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ARDUINO UNO BASED FIRE FIGHTING ROBOT USING MOBILE PLATFORM

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Abstract -The advent contribution of advanced automation systems and the design of a fire extinguisher robot was made to create a mobile robot to detect fire simulated in a closed environment that could occur. It is often that fire fighters cannot access the source of fire due to damage of building and very high temperature, or even due to the presence of explosive materials. With such constraints and high risk in handling of the fire, a technological breakthrough that can help fighting the fire is necessary. This paper proposed the use of a fire extinguisher robot which is assembled with the intention to extinguish the fire by using a water pump as actuators. The robot movement was controlled using Android smart phone via Bluetooth network utilizing Bluetooth module contained in the robot. User commands were sent to the microcontroller on the robot and then translated into robotic movement. We used Arduino UNO as the main microcontroller. The robot was equipped with camera and fire sensors. The camera played role in giving feedback to the user and in finding the source of fire. Fire sensors were used to detect the fire during the movement.

Key Words:Arduino UNO, Bluetooth, Fire Sensor

1. INTRODUCTION

The raising global population is putting together unavoidable issues. Fires are among the most important of those issues, within this area the robotics industry has a lot of work to do. Some of these are fixed mobile robots with different features, fixed with various sensors that detect before the fire is out, mobile rescue robots as fire search and rescue equipment. With ever growing technology, the advances are rising in the face of human life-causing situations [8]. The robot industry merges everyday as a concept which is created in a new branch as an alternative to the human factor. Flying robots, legged robots with wheeled robots, humanoid robots and underwater robots are just a couple. The components and working of this prototype are discussed in Sec. 2.

2. SYSTEM ARCHITECTURE

Each block of system architecture is discussed in detail below.

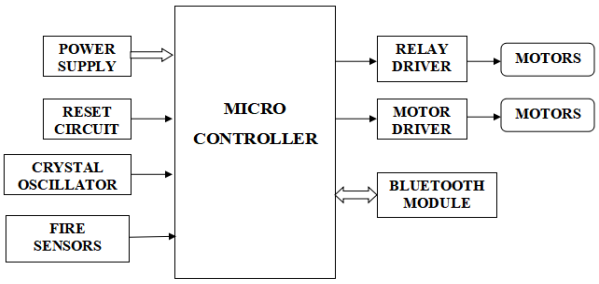

Fig-1: Architecture of Microcontroller

2.1POWER SUPPLY

Any invention of latest technology cannot be activated without the source of power. So in this fast moving world we deliberately need a proper power source which will be apt for a particular requirement [1]. All the electronic components starting from diode to IC's only work with a DC supply ranging from 5V to 12V. Battery is used as a power supply medium.

2.2 ARDUINO UNO

The Arduino UNO is a microcontroller board based on the ATmega16U2. It has 14 digital input/output pins of which 6 can be used as PWM outputs, 6 analog inputs, a 16MHz crystal oscillator, a USB connection, a power jack 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 [2][3].

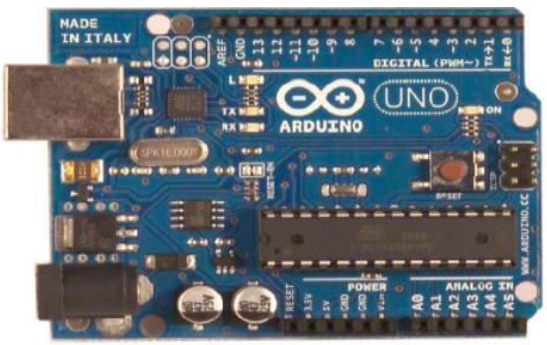

Fig-2: Arduino UNO Microcontroller

The board can operate on an external supply of 6 to 20V. It supplied with less than 7V, however the 5V pin may supply less than five volts and the board may be unstable. The ATmega328 has 32 KB of flash memory for storing code. It also has 2 KB of SRAM and 1KB of EEPROM.

2.3 FIRE SENSOR

The fire sensor used here is a thermistor. The fire sensor is a sensor designed to detect and respond to the presence of fire [6]. It has an input voltage of DC 3.3V to 5V, Sensitive adjustable, Resistance at 25 degree Celsius, Thermistor temperature range 55 to 125 degree Celsius.

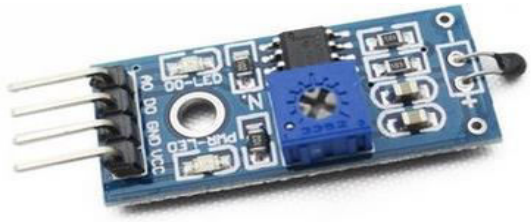

Fig -3: Thermistor

2.4 BLUETOOTH MODULE

Bluetooth is a technology for wireless communication. It is designed to replace cable connections. It communicates with microcontroller using serial port [7]. Usually it connects small devices like mobile phone, tablet, etc using a short-range wireless connection. HC-05 module is an easy to use Bluetooth SPP module designed for transparent wireless serial connection [5].

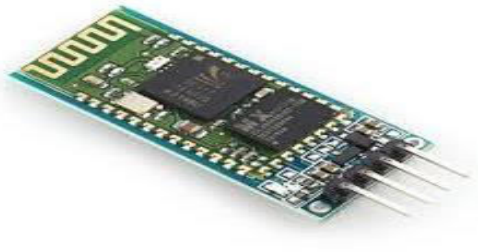

Fig-4: Bluetooth Module

2.5 L293D

The L293D acts as an interface between the motors and the control circuits. Motors allow high volume of current while the controller circuit operates on low current signals. So L293D's job is to take a low current control signal and the transform it into a high current signal that can drive a motor [9]. The fire extinguisher movement is performed in an up and down motion by L293D.

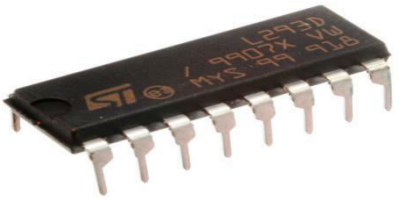

Fig- 5: L293D IC

2.6 RELAY MODULE

A relay is an electrically controllable switch widely used in industrial controls, automobiles and appliances [4]. 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 [10].

Fig-6: Relay Module

2.7 BUZZER

A buzzer or beeper is an audio signalling device; the buzzer used here is of the electromagnetic form built in Arduino UNO. Here we use a piezo electric buzzer which can be driven by an oscillating electronic circuit or other source of audio signal. A click, beep or ring can indicate that a button has been pressed.

Fig-7: Buzzer

2.8 MINI-SUBMERSIBLE PUMP

Submersible pump is a system that has a hermetically sealed motor close to the pump body. The whole assembly is inserted into the fluid to be pumped. Instead of jet pumps needing to pull fluid, submersible pumps move fluid to the surface. Submersible fluids are more powerful that jet pumps

[7]. This is a low cost, small size submersible pump motor that can be powered from a power supply of 2.5-12V. With very low current consumption of 220mA it can take upto 120lts per hr. Only attach the tube pipe to the motor outlet, submerge and power it in water. Make sure the water level is still greater than the pump. Further, the working of the system is explained in the Sec 3.

Fig-8: Submersible Pump

3. METHODOLOGY

When the system is turned ON, the fire sensor is triggered and the fire quest begins. DC power supply of 12V is supplied to the regulator with the help of a battery. Regulator acts as a medium between battery and the microcontroller unit. In order to operate this prototype model there should be a communication in between the system and the operator. So Bluetooth module HC-05 is interfaced. A pair of two-channel relay modules is connected to the digital input/output pins of a microcontroller. These are used to drive the motors connected to the wheels which help in their movement. Then the motor driver connected to the BO motor helps sprinkle the water from the tank when the command is given.When a certain temperature range is detected on either side, the command which says LEFT or RIGHT is sent to the end-users mobile Bluetooth application via the HC-05 Bluetooth module. When the user receives the alert, the micro-controller is sent an ASCII action order [3]. Further the machine performs the operation of sprinkling and foam spray to extinguish the detected fire. In the below flowchart 'MCU' is the microcontroller unit and 'M' is the motor used for the movement of the prototype.

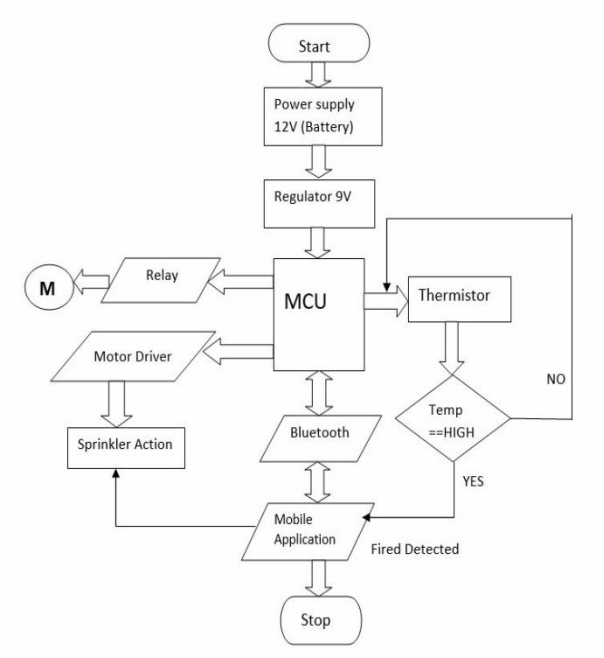

Fig-9: Flow Chart

4. RESULT ANALYSIS

The output of this system is shown in this section. The fig-13 is the user interface where the mobile app bluetooth is connecting to the prototype bluetooth module i.e; "Fire Fighting Robot". When the fire is detected, the mobile bluetooth application receives commands from the HC-05 bluetooth module indicating which side the fire has been detected. The following images shows that the fire is being detected through a candle i.e; fig 10 and 11. When the fire is detected, a command from the HC-05 module is sent to the mobile app which says the direction of fire detected as shown in fig-12.

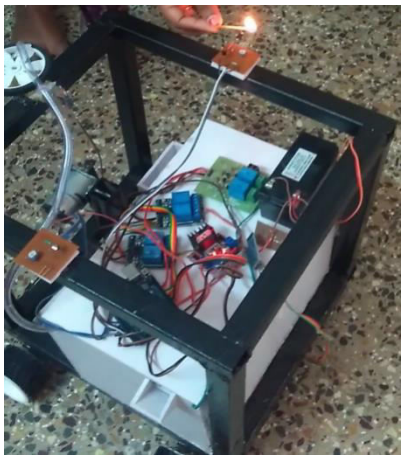

Fig-10: Fire detection at Right end

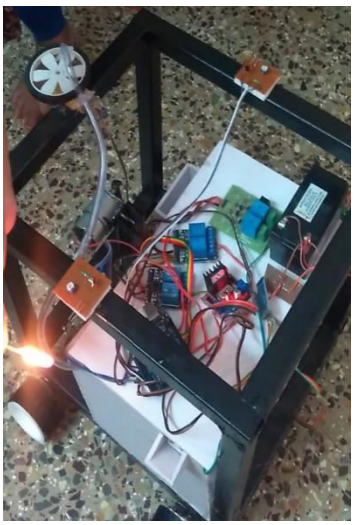

Fig-11: Fire detected at Left end

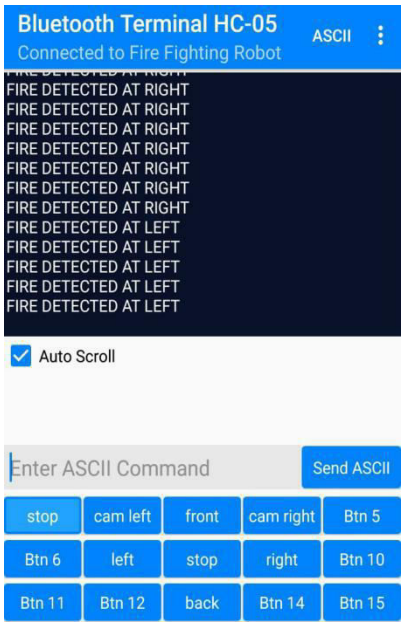

Fig-12: Messages of fire detected

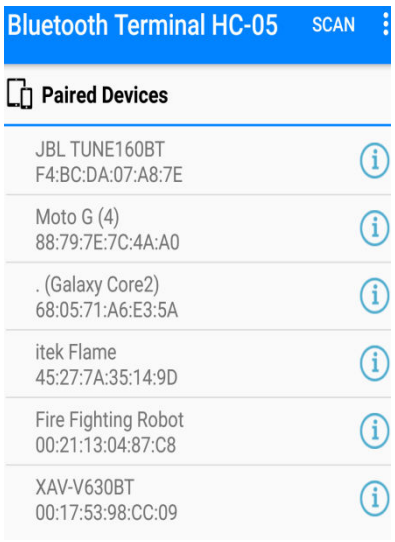

Fig-13: Use Interface

5. CONCLUSION

This paper presents the design and implementation of a system that can detect the fire and take the appropriate action required. The proposed method is used for beneficial of security purpose and industrial purpose. The project has been motivated by the desire to design a system that can detect fire and perform the required actions to put off the fire using commands like spraying and sprinkling. This provides us the opportunity to pass on to robots to do the tasks that traditionally humans had to do but was lifethreatening. It can be enhanced by interfacing it with Bluetooth and wireless camera so that the person controlling it can view the operation of the robot remotely on a screen.

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BIOGRAPHIES

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