Fire Fighting Robot Using Arduino

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Abstract - *The project is designed to develop a fire fighting robot using XBEE module for remote operation. The robotic vehicle is loaded with water tanker and a pump which is controlled over wireless communication to throw water. An Arduino is used for the desired operation. At the transmitting end using GUI, commands are sent to the receiver to control the movement of the robot either to move forward, backward and left or right etc. At the receiving end three motors are interfaced to Arduino UNO where two of them are used for the movement of the vehicle and remaining one for the pump .The RF transmitter act as a RF remote control that has the advantage of adequate range (up to 300 meters) with proper antenna, while the receiver decodes before feeding it to another Arduino UNO to drive DC motors via motor driver IC for necessary work.The whole operation is controlled by an Arduino UNO. A motor driver IC is interfaced to the Arduino UNO through which the controller drives the motors. Further the project is modified by interfacing it with a wireless camera so that the person controlling it can view operation of the robot remotely on a screen.*

1. INTRODUCTION

Advances in economic growth in modern industrialized society have resulted in factories complex office buildings and dense apartment blocks located in metropolitan areas. When a fire occurs in such places, fire-fighting is difficult due to mazes of crowed buildings, high temperatures, smoke and the danger of explosion. Fire causes enormous damage to life and property.

Current fire-fighting systems are based on humans using water guns and chemical fire repression systems. However, humans cannot work effectively in all fire environments. In this case, it is desirable to extinguish a fire quickly using fire- fighting robots. Recently, in order to cope with catastrophic fire related accidents, research on fire-fighting robots has advanced in many countries Fire-fighting robots are operated in places where fire-fighters are not able to work. Hence, it is desirable to control firefighting robots using a remote control system located away from the fire. In order to control fire-fighting robots in remote places, robust radio communication systems are necessary. The robot is monitored through a wireless camera present on it's top from the remotely situated control station using XBEE module. Thus according to the status of the various

sensors of the robot, user can take required action. With the development in the field of robotics, human intrusion has become less and robots are being widely used for safety purpose. In our day-to-day life, fire accidents have become common and sometimes may lead to hazards that make it hard for the firemen to protect human life. In such cases, a fire fighting robot is used to guard human lives, wealth, and surroundings from the fire accidents.[2] This fire fighting robot project is an advanced project for engineering students, who are interested in robotics. This project incorporates RF technology for remote operation and also uses 8051 microcontroller. A fire-fighting robot is capable of detecting fire if a house catches fire while someone in the house is either sleeping or not present in the house.

2. IMPLEMENTATION

There are several components and technologies that have been used to implement the robot. The implementation of project consists of two parts.

1] Hardware Implementation: The robot is constructed from scratch using plywood frame work. Using plywood from the framework is desirable for its stability and strength. Build a chassis such that the robot has to enough space for the water can and all the electronic components equipments that required for this project. The chassis uses four rubber dummy wheels. Fixed two dc motor on each side at the bottom and water can between two plywood frame. The sensors have to be fixed in front of the robot such way that sensors can detect the flame in front of the robot. Design the PCB and mounted all electronic components on it. The outlet of the water pump should be fixed at center of the robot facing towards front of the robot. Wireless camera is for user to detect the fire.

2] Software Implementation: The robot is implemented using simple open source technologies. For communications a modified XBEE module is used. The heart of robot is programmable Arduino UNO. Arduino is an open source embedded system that provides a low cost interface between high level software and robot hardware. In this software, we can also used matlab software. Matlab helps to create and easier interface and processing data from sensors easily.

3. WORKING

The main controlling unit of this robot is ARDUINO, which is connected with fire sensing unit The fire sensing unit consist of temperature sensor, smoke sensor and gas sensor. The robot consist of wireless camera which will transfer front view of robot to the receiving unit , which is controlled by user . The receiving unit consist of XBEE arduino computer and camera receiving unit. By operating GUI and looking at front view of the camera the operator of robot can take decision and operate robot as per his decision.
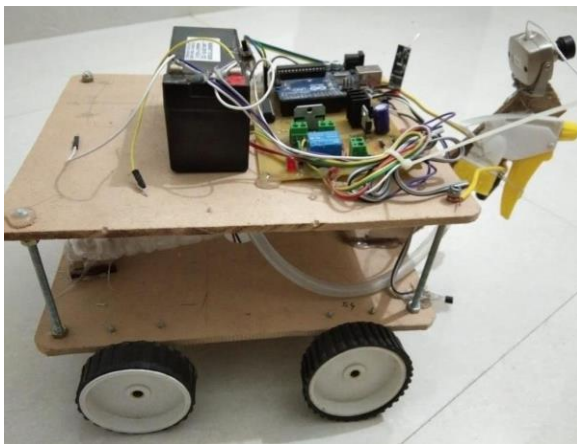

Fig: Prototype

The robot unit also consist of motors and motor driving unit L298 as per the requirement arduino can control the motors. When the sensing unit data is above threshold level i.e. high temp and smoke is detected the sprinkler will be switched on. This unit consist of sprinkler pump, water tank, relay and relay driver circuit. The robot unit supplied with powered with battery of specification 12 v,1.2amp. The main brain of this project is the Arduino, but in-order to sense fire we use the fire sensor (Temp sensor) that is shown below which is used to detect the fire. 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 L298. 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 we can control the direction in which the water has to be sprayed. Let's proceed with the connections now[4].

4. CONCLUSION

Fire causes tremendous damage and loss of human life and property. Recently, in order to cope with such catastrophic accidents, research on fire-fighting robots has been carried out in many countries. It is sometimes impossible for robots in dangerous places, robust radio communication systems are one of the important Components of the robots. The movement of the robot is controlled by the sensors which are fixed on the mobile platform. Experimental results are carried out for a four wheel mobile robot to illustrate the proposed methodology. The results show that the proposed robot model is successfully implemented.

In conclusion, our approach of modular design strategy was a good solution in implementing the firefighting robot as it made it easier for individuals to work on their tasks independently. The extensive use of Arduino UNOs ensured the integration step to be simpler. There were still some problems at integration step but they were solved easily because debugging can be done on each module. Therefore, our final model of the robot can successfully find "fire" and reach it without running into obstacles. Throughout the project, our technical knowledge was put to practical use and hence learnt many technical skills.

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