



## IoT Based Smart Kit For Coal Miners Safety Purpose

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### ABSTRACT

Keeping this mindset and imagine social problems in Pakistan and other countries; it is perceive that each year several people die working inside coal mines and industries. By recognize this problem, this paper suggests a wearable smart kit design for securing the life of labours in Pakistan. This Prototype senses the various health related parameters that's the presence of hazardous gas, heart beats of Labour, LDR function, and presence of fire, pulse rate of labours, updated temperature/humidity, location & global positioning of miner. These all parameters will be then transmitted through a Wi-Fi to a dynamic internet protocol. In this way, one may monitor all labors working inside the mines and moreover in case of disaster the life of miner can be secured immediately. This proposed wearable embedded system will not only send the last GPS location to a specific IP but will also send continuous update of pulse rate of miner which is sensed by pulse sensor; to base camp hence if someone dig the coal mine in case of disaster, they may set the priority to retain maximum life back from a coal mine.

**Key words :** Internet of Things, Sensor, GPS, Raspberry Pi

### 1. INTRODUCTION

In the present period where wellbeing and security is the top most need in different basic procedures also in coal Businesses the individuals guarantee something very similar. While contemplating. The most recent certainties it has been accounted for around one occurrence by Global Alliance in Support of Workers in Iran. This Episode held inside sanjdi coal mineshaft close Quetta, Baluchistan in which 6 individuals kicked the bucket because of harmful gases. The Industrial Global Union alongside Pakistan Central Mines Labor Federation is particularly cognizant about this issue but then this issue is unsolved with any ideal arrangement. The proposed framework can never be executed inside coal mine however whenever oversaw on a remote sensor system and after that sent to a specific powerful IP the great many lives which are squandered inside a few neighborhood coal mineshafts can be spared at Correct time. Besides, the quantity of effective sensors proposed in this paper make this arrangement one of its sorts. There are a few different ways out which can be executed on same issue and different are executed beforehand too yet, they have one significant issue of observing when the coal mine has been crumpled because of any explanation. In such situation the catastrophe the

executive's authority start burrowing the total site which is tedious. It happens more often than not at the point when salvage group can't spare most extreme lives in light of the fact that the lives who have legitimate heartbeat rate can't be found appropriately. Before designing of an automation system for parameterizations of the parameters that are related to the miner who is working in local mines of the Pakistan. It was very important to know about the previous proposed systems being proposed in past era for same issue and do comparative analysis. There are number of manuscripts available for describing the same automation systems by which one can observe an accurate and exact situation awareness along with alarming mechanism for rescue teams. Computing aid is added for rapid support from data acquisition system. This strategy will not only increase the computational capacity for communicating desired information but it will also provide an easiest way to perform useful tasks that reduces the less interaction with computers [1]. In some of literature, the usage of audio communication is also proposed but this may create an overload and a confusion for rescuers as this system design is proposed to provide an easy way out for rescuers to set a priority to dig at particular places where one may find maximum chances to retain the live of a miner [2]. Moreover, there are several systems, which are easy to carry, and wearable i.e. a wrist band using Arduino Platform for the rescuer [3]. These solutions are majority proposed in underground workplaces where Labour is engaged for clearing drain line or mines [4]. In proposed papers regarding automation systems which will not only detect the parameters that can create hazardous situation in predefined range but also recognize it [5]. The main issue for establishing such kind of underground monitoring system is to have a communication alive and in this regard effective system is required that can plan via Internet protocol or receiver/transmitter antenna loops.[6]. Several proposed systems are planned under the umbrella of Digital Communication and are based on IEEE 802.15.4 standard which describes the operation of low range wireless area network.[7]. One more IoT-based protection device [8], was suggested with the support of GPS. The object's meticulous site is probable to be revealed, and signals will be sent to the interactions for help as soon as possible.

In this paper, a wearable smart kit designed for securing the life of labours in Pakistan.

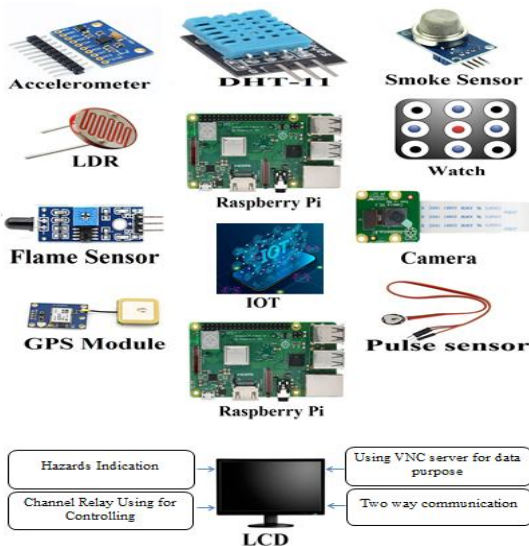
Section 2 discusses the methodology, Section 3 provides results and discussions and finally conclusion is given.

## 2. METHODOLOGY

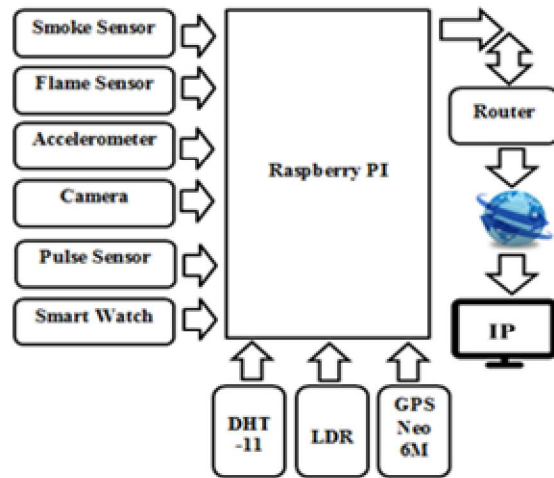
In this paper, the focus of applied methodology is to discuss the suggested components that are gathered for shaping of a Prototype product that carry wearable jacket design for securing the life of coal miners and Labour that perform their working in underground workplace. The components are mentioned as below:

1. DHT11 Temperature and Humidity Sensor
2. Pulse Sensor
3. Gas Detecting Sensor
4. GPS Module
5. Raspberry Pi
6. LDR
7. Accelerometer
8. Flame Sensor
9. Smoke Sensor
10. Push Button
11. Watch
12. Camera

Discussing from the Light Dependent Resistor which is utilized as a Dark Sensing element. For computational measures related to temperature and humidity prototype system is incorporated with DHT 11, Gas sensor for encounter the hazardous gas leakage, GPS module for calculating the location of miner or Labour, pulse sensor is utilized for updating regarding pulses of Labour or miner for immediate action and accelerometer is utilized for checking the movement and vibration of body. VNC server is utilized for communicating the sensors' readings with receiving end for immediate action to secure Labour/miners.



**Figure 1.** Hardware components



**Figure 2.** Block diagram of smart kitt using Raspberry technology

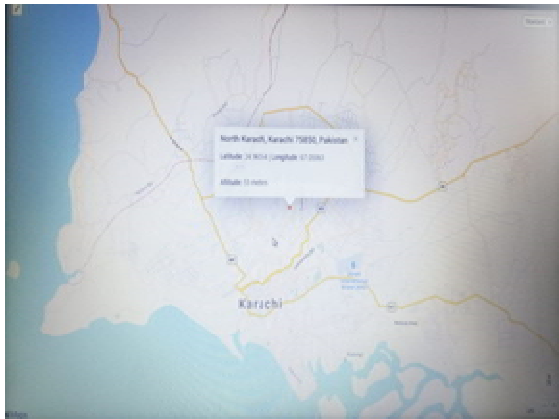
At first stage the whole prototype project was initiated on a simple acrylic sheet and in second phase fixed in a jacket as shown in fig. This mentioned prototype system will be fixed in any jacket depending on the temperature conditions inside coal mines. If the temperature is hot than the jacket would be thin so that labour/miner may carry it while working inside the underground workplaces. Similarly, If the condition is cold then jacket will be used a per cold situation.



**Figure 3.** IoT based Smart Kit for Coal Miners

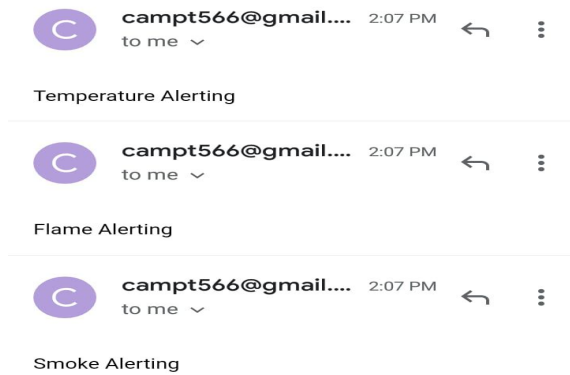
### 3. RESULTS AND DISCUSSIONS

The results have been concluded by hanging the jacket into a rope from a height of building to downstairs in order to check the effective parameterizations of parameters. For checking the calibration of pulse sensor simply one may place his/her finger on sensor and sensor will show pulse rate against this action. GPS module will give the exact location during testing. GPS module will also show variations in magnitude for ensuring its effective functionality. For cross verify the reading of GPS Google mapping service is available that can countersigned the values of GPS and also pin location.



**Figure 4.** GPS Google mapping service

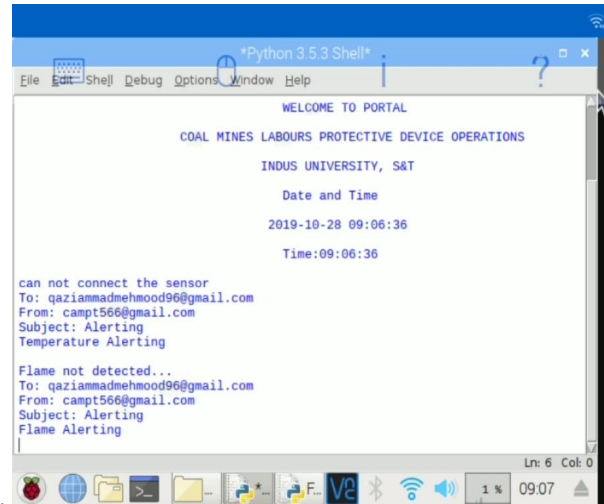
Gas sensor is engaged to indicate the diffusion of hazardous gas that can create life threat for those who are working in underground workplaces. Gas sensor have two states when any gas is diffused for testing Gas sensor it will generate output that can show indication via buzzer or indicator that is associated with circuit. Multiple sensors of prototype system are engaged to shape the actual situation of underground workplace for the facilitation of Labour and Rescue team.



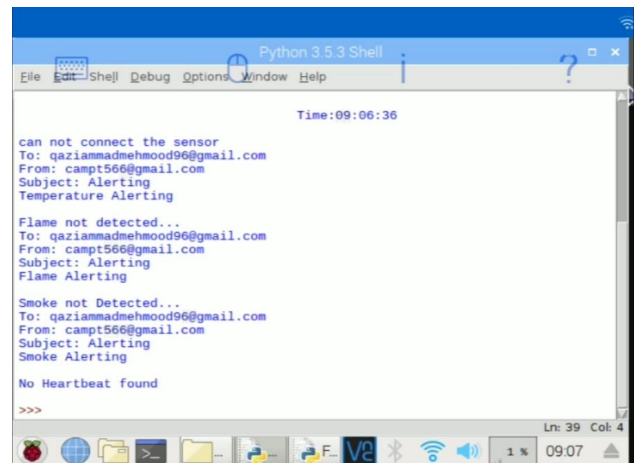
**Figure 5.** Reading alert informed via email

This system is recently tested at Indus University Karachi where a group of students carried this jacket and check the

integrity of this prototype system at the various points to check its efficiency level. The readings that are capture during test mentioned in below figures:



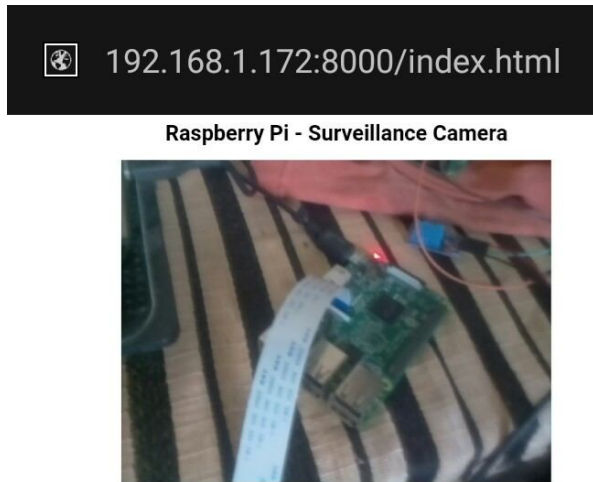
**Figure 6.** Portal of coal mine labours protective device operation



**Figure 7.** Reading alert situation on portal



**Figure 8.** Laptop connected with smart kit



**Figure 9.** Raspberry Pi controller

#### 4. CONCLUSION

When working in mines specially in coal there are lot of factors that create disturbance for human health, these effects carry leakage of gas, temperature situation, humidity problem and pulse rate etc. Number of accidents have been reported in such kind of job. Rescue teams are involved to carry out solutions for recovering the affected person from the accidental site via investment of lot of money and time. To overcome this issue ,a prototype system has been established which is not only engage for facilitating exact location but will also monitor pulse rate in continuation with best priority if required. In this proposed paper, a brief and solution finder comparison has been planned among other techniques utilized for monitoring any uncertain incident and recuing the in coal miners or Labour that are engaged in working inside the confined spaces. Hence proposed system is designed for coal miners or Labour for providing the essential or desired parameters regarding health status. In additional statement the proposed

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