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Smart Fire Detection System with Water Head Sprinkler

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Abstract: *It describes about the Smart fire detection system with water head sprinkler. The main aim of this project is a security system for the people to alert from fire disaster. The fire detection system saves many lives of people and also decreases the property losses. Fire presents significant threat to life due to its severe hazards and ability to spread rapidly. Fire poses a huge threat to human life. Fire detection systems, particularly vision-based systems, identify flames before any loss or destruction occurs. In this project we used Arduino Atmega328P and done a program for software. We used Fire sensor, gas sensor and DHT11 temp sensor for detection of environmental changes. We also used buzzer to alert the people from the fire. For water sprinkler we used a 5v relay and dc water pump, relay is connected with dc water pump and pump will suck the water and extinguish through sprinkler head. Also, we used an LCD to display the alphabet image when the sensor senses the fire and smoke. The appliance system includes components such as a buzzer for alarming, displaying temperature, humidity and to put out the fire, we use a motor pump.*

Keywords: Fire Detection, Alert System, Sensors, Arduino, Water Sprinkler

I. INTRODUCTION

Fire hazard is the major problem for the builders, designers and godown workers. Many of people died every year due to fire hazard. It is observed a fire situation when the temperature goes above 60*C. This project is a security system which can relevant anywhere and by anyone. The main purpose of the fire detection system is to suggest or give signal to the people. So that they can remove from that place or take immediate action to the fire effect as soon as possible. Sensor was used to detect fire and smoke. Buzzer will alert the people. Sprinkler system is used to extinguish the fire or affected area around its boundary. The proper allotment of fire alarm with a proactive warning can save lives and decrease property losses. Fire alarm system has become very important or useful to us, because nowadays we come to know that the fire disaster is increasing day by day and also people are dying because of this incident. This project helps in many places such as buildings, factories, schools or colleges and other area. The fire detection system is very convenient for people because the fire incident will not come by saying to the people, this incident will happen unconditionally because it's a natural disaster. We can use different type of alarm like bell, horn and siren. This type of alarm is very convenient for the people whose hearing sense is less and also who are stuck in the accidental places. Sometimes fire detection system detects false alarm because of our room temperature, kitchen work and other. Fire is a serious danger to life and property in worldwide. It is usually caused by combustion of materials which releases heat and light in large amount. Fire accident is common feature in factories, house, markets etc. due to inadequate fire protection and a lack of adequate e fire alarm system. So we try to design automate fire detection with water sprinkler system because the event is very dangerous in our life A good firefighting system is one that reduces fire damage while also limiting the harm caused by the firefighting system itself. Fires have become a serious issue in recent years, and they must be dealt with quickly and efficiently to avoid the loss of lives and property. When the observed temperature exceeds 50degrees, it is considered a fire situation. It takes about 15 minutes for personnel to arrive for help in the event of fire threats in vital places such as hospitals, schools, and banks. Appropriately allocating fire alarms with proactive warnings could save lives and prevent property loss.

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II. LITERATURE SURVEY

Wireless Sensor Networks for Building Fire Emergency Detection and Response Seán g Murphy, Lanny Sitanayah, Tatiana Maria Tabirca, Thuy Truong, Ken Brown, and Cormac J. Wireless sensor networks (WSNs) offer a low-cost alternative for maintenance and installation, and building refurbishment and retrofitting are especially simple with wireless technology. Fire emergency detection and response in building environments is a fresh application area for wireless sensor network deployment.For successful building automation in such a sensitive context, fast data capture, detection, and response are required. This paper provides an overview of our recent research in this area. First, we will discuss research on communication protocols that are appropriate for this problem. The work on the use of WSNs to improve fire evacuation and navigation is then described.

Avoidance of a Train Fire Using a ZigBee Wireless Sensor Network M. Praveen Kumar1, R. Pitchai Ramasamy1, S. Sarath Kumar2, and R. Raghu Raman3:- The primary goal of our suggested system is to protect people's lives and government property. This study will concentrate on the system that will detect and control railway fires. Real-time monitoring of internal characteristics such as temperature and humidity in each coach is possible. The relevant system or engine driver can make faster decisions for firefighting, alarms, and automatic water sprinkler system based on the information acquired by the sensor system. The engine driver will stop the train and take the necessary action after getting the signal. Fire alarm system, fire prevention systems, wireless sensor network, automatic sprinklers, signal transmission are some of the terms used. Trains are medium-sized vehicles used to transport people and commodities. People generally prefer rail travel for larger distances because it is less expensive. The Indian Railways has not taken fire accidents seriously since the introduction of trains for passenger transit. The only preventative signs regarding the fire in each compartment are "Do not smoke" and "Do not carry inflammable material." However, fire accidents in trains occur regularly due to failures in the routine maintenance system or the activity of illicit social elements.

AUTOMATIC FIRE DETECTION: A SURVEY FROM A WIRELESS SENSOR NETWORK PERSPECTIVE Majid Bahrepour, Nirvana Meratnia, and Paul Having a Pervasive Systems Group, University of Twente:- Automatic fire detection is critical for detecting and fighting fires as soon as possible. Numerous investigations have been conducted to determine the optimum sensor combinations and acceptable approaches for early fire detection. In past studies, fire detection was either considered an application of a certain field (e.g., event detection for wireless sensor networks) or the primary concern for which approaches were specifically devised (e.g., fire detection utilising distant sensing techniques). These various techniques arise from the diverse backgrounds of fire researchers, which include computer science, geography and earth observation, and fire safety. In this study, we examine prior studies from three perspectives:(1) fire detection strategies for residential areas, (2) forest fire detection techniques, and (3) sensor network contributions to early fire detection There are numerous challenges in automatic fire detection, the most important of which are diverse sensor combinations and appropriate techniques for rapid and noise tolerant fire detection. Fires have been studied by scientists. taking place in diverse locations such as residential areas (Milke and McAvoy 1995), forests (Yu, Wang et al. 2005; Bagheri 2007), and mines (Tan, Wang et al. 2007) to identify some methods for fire monitoring.

III. METHODOLOGY

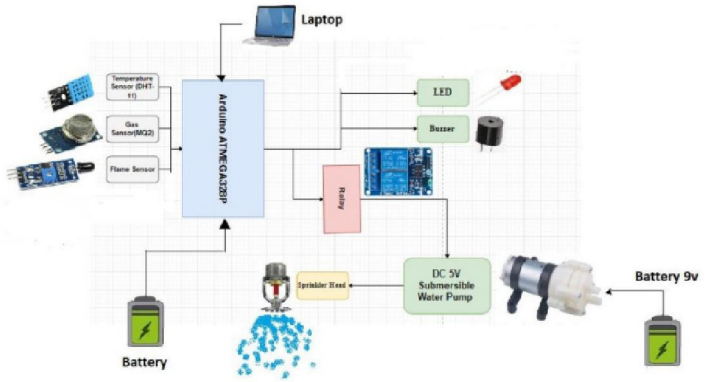

Fig. 1. Block Diagram

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The proposed fire detection system with an automatic water sprinkler. As described in the figure, the Arduino Mega controls the sensors to extract reading from the surroundings. Each indicator for these readings has a threshold to check the potentiality and criticality of fire. For example, the temperature exceeds 80C, CO2 exceeds 30%, and/or flames detection. Smoke and flame, indicators of fire criticality, represent the extra needed readings to see fire plus, if one sensor does not work, then back up reading is required. If the above thresholds are met, the water system would be activated to stop the danger. The pump sucks water from the tank to pass into the sprinkler head through the pipe. Besides, LED and Buzzer are used in the system as visual evidence to show danger. In this section several test have been conducted to carry out the objective of the study and get more accurate values with precision. Therefore, efficiency becomes higher with accurate readings; thus, the testing is conducting on seven elements because a smart fire detection system is a life linked matter, so accuracy matters.

Arduino Atmega328 Microcontroller

The ATmega328 is an Advanced Virtual RISC (AVR) microcontroller. It supports 8-bit data processing. ATmega-328 has 32KB internal flash memory.

ATmega328 has 1KB Electrically Erasable Programmable Read-Only Memory (EEPROM). This property shows if the electric supply supplied to the micro-controller is removed, even then it can store the data and can provide results after providing it with the electric supply. Moreover, ATmega-328 has 2KB Static Random Access Memory (SRAM). Other characteristics will be explained later. ATmega 328 has several different features which make it the most popular device in today's market. 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.

ATmega328 is an 8-bit, 28-Pin AVR Microcontroller, manufactured by Microchip, follows RISC Architecture and has a flash-type program memory of 32KB.

Atmega328 is the microcontroller, used in basic Arduino boardsi.e Arduino UNO, Arduino Pro Mini and Arduino Nano.

Fig. 2.Arduino Atmega328

Flame Sensor

A flame detector is a type of sensor that can detect and respond to the presence of a flame. These detectors have the ability to identify smokeless liquid and smoke that can create open fire. For example, in boiler furnaces flame detectors are widely used, as a flame detector can detect heat, smoke, and fire. These devices can also detect fire according to the air temperature and air movement. The flame detectors use Ultraviolet (UV) or Infra-Red (IR) technology to identify flames meaning they can alert to flames in less than a second

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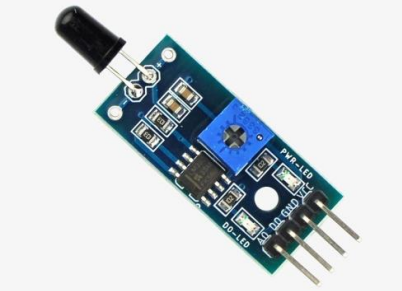

Fig. 3.Flame Sensor

Temp Sensor

The DHT11 is a commonly used Temperature and humidity sensor that comes with a dedicated NTC to measure temperature and an 8-bit microcontroller to output the values of temperature and humidity as serial data.

DHT11 Specifications

- Operating Voltage: 3.5V to 5.5V
- Operating current: 0.3mA (measuring) 60uA (standby)
- Output: Serial data
- Temperature Range: 0°C to 50°C
- Humidity Range: 20% to 90%
- Resolution: Temperature and Humidity both are 16-bit
- Accuracy: ±1°C and ±1%

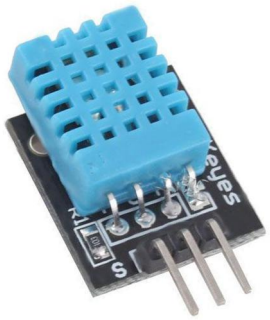

Fig. 4.Temp Sensor

Gas sensor

This is a very easy to use low cost semiconductor Gas sensor Module with analog and digital output. This module uses MQ5 gas sensor as a gas sensing element. It requires no external components just plug in Vcc& ground pins and you are ready to go. For Digital output the threshold value can be easily set by an on-board potentiometer. Using this module you can easily interface MQ5 gas Sensor to any Microcontroller, Arduino or even Raspberry Pi.This Gas Sensor module is sensitive to LPG, natural Gas & Town Gas. it is also small sensitivity to alcohol & smoke

Fig -5: MQ5 GAS SENSOR

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Automatic Water System

The delay time is tested according to the response time of the flame sensor. The water pump is connected into a relay switch; if a flame is detected, a delay is counted to switch on the relay that activates the water pump. The flame sensor detects lights wavelengths that are less than 100nm. Once fire detected, the relay switch on. The water pump activated and suck water from the tank and release it into the water sprinkler. The tested part is how many seconds it took the relay to switch on after fire is detected. Figure 6 illustrates the automatic water sprinkler unit design.

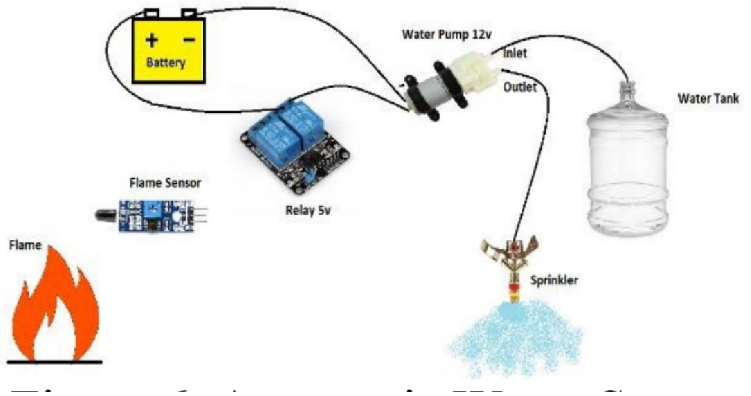

Fig -5: Automatic Water System

IV. CONCLUSION

The fire detection systems proposed in the literature served fire stopping with no care of the responsiveness. Thus, this study considers the existing issues and builds an efficient and effective fire detection system based on gas, temperature, and smoke sensors to collect the data accurately and rapidly. The continuous readings sent over WIFI modules to the central unit to analyse the data and trigger the water sprinkle. This system structure enhances the efficiency and effectiveness of fire detection. Moreover, using the Bidets platform in this system made the data exchange faster and reliable. However, this study's proposed approach obtained an average response of 5 seconds to detect the fire and alert the property owner. Meanwhile, the water pump activated to suck water from the tank and release it into the water sprinkler to minimize the fire until the property owners and emergency services reached. Hence, the proposed system overcame the challenges of the issues of affordability, effectiveness, and responsiveness. The proposed system still needs further enhancements. Thus, one of the enhancement directions is integrating machine learning with the system to predict the potentiality of fire based on the collected data from different sources. Machine learning may help the operators find and overcome the vulnerabilities in their building to prevent fire instead of detection only.

V. ACKNOWLEDGMENT

It gives us great pleasure in presenting the paper on “Smart Fire Detection with Water Head Sprinkler”. We would like to take this opportunity to thank our guide, Prof. S. P. Tambe., Professor, Department of Electronics and Telecommunication Engineering Department, Ashok Institute of Engg. & Technology Polytechnic, Ashoknagar, for giving us all the help and guidance we needed. We are grateful to him for his kind support, and valuable suggestions were very helpful.

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