could act automatically depends on the program that has been programmed into the microcontroller PIC. This robot used sensor to detect the fire. When the robot senses the fire, it will start to beep. With these tools, people and the fire brigade would be warned. Firemen and any people could control the robot using remote to extinguish a fire. This remote equipped a 6-channel transmitter module RF with 433MHz PCR 1A connected with PIC16F887 as main board microcontroller. For software we use Power Logic for schematic circuit design and Proteus for designing the PCB layout. Then, we use MP lab for programming the PIC micro-controller using C language. It is hoped that this robot will be fully functioned and achieve the objective of this project.

Introduction

The world of fire extinguishers is full of potential and is constantly under studies. Numerous disasters have taken place over the years causing the destruction of forests and many deaths. There are a lot of ways to fight against the fire, but none is good enough to ensure the safety of civilians. Firefighting is an important but dangerous job. Fire fighters must be able to reach the location quickly to extinguish the fire, preventing further damage and thus reduce mortality. Technology has finally reduced the gap between fire and the machine that enables more efficient methods for fighting fire. The robot can be designed to detect and remove the fire, especially in places difficult for humans to reach. The robot is also designed to work with firefighters to continue to reduce the number of victims. The fire fighter robot is a microcontroller robot programming. The PIC16F887 microcontroller is used as a brain for the robot. The program code to control the firefighting robot is written in C language. This is because it is user friendly language and easy to understand. This robot used sensor to detect the fire. When the robot senses the fire, it will start to beep. With these tools,

people and the fire brigade will be warned. Anyone can control the robot using remote to extinguish a fire.

Problem Statement

One of the most important problems in the world today is the fire extinguishing problem. This problem is resulted from the increase of demand for human energy and extinguishing a big fire. Nowadays, fire cases have increased year by year. There are a lot of ways to fight against the fire, but it is still does not ensure the safety of our people. Maybe this study can contribute in the search for solutions to address this problem. This project will focus on how to control this robot movement and extinguish fire during the movement.

Project Objectives

The aims of this project are to achieve the following objectives:

- a) To design a robot that can detect and extinguish fire.
- b) To reduce and save human life especially fireman who expose to danger while extinguish the fire.
- c) To analyze the efficiency of the robot system.

Literature Review

Manual fire extinguishers. A fire extinguisher is a device which contains a pressurized fire fighting agent; the agent will come out through a hose by opening a valve at the fire extinguisher. The hose then needs to be pointed directly to the flame. A normal fire extinguisher will have a device that avoids an accidental start off; it has to be disabled before using the fire extinguisher. Fire extinguishers have a lot of different sizes and types, from small ones which are carried in cars, to larger ones which are called cart-mounted, or also known as wheeled extinguishers. The content of extinguishing agent varies from 1 to 250 kilograms. The problem with these devices (except the largest ones) is that the agent runs out quickly. The time of continuous download is from 18 to 20 seconds. They are also distinguished by the fires that they are able to put out. Different classes of fire are shown in next table.

OLE, Fire Fighting Beetle. Robots can be either simple or, they can even have a personality. Some of them have been designed based upon the shape of animals or insects like this robotic beetle. OLE (short for “Off-road *Loescheinheit*,” which means “off-road extinguishing apparatus” in German) simulates the displacement of a beetle, but with the work which a fireman would have to do. The robot is equipped with tanks full of water or dust like that is used in fire extinguishers, but it has not to be carried where the fire is, it is autonomous and it is guided by a GPS chip. They have several intelligent feelers, infrared sensors, heat sensors and smoke detectors. It also possesses two antennas at the front to improve its navigation skills. With this system, it is easy to detect small fires to the largest ones, starting to act by itself and simultaneously sending messages about the fire.

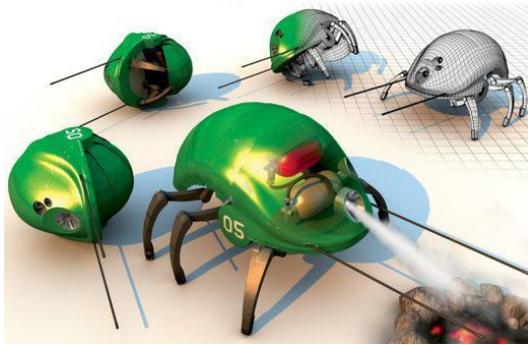


Figure 1: OLE, Fire Fighting Beetle

Their designers are from the Magdeburg-Stendhal University in Germany. They have demonstrated in some tests that 30 OLEs could control a 7000 square meters area. A fire advances very rapidly, but this robot can reach a speed of 20 km/h. In dangerous situations it would roll like a ball to protect its circuits till it's in better conditions. It has been manufactured from fireproof material being able to bear temperatures up to 1300 degrees centigrade. According to staff at the University of Magdeburg, the cost of an OLE unit is between 100.000 and 250.000 Euros; but annual forest fire damage in Europe alone is around 2.5 billion Euros [2].

Fire Spy Robot. Most fires happen when there is nobody at home to avoid them, nevertheless in South Korea a robot has been developed which is able to smother fires when they are still small. This robot is called Fire Spy, and it is able to detect by means of images and sounds, as well as monitoring the room temperature or the air quality when a fire appears. It activates alarm sensors using wireless technology. It is even waterproof. Its diameter is 12.5 cm and it weighs 2 kg. It can tolerate temperatures of 500 degrees Celsius for a period of an hour.



Figure 2: Fire Spy Robot

These robots are very useful in houses, because they are constantly monitoring the house and in case of detecting some fire, they act and send remote messages about the state of the house. The Spy Robot is the work of Hoya Robot. For the time being it is under development, but it will be available in the stations of Daegu, South Korea [3].

Methodology

There are six main stages that will be conducted in this study which are:

Literature review on fire extinguisher. Review on types of manual fire extinguisher and robot fire extinguisher had showed many differences, where the robot fire extinguisher act faster compared to manual when it senses the fire. Then, we choose to design robot fire extinguisher but different design with better specification to get fastest action.

Designing fire extinguisher robot program using MP lab. We used MP lab for programming the PIC micro-controller using C language. Burn the program into microcontroller.

Develop the fire extinguisher robot circuit board.

- Draw circuit using Power logic (simulation)
- PCB layout
- Etching PCB layout
- Drill and solder process
- Insert component
- Testing circuit

Develop the fire extinguisher robot hardware. There are five parts that we have to build:

- a) Frame of robot -We have to choose suitable material to be used as part of the robot body so that it can move fast. We have to make this robot in a simpler way. First of all, it is decided to make the shape of the robot in round so that it will not have any sharp edges, helping the robot to not get stuck to any corner of the room. The wheels of the robot are kept within the circumference of the chassis. There will be two levels of designing and the upper deck is mounted on the lower deck with the help of long screws. It will help us to adjust the final height of the robot when everything is installed on it. Stability is maintained by keeping the wheels and motor on the center of the chassis.
- b) Fire extinguisher system- We have planned to use a fan to extinguish small fire. We have connected the fan with the DC motor which connected to switching circuit to drive power supply as DC motor will draw high current from the battery.
- c) Motor- Standard DC motor is an option that can be used to the robot but our main motive is to make the robot as light as possible, because at the time of collisions, it will make less vibrations in the components and hence balance can be maintained. So keeping this in mind, we have decided to use a servo. Servo has light weight, small as compared with dc motors and easy to control.
- d) Power- Power is the most critical part to be handled in the projects. We have to ensure that we are not overloading the circuit or providing insufficient supply to the components. In both cases, it can be dangerous for the working of the components. We have decided to use individual power supplies to make component independent of each other. We have selected different power supply for motor and for extinguishing fan. This division will help us to run

a component without worrying about its effects onto the other. Moreover, we will not have to vary the voltage supply to different circuits and hence will be beneficial.

- e) Sensor - Flame sensor is the most important sensor for the firefighting robot .This sensor is used to locate the flame so that it can be extinguished quickly. The intensity of the flame is indicated by the frequency of the pulses that are continuously read from the fire sensor. This fire sensor is capable of detecting flame that is few meters away from the robot.

Assembly process. We must combine circuit board (electrical part) and the body of robot (mechanical part)

Testing. A test must be done to get proper communication between the circuit and the robot.

Conclusion

We can conclude that this robot can be used in many places without risking any life of our fire fighters. We can use them in our homes, labs, offices etc. They provide us greater efficiency in detecting the flame and extinguishing it before it become uncontrollable.

References

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