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Automatic Fire Suppression System Using Temperature Monitoring Sensor

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Abstract

This paper deals with the major advancement's made to the fire suppressor systems in the recent years. The main problems faced by the fire systems are Portability, Automation and its cost. Existing fire extinguishers systems are not portable, setup cost is huge and operating it becomes a hurdle in times of emergency. So we device new methods wherein we can make the systems portable, automated and easily accessible .The newly devised system can provide a lot of safety to urban consumers where space is the biggest constraint. Use of Internet of things can help us connect the consumer to the systems thus reducing the real danger in emergency situations.

Keywords: *Suppressors, Portability, Automation, Urban, Space, Internet of things*

INTRODUCTION

Fire suppressor systems are diverse application systems. They can be implemented into number of ways to suppress or douse the fire. A fire is a major cause of destruction in most cases as some or the other factor leads to ignition of fire and causes the infrastructure to burn. The ecological impacts of Fire are way more than they can be comprehended. Fire in a controlled form can be very useful but if left uncontrolled it can cause major destruction. The application of fire suppressor system varies from as simple as

from a kitchen use to a spacecraft. The fire suppressor systems available in the market are mainly huge in size and are complex to install. This also includes the high setup cost as well as human intervention which is needed at sometimes to activate the fire suppressor systems A full-fledged research is conducted to design and fabricate a smart portable fire suppressor.

The basis of this system is developed such that it can be installed anywhere to cover area where a fire is certainly to be caused. The main aim of developing this system was to automate the triggering of fire extinguisher which otherwise needs a human interaction.

Composition of fire

Fire is rapid oxidation of any material by which a chemical process of combustion takes place which release's heat and light. It is exothermic process. Fire is caused when the two elements i.e. oxygen and combustible material are present in enough quantity so as to start the fire. There are different types of fire according to the source of fire and the type of combustible material. Fire temperature ranges from 60°C to 1500°C so it becomes necessary to categorize the different types of fires.

Experimental Setup

In this setup we have a fire extinguisher coupled to servo motor by a stainless steel string .The servo motor is actuated by signals given from temperature sensor which is connected to Arduino board. The Arduino board used here is Mega 2560 and the temperature sensor used is DS18B20.A wooden body is fabricated according to dimensions of the fire extinguisher and its attached component's. The area considered for the experimental purpose is a room of 100sq ft. A average ambient temperature of 27°C is taken into consideration. This an open type system so different types of fire extinguishing cylinders can be used namely water type, foam type and gas type.

SPECIFICATIONS AND CALCULATIONS

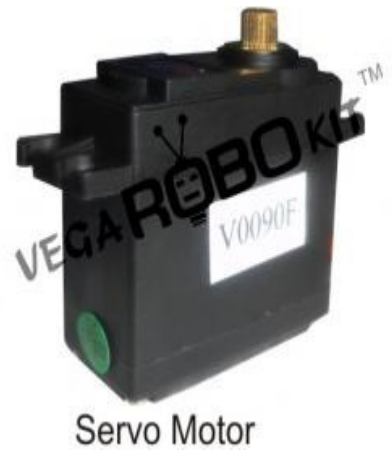

Fig 1:V0090F SERVO MOTOR

Table -1: Servo specifications

Operating Voltage	4.8-6.0V
PWM Input Range	Pulse Cycle 20±2ms, Positive Pulse 1~2ms
STD Direction	Counter Clockwise / Pulse Traveling 1500 to 1900µsec
Stall Torque	9 kg-cm at 4.8V, 10.2 Kg-cm at 6V
Operating Speed	0.18 sec/ 60° at 4.8V, 0.16 sec/ 60° at 6V at no load
Weight	56 g
Size	41.3*20.3*38.7*48.5*10
Special Feature	Heavy Duty Metal Gears

Selection of this servo was done by testing the torque force required at the handle of the fire extinguisher. To have a required value, a spring balance was attached to the handle of the extinguisher and was pulled such that it depresses all the way to its end. By this method the stall torque acquired was of 8 kgf .This method takes into consideration all the efficiency and coefficient of frictions. So a standard motor of 9kgf torque capacity was selected.

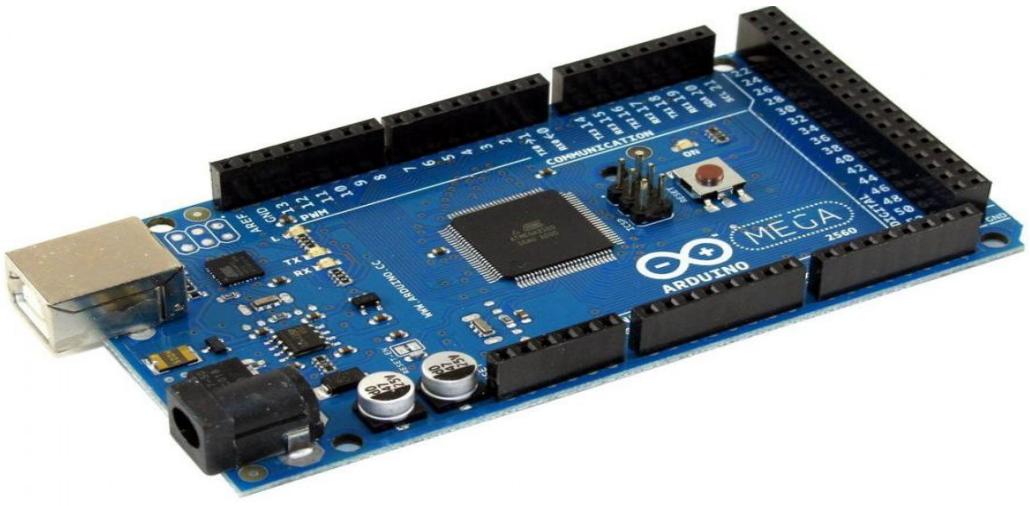

Fig-2: Arduino Mega Board

Table 2: Arduino board specifications

Operating Voltage	5V
Input Voltage (recommended)	7-12V
Digital I/O Pins	54 (of which 15 provide PWM output)
Flash Memory	256 KB of which 8 KB used by bootloader
SRAM	8 KB
Length	101.52 mm
Width	53.3 mm
Weight	37 g

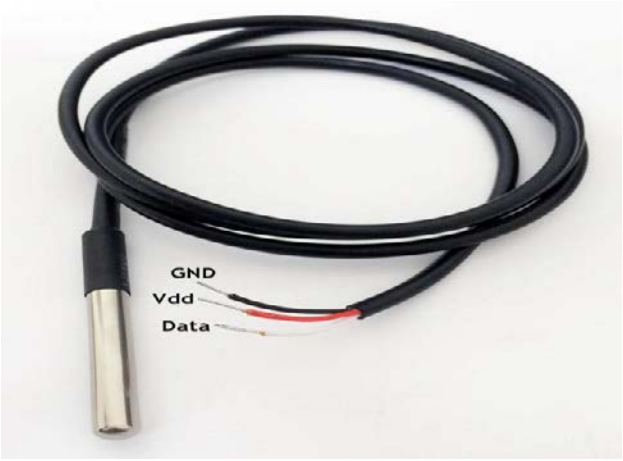

Fig -3: DS18B20 Temperature Sensor

Features

1. Power supply range is 3.0V to 5.5V
2. Measures temperatures from -55°C to +125°C. ±0.5°C accuracy from -10°C to +85°C
3. Can be powered from data line.

WORKING

A wooden box was designed such that it fits all the stated components within it. A stainless steel wire was attached between the Fire extinguisher handle and the attachment of the servo motor such that it is has 3 cm distance from the center of the servo motor. The string wire used has a thickness of 2mm.The temperature

sensor's line and ground wires were connected to the line and Ground of the board. A pullup resistor of 4.6 ohm was connected between the line and data such that it doesn't have garbage values as readings. The data wire of temperature sensor was connected to the Digital Pin no 2. The data pin of servo was connected to Pin no 9.The board was such programmed that it had a temperature threshold value of 45°C.The extinguisher used for experimental purpose was water type.

The temperature sensor always sends the temperature data to the Arduino board. If the value given by the temperature exceeds the threshold value a PWM signal was given to servo to actuate. The servo motor then rotates full 180° such that it pulls the fire extinguisher lever all the way to its end. If the temperature lowers down after initial spraying of the extinguishing agent the servo retracts back to its starting position. The Arduino board and the servo are powered by 12V 4A mp battery.

FUTURE SCOPE

This is open type system i.e. the user can use any type of fire extinguishing cylinders according to the determined cause of fire in that particular area. The board is such selected that it can be converted to IOT device. The system can be made with less possible cost such that it is compact and affordable than traditional systems.

SETUP IMAGES

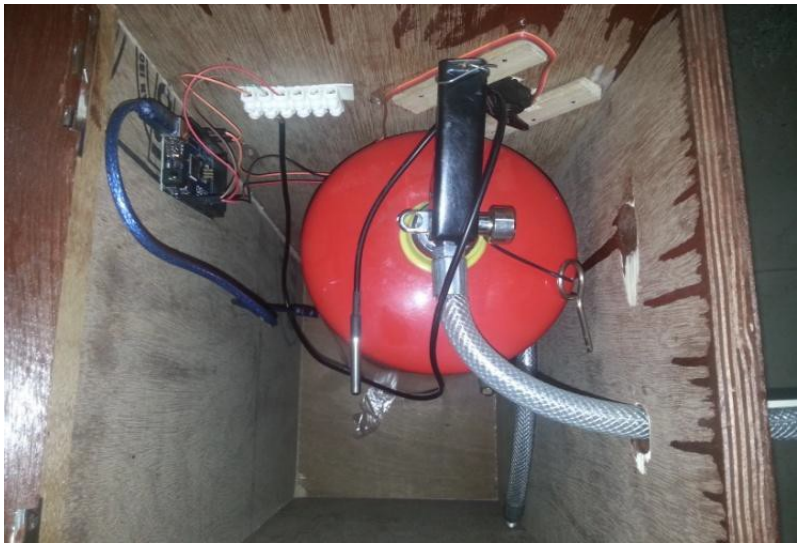

Fig 3: Setup image

Fig 4 External Housing with hose

CONCLUSION

Fires are the major cause in most of the urban landscapes as well as in the industrial areas. Fire causes a lot of physical as well as economical damage which costs are direct as well as indirect. A major role of causing this fire lies in the behavioural issues and attitude of the occupants of the premises or the company. In a developing country like India Fire safety is considered as a secondary cost to every other cost. A wide spread awareness about fire safety in public as well as providing cheap yet reliable solutions like automatic fire suppression systems can help change people's attitude towards safety. This system takes out the human intervention in case of a fire and acts as a preventive measure to stop fire at its source. Being a versatile system I can be fitted in any scenario by doing a fire ignition point analysis of the place in which it is to be installed. Easy to repair and maintain are main benefits of this system. Easy modifications can be done as per the user requirement.

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