Emergency Alert System For Construction Site Safety

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Abstract- For a construction project to achieve success , safety of the structures also as that of the personnel is of utmost importance. Construction industry employs both skilled and unskilled laborers subject to construction site accidents and health risks. To protect construction workers and stop accident we've propose a design for autonomous system that monitors, localizes and warns site laborers who avail within zone . Though site and labour safety laws are available, the various accidents happening at construction sites are continuing. Management commitment towards health and safety of the workers is additionally lagging. In this study main focus is on to develop system for various hazardous situation occurs on different construction sites due to natural disaster or man-made situations. The proposed system is user-friendly, and its architecture is predicated on Internet of Things (IoT). The system represents the environmental and ambient parameter monitoring using Raspberry Pi with low power wireless sensors connected to Internet, which sends their output to a central server. And then further actions will be taken by appropriate person and situation will be alerted to everyone.

Keywords- Construction, Safety, Internet of Things, Raspberry Pi, Sensor

I. INTRODUCTION

The nature of construction project itself has potential hazard of accident since its uniqueness, open space, exposure to weather, involving and working at height in confined spaces and psychological and physically vulnerable working environment. Thus there is a need for awareness among workers working at dangerous place and conditions. civil construction sites are considered as one of the riskiest environments where many potential hazards may occurred. e. Throughout the world, the construction area of civil engineering is one of the most hazardous industries[1]. The number of fatal accidents taking place at the construction sites is quite alarming and the major cause was found to be fall of persons from height and through openings. Thus the major issue of construction industry is safety. The injuries and fatalities costs much to the contractor

and ultimately to the nation economy by way of time loss, cost of compensation to workers and loss in productivity.[4] In addition to the above toll, there is addition to humansuffering and pain due to loss or injury of a dear one for his family and friends.

II. NEED OF STUDY

As mention earlier the construction industry is highly risky occupation. For taking precaution from hazardous situations comprised due to vibrations, any gas leakage or fire or increase in water level due to rainfall or by any other means the proposed system is to be developed[4]. The lack of prediction and identification of accidents and hazard results in losing the gear of progress of works. The increase number of fatalities, injuries & hazard at construction site identifies the understanding critical problem related to safety[2]. Though labor safety laws are available, the numerous accidents taking place at construction sites are continuing. Management commitment towards health and safety of the workers is not upto the mark. Thus, we have to proposed system to protect construction workers and prevent accident. We have to propose a design for autonomous system that monitors, localizers and warns site laborers who available within danger zone

III. PROBLEM STATEMENT

Number of accidents occurs on construction site due to miscommunication between safety officers and workers. Thus, with help of Internet of Things early warning system will be developed to minimize losses of life as well as material & machinery present at site. With help of multiple sensors like gas sensors, water sensor, vibration sensor, PIR sensor. RFID sensors construction site and workers safety will be achieved.

IV. OBJECTIVES

1. To understand concept of Internet of Things and its applications in construction site and worker safety.
2. To develop alert system based on IoT with help of various sensors for detecting Water level, Earth movement, Gas level and Motion detector.

V. LITERATURE REVIEW

1. Joseph Louisa, Phillip S. Dunstonb, "This paper provides a framework for leveraging the growing ubiquity of devices that can be considered part of the internet of things (IoT) to inform real-time decision-making on the construction site, This paper illustrates the types of insights that can be synthesized from an operations-level IoT network that gathers and transmits information".

2. Rastko Martac, Nikola Milivojevic, Vladimir Milivojevic, Vukasin cirovic, Dusan Barac, "The aim of the paper is to describe possibilities of the Internet of Things application within a specific system for dam safety management. The system should provide on time alerting in case security parameters deviate from the expected values."

3. L.Y. Ding, C. Zhoua, Q.X. Deng, H.B. Luo, X.W. Ye, "This research presents a real-time safety early warning system to prevent accidents and improve safety management in underground construction, based on the "internet of things" (IoT) technology. The proposed system seamlessly integrates a fiber Bragg grating (FBG) sensor system and a RFID (radio frequency identification)-based labor tracking system."

4. Nassim Mozaffaric, Javad Rezazadeh, Reza Farahbakhsh, Samaneh Yazdani, "In this paper, authors have discussed the three stages of fall as Prediction, Prevention, and Detection. We have illustrated Edge, Fog, and Cloud layers as IoT layers to develop a fall diagnosis system. At the end of the paper, they have considered the challenges of fall diagnosis systems and suggested future aspects"

5. Mohamed Abdel-Basset, Mai Mohamed, M. Gunasekaran, "For establishing a largescale of smart infrastructure to merge data, information, products, physical objects and all processes of supply chain, author applied the internet of things (IOT) in supply chain management (SCM) through building a smart and secure system of SCM"

6. Venkat Subramanian Arumuga Perumala, Krishnamoorthy Baskarana, Suleman Khalid Raia, "The overall objective of this paper is to utilize Raspberry Pi as a key element of Building Monitoring System to monitor parameters such as Temperature, Barometric Pressure, Humidity, Light etc."

7. Ibukun Awolusi, Chukwuma Nnaji, Eric Marks and Matthew Hallowell, "This paper provides an evaluation of the potential applications of Wearable Sensing Devices WSDs and IoT for the continuous collection, analysis, and monitoring of construction workers' safety metrics to mitigate safety hazards and health risks on construction sites."

Concluding remark:

By studying various literature current research on various early warning alert system, implementation and challenges can be known.

Thus, it is helpful to counter problem of other hazardous situations such as water level increase, leakages of harmful gases and vibrations at site Thus further methodology is based on above literatures and research papers.

VI. METHODOLOGY

Proposed System:

System comprised of Raspberry Pi 3 model B+ for our data collection, visualization and analysis process. Our system mainly consists of three components viz., sensors, controller and Raspberry Pi for data manipulation. The data from the sensors are transferred to the controller by ZigBee protocol which have the ability to cover a total distance of 300 meters when kept in line of sight.

Then the controller is connected with the raspberry Pi wirelessly for our data collection, visualization and analysis Process. The Sensor we have used here is able to read the parameters viz., Gases or fire smoke, rainfall, vibrations and motion detectors the data .The controller is connected with a local network which creates a wireless connection for Raspberry Pi. Now Raspberry Pi is programmed to perform data collection and can be made to store as a CSV based file type on a daily basis or can be stored in a MySQL database for user friendly visualization and also to analyse the data easily and if limits crossed buzzer will automatically sound and message will be forwarded to admin.
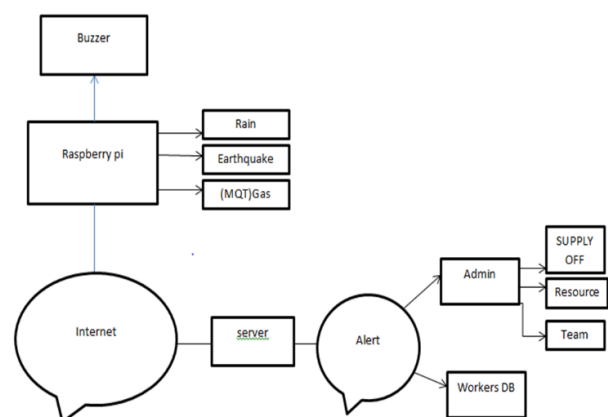
SystemArchitecture:

Fig. 1: System Architecture

Raspberry Pi:

Raspberry pi3 model B is used as shown in figure 3, as this model has better specifications as compared to other raspberry pi models. It supports a number of operating systems including a Raspberry pi which is recommended by raspberry pi foundation, which is used in our design.
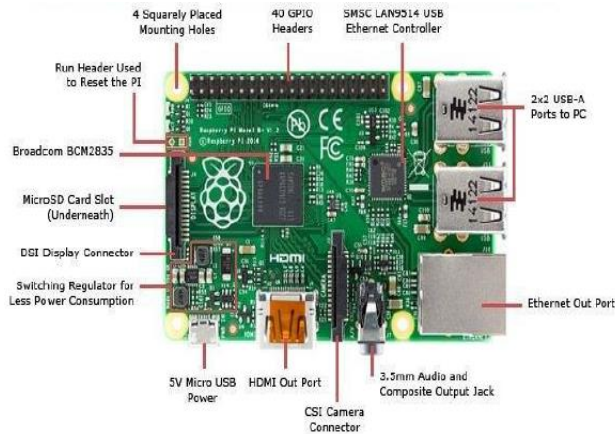

Fig.2 : Raspberry Pi 3 Model B+ and Its Components

VII. SYSTEM CONFIGURATION

After initially setting up sensors with raspberry Pi connecting it with monitor.

Running python code in background will give results as per information transfer through various sensor attached.

Following figure indicates performing gas/smoke sensor demonstration which concludes with detecting smoke to server.
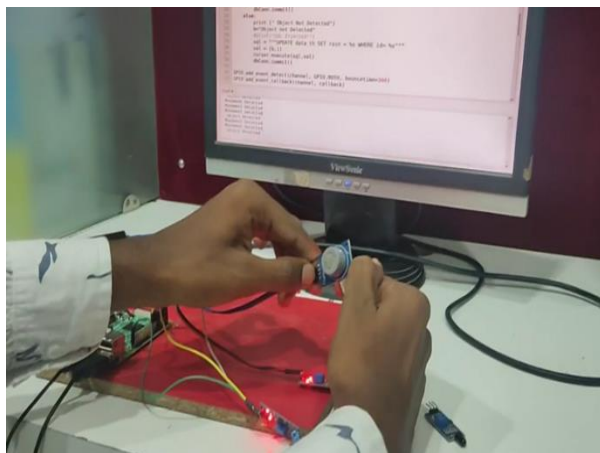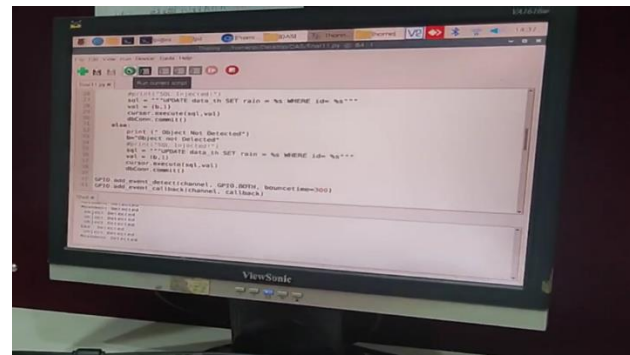

Fig 3. Gas Sensor Demonstration

Fig 4. Gas, Object & Movement Detected

Thus all other sensors were tested and found correct and working.

VIII. CONCLUSION

1. The proposed IoT- based smart emergency response system can reduce casualties by determining the point of occurrence of a disaster in a construction site to prevent directional confusion and inappropriate evacuation guidance.
2. The sensors installed in hazard zones detect the approach of workers and outsiders, generate warning signals in the hazard zones when approaching the hazard zones, and provide the situation to the construction safety manager and top authority.

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