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Industry Fire Monitoring System using WSN Aand IOT

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Abstract - *Smoke detection based on automatic visual system has been applied to fire alarm in open spaces, where traditional smoke detection system is not suitable for it. To address this problem, we propose a new method that combines context-aware framework with automatic visual smoke detection. The system uses RF for short-range wireless communications, Wireless Fire Detector sensor for each node. Wireless Fire Detector sensor is formed of the low-power electrochemical carbon monoxide sensor, photoelectric smoke detector and semiconductor temperature sensor. Internet of Things (IoT) provide a good chance to build powerful system in fire industry. The fire IoT aims to connect different things over the networks related with fire.*

Key Words*: *Internet of Things (IoT), Radio Frequency Identification (RFID), wireless sensor networks, fires alarm systems; smoke detectors.

1. INTRODUCTION

Fire brings great harm to the country's economic and social stability, detecting the location of a fire timely and accurately is an effective way to prevent or mitigate lose. The current fire detection and alarm system use the two bus for connecting Smoke temperature composite fire detector and central console. It has ant interference, high reliability, etc., It has been widely used in society and played an important role in Socio-economic, national security. But it is high cost, design, construction and maintenance is complex. So people invented the wireless fire detection and alarm system. Recently, wireless fire detection and alarm system has been rapid development Has Emerge in the wireless temperature, smoke, smoke temperature composite fire detection and alarm system. The most influential wireless fire detection and alarm system is invented by ITI Company in the United States. Internet of Things (IoT) provides a good chance to build powerful system in industry for fire monitoring. The issue of industry safety is quite outstanding recent years. Many shortages exist in industry safety systems supported by current technologies. The features of wireless sensor network determined that it well adapts the special needs of the environment monitoring. This project presents the design of a industry safety system based on wireless sensor network which is called WISS .It has anti interference, high reliability, etc. It has been widely used in society and played an important role in Socio-economic, national security. Considering the unsafe factors under the industry, a sensor network was designed which can gather and monitor the data Automatic visual object detection has been fully used of in order to alarm fire. This technology currently is the world's most advanced wireless alarm technology. Wireless sensor network (WSN) refers to a group of spatially dispersed and dedicated sensors for monitoring and recording the physical conditions of the environment and organizing the collected data at a central location. WSNs measure environmental conditions like temperature, sound, pollution levels, humidity, wind etc. These are similar to wireless ad hoc networks in the sense that they rely on wireless connectivity and spontaneous formation of networks so that sensor data can be transported wirelessly. WSNs are spatially distributed autonomous sensors to monitor physical or environmental conditions, such as temperature, sound, pressure, etc. and to cooperatively pass their data through the network to a main location. The more modern networks are bi-directional, also enabling control of sensor activity. The development of wireless sensor networks was motivated by military applications such as battlefield surveillance; today such networks are used in many industrial and consumer applications, such as industrial process monitoring and control, machine health monitoring, and so on. In this proposed project the real-time control via the Internet or wireless network will extend the monitoring and control of fire safety systems outside the building. The status of the fire safety system and other building systems can be monitored at any time and from anywhere via the Internet or wireless network. The fire safety systems located in many buildings will be controlled from one central facility office. This will increase the efficiency and reduce costs for building management operations, more efficiently discriminate between fire and non-fire threats and increase the time available for property and life protection.

The Internet of Things offer promising solution to convert the operation and role of many industrial systems such as manufacturing systems, logistics systems and transportation systems. When this is used in creating intelligent system for transportation, the concerned authority is able to track each vehicle along with its movement and monitor its location and predict future path based on road traffic. This technology also related with other technology such as wireless sensor network which has sensors, actuators, GPS devices and mobile

devices as its units. IoT is a global network infrastructure along with self configuration based on communication protocols in which physical and virtual things have identities, physical attribute and intelligent interface and all are integrated into the information network.

A fundamental technology for IoT in fire industry is the RFID technology. This technology allows microchips to transmit the identification information about the fire products to a reader through wireless communication. By using readers every one can identify, track and monitor any product attached with RFID tag automatically. It is widely used in logistics, production units, retailing and supply chain management. Another fundamental technology for IoT is the wireless sensor networks. In which it uses interconnected intelligent sensors to sense and monitoring fire. Wireless sensor network used in many monitoring applications such as environment. healthcare, industry and traffic management and so on. The advancements in both the technology RFID and WSN contributes the development of IoT in fire industries. Along with these two main technologies some additional technologies and devices such as bar code, smart phone, social network, IPv6, 3G/4G, Wife, WiMax and cloud computing are used to form a network for supporting IoT.

Wireless sensor network in IoT is used in the fire monitoring safety field to detect potential fire and provide prior information about fire disasters. RFID tags and bar codes are attached with fire fighting products. It gives development of fire fighting product information databases and management systems. By using RFID tags, RFID readers, intelligent video cameras, wireless sensor networks and ad hoc communication networks, the fire fighting authority and fire fighting organizations could perform automatically real time environment monitoring for fire and warn and/or rescue people as and when they needed. Automatic visual object detection has been fully used of in order to alarm fire disaster as soon as possible for open space. Considering the traditional fire detection system's monitoring region's limitation and data transporting latency, along with the development of visual processing technology, vision technology based on fire detection has attracted researchers' attention.

2. LITERATURE SURVEY

Fire detection and alert systems are very important for early fire detection and speeding the process of fire control. Conventional fire alarm systems have been used for quite a long time. They are mostly used in large buildings and smaller sites such as stores, restaurants, schools, and apartments. A conventional system utilizes initiating circuits which are connected to sensors and wired in parallel. These sensors are designed to decrease the circuits resistance when the environmental influence on any sensor exceeds a predetermined threshold. Usually, a floor plan of the building is placed near the main entrance with a diagram of the defined zones and LEDs indicating whether a particular circuit or zone has been activated. One advantage of this system is that it is a cost effective for small applications. The main issue with a conventional fire alarm system is that we cannot tell which specific device or location has been activated within a circuit. For example, fire might occur in one small room but the fire could exist anywhere within a zone. This could delay emergency responders from locating the fire. Wireless fire alarm [2] can be used to reduce the cost of conventional wired fire alarm system. Advances in technology have made wireless based system as reliable as the wired one. Fire alarm system that utilizes wireless communications such as Wi-Fi have several advantages. The main advantage of a wireless system is its portability. This means that it can be installed anywhereand easy to modify when there is need to update the layout of the building. Wireless fire alarms can also be moved around as required to obtain the best protection possible. However, wireless fire alarms have range restrictions. For large building or areas, a wireless system can have an issue with transmitting information to the main control panel. There are many works that investigated fire detection system utilizing different technologies and components. ZigBee is used as the wireless technology in a fire detection system. The work in developeda low power and multiparameter composite fire detection node to detect temperature, smoke concentration and CO gas concentration. The hardware and software implementation are based on 2.4GHz wireless communication chip, CC2430. ZigBee is adopted in the system to form reliable wireless communication. This system uses fusion theory to handle the data to determine the possibility of fire happening. A wireless fire detection node based on wireless sensor network (WSN) which can detect temperature, humidity and smoke concentration is proposed in .Shortest path routing algorithm is proposed according to multi-hop transmission based on CSMA/CA principle. The sensor nodes can connect each other automatically and the sensor data can be transmitted within minimum hops to build a real-time fire monitoring system. The work in proposed WSN technology to the fire safety which can actualize wireless requirement, network, and intelligent fire monitoring. This system acquired data of temperature and smoke concentration. Fire detection nodes using SOC CC2430 as the control unit to realize the communication between nodes. The software running on the nodes applies CSMA/CA Medium Access Control (MAC) protocol and a shortest path routing algorithm for data-transmission in multi-hop. Agateway is designed and implemented based on ARM9 and Linux, which connects wireless fire detection network and the Internet. It has a strong processing, storage and network communication capabilities, Remote users may share real-time fire

parameter from Internet which connects with the wireless fire data acquisition network through the gateway. A fire monitoring system is designed in [10]. The hardware part includes the fire detection trigger module, the control module and the monitoring centers module. The fire detection trigger module transmits the smoke and temperature parameters to the control module through CC2430. The control module analyzes the information coming from the detector and transmits the fire information to the monitoring center. The monitoring center module is responsible for monitoring the whole operation condition of the system and making decision. The software design of the system is mainly used to initialize the device and revive or send the parameters or command. In this work, an intelligent fire detection and alert system based on ZigBee technologies which are using temperature and flame sensors are designed. ZigBee is a typical wireless communication technology which is widely used in wireless sensing network. The reason of using two types of sensor is to reduce the possibility of false alarms. In addition, an interactive and user friendly Graphical User Interface (GUI) is designed to provide the temperature values, and alert the occupants when fire is discovered.

Compared with traditional fire detection method, vision technology based on fire detection has three main advantages: availability, controllability and instantaneity. First, the installation of various surveillance cameras makes sure monitored regions can be available to visual detector system, which enable security attendants to master real-time situation. Next, controllability is reflected in videos being stored via transmission once fire disasters happened. Finally, limited computational cost and efficient algorithm ensure the instantaneity of fire alarm. As visual detectors, the characteristic of targets to be detected should be extracted precisely. The key to detecting fire alarm automatically based on vision is to express fire situations' features definitely. There have been considerable procedures in extracting the features of fire disaster images by far: the existing work focuses mainly on early detection of smoke and fire flame. In [1-5], smoke in early fire can be extracted from image mainly for its color, contours and motion orientation, while fire flame's distinctive characteristics includes color and motion frequency. Owing to the visibility and widely spreading of smoke in fire disasters, researchers are inclined to use smoke as the detection target to get fire alarm.

In this paper, Zigbee module is used. Zigbee generates field continuously, so it consumes continuous power and fire events occur very rarely in industries. Hence, unnecessary power is wasted. Moreover, Zigbee module is very costly and cannot be implemented in every industry. specifically small scale industry.

3. METHODOLOGY

The aim of this paper is to design a system which will detect smoke particles using MQ-3 sensor.It will transmit alert signal to cloud and finally it will report to industrial section at which fire accident has occurred. In the proposed system the RF transmitter transmit detected fire signal to Node MCU and the aim of this paper is, firstly to design a system which will detect smoke particles using MQ3 sensor. Secondly, to transmit alert signal to cloud. Finally, to report the industrial section at which fire accident has occurred. We started with drawing an efficient hardware design for the system using OrCAD. After finalizing the design, we started building the hardware of the system. In the proposed system, the RF transmitter is fixed in assembly section, warehouse section, boiler section and other vulnerable sections. HT12E is used for converting parallel data into serial form for RF transmitter. Address pins of HT12E of transmitter and HT12D of receiver must have same combination. This RF transmitter has a range of 3m(without antenna) and up to 100m(with antenna). Transmitter uses different 4-bit data codes for assembly, boiler, and warehouse. The module placed in the section consists of RF receiver, NodeMCU, LCD display, buzzer, LEDs. As the smoke detector detects smoke particles in the vicinity of sensor, a alert signal is transmitted to ubidots. Ubidots processes the data received and generates signal to be received in control room. This signal consists of location of section at which fire has occurred, alerting signal for buzzer and LEDs. NodeMCU acts on the received signal to interact with buzzer, display and LEDs. Condition in which no fire accident has occurred, the LCD will display the message "NORMAL" and Buzzer is off with green LED ON. When fire occurs at assembly section, the LCD displays the message "Fire at assembly" with Simultaneous beeping of buzzer, blinking of Red LED.When fire occurs at warehouse, the LCD displays the message "Fire at boiler" with Simultaneous beeping of buzzer, blinking of Red LED. When fire occurs at warehouse, the LCD displays the message "Fire at warehouse" with Simultaneous beeping of buzzer, blinking of Red LED. We have created cloud account on ubidots with three fire variables, map widget along relevant indicators. This dashboard is displayed on control room. Ubidots generates call and message triggers in response to the signal received by associated transmitter. A call will be made to maintenance worker with recorded message, "Fire has occurred at - section, please check sms for location link". Simultaneously, a message will be transmitted to the same number with location link.

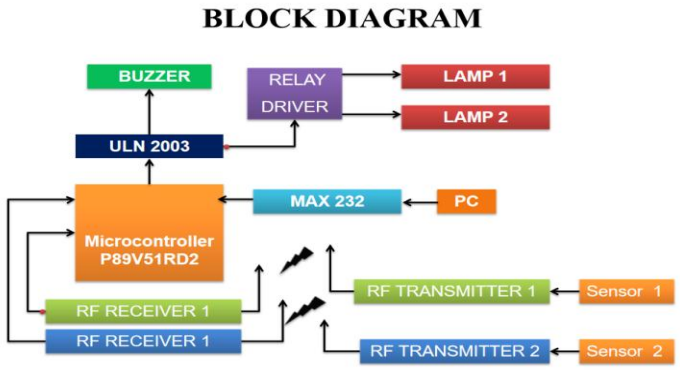

Fig -1: Block diagram of proposed system

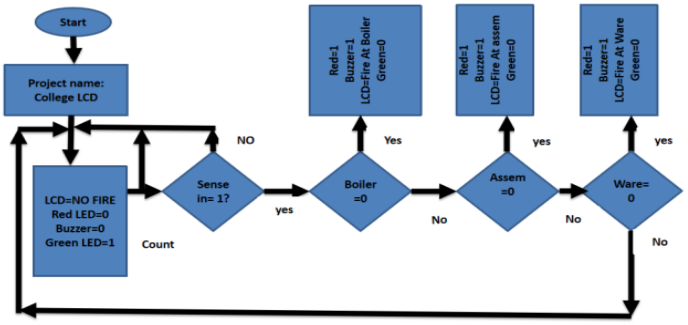

Fig -2: Flowchart

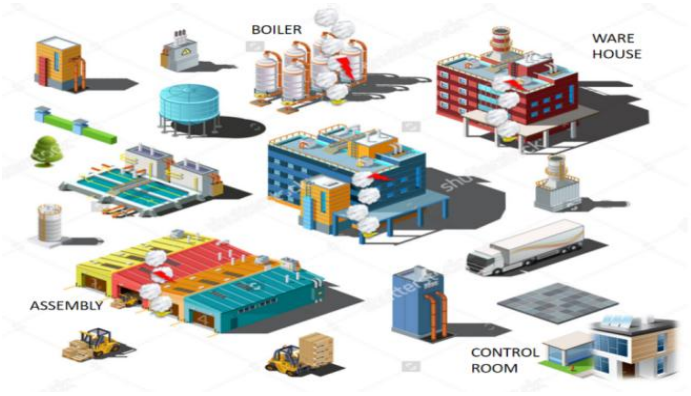

Fig -3: Industrial Setup

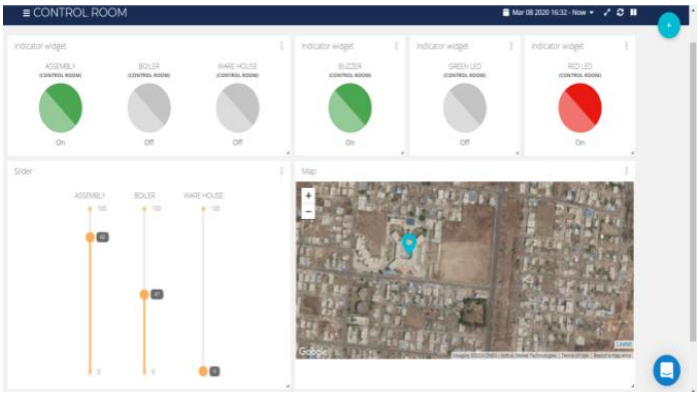

Fig -4: Control Room Dashboard

4. CONCLUSION

The aim of the proposed system is to detect smoke particles and send alert signal to cloud database and to the control room. The proposed system is cost efficient as it uses RF technology as compare to Zigbee. Another advantage of this system is that it is no wired system. Because of that cost reduces and generate the alert signal without damaging the system.

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