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Iot Based Smart Safety Jacket

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Abstract
Workers face hazard risks in industrial and outdoor workplaces from toxic gases and extreme temperatures. The work environments create numerous conditions which lead to many preventable injuries and fatal events. The solution to this problem utilizes an IoT-based Smart Safety Jacket. Safety tracking for workers is carried out through a system that combines environmental sensing devices with physiological sensors and a wireless communication system. A microcontroller unit handles real-time data processing and then sends the information to an IoT-based system for centralized monitoring. The system automatically produces alerts whenever it identifies abnormal system operation. This affordable mobile safety system improves occupational safety because it facilitates quick reactions and allows for remote oversight
Keywords: *IoT, Smart Safety Jacket, Blynk, Temperature Sensor, Heart Rate Sensor, GasSensor, GPS, Real-time Monitoring, Worker Safety.*

1. Introduction
The personnel involved in industrial sectors such as construction, mining, fire-rescue operations, and chemical-manufacturing plants are usually exposed to hazardous conditions. In contrast, the majority of traditional safety equipment is helpless in providing current hazard information to supervisors in real-time. IoT-based Smart Safety Jacket embeds intelligent features and network connectivity into face safety protection attire. The jacket uses temperature detectors, gas detectors, heart-rate modules, and GSM for maintaining twin monitoring of environmental conditions and human parameters. The system evolves into three major safety features: non-stop monitoring of work space of employees, timely response to accidents, and reliable safety architecture developed for hazardous professions.

2. Method
- Continuous Monitoring:Gas sensor, temperature sensor, heart-rate sensor, and GSM module integrated into the jacket continuously measures environmental and body-related parameters.
- Data Processing:The microcontroller (ESP32) will collect raw sensor readings, process those readings, and compare values against a predefined safety threshold.
- Hazard Detection:In these circumstances, whether unsafe conditions of toxic gas presence, high temperature, or abnormal heart rate occur, the system identifies the abnormal reading.
- Local Alert Activation:In that moment, a buzzer or vibration motor is triggered to alert the worker in real time about the detected danger.
- IoT Data Transmission:This processed information along with a worker's GPS location is sent by the microcontroller to an IoT platform-ThingSpeak/Blynk/Firebase via Wi-Fi[4 -6].
- Remote Monitoring & Alerts: Supervisors get live alerts, and they can also track the worker's safety status and location from the IoT dashboard for quick emergency response.The Methods sections should be brief, but they should include sufficient technical information to allow the experiments to be repeated by a qualified reader. Only new methods should be described in detail. Cite previously published procedures in References.As shown in Table 1 Component for IOT Based Smart Jacket,

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Figure 1 Output of Smart IOT Based Smart Jacket[7 – 10].

Table 1 Component for IOT Based Smart Jacket

S.no	Components/	Board Name	Qnty
1	Microcontroller/ ESP -32	ESP -32	1
2	Gas Sensor	MQ135	1
3	Temperature and Humidity sensor	DHT22	2
4	Heartrate sensor	SKU SEN0205	1
5	GSM module	NEO 6M GSM	1
6	Power source	Li Battery(2000 v)	4
7	Power protection	2SBMS	1
8	Voltage convertor	DC to DC buck booster	1
9	Alert system	Buzzer (3v)	1

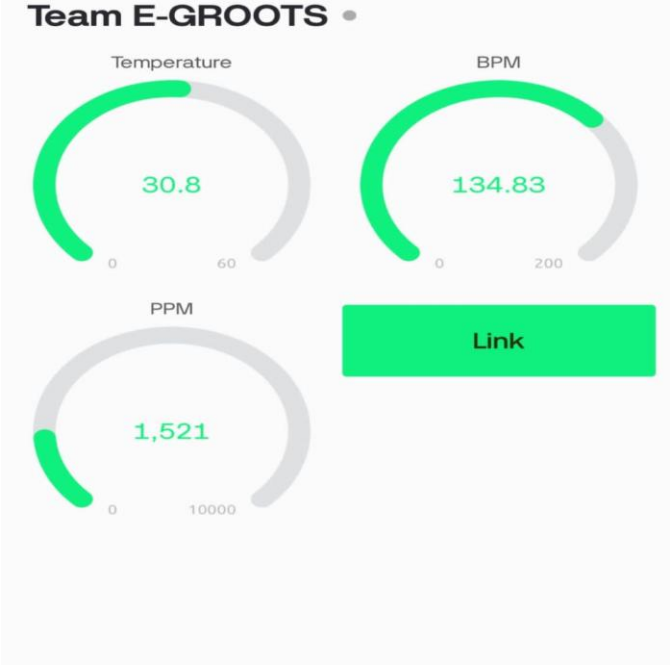

Figure 1 Output of Smart IOT Based Smart Jacket

3. Results And Discussion

3.1.Results

The developed prototype of the IoT-based Smart Safety Jacket was tested in controlled conditions, and all integrated sensors performed reliably. Continuous and accurate real-time readings were provided by temperature, heartbeat, and gas sensors under multiple test cycles. There is almost no delay in transmitting data from the IoT module to the cloud dashboard, hence allowing for continuous monitoring. Immediately when there was a detection of abnormal conditions, such as high temperatures, detection of gas, abnormal heart rates, or fall events, this alert system turned on. The GSM module accurately provided the worker's location, thus supporting emergency tracking. Moreover, the jacket remained lightweight and didn't create any discomfort for the wearer. It thus proved suitable for long-duration use. Overall, these systems demonstrated stability, low power consumption, and strong performance across all functional tests[11].

3.2.Discussion

These results illustrate that the IoT-based Smart Safety Jacket is a competent and effective solution to improve worker safety in hazardous working conditions. Real-time monitoring enables early

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detection of health or environmental risk, hence reducing chances of severe accidents. The immediate alert mechanism significantly improves emergency response by way of enabling quick action by supervisors. GSM tracking adds an important layer of safety by helping find workers instantly in critical situations, especially in huge industrial zones or underground areas. Data transmitted to the IoT dashboard provides valuable insights into the analysis of risk patterns and environmental conditions, which can be further used to strengthen workplace safety protocols. Overall, this project depicts how IoT technology can effectively enhance conventional safety gear by rendering it smarter, responsive, and more reliable for real-world industrial application.As shown in Figure 2 Process of the dataset [3]

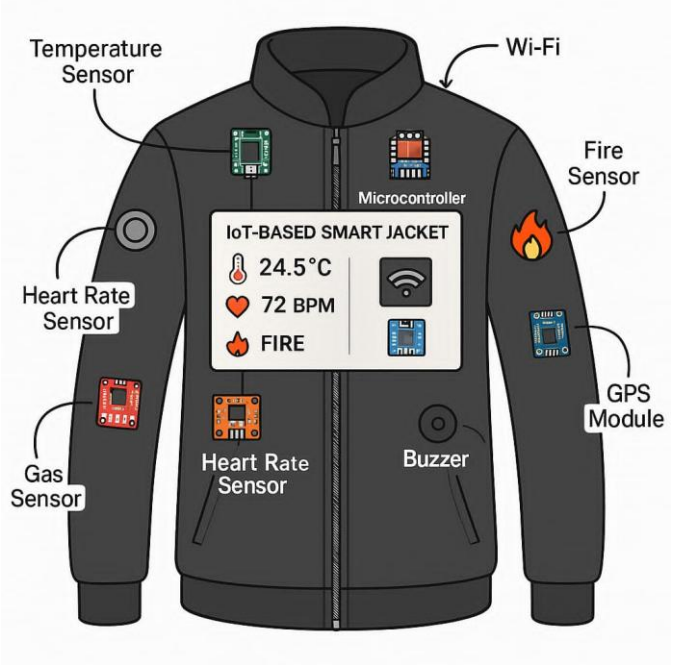

Figure 2 Process of the dataset [3]

Conclusion

- The IoT-based smart safety jacket provides continuous real-time monitoring of workers.
- Integrated sensors measure temperature, heart rate and gas levels
- The system detects early unsafe conditions and averts major incidents[12].
- IoT connectivity allows the instant alerting of supervisors through cloud or mobile.
- The jacket allows for quick emergency response in hazardous environments.
- Data logging allows for the analysis of worker health and workplace risks.
- The device is portable, lightweight, and suitable for long working hours.
- The solution adds smart features to conventional safety equipment.
- It reduces human error by automating safety monitoring.
- The jacket is economically viable and, hence, can be afforded industrially.
- The prototype proves to be highly reliable during testing under variable conditions.
- Overall, it is a scalable system that can be integrated into various industries such as mining, construction, and factories

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