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FIRE FIGHTING ROBOT

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Abstract: Fire-fighting is an important as well as a dangerous occupation. A fire-fighter must be able to get to the fire quickly and safely so as to prevent further damage and reduces fatalities. Technology has bridged the gap between fire-fighting and machines allowing for a more efficient and effective method of firefighting. Robots can be used in many applications in industries, military, domestic applications. One of the major uses of Robots is an asset to human beings. Whether it is any kind of hazardous situations like a fire breaking out or a place full of landmines, Robots can easily work out a way out of these problems. So, let us discuss a Fire Fighting Robot.
There are many possibilities- a fire can start in an industry or in any remote area. For example, in cotton mills, garments, fuel storages, etc., electric leakages can lead to huge damage. Also, in a worst-case scenario, causing heavy losses not only financially but also destroying areas surrounding it. Robotics is the emerging solution to protect human lives and their wealth and surroundings. The aim here is to design a FIRE FIGHTING ROBOT using embedded system. A robot capable of fighting a simulated household fire will be designed and built. It must be able to autonomously navigate through a modeled floor plan while actively scanning for a flame. The robot can even act as a path guider in normal case and as a fire extinguisher in emergency. Robots designed to find a fire, before it rages out of control, can one day work with fire-fighters greatly reducing the risk of injury to victims and fire-fighters. The project will help generate interests as well as innovations in the fields of robotics while working towards a practical and obtainable solution to save lives and mitigate the risk of property damage.

Fire-fighting robot has been invented and modified by various inventors. Still, the research on this topic is to be continued. Our focus during modification in this robot is:

1) To make its design simple.
2) To invent a robot which can easily be used by common people?
3) To reduces the number of parts used in a household fire-fighting robot.
4) To enhances the responsive nature of robots.

Keywords: *Robot, firefighter, automation, sensor, microcontroller, GSM*

1. INTRODUCTION

A robot is a machineespecially one programmable by a computercapable of carrying out a complex series of actions automatically. Robots can be guided by an external control device or the control may be embedded within. Robots may be constructed to take on human form but most robots are machines designed to perform a task with no regard to how they look.

Robots can be autonomous or semi-autonomous and range from humanoids such as Honda's Advanced Step in Innovative Mobility(ASIMO) and TOSY's TOSY Ping Pong Playing Robot (TOPIO) to industrial robots, medical operating robots, patient assist robots, dog therapy robots, collectively programmed swarm robots, UAV drones such as General Atomics MQ-1 Predator, and even microscopic nano robots. By mimicking a lifelike appearance or automating movements, a robot may convey a sense of intelligence or thought of its own. Autonomous Things are expected to proliferate in the coming decade, with home robotics and the autonomous car as some of the main drivers.

Similarly, our project is an autonomous fir fighting robot to make fire fighters work easy.

Our task as Mechanical Engineers was to design and build a prototype system that could autonomously detect and extinguish

a fireand aims at minimizing air pollution. It is the Robot that can move through a model structure, find a lit candle and then extinguish it with help of a blowing technique. Our research paper describes the design of a small autonomous Fire Fighting Robot. We have worked on the same project at our college presenting a synopsis showing its basic construction and working. The Fire Fighting Robot is designed to search for a fire in a small floor plan of a house of the specific dimensions, extinguish the fire with the help of the front fan of a toy hovercraft, and then return to the front of the house. The fire detection to be put into use is relatively free of false alarms, it is anticipated that it will not overreact in non-fire simulations. This mission is divided into smaller tasks, and each task is implemented in the most efficient manner such as self-autonomous start of the robot, navigation of the robot in every room step by step, finds the fire in a specific room, approaches the fire at a very fixed distance, and extinguishes it and finally returning to the front of the house.

2. LITERATURE REVIEW

In today's era, fire-fighting is a dangerous issue. Many authors are working on different techniques for fire-fighting. Several losses occur due to fire. Fire becomes the biggest disaster if it takes place near any forest area, petrol pump, gas line and any educational place. If the fire is not extinguished initially, it can harm a huge number of people as well as areas.
Author Zervas developed a "Multisensor data fusion for the fire detection". Here he takes the example of forest fire. He says if forest fire is detected using the temperature, humidity and vision sensor, probability of fire blow-out can be reduced or closed. It is profitable to county government as well as for the citizens who live there. By this robot, properresults areobtained and this data is fused with the fusion sensors that monitors the same graphical area. [1].

In the paper "Autonomous Fire Fighting Mobile platform", Author Teh Nam Khoon proposed a novel design of an autonomous robot. This robot, called AFFMP, has a flame sensor and an obstacle avoidance system. Working of this robot is totally based on programming. The AFFMP follows a preset path through a building and uses a guide rail or markers such as black painted line or a tape to navigate through the environment until it detects an elevated possibility of a fire. But when it senses any fire activity within its range, at that point it will leave its track and follow the fire. Itsrange to detect fire is up to-30cm from it. Then it would unlock the fire extinguisher that is mounted on it. If there is any blockage or it has divert from its route during fire extinguishing, the obstacle avoidance will start to perform and it will be able to guide the AFFMP to reach to the fire point again. When it has blown-out the fire completely then it returns to its guiding track to continue again with its further investigation of any other fire sources. [2]

Author H. P. Singh has developed an Autonomous Industrial Fire Fighting Mobile Robot. He said that the system contains two optically isolated D.C. motors. This robot is based on analog to digital converter. Whatever data is provided to the robot via infrared sensor, it converts data from analog to digital signals. There are five infrared sensors used. Two sensors control the motion of the robots and three are for flame detection. Besides these sensors, it uses water to extinguish the fire. It also contains a D.C. water pump as well as a water container. The main task of the robot is to sense the flames or fire and extinguish it. For this task, infrared sensor is used. This sensor is used for input data which comes in the form of rays (these rays are generated from the fire and sensed by the infrared sensor). Microcontrolleris used to control the robot by controlling its sensors as well as other electrical and electronic devices. [3]

3. Description of Various Parts, Weight and Quantities

3.1Components Utilized

3.1.1 Temperature sensor
3.1.2 Smoke sensor
3.1.3 Ultrasonic sensor
3.1.4 3Microcontroller
3.1.5 GSM
3.1.6 DC water pump
3.1.7 H- bridge
3.1.8 Water tank
3.1.9 12v battery
3.1.10 Connection pipe
3.1.11 Four wheels
3.1.12 Two DC motors and shafts
3.1.13 Water sprinkler
3.1.14 Miscellaneous(switches, wires, screws)

3.2. Weight of the Model and Quantities

S . No.	ITEMS	Quantity*Wt.	TOTAL Wt.(g)
1	Motor	4*100	400
2	Wheel	4*80	320
3	Tank	1*75	75
4	Pump	1*200	200
5	Water	300 ml	300
6	Chassis	1*800	800
7	Battery	1*500	500
8	GSM module	1*200	200
9	Pipe	-	50
10	Circuit	-	100
	TOTAL WEIGHT		2.94=3kg

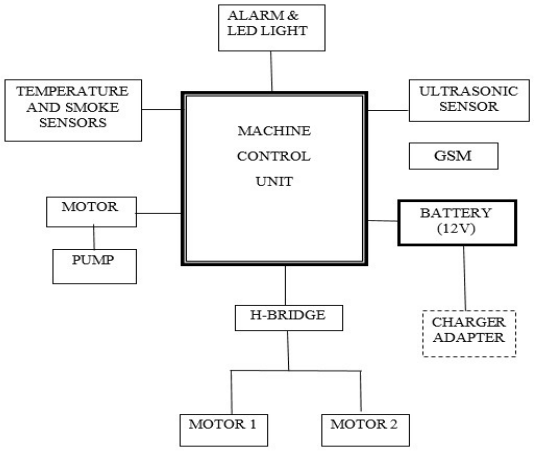
Table: 3.2- Weight of Model

4. WORKING PRINCIPLE

The robot vehicle is loaded with water tanker. The pump is controlled by wireless communication (RF and Mobile

communication). The transmitter end is connected to the push buttons. Using this pushbutton, commands are sent to the receiver and control movements of the robot like forward, backward, left, and righted. The receiving end three motors are connected to the microcontroller.

4.1. Block Diagram [4]



4.2. Household GSM based FirefightingRobot [5]

The field action is constrained on the current floor of house. This robot is detecting many house hold items which may catch fire when someone is asleep or away. This robot is used to secure the home and using this application all doors are opened in the floor because this vehicle is moving one place to another place in the home. The firefighting area is must be made safe not to cause a new accident. The additional feature of this robot is to operate at long distances.

GSM modems have developed public utility products for mass communication. This GSM based firefighting robot is used to prevent fire in house, offices and shops. This robot moves in suffocated fire area in our house, office, shopping malls, etc. This robot is capable of sensing fire using IR sensors and then putting it out even in the absence of anyone. It then immediately sends the message to the concerned person.

This project is made efficient by incorporating SIMs so that an SMS can be sent to a number of devices and boards in the locality by using techniques of time division multiple access. These robots can be used at different areas like factories, houses, office, etc. By using GSM- based firefighting robot, it is possible to control everything automatically through embedded system. The use of embedded system in communication has given rise to many interesting applications that ensure safety and comfort.

4.3. Flow chart [6]

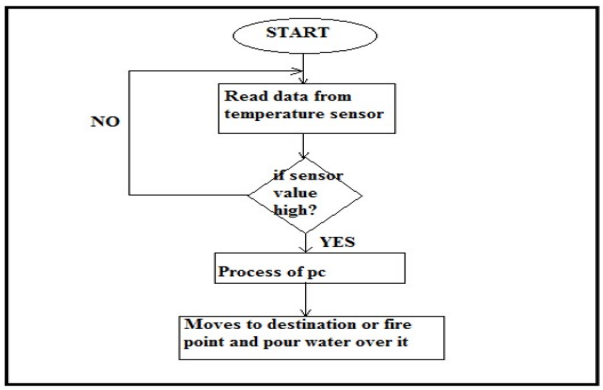


Figure 3.3: Flow Chart

5. Tools or Equipment's required

5.1 Soldering Iron
5.2 Grinding Machine
5.3 Hot Glue Gun
5.4 Drilling Machine
5.5 Tap cutter
5.6 Wrench, Screwdriver
5.7 Wire cutter
5.8 . Compressor Painting Machine

6. APPLICATIONS

1) .The robot can be used to guide the visitors from the entrance to the main office [1].
2) It can help doctors to carry medicines from one ward to another.
3) The main purpose is to rescue the people by extinguishing fire in a building.
4) Can be used in record maintaining rooms where fire can cause loss of valuable data.
5) Can be used in Server rooms for immediate action in case of fire.
6) The potential application of the multifunctional firefighting system has been defined as a group that includes the chemical and oil industry, nuclear plants, military Storage facilities, as well as mine fields and dangerous substance transport.

7. FUTURE ENHANCEMENT

- LCD panel
- Camera and Video Transmission
- Chain- wheel Mechanism
- Powerful pump
- Solar Panel
- Improved weight capacity of the robot
- 360 degree rotating wheel mechanism

8. FUTURE SCOPE

This project has been motivated by the desire to design a system that can detect fires and intervention. In the present condition it can extinguish fire only in the way and not in all the rooms. It can be extended to a real fire extinguisher by replacing the fan by a carbon-di-oxide carrier and by making it to extinguish fires of all the room using microprogramming. This provides us the opportunity to pass on to robots tasks that traditionally humans had to do but was inherently life threatening. Fire-fighting is an obvious candidate for such automation. Given the number of lives lost regularly in firefighting, the system we envision is crying for adoption. Of course, this project has only scratched the surface. As in the design simplifications and the implementation constraints in suggest, our project is very much a proof-of-concept. In particular, a practical autonomous fire-fighting system must include a collection of robots, communicating and cooperating in the mission; furthermore, such a system requires facilities for going through obstacles in the presence of fire, and ability to receive instructions on-the fly during an operation.

9. RESULTS

- Less cause of accident cases.
- Even Working is carried out automatic mode.
- Human control required is less.
- Maintenance cost is less.
- Easily repairable.
- Improved safety.
- Protection of property from loss.
- Simple in construction.

10. CONCLUSION

This report has presented a unique vision of the concepts which are used in this particular field. It aims to promote technology innovation to achieve a reliable and efficient outcome from the various instruments. Experimental work has been carried out carefully. The result shows that higher efficiency is indeed achieved using the embedded system. With a common digitalized platform, these latest instruments will enable increased flexibility in control, operation, and expansion; allow for embedded intelligence, essentially foster the resilience of the instruments; and eventually benefit the customers with improved services, reliability and increased convenience. The day is not far when this technology will push its way into your house hold, making you more lazy.

11. FINAL MODEL

Figure 11: Final model

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