

Design and Implementation of Automation to Fire Safety Systems using Powder Sprayer

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Abstract - Fire accident is common feature in office building in every country. Contributory factor is the lack of a sophisticated fire safety system on the automation. The system module developed is basically the sophisticated low-cost fire monitoring and suppression system based on smoke and temperature detection using different sensors installed. System is designed for different mode option for building fire detection and fire suppression. The optimum system type and selected extinguisher will be selected upon the building application for fire control. The system has sufficient devices and sensors working organized to detect and alert people through audio alarms and visuals LEDs.

In proposed system the powder sprayer is activated by the controller NODE-MCU when fire situation is erected. Material used for extinguishing fire is dry chemical type powder. The fire due to short circuit can be easily controlled using the powder rather than traditionally used water in its incipient stage of fire. Use of powder here ensures the safety of electric shock and saving electrical means devices from water damages, also ensuring that any item that is weather sensitive like paper or digital media is protected. Along with fire control action the occupants are warned by alarm sounds and navigation for evacuation from sites. The safety management team get informed instantly as the event of fire is detected to take corrective action for saving human lives. Real time monitoring of the situation is added to the proposed system to control room. Modified version of this module can be suitable for automobile industries. Reduces human work and time saving by automating the alert system to inform nearby fire brigade.

Keywords: - Sophisticated fire safety system, fire detection and suppression, powder sprayer, smoke sensor, temperature sensor, Real time monitoring.

I. INTRODUCTION

Nowadays in market the existing fire detection system, is too vast in term of its design and structure. Since the system is too complex, it needs regular preventive care to be carried out to make sure the system works properly. Meanwhile, when the maintenance is being done to the existing system, it could increase the possibility of non-availability of the system. Therefore, the proposed project is designed with low-cost components, easily available marketing factor and all level users can have one for a safety purpose. To monitor and detect fire in office building is done by intelligent system using various sensors such as flame sensors and gas sensors.

When the system is working properly, it detects the area where fire is caught via flame sensors, smoke detectors and immediately take action to suppress the fire. The proposed module uses fire extinguisher powder to control fire caused due to short circuit near any vulnerable site by flashing the powder over the area preventing fire to expand more to other areas. This system also uses cloud storage to continuously monitor and alert the humans inside the campus if there any fire caught. Under normal condition system indicates 'safe' when fire is being controlled.

II. SYSTEM MODEL

System is designed for different mode option for building fire detection and fire suppression. The optimum system type and selected equipment will be dependent upon the building usage application for fire control. The system has some number devices working together to detect and alert people through visuals. In proposed system the powder sprayer is activated by the controller when fire situation is erected. In control action the powder is sprayed over the floor where fire occurred. Along with fire control action the occupants are warned by alarm and visualisation of emergency situation. The safety management team get informed instantly as the event of fire is detected to take corrective action to save human lives.

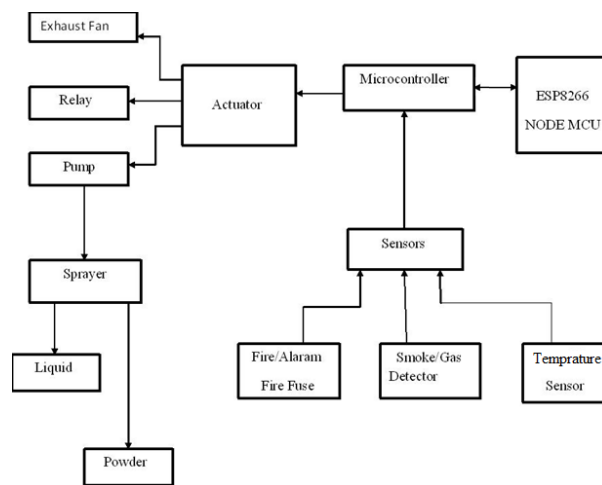


Fig.1 Automation to fire safety system using powder sprayer

• WIFI MODULE

ESP 8266 node MCU for sending the data to cloud storage which enables the user and management system to have real time monitoring over the safety system. In emergency situation it alerts the occupants to escape immediately as soon as possible. The required voltage is 3.3Volt. Consumption of current is 10micro ampere to 170mili ampere. Maximum attachable flash memory is 16MB (512K normal). The chipset hasprocessor Tensilica L106 32-bit with processor speed of 80-160MHz. ESP8266 have RAM of 32K + 80K. Connectivity Wi-Fi direct (P2P), soft-AP with integrated TCP/IP protocol having 802.11 b/g/n support allowing up to 5 maximum TCP connections. [9]

• SMOKE SENSOR

MQ5 is used as smoke sensor. This sensoris used in gas leakage detecting devices in commercial and industry. They are suitable in detection of LPG, natural gas, town gas,etc. they are small sensitive to alcohol and cooking fumes and cigarette smoke. The sensor is fast responsive. They have stable and long life. Simple drive circuit make it reliable. The required supply is 5v. The load resistance is about 20K ohm. Heating compensation provide is less than 800mw. AL₂O₃ceramic tube is used to compose sensor. Gas sensing layer is of tin dioxide (SnO₂). Measuring electrode and heater are fixed into a crust made by plastic and stainless-steel net. When accurately measuring, the proper alarm point for the gas detector should be determined after considering the temperature and humidity influence. [10]

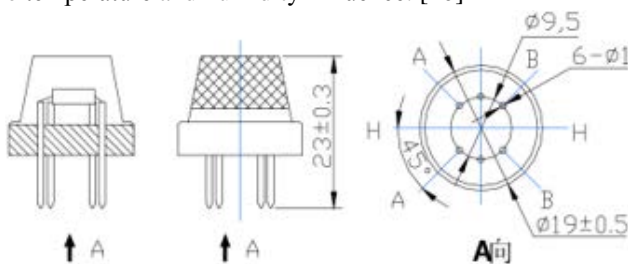


Fig.2 Smoke sensor MQ5 structure and configuration

• TEMPRATURE & HUMIDITY SENSOR

The temperature and humidity sensor used is DHT22. It's a full range temperature compensated and output calibrated digital signal. Its size is small and consumption of power is low. DHT22 have long range transmission distance up to 20m. Its 4 pins packed and fully interchangeable. Required power supply is 3.3volts to 6volts DC. The sensing element used is polymer capacitor. DHT22 operating range for humidity is 0-100%RH and for temperature is -40 to 80 Celsius. The minimum sensing period is 2 seconds. Its fully

interchangeable. Dimensions for small size 14*18*5.5mm. Also available with big size 22*28*5mm. [11].

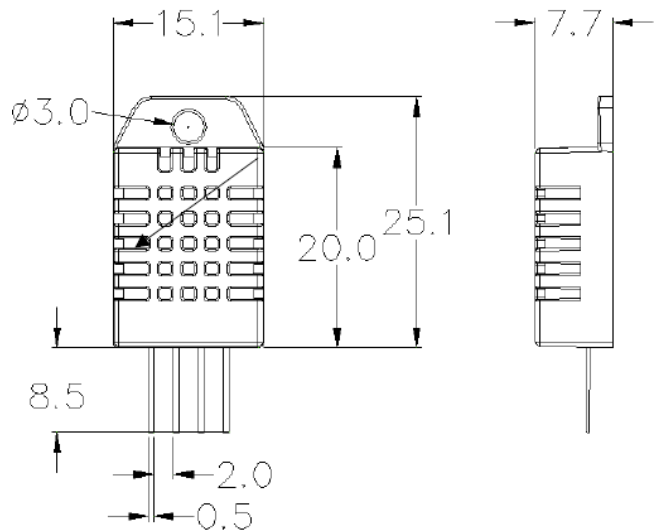


Fig.3 DHT22 small size dimensions: (units: - mm)

III. LITERATURE REVIEW

Huide Liu, Lili Gao, Suwei Li, Tao Wu [1] has proposed the automatic firealarm system, the composition and working principle. Proposed work describesthe overall structure of the fire alarm system, fire alarmcontrol software in the design. Fire detectors using two-wiremethod to reduce the wall alignment, improve reliability, easeof construction and installation.

Deep Shrivastava, Raina Shrivastava [2] has proposed a model focusing on cost effective design of a S.A.F.E i.e. SELF ACTIVATING FIRE EXTINGUISHER. S.A.F.E is self-activating fire extinguisher which on sensing flame/smoke from the fire automatically activates and extinguishes the fire.

Santosh P. Patange, Sagar V. Yadav [3] has proposed an automatic fire alarm system based on wireless sensornetworks is developed, which is designed for high-risebuildings. Test results from the prototype system show that the automatic fire alarm system achieves the design requirements.

IV. EXPERIMENTAL RESULTS

- 1.As smoke is detected by the MQ2 smoke detector theblower started blowing the powder.
- 2.Also when heat is detected over 32-degree C blower startblowing powder.
- 3.Also buzzer starts beeping indicating fire detected.
- 4.Servo opens the gate for powder.

5. And fire gets extinguished in early stage.

V. CONCLUSION

This module can be used for detection and suppression of fire at very early stage. Module detects the fire at incipient stage using smoke detector, gas detector, temperature detector and transmits the alert message to Wi-Fi module (ESP 8266 Node MCU). Afterwards fire suppression is done using proposed powder sprayer (powder blower). Also creates emergency alarm signal. Sends emergency notification to central control room, fire brigadefighters and authorised person of that building or affected area.

VI. FUTURE SCOPES

The model can be modified to use in automotive vehicles. The extinguisher material used is powder. This system can be installed in residential buildings, hotels, school, colleges, IT parks, companies.

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