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Sonic Wave Fire Fighter Robot Using Master Slave Concept

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Abstract - *In today's world, A lot of innovation has been going on in the field of fire safety and management. Automated Water and chemical sprinklers are commonly used in various skyscrapers. But these sprinklers have to be pre-installed at a particular distance apart from each other. for it to work efficiently many sprinklers are used on each floor and rooms of skyscrapers. Also, the maintenance of this system is a difficult task, and the cost of maintenance is very high. Hence, we are looking for another more reliable method which may overcome the disadvantages of the traditional method and also replace the chemical use. We are not only looking to extinguish the fire in the early stages but also, we are planning to take precautions in our project to avoid and reduce the rate of fire. To make our project most effective in a dangerous situation we are going to use a master-slave concept, so basically, we divide our project into the master which control the information, and the slave which is going to extinguish the fire when it occurs*

Keywords – *Collimator, Fire extinguisher, Master control unit, Power cut-off, Sound/acoustic waves.*

I. INTRODUCTION

In ancient times Fire is introduced to our ancient peoples. At that time fire helps in there day to day life. The occurrence of hazardous fire at that time was very low but nowadays because of various machines, chemical experiment, devices which used in day-to-day life the unwanted and hazardous fire occurs which may harm us. There are so many ways to control the fire but that is not sufficient. The traditional methods now use to extinguish the fire have many drawbacks. In the traditional method, we use chemicals and water but when we use chemical extinguishers, we not only waste chemicals but the reaction takes place to extinguish the fire pollute our environment by creating residues behind it. There are 4-5 ways to extinguish the fire and the chemicals which are used to extinguish also different in some conditions we use water also.

1.1 Importance of Project

Here we have made a slave robot which can easily move around complete room and can detect exact place of fire in the room and extinguish it. To control this slave robot, we have master control unit which will continuously monitor fire and smoke in the room and guid the slave robots to the fire destination. Our research work is aimed at introducing a type of fire extinguisher that eradicates the use of both water as well as chemicals by using sound/acoustic waves, thus saving resources as well as preventing equipment and health damage caused by chemicals. This Sound based fire extinguishers will be installed on slave robot along with traditional water sprinkler Also our system includes automatic door and windows opening which will have a way for smoke to come out of room hence preventing death by smoke clogging. our system also includes automatic mains power cut on fire or smoke detection.

1.2 Motivation

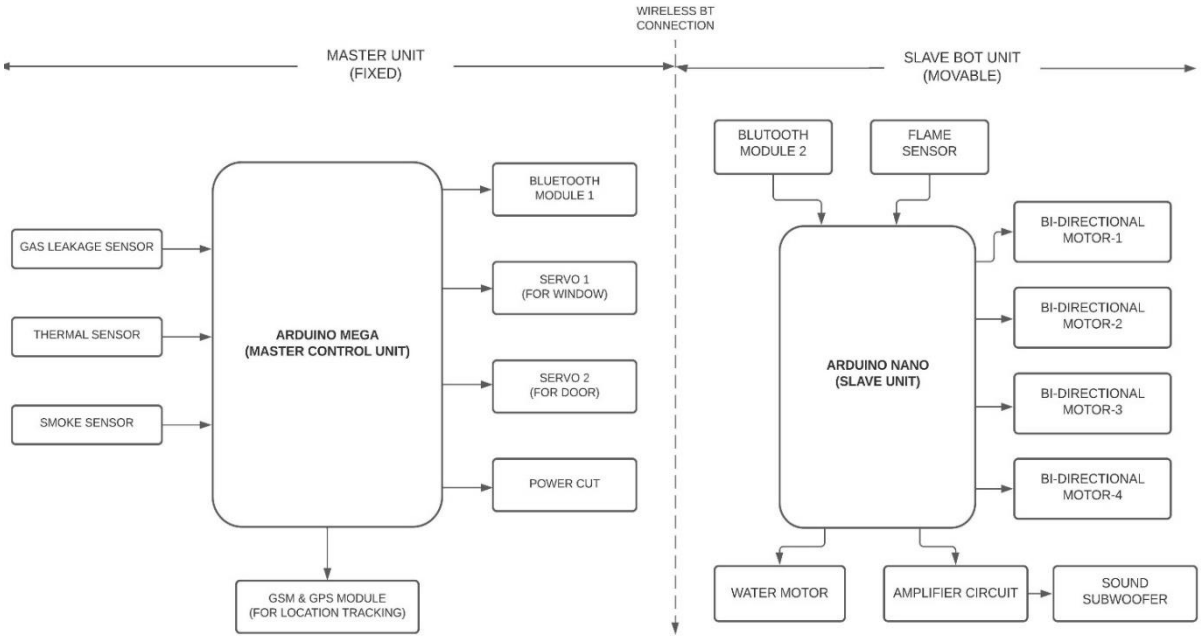
Most Fire accidents took place in Delhi, Maharashtra and Rajasthan Since May 2020, there have been 30 industrial accidents in India, killing at least 75 workers, according to Industrially, a global union of workers. From 2014 to 2017, 8,004 such incidents occurred in Indian workplaces killing 6,368 employees. While Delhi (1,529), Maharashtra (1,239) and Rajasthan (946) recorded most such industrial accidents in the period, Rajasthan (948), Gujarat (629) and Maharashtra (557) witnessed the highest number of deaths.

Some industrial incidents that shook the nation's conscience

- Bombay High, July 27, 2005: At around 4 pm, the Bombay High North oil platform The collision caused a major oil spill which caused both the platform and the ship to catch fire. The fire claimed 10 lives and many were reported missing.
- Kolkata, November 22, 2006: leather factory was caught unawares as the fire broke out at the unit. When workers realised the factory was ablaze, they were unable to break open the locked doors of the unit. 30 people were burnt to death in the inferno.
- Unchahar, November 1, 2017: A boiler explosion occurred at the 1,550-Mw thermal power plant Forty-three people were killed in the blast and more than a hundred were injured.

II. METHODOLOGY

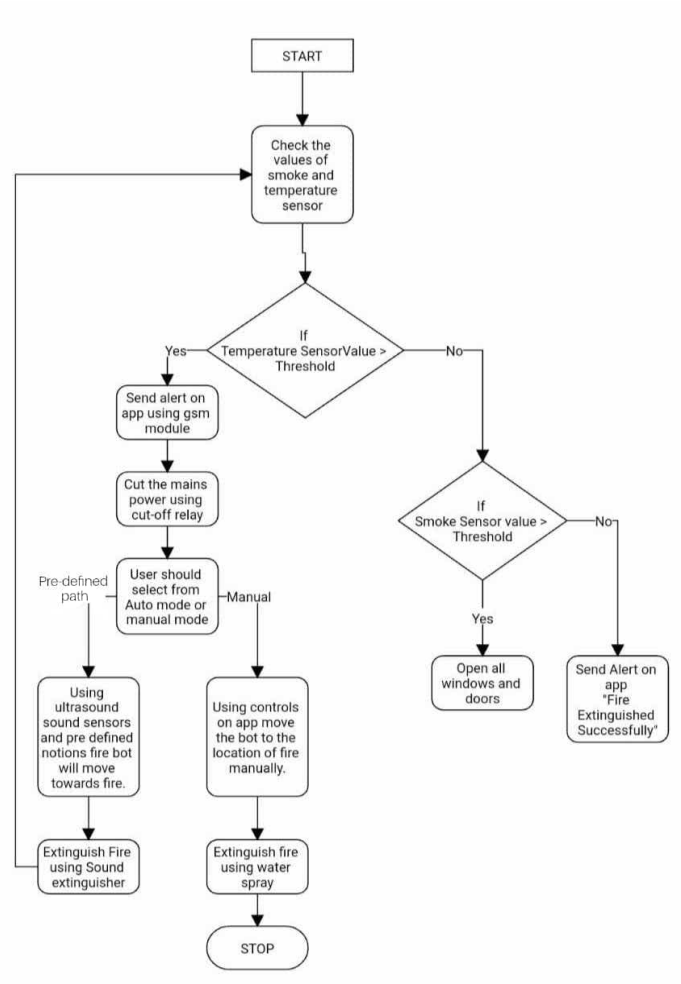
2.1 Block Diagram



2.1 Block Diagram

The Block diagram for Master - Slave Process is shown in above Figure. As we can see Master Unit is a Fixed. Gas Leakage Sensor, Thermal Sensor, Smoke Sensor take digital inputs from environment and provide that input to Arduino MEGA. Condition is set on Arduino MEGA if any condition breaks than it passes the signal forward to Bluetooth Module, servo motors and all emergency component like relay and GSM and GPS module. Now as you can see Slave Unit which is movable, Arduino NANO use for Slave robot, here input is apply using Bluetooth which is send by mobile app, it follows the instruction and send it to Bi-Directional motors. When we reach to fire destination Slave send analog input to Amplifier Circuit and generate the wave which applied to sound woofer and then it passes through collimator. We also use water sprinkler for that we send input to water motor which start pump and spread through small pipe.

2.2 Flowchart



2.2 Flowchart

Figure 2.2, shows the flowchart for the overall process. The system starts by taking and comparing values to threshold value, system check both temperature and smoke value. If only smoke value crosses the threshold value than it opens the window and doors when the smoke value goes below the threshold message sent on app. If temperature value crosses the threshold than alert send on app using GSM, It cut the mains power using cut-off relay, Now there is two option one is pre-defined path mode and Manal mode, If we select the Pre-defined path here we use ultrasonic sensor to move and avoid the obstacle and move forward after reach the fire position extinguish using sound waves, If manual mode select than it control via mobile app using Bluetooth and extinguish the fire using water and when temperature value goes down the process will stop.

2.3 Working

Sonic wave fire fighter using master slave concept as the name suggest we have extinguisher which is not use any chemical reaction to extinguish the fire. We also use the water sprinkler to extinguish the fire. In this method we introduce the pair of master and slave, Let's talk in deep about it.

Our Project divide in two different parts

2.3.1 Master Control Unit (MCU)
2.3.2 Slave Robot

2.3.1 Master Control Unit (MCU):

Master Control Unit is basically Brain of out project the sensor which is placed in a room are connected to MCU to perform all the task we use Arduino Mega. Master also has some major Controls like when Fire or Smoke Occurs to avoid suffocation and to remove fume outside it open the window by sending instruction to the Servo Motor placed in a window, it can control the Emergency Doors to escape people from the building or factory. Our master control unit not only took the precaution to avoid deaths but it also helps to reduce the rate of fire for that they have access of electricity in which if fire occurred in a room than electricity of that room is disconnected. If our slave robot unable to extinguish the fire our master control unit have GSM and GPS module which help to send message to the nearby fire station with location

2.3.2 Slave Robot:

Slave Robot have Arduino UNO to perform all the given task, Our Slave Robot contain of two extinguisher first is Sound/Acoustic Wave Extinguisher and Second is Water sprinkler. Sound wave Extinguisher made up off Sound woofer, sound wave generator, power amplifier, and collimator here collimator plays very important role in a sound extinguisher because if collimator fail to concentrate the sound waves in one direction than sound wave extinguisher failed to avoid this, we choice aluminium foil as material for collimator. We use this Sound wave extinguisher if fire occurred in ground or where robot can easily reach. Water extinguisher are made up off water tank, pump, and spray this extinguisher are going to use when fire occurred on some height also where robot can't reach easily. Our Slave robot Controlled via mobile in which we use Bluetooth to give the instruction

III. FIGURES AND TABLES

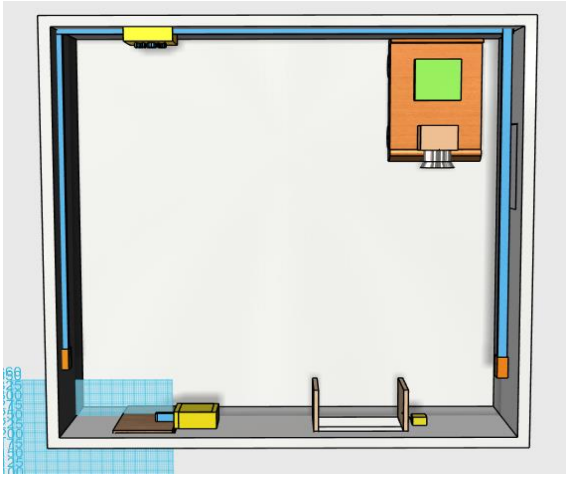


Fig 3.1 Top View of 3D Model

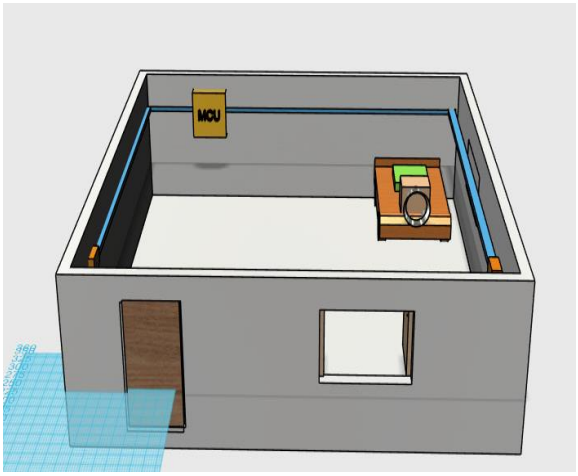


Fig 3.2 Side View of 3D Model

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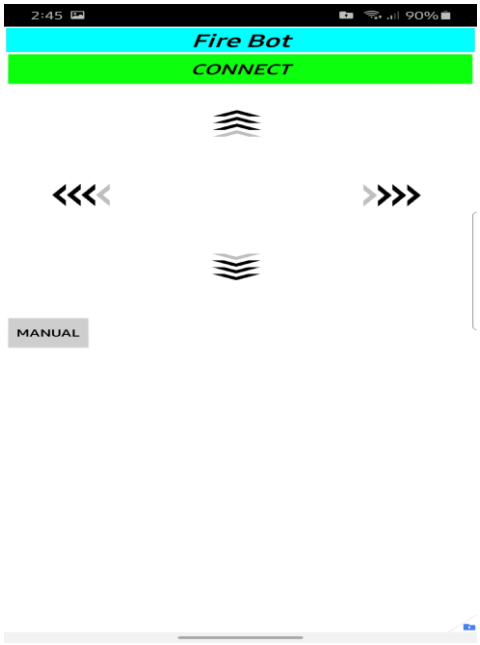
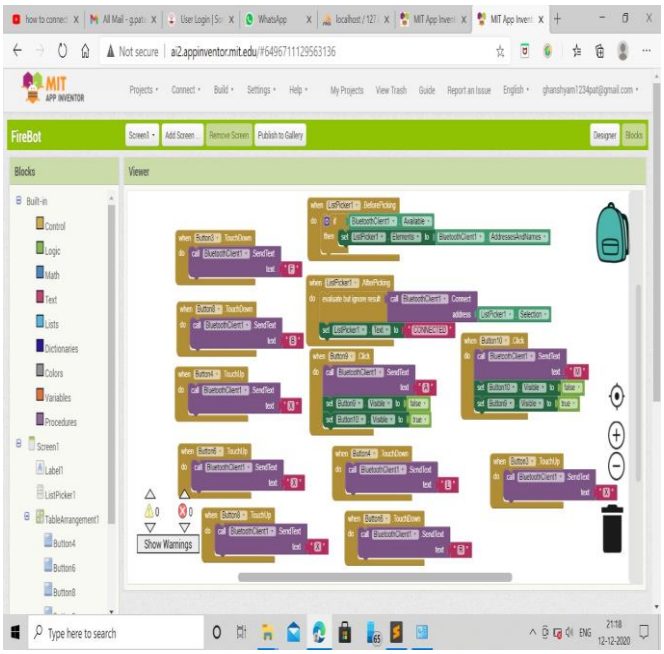


3.3 App Front View



3.4 Background Code (MIT)

IV. CONCLUSION

The idea of extinguishing fire with sound is a novel one. A small fire which is left untreated leads to a bigger one. The proposed system will indeed be useful in fighting fire in multilevel information conveyance capabilities so that a bigger disaster can be avoided. Working capacity of sound extinguisher majorly depends on the shape of collimator, amplifier circuit and the output of subwoofer. To make more reliable and effective we include water sprinkler also in our robot to extinguish fire when it occurs on some height. If we talk about the connectivity here in this project to control the slave robot, we use Bluetooth, in which simple app to control the robot via mobile. The range of our slave and mobile is about 20m it's less but the connectivity can be change according to need and budget, here we focus to make our project easy to use and cost effective

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