**Motivation :**

According to the Center of Fire Statistics of the International Technical Committee for the Prevention and Extinction of Fire (CTIF), between 70,000 and 80,000 deaths occur annually due to fire outbreaks since the beginning of the 21st century

The primary motivation to introduce a flame and smoke detector system is obviously to keep fires from occurring. And the goal of a fire alarm system is to ensure that a fire can be dealt with before it causes major damage. It's obvious to see that a fire alarm is important for commercial buildings.

**Introduction :**

FIRE is a phenomenon combustion manifested in light, flame, and heat. There are three main elements required for fire to exist, these are; oxygen, heat and fuel. These make up what is known as the fire triangle. The proportion of each of these elements determines the nature of the fire. With fire and some of its byproducts being employed in a lot of useful applications such as cooking, power generation and the manufacturing process, among others, it has the potential to also cause havoc. According to the Center of Fire Statistics of the International Technical Committee for the Prevention and Extinction of Fire (CTIF), between 70,000 and 80,000 deaths occur annually due to fire outbreaks since the beginning of the 21st century [1]. In a developing like Ghana, the situation is no different. In 2014, about GHS3.4M (894,761USD) [2] was lost due to fire outbreaks. Fire related loss of lives and properties continue to increase despite vigorous fire safety campaigns being carried out by the public agencies. Even though it is important to adhere to fire safety measures, putting in place early detection systems greatly mitigate the effects of fire outbreaks. This has led to a lot of novel contributions in the field of fire detection.

The building industry is undergoing transformation with the advancements in sensors, electronics, information communications and technologies. As a result many new technologies have emerged. Digitalization is helping significantly in lowering the operating costs while improving the performance. Similarly, with the advancements in materials and insulation technologies and their extensive use in buildings, the risk to life and property is also increasing due to fire. This has led to the development of many new fire sensing and detection technologies in recent years. Thus, there is increased focus on the development of intelligent buildings and systems worldwide

In the past, smoke sensors were used for fire detection, but often the smoke sensors triggered a false alarm when someone smoked in the chamber. Therefore, multisensor fire-detection methods are one of the current important developments for fire-detection technology in homes and buildings. In recent years, quite a few researchers have looked into fire-detection methods.

**Problem Statement :**

**NOTE :** 4.1 se utthakar 1st chapter mai daal

**Purpose :**

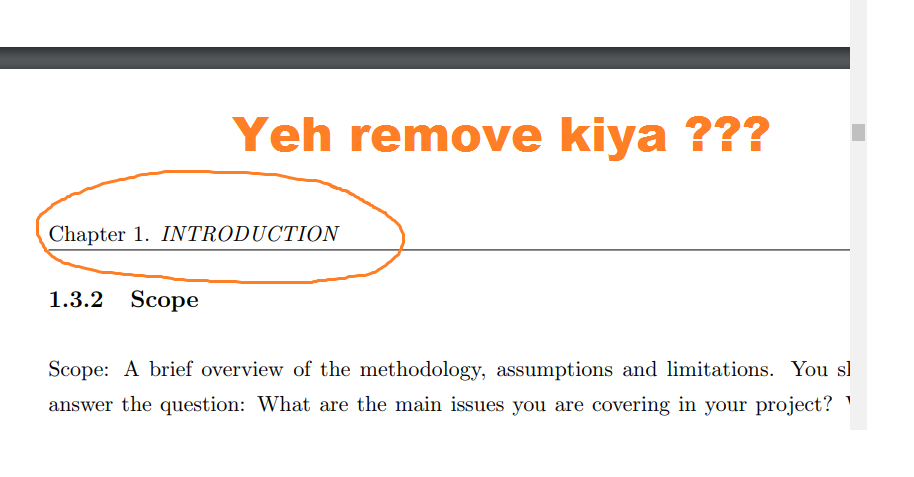
The purpose of developing the flame and smoke detector is to provide early detection of a fire to save lives and reduce the property damage. The fire detection has a become a very big issue, as it has caused severe damage including the loss of human lives. Sometimes, these incidents are more destructive when the fire spreads to the surroundings. To escape a fiery place and to do use the fire source, the fire must be detected at its initial stage. The installation of a fire alarm system is the most convenient way to detect a fire early and avoid losses.

**Literature Survey :**

* Robert A. Sowah , Abdul R. Ofoli, Selase Krakani, Seth Fiawoo presents the design and development of a fuzzy logic based multi-sensor fire detection system and a web-based notification system. Until recently, most consumer grade fire detection systems relied solely on smoke detectors. The protection provided by these have been established to be limited by the type of fire present and the detection technology at use. The problem is further compounded by the lack of adequate alert and notification mechanisms. A typical system relies on the physical presence of a human being to act on the alert. In developing countries, poor planning and addressing negatively affects the fire and rescue crew’s response time. To address this problem, a fuzzy logic system was implemented using an Arduino development board with inputs from an MQ2 smoke sensor, a TMP102 temperature sensor and a DFRobot flame sensor. The output of the detection system is sent over SMS (Short Message Service) using a SIM900 Global System for Mobile Communication (GSM) module to the web-based system and the house owner or caretaker in real-time. With access granted to the web-based system, the fire and rescue crew also get notified in real-time with location information. A comparison between the efficiency of the notification system employed by standard fire detectors and the multi-sensor remote based notification approach adopted in this paper showed significant improvements in the form of timely detection, alerting and response.
* Ren C. Luo and Kuo L. Su, introduced the multisensor fire-detection algorithm is one of the current important issues in the field of fire-detection systems for intelligent buildings. This paper proposes an adaptive fusion algorithm for fire detection, and uses a smoke sensor, flame sensor, and temperature sensor to detect fire incident. In reality, the phenomenon of the fire incident may have smoke, flame, and hightemperature situations. However, these signals may happen simultaneously or sequentially. We use adaptive fusion algorithms to a more reliable decision. However, the adaptive fusion algorithm is more complex in real conditions. Therefore, we use a Taylor expression to modify the adaptive fusion algorithm and simulate to compare with results on first-order, second-order, and thirdorder expressions. The modified adaptive fusion method can provide adequate reliable fusion for fire detection. We use computer simulation to improve the adaptive fusion algorithm that is accurate and adequate. Then, we design a fire-detection module using an ionization smoke sensor (TG-135), temperature semiconductor sensor (AD590), and ultraviolet sensor (R2868). The experimental results of the fire-detection module demonstrate that it can detect fire incidents in a variety of conditions. Finally, we implement the real-time fire-detection module in an intelligent security robot (Chung Cheng I). If a fire incident occurs, the security robot can find the fire source using the fire-detection module and transmit the detected message to the user via the Internet and a GSM modem.
* Ivan A. Csiszar, Jeffrey T. Morisette, and Louis Giglio discusses the process of validating active fire “yes/no” binary fire detection products from moderateresolution satellite sensors. General concepts and practical issues are illustrated by the validation of the Moderate Resolution Imaging Spectroradiometer (MODIS) active fire product in Siberia. Coincident Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) imagery is used to characterize spatial patterns of flaming at sub-MODIS pixel scale. It is shown that for proper evaluation reference fire observations are needed at the scale of the satellite pixel, as only 60% of the MODIS footprints contain single contiguous clusters of ASTER fire pixels. In Siberia the size of a single ASTER fire cluster within the MODIS footprint that has a 50% probability of being flagged as “fire” is 60, compared to 45 in the Brazilian Amazon, whereas previous radiative transfer simulations suggested similar detection probabilities. The lower-than-expected detection rates in Siberia are largely attributable to flaming underneath heavy smoke, which is not detected by the current MODIS algorithm. Pixel-based and cluster-based omission error rates are derived, and it is shown that the probability of flagging as “fire” a MODIS pixel which contains a given number of 30-m ASTER fire pixels is typically 3–5 times lower than detecting a contiguous cluster with the same number of ASTER fire pixels. The procedures described are recommended for a consensus active fire validation protocol, but with the inclusion of multiplatform sensor configurations to complement the near-nadir angular sampling from single-platform observations such as MODIS and ASTER on Terra.
* Anshul Gaur, Abhishek Singh, Ashok Kumar, Kishor S. Kulkarni, Sayantani Lala, Kamal Kapoor, Vishal Srivastava, discusses the progress on fire sensing technologies has been quite substantial in recent years due to advancements in sensing, information and communications technologies. In this paper, the authors have discussed the fire sensing technologies and what is essential for the discrepancies in the development of hardware and algorithm. The review presents an overview of the existing stateof-the-art practices in the area of fire sensing and control system and it is focused mainly on the excellent capability to detect fire, reduce the detection of false positives, the ability to notify the occupants, passes the information and status of the fires to the fire department, and automatic control capability of the occupants’ safety and controlling functions. The major elements of the fire moment like surrounding heat, flame, smoke, and gases level are discussed with their merits, demerits, measurement benchmarks, and measuring the span of the parameters. The reasons and controlling parameters of the fire in commercial and residential buildings are also discussed. Research articles on fire sensing technologies although acknowledged the above concerns. However, importance of robust systems that address all or most of the above-stated benchmarks still remains a challenge and partially addressed. To address the gaps, a modified fire sensing and control system concept has been proposed.

**References :**

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