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Active Fire Evacuation and Control System (AFECS)
For High-Rise Buildings

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Abstract

Fire is regarded as one of the greatest gifts mother nature gave mankind that changed the course of human evolution. According to Darwin, it is the greatest discovery made by humanity, excepting only language (Gowlett, 2016).

Fire has posed both positive and negative impacts on our lives. Even after being in the hands of curious and intelligent human beings for thousands of years, we are yet to discover ways of protecting ourselves and controlling them. This is why it is one of the greatest discoveries with numerous uses in a controlled environment but a catastrophe when it gets out of hand.

Given the statistics, which will be presented in the project, it is very clear that structural fires, especially those in high rise buildings are the most significant cause of damage to both infrastructure and human mortality. This is as a result of various reasons which will be explored in depth such as, when a fire occurs inside a complex structure, the exit route is not obvious to the people as it is reliant on familiarity to the building, clear vision and being able to think straight in a state of chaos and with the obscuring of vision, difficulty in breathing and heightened sense of panic, most people end up being disoriented and trapped. In addition, currently the firemen handle the fire and carry out evacuation procedures almost blindly as they have minimal information about the nature of the fire and its spread. This puts the firemen at unnecessary and avoidable risks and they won't be able to carry out their rescue programs as effectively. Further contributing to the high mortality rates and costs incurred due to the high occupation density, expensive infrastructure and equipment a minor event of fire can yield disastrous results. Increasing the gravity of this issue is the fact that a progressive increment of fires in high-rise buildings can be expected as a result of the high-rise buildings' structural integrity deteriorating over the years to come. An alternate to high-rise buildings isn't possible given the rise in urbanization and spatial limitations. High rise buildings are the only feasible means to meet the demands of a rising urbanization.

The current fire safety systems are not competent enough to overcome the mentioned limitations efficiently, thus the Active Fire Evacuation and Control System(AFECS) is introduced. AFECS is an enhancement of the contemporary systems by elevation of the existing basic functions and addition of a brand new basic function of 'evacuation' together with other special features.

AFECS prototype modules were developed using java language with n-tier architecture, RESTful API implementation and Arduino hardware platform. The implemented system was tested thoroughly under different conditions and AFECS was subjected to an evaluation by experts of the relevant industries. The test results along with the evaluation attested to the fact that the analysis, design, implementation and documentation have been carried out effectively.

Key Words: Fire Safety, Evacuation, High-Rise, Arduino, IoT