

DESIGN AND IMPLEMENTATION OF FIRE DETECTING AND CONTROLLING ROBOT USING EMBEDDED SYSTEM

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ABSTRACT

A large number of fire accidents occur in world, be it natural or man-made. There are many possibilities a fire can start in an industry or in any industry like cotton mills, fuel storage, etc. In worst case this can cause huge financial loss, environmental damage, and also there is always the risk of life. Fire fighters have to divide their resources between rescue and extinguishing fire. To counter this, we need a system that can be employed to fight alongside the fire fighters making it easy to manage the resources. The goal here is to build a Fire Fighting Robot using embedded system. It is designed to navigate autonomously and find and extinguish fire before it rages out of control. This project will help generate interest in the field of robotics while working towards a practical and obtainable solution to save lives and minimize the risk of property damage.

Keywords: Arduino, Dc motor, Servo motor & Flame sensor.

1.INTRODUCTION

From the recent years, robotics has turned out to be ingredient over which peoples shown their interest. Robotics has gained popularity due to advancement of many technologies of computing and nanotechnologies. So we decided to make human life easier and reduce the efforts taken by them. Our review is to make fully automated fire fighting robot which deals with the fire problems in household, laboratories, small scale industries. This robot follows the predefined path and performs the various tasks. We can use this robot to perform those tasks that may be harmful and dangerous to human. The Fire sensors equipped fixed in the rooms where there will be a possibility of fire is to be occurred. When it senses fire the address of location received by robot and accordingly it will reach to the destination and extinguish fire immediately.

II. LITERATURE SURVEY

A.Paper [1] - "Implementation methods of fire fighting robot" Author - Mrs. Bhavna K. Pancholi, Miss. Kena Patel The robot presented here is an embedded device in real time. C language is the software used to implement this type of robots. During automatic mode the robot tracks the environment to detect fire accidents. This robot uses IR sensors and output of this electrical sensors is fed to amplifier transistor. This signal is later fed into the microcontroller's INpin. When a fire is observed, the microcontroller drives the motors and triggers the actuators. A water reservoir is mounted on the frame which has 10rpm DC pump motor.

The water reservoir is attached to the hose and the end of which is placed on the robot's head . The water is sprayed to the flames in order to eliminate the fire. This paper also shows us how a robot is voice controlled. The robot is operated through the speech system. The commands are given to the robot in order to make them operated. The advantage of this type of robot is , hand free operation and fast data input. Disadvantage is the robot is affected by the environmental or external noise.

B. Paper [2] –"Intelligent fire fighting tank robot." Author - E. Merry Sartika , Kristi Kosasih, Dan Muliady, M. Jimmy Hasugian. The tank robot is made of a mixture of acrylic, plastic, aluminum and iron. There are two servo motors for each wheel, two DC motors for two flame extinguishing fans, there are many other sensors like ultrasonic, compass, flame thermal array and many other. The robot is switched on by the sound and a sound activator circuit is mounted on it.

The audio activation circuit consists of a Dual Tone Multi Frequency receiver and transmitter. Microcontroller AVR ATmega16 receives data from a sound activation circuit, an infrared and photodiode circuit as a white detector, a micro switch sensor as a furniture detector, UVTRON and TPA81 as flame detectors and thermal detectors, CMPS03 as navigation detectors, SRF04 as ultrasonic sensors. Microcontroller processes signal inputs and delivers signal outputs to the servo motor (GWS S03 4.8V) on the front-left wheel and the front-right wheel, and the DC motor to spin the fan to extinguish the flame.

III. PROBLEM STATEMENT

Detecting fire and extinguishing it is a dangerous job that puts the life of a firefighter at risk. There are many fire accidents which firefighter had to lose their lives in the line of duty each year throughout the world. The research and development in the field of Artificial Intelligence have given rise to Robotics. The aim here is to design a Fire Fighting robot. The robot will not only extinguish the fire but can even act as a path guider. The Robot should be able to find a fire before it rages out of control and must also reduce the risk of injury to victims.

IV. PROPOSED METHOD

In this paper, the aim is to achieve proper parking system by using the concept of Bluetooth, wherein an Android Application is created for the customer, whose details are constantly updated by the hardware/server at the location. The features include unique identification for each vehicle, display of available parking slots on the mobile application, possibility of making reservations for the same, maintenance of a database (for the management).

V. BLOCK DIAGRAM



HARDWARE MODULES USED

ARDUINO UNO



The **Arduino Uno R3** is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

BLUETOOTH MODULE (HC 05)



Bluetooth is a technology for wireless communication. It is designed to replace cable connections. It uses serial communication to communicate with devices. It communicates with microcontroller using serial port (USART). Usually, it connects small devices like mobile phones, PDAs and TVs using a short-range wireless connection to exchange documents. It uses the 2.45GHz frequency band. The connection can be point-to-point or multi-point where the maximum range is 10 meters. The transfer rate of the data is 1Mbps.

HC-05 Bluetooth module provides switching mode between master and slave mode which means it able to use neither receiving nor transmitting data. You can use Bluetooth module simply for a serial port replacement to establish connection between MCU, PC to your embedded project and etc.

L293D Description



L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single L293D IC. Dual H-bridge *Motor Driver integrated circuit (IC)*.

It works on the concept of H-bridge. H-bridge is a circuit which allows the voltage to be flown in either direction. As you know voltage need to change its direction for being able to rotate the motor in clockwise or anticlockwise direction, hence H-bridge IC are ideal for driving a DC motor.

DC MOTOR



A direct current or DC motor convert's electrical energy into mechanical energy. It is one of two basic types of motors: the other type is the alternating current or AC motor. Among DC motors, there are shunt-wound, series-wound, compound-wound and permanent magnet motors.

SERVO MOTOR:



A **servo motor** is a type of motor that can rotate with great precision. Normally this type of motor consists of a control circuit that provides feedback on the current position of the motor shaft, this feedback allows the servo motors to rotate with great precision. If you want to rotate an object at some specific angles or distance, then you use a servo motor. It is just made up of a simple motor which runs through a **servo mechanism**. If motor is powered by a DC power supply then it is called DC servo motor, and if it is AC-powered motor then it is called AC servo motor.

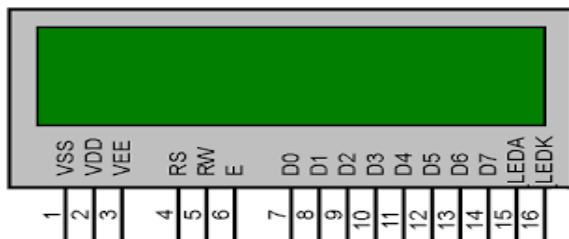
For this tutorial, we will be discussing only about the **DC servo motor working**. Apart from these major classifications, there are many other types of servo motors based on the type of gear arrangement and operating characteristics. A servo motor usually comes with a gear arrangement that allows us to get a very high torque servo motor in small and lightweight packages. Due to these features, they are being used in many applications like toy car, RC helicopters and planes, Robotics, etc.

FLAME SENSOR



A flame-sensor is one kind of detector which is mainly designed for detecting as well as responding to the occurrence of a fire or flame. The flame detection response can depend on its fitting. It includes an alarm system, a natural gas line, propane & a fire suppression system. This sensor is used in industrial boilers. The main function of this is to give authentication whether the boiler is properly working or not. The response of these sensors is faster as well as more accurate compare with a heat/smoke detector because of its mechanism while detecting the flame.

LCD



It is called Liquid Crystal Display. We are going to use 16x2 characters LCD. This will be connected to microcontroller. The job of LCD will be to display all the system generated messages coming from the controller. LCD will provide interactive user interface. This unit requires +5VDC for it proper operation. This module is used for display the present status of the system.

VI.RESULT

Firefighting robot designed to detect fire or harmful gas in a certain area and send a signal to the operator. To implement this function, we need to integrate different sensors and systems together. The project is successfully tested for all the commands and it also detected the fire with the help of a flame sensor. Once the flame is detected, a buzzer is activated and a motor drives the water pump.

VII.ADVANTAGES

1. Easy to operate
2. Low power consumption
3. User friendly
4. Single equipment, multiple applications
5. When extended further in the hardware section, numerous applications can be added

VIII.APPLICATIONS

1. It extinguishes big fire and does not spread the fire
2. It has suitable for all open area
3. It has fast to reach and turn off the fire

IX.CONCLUSION

The robot can operate in the environment which is out of human reach in very short time. In such environments, fire fighting robots can be useful for extinguishing fire. These robots should be controlled remote operators who are located far away from the fire site using remote communication systems. The robot accurately and efficiently finds the fire within minimum time after the fire is detected. In future work Project aims to promote technology innovation to achieve a reliable and efficient outcome. Mobile robot that can move through a model structure, find fire and extinguish it. The movement of the robot is controlled by the sensors which are fixed on the mobile platform .is to provide security of home, laboratory, office, factory and building is important to human life.

X.FUTURE WORK

The project is expected to be deployed on a global scale. This project has been motivated by the desire to design a system that can detect fires and try to extinguish at a smaller scale. In the present condition, it can extinguish fire only as a prototype and not an actual fire in a location. A practical autonomous fire-fighting system must include a collection of robots that will work together to doze away a building under fire. Furthermore, a thermal sensing camera that can detect human beings once the fire quenched away can be used to protect the life of human beings trapped inside the building. Nowadays, compressed liquid Nitrogen balls are available that have a faster and cleaner effect in dozing off the fire. Such ball can also be used in the robot.

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