INDUSTRY SPECIFIC INTELLIGENT FIRE MANAGEMENT SYSTEM

INTRODUCTION

Fire and smoke kill more people every year than many other forces. While controlled fire serves us in so many instances, uncontrolled fire can be of harm, however, the rapid detection of fire and its control can save lives and property damage worth millions. Conventional and addressable are two main types of fire alarm systems, but unfortunately, these fire alarm systems often generate false alarms. The ratio of false alarm is higher in conventional alarm systems compared to addressable, but addressable alarm fire systems are more expensive. The most likely cause of a false warning is different for distinct types of detection systems, such as a smoke sensor often being activated falsely due to an environmental effect. So, there is a need for a cost-effective multi-sensors expert alarm system that is artificially trained and assists FDWS (fire detection and warning system) to make the right decisions and to reduce the number of false alarms. False alarm warnings are so common that London fire brigade alone is called out almost every 10 min to attend a false alarm causing them a loss of about £37 million per year. To achieve the aforementioned goal, in this paper, we introduced a home-based FDMS that uses a microcontroller Arduino UNO R3 (Arduino, Somerville, TX, USA) based on the atmega328p. It is easily available and programmed using the Arduino Software (IDE) with a set of cost-effective sensors. The proposed solution effectively uses a smoke sensor with flame sensors with a particular increase in room temperature; to further investigate the true presence of fire and to avoid false alarm, the FDWS is trained with a neuro-fuzzy designer. The purpose of this intelligent fire alarm system is to sense true occurrences of fire, alert the proper authorities, and notify the occupants via GSM to take necessary action immediately.

A false alarm can burden the fire brigade and can turn out to be a costly event; so many studies conducted to reduce them. Previous studies proposed different methods such as autonomous firefighting robots, fire alarm systems with notification appliances, and wireless warning

systems. Fire alarm systems with notification appliances can be costly because they use visible and audible stimuli to notify residents. The primary objective of this paper is to develop a reproducible and economical solution with minimum false alarms and a system that alerts via GSM (global system for mobile communication). The innovative idea is to use neuro-fuzzy logic to design a smart alarm system. Our proposed system is ANFIS-simulated in MATLAB environment; the obtained results show effectiveness and the robustness with good performances compared with the FIS method (in Section 3). The ANFIS idea was originally proposed by Jang [1] in 1993. Typically, an ANFIS is a combination of a neural network and a fuzzy inference system (FIS) and is effective in making decisions.

LITERATURE

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 LEDsindicating whether a particular circuit or zone has beenactivated. One advantage of this system is that it is a costeffective for small applications. The main issue with aconventional 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 ofconventional 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 developed low power and multiparametercomposite 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 canactualize wireless requirement, network, and intelligentfire 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 datatransmission 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 fireparameter 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 cannot be implemented in every industry. specifically small scale industry.

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