Chapter 7
Prototype of the Multi-Points IoT-Based Heat and Smoke Monitoring for Open Sites

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ABSTRACT

Public awareness is one of the most neglected causes of fire. To ensure the security of the premises and its clients, the crucial highlights rely upon the fire precautionary measure framework and hardware which ought to accord the standard necessities. This also means that the fire safety precautions also need to be taken in an open site working space. This application with all means is to operate a portable fire alarm and monitoring system built using IoT in order to provide fire safety to open site working space. The prototype is developed using the Arduino IDE, Android Studio, PyCharm, and Command Prompt. Meanwhile, the hardware used during the development of this system are MQ-2 smoke sensor, MPL3115A2 12C temperature sensor, MH Flying Fish infrared sensor, NodeMCU ESP8266, and a buzzer. At the end of this application prototype development, the testing phase has shown that the development of the application is a success and the application was able to conduct its functional requirements.

INTRODUCTION

Fire is the most unwanted tragedy to happen in everyday life. Damages cause by fire can takes up a lot where the lost are not only on valuable item but also human's life. Fire sometime starts only from sparks which people tend to ignore it. It can easily start from a faulty wire or even the slightest spark from any machinery that produce tiny sparks of fire. People usually overlooked at construction site workers which

are handling flammable machinery or objects. Some construction site workers do not even have the proper fire safety equipment to work. Construction company mostly take only slight action on their workers' safety. On March the 26th 2019, a fire has broken out in a huge building site in Southampton, England (Stinson, 2019). This shows on how there is a possibility for a construction site can get caught on fire. There are numerous other potential construction site hazards that can cause a fire such as combustible materials, unattended heating units, careless smoking, and etc.

Various researches have been conducted especially in occupational safety to protect humans and assets. For example, in (Mikalsen, Lönnermark, et al. 2021), it studies fires in waste facilities in Norway and Sweden and make an overall fire safety assessment and propose measures for increased fire safety. On the other hand, another recent paper (Ronchi, 2021) worked on developing and validating evacuation models for fire safety engineering. As compare to the previous paper, this work specifically focuses to propose the after-fire event actions to be taken if it occurred.

Very often, open site workers are not geared with adequate fire safety tools. It is true that there are less cases on fire for construction site and open site workers but the worker's safety is very important. Failure to abide by these rules, employers could be taken for legal action for disobeying the OSHA Act 1994 for not providing a safe and without risks to health environment towards the employee (OSHA Act, 1994). As open sites can be varied from small to large area, multi- points monitoring would be beneficial to the site workers. Not only to prevent fire, but it is important for an open sites manager to monitor site's surrounding as overheat may affect employees while working and cause illnesses (Tyler, Asher & McAndrew, 2021).

Figure 1 is a sample of optimized layout of a construction site taken from (Huang & Wong, 2015). The layout shows a site layout of the modelled construction site in construction their proposed multiple-stage site layout optimisation with additional safety constraints. In any construction site similar to this, one of the valuable things to do is to keep giving alert and awareness to workers about their surroundings. Multiple points on the site should be fitted with sensors to observe to the surrounding. A monitoring system can be beneficial for them to keep track on the situation.

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