

SECURITY - Smart Equipment for Construction Units to Reduce Injury by Technology

Chayan Datta

Rajeev Pandey

Sandeep Kumar Arora*

Lovely Professional University

Lovely Professional University

Lovely Professional University

Jalandhar, India

Jalandhar, India

Jalandhar, India

chayandatta40@gmail.com

rajeevpandeyrs@gmail.com

sandeep.16930@lpu.co.in

*Corresponding Author

ABSTRACT :-

Heat related illness is a serious health concern for construction workers in tropical climates or those working under hot and humid environmental conditions. It can cause damage to body organs and the nervous system resulting in permanent disability or even death. Development of systems for construction workers to detect and alert temperature-warning signs early is a timely and strategic need. The advancement and rapid development of wearable computers and wearable electronics has produced electronic textiles. This paper presents the smart safety vest prototype developed to senses the temperature and alert the wearer and surrounding workers/management about thermal abnormalities. It can be used as an early warning system for construction workers. The Lily Pad Arduino platform was used as the main technology. The temperature variations were alerted in visual format using coloured LED lights and in audible format using a speaker stitched on to the safety vest. Early detection of heat stroke conditions can mean the difference between life and death for construction workers. Hence, it is expected that the proposed technology will enable a step change in construction personal protective equipment globally.

Keyword- WIFI, Temperature, Sensor, Lily Pad

INTRODUCTION :-

In India we have seen that all workers always at a high risk. Workers in a dangerous environment work for long time.[7]. That will affect their health and body temperature. A worker following have to face all the struggle and difficult is on the construction area and it might be some time effect on their body balance and all [5]. Now a days iot becomes a regular thing employ integrated system to communicate and interact with the workers and other people [9]. This is a project is an initiative to build up a smart system to detect the behaviour of the workers body which really a big concern in this time [10]. Most of the work Where other focused on Environment safety or sides for health monitoring of workers and staff working over there. So that our aim is to provide a complete solution to monitor the health of the worker as well as safety precaution and record all the data and monitoring all unwanted think happening around the workers or staff at the construction area. In previous work we have seen that there was no proper arrangement to track the records. But our system provides a proper arrangement and throw that Falls area could be easily track. But our main focus will be detecting the health-related issue occurs in the workers body and monitoring all the health related record changing in the workers body. Apart from that we also monitoring the movement of workers.

Related Work:-

The Smart helmet is perfect prototype development for the use of workers those are working on industry. This solution is developed not only monitoring safety but also offer a variety of application. According to the data, the right way to use of helmet can lead a reduced in 69% head injuries and 49% of other injury [4]. The upcoming objective of the proposed device is to improve workers health and safety; workers performance by decreasing the probability of illness in injury and health issue [6]. The structure followed in the implementation of the purpose helmet are steps involved in the prototype development mythology identifying the parameters to be mentioned in the environment [6]. One project called 'IOT based smart helmet' propose for safety which is mentioned accelerometer and gyroscope to detect The Fall of worker which is best for industrial workers. Combination of both sensors can able to detect The Fall of workers [2]. One project referred for workers where project was made for gas workers where gas sensor was used for detect the gas and adoption RF is used for the Signal transferred. This is basically for workers those are working in a coal mine [3]. One project was established for bikers those are not wearing helmet while they are Riding on bike. This project is established with RF transmitter and RF receiver and RF transmitter is placed in the helmet in the bike. Bike will be start wireless RF transmitter transmit the signal to the receiver and receiver received the signal [1]. One project called 'IOT based safety and health material in construction workers' referred for smart helmet where he used HP sensor, GSM modem, IR sensor, power supply and IOT modem for the monitoring the health condition of the workers and transfer to the higher authority [5]. Recently one project on smart helmet done which is basically made for accident Prevention where GPS sensor and speed indicator is used in project [4]. One project proposed for miners where temperature sensor and accelerometer used. The data collected from temperature sensor and accelerometer is processed by main processor then that data is transferred to the Wi-Fi module and that Wi-Fi module transfer to the data to main authority [7]. A very famous paper published where he introduces smart helmet for mining workers. On that project is about micro-controller called ARM-11 is used. Every component like power supply, IR sensor, gas sensor, LED display, voice IC and speaker is connected to the micro-controller. Micro-controller process theory information and show the reading on LED display [8]. One project is introduced earlier where that helmet called smart helmet and it is basically used for detection the alcohol consumption. This project is iot based project where one alcohol detection sensor called MQ-3 is used [9]. We want know their head gesture and brain activity might be the cause of accident. To solve that accident, one project is proposed where they using IMU and EEG sensor for worker fatigue detection. IMU stands for internal measurement you need which is used to measure body's specific force, angular rate and orientation. EEG sensor is basically used for detect the wave coming from the brain. it is actually attached in the top of the head [10].

Proposed work:-

Here we are working on a smart helmet which is capable to gather the information from the worker body such as temperature, heart pulse. We have to ensure that all information should be collected correctly and transfer to the higher authority. So, that we mentioned some component below –

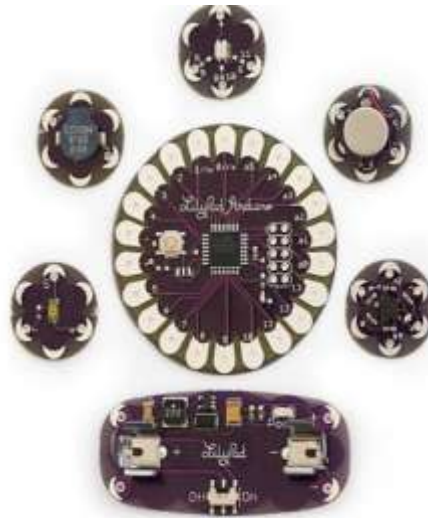
COMPONENTS USED :-

- 1) Lily Pad Arduino
- 2) Body Temperature Sensor
- 3) Heart Rate Sensor
- 4) Esp8266 Wi-Fi Module

- 1) **Lily Pad:-**The Lily Pad Arduino is a microcontroller board designed for wearables and e-textiles. It can be sewn to fabric and similarly mounted power supplies, sensors and actuators with conductive thread. Each and every lily pad has a huge conductivity sew tabs for easy sewing and round shape. Every Lily Pad has three basic parts. That's are

- Conductive path between all components
- the Lily pad pieces

Fig. 1. Lily Pad



- Power source

- **power source-**

almost every power source of lily pad is operated with 3 volt coin cell battery 3.7 volt Lithium polymer rechargeable battery. The need of lily pad power source is depend upon the size of the project and the types of lily pad Arduino. It will defined that rechargeable battery is required for only normal battery is required.

- **Conductive path between all components-**

it is better to use conductive thread instant of copper wiring to connect clip Lily Pad pieces together. Lily pad conductive thread is comparatively soft and flexible as compared to Copper thread those are used earlier.

- **Lily pad pieces-**

Lily pad pieces are available in variety of colour and specifications. Which lily pad space is required in the project is basically depend upon the need of project and it varies person to person. Varieties of products like button, switches, sensors, buzzers and arduino Controller board are easily available in market. The type of lily pad project is divided into three categories. That is e-sewing, pre-programmed and programmed with Arduino.

2) **Body temperature sensor(MLX90614) :-**

This is a sensor which is used for detect the body temperature correctly. This sensor plays a great role in this project. It is actually a non contact temperature sensing component. It has internal 17 bit ADC and powerful high-efficiency DSP contribute to the MLX90614 very good accuracy and resolution.

Features-

- factory calibrated
- temperature sensing range is - 40°C to +85°C
- Object temperature sensing range is - 70°C to +380°C
- SMBus compatible with digital interfaces
- Customisable pwm output
- High Accuracy
- 4.5V~5V power supply
- 0.02°C measurement resolution



Fig. 2. Heat sensor

3) HEART RATE/PULSE RATE SENSOR:-

It is used to detect the heart rate or pulse rate. It is working on IR Technology. It is actually a plug-and-play heart rate sensor for Arduino. It has a simple optical heart rate sensor with amplifier in noise cancellation Technology.

Fig. 3. Pulse sensor



Features-

- Easily able to attached with arduino
- Comes with plug and play Technology
- operated with 3V-5V supply
- instant and accurate output
- no soldering required

4) ESP8266 Wi-Fi Module:-

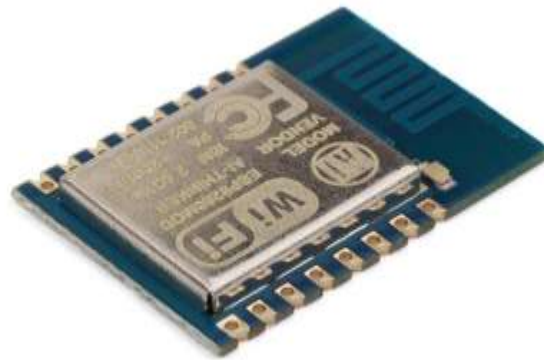
The ESP8266 is a low-cost Wi-Fi microchip. It has wide application in IoT. It is used to send the data to the cloud. It allows microcontroller to connect with wi-fi to build up a TCP/ IP connection.

Features-

- It has L106 32bit microprocessor core which is based on Tensilica Xtensa Diamond which is running at 80 MHz speed.
- It has 32 Kb instruction RAM.
- It has 80 KB user data RAM

- it also has 16 Kb ETS system data RAM
- it has 16 GPIO pins.

Fig. 4. Wifi module



- it is extremely power efficient and flexible

Here human body sensor will sense the body temperature, heartbeat, and presence of human body and then this whole information will be sent to the main board(Lily Pad) where it will be processed and sent to the health department or onto mobile application. The health department to know the present health condition of all worker working there through this we can also find there location and if we want to send any information we can easily do it with the help of this device.

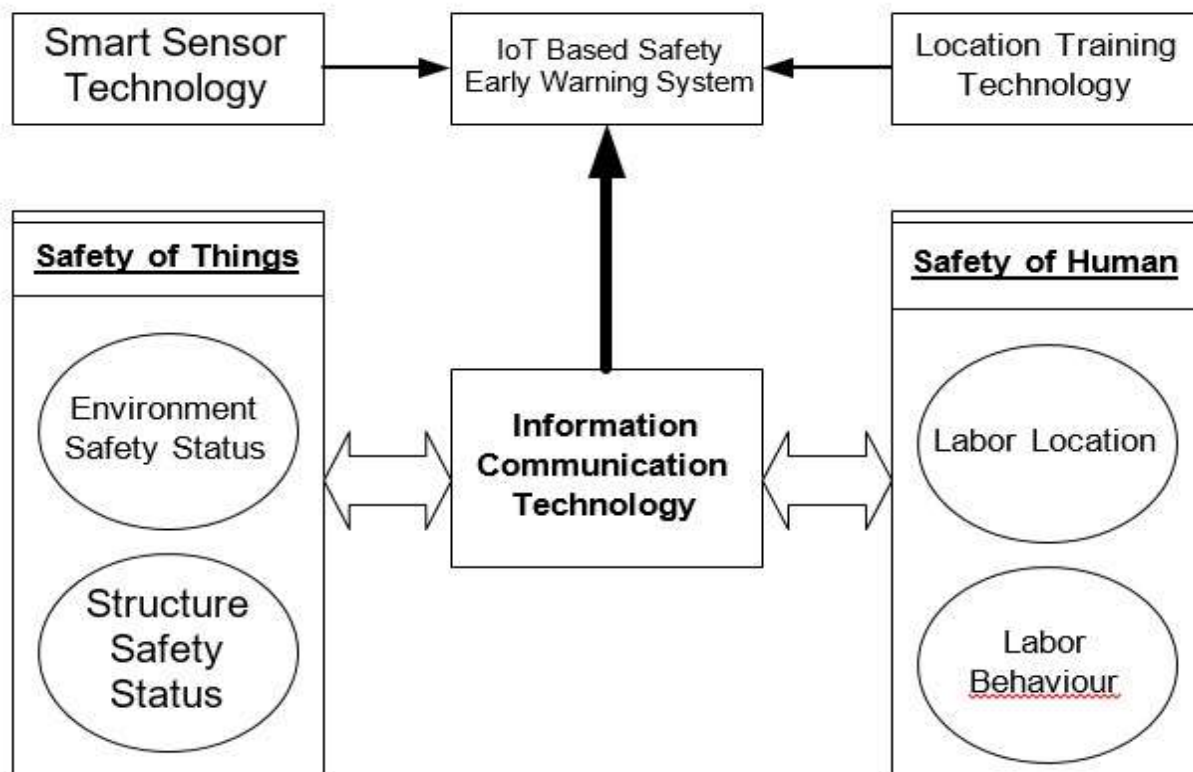


Fig. 5. Block Diagram

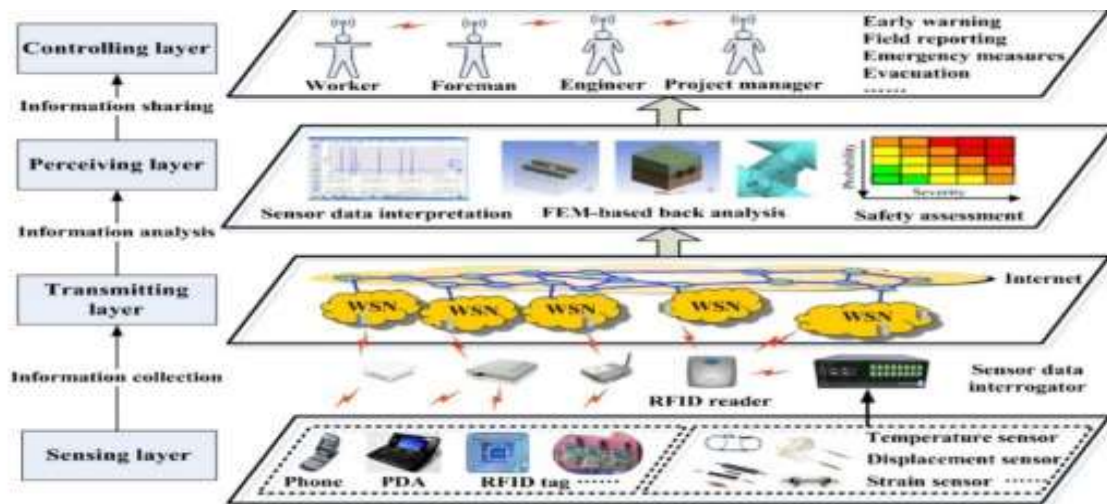
In this block diagram, smart sensing Technology indicate the smart sensor that we using in this project which we already discussed. Smart sensor is like temperatures is a Lily pad and all the elements which is basically used in this project are really very important part for this project. This all sensors will gather all information and transfer to the iot based system that is also Connected with location tracking system well known as GPS system. After gathering all the information, processor will process the information accordingly.

Then Wi-Fi module is used for transferring the signal over Internet. Then all the signal will be transfer to the base station. Then member of authority can check all the data accordingly and track the record of the workers. if they find any kind of problem or admirable things then they take test reaction. Daikin easily track the location of worker by GPS system and follow the movement of workers.

A smart helmet which will include a very smart centre processing units which will command the working of helmet through gathering the information from all the sensor!

Brief description:-

This picture represents a brief introduction of the project work. On the first controlling layer we have seen that workers are working on a field and the sensor is attached on their head. All sensor used in a project will



be attached in helmet itself. The sensor will detect the temperature of the workers body and monitor in every moment of time. Pulse sensor is also implemented in helmet which is attached with the body and always detect the pulse from the workers body and collect all the data.

Fig. 6. Working Procedure

This data inscriptions will be done by the processor and it will be transferred to the main module. Then all data transferred through the internet. There are GPS technology include in it. This GPS technology is used for tracking the location of the workers in construction site. This all data information gathered on a RFID reader which is attached to their office and then they access all the data easily and take the necessary action.

Result Analysis-



Fig .7. Result Graph

We are working in a project where we need to note all the data in every step. Here in this graph clearly mentioned that how heat of that construction area is rapidly changing according to the weather of that environment. In this graph, it is also mentioned that how body temperature is rising according to the heat of that environment. Their pulses are also responding very high and it is rising also. These data are representing that workers are not same in construction area and someone have to monitor their activity in every moment of time. This data is also telling us that smart helmet is very important in this time.

Conclusion-

This research paper is based on Smart helmet technology. This technology is growing rapidly because of its speed of heat sensing technology and high security as compared to another smart helmet technology. The model of smart helmet is all about sensing temperature and pulse and collect all data and transmission, in this communication between two sections is done by Wi-Fi. The concept behind the transmission of data by WiFi because it is easy to implement as compare to other. The application of this smart sensor-based helmet only for workers those are working in a harsh construction area. It will very helpful for workers those are conscious about their health.

References :-

- 1) Nitin Agarwal, Anshul Kumar Singh, Pushpendra Pratap Singh, Rajesh Sahani, "Smart Helmet ", e-ISSN: 2395-0056, p-ISSN: 2395-0072, May-2015.[CrossRef]
- 2) V Jayasree, M Nivetha Kumari, "IOT Based Smart Helmet for Construction workers ", IEEE Access, 1-5, 2020. [CrossRef]
- 3) T. Nithya , M. Mohammed Ezak , K. Ranjit Kumar, V. Vignesh, D. Vimala, "Rescue and Protection system for underground mine workers based on ZIGBEE ", Aspects ISSN: 2349-7688, Vol. 4, Issue 4, Dec 2017, pp. 194-197. [CrossRef]
- 4) Syed Umaid Ahmed, Riaz Uddin, Muhammad Affan, "Intelligent Gadget for accident prevention :Smart Helmet ", Issue: ICCIT-1441, Page No:31-34, 10-09-2020. [CrossRef]
- 5) K. M. Mehata, S. K. Shankar, Karthikeyan N, Nandhinee K, Robin Hedwig P, "IoT Based Safety and Health Monitoring for construction workers ", Technology (IRJET), Dept. Of Electronic and Telecommunications, Volume 05, Issue 03, Mar-2018.[CrossRef]
- 6) Israel Compero-jurado, Sergio Marquez-Sanchez, Juan Quintanar-Gomez, Sara Rodriguez, Juan M. Corchado, " Smart Helmet 5.0 for Industrial Internet of Things Using Artificial intelligence ", Sensors 2020,20,6241;doi:10.3390/s20216241.[CrossRef]

- 7) Mehmet Bozdal, Emrah Irmak, “Smart lifesaving helmet for miners”, 02-2019.[CrossRef]
- 8) G. Ravi Kumar, B. Keerthi Reddy, “ INTERNET OF THINGS BASED AN INTELLIGENT HELMET FOR WIRELESS SENSOR NETWORK “, ISSN:2277-9655, June-2018.[CrossRef]
- 9) K. Maheswari, U. Madhumitha, S. Madhusurya, T. Divya, “Alcohol Consumption Detection Using Smart Helmet System “, Online ISSN: 2394-4099, 27-03-2020.[CrossRef]
- 10) Ping Li, Meziane, Martin J. – D. Otis, Hassan Ezzaidi, Philippe Cardou, “A Smart Safety Helmet using IMU and EEG sensor for worker fatigue detection “. [CrossRef]

