



Fire Detecting and Water Sprinkling Using Robotics

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ABSTRACT

This project is about the design and manufacturing of fire detecting and water sprinkling vehicle. Fire accident which is a global devastating problem leads to loss of lives and properties on a daily basis. Robot is designed and implemented to scan the environment in order to detect fire source using fire sensor. The security of home, laboratory, office, factory and building is important to human life. We develop an intelligent robot with a fire sensor, which is used to detect fire. The destructive burnt cause by electrical is the highest source. It is because security system can't detect abnormal and dangerous situation and notify us. Besides, user had difficulties to detect the small burnt cause by electrical appliances. User may take a late time to extinguish fire like finding the water source to extinguish fire when want to extinguish the fire. This robot will move to the fire source when the flame sensor detected the fire and it will give buzzer sound. This robot also programmed to stop before the robot hit the flame.

Key words: AT89S52 Microcontroller, IR Sensor, Bluetooth Module, Relays, DC Motors, Sprinkler, LCD, L293D, Keil uVision4, Bluetooth SPP PRO.

INTRODUCTION

An embedded system is a special-purpose computer system designed to perform one or a few dedicated functions, sometimes with real-time computing constraints. It is usually embedded as part of a complete device including hardware and mechanical parts. In contrast, a general-purpose computer, such as a personal computer, can do many different tasks depending on programming. Embedded systems have become very important today as they control many of the common devices we use. An embedded system is some combination of computer hardware and software, either fixed in capability or programmable, that is specifically designed for a particular kind of application device.

One of the major problems to the human beings is fire. Whenever fire occurs then lot of loss will happens. So to reduce that fire we have to sprinkle water on it, this is one of the motivations for this research. In this project a robot will detect the fire, by giving commands water will sprinkle on fire. In previous joysticks were used. But through that some robot moving problem will occur. Here we are using Bluetooth as control device for the robot. Through the app we will control our robot by mobile phone by giving certain commands through Bluetooth module. Robot is defined as a mechanical design that is capable of performing human tasks or behaving in a human like manner. Building a robot requires expertise and complex programming.

Hardware Components

AT89S52

The AT89S52 is a low-power, high-performance CMOS 8-bit microcomputer with 4 Kbytes of Flash Programmable and Erasable Read Only Memory (PEROM). The device is manufactured using Atmel's high-density non-volatile memory technology and is compatible with the industry standard MCS-51[®] instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional non-volatile memory programmer. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcomputer, which provides a highly flexible and cost effective solution to many embedded control applications.

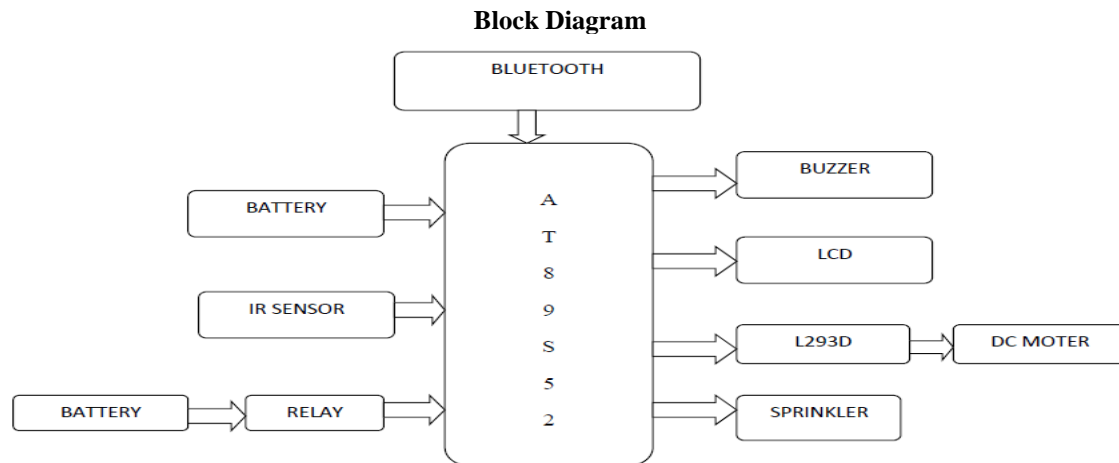


Fig. 1 Block Diagram of fire detecting and water sprinkling

Battery

An electric battery is a device consisting of one or more electrochemical cells with external connections provided to power electrical devices such as flashlights, smart phones and electric cars. When a battery is supplying electric power, its positive terminal is cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons than when connected to an external circuit will flow and deliver energy to an external device.

Driver IC

L293D is a dual H-Bridge motor Driver, so with one IC we can interface two DC motors which can be controlled in both clock wise and anticlockwise directions when we have motor with fixed direction of motion.

We can also make use of all the four I/o's to connect up to four DC motors. L293D has an output current of 600mA and peak output current of 1.2A per channel. Moreover the protection of the circuit from back EMF output diodes are included within the IC. The output supply (VCC2) has a wide range from 4.5 V to 36V, which has made L293D as the best choice for DC motor Driver.

DC Motor

In any electric motor, operation is based on simple electromagnetism. A current-carrying conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field.

Every DC motor has six basic parts -- axle, rotor (a.k.a., Armature), stator, commutator, field magnet(s), and brushes. In most common DC motors (and all that Beamers will see), the external magnetic field is produced by high-strength permanent magnets. The stator is the stationary part of the motor -- this includes the motor casing, as well as two or more permanent magnet pole pieces. The rotor (together with the axle and attached commutator) rotates with respect to the stator. The rotor consists of windings (generally on a core), the windings being electrically connected to the commutator.

Relay

A relay is an electrically controllable switch widely used in industrial controls, automobiles and appliances. The relay allows the isolation of two separate sections of a system with two different voltage sources i.e., a small amount of voltage/current on one side can handle a large amount of voltage/current on the other side but there is no chance that these two voltages mix up.

Transistors and ICs must be protected from the brief high voltage 'spike' produced when the relay coil is switched off. The above diagram shows how a signal diode (eg 1N4148) is connected across the relay coil to provide this protection. The diode is connected 'backwards' so that it will normally not conduct. Conduction occurs only when the relay coil is switched off, at this moment the current tries to flow continuously through the coil and it is safely diverted through the diode. Without the diode no current could flow and the coil would produce a damaging high voltage 'spike' in its attempt to keep the current flowing.

Liquid Crystal Display

A liquid crystal display (LCD) is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector. Each pixel consists of a column of liquid crystal molecules suspended between two transparent electrodes, and two polarizing filters, the axes of polarity of which are perpendicular to each other. Without the liquid crystals between them, light passing through one would be blocked by the other. The liquid crystal twists the polarization of light entering one filter to allow it to pass through the other.

A program must interact with the outside world using input and output devices that communicate directly with a human being. One of the most common devices attached to a controller is an LCD display. Some of the most common LCDs connected to the controllers are 16X1, 16x2 and 20x2 displays. This means 16 characters per line by 1 line 16 characters per line by 2 lines and 20 characters per line by 2 lines, respectively.

Buzzer-Audio Indication

Digital systems and microcontroller pins lack sufficient current to drive the circuits like relays, buzzer circuits etc. While these circuits require around 10milli amps to be operated, the microcontroller's pin can provide a maximum of 1-2milli amps current. For this reason, a driver such as a power transistor is placed in between the microcontroller and the buzzer circuit.

The input to the base of the transistor is applied from the microcontroller port pin P1.0. The transistor will be switched on when the base to emitter voltage is greater than 0.7V (cut-in voltage). Thus when the voltage applied to the pin P1.0 is high i.e., P1.0=1 (>0.7V), the transistor will be switched on and thus the buzzer will be ON. When the voltage at the pin P1.0 is low i.e., P1.0=0 (<0.7V) the transistor will be in off state and the buzzer will be OFF. Thus the transistor acts like a current driver to operate the buzzer accordingly.

Pump/Sprinkler

A pump is a device that moves fluids (liquids or gases), or sometimes slurries, by mechanical action. Pumps can be classified into three major groups according to the method they use to move the fluid: direct lift, displacement and gravity pumps. Pumps operate by some mechanism (typically reciprocating or rotary), and consume energy to perform mechanical work by moving the fluid. Pumps operate via many energy sources, including manual operation, electricity, engines, or wind power, come in many sizes, from microscopic for use in medical applications to large industrial pumps.

Infrared Flame Detector

Infrared radiation is electromagnetic radiation (EMR) with longer wavelengths than those of visible light, and is therefore invisible to the human eye. It is sometimes called infrared light. It extends from the nominal red edge of the visible spectrum at 700 nanometers (frequency430 THz), to 1 millimeter (300 GHz) [1] (although specially pulsed lasers can allow humans to detect IR radiation up to 1050 nm [2-5]). Most of the thermal radiation emitted by objects near room temperature is infrared. Like all EMR, IR carries radiant energy, and behaves both like a wave and like its quantum particle, the photon.

Bluetooth

Bluetooth is a wireless technology standard for exchanging data over short distances (using short-wavelength UHF radio waves in the ISM band from 2.4 to 2.485 GHz [3]) from fixed and mobile devices, and building personal area networks (PANs). Invented by telecom vendor Ericsson in 1994, [4] it was originally conceived as a wireless alternative to RS-232 data cables.

Bluetooth is managed by the Bluetooth Special Interest Group (SIG), which has more than 30,000 member companies in the areas of telecommunication, computing, networking, and consumer electronics [5]. The IEEE standardized Bluetooth as IEEE 802.15.1, but no longer maintains the standard. The Bluetooth SIG oversees development of the specification, manages the qualification program, and protects the trademarks [6]. A manufacturer must meet Bluetooth SIG standards to market it as a Bluetooth device [7]. A network of patents apply to the technology, which are licensed to individual qualifying devices.

RESULTS AND DISCUSSION

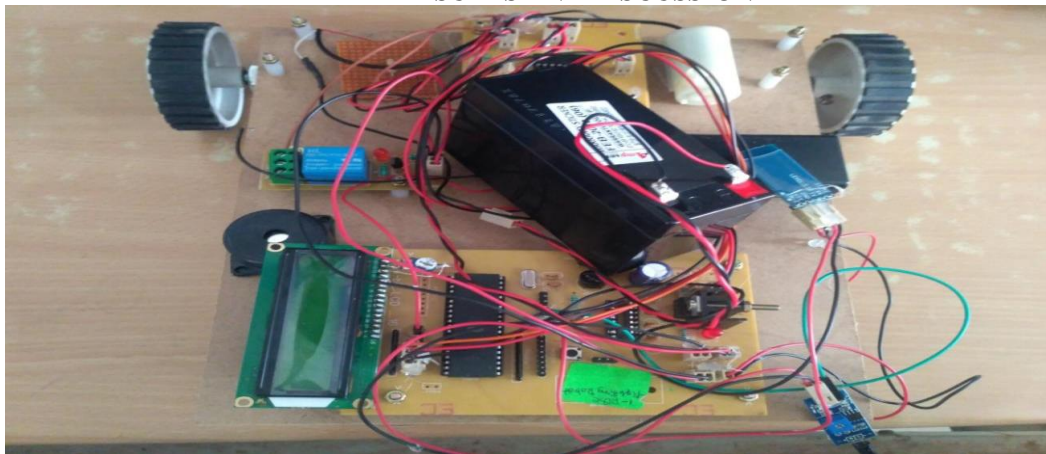


Fig. 2 Photocopy of Fire Detecting and Water Sprinkling using robotics

Keil Software

The micro vision IDE from keil combines project management, facilities, source code editing, and program debugging and complete simulation in one powerful environment.

Installing the Keil software on a Windows PC

- Insert the CD-ROM in your computer's CD drive
- On most computers, the CD will —auto run||, and you will see the Keil installation menu. If the menu does not appear, manually double click on the Setup icon, in the root directory: you will then see the Keil menu.
- On the Keil menu, please select —Install Evaluation Software||. (You will not require a license number to install this software).
- Follow the installation instructions as they appear.

Loading the Projects

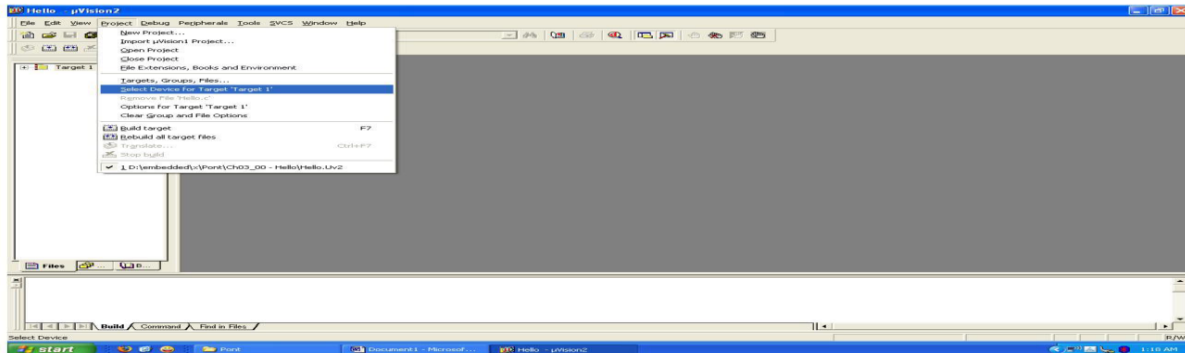


Fig. 3 To select device for Target 1

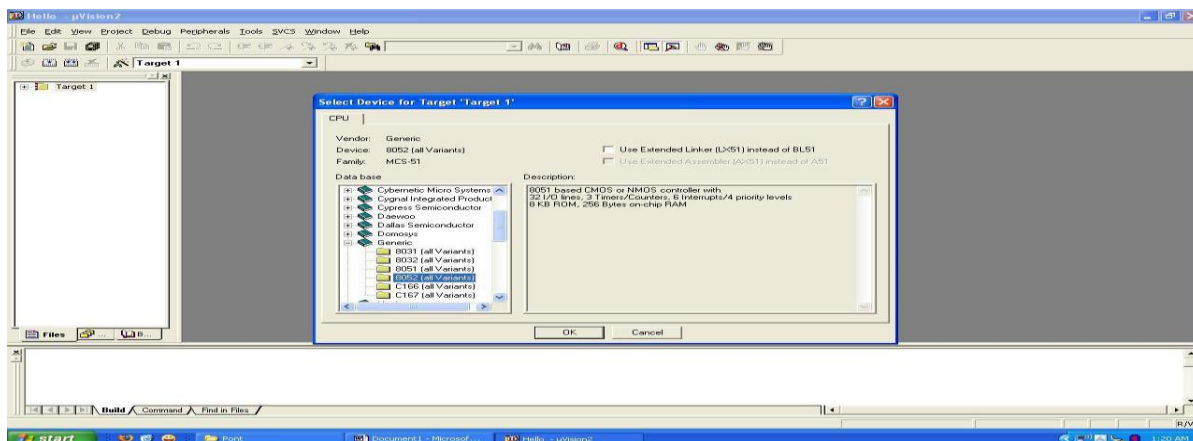


Fig. 4 To select 8052

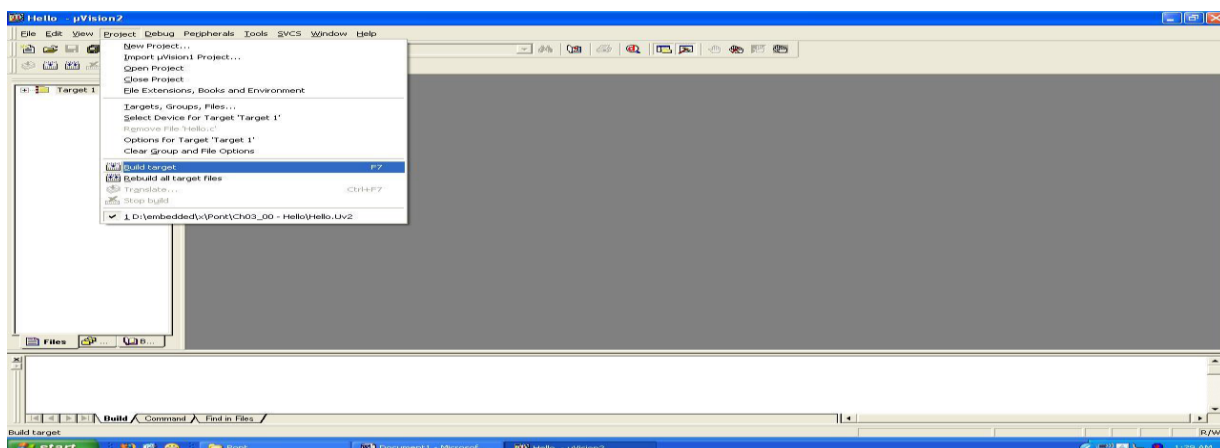


Fig. 5 To build the target

Bluetooth SPP Pro

Bluetooth Serial Port Profile which comfortable to developer application to communication with microcontroller or android device via Bluetooth. The range of it 10m-20m which is not only works in line of sight. From all 360 radius it can be work. The commands already given in program. When we dump it to IC, after from Bluetooth in mobile phone the app is work by applying such commands in your android mobile. The process of pairing between Bluetooth module and mobile phone are shown below



Fig. 6 Pairing process between mobile phone and Bluetooth module

After paring we have to give commands from your app, then the robot will move. We already gave commands like forward, backward, left, right and stop in the program. If we give these commands the robot will move. The photocopies of these commands are shown below. The movements/pictures of the commands on the app shown below

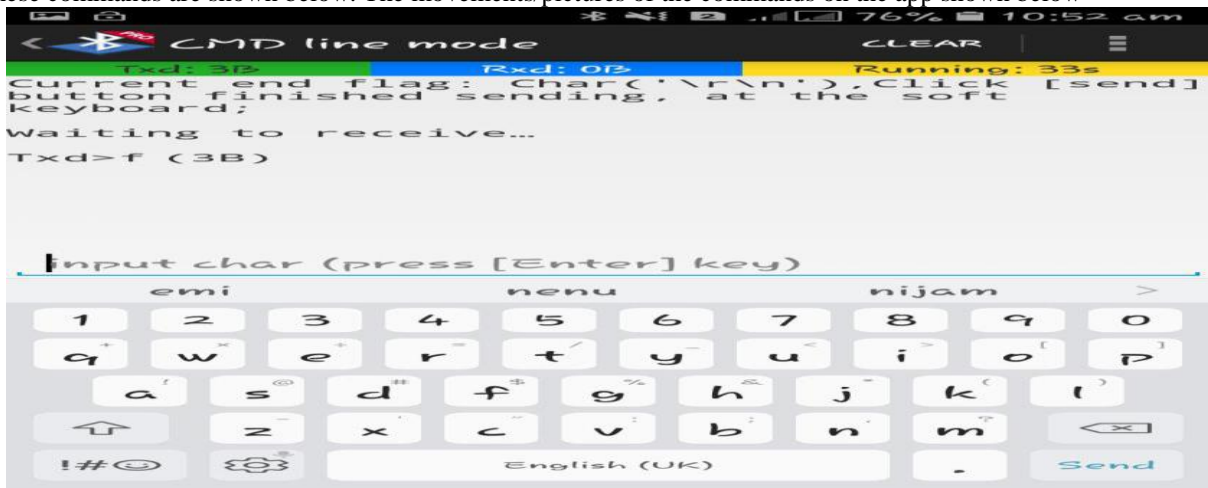


Fig. 7 Robot moving forward command

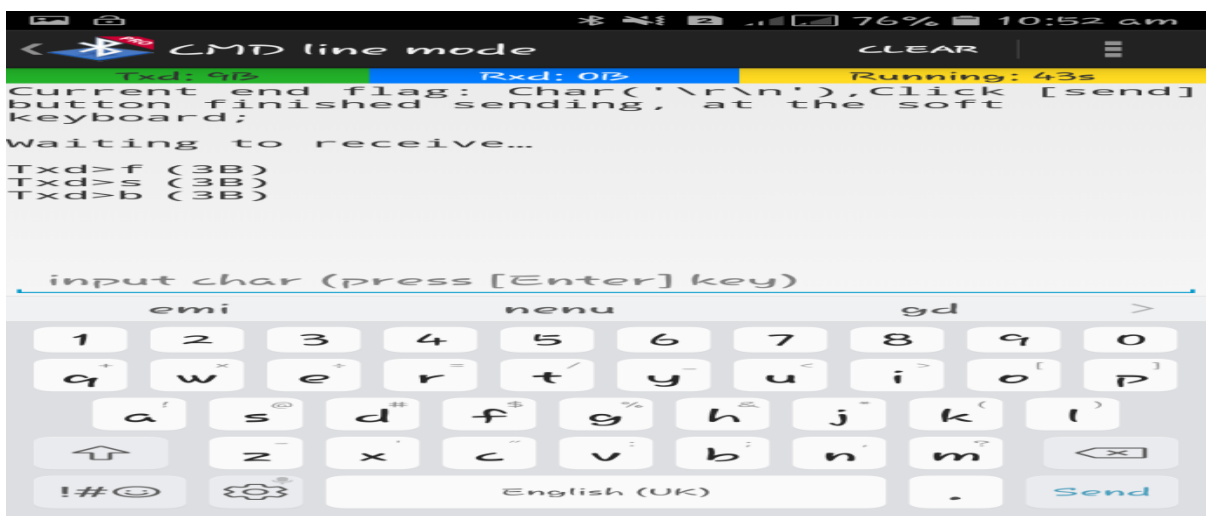


Fig. 8 Robot moving back command



Fig. 9 When fire sensor activated

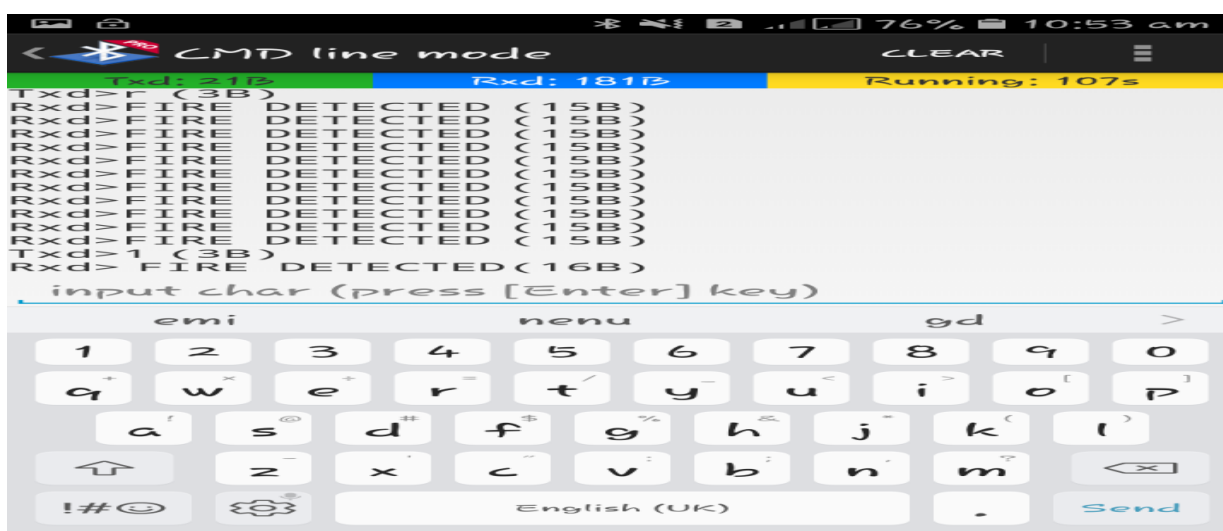


Fig. 10 Sprinkler on command

For water sprinkling we have to give 1 and to stop sprinkling we have to give 0. Whenever fire detect then “fire detected” message will come. Then we press 1 water will sprinkled by robot. And here whenever fire detected when the robot is in motion, then the robot automatically stop and gives us message as fire detected.

This project fire detecting and water sprinkling using robotics is a very useful to humans in real life which informs that whenever fire will occur, which system gives sound as well as also sprinkle water by giving some commands. The system makes use of 8052 family microcontroller, LCD screen, Bluetooth, battery, IR sensors, relay, l293d, dc motors, sprinkler and a buzzer. The system is powered by a 12V dc battery.

The LCD screen is used to display the commands. Whenever we give 12V supply through battery as input then the bridge rectifier will receives that, after one capacitor filter will placed. The work of that is which supplies all 12V to circuit and also the capacitor which allows ac and blocks DC. After that we have one voltage regulator, which is used for supply a 5V DC to circuit. Whenever power reaches to circuit then IC will on and if the fire is occurs, then the robot will detect the fire and give us sound through buzzer. By the Bluetooth module we will operate that kit, and by giving some commands water will sprinkle on to fire through sprinkler. To move robot we contain dc motors and top drive that that motors we have l293 driver. And we have relay also because to run the sprinkler. 7805 three terminal voltage regulator is used for voltage regulation.

CONCLUSION

This project is about to design and produce a fire detection and water sprinkling robot which can operate especially in industrial areas and to test its system functions. Throughout this study; design and manufacturing process are explained, functions of the robot are tested and results are discussed. The manufactured robot is a prototype of the planned advanced firefighting robot. The budget of this project is limited and advanced manufacturing machines and sensors. So the robot is produced using the cheapest components that can be found in the market easily. Despite the disadvantages, fire detection robot passed the functions tests successfully.

The project has been motivated by the desire to design a system that can detect fires and take appropriate action, without any human intervention. The development of sensor networks and the maturity of robotics suggest that we can use mobile agent for tasks that involve perception of an external stimulus and reacting to the stimulus, even when the reaction involves a significant amount of mechanical action. This provides us the opportunity to pass on to robots tasks that traditionally humans have to do but was inherently life threatening.

FUTURE SCOPE

By further developments and improvements, fire detection robot will have more functions and produce more reliable fire detection results. To improve the fire detection robot functions some additions and changes should be done. Chassis and the main body of the robot can be manufactured using fire proof material. With the fireproof material, robot can get into fire. The smoke, temperature and flame measurements can be carried out closer to fire source so that more reliable detection results can be obtained. Robot can be equipped with advanced fire detection equipment. With a minor change; using more flame sensor instead of scanning the environment only one flame sensor and servo motor, more reliable flame detection results can be obtained. To produce an advanced level of firefighting robot which can operate at real fire scenarios; combination of optical flame detectors, thermal camera and image processing are required. Wireless communication module and camera system can be integrated to robot so that it can send information about the fire site and communicate between the victims and operator.

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