Research Topic:
The implementation of safety helmet product with the help of IoT to ensure the safety of workers at high hazardous work environment

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Abstract:

It is very crucial to ensure the safety of workers in dangerous and higher altitudes as they are at risk of getting seriously injured due to the work environment they are in. For this important issue to be addressed, this research proposal suggests the implementation and development of highly developed helmets with real-time monitoring and immediate response in emergencies(Li & Zhang, 2018). The helmet will monitor several vital parameters such as heart rate, SPO2 levels, and body temperature. As well as altitude, and location tracking using latitude and longitude, it will also include fall detection advantage using vibration sensors that will send immediate alerts to the concerned authorities.

Keywords - Helmet, Interface, IoT(Internet of Things), Sensor, Wearable sensing device, WSD(Web Services for Devices)

Introduction:

As mentioned, laborers' safety in a hazardous work environment, especially at construction sites is crucial. It is essential to implement solutions to ensure the safety of the human being, such as workers at high altitude jobs due to the great consequence of getting severely injured or even being a victim of death (Smith & Jones, 2020). Traditional safety measures and solutions usually depend on periodic monitoring or manual inspection, which is very unreliable and causes delays in addressing specific and urgent emergencies. As a result, creative and beneficial products such as smart helmets are required that can monitor real-time and notify concerned employees (Chen & Wang, 2019).

Literature Review:

Wibowo et al. (2020), identifies factors that affect laborers into falling, causing severe injuries or even death. The research gathered data from 43 responses in a survey and conducted some interviews relating to projects done in Indonesia between 2010-2019. The research concluded that human factors are the major reasons for accidents and injuries for workers at heights, this includes exhaustion, physical capacity, narrow knowledge and suitable safety procedures and guidelines, and reckless behaviors. The research suggests clear work training and safety guidelines should be integrated and highlighted to reduce accidents.

However, an opposing research written by Nnaji et al. (2020) does not agree with the previous research. The research first explains that in the early years between 1973 and 2010, there was a decrease in accidents in the construction industry due to safety guidelines and practices. However, the research later mentions that this reduction was only temporary because as time evolved construction became more complex, and work pressure also increased with the growth of the construction industry. The research then suggests the implementation of technology to help and asset a person's safety. The research states that WSDs are helpful including IoT in fall detection features which can use machine learning algorithms to predict and detect potential slips and trips.

The hardships that construction workers experience on a regular basis are what inspired this research idea. There have been a number of recent deaths related to job holders' failure to wear helmets. The individual's heart rate, oxygen saturation, temperature, and altitude will all be

monitored by a device that will be added to the helmet. In the event of an emergency, the person in peril can also send an SOS signal to the application.

Research question:

How can a comprehensive sensor system be developed to monitor vital parameters, detect falls, and provide real-time alerts for workers at high altitude to ensure their safety and well-being?

Objectives:

- Create an easily wearable product that uses sensors to secure the safety of individuals in dangerous high work environments.
- Include real-time vital sign monitoring capabilities.
- Track fall detection using vibration sensors and track the location of the person and get their longitude and latitude.
- Create an interactive user interface and send all data to the IoT application.

Methodology:

To develop this research solution we have to go through several steps. **The first step** involves choosing the right hardware components such as sensors for the system. This will ensure the quality of the product and an efficient and easy way to use it. **The second step** is about creating software that is linked to The Internet Of Things (IoT) (Wang & Zhang,2017) that can read and process data from the sensors used to display them on the OLED screen. Also to activate vibration sensor (for fall detection feature) and location tracking feature. This will make processing data much easier and clear. And **the final step** requires testing the product and checking for any errors. This will ensure the dependency and accuracy level of the product and its implementation. Making certainty that the user interface is easy to read and understand even in emergencies.

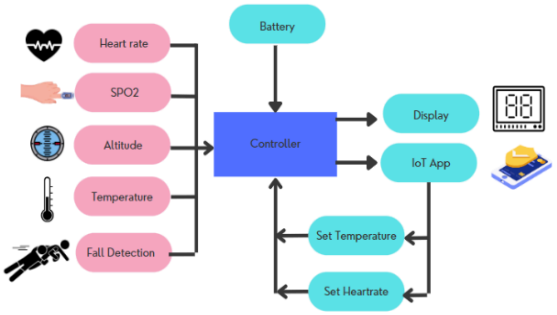

Figure 1: Flow chart

No.	Name	Purpose	Parameters	Advantage
1	ESP32	It's a microcontroller, perform calculations using different mathematical formulations. Get sensor data and display it after processing.	Control	Faster
2	Neo6m GPS	It is a GPS sensor, able to measure the location and speed	Location speed	Accuracy up to 1m and get 10 values in 1 second
3	MPU6050	Gyro and Accelerometer sensor, track acceleration. In this project it will measure the fall detection and acceleration	Acceleration Fall Detection	Very accurate and have fast response rate
4	DS18b20	Measure temperature of body. It is also sweat/waterproof	Temperature	Sweat proof
5	SD card Reader	Module used to connect SD card with Arduino	Save data to SD card	Continent
6	SD card	Storage	Store	Backup
7	OLED display	Display all parameters and sensor data	Show data	Small size

Table 1: Hardware components

Conclusion:

To make sure workers are safe in their high-altitude workplace a smart, creative, and easy comprehensive sensor system must be implemented (Kim & Park, 2020). The objective of this research proposal is to provide an idea to develop a safety wearable helmet sensor system for workers' at construction sites. This research has the potential to save lives and raise workplace safety standards by offering a safety-sufficient solution (Gupta & Kumar, 2021).

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