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Fire Fighting Robotic Vehicle Using Arduino

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ABSTRACT: The aim of the thesis is to develop a system automation and also to design an unmanned fire extinguisher robot. For this purpose, an attempt was made to create a mobile robot to detect the fires that could occur in a closed environment. Designing robot able to motion by using the rotor motor, beyond the barriers by a sensor, find the flame by flame sensor, and extinguish the fire by fan, it progresses in conjunction with the search for the fire to control it, when it founded the fire, and all of this is controlled by the microcontroller that is Arduino uno. The robot can move on the specified route without being caught in the obstacles, and conducts a fire scan as it progresses. By using the microcontroller module on it evaluates the data in the direction of the software and performs obstacle detection, flame detection, actuation, informing, and extinguishing processes.

KEYWORDS: Arduino Uno, Motor Driver, Bluetooth Module, 433MHz Rx Tx Module, Encoder and decoder HT12E

I. INTRODUCTION

Robots with different features, which are facilitated with different sensors that detect before the fire is out, every day, aims to develop microcontroller based firefighting robot, now a days the robot industry becomes visible as a model that is produced as an alternative to human element in a new branch. Flying robots, wheeled robots, legged robots, humandroid robots, underwater robots are some kinds of them. The growing world population is bringing involuntary problems together. Among all the problems Fires most important. Robotic industry has a lot of work in this area. Some of these are fixed mobile fire search and rescue equipment, mobile locating robots used for fire detection, fire extinguishing robots in many different models designed to help firefighters in the fire. During the design and development of the mechanical system; draft drawings, measurements, computer aided design and solid modelling programs. The robot designed in the study was able to detect fire source randomly placed in random obstacle areas and extinguished with determined fire extinguishing systems, randomly placed in random obstacle areas and extinguished with determined fire extinguishing systems.

II. FIRE FIGHTING ROBOTIC SYSTEM

A robot is a machine especially one programmable by a computer capable of carrying out a complex series of actions automatically. Robot is also a mechanical design that is capable of performing human tasks or behave like human manner. Building a robot requires a complex programming. It is about building systems and putting together motors and wires among other important components. A fire fighter robot is one that has a small fire extinguisher (in this project we use water jet). By attaching a small fire extinguisher to the robot, the automation put out the fire by human controlling. This project covers the design and construction of a robot that is able to sense and extinguish fire. The robot turns on an electronic valve releasing stored water on the flame. Fire fighters face risky situations when extinguishing fires and rescuing victims, it is an inescapable part of being a fire fighter. In contrast, a robot can function by itself or controls from a distance, which means that firefighting and rescue activities could be accomplished without putting fire fighters at risk by using robot technology instead. On the other hand, robots decrease the need for fire fighters to get into dangerous circumstances. This robot uses dc motors, castor wheel, microcontroller, sensors, pump and sprinkler. Microcontroller is the heart of the proposed project. Microcontroller and Rx Tx module controls all the parts of the robot by using of programming. In this paper, a firefighting robot is proposed. The main function of this robot is to become an unmanned support vehicle, developed to search and extinguish fire. There are several existing types of vehicles for firefighting at home and extinguish forest fires. Our proposed robot is designed to be able to work on its own or be controlled remotely. In other words, robots can reduce the need for fire fighters to get into dangerous situations. Additionally, having a compact size and automatic control also allows the robot to be used when fire occurs in small and narrow spaces with hazardous environments.

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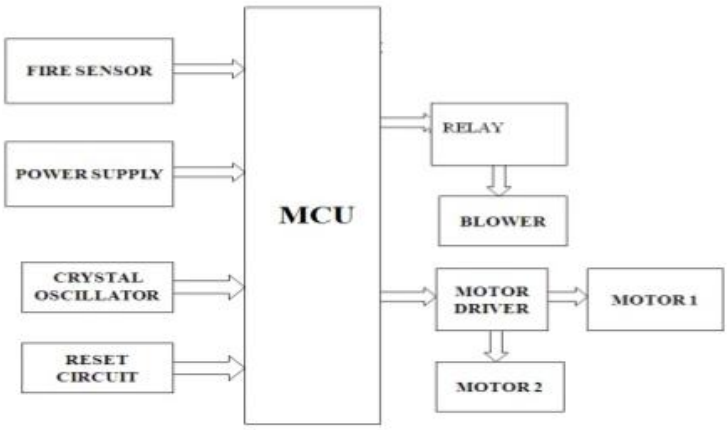

Fig 1: Block diagram of firefighting robot

III. COMPONENTS LIST

a) Arduino Uno (Atmega328P-PU)
b) Motor Driver L293D
c) Bluetooth Module
d) 433MHz Rx Tx Module
e) Encoder HT12E
f) Decoder HT12D
g) 12V Battery
h) Fire Sensor
i) Chassis
j) Wheel
k) Gear Motor
l) Android OS support Mobile

IV. COMPONENT DESCRIPTION

a) Arduino Uno: The Arduino Uno 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 AC-to-DC adapter or battery to get started.

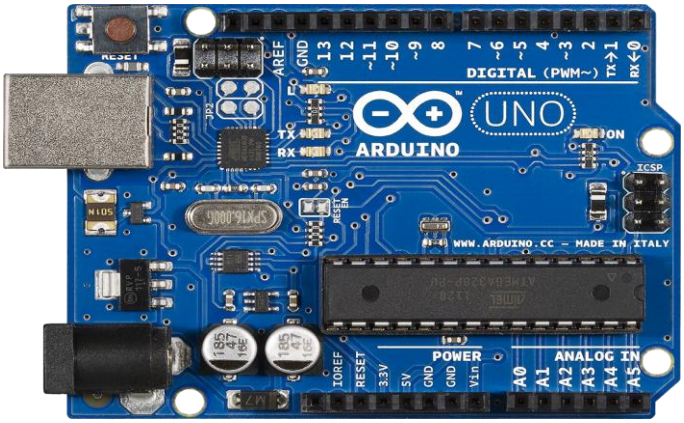

Fig 2: Arduino Uno

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b) Motor Driver L293D: A Motor driver is a device or group of device that serves to govern in some predetermined manner the performance of an electric motor.

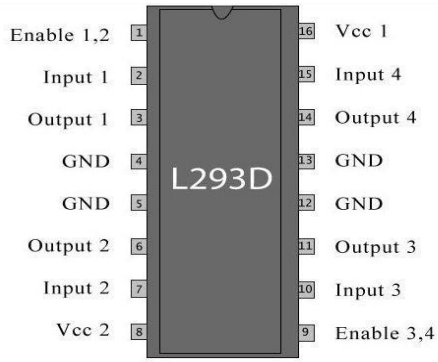

Fig 3: Motor Driver L293D

c) Bluetooth Module HC-05: The Bluetooth module HC-05 is a MASTER/SLAVE module. This module is an easy to use Bluetooth Serial Port Protocol module, designed for transparent wireless serial connection setup.

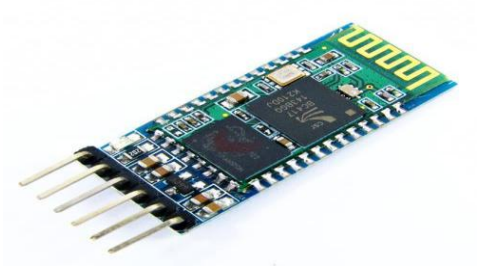

Fig 4: Bluetooth Module HC-05

d) 433 MHz Rx Tx Module and HT12E 12D: This radio frequency (RF) transmission system employs Amplitude Shift Keying with transmitter/receiver (Tx/Rx) pair operating at 434 MHz. The transmitter module takes serial input and transmits these signals through RF. The transmitted signals are received by the receiver module placed away from the source of transmission. The system allows one way communication between transmission and reception.. Here HT12E & HT12D have been used as encoder and decoder respectively. The encoder converts the parallel inputs into serial set of signals. The decoder is used after the RF receiver to decode the serial format and retrieve the original signals as outputs. These outputs can be observed on corresponding LEDs.

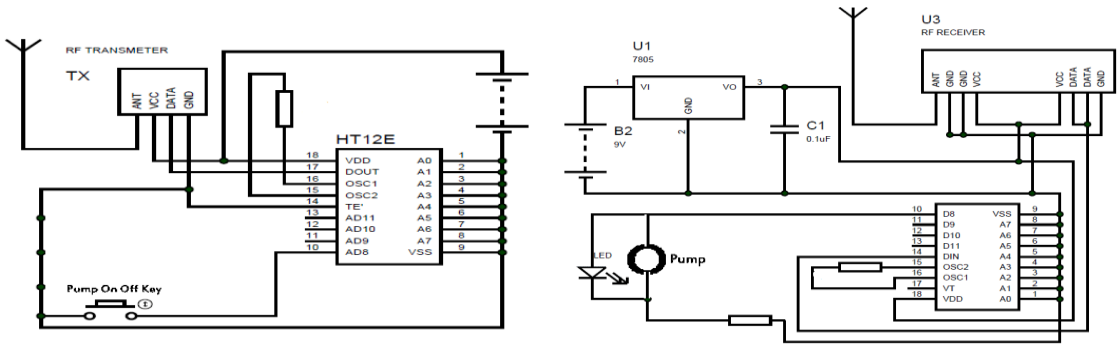

Fig 5: 433 MHz Rx Tx Module and HT12E 12D

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e) Gear Motor: Dc motor converts electrical energy into mechanical energy. It reduce the speed of the vehicle but increase its torque. Whole Process is known as gear reduction.

Fig 6: Gear Motor

f) Fire Sensor: The Fire sensor as the name suggests is used as a simple and compact device for protection against fire. The module makes use of IR sensor and comparator to detect fire up to a range of 1to 2 meters.

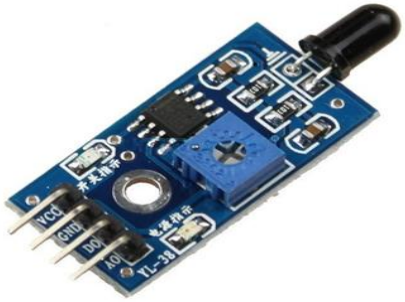

Fig 7: Fire Sensor

V. MATERIALS REQUIRED

Hardware:

1. Arduino / Arduino Clone or make your own custom Arduino board with this tutorial.
2. A 5v TTL -UART Bluetooth module like: JY-MCU BT_BOARD
3. Five 12V SPDT relays like: 12V relay.
4. Prototype board or breadboard.
5. Connecting wires.
6. Vero Board

Software:

1. Arduino IDE
2. Eclipse for Android programming

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VI. FLOWCHART

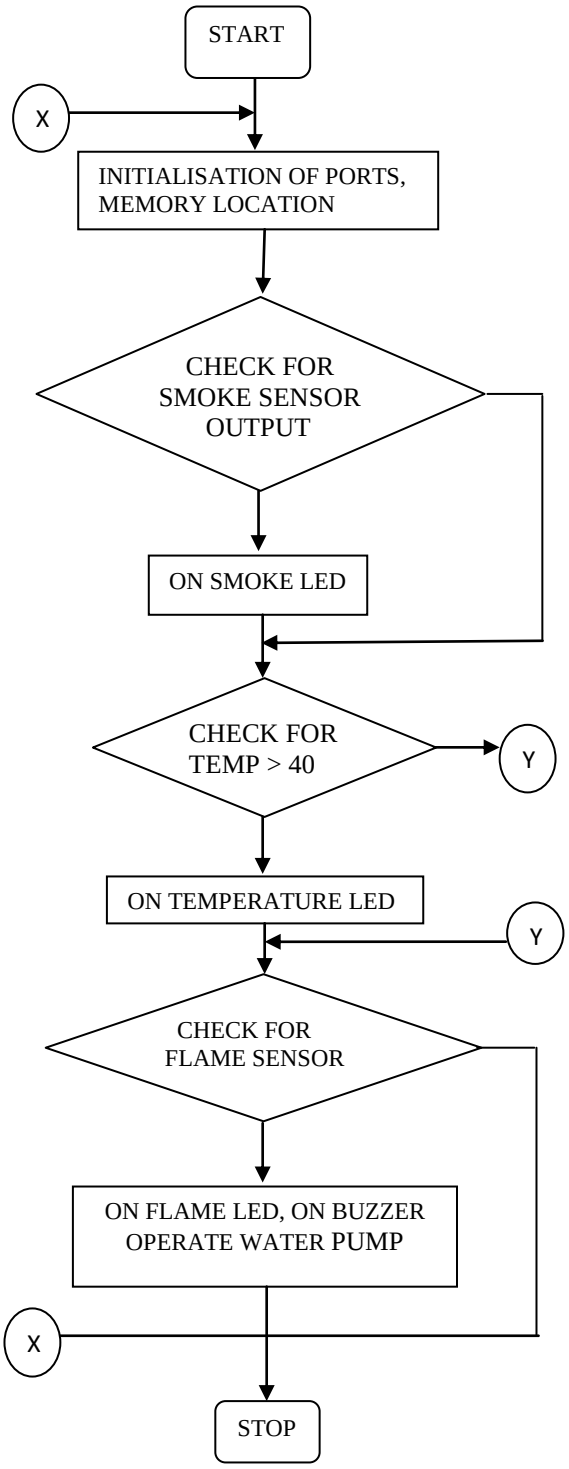

Fig 10: Flowchart of the Proposed System

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VII. HOW DOES IT WORK

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.

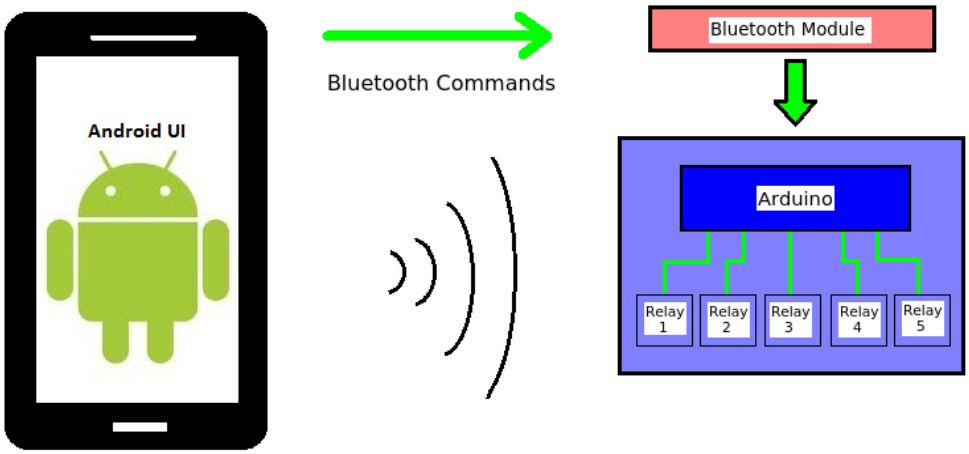

Fig 9: Working Principle of Proposed Model

VIII. PROPOSED MODEL PROTOTYPE

Fig 10: Proposed Model Prototype

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IX. CONCLUSION

The circuit of our project was designed and setup using Arduino uno which is very 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 and motor 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 the microcontroller control so as to determine 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 selected instead 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.

X. FUTURE SCOPE

1. Camera and video transmission can be added in our future prospect with the robotic vehicle.
2. Improving the weight capacity of the robotic vehicle.

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