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# Smart Building Sites: Leveraging RSSI for Automated PPE and Safety Compliance

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## Abstract
*In construction and building sites, workers are often at risk of injury or entrapment due to accidents such as building collapses, where individuals may become buried beneath debris and rendered unreachable. To enhance search and rescue efforts, we integrated Received Signal Strength Indicator (RSSI) technology, which uses signal strength from devices like smartphones or personal locator beacons to accurately triangulate the location of trapped individuals beneath rubble. By incorporating RSSI into our rescue protocol, we can rapidly assess the environment and streamline rescue operations, significantly reducing the time required to locate injured workers. Additionally, our system continuously monitors the RSSI of workers on-site, triggering an alert via a buzzer if a worker moves away from the designated construction area, ensuring real-time safety and preventing unauthorized departures. This innovative approach improves the overall effectiveness of rescue missions and workplace safety by enabling quick and accurate worker location both during emergencies and routine operations. The use of RSSI in high-risk environments highlights the potential of advanced technology to safeguard workers, ensuring timely rescues and proactive safety measures.*

***Keywords:** construction safety, RSSI technology, search and rescue, worker monitoring, emergency response, signal strength, location tracking, building collapse, debris recovery, real- time alerts, workplace safety.*

## 1. Introduction

Enhances safety and emergency response at construction sites using RSSI technology. Helps locate trapped workers during collapses for faster rescue. Aims to reduce risks and improve on-site safety measures.Our system aims to revolutionize search and rescue operations. By leveraging the signal strength from personal devices, such as smartphones or locator beacons, we can accurately pinpoint the location of individuals in distress, significantly reducing the time needed for rescue efforts. Additionally, our monitoring system tracks workers' movements on-site, providing real-time alerts if they stray from designated areas. This dual functionality not only facilitates swift location and recovery during emergencies but also fosters a proactive safety environment, ensuring that workers remain within safe zones. By integrating advanced technology into construction safety protocols, we aim to improve rescue mission effectiveness and safeguard workers in high-risk environments, ultimately contributing to a safer workplace culture. This innovative approach exemplifies how technology can be harnessed to address critical safety challenges in the construction industry. The scope of this project encompasses the integration of RSSI technology into construction safety protocols to enhance search and rescue operations and monitor worker movements. It includes developing a robust system for accurate location tracking of trapped individuals during emergencies and implementing real-time alerts for workers straying from designated areas. This project aims to improve response times in critical situations, foster safer working environment, and reduce the risks associated with construction sites through advanced technology solutions. Existing System Reactive Safety Systems: Current safety systems in the construction industry are predominantly reactive, focusing on incident reporting after accidents occur rather than preventing them in real- time. Limited Scope of Safety Measures: Existing systems often only ensure compliance with safety equipment usage, neglecting broader proactive measures to minimize injury risks during operations.

## 2. Literature Survey

Heart Rate Variability (HRV) has gained considerable attention as a physiological indicator for assessing stress and workload in industrial settings. Tran and Péntek conducted a systematic scoping review on HRV as a reliable indicator for assessing acute work-content-related stress (AWCRS) among

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industrial workers [1]. Their analysis of studies from 2000 to 2022 concluded that HRV may not fully capture the dynamic aspects of AWCRS during actual work processes, suggesting the need for further trials in real manufacturing environments. Similarly, Tatsuzaki et al. carried out a 10-year follow-up study on nuclear workers exposed to I-131 radiation at the Fukushima Daiichi Power Plant and found no significant thyroid abnormalities, indicating that physiological monitoring methods, including HRV, can support long-term worker health surveillance in hazardous industries [2]. Recent advancements in cognitive ergonomics have explored AI-driven and vision-based approaches to complement HRV based stress assessment. Lagomarsino et al. proposed a vision based framework for real-time assessment of cognitive workload in human–robot collaborative assembly systems [3]. Using stereo cameras and AI-based tracking, the system continuously monitors attention and body kinematics to adapt robot behavior, reducing cognitive strain and enhancing operator safety. This integration of cognitive ergonomics with physiological sensing marks a shift toward intelligent adaptive industrial systems. Computer vision-based approaches have further expanded stress and behavior monitoring in industrial and construction domains. Li et al. reviewed vision-based monitoring techniques for construction workers' behaviors, focusing on detection, localization, and safety assessment [4]. The study emphasized the importance of combining object detection algorithms and multi-sensor data to improve robustness in realworld conditions, paving the way for hybrid HRV-vision monitoring frameworks.Cittadini et al. explored a robotic approach to contactless physiological monitoring, introducing a robot-aided system capable of tracking workers' cardiac activity in hazardous environments [5]. The system utilizes adaptive zoom and distance control to ensure non-invasive yet accurate HRV data acquisition, outperforming earlier models in both precision and safety. Such systems highlight the potential of robotics to support health-aware workplaces through continuous, noncontact biometric monitoring.Collectively, these studies underscore the evolving role of HRV and related physiological measures in occupational health and industrial ergonomics. While HRV offers valuable insights into stress and workload, integrating it with computer vision, robotics, and cognitive modeling could yield comprehensive, real-time frameworks for monitoring worker well-being. Future research should focus on developing integrated systems that combine HRV-based sensing, visual behavior analysis, and intelligent robotic monitoring to enhance safety, productivity, and human-centered design in industrial environments.

## 3. Proposed System

RSSI-Based Location Tracking: Implement RSSI technology using Arduino microcontrollers to triangulate the positions of workers on-site, enabling quick identification of individuals trapped beneath debris. This system continuously monitors signal strength from personal devices to provide real-time location data. Health Monitoring and Alert System: Integrate heart rate sensors to continuously track workers' vital signs, automatically detecting anomalies. Upon detection, the system transmits location data to management and alerts caregivers via GSM for immediate intervention, ensuring timely medical response. RSSI-Based Location TrackingEnables precise worker location in emergencies, reducing rescue time. Continuous monitoring improves overall site safety. Helps quickly identify trapped individuals under debris for faster intervention. Health Monitoring and Alert System: Tracks vital signs in real-time, ensuring early detection of health issues. Sends instant alerts to management and caregivers for timely intervention. Enhances worker safety by providing immediate medical assistance when needed.Integrates RSSI-based location tracking and health monitoring to enhance safety and emergency response on construction sites. By implementing RSSI technology using Arduino microcontrollers, the system can accurately triangulate the positions of workers, continuously monitoring signal strength from personal devices to provide real-time location data. This ensures quick identification of workers trapped beneath debris in the event of accidents, enabling faster rescue operations and improving overall site safety. Additionally, the project incorporates a health monitoring system that utilizes heart rate sensors to track workers' vital signs in real time. Any detected

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anomalies, such as irregular heartbeats or signs of distress, are immediately flagged, and the system sends alerts containing the worker's location to management and caregivers via GSM communication for prompt medical intervention. This proactive approach not only reduces the risk of unnoticed health emergencies but also ensures timely response to potential lifethreatening situations. Together, the integration of RSSI technology for location tracking and health monitoring significantly enhances worker safety in high-risk environments by combining real-time monitoring, quick alert systems, and efficient rescue protocols. This project demonstrates the potential of technology to safeguard workers, minimize risks, and ensure that emergency responses are both timely and effective, contributing to a safer and more secure construction work environment. Shows Figure 1 Architecture diagram.

## 4. Architecture Diagram

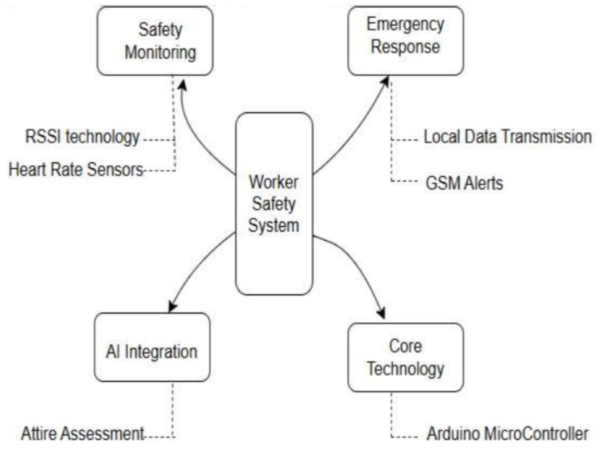


**Figure 1 Architecture diagram**

## 5. Methodology

The proposed system is designed with four core modules that collectively enhance worker safety, ensure compliance with safety standards, and minimize risks caused by hazardous conditions on construction sites. By integrating advanced technologies such as RSSI-based positioning, wearable health sensors, artificial intelligence–based safety monitoring, and structural vibration analysis, the system provides a robust real-time safety management solution.

### 5.1 Rssi - Based Location Tracking

This module utilizes the Received Signal Strength Indicator (RSSI) technique to enable continuous real-time tracking of workers within the construction area. The system determines worker positions by analyzing and triangulating signal strength data received from wearable devices. This capability is particularly beneficial during emergency situations, such as accidents, collapses, or worker entrapments, as it allows rapid identification of affected individuals (Figure 1). In addition, a geo-fencing mechanism is implemented to define safe working boundaries. If a worker crosses the designated perimeter, automatic alerts are triggered, enhancing site security and preventing unauthorized movement. This proactive tracking approach improves workforce monitoring and significantly reduces emergency response time.

### 5.2 Health Monitoring And Alert

This module continuously monitors workers' physiological parameters and movement patterns using wearable sensing devices. It is capable of detecting abnormal health conditions such as irregular heart rate, extreme exhaustion, or sudden falls, which may indicate potential medical emergencies. When such conditions are identified, the system immediately generates alerts and transmits the worker's real-time health status and location details to supervisors and medical personnel (Figure 1). This ensures rapid medical assistance, reduces accidents caused by health-related issues, and supports overall worker well-being.

### 5.3 Ai-Driven Safety Equipment Compliance

Ensuring the proper use of personal protective equipment (PPE) is critical for minimizing workplace injuries. This module employs artificial intelligence and computer vision techniques to monitor workers' adherence to safety gear requirements. By analyzing live video streams captured by on-site cameras, the system detects the absence of essential safety equipment such as helmets, gloves, and protective vests. Upon identifying any safety violation, an automated alert is sent to site supervisors, enabling immediate corrective action (Figure 1). This intelligent monitoring mechanism strengthens safety enforcement and reduces injury risks caused by

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inadequate protective measures.

### 5.4 Structuralvibrationmonitoringandalert System

This module uses gyroscope sensors to continuously observe structural vibrations, functioning as an early detection system for potential structural instability. By analyzing vibration patterns in real time, the system can identify anomalies that may indicate structural stress, damage, or weakening. If vibration levels exceed predefined safety thresholds, immediate alerts are issued to workers and supervisors, allowing preventive measures or evacuation procedures to be initiated before a structural failure occurs (Figure 1). This proactive monitoring approach significantly enhances site safety by addressing structural risks at an early stage. Shows Figure 2 Working model.

## 6. Working Principle

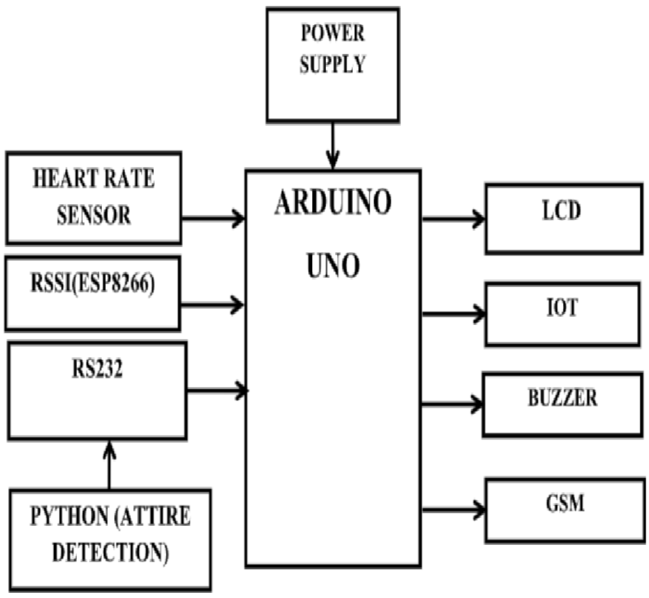


**Figure 2** **Working model**

The proposed system is centered on an Arduino microcontroller that functions as the main processing unit to enhance safety at construction sites by combining realtime location tracking, health monitoring, AI-based safety compliance, and automated emergency response features. Worker positions are determined using Received Signal Strength Indicator (RSSI) technology, which estimates location by measuring signal strengths from wearable devices such as RFID tags, smartphones, or smart helmets. This enables accurate identification of worker locations, which is particularly useful during emergency situations like structural collapses where workers may be trapped. In addition, wearable heart-rate sensors continuously observe workers' vital signs and detect unusual conditions such as abnormal heartbeats, extreme fatigue, or sudden falls. When a critical health event is detected, the system immediately sends the worker's location information to the site management team, while a GSM-based notification mechanism alerts caregivers and emergency services to ensure rapid medical assistance.An AI-enabled safety compliance module is also integrated into the system to monitor the use of pers onal protective equipment (PPE). By processing real-time video streams from construction site cameras, the AI model checks whether workers are wearing essential safety items such as helmets, gloves, and reflective vests. If any required equipment is missing, instant alerts are sent to supervisors, enabling immediate corrective action. Through the combined use of RSSI-based tracking, biometric monitoring, and intelligent safety compliance checks, the system greatly improves the effectiveness of emergency rescue operations and reduces workplace risks. Overall, this integrated approach strengthens accident prevention measures and ensures faster response during emergencies, creating a safer and more reliable construction environment.

## 7. Ethical Considerations

Ensuring Ethical Use of AI and RSSI for Worker Safety and Compliance With the increasing adoption of smart technologies such as Artificial Intelligence (AI) and Received Signal Strength Indicator (RSSI) systems in industrial and construction environments, ethical considerations have become critically important. While these technologies significantly enhance worker safety by identifying hazards, monitoring safety gear compliance, and reducing workplace accidents, they also raise concerns related to privacy, bias, data security, and responsible AI deployment. Addressing these ethical challenges is essential to ensure fair, transparent, and trustworthy safety monitoring systems.

### 7.1 Worker Privacy And Surveillance Ethics

Employees must be clearly informed about the nature of data being collected, the purpose of its collection, the entities authorized to access it, and the duration for which it will be stored. Surveillance and monitoring technologies

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should only be deployed after obtaining explicit and informed consent from workers. The consent process must be transparent, easy to understand, and allow employees to raise questions or withdraw consent where appropriate.To safeguard individual privacy, data anonymization techniques should be implemented wherever possible to prevent direct identification of workers while still enabling effective safety monitoring. Additionally, secure data storage mechanisms, including encryption and access control measures, must be enforced to protect against unauthorized access and data breaches.

### 7.2 Bias And Fairness In AI-Based Safety Gear Detection

AI-driven safety compliance systems must be designed to operate fairly across diverse workforces. Training datasets should represent variations in ethnicity, gender, clothing styles, and personal protective equipment to minimize biased outcomes. Safety detection models should accurately recognize culturally and religiously significant attire, such as turbans or hijabs, and distinguish them appropriately from safety violations. Both false positives and false negatives pose ethical and operational risks. False positives may lead to unjust disciplinary actions and reduce employee trust, while false negatives may fail to detect missing safety equipment, increasing the likelihood of accidents. To mitigate these risks, AI outputs should be regularly tested, validated, and supplemented with human oversight to improve reliability and accountability.

### 7.3 Data Security And Protection

Worker location data and health-related information must be treated as highly sensitive and protected using industrystandard encryption techniques. Biometric data, including heart rate, body temperature, and motion patterns, should be securely stored and processed in compliance with relevant legal and regulatory frameworks. Strict policies must be established to prevent the misuse of health data for discriminatory or non-safety-related purposes, ensuring that such information is used solely to protect worker wellbeing[6].

### 7.4 Responsible And Ethical Use Of Ai In Safety Systems

AI technologies should function as decision-support tools rather than fully autonomous decision-makers, particularly in critical or emergency scenarios. A manual override mechanism must be available, enabling human supervisors to intervene when necessary. Clear accountability structures should be defined to address system errors or failures, ensuring timely corrective action. Furthermore, AI-driven decisions must be explainable and auditable, allowing stakeholders to understand the reasoning behind safety alerts and actions. Access to sensitive worker data should be restricted to authorized personnel based on role-based permissions, and periodic security audits should be conducted to verify compliance with ethical and security standards.

### 7.5 Employee Rights And Autonomy

Employees should retain autonomy over their personal data and be given the option to opt out of non-essential monitoring activities. Designated areas such as restrooms and break rooms must be explicitly excluded from surveillance to protect personal privacy. Workers should receive proper training on how AI- and RSSI-based systems function, the benefits they offer, and the rights employees have regarding data collection and usage. Explicit consent must be obtained before implementing any health or biometric monitoring systems. Additionally, organizations should establish feedback mechanisms that allow employees to express concerns, report issues, and suggest improvements, ensuring that the system evolves in a manner that respects worker rights and fosters trust.

## 8. Hardware Components And Their Roles

A smart worker-safety system requires multiple hardware components working together to monitor environmental conditions, worker health, and safety compliance. By integrating sensors, controllers, and communication modules, the system can detect hazards in real time and enable preventive safety actions. The primary hardware components and their functions are described below[7].

### 8.1 Power Supply

The power supply unit is responsible for providing a stable and regulated voltage necessary for the proper functioning of the entire system. A step-down transformer rated at 0–12 V is used to reduce the main supply voltage. The transformer’s primary winding is connected to the main power source through a switch and fuse, which protect the circuit from overload and short-circuit conditions. The secondary output is passed through rectifier diodes to convert the 12 V AC signal into DC. Capacitors are then used to smooth the output, and an IC 7805 voltage regulator ensures a constant +5 V supply required by the microcontroller and connected modules.Shows Figure 3.

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Power supply.

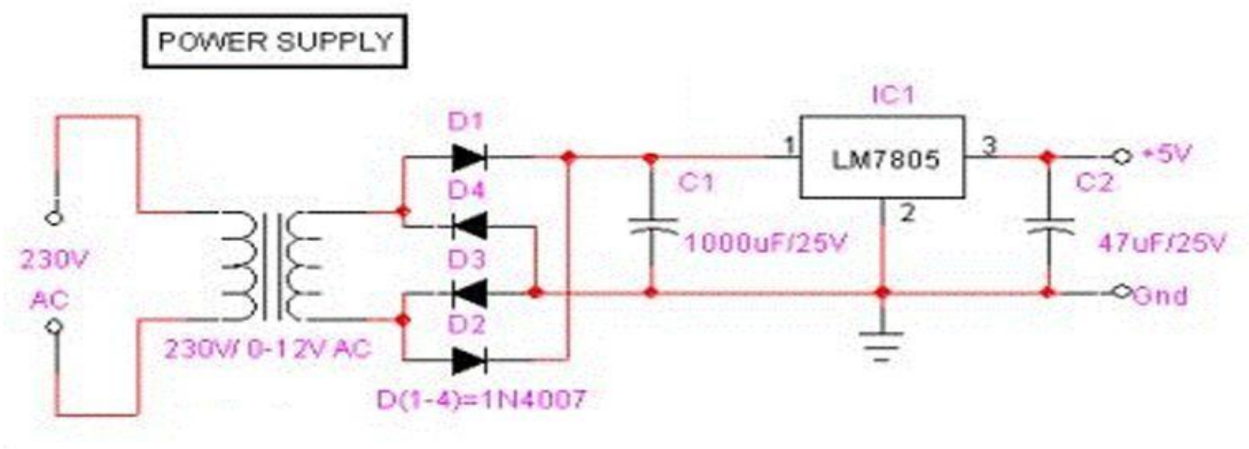


**Figure 3 Power supply**

## 8.2 Arduino Uno

The Arduino Uno serves as the central control board of the system and is particularly suitable for beginners due to its ease of use, reliability, and extensive documentation. Built around the ATmega328P microcontroller, the board includes 14 digital input/output pins (six of which support PWM), six analog input pins, a 16 MHz crystal oscillator, USB connectivity, a power jack, an ICSP header, and a reset button. It contains all the essential components needed for standalone operation and can be powered either through a USB connection or an external adapter or battery. The Arduino Uno processes sensor data, controls communication modules, and executes the programmed safety monitoring functions, making it a widely adopted platform for embedded system applications[8].shows Figure 4 Arduino UNO.


**Figure 4 Arduino UNO**

### 8.2.1 Programming

The Arduino Uno can be programmed using the Arduino Integrated Development Environment (IDE). To begin programming, the user must select “Arduino/Genuino Uno” from the Tools → Board menu according to the microcontroller installed on the board. The IDE allows users to write, compile, and upload programs directly to the microcontroller through a USB connection. The ATmega328P microcontroller used in the Arduino Uno comes with a preinstalled bootloader, which enables code uploading without the need for an external hardware programmer. The communication between the IDE and the board occurs using the standard STK500 protocol, allowing simple and fast program transfer. If required, the bootloader can be bypassed and the microcontroller can be programmed directly through the ICSP (In-Circuit Serial Programming) header using tools such as Arduino ISP or any compatible external programmer. Firmware for the ATmega16U2 (or ATmega8U2 in earlier board revisions), which manages USB communication, is available in the official Arduino firmware repository. These boards also contain a DFU (Device Firmware Upgrade) bootloader, which can be activated depending on the board version. For early revision boards, DFU mode can be enabled by connecting the

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appropriate solder jumper and resetting the controller. For later revisions, a built-in resistor automatically enables the required hardware configuration for entering DFU mode. Once activated, firmware updates can be uploaded using Atmel FLIP software on Windows or a DFU programmer on macOS and Linux. Alternatively, the firmware can also be written through the ISP interface using an external programmer, which replaces the existing DFU bootloader if necessary[9].Shows Figure 5 Heart rate sensor.

### 8.3 Heart Rate Sensor

**Figure 5 Heart rate sensor**

The heart rate sensor is used to continuously monitor the worker's pulse and detect possible health abnormalities. It operates using an infrared (IR) LED and a phototransistor placed on opposite sides of the finger. When blood flows through the finger, the amount of infrared light absorbed changes, causing variations in the phototransistor output. The changes are processed to determine the pulse rate, and an indicator LED typically flashes with each detected heartbeat.Because the finger absorbs a large portion of the emitted light, a high-value resistor is used to improve detection sensitivity. Proper shielding of the sensor from external light sources, such as indoor lighting operating at 50 or 60 Hz, is necessary to reduce signal noise and improve measurement accuracy. The sensor functions at a 5 V supply and is commonly connected to the Arduino's analog input pin for signal acquisition.

### Typical Specifications

- Operating voltage: 5 V
- Pulse detection using IR LED and phototransistor
- Compact and lightweight design suitable for wearable monitoring Figure 6 Connecting to Arduino.

### Basic Connection

- Signal pin → Arduino Analog pin (A0)
- VCC → 5 V
- GND → Ground


**Figure 6 Connecting to Arduino**

### 8.4 Rs232 Serial Communication Interface

The RS232 interface provides a reliable wired communication link between the microcontroller and external devices such as monitoring units or communication modules. It enables the transmission of sensor readings and control signals in a stable and synchronized manner, ensuring that different components of the safety monitoring system operate together without data loss or timing errors.

### 8.5 Esp8266 Wi-Fi Module

The ESP8266 module offers wireless connectivity, allowing real-time transmission of sensor data to remote servers or cloud platforms. Through this module, supervisors can monitor worker health, environmental conditions, and safety compliance from remote locations. The Wi-Fi connection also supports instant alerts and remote data analysis using AI-based monitoring systems[11].

### 8.6 Liquid Crystal Display (Lcd)

A 16×2 LCD module is used to display real-time system information such as temperature values, heart rate readings, and safety alerts. The display can show two lines of text, each containing up to sixteen characters. Internally, the LCD operates using command and data registers. The command register controls display functions such as cursor positioning and screen clearing, while the data register stores the characters that appear on the screen. LCD modules are widely preferred because they are economical, easy to interface, and capable of displaying custom characters and messages[10].Shows Figure 7 16 x 2 LCD 7.Buzzer.

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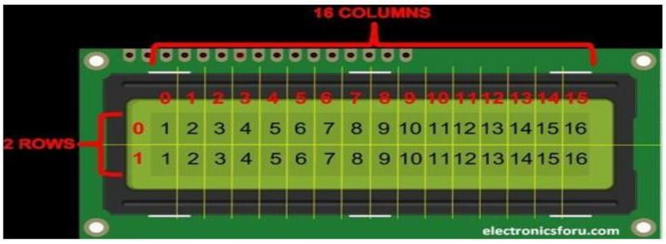


**Figure 7** **16 x 2 LCD 7.Buzzer**

A buzzer, also referred to as a beeper, is an electronic device designed to generate audible sound signals. Depending on its operating principle, it can be categorized as mechanical, electromechanical, or piezoelectric (piezo) type. Buzzers are widely used in electronic systems to provide warning sounds, notifications, or user feedback. Common applications include alarm systems, timers, safety alert mechanisms, and indication of system operations such as button presses or key inputs. In safety monitoring systems, the buzzer plays an important role by producing immediate audible alerts whenever abnormal conditions or emergency situations are detected.Shows Figure 8 Buzzer.

**Figure 8** **Buzzer**

## 9. Gsm Network

The Global System for Mobile Communications (GSM) is a cellular communication standard that defines operational and interface requirements while allowing flexibility in hardware design, enabling operators to use equipment from **different manufacturers.**

A Gsm Network Consists Of Three Main Subsystems

- Switching System (SS): Handles call routing, subscriber management, and network control.
- Base Station System (BSS): Manages wireless communication between mobile devices and base stations.
- Operation and Support System (OSS): Responsible for network monitoring, maintenance, and performance management.

## 10. Software Used And Its Functionality

### 10.1 Arduino IDE

The Arduino Integrated Development Environment (IDE) is a software platform used to write, compile, and upload programs to Arduino boards. It includes a code editor, message display area, serial monitor, toolbar for frequently used commands, and various menu options. The IDE allows users to easily connect the Arduino hardware to a computer, upload programs, and monitor communication between the system and connected devices[12].

### 10.2 Embedded C

Embedded C is a programming language widely used for developing software that runs directly on microcontrollers and embedded systems. It enables the processor to control sensors, communication modules, and other electronic components by executing specific instructions. Many everyday electronic devices—such as mobile phones, washing machines, and digital cameras—operate using microcontrollers programmed with Embedded C, making it essential for hardware-level control in embedded applications.

### 10.3 Python

Python is used for implementing the AI-based safety monitoring features of the system. With libraries such as OpenCV, TensorFlow, and YOLO, Python processes video streams from cameras to detect safety violations, including the absence of helmets or protective clothing. It also records safety-related data, generates automated alerts, and performs data analysis to identify potential hazards. The combination of Python for intelligent monitoring, Arduino for hardware interfacing, and Embedded C for microcontroller programming enables the development of an efficient and automated workplace safety system.

## 11. Display Devices

In modern worker safety monitoring systems, the effective coordination between input devices

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(sensors) and display devices plays a crucial role in identifying hazards, processing data in real time, and delivering immediate feedback to both workers and supervisors. This seamless interaction ensures rapid response to unsafe conditions, thereby enhancing overall workplace safety and minimizing accident risks.

### 11.1 Data Acquisition through Sensors (Input Devices)

The system continuously collects critical data related to worker location, health status, and safety equipment usage through multiple sensors. A heart rate sensor monitors vital parameters such as heart rate and oxygen saturation levels, enabling early detection of physical stress, fatigue, or potential medical emergencies. Safety compliance is verified using an AI-enabled camera, which detects whether workers are wearing mandatory protective equipment such as helmets, gloves, and safety vests. If any required safety gear is missing, the system automatically identifies the violation and generates an alert[13].

### 11.2 Data Processing and Decision-Making Using the Arduino Microcontroller

The Arduino microcontroller processes the incoming sensor data by applying predefined safety rules and threshold values. By analyzing real-time inputs and comparing them with established safety standards, the system determines the current safety condition of each worker. Based on this evaluation, safety status is classified into three categories: Safe, where no violations are detected; Warning, indicating minor issues such as missing protective equipment; and Danger, representing critical situations such as entry into restricted zones or detection of medical emergencies. Upon identifying any unsafe condition, the system immediately activates the appropriate alert and display mechanisms to ensure timely intervention[14].

### 11.3 Feedback and Alert Generation through Display Devices

After data analysis, display devices provide real-time visual feedback and alerts to both workers and supervisors, enabling quick decision-making. An on-site LCD display continuously presents the current safety status, allowing immediate monitoring at the workplace. Status messages such as “All Safety Requirements Met” (Green), “Missing Safety Gear Detected” (Yellow), and “Worker in Restricted Zone” (Red) are displayed to clearly indicate the level of risk. In addition to local displays, supervisors can remotely monitor worker safety using a cloud-based dashboard accessible through web and mobile platforms. This dashboard provides real-time alerts, live worker tracking, and historical safety compliance data, supporting longterm safety planning and policy improvements. For severe safety violations, audible alerts are triggered using a buzzer and notifications are transmitted through the GSM module to ensure immediate attention[15].

### 11.4 Enhancing Workplace Safety through Automation

By integrating sensor-based input devices with intelligent display and alert mechanisms, the system significantly reduces reliance on manual supervision while enabling continuous and proactive safety monitoring. This automated approach helps prevent accidents, ensures consistent compliance with safety regulations, and provides rapid assistance during emergency situations. The inclusion of a smartphone-based dashboard and future cloud connectivity further strengthens remote monitoring capabilities and contributes to a safer and more efficient workplace environment.

## Conclusion

In conclusion, this system provides a comprehensive solution to enhance worker safety and operational efficiency in construction sites by integrating advanced technologies like RSSI, health monitoring, and AI-based safety gear detection. The RSSI-based location tracking module ensures real- time identification of workers, particularly in emergencies such as building collapses, enabling faster rescue operations. By precisely triangulating workers' locations, the system reduces response time in critical situations, significantly improving the chances of survival for those trapped under debris. Simultaneously, the health monitoring module tracks vital signs, automatically detecting anomalies and transmitting real-time alerts to both management and caregivers for immediate intervention. This proactive approach prevents health emergencies from going unnoticed, ensuring prompt medical attention when

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needed. The AI-based safety gear detection module further ensures that workers adhere to safety protocols, minimizing the risk of injury caused by non-compliance. By monitoring safety equipment in realtime, the system helps enforce a safe working environment, ultimately reducing the likelihood of accidents. This integration of location tracking, health monitoring, and safety compliance creates a robust safety framework that optimizes both worker protection and operational workflows. The solution highlights how leveraging modern technology can address critical safety challenges, ensuring that workers are safeguarded against the inherent risks of construction sites while providing timely interventions in emergencies.Shows Figure 9 Website, Figure 10 Reduction in response time, Figure 11 Worker Health Monitoring Efficiency, Figure 12 Comparison between existing and proposed system.

## Result

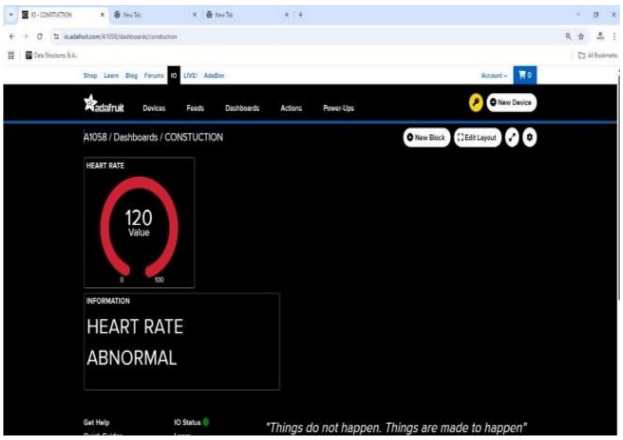


**Figure 9 Website**

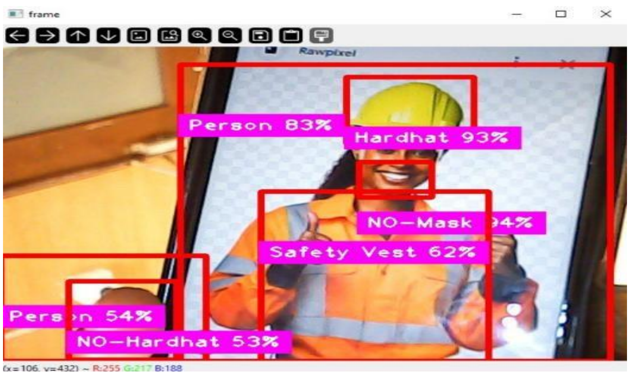


**Figure 10 Reduction in response time**

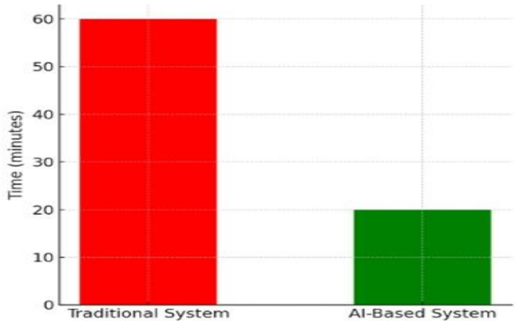


**Figure 11 Worker Health Monitoring Efficiency**

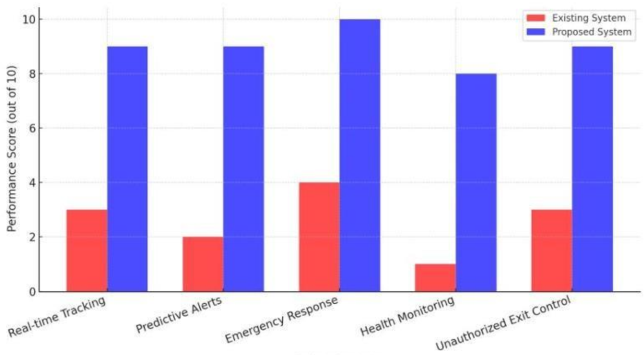


**Figure 12 Comparison between existing and proposed system**

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