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Smart Jacket for Industrial Employee Health and Safety

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ABSTRACT

In contribution with Industrial safety and Employee health at work place a new costume which is equipped with the advanced technologies such as Internet of Things (IoT) and Wireless Body Area Network (WBAN) is proposed and framed as "Smart jacket". A Smart Jacket is a connectivity of smart sensors which will monitor the employee health and also provide precautionary measures for their safety at work from the Industrial hazards. The WBAN provides mechanisms for monitoring the health condition of the employee with a small device connected with sensors such as ECG, EEG, EMG, Pulse sensor and Respiration sensor. The safety precautions sensors as are also connected with the jacket for tracing the hazards that cause in the workplace due to Heavy machinery, harmful smoke or Gases. The monitoring will be done with a mobile device connected to the sensors with low power Bluetooth which will connect to the central Monitoring using the Bluetooth, Wi-Fi and ZigBee network.

Keywords: IIoT, ZigBee, WBN, Smart Jacket, Sensors

I. INTRODUCTION

The Industrial growth is increasing with the needs for the society. In this competition of production a huge number of industries are facing problems with employee health and safety. As many of the workers are losing their life at workplace, due to unawareness of their health conditions and also due industrial hazards and accidents. Industrial workers are the key parts for running the industries, so their health and safety should be considered by any organization. As contribution to the industrial employee health and safety with emerging technologies such as Wireless Body Area Networks and Internet of Things a new concept is proposed with invention of Smart Jackets into the industries. A Smart Jacket is implemented with connected sensors for reading the employee health. As technology is improving in industries with the fourth revolution with IIoT (Industrial Internet of Things). Where the worker is in a connected network while wearing this Smart Jacket. As the Smart Jacket is equipped with different sensors such as ECG, EEG, EMG, Pulse sensor and Respiration sensor using the WBAN- Wireless Body Area Networks, which will monitor the Health conditions of the Employee from time and time and report to the Central server through the wireless connected networks such as Bluetooth, Wi-Fi and ZigBee. So using this information the managing team of the Industry will be aware of the Health Condition of the Employee and certain immediate measures are taken if any Worker is affected with any Health issue. The Health of the workers for every second is monitored without any interruption to them. Along with the WBAN network sensors, For the Prevention of any Accident from the workplace different safety precaution sensors such as Ultrasonic, IR, Smoke, and Gas sensors, Proximity sensors are also attached with the Smart Jacket in such a way that if any of the worker is about to be affected with any of the Hazard the will sense beforehand and the several immediate measures are taken as of giving an alert to the worker so that he will be aware of it and will be saved from the hazardous situations before they leads to the accidents. The complete proposal of the model for Smart Jacket is given in brief in the Methodology.

II. METHODS AND MATERIAL

A Smart Jacket is Equipped with different internal sensors and external sensors which will sense the input by using the designed working approach of the sensor and the information from all these sensors is transferred using a connectivity such as Bluetooth to the Gateway such as the user mobile and then the data is transferred

to the central servers which are monitored from time to time and take immediate actions responding to the signals received by the sensors. The brief architecture is shown the figure 1. The figure shows the connections of the Smart jacket, smart mobile and the supervisor.

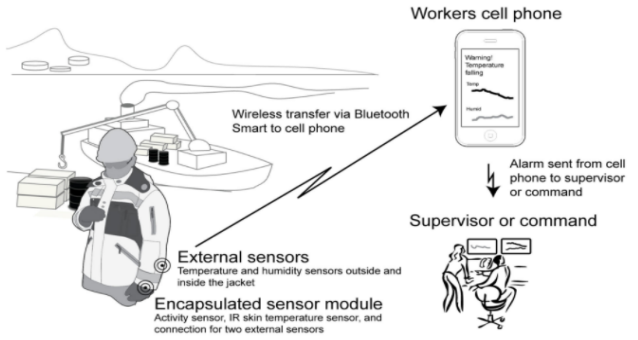

Figure 1: Working Principal of Smart Jacket

Internal Sensors are the sensors which are equipped inside the Jacket which are connected to the human body for sensing the human health conditions from time to time and forwarding the monitoring unit. The different internal sensors are ECG: An electrocardiogram (ECG or EKG) is a recording of the electrical activity of the heart over time produced by an electrocardiograph, usually in a noninvasive recording via skin electrodes. In the US, the abbreviation "EKG", (abbreviated from the German Electrocardiogram) is often preferred over "ECG", while "ECG" is used universally in the UK and many other countries. It is preferred as "EKG" in the US and most of the former USSR countries because doctor's handwriting of "ECG" can often be confused as "EEG" when transcribing orders or with echocardiography which is also abbreviated "ECG"[5]. Electrical impulses in the heart originate in the Sino atrial node and travel through the heart muscle where they impart electrical initiation of systole or contraction of the heart. The electrical waves can be measured at selectively placed electrodes (electrical contacts) on the skin. Electrodes on different sides of the heart measure the activity of different parts of the heart muscle. An EKG displays the voltage between pairs of these electrodes. EEG: Electroencephalography (EEG) is an electrophysiological monitoring method to record electrical activity of the brain. It is typically noninvasive, with the electrodes placed along the scalp, although invasive electrodes are sometimes used such as in electrocorticography. EEG measures voltage fluctuations resulting from ionic current within the neurons of the brain. [5] In clinical contexts, EEG refers to the recording of the brain's spontaneous electrical activity over a period of time, as recorded from multiple electrodes placed on the scalp. Diagnostic applications generally focus either on event-related potentials or on the spectral content of EEG. The former investigates potential fluctuations time locked to an event like stimulus onset or button press. The latter analyses the type of neural oscillations (popularly called "brain waves") that can be observed in EEG signals in the frequency domain.

Pulse Rate Sensor: This pulse sensor fits over a fingertip and uses the amount of infrared light reflected by the blood circulating inside to do just that. When the heart pumps, blood pressure rises sharply, and so does the amount of infrared light from the emitter that gets reflected back to detector.

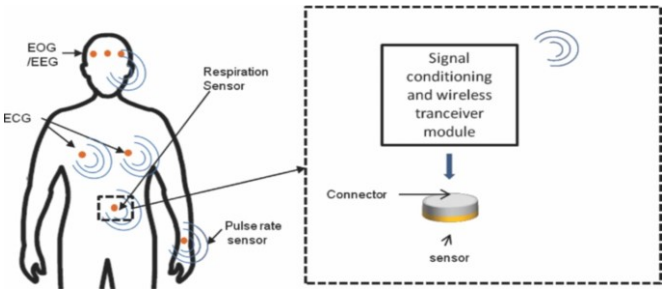

Figure 2: Working principal of Internal sensors

External sensors are the sensors which are connected outside the Smart Jacket. Sensors such as Ultrasonic, IR, Smoke, and Gas sensors, Proximity are used used for the indentifation of the hazards before hand. An Ultrasonic sensor is a device that can measure the distance to an object by using sound waves. It measures distance by sending out a sound wave at a specific frequency and listening for that sound wave to bounce back. By recording the elapsed time between the sound wave being generated and the sound wave bouncing back, it is possible to calculate the distance between the sonar sensor and the object. Using ultrasonic sensors the employee can be aware of any hazardous machine or any vehicle to him, it will sense the distances from time to time and alert to the worker. A smoke detector is a device that senses smoke, typically as an indicator of fire. Commercial security devices issue a signal to a fire alarm control panel as part of a fire alarm system, while household smoke detectors, also known as smoke alarms, generally issue a local audible or visual alarm from the detector itself. A gas detector is a device that detects the presence of gases in an area, often as part of a safety system. This type of equipment is used to detect a gas leak or other emissions and can interface

with a control system so a process can be automatically shut down. A gas detector can sound an alarm to operators in the area where the leak is occurring, giving them the opportunity to leave. A proximity sensor often emits an electromagnetic field or a beam of electromagnetic radiation (infrared, for instance), and looks for changes in the field or return signal. The object being sensed is often referred to as the proximity sensor's target. Different proximity sensor targets demand different sensors.

By using all the sensors connected to the Smart Jacket the hazardous information is traced from time to time and immediate measures are taken. As the sensors sense the information in a lively manner many workers can be saved from fatalities and injuries or any effect due to their health issue can also be traced and maximum precautions are taken on hand.

III. CONCLUSION

In Contribution to the Safety of workers in industries a smart jacket is proposed which may be useful for the workers for saving their health form any disorders and also they will be aware of the Hazardous situations. If the model of Smart Jacket is implemented in reality it will be more useful for the industrial safety.

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