The design and development of a robot for wireless sensor network-based fire detection and control

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ABSTRACT

The most objective of this project is to create a robotic vehicle which is utilized to discover and battle fire remotely in an occasion of any major fire risk especially in businesses. Major fire mishaps do happen in businesses like atomic control plants, petroleum refineries, gas tanks, chemical manufacturing plants and other large-scale fire businesses coming about in very genuine results. Thousands of individuals have misplaced their lives in such disasters. Subsequently, this extend is upgraded to control fire through a mechanical vehicle with the progression within the field of Mechanical autonomy, human mediation is getting to be less each day and robots are utilized broadly for reason of security. In our day to day life fire mishaps are exceptionally common and at some point it gets to be exceptionally troublesome for fire fighter to spare human life. In such case fire battling robot comes in picture. The fire extinguishing robotic vehicle can be controlled wirelessly Bluetooth communication. The proposed vehicle has a water jet spray which is capable of sprinkling water. The sprinkler can be moved towards the required direction. This project describes a new economical solution of robot control systems. The controlling devices of the whole system   are Microcontrollers, wireless transceiver modules, water jet spray, DC motors flame sensor and buzzer are interfaced to Microcontroller. When the user fed the commands through a remote controlled device, the microcontroller interfaced to it reads the command and sends relevant data of that command wirelessly using transceiver module. This data is received by the transceiver module on the robot and fed sit to microcontroller which acts accordingly on motors and pump. The complete system consists of two subsystems transmitter section and the receiver section. This project controls left, right, forward and backward movement of robot wirelessly. At the receiver side of robot microcontroller is also used.

Keywords: Fire sensor, HC05, DC motor, relay

INTRODUCTION

With the ever-increasing technology, the developments are increasing in the face of the situations that cause human life. Every day, the robot industry emerges as a model that is produced as an alternative to human element in a new branch. Flying, robots, wheeled robots legged robots, humanoid robots, underwater robots are just some of them. The growing world population is bringing involuntary problems together. Fires are among the most important of these problems. Robot industry has a lot of work in this area. Some of these are fixed mobile robots with different features, which are equipped with different sensors that detect before the fire is out, mobile rescue robots as fire search and rescue equipment, mobile locating robots used for fire detection, fire extinguishing robots in many different models designed to assist   fire fighters in the fire. There are several possibilities of fire in any remote area or in an industry. For instance, in garments go-downs, cotton mills, and fuel storage tanks, electric leakages may result in immense fire & harm. In the worst of cases & scenarios, fire causes heavy losses both financially and by taking lives. Robotics is the best possible way to guard human lives, wealth and surroundings. A Firefighting robot is designed and built with an embedded system. It is capable of navigating alone on a modeled floor while actively scanning the flames of fire. The robot could be used as a path guide in a fireplace device or, in normal case, as an emergency device. This robot is designed in

such a way that it searches a fire, & douses it before the fire could spread out of range & control.

The main intention of this project is to design a firefighting robot using Android application for remote operation. The firefighting robot has a water tanker to pump water and spray it on fire; it is controlled through wireless communication. For the desired operation, ARDUINO microcontroller is used.

In the proposed system, an android application is used to send commands from the transmitter end to the receiver end for controlling the movement of the robot in forward, backward, right or left directions. At the receiver side, two motors are interfaced to the 8051 microcontroller wherein two of them are used for the movement of the vehicle and the remaining one to place the arm of the robot.

Remote operation is done by android OS based Smartphone or tablet. The Android device transmitter acts as a remote control with the advantage of being having adequate range, while the receiver has a Bluetooth device fed to the microcontroller to drive DC motors through the motor driver IC for particular operation.

LITERATURE SURVEY

To design and build a small Fire Fighting robot, where a robot will be put in a house model where a light candle is available and the robot should be able to detect, and extinguish the candle in the shortest time while navigating through the house and avoiding any obstacles in the robot's path. Researches were done in the beginning of the project to get more information about robotics in general and to think about the design, hardware components, and the software technique which will control the robot. This robot contains Light Sensor, 2 DC motors, and Buzzer is used in the robot's body. Two DC series motors are used to control the rear wheels and the single front wheel is free. The software part of the project is the program code written in the micro- controller to control the Fire Fighting Wireless Controlled robot using 8051.Detecting the fire and extinguishing it is a dangerous job and that puts lives of fire fighters at risk. There are number of fire accidents in which fire fighter had to lose their lives in the line of duty each year throughout the world. Increase in the number fire accidents are due to expanding human population and growing industrialization. The physical limitations of humans to deal with these kinds of destructive fires make fire extinguishing a complicated task. The use of firefighting robots

can reduce the errors and the limitations that are faced by human fire fighters. This paper contains various methods for implementation of firefighting robots. Here we compare various design and construction of building a firefighting robot. When we the field of firefighting has long been a dangerous one, and there have been numerous and devastating losses because of a lack in technological advancement. Additionally, the current methods applied in firefighting are inadequate and inefficient relying heavily on humans who are prone to error, no matter how extensively they have been trained. A recent trend that has become popular is to use robots instead of humans to handle fire hazards.

This is mainly because they can be used in situations that are too dangerous for any individual to involve themselves in. In our project, we develop a robot that is able to locate and extinguish fire in a given environment. The robot navigates the area and avoids any obstacles it faces in its excursion. Hear about robots, we think of science fiction novels and sci-fi movies. It is due to the fact that we do not know how to create robots of high intelligence.

PROPOSED SYSTEM

The directions of movement of the robot are described by the motor driver board. It is used to give high voltage and high current is given as an output to run the motors which are used in the project for the movement of the robot. In this project a simple DC motor is used for the rotation of the wheel which is responsible for the movement of the robot. DC motors usually convert electrical energy into mechanical energy. To extinguish the fire a pump is used to pump the water on to the flame. A simple motor is used to pump the water. The pumping motor in extinguishing system controls the flow of water coming out of pumping.
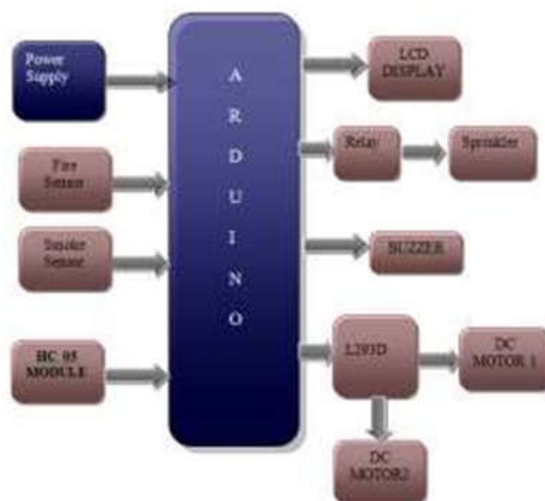

Fig.1. Block diagram.

RESULTS

Fig.2. Hardware circuit.

This project comes with an application called "Smart Home". This app controls the various appliances connected to our Arduino and also relays. When we on the toggle buttons the application are pressed, corresponding Bluetooth signals are sent from our Android phone to the Bluetooth module. Here five relays are connected with Arduino. The Arduino finds the signal which was sent and compares it to the predefined signals allocated for each appliances. When it identifies that signal, the Arduino activates the relay hooked up to its digital pin. It passes 5V through it. Thus the relay is switched ON and the corresponding appliance connected to the relay is turned ON. On the other hand, to OFF the switch, Arduino passes a 0V or logic low to the digital pin.
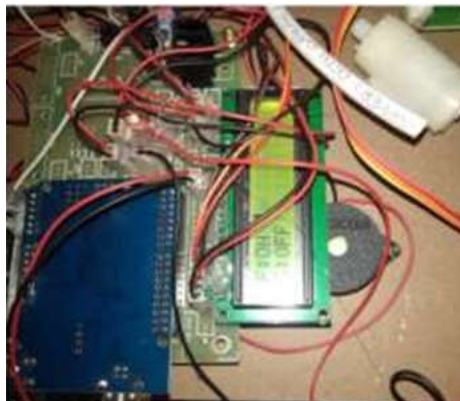

Fig.3.Fire indication.

Fig.4.Output results.

CONCLUSION

The circuit of our project was designed and setup using Arduino uno which isvery reliable & stable. In the fire extinguishing robot project, we developed a system that detects and extinguishes the fire before the fire starts and informs the electronic environment. Here targets are microcontroller andmotor control with reductive motor, flame detection with fire sensor. The robot which is designed here as a result of this study communicates through the serial port via the serial port and processes the analog and digital data received from the sensors in themicrocontroller control so as todetermine the fire in the open or close environment. In this work, a system that works successfully both hardware and software has been realized. This system "fire detection and extinguishing robot" is capable of being used in our everyday life, if more professionals are selectedinstead of the elements used in the project, which can be added to the robot, the fire can be firstly intervened and most of the fire can be extinguished without any growth

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