Fire Fighting Robot with a Voice

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***Abstract*— Fire mishaps are becoming more common these days, and it might be difficult for a fire-fighter to save someone's life. It is impossible to assign someone to constantly monitor whether an unintentional fire has begun, whereas a robot can. A robot will remotely detect fire. These robots are primarily used in manufacturing. The proposed vehicle can detect the existence of a fire and automatically extinguish it using a temperature sensor. The goal of this project is to build an autonomous fire extinguisher robot to contribute to the improvement of automation systems. In order to detect fires (simulated with fire, candle) that may occur in a closed area, a mobile robot was designed for this purpose. Designing a robot that can move with (rotor motor), go beyond barriers with (sensor MZ80), find the flame with (flame sensor), extinguish the fire with (fan), and progresses in tandem with the search for the fire to control it and send messages to the mobile or tablet with (Bluetooth HC-05) when it finds the fire (Arduino Uno). The robot can walk along the set path without colliding with obstacles and conducts a fire scan while doing so. The microcontroller module analyses data in the direction of the programme and performs obstacle identification, flame detection, actuation, informing, and extinguishing actions. The robot used in the investigation was capable of recognising fire sources placed in random obstacle zones and extinguishing them using pre-programmed fire extinguishing systems. A water spray can be sprayed at an angle of 1800 degrees on the proposed robot. The sprinkler can be moved in the direction that is required. It is possible that while travelling towards the source of fire, it will encounter certain obstacles; in such case, it has obstacle avoiding capabilities. It uses ultrasonic sensors to identify impediments. Bluetooth will be used to communicate between the mobile phone and the robot, with a GUI to control the robot's movement. When a phone connects to Bluetooth, it first sets the module name and baud rate.**

Keywords*— Robot; Arduino Uno; Sensors; Bluetooth HC05; Temperature; Motor Driver; Ultrasonic.

I. INTRODUCTION

Mobile robots are now widely used in building sites, warehouses, and manufacturing facilities. Mobile robots may also be utilised in material handling applications, which are becoming increasingly popular. Mobile robots can be used to analyse various products and to handle materials. Wireless navigation for mobile robot motions is also conceivable, and may be controlled through Android. The robot is controlled using a fuzzy logic control system. No mathematical model is required to govern that model. Previously, several electrical devices were used to control Fire Fighting Robots. However, this limits the control capabilities of the fire fighting robot. However, utilising modern approaches, we can create the same robot while controlling its activities via an Android application. The job of firemen has been greatly reduced thanks to such robots, and robot motions have become considerably more effective. The fire-fighter can detect the fire and extinguish it using an Android app. Using ultrasonic sensors, the robot can identify and avoid obstacles at the same time. Our objective is to create an Android application that can control the fire fighting robot's activities. A Bluetooth module put on the robot allows the fireman to communicate orders to it. Bluetooth is a feature on smart phones that allows fire-fighters to control the movement of a fire fighting robot. It employs two sensors to detect fire. The temperature sensor is one, while the smoke detector is the other. When a fire detection system detects a fire, the fire extinguishing system will be engaged. When a fire is detected, the sprinkler will begin to spray water. An Android application is used at the broadcasting end, and two motors are coupled to a microcontroller at the receiving end.

II. LITERATURE REVIEW

Vehicle obstacle avoidance is controlled using a fuzzy controller. The goal of the paper's suggested approach is to lead the Vehicle along its course while avoiding any static surroundings with static barriers in front of it. In an unfamiliar area, real-time obstacle avoidance is a must-have function for a vehicle [1]. The person may operate the robot via the Bluetooth module, according to Shiva and Nidi Agrawal. The Android application is compatible with the Bluetooth module. To interact with an Android application, this Bluetooth model includes a driving motor, an Arduino mega, a voltage divider, tyres, Bluetooth, and a motor driver [2]. The Locomotion system is utilized to identify obstacles, and four ultrasonic range finders are used to determine the distance between the obstacle and the system. For the detection of fire, a fire detection system with a gas sensor is employed. The purpose of an extinguishing system is to put out a fire [3].

III. PROBLEM STATEMENT

The robot normally travels at a constant pace. When the gas sensor detects a fire in the area, it sends a signal to the Arduino, which controls the fire suppression. When the robot senses a fire, it will stop near it and activate the pump, which will spray water through a sprinkler until the smoke has dissipated. Thanks to an Arduino and an infrared sensor, the robot is controlled automatically.

IV. OBJECTIVES OF THE PROJECT

This research paper must create/develop a prototype firefighting robot in order to be effective (F2R). To detect the fire, a flame sensor was used, as well as a micro pump, a relay as an indication, a water sprayer, and Bluetooth as a moment of control.

V. SYSTEM DESCRIPTION

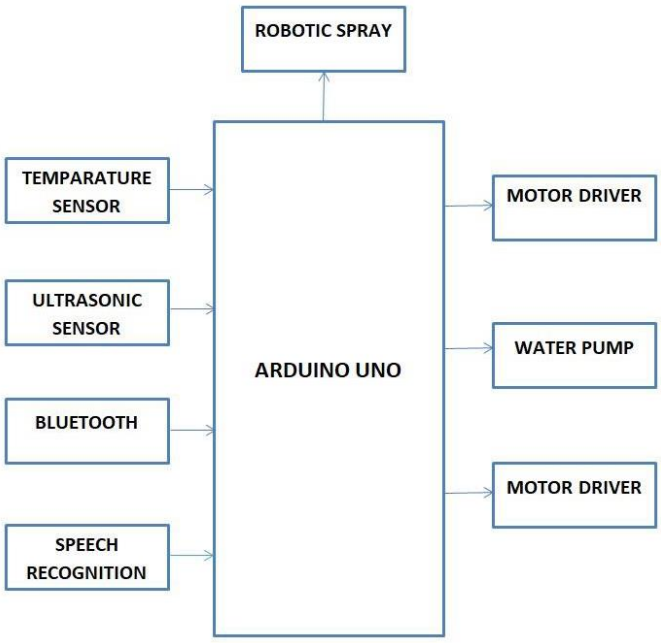

Fig 1: The suggested system's block diagram.

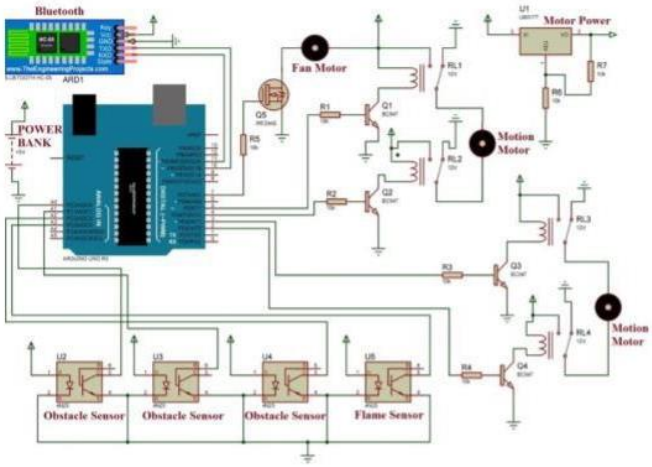

Fig 2: In Robort control, a circuit is employed.

An Arduino Uno development board was used to drive the HC-SR04 sensor-based firefighting robotic system. A gas sensor (MQ2) detects and senses harmful smoke, a temperature sensor (LM35) measures temperature more precisely, and a fire flame sensor (IR) detects and senses an approaching fire. A water tank and a fire-fighting device with spray cannon are also included. A 12V pump pumps water from the main water tank to the water nozzle.

VI. HARDWARE DESCRIPTION AND DESIGN

A. *ARDUINO UNO*

Arduino was developed at the Ivrea Interaction Design Institute as a basic tool for quick prototyping for students who had no prior knowledge with electronics or programming. The Arduino board began to grow to suit new requirements and challenges as soon as it gained a bigger audience, expanding its product line from simple 8-bit boards to IoT, wearable, 3D printing, and embedded contexts.

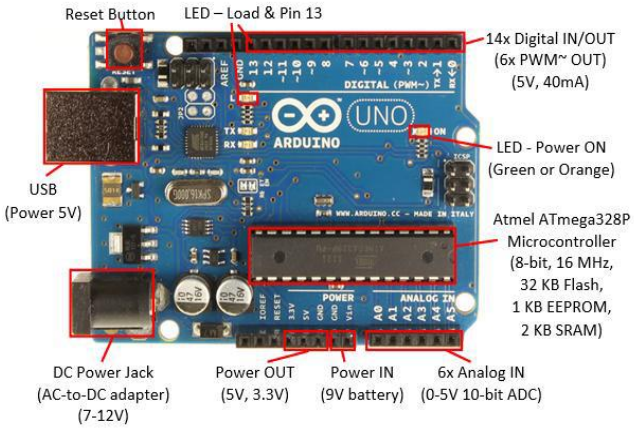

Fig 3: Arduino Uno board

All Arduino boards are open-source, allowing users to build and tweak them to their own specifications. The application is also open-source, and it is constantly improving as a result of contributions from all over the world.

B. *CHANNEL RELAY*

This is a 2 channel LOW LEVEL 5V relay interface board with a 15-20mA driver current per channel. It can operate a wide range of high-current appliances and machines. High-current relays with AC250V 10A or DC30V 10A are included. It features a standard interface that a microcontroller may access directly. This module is optically separated from the high voltage side and eliminates ground loop when connected to a microcontroller for safety.

C. *TEMPERATURE SENSOR LM 35*

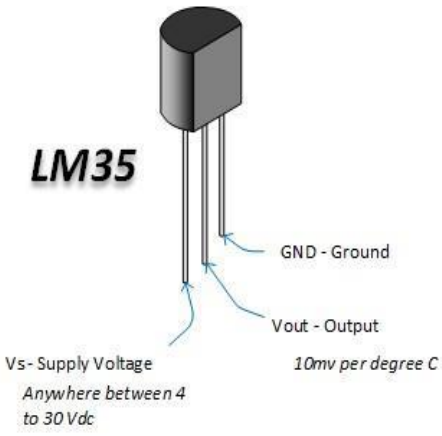

Fig 4: LM35 Temperature sensor

Temperature measurement serves a wide range of needs and applications in today's industrial environment. The process controls sector has created a wide range of sensors and equipment to fulfill this vast range of applications. Temperature is a critical and often measured parameter for most mechanical engineers. In the world of medical, temperature is a critical amount that must be managed in order to maintain a healthy living; but, in the world of engineering, temperature is either conserved for the goal of effective work or released so as not to hurt the task. Galen appraised someone's 'complexion' based on four visual traits about 150 A.D., igniting the need to measure and quantify temperature. The first real thermometer was described in Natural Magic (1558, 1589), which led to the creation of the thermometer. The liquid in glass thermometer was the first calibrated thermometer, and it was later separated into mercury in glass thermometers and alcohol in glass thermometers. Some facts were not in place when this thermometer was invented, which led to its shortcomings, and with the help of technological development, the digital thermometer was born. A digital thermometer combines components such as a microcontroller and an Lm35 temperature sensor, all of which are controlled by an embedded C programming language. As technology advances, digital thermometers may be used in home automation, IoT services for medical records, industrial activities, and many other applications.

D. MOTOR DRIVER

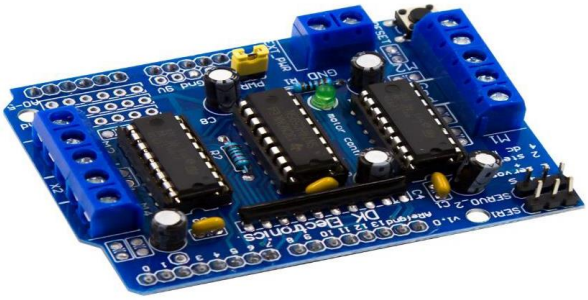

Fig 5: Motor driver board L293D

The L293D is a common motor driver IC that allows DC motors to spin in any direction. The L293D is a 16-pin IC that can operate two DC motors in either direction at the same time. As a consequence, two DC motors may be controlled by a single L293D IC. Integrated Dual H Bridge Motor Driver Circuit (IC). The H-bridge is the foundation of the concept. The H-bridge circuit allows current to flow in both directions. Because voltage must change direction to rotate the motor clockwise or anticlockwise, H-bridge ICs are perfect for controlling a DC motor. On a single L293D chip, there are two h-Bridge circuits that can rotate two dc motors separately. It is commonly used in robotic applications to operate DC motors because to its compactness. A pin diagram for an L293D motor controller is shown below.

E. ULTRASONIC SENSOR

Fig 6: Module for ultrasonic sensors

An ultrasonic sensor is an electronic device that uses ultrasonic sound waves to determine the distance between two target items and transforms the reflected sound into an electrical signal. Ultrasound waves move more quickly than audible sound waves (i.e., the sound that humans can hear). The transmitter (which generates sound using piezoelectric crystals) and the receiver are the two basic components of ultrasonic sensors (which encounter the sound after it has travelled to and from the target). The sensor monitors the duration between the transmitter's sound emissions and its contact with the receiver to compute the distance between the sensor and the item. D = 12 T x C is the formula for this calculation (where D is the distance, T is the time, and C is the sound speed of 343 metres per second). If a scientist placed an ultrasonic sensor against a box and the sound bounced back after 0.025 seconds, the distance between the sensor and the box would be.

F. MODULE HC-05 BLUETOOTH TO SERIAL PORT

The HC-05 is a simple Bluetooth SPP (Serial Port Protocol) module for connecting to a serial port wirelessly. It has a CSR Blue core 04-External single chip Bluetooth system with CMOS and AFH technology (Adaptive Frequency Hopping Feature). It has a compact footprint and is 12.7mmx27mm. I hope it makes your design/development process easier.

G. SPEECH RECOGNISER

- It is robot controller.
- It is operating on the basis of Google speech.

VII. SOFTWARE REQUIRMENT

The Arduino IDE is installed on the PC. A compiler, serial monitor, and other tools are included with the IDE. The Arduino programming language resembles C++ in appearance. The IDE is used to develop, build, and upload the programmer to the board. The language is easy to understand! The IDE lets you pick from a variety of Arduino boards with various

controllers, as well as the communication port to which the Arduino board is attached. The Internet of Things has grown thanks to real-time analytics, machine learning, pervasive computing, cheap sensors, and embedded systems.

VIII. EXPERIMENTAL RESULTS

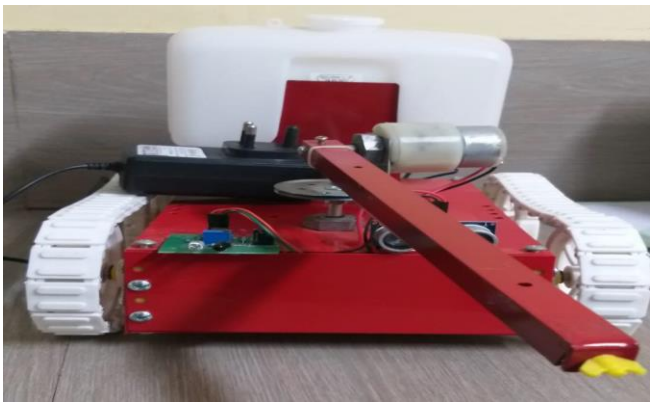

Fig 7: Actual representation of the planned system

In this study, an autonomous Firefighting Robot was built, capable of sensing flames and gases and successfully extinguishing them. This robot can move forward, left, and right with ease. The motors and Arduino programming are in charge of the robot's mobility. The buzzer will begin to ring if any of the flame or smoke sensors are activated, and a warning about the dangerous environment will be displayed on the Virtual Terminal, while a safe environment will be displayed if no such detection is made. The motor will start rotating and moving the robot to the danger spot after getting a signal about the risk environment, and the servo motor will start pumping the water. This process will be repeated until the fire or smoke is completely extinguished. The secure environment will then be displayed. After the project was successfully constructed and the necessary result was received, the simulation was run. Snapshots were taken to capture the outcomes. As a consequence, an autonomous firefighting robot was developed to meet the project's objectives.

IX. CONCLUSION

The goal of our proposed post is to create an Arduino controlled firefighting robot that can be used to put out fires remotely in places like schools and colleges. We can avoid fire mishaps and fire extinguishing manual intervention by doing so. The directions of the Fire Fighting Robot are controlled using DTMF technology. We created a fire detection system that employs a flame sensor that can detect flames with wavelengths ranging from 760 to 1100 nm and sensing ranges of 10cm to 1.5 feet, depending on sensitivity. The robot can operate in situations that are inaccessible to humans in a short period of time and with minimal delay. The robot accurately locates the fire and extinguishes it in the lowest amount of time. With the assistance of the aforementioned robot, it may be concluded that a robot can be utilized in lieu of people, minimizing the risk of a firefighter's life. It can be used in our labs, residences, and offices, among other places. They are highly efficient and can put out a fire before it gets unmanageable and dangerous to people.

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