

Need for Wireless Fire Detection Systems using IOT

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Abstract - Internet of things is an interconnection of physical devices embedded with electronics, software, sensor which is capable of collecting data from the surrounding and sending data over internet is called IOT. The fire detection gathers all of the techniques and processes that contribute to early detection of a fire. We identify three main categories: Smoke detection, Flame detection and Temperature detection. Automatic fire alarm system provides real-time surveillance, monitoring and automatic alarm. An automatic fire alarm system based on wireless sensor networks is developed, which is designed for high-rise buildings. To provide early extinguishing of a fire disaster, large numbers of detectors which periodically measure smoke concentration or temperature are deployed in buildings. In this paper will we present the different techniques we had been already used to detect fire. Some of those techniques include fire detection using image processing and sensors, fire detection using CCTV technology, Fire detection using zigbee which is a kind of personal area network.

Key Words - Arduino microcontroller, Fire alarm system, Wireless sensor networks, Sensor etc.

1. INTRODUCTION

The main characteristics of sensor nodes include: small physical size, low cost, limited processing power, low battery capacity, and short-range communications. A Wireless Sensor Networks consist of huge number of sensor nodes and is a set of hundreds or thousands of micro sensor nodes that have capabilities of sensing, establishing wireless communication between each other and doing computational and processing operations. Internet of things

is an interconnection of physical devices embedded with electronics, software, sensor which is capable of collecting data from the surrounding and sending data over internet is called IOT. The devices that provides to the Internet Of Things extends personal, household, public, business and industrial spaces and any area that's not affected by them now likely will be in the future. In daily life many of us see and interact with smart gadgets to our internet connected smartphones, which have containing accelerometers, gyroscope, GPS and sometime heart rate monitor. In the personal area we have wearable devices like fitness trackers and heart monitors that use our phones to send and receive data.

Applications of IOT:

1. IOT for mobile operator
2. IOT for manufacture of smart devices
3. IOT for Banks and payment solution
4. IOT for Automobile industry
5. IOT for Airlines
6. IOT for Health

Wireless sensor network is a network in which a large number of sensors are deployed and data is collected from them and send to a particular system for processing. In this paper will we present the different techniques we had been already used to detect fire. Some of those techniques include fire detection using image processing and sensors, fire detection using CCTV technology, Fire detection using zigbee which is a kind of personal area network. All this techniques have some advantages and some disadvantages which is

mentioned in the further section. Some of the components that are generally used in IOT for fire detection are:

1.1 Microcontrollers:

In microcontroller system has middle ware that sends data to system and detects fire generation or not. Microcontroller is the main part of this system. To which all the sensor outputs are given as input to microcontroller. Power supply is given for the release of the functions in the microcontroller. As PIC18f4450 has feature of inbuilt ADC it makes the circuit less bulky. In controller transfer analog signal to digital signal and transfer data to server.

1.2 Temperature Sensor:

Temperature sensor is a sensor which will sense the temperature of its surrounding and send these details to the processing unit. In this system our processing system will be the Arduino board which will take the readings of the sensor and then send these values to our system. We will consider a constant value of temperature sensor, whenever the sensor value will be less than the constant value it will return zero else will return one. This combination of zero and ones will be used to detect fire.

1.3 Gas sensor:

Gas sensor is a sensor which will detect gas. It will detect gases which are released when fire is caused like carbon dioxide, carbon monoxide and many more. When any gases will be detected the sensor will give value as one, if no particular gas is detected it will give value zero. This combination of zero and ones will be used to detect fire. The gas sensor will particularly detect the gases that are released when fire is detected

1.4 Flame sensor:

Flame sensor is a sensor which will detect presence of Flame. It will detect flame which is generated when fire is caused. When flame of any intensity will be detected the sensor will give value as one, if no particular flame is detected it will give value zero. This combination of zero and ones will be used to detect fire. Thus value of this three sensors will be used to form combination which will be used

to detect fire has occurred or not. If among this three if value of two or more sensor is one then fire will be present that means alarm will ring as the fire will be detected. If value of only one sensor is one then fire will not be detected.

2. LITERATURE SURVEY:

Zigbee based Technique [3][12]: Wireless sensor network is a network which consists of nodes deployed for gathering information and using it for processing. WSN is used for various application like security, agriculture, monitoring and for many other purposes. Fire detection can be done using zigbee. Zigbee is an IEEE 802.15.4 specification which is used for data transmission. It is used to create a personal area network which is cheaper than Bluetooth, WIFI and other network. In zigbee loss of data is negligible hence it is efficient. For detecting fire using zigbee RS 232 is used it is zigbee device. A large number of nodes are deployed to form cluster, these nodes are sensors consisting of zigbee devices. Each clusters consists of cluster head, it collects data from the different sensors and pass it to the computer for processing or manipulation. When fire occurs in the room, where this nodes are deployed the reading of the sensors (temp sensors, smoke sensors) is above the normal reading. The changes in the sensors reading lets computer know that a condition of fire being occurred is detected. Thus when fire is detected the alarm rings. The advantage of this technique is that it is simple, less expensive. Disadvantage is that it requires large number of clusters or sensors to be deployed.

Safe From Fire [2]: It is an algorithm which is used for fire detection. The technique which uses this algorithm is known as Safe From Fire technique. In this technique three sensors are used which are flame sensors, gas sensors and temperature sensors. Arduino is a microcontroller which is used for collecting data from the sensors. The technique consists of two parts that are software module and hardware module. The software part consists of webpage through which user will login in the system and the sensors along with Arduino will start working. The reading of sensors is passed to the Arduino to through which it is stored in the

database. Database maintains record of all the readings of sensor whenever fluctuation occurs in the reading at least any two sensors then automatically alarm rings. Which detect that fire has been occurred.

Fire detection using image processing and sensors [6]: It uses a camera along with sensors. The camera keeps on capturing images every 30 seconds and sensors keep on sensing the environment parameter. Whenever a picture is capture which contains red, yellow or orange color in specific pattern image processing is done. The RGB image is converted into grey image which is further converted to binary value. When specific pattern indicating fire is found, value of sensor is also checked at that moment. If pattern of fire is found in grey image and if reading are also corresponding to the fire condition then fire detected. It rings alarm, or generate some voice to inform others about the fire.

CCTV (Closed Circuit Television) technology [13]: It has great advantage for use on sensing and monitoring a fire. Compared with other types of fire detectors, the video cameras cannot be fooled by visible, or emissions from common background sources, eliminating such false alarm problems. It is processes multiple spectral images in real time to reliably detect a small fire or smoke at greater distances in very short times, and at the same time, it can identify the location of a fire, track its growth and monitor fire suppression. It can be trained for very rapid response, making it suitable for explosion suppression

Fourier Transform Infrared (FTIR) spectrometers for fire detection [13]: FTIR can examine the entire spectrum from about 2.5 m to 25 m, and quantify the presence of multiple species of interest to provide early fire warning with low false alarms. FTIR measurement also provided significant amounts of additional data prior to ignition and during early stage of combustion, including monomeric species, unburned fuel, oxygenates, olefins, and pyrolysis

products. Commercial FTIR instruments are now available, and have the potential to sense CO, HCN, HCl, CO₂, H₂O, and miscellaneous hydrocarbons. Their measurements for CO, CO₂ and total hydrocarbons were found to follow similar trends as the measurements of single parameter instruments. However, advanced data analysis scheme for the FTIR-based fire detection system must be developed to quantify the gas and smoke concentrations and to determine if a fire condition is present. In addition, a wide range of applications of FTIR-based fire detection systems is limited by high initial costs and maintenance requirement.

3. CONCLUSION

There is an immense need of implementation of automatic fire detecting system to protect lives and assets from fire hazards. In this paper full fire protection systems are explained. Use of real-time control via the Internet or wireless network will extend the monitoring and control of fire safety systems outside of 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. However, Internet-based monitoring and control of building service systems will need security protection to prevent false fire information being provided to building owners and fire brigades.

REFERENCES

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

- [2] Md Iftekharul Mobin, Md Abid-Ar-Ra_, Md Neamul Islam, and Md Rifat Hasan, "*An Intelligent Fire Detection and Mitigation System Safe from Fire(SFF)*", International Journal of Computer Applications (0975 - 8887) Volume 133 - No.6, January 2016.
- [3] L.R.Patil, Divya Chopda, Mansi Borse, "*Forest-Fires Monitoring System Using WirelessTechnology*", International Journal of Emerging Technology and Advanced Engineering Website: www.ijetae.com (ISSN 2250-2459, ISO9001:2008 Certified Journal, Volume 6, Issue 4, April 2016).
- [4] Mr. Santosh P. Patange, "Design and Implementation of Automatic Fire Alarm System based on Wireless Sensor Networks", September 2015, Volume 2, Issue 9.
- [5] S.R.Vijayalakshmi and S.Muruganand, "*DESIGN CHALLENGES IN WIRELESS FIRE SECURITY SENSOR NODES*", International Journal of Embedded systems and Applications (IJESA) Vol.5, No.2, June 2015.
- [6] Sadiccha C. Pol, Ashwini H. Wagh, Pooja T. Ramole, Smrati H. Sharma, "*Fire Detection Using Image Processing and Sensors*", International Journal of Engineering Trends and Applications (IJETA) Volume 3 Issue 2, Mar-Apr 2016.
- [7] Osman S. da Penha Jr., Eduardo F. Nakamura, "Fusing Light and Temperature Data for Fire Detection".
- [8] Jimin Cheon, Jeonghwan Lee, Inhee Lee, Youngcheol Chae, Youngsin Yoo, and Gunhee Han, "*A Single-Chip CMOS Smoke and Temperature Sensor for an Intelligent Fire Detector*", IEEE SENSORS JOURNAL, VOL. 9, NO. 8, AUGUST 2009.
- [9] Ren C. Luo Fellow, ZEEE, Kuo L. Su, Kuo Ho Tsai, "Intelligent Security Robot Fire Detection System Using Adaptive Sensory Fusion Method".
- [10] Kausik Sen¹, Jeet Sarkar¹, Sutapa Saha¹, Anukrishna Roy¹, Dipsetu Dey¹, Sumit Baitalik¹, Chandra Sekhar Nandi², "*Automated Fire Detection and Controlling System*", International Advanced Research Journal in Science, Engineering and Technology Vol. 2, Issue 5, May 2015.
- [11] Robert A. Sowah, Abdul R. Ofoli, Selase Krakani, Seth Fiawoo, "Hardware Design and Web-based Communication Modules of a Real-time Multi-Sensor Fire Detection and Notification System using Fuzzy Logic", DOI 10.1109/TIA.2016.2613075, IEEE.
- [12] P. N. Narendra Reddy, P. I. Basarkod, S. S. Manvi, "*Wireless Sensor Network based Fire Monitoring and Extinguishing System in Real Time Environment*", Int. J. Advanced Networking and Applications Volume: 03, Issue: 02, Pages: 1070-1075 (2011).
- [13] Zhigang Liu and Andrew K. Ki, "Review of Recent Development in Fire Detection Technologies".