WIRELESS SAFETY SYSTEM IN CRACKERS FACTORY AND GAS DETECTION USING IOT

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Abstract

This project is about the fire detection using sensor networks and providing safety measures to prevent the huge fire accidents in Industries. This paper includes the design of a fire detection monitoring with Arduino based system by means of Bluetooth Module. The Arduino which controls the fire alert subjected to the temperature sensor and Smoke detector. A Fire sensor is used to detect the heat from the fire. The outputs from the Arduino are Buzzer , Water pump, LED(indicating Electricity shut down), Automatic opening and closing of door(for quick rescue purpose).All these functions are controlled by Relays which are connected with the arduino. When the system detects either the gas leakage or fire, it will immediately display the current status and alert notification on LCD display and simultaneously an alert message will be sent to the user (nearby fire station) via short message service (SMS) via Bluetooth module. Results to be obtained are, automatic fire extinguisher (water pump) will be opened in order to extinguish the fire, LED turns off which resembles the electric shut down, then the buzzer will be working for alerting the people. After fire is defected, the door opens automatically for escaping from the major issues. This will eventually allow the users to protect their lives and the properties as well from the disaster.

Keywords : Temperature sensor, Smoke sensor, Fire sensor, Buzzer, Relay, Arduino UNO and Bluetooth module.

I. INTRODUCTION

A. General

In this project, we have built a fire alarm using Arduino Uno which is interfaced with a temperature sensor, a smoke sensor, and buzzer Fires represent a constant threat to ecological systems, infrastructure and human lives. Past has witnessed multiple instances of fires. With the faster and faster urbanization process, more and more high-rise buildings appear around us. This also can make the frequency of fire increase and bring great losses to people's lives and property. In areas where fire would pose an unreasonable threat to property, human life or important biological communities, efforts should be made to reduce dangers of fire. As the damage caused by fires is so tremendous that the early fire detection is becoming more and more important. Recently, some fire detectors have been used in many places, they used the smoke, temperature and photosensitive characteristics to detect fires. But they are too worse to meet the needs in a large space, harsh environment or the outdoor environment etc. Traditional fire protection methods use mechanical devices or humans to monitor the surroundings. The most frequently used fire smoke detection techniques are usually based on particle sampling, temperature sampling, and air transparency testing.

Arduino fire alarm system is an important system for industrial purposes as well as for household purposes. Whenever it detects fire or smoke then it instantly alerts the user about the fire through the Bluetooth module. For this purpose, we are using Arduino Uno which is from the Arduino family. Also, the Arduino interfacing with an LCD display is done to display the status of the system whether the Smoke and Overheat are detected or not. And Arduino interfacing with the Bluetooth module is done so that the user gets an alert message. It intimates the user about fire detection. This system is really useful whenever the user is not in the house or industry or inside the premises. Whenever a fire occurs, the system automatically senses and alerts the user by sending an alert to an app installed on a user's Android mobile.

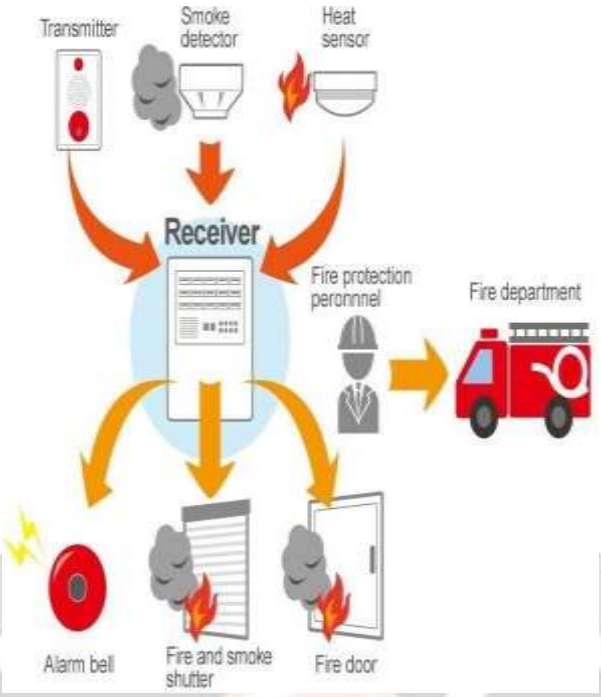

Figure.1.Arduino fire alarm system

B.Objective

The purpose of a fire detection system is to gain immediate knowledge of a fire and to then minimize damage property. This can only be achieved if these devices operate with high reliability and accuracy. This is however not the case.

Fire detection devices have myriads of challenges particularly high false alarm rates and the lack of "intelligence" that IOT seeks to introduce to such objects (devices). In most cases, the high false alarm rate is due to the fact that these detectors rely on a single sensor to detect the presence of a fire which makes it susceptible to deceptive phenomena that might mimic a fire, while those that attempt to combine different sensors are relatively over-priced. Other reasons for the false alarms include equipment failure, human error and malice. In countries such as countries like Sweden recording values as high as 94% (Rutimann, 2014).It is clear then that the solution to this problem pegged on the modernization and upgrading of fire detection devices. Therefore, it is coherent that a prototype of an intelligent residential fire detection system that is more accurate in detecting fires, has timely interventions such as alerting fire response personnel, is cost effective and that can transmit data to a server is developed. This data if collected over time can be mined and used to improve the efficiency in fire and emergency response teams across the globe. The evolution of the Internet of things has brought along low cost hardware particularly micro controllers such as the Arduino Uno, transmitters, receivers and sensors for instance the flame and temperature sensors that are able to be customized and programmed to detect accidental fire out breaks. This research aims at harnessing these capabilities and using them to combat the challenges facing fire detection. This project is to analyze the temperature and smoke parameters around the particular area in an industry in order to provide the early detection of fire. If the fire detects then the buzzer connected to the UNO will be turned on. Then the electric shutdown will happen automatically, opening and closing of door for escaping purpose, then at the same time automatic fire extinguisher will be opened automatically to provide the safety measures to minimize the effects of fire.

II. METHODOLOGY

A. Introduction

The System analysis and design chapter in this research reports on the planning process for development of the prototype through understanding and specifying in detail what the proto typed system should do and how the components of the system should be implemented and work together. The chapter also contains data analysis for data collected in the research. Finally, a visual modeling language (VML) has been used to visualize the proposed solution in multiple dimension, so that the proto typed system can be completely understood before construction begins.

Existing System

In this chapter introduce about the existing system and answers the questions of who will use the system, what the system will do, where and when and how it will be used.

Problem Analysis of Existing System

The system which is recently in used in fire industry. The Existing system contains Sensor wireless network which is little complicated to predict the fire at fireworks earlier. Although this is better than the earlier methods

of fire detection, the enormous amounts of time that it requires and the heavy resources that it consumes has made this system highly inefficient and hence has hardly been implemented in the real world yet. The existing system is so heavily dependent on advanced technical concepts like machine learning that grasping the idea of it has become at least slightly more difficult. The existing system also requires more time and monetary cost which are both highly valued.

Requirement Specifications

Requirements specification is a complete description of the behavior of the prototype to be developed. Requirements are categorized in several ways. This section covers functional and non-functional requirements of the prototype.

Functional Requirements

Functional requirements explain what has to be done by the prototype by identifying the necessary task, action or activity that must be accomplished. They include:

The prototype should read analog temperature, gas, smoke and UV light data from the environment.

The prototype should convert the sensor data into digital form.

The prototype should send a text alert and sound the buzzer during the smoke or heat sensed.

The prototype should the sound buzzer and send a text notification to relevant parties if a fire accident occurs.

Analysis of the Characteristics of a Fire in a Compartment

As outlined earlier, the first objective of this research was to identify the behavioral characteristics of a fire and better understand the combustion process. It is of great significance to note that despite the clear fact that the characteristics of fire in regards to the chemical composition vary depending on the type of accelerant, there are common characteristics that are standard across all types of fires. The purpose of this objective was to clearly identify components of a fire that can be detected in order to trigger a fire alarm. Secondly, understanding the characteristics of the fire was meant to better understand the type of sensors to be used as well as the threshold values that will be set on the detection device to improve accuracy. Credible secondary data from reviewing literature was used to provide insight on some of these characteristics. The common elements characteristics identified were smoke, heat and light (flame). The composition of smoke depends on the nature of the burning fuel and the conditions of combustion. Smoke is a collection of tiny solid, liquid and gas particles. Although smoke can contain hundreds of different chemicals and fumes, visible smoke is mostly carbon (soot), tar, oils and ash. It is, however, the presence of carbon monoxide in the smoke that enables for detection. Although average temperatures have risen dramatically due to global warming, the standard room temperature in most climates is between 21 degrees Celsius and 26 degrees Celsius. These reading are important as they aid in understanding the normal rate of change in temperature thus subsequently aiding setting temperature thresholds for fire detection the LM35 precision temperature sensor.

fire accidents.

The researcher noted and concluded that changes in temperature during the day occur at the rate of 1-4 Degrees Celsius during the day after every hour (Both rise and drop). The researcher also noted that the average maximum temperature during the week stood at 31degree Celsius. This implies that the temperature threshold for the device should be above 31 Degree Celsius to avoid false alarms while increasing the accuracy of the device.

Proposed System

Immediate identification and control of a developing fire. Sprinkler systems respond at all times, including periods of low occupancy. Control is generally instantaneous. Immediate alert, in conjunction with the building fire alarm system, automatic sprinkler systems will notify occupants and emergency response personnel of the developing fire. Reduced heat and smoke damage. Significantly less heat and smoke will be generated when the fire is extinguished at an early stage. Enhanced life safety. Staff, visitors and fire fighters will be subject to less danger when fire growth is checked.

B. Circuit Diagram

Figure-2. Fire detection and monitoring system

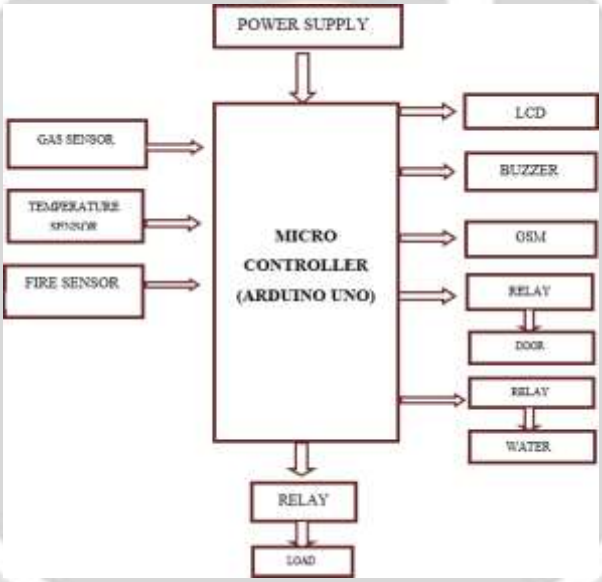

Figure-3. Block diagram

C.Advantages Of Proposed System

- Most early detection through three detection principles in one detector
- High safety against false alarms
- Excellent price-performance ratio
- Remote diagnosis
- Patented technology

The poor safety precautions have provoked us to create a new technique to avoid the causalities. To make sure that such accidents don't happen anywhere in the near future, the system with emerging technologies has been developed. In the proposed system, sand is not used as a fire extinguisher as it is not economic when compared to the crusher dust. Dust stored in a tank that is placed onthe roof top of each room. All the sensors are interfaced with the Arduino. Consider a 10 by 10 room of the working area. The entire floor is connected with an array of temperature sensors, gas sensors and fire sensors. The PVC pipes of length 40-50cm are fixed at all sides of the entire room. These pipes have a coneshaped opening so that it can cover a wide area. The crusher dust is stored in a tank that is placed on the roof top of each room. All the sensors are interfaced with the Arduino. The programs are loaded into Arduino such that it satisfies the criteria. There are three criteria to activate the proposed system. First is that, if the fire startsanywhere on the floor, the fire sensor will get triggered. Second is that, if the temperature level goes beyond the critical level, the temperature sensor will be triggered. Third is that, if there is presence of gas, then the gas sensor will be triggered. The supervisors will be able to monitor the temperature level in the working environment with the help of LCD. The signal will be sent to the Arduino,

System Architecture

A system architecture is the conceptual model that defines the structure,behavior, and more views of a system. An architecture description is a formal description and representation of a system, organized in a way that supports reasoning about the structures and behaviors of the system.

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III. RESULT AND DISCUSSION

Fire safety practices protects people from hazardous damage. From the project, most of the fire safety methods monitors the environmental condition and once the fire is triggered automatically it extinguish the fire. The developed Prototype has been tested to evaluate performance analysis as well as to demonstrate the ability to extinguish the fire. The Prototype has shown quite good performance to detect and extinguish the fire using MQ5 sensor and developed fire extinguishing unit. It also sends notification SMS to the users which can alert the users that there is gas leakage in the floor. In the other view of point, a gas leakage detection system with SMS and alarm is costly device. In the proposed system the fire safety measure for the industry is going to be implemented. In this the root cause for the fire is identified at the basic stage, from that the major fire accidents and damage to lives are avoided. Some people imported this kind of device from abroad which is much costly.

Figure-4. Hardware Setup

Thus the fire in fireworks industries can be monitored using LCD, detected using sensors and extinguished using the crusher dust. Thereby, it ensures the safety of the people under work by the proposed automated system.

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Testing Results

When there is no fire:

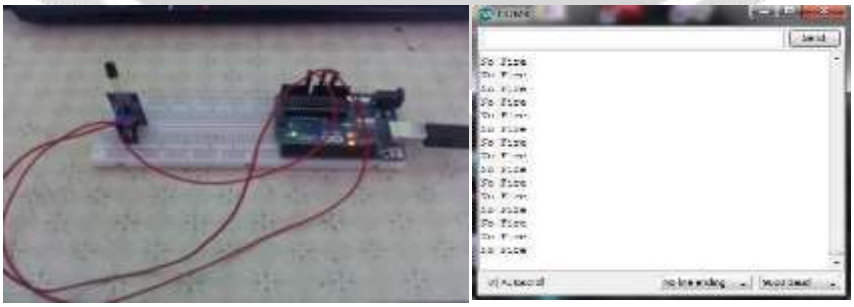

Figure. 5. No fire image

When there is a fire:

Figure.6. Fire Image

IV. CONCLUSION

This Project has been inspired with the aid of using the choice to lay out a machine that may hit upon fires and try and extinguish at a smaller scale. In the prevailing condition, it is able to extinguish hearth place best as a prototype and now no longer a real hearth place in a location. A sensible self-sufficient hearth place- preventing machine need to consist of a set of robots with the intention to paintings collectively to doze away a constructing beneath hearth place. Furthermore, a thermal sensing digital cam that may hit upon humans as soon as the hearth place quenched away may be used to guard the existence of humans trapped with inside the constructing. Nowadays, compressed liquid Nitrogen balls are to be had which have a quicker and purifier impact in sound asleep off the Hearth place. Such ball also can be used with inside the robotic.

There were numerous challenges identified relating to fire detection and response. The main challenge identified under fire detection were high false alarm rates by detection devices others being unaffordability of some of the devices and lack of sufficient awareness on the importance of installing these devices. The high false alarms especially by smoke sensors and heat/ thermal sensors stood out as the major challenge. The researcher's main agenda was to investigate the problem and subsequently develop a solution that solved the false alarm problem while considering the cost of the final product. To achieve this, the researcher laid his emphasis on using more than one percent from the environment during a fire outbreak. The researcher investigated extensively and identified three main percepts that formed or were emitted during a fire. They were smoke, heat and a flame.

REFERENCE

[1] Suresh. S, Yuthika. S and G. Adithya Vardhini Department of Information Technology SRM University Kattankulathur Campus, Tamilnadu, India, "Home Based Fire Monitoring and Warning System" in Journal of Fire Protection Engineering, 2003 May; 13(2):129–151.

[2] Oh-Hyun Kwon , Sung-Min Cho, Sun-Myung Hwang Dept. of Computer Engineering, Tongmyong University, Korea, "Design and Implementation of Fire Detection System" in 2008 Advanced Software Engineering & Its Applications.

[3] Yu Chunyu, Zhang Yongming, Fang Jun, Wang Jinjun State key laboratory of fire science of USTC Hefei 230027, Anhui province, China, "Texture analysis of smoke for real-time fire detection" in 2009 Second International Workshop on Computer Science and Engineering.

[4] Suzilawati Mohd Razmi , Nordin Saad , Vijanth Sagayan Asirvadam, Dept. of Electrical & Electronic, Universiti Teknologi PETRONAS, Bandar Seri Iskandar, Perak, "Vision-Based Flame Detection: Motion Detection & Fire Analysis" in Proceedings of 2010 IEEE Student Conference on Research and Development (SCOReD 2010), 13 - 14 Dec 2010, Putrajaya, Malaysia.

[5] Muhammad Salihin Ahmad Azmil, Norsuzila Ya'acob, Khairul Nizam Tahar, Suzi Seroja Sarnin, "Wireless Fire Detection Monitoring System for Fire and Rescue Application" in 2015 IEEE 11th International Colloquium on Signal Processing & its Applications (CSPA2015), 6-8 Mac. 2015, Kuala Lumpur, Malaysia.

[6] Dattathreya, Heegwang Kim, Jinho Park, Hasil Park, and Joonki Paik Department of Electronics and Communication The Oxford College of Engineering, Bangalore - 68, India, Image Processing and Intelligent Systems Laboratory Graduate School of Advanced Imaging Science, and Film Chung-Ang University, Seoul, Korea. "Fire Flame Detection Based on Color Model and Motion Estimation" in 2016 IEEE International Conference on Consumer Electronics-Asia (ICCE-Asia)

[7] Solórzano, J. Fonollosa, L. Fernández, J. Eichmann, S. Marco, Department of Engineering: Electronics.

Universitat de Barcelona, Barcelona, Spain.2 Institute for Bioengineering of Catalonia, Barcelona, Spain. 3 Minimax GmbH & Co, Bad Oldesloe, Germany, "Fire Detection using a Gas Sensor Array with Sensor Fusion Algorithms" in in 2017 IEEE Technology.

[8] Shivani Sharma ,Kailash Chand, Deepak Sharma, ParamitaGuha CSIR-CSIO Chandigarh , New Delhi , "Development of an early detection system for fire using Wireless Sensor Networks and Arduino" in 2018 International Conference on Sustainable Energy, Electronics and computing Systems (SEEMS).

[9] Shixiao Wu College of Information Engineering Wuhan Business University Wuhan, China , Libing Zhang Department of Organization Wuhan Business University Wuhan, China, "Using Popular Object Detection Methods for Real Time Forest Fire Detection" in 2018 11th International Symposium on Computational Intelligence and Design.

[10] Oxsy Giandi Management Informatics Management Technology Graduate School Institute Teknologi Sepuluh Nopember Surabaya, Indonesia .Riyanarto Sarno Departement of Informatics Institute Teknologi Sepuluh Nopember Surabaya, Indonesia, "Prototype of Fire Symptom Detection System" in 2018 International Conference on Information and Communications Technology (ICOIACT).

[11] Xuan Zhao, Hang Ji, Dengyin Zhang, Huanhuan Bao Nanjing University of Posts and Telecommunications Nanjing, China. "Fire Smoke Detection Based on Contextual Object Detection" in 2018 3rd IEEE International Conference on Image, Vision and Computing

[12] Shivani Sharma , Kailash Chand, Deepak Sharma , ParamitaGuha , CSIR-CSIO Chandigarh, CSIO Delhi, CSIO Delhi, CSIO Chandigarh, CSIO Delhi New Delhi, "Development of an early detection system for fire using Wireless Sensor Networks and Arduino" in 2018 International Conference on Sustainable Energy, Electronics and computing Systems (SEEMS).

[13] Sourav Kumar Bhoi, Sanjaya Kumar Panda, Biranchi Narayan Padhi, Manash Kumar Swain, Balabhadrah Hembram, Debasish Mishra, Chittaranjan Mallick, Munesh Singh, Pabitra Mohan Khilar Department of CSE, Parala Maharaja Engineering College, Berhampur - 761003, India, "FireDS-IoT: A Fire Detection System for Smart Home Based on IOT Data Analytics" in 2018 International Conference on Information Technology (ICIT).