# An Embedded Smart Affordable Helmet For Construction Workers To Reduce Fatality Rate Using Iot Device

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## Abstract

On a daily basis, the death rate of construction workers on the job site is on the rise. However, there are still no such remedies to reduce the level of lethality. Even though they wear a helmet to protect themselves from all types of dangers that they could experience during construction of large buildings at construction site, it cannot en sure that the single helmet is strong enough to save the workers from danger or any health issues. The proposed system describes a smart inexpensive helmet for the construction workers made up of chromium embedded with Pulse sensor, Accelerometer and Gyroscope sensor. The pulse sensor is used to give the physical condition of him by measuring his/her heart rate. The Gyroscope sensor is used to indicate the rotation and orientation of the person with respect to gravity whereas the Accelerometer sensor is used to measure the linear acceleration or motion of the worker. These two sensors are used to detect falls due to sleepiness, fatigue, etc. All these components are connected with the Arduino Uno kit. Alert message are sent through GSM module. All other detail can also be viewed in the mobile application also. A Dc-Dc converter is used to regulate the flow of current.

**Keywords:** Smart Helmet, Pulse Sensor, Accelerometer and Gyroscopic Sensor, Mobile App, GSM Module.

## 1. INTRODUCTION

The physical components of Internet of Things such as sensors, home appliances are interconnected with each other through Internet. These components exchange information by communicating among them.

The death rate of the construction workers at the site has been increasing every year. If the worker working at some 15th floor of the large building gets severe heart attack, it takes some amount of time to reach that floor and recover him. Within that time, he may be expected to death.

In order to provide continuous monitoring of the workers and to prevent them from any health hazards during working, this system proposed a smart embedded flexible helmet for the workers to provide security in the construction site and rescue measures in case of any emergency conditions present.

## 2 LITERATURE SURVEY

KishorShresthaet all proposed the "Hard Hat Detection for Construction Safety Visualization". They used image processing techniques to check whether the worker is wearing the helmet or not. This system is used to detect whether the worker is wearing the hat during working. But it does not provide any safety measures to overcome in case of any emergency conditions

S. Nandhiniet all proposed "IOT based Smart Helmet for ensuring Safety in Industries". This system uses sensors to monitor the workplaces. This system isparticularly used for detecting safety at workplaces but not for the workers.
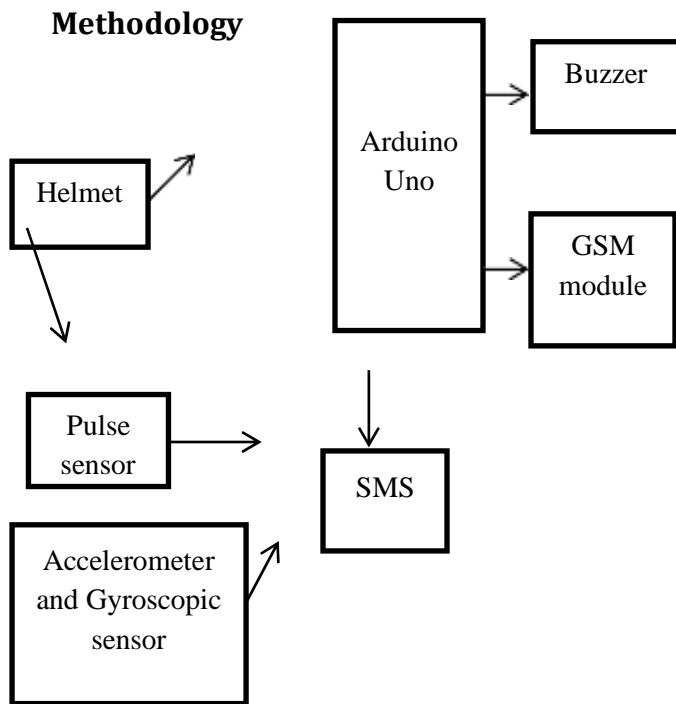
S.R.Deokaret all proposed "Smart Helmet for Coal Mines Safety Monitoring and Alerting"
system. This system seems to be very efficient as it ensures safety for both theworkers and the workplace using wireless sensor networks. It also includes falldetection, toxic gases emission from industry, etc.

Shruthiet all proposed "Smart Helmet for Coal Miners using Zigbee Technology". This system devises a smart helmet using Zigbee technology for monitoring the emission of hazardous gases, abnormal temperature conditions, humidity levels etc. This proposed system ensures the safety of workers during mining but this helmet is not purposely provided safety to the workers.

## 3. PROPOSED SYSTEM

The smart helmet is made up of the world's hardest metal chromium which is very inexpensive and abundantly found in nature. The smart helmet is embedded with Arduino

Uno kit to which the sensors like Heartbeat sensor, Accelerometer and Gyroscope sensor are connected. The helmet is also provided with a panic button to alarm others in case of any disaster. All these smart helmets are worn by the construction workers at the time of working. The civil engineer or the contractor receives all the information about the worker provided by the helmet with the use of the GSM module involved in it.Through this GSM module, alert message are sent through SMS. DC-DC converter is used to regulate a flow of current. The contractor or the civil engineer monitors functions of all the workers provided by the helmet with the use of a mobile app which designed to serve this purpose.

**Methodology**

Helmet → Arduino Uno → Buzzer

Arduino Uno → GSM module

Arduino Uno → SMS

Pulse sensor →

Accelerometer and Gyroscopic sensor →

**Fig: system architecture.**

**OVERVIEW**

There are four phase in this one is to continuously monitors physical condition of the workers. Next is that detecting to check the workers Motion and orientation, once the axis of the three trigger must activated through the person can fall.

Fall sensing phase is once the person can fall alert message and location link are send to the contractor.once the message are send through the contractor, sometimes if the contractor doesn't receive the message the buzzer was automatically indicate. So other will help the person in a critical situation.

```
┌─────────────────┐
│                 │
│                 │
│                 │
└─────────────────┘

┌──────────────────────┐
│  Continuously monitor│
│  the physical condition│
│  of the workers      │
│                      │
└──────────────────────┘
Detecting phase
┌──────────────────────┐
│  Check The      Once Trigger Is │
│  Workers        Activated  Fall │
│  Orientatio      Is Detected    │
│  n      And                     │
│  Motion                         │
└──────────────────────┘

Fall sensing phase
┌─────────────────┐     ┌──────────────┐
│ Once Person Fall Is│  │    Buzzer    │
│ Detected, Alert Message Are│      │
│ Sent To The Contractor│  └──────────────┘
└─────────────────┘
```
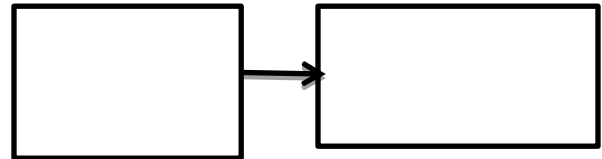
```
┌──────────┐        ┌──────────┐
│          │───────▶│          │
│          │        │          │
└──────────┘        └──────────┘
      Smoke sensing
```

## ARDUINO UNO

It is a Microcontroller board based on the Microchip Atmega328. The arduinouno is designed with 14 digital input/output pins and 6 analog input pins. This kit in this system is used as a microcontroller for controlling all the activities of all the modules involved in the process. The sensors are connected to this arduino board. This kit is embedded inside the smart helmet during the manufacturing process.

**PULSE SENSOR**

The pulse sensor is a plug and play heart rate sensor specially designed for Arduino. It is used to measure the heart rate of the worker. By doing so the physical condition of the worker is obtained. The pulse sensor is fixed to the strap of the smart helmet which measures the heart rate near the ear. The pulse sensor gives the pulse rate of the person from time to time from which we can detect whether the person is physically good or not.



**ACCELEROMETER        ANDGYROSCOPE SENSOR**

The gyroscope sensor is used to measure the angular velocity of the object. The 3 axis gyroscope sensor can find the orientation and rotation of the person in all three directions with respect to gravity. This provides an angle value ɵ which is then used to indicate the position of the person during fall.

An accelerometer sensor is used to measure the acceleration or motion of the human body. A tri axial accelerometer measures the acceleration in all 3 axes x, y and z respectively. The accelerometer sensor provides a parameter value for measuring the person motion. Both these sensors are used for Fall detection.

## FALL DETECTION ALGORITHM (EXAMPLE)

(1) if the parameter > threshold value of the parameter then

(2) if ϴ> threshold value of ϴ then (3) return fall detection
(4) return no fall detection
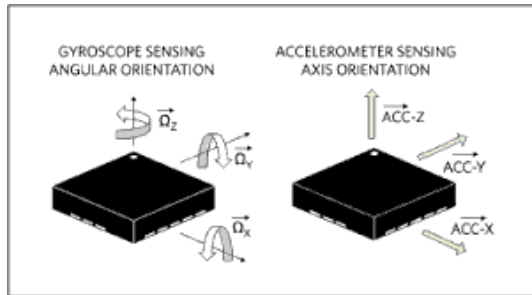


**Fig :Axis And Angular Orientation**

## DC-DC CONVERTER

Though at signal feeds the primary of a transformer which can step up or down the AC signal. The output of the secondary is rectified and filtered to produce DC of the required voltage. It is used to regulate or control the flow of current. It consume low voltage pass through the arduino.



## GSM MODULE AND THE MOBILE APP

It is used to describe the protocols for second- generation (2G) digital cellular networks used by mobile devices such as mobile phones and tablets. Alert message are sent through GSM Module. All other detail can also view in the mobile application. . The contractor monitors and receives all the information about the worker with use of this GSM facility.

Fig: GSM module and mobile app

**BUZZER**

The helmet is also designed with panic button. This button is used to alarm other workers working at various floors of the large building in case of any disaster or emergency situations. It is set primarily to intimate every other workers involved in the construction process instantly to avoid large disaster.It is an audio signaling device.



### 4. EXPERIMENTAL RESULTS

The below project kit model consist of helmet, accelerometer and gyroscope sensor, dc-dc controller step down , pulse sensor, buzzer, Arduino uno, GSM module.

**Hardware design:**

**Mobile application:**

The mobile application helps in every workers as well as contractor. It consist of admin and employee page. While clicking admin login page to check whether the how many employees are present or absent in everyday. It will be easy for contractor. In Employee page contain with in every employee contain id and designation.
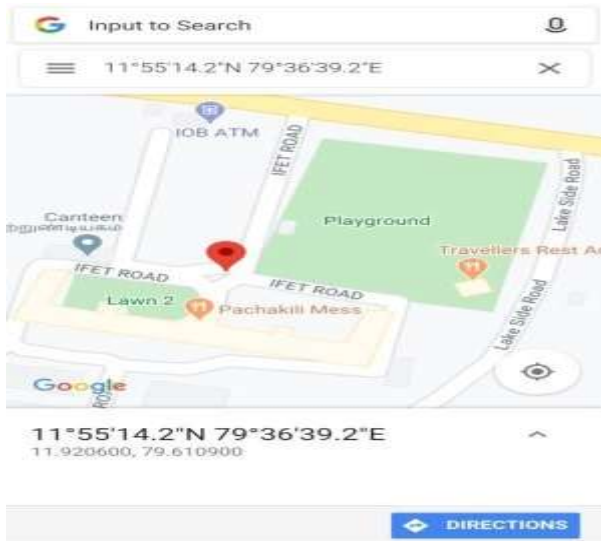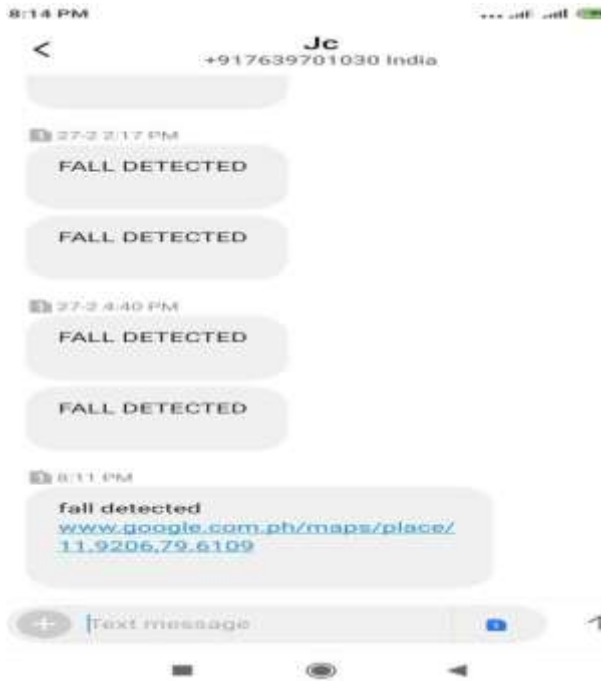


**Arduino output**
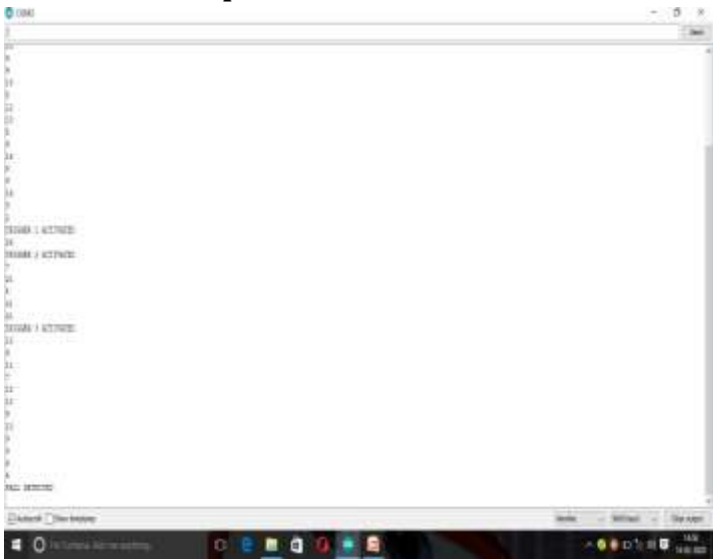
**Alert message:**





**Fig: alert message and location of person fall 4.5ADVANTAGES OF PROPOSED SYSTEM**

- Monitoring of workers health condition at the construction site.

- Fall detection of the workers due to fatigue, drowsiness, etc.

- Alarming system provided in case of any natural calamity.

- Prior intimation and notification of the workers condition to the contractor.

- Reduction in death rate of construction workers.

- Quick location identification of the construction workers in case of any emergency situation.

- Enhanced security to the workers working at some highest floors for a large building.

- Inexpensive user-friendly hardest shield that could save the workers from all type of hazards.

- **CONCLUSION**

  If this proposed system is implemented to ensure the complete safety of the workers at the construction site. Through this smart helmet, the contractor can continuously monitor the entire workers involved in construction process and can also get notification about the workers' physical condition and can immediately save the workers from any serious issues in case of emergency. Hence we can reduce the death rate of the construction workers and provides increased security to them.

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