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# Acoustic Fire Extinguishing Robot

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**Abstract:** The need for fire extinguishing methods is essential as fire accidents are disastrous in nature, leading to unrecoverable loss. The current fire extinguishing technique comes with various drawbacks. The existing techniques are not eco-friendly. The need for brand spanking new hearth conclusion techniques is important as hearth accidents cause deaths and injuries. Sound waves may well be one in every of the potential alternatives as hearth extinguishers. The low frequency acoustic waves spilled from a speaker tend to extinguish the flames. Our aim is to develop a portable fire extinguisher robot using a microcontroller and to analyse the effect of different frequencies of sound waves on flames. Experiments need to conduct for suitable sound wave frequency range to extinguish flame and to analyse the acoustic -flame interaction through observations using a portable and innovative approach to reduce the overall cost. Microcontroller and Mobile sensors are used to record the data and control the robot . Wireless transceivers(LoRA) are used to control the fire extinguisher robot remotely.

**Keywords :** Sound waves, fire extinguisher, mobile sensor, Wireless transceiver (LoRa).

## I. INTRODUCTION

The twenty-first century is being called an Internet Industrial Revolution due to the rapid rise of technological systems. The advancing technologies of this modern industrial revolution are increasing preventability and recovery from destruction caused by both natural and human-made disasters. Emergency response teams are now using technologies including drones, satellite imagery, social media, and robotics to aid their response to unfolding disasters while modern buildings are now outfitted with advanced fire and smoke detectors. Additionally, firefighters are equipped with durable protective equipment and go through comprehensive training to increase their success while fighting a fire. Despite these improvements, firefighting remains one of the deadliest jobs in the world .

The area in which firefighters carry out their operations, known as a fire ground, is a dangerous and constantly changing environment. Currently, operational decisions at a fire ground are made by an Incident Commander (IC). The IC is typically a senior member of the crew that makes decisions about tactics and resource management primarily based on their past experiences and instinct. Decision making on the fire ground is limited by the collection of available data. Real-time data about the building, fire, and firefighters would help ICs make better-informed decisions. A strategy to improve the IC's decision making would be to increase the available information by collecting and integrating information from a wide range of databases and sensor networks, both within and beyond the fire ground. According to the National Institute of Standards and Technology (NIST), the addition of "Smart" technologies to firefighting would

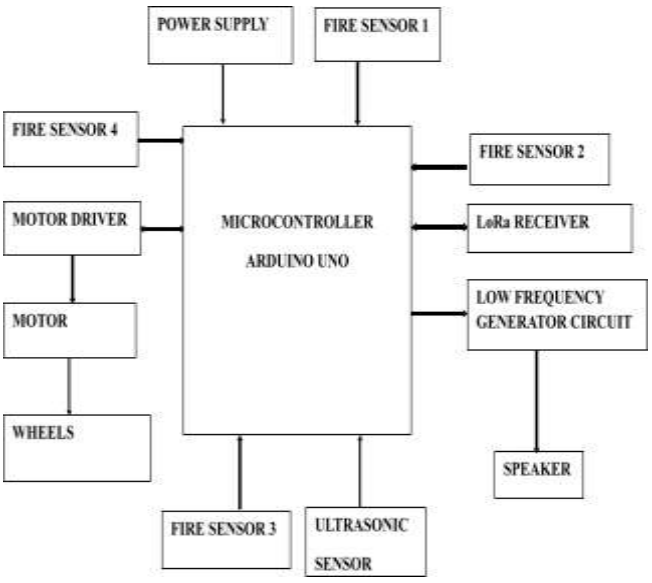
"enable [considerably] better situational awareness, predictive models and decision making."

There is a clear need for a "Smart" system to facilitate and improve the way fire situations are currently addressed. In Worcester, Massachusetts, firefighters have a particular need for technologies when working in converted manufacturing buildings. Worcester is no longer a primarily industrial city; therefore, many of its factory buildings have been repurposed as restaurants, stores, and office spaces. These renovations have made large buildings compartmentalized, which makes interior navigation more complicated for firefighters. Challenges in Firefighting. Firefighting is one of the most dangerous professions due to its unsafe and constantly changing environment. Firefighters may be required to operate under conditions with a high level of uncertainty and must make time-critical decisions using insufficient information Despite thorough preparation, firefighters continue to face challenges while operating in structural fires.

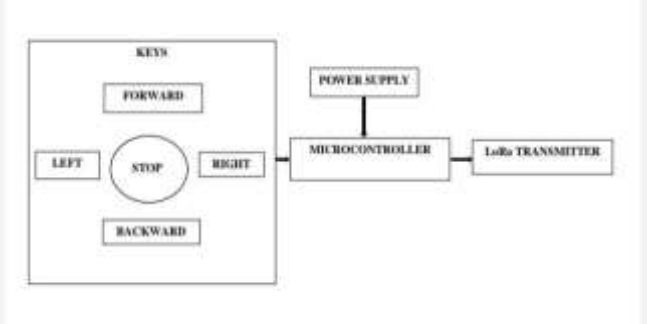
These challenges are the result of uncertainties of structural integrity, unpredictability of fatal events such as flashovers and backdrafts, and getting disoriented or lost when entering buildings with unknown layouts..

## II. BLOCK DIAGRAM

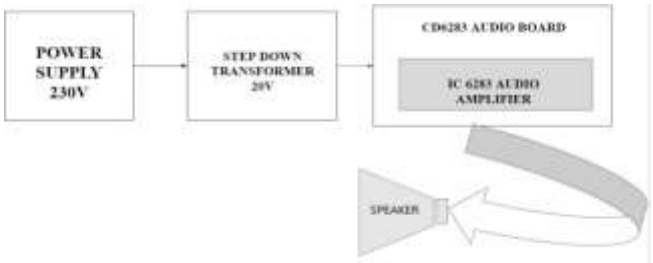
- EXTINGUISHER CIRCUIT




- REMOTE CONTROL CIRCUIT



- LOW FREQUENCY GENERATION CIRCUIT




## III. HARDWARE

### A. MICROCONTROLLER

- ATmega-328 is basically an Advanced Virtual RISC (AVR) micro-controller. It supports the data up to eight (8) bits. ATmega-328 has 32KB internal builtin memory.
- ATmega-328 has 1KB Electrically Erasable Programmable Read Only Memory
- Moreover, ATmega-328 has 2KB Static Random Access Memory (SRAM). These features consist of advanced RISC architecture, good performance, low power consumption, real timer counter having separate oscillator, 6 PWM pins, programmable serial USART, programming lock for software security, throughput up to 20 MIPS etc. ATmega-328 is mostly used in Arduino.

### B. FIRE SENSOR

- A flame detector is a sensor designed to detect and respond to the presence of a flame or fire. It also can detect ordinary light sources in the range of a wavelength 760nm-1100 nm.
- The detection distance is up to 100 cm. The Flame sensor can output digital or analog signal. It can be used as a flame alarm or in fire fighting robots.

### C. ULTRASONIC SENSOR

- The working principle of this module is simple. It sends an ultrasonic pulse out at 40kHz which travels through the air and if there is an obstacle or object, it will bounce back to the sensor. By calculating the travel time and the speed of sound, the distance can be calculated.

### D. MOTOR DRIVER

- bidirectional drive The L293 and L293D are quadruple high-current half-H drivers. The L293 is designed to provide currents of up to 1 A at voltages from 4.5 V to 36 V.

### E. LOW FREQUENCY CIRCUIT

- An audio frequency generator outputs frequencies in the range 20 Hz to 20 kHz. The sounder output is toggled with a delay between each operation determined by the frequency required, as in the BUZZ1 program.

- An audio power amplifier (or power amp) is an electronic amplifier that amplifies low-power electronic audio signals such as the signal from radio receiver or electric guitar pickup to a level that is high enough for driving loudspeakers or headphones.
- A collimator is a device which narrows a beam of particles or waves. To narrow can mean either to cause the directions of motion to become more aligned in a specific direction (i.e., make collimated light or parallel rays), or to cause the spatial cross section of the beam to become smaller (beam limiting device).
- Speakers are one of the most common output devices used with computer systems. The speakers receive audio input from a device such as a computer or an audio receiver. This input may be either in analog or digital form.

F. LoRa

- Long range modem that provides ultra-long range spread spectrum communication and high interference immunity whilst minimizing current consumption. Using Hope RF's patented LoRa TM modulation cost crystal and bill of materials.
- The technique RFM95/96/97/98(W) can achieve a sensitivity of over - 148dBm using a low high sensitivity combined with the integrated +20 dBm power amplifier yields an industry leading link budget making it optimal for any application requiring range or robustness.

## IV. SOFTWARE

A. ARDUINO IDE – 1.8.5

- Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online.
- You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.

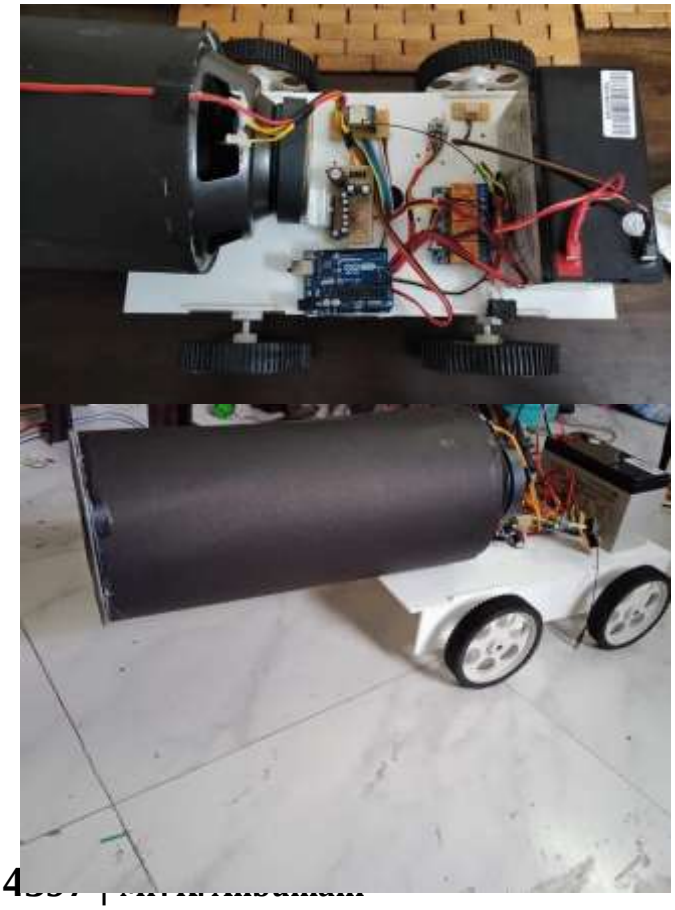
B. EMBEDDED C

- Embedded C is a set of language extensions for the C Programming language by the C Standards committee to address commonality issues that exist between C extensions for different embedded systems.

## V. PROPOSED SYSTEM

We design this project based on robots; all components are mounted on the robot and controller by remote device using a transceiver there is fire detected, then the fire sensors send signals to the processor. Based on which sensor is triggered the location of the fire is found. Therefore the robot will go to the location of the fire based on the signals. Module is a trans-receiver which is used to send the signals from the sensors to the robot. It is used for wireless transmission of signals. Once it reaches the fire, the microcontroller gives signals for tone (sound) generation. The tone generated is amplified by an amplifier and then given to the speaker. A speaker is dedicated to the pre-production of pitched audio frequencies and fire is extinguished.

## VI. OUTPUT



## VII.CONCLUSION

Overall, a fire-fighting robot that can be controlled from some distance has been successfully developed. It has advantageous features such as ability to detect location of fire automatically besides having a compact body and lightweight structure. Robot also has the ability to avoid hitting any obstacle or surrounding objects due to its provision of an ultrasonic sensor. The operator is able to extinguish fire using remote control from a longer distance. The robot can sense smoke and fire accurately in a short time. As conclusion, the project entitled "LoRa BASED FIRE EXTINGUISHING ROBOT WITH ALARM SYSTEM AND PRECISE
MOVEMENT" has achieved its aim and objective successfully.

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