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IOT BASED EMERGENCY EVACATION SYSTEM

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Abstract: With the increase in the number of complex high rise buildings, ensuring safety is a primary requisite. In the event of an emergency such as an earthquake or a fire, the protocol followed is exiting the building as soon as possible. But in such modern day complex buildings, evacuation becomes slightly more complicated as they have multiple levels, limited exits and house larger number of people. This calls for a system that evacuates people efficiently.

The Emergency Evacuation System (EES) based on Internet of Things (IoTs) aims to achieve an effective evacuation process that ensures safety and minimum casualties using sensors for early detection and monitoring, an alarm for warning about the casualty and application for evacuee guidance and easy navigation. In the occurrence of an emergency, the EES detects it, alerts the civilians in the building and provides guidance through an application. Keywords-Emergency, Evacuation, Internet of Things, Guidance Routing, Fire, Earthquake.

***Keywords*: IOT, Microcontroller, LCD, Emergency Evacuation System (EES)**

I. INTRODUCTION

The Emergency Evacuation System (EES) based on Internet of Things (IoTs) aims to achieve an effective evacuation process that ensures safety and minimum casualties. The sensors connected to the arduino mega sense the temperature, humidity and the vibration values. If either of these values exceeds the threshold value, the LED turns on as a warning. The occupants of the building receive an alert message on their mobile phones. Furthermore, the application guides them to the nearest safest exit route indicating directions, based on their location. Information about direction of escape helps people find proper evacuation routes. Thus, the Emergency Evacuation System not only warms but also detects, monitors, warns and provides guidance routing to the occupants.Frequently reported threatening events show that there is little time to react and it is highly difficult to identify a safe zone in the lack of accurate and timely information. To compensate the need of accurate information, practice drills take place in public places, such as schools and public offices. In cases of fire or earthquake, all occupants may be required to vacate the zone under threat as a general safety rule. Therefore, evacuation is the common measure in these scenarios. The underlying assumption is that there is an evacuation path and this path is safe . During a fire, uniform evacuation guidance is inadequate because existing emergency guides do not consider the location of the fire and merely direct people to the nearest exit which could be fatal if the fire has occurred at that exit. The availability of cheap credit card sized single board computer such as the Raspberry Pi has enabled the creation of numerous automated and monitoring systems that has low power consumption, faster processing ability at a lower cost.

II LITERATURE SURVEY

The 1. **An IoT-based Emergency Evacuation System – paper 1**

Author : - Imran A. Zualkernan; Fadi A. Aloul; Vikram Sakkia; Hassan Al Noman

This paper presents a system that uses IoT technologies to track location of the fire and building occupants, and then directs the occupants smartly towards a safe exit. The system uses Bluetooth Low Energy (BLE) beacons for indoor localization using the occupant's mobile phones. The system also tracks areas of danger using smoke and temperature sensors. For resiliency in face of a fire, the system uses multiple networks including WiFi and the DigiMesh. A publish/subscribe architecture using an MQTT broker was implemented. In case of a fire, occupants can use a smart mobile application that provides the occupants with a live map of the current danger levels within the building. In addition, smart exit signs are deployed throughout the building that dynamically change their state based on location of the fire to guide the occupants to safety. Real-time information gathered from sensors and occupants is also provided to emergency response services. The proposed system can be scaled to a city-wide emergency network.

2. **Smart apparatus for fire evacuation — An IoT based fire emergency monitoring and evacuation system – paper 2**

Author : Swarnadeep Majumder; Sean O'Neil; Ryan Kennedy

According to the National Fire Protection Agency, 14,500 high rise fires occur every year causing 40 deaths and 520 injuries per year on average . Many of these deaths and injuries can presumably be avoided if evacuees had knowledge of the location of the fire and a solid exit strategy. In an age of IoT devices, there are no such commercial products available to address this problem. We have developed a technology that can be used as a smart fire defense guidance system. The goal is to inform occupants and emergency services of the location of the fire and provide a real-time safe path of evacuation. It proposes to use a mesh network of smart fire alarms and path planning algorithms to provide these essential services.

2.1 Outcome of Literature Survey

By the literature survey we came to know that we can solve the problem of underground fault detection. We can implement advanced form of fault detection in 3 phase underground system using Arduino and IOT module from ohms law. Fault is determined the distance of underground cable fault from the base station and also find the exact location of that faulty place.

When any fault like short circuit occurs, voltage drop will vary depending on length of fault in cable, since the current varies. The fault is detected by detecting the change in the voltage and a microcontroller is used to make the necessary calculation.

III PROBLEM STATEMENT

Unlike fire detection and alarm systems (which detects signs of a fire through smoke and/or heat, thus triggering an alarm to notify building inhabitants), an evacuation alert system is for the Fire & Rescue Service to control an evacuation upon their attendance following the alert that there's a fire.

Your evacuation alert system (also called 'Evacuation Alert Control & Indicating Equipment' or simply an 'Evacuation System'), however, is for use solely by the Fire Brigade when they attend a building to fight a fire.

You won't see triggering devices such as fire detectors or manual call points for this reason. But, similar to a fire alarm, you might notice that sounders are visible on floors to allow the warning sounds/alarms to be heard.

IV OBJECTIVES

The working of the Emergency Evacuation system is shown . The proposed emergency evacuation system uses Arduino Mega to read the sensor values. If the threshold value of any of the sensors is exceeded, the alarm is activated. The value of the output voltage of the sensor circuitry varies linearly with the resistivity of the sensor. So any change in the resistivity of the sensor changes the output voltage.

To provide an integration system which saves life on hazards and which is easy to use and understand . An alerting system which triggers voice message and provide announcing facilities on fire accidents

V METHODOLOGY

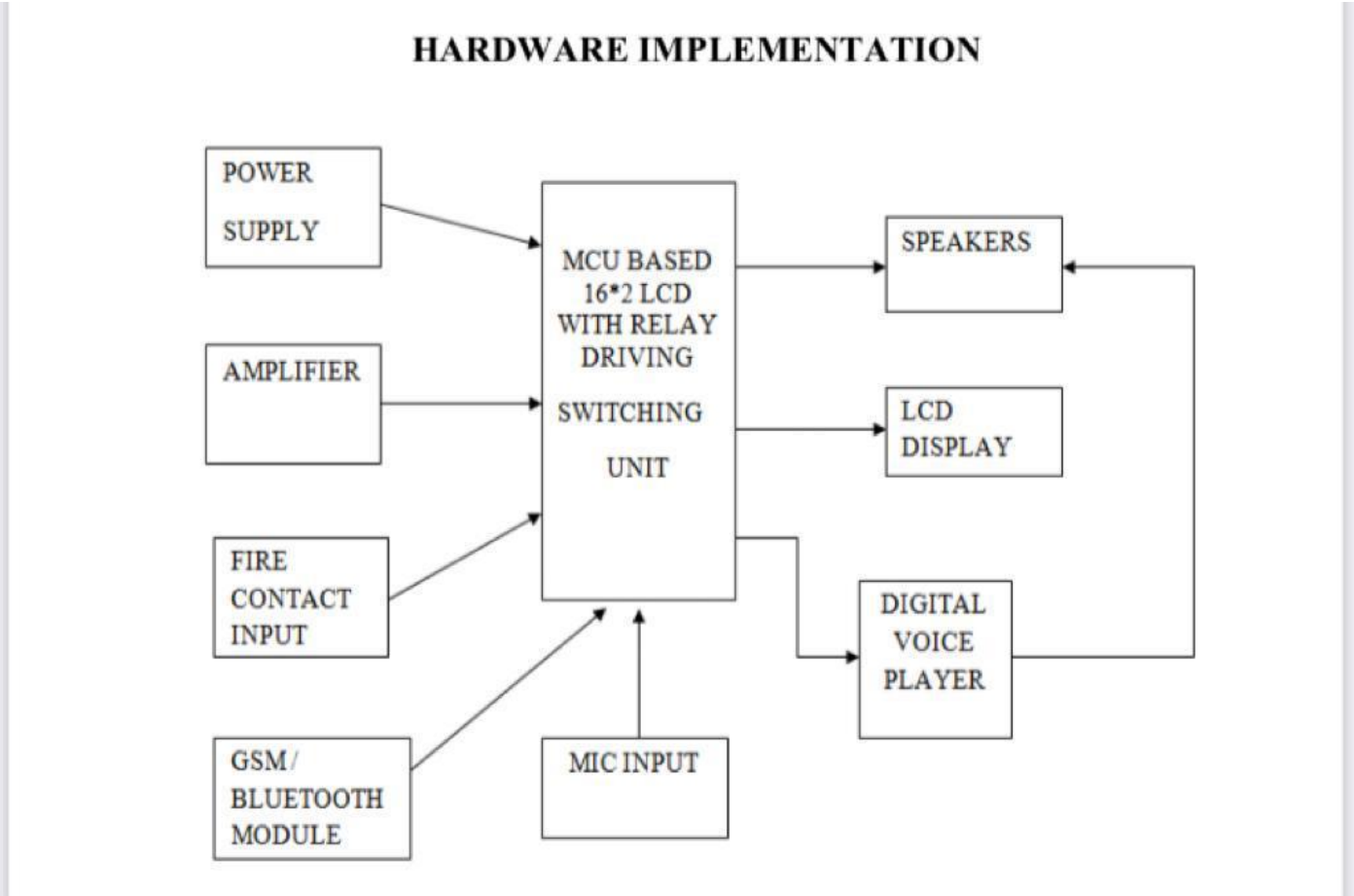

Fig.5:Block Diagram IoT BASED EMERGANCY EVACUATION SYSTEM

Fig. 1 shows the primary use cases for the proposed system. As the Figure shows, an occupant of a building under fire should be able to receive an emergency response in case of a fire on their mobile phone. In addition, an occupant should be able to see a danger map on the mobile phone that shows them where the fire is in the building and where the safest exits are. If the occupant does not have a mobile phone then they should be able to use smart exit signs that dynamically change state based on the fire to guide the occupants to safety. Finally, the occupant should be able to send their location to concerned individuals to indicate where they are and if they are safe. This information can be used by family members and emergency respondents. As Fig. 1 shows, various emergency response services like the fire department should also be able to see where the various occupants are within a building, receive emergency alerts and should be able to see a danger map showing where the fire is raging the most. In addition, they should be able to and view smoke levels within various parts of the building. When firefighters enter the building, their locations should also immediately become available to emergency services using their mobile phones. Fig. 1. Use case diagram. Fig. 2 shows the overall architecture of the proposed system. The system was designed using an IoT paradigm and the various IoT layers are described next.

The sensing layer has two types of edge nodes: Bluetooth Low Energy Beacons (BLE) and the ESP32 microcontrollers. The BLE beacon has a built-in temperature sensor while the ESP32 microcontroller is interfaced with an MQ-2 gas sensor. The MQ-2 gas sensor can detect 300〜10000 ppm of flammable gases including smoke. As opposed to previous approaches such as that have proposed that fire fighters carry a device embedded with sensors, the solution proposed here relies on a static infrastructure of sensors to localize both occupants and firefighters based on their mobile phone locations. Most people are willing to allow access to their mobile phones if they feel that useful services are being provided. For example, a recent survey shows that over 80% of participants mentioned that they would be willing to share the location of their mobile phone if required .

B. Communication Layer As

BLE beacons communicate their location and signal strength to an occupant's mobile phone or an intermediary Raspberry Pi server using the Eddystone Beacon protocol over BLE. The ESP32 edge node and the Raspberry PI can communicate either using WiFi or the DigiMesh ad-hoc wireless protocols. Both protocols are supported for redundancy and resilience. During initial stages of the fire WiFi is used to convey the dynamic path information the occupants. However, if WiFi routers are damaged due to the fire, then the system automatically switches to the DigiMesh network which is entirely peer-topeer and does not require a centralized coordinator. This degrades the location services being provided but keeps various components of the system like the smart signs alive. At the application level, the ESP32, Raspberry PI, and the occupant's mobile App rely on the Message Queuing Telemetry Transport (MQTT) protocol when WiFi is available and native protocol otherwise. Similar ideas of implementing network resilience for emergency evacuation have been proposed in.

ADVANTAGES/DISADVANTAGES/APPLICATIONS

Advantages:

- Easily locate source of fire
- wireless
- Strobe and sound alarms
- Quick set-up
- Built for outdoors jobs
- the fault because fault is invisible.

Applications:

- Hospitality
- 2. Residential buildings
- 3. IT sectors
- 4. Public sector
- 5. Malls and theaters
- 6. Educational institutions
- Industrial sector

CONCLUSION

A framework for efficient and effective evacuation route guidance for the occupants in an indoor environment which is threatened by earthquake or fire is proposed. The sensors connected to the Arduino mega sense the temperature, humidity and the vibration values. If either of these values exceeds the threshold value, the LED turns on as a warning. The occupants of the building receive an alert message on their mobile phones as a notification. Furthermore, the application guides them to the nearest safest exit route indicating directions, based on their location. Thus, the Emergency Evacuation System detects, monitors, warns and also provides guidance routing to the occupants.

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