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WORKPLACE SMART KIT USING IOT

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Abstract - Around the world, workplace safety has become a top priority for the organization. In order to maintain a safe workplace, employees are looking for new methods to ensure their remote, frontline, and office employees are safe and healthy. The importance of workplace safety was realized when it was discovered every year that millions of occupational industrial accidents occur that result in loss of production time equivalent to millions of man hours, machine hours, etc. Hence, there is a requirement for workplace safety across all industries today. A new phase in the industrial revolution, Industry4.0 involves intelligent networking of machines and processes with the help of information and technology. The industry 4.0 technology helps you manage and optimize every aspect of your manufacturing and supply chain process. You can access the data and insights you need in real-time to make smarter, faster decisions about your business, which can enhance efficiency and profitability.so our device is to reduce the number of accidents due to health issues of workers in the industry. In our device it has two system,1. Health Monitoring, 2. Location of worker.

***Key Words*:** Safety, Health Monitoring System, Industry 4.0 and IoT.

1.INTRODUCTION

Industrial safety means the management of all operations and procedure in an industry in order to protect employees and assets by minimizing risks, hazards, accidents and near misses. Every year, thousands of industrial accidents cause the realization of industrial safety with technological advancements in manufacturing. The risks to human life are increasing day by day. To avoid accidents, the employee must be aware of industrial safety principles and dangerous areas of the industry. Therefore, industrial safety is necessary for people in their workplace and to protect the environment against damage from industrial accidents. Industrial safety is required to check all the possible chances of an accident to prevent the loss of a worker's life and permanent disability of any industrial employee, and any damage to machines and material. Industrial Revolution is the major changes and transitions in manufacturing and industrial process with new innovative technologies. Today we are in the Fourth Revolution that was triggered by the concept of cyber-physical systems. It connects real world with the virtual digital world. Industry4.0 is a new phase in the industrial revolution that introduce intelligent networking of machines and processes for an industry with the help of information and technology. Industry 4.0 focuses on technologies that have a great impact on safety management. The Internet of things (IoT) is a network of a physical body that is embedded with sensors and other digital technologies to share data with other devices over the Internet. The innovation of IoT has brought workplace safety to another new level. The main strength of the IoT concept is the big impact it will have on various aspects of everyday life and the behavior of potential users. As one of the most advanced tools available for improving safety in a company's working environment, the internet of things has helped companies worldwide improve working conditions, collect data, streamline operations and increase productivity.

In a survey, the Indian Institute of Technology (IIT) reported that about 48000 workers die every year due to worker health issues that occur in their workplace, approximately equal to 38 workers each day. In the workplace, safety equipment should be in the right place. Otherwise, more accidents will happen. Keeping the working environment as safe as possible is the number one priority for any organization. There is no product available to monitor industrial worker health. We have designed a handy IOT based kit for worker safety that is portable. If an accident on the workplace site causes a worker's health issue, this kit will be instrumental in the rescue process. The main objective of our project is to reduce the number of accidents due to health issues of workers in the industry. Enhancing the workability of employees by ensuring a safe and congenial work environment. Achieve higher productivity among the employees by providing a safe and secure environment.

2. LITERATURE SURVEY

Some reviews were done before as a part of research papers on IOT based workplace safety.

[1] K. Divya and its teammate (2017)_proposed a "Smart Helmet for Improving Safety in Mining Industry" system. In the event of poisonous gas detection, the helmet opens a valve, providing oxygen when necessary to avoid inhaling poisonous gases. But the helmet is too heavy because it contains oxygen cylinders that are uncomfortable to handle.

[2] Tran Tri, Dang, Hai Truong, and Tran Khanh Dang (2016) _ have developed Automatic Fall Detection using

Smartphone Acceleration Sensor. As described in this paper, they have proposed a technique for automatic fall detection by utilizing smartphone accelerometer data. The method comprises two algorithms: fall detection and long lie detection.

[3] K. M. Mehata, S. K. Shankar, N. Karthikeyan, K. Nandhinee and P. R. Hedwig (2019) _ have designed IoT Based Safety and Health Monitoring for Construction Workers. In this project, they will create smart wearable devices such as a band and helmet that will be used to monitor the health and safety of workers. These wearable devices will use IoT to detect the fall of workers and issue an SMS notification to alert the supervisor.

[4] Ravi Gorli (2018)_invented a new approach for employee safety in industries with IoT. In this paper, the safety in industries will be considered with two perspective models: Employee Health Monitoring (EHM) and Safety Automation Model (SAM). In EHM, the safety measures that should be taken by the employee are presented with smart sensors that connect to Wireless Body Area Network (WBAN). Therefore, it is useful for the employee to track the health of their employees on time, and in SAM, the safety measures in industries are proposed with third party equipment, which places the sensors in the factory surveillance to track the real-time information so that mmediate countermeasures can be taken.

[5] Anil Kadu, Manasi Gajare, Pritesh Chaudhari (2021) _ IOT based health monitoring system. The system monitored oxygen saturation and body pulse rate using sensors, which are also displayed on LCD. These sensor data are then sent to the app. By entering output values on the website, we can predict heart disease. The system is getting only two parameters as input.

[8] David E. Cantor (2008) _Workplace Safety in the Supply Chain, analysed the literature and called for further research into the human, operational, and regulatory factors involved in workplace safety in the supply chain. This paper identifies several potential research opportunities that can increase awareness of the importance of improving a firm's workplace safety practices. In this paper, we identify 14 future areas of research in the area of supply chain workplace safety, which will be useful for practitioners who are faced with safety concerns.

3. METHODOLOGY

The main objective of our project is to reduced number of accidents due to the health issues of workers in industry. In our project there are two systems 1. Health Monitoring System (On Hand). 2. Location and Position of Worker (Entrance to the Room). Our proposed system is a small kit which comprises of the following components ESP8266, RFID reader, RFID card and tag, LI ion battery 3.5 V, OLED, Accelerometer, DS18B20 (temperature sensor), Pulse sensor, Bread board, Jumper wires and Adafruit is used as the cloud platform. There are five different modules present in our model are 1. Fall Detection Module 2. Temperature Sensing Module 3. Location Sensing Module 4. Heart Rate Detection Module.

ESP8266 Board (Wi-Fi module)

The Wi-Fi module, also known as the serial to WIFI module, belongs to the transmission layer of IoT. The function is to convert the serial port or TTL level into an embedded module that can conform to Wi-Fi wireless network communication standard, with built-in wireless network protocol IEEE802. An ESP8266 Wi-Fi module is a SOC microchip mainly used for the development of end-point IoT uses. It is referred to as a standalone wireless transceiver, and this is a very affordable option. It is used to enable the network connection to different applications of embedded systems.

Figure 1 ESP8266 [16] (Wi-Fi module)

Pulse Oximeter and Heart rate sensor (MAX30100)

The MAX30100 is a modern, integrated pulse oximeter and heart rate sensor IC from Analog Devices. MAX30100 has two LEDs – a RED and an IR LED and one photodetector. The MAX30100 works by shining both lights onto the finger or earlobe (or essentially anywhere where the skin isn't too thick, so both lights can easily penetrate the tissue) and measuring the amount of reflected light using a photodetector. This sensor is used to find out the heart rate and oxygen level of the user (worker), so it will be useful in finding whether the worker is healthy or not.

Figure 2 MAX30100 (Pulse Oximeter and Heart rate sensor) [14]

Accelerometer (MPU6050)

This module consists of a tiny self-assembled sensor unit which is used to calculate the angular velocity of an object and the human body's acceleration. The MPU6050 is a Micro-Electro-Mechanical Systems (MEMS). It contains a 3-axis Gyroscope and a 3-axis accelerometer inside it. This assists in calculating acceleration, velocity, orientation, displacement and many other motion allied parameters of a system or object.

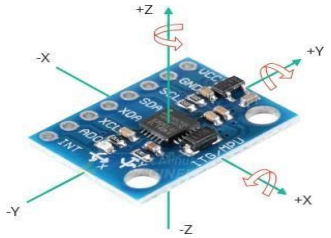


Figure 3 Accelerometer (MPU6050) [13]

OLED Driver (SSD1306)

At the heart of the module is a powerful single-chip CMOS OLED driver controller – SSD1306. It can communicate with the microcontroller in many ways, including I2C and SPI. The SSD1306 is a 128*64 dot single chip driver with a controller that's used for a graphic display system. It's commonly integrated into OLED display modules like the one seen above for Arduino, Raspberry Pi, or other microcontroller usages.

Figure 4 OLED Driver (SSD1306) [16]

Temperature Sensor (DS18B20)

DS18B20 is 1One of the easiest and most inexpensive ways to add temperature sensing to the Arduino project is to use the DS18B20 1-Wire Temperature Sensor. These sensors are fairly precise and need no external components to work. One of the easiest and most inexpensive ways to add temperature sensing to the Arduino project is to use the DS18B20 1-Wire Temperature Sensor. These sensors are fairly precise and need no external components to work.

Figure 5 Temperature Sensor (DS18B20) [13]

RFID System

Radio Frequency Identification (RFID) refers to a wireless system comprised of two components that are tags and readers. It consists of one or more antennas that emit radio waves and receive signals back from RFID tags. RFID tags are a type of search system that uses radio frequency to search, identify, track, and communicate with items and people.

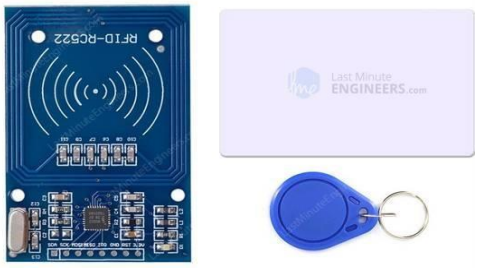


Figure 6 RFID System [19]

Adafruit Software [9]

Adafruit IO is a cloud service that is available on the internet and that allows us to connect our devices, such as Arduino boards, to it. Its main function is to store data acquired by one or more boards connected to sensors, to show them both in real time and in the future, but it can also perform other interesting functions. A dashboard (control panel) can be used to view live data in real time online using graphs and squares.

Health Monitoring System (On Hand)

We have implemented a smart kit that includes many sensors for detection and analysis. This device detects various parameters in the worker's body. A sensor detects the data from the person who wears a kit and sends it to an ESP8266 Wi-Fi module. The Wi-Fi module transmits that data to Adafruit's IoT cloud platform for storing.

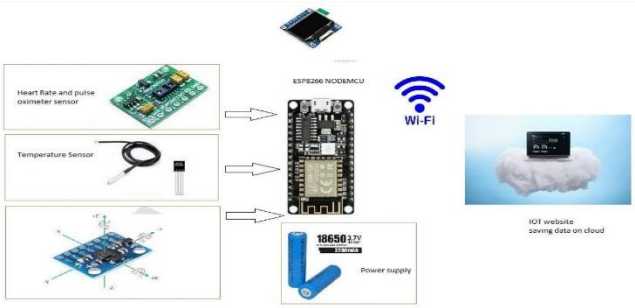


Figure 7 Health Monitoring System

Location of Workers - RFID System (Entrance of the Door)

This is 2nd system for use to find out the location and position of workers. This system has ESP8266 Wi-Fi module, one RFID card/tag, and RFID Reader. Every user will have these RFID tags. This card has a unique address or unique number written in the memory of a card. So, when the worker moves the card closer to the RFID reader, the reader will read it and send the data to the ESP8266 board. This board will compare the

database with the reading id, and it will give the worker's location on a serial monitor displayed on the supervisor's laptop.

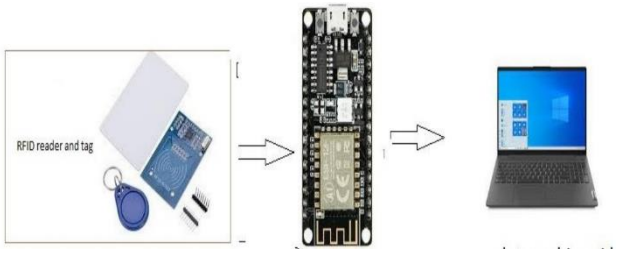


Figure 8 Location of Workers (RFID System) [19]

Circuit Diagram Health Monitoring System

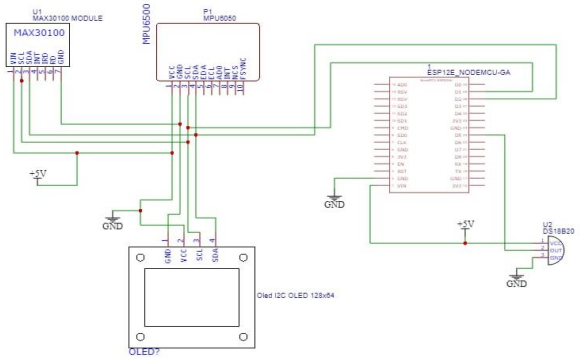


Figure 9 Circuit Diagram of Health Monitoring System

Connections
1)MAX30100 to ESP8266
VCC to 3.3V
SCL to 3PI05
SDA to GPI04
GND to GND

2)MPU6050 to ESP8266
VCC to 5V
SCL to GPI05
SDA to GPI04
GND to GND

3)DS18B20 to ESP8266
VCC to 3.3V
DQ to GPI14
GND to GND

4)OLED to ESP8266 and MAX30100, MPU6050, DS18B20
VCC to 5V
SCL to SCL of MAX30100, MPU6050, DS18B20
SDA to SCA OF MAX30100, MPU6050, DS18B20
GND to GND

Circuit Diagram Location of Workers (RFID System)

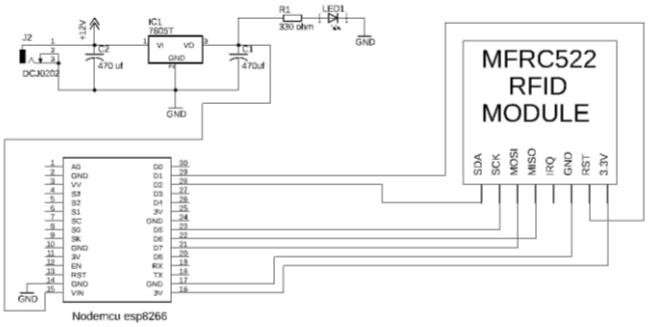


Figure 10 Circuit Diagram Location of Workers (RFID System)

Connections
MFRC522 module to RFID ESP8266
VCC to 3.3V
GND to GND
RST to RST
MISO to SDDO
SCK to SDCLK
CS to SDCMD

Assembly Images

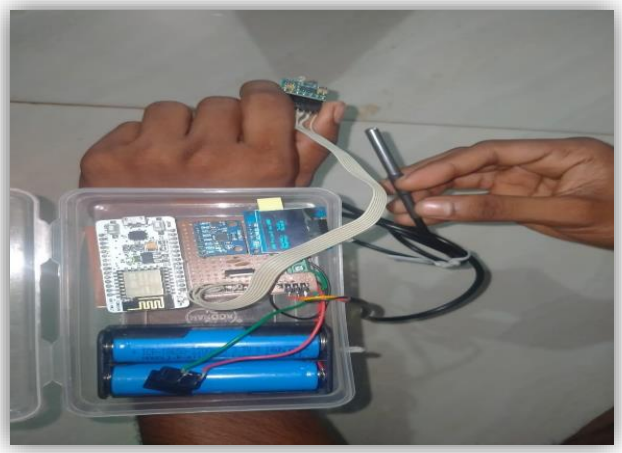


Figure 10 System 1

Figure 11 System 2

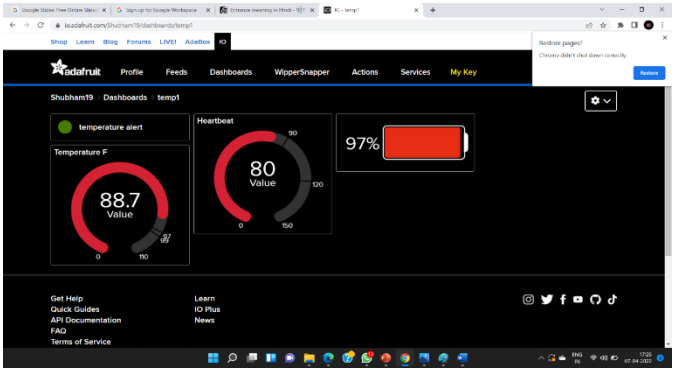
RESULT AND DISCUSSION

As a result, it is a device in which the industrial workers can easily wear it while doing their job. The sensor they are falling down, their heart rate, the amount of oxygen in their blood and their body temperature, and then sends the information to the building supervisor's system.

The sensor output values are calculated and displayed on an OLED screen, so that the worker can see the values. The overall data stored in an Adafruit cloud website. Sensor readings will be stored on this website for 28 days. The data is presented both in table format and graphically. This can improve workplace safety and prioritize of workers.

The following table shows the readings obtained from sensors attached to workers' bodies.

Output Image of Readings



CONCLUSION

The outcome of this project is a system that workers can easily wear in their hands while doing their jobs. This device finds out if the person is standing straight or if he has fallen down, the amount of oxygen level in their blood, their body temperature and the status of their body's temperature, their heartbeat rate and the status of their heartbeat, their location, and sends the result to the supervisor's system. In an accidental situation, the device will act as a rescue system.

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REFERENCES

[1] Mrs. A. Dhanalakshmi, P. Lathapriya, K. Divya (2015) have developed A smart helmet for improving safety in mining industry.
[2] Tran Tri, Dang, Hai Truong, Tran Khanh Dang (2016) have developed Automatic Fall Detection using Smartphone Acceleration Sensor
[3] K. M. Mehata, S. K. Shankar, N. Karthikeyan, K. Nandhinee and P. R. Hedwig (2019) _have designed IoT Based Safety and Health Monitoring for Construction Workers.
[4] Ravi Gorli (2018) _invented a new approach for employee safety in industries with IoT.
[5] Adlian Jefiza, Eko Pramunanto, Hanny Boedinoegroho, Mauridhy Heri Purnomo have designed Fall Detection Based on Accelerometer and Gyroscope using Back Propagation.
[6] Anil Kadu, Manasi Gajare, Pritesh Chaudhari, Payal Deshmukh (2021) have developed IOT based health monitoring system
[7] S. R. Deokar, V.M. Kulkarni, J. S. Wakode (2017) have designed Smart Helmet for Coal Mines Safety Monitoring and Alerting.
[8] David E. Cantor (2008) _Workplace safety in the supply chain.
[9] https://io.adafruit.com/
[10] Having the latest Arduino IDE software installed from arduino.cc/en/Main/Software
[11] Installing ESP8266 Board in Arduino IDE https://randomnerdtutorials.com/how-to-install-esp8266-board-arduino-ide/
[12] https://www.maximintegrated.com/en/products/sensors/MAX30100.html
[13] https://lastminuteengineers.com/max30100-pulse-oximeter-heart-rate-sensor-arduino-tutorial/
[14] https://lastminuteengineers.com/mpu6050-accel-gyro-arduino-tutorial/
[15] https://datasheets.maximintegrated.com/en/ds/DS18B20.pdf
[16] https://lastminuteengineers.com/ds18b20-arduino-tutorial/
[17] https://randomnerdtutorials.com/esp8266-0-96-inch-oled-display-with-arduino-ide/
[18] https://lastminuteengineers.com/oled-display-esp8266-tutorial/
[19] https://lastminuteengineers.com/how-rfid-works-rc522-arduino-tutorial/
[20] https://www.espressif.com/en/products/socs/esp8266