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"AN IOT BASED WEARABLE SYSTEM FOR THE SAFETY OF WORKERS IN INDUSTRIAL SCENARIO"

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Abstract: In the ever-evolving industrial landscape, worker safety remains a paramount Concern. With the advent of Industry 4.0 and the proliferation of connected devices, the Internet of Things (IoT) has emerged as a transformative force in enhancing workplace safety. IoT-based wearable systems offer a promising solution to realtime monitoring and Intervention, minimizing workplacehazards and fostering a culture of safety. Traditional safety Measures often rely on passive approaches, such as personal protective equipment (PPE) and Safety training. While essential, these methods may not always prevent accidents or provide Timely intervention in critical situations. IoT-based wearable systems address these limitations By transforming workers into active participants in their own safety. These systems compriseWearable devices equipped with a suite of sensors that collect real-time data on the worker's Environment and physiological parameters. This data is then transmitted wirelessly to a Central hub foranalysis andvisualization. By continuously monitoring workers' exposure to Hazards, such as toxic gases, excessive noise, or extreme temperatures, IoT-based wearable Systems can trigger immediate alerts and initiate preventive measures of fatigue, heat stress, or Potential health risks, enabling early intervention and preventing accidents.

I. INTRODUCTION

Internet of Things (IoT) leads to an improvement of services efficiency, a smart monitoring of the production, and an accurate tracking of the products from the initial phases to the delivery .The widespread diffusion of this kind of technology in the industrial context is unrestrainable: in recent years the contribution of IoT is increasing especially in the Industry sector, despite the presence of issues related to cyber threats, safety, and security aspects, nowadays considered a hot topic.

Taking into account that the IoT technology offers for academic and industrial research communities the opportunity to enhance the safety of human related environments, the issue related to the conscious use of such systems becomes of primary importance. As stated in Health, Safety & Environment (HSE) management would benefit greatly from the improvement of environmental performance indicators, that identify the conditions prior to accidents through the measurement of physical parameters related to relevant conditions for occupational health.

Typical techniques use simple features based on mathematical operators (i.e. means, standard deviations, signal magnitude vector, etc.) and/or statistical indexes (e.g. skewness, kurtosis, eccentricity, etc.)

Other approaches are based upon the frequency spectrum analysis of the raw accelerometer data or combine time–frequency features using multi-resolution analysis, such as continuous or discrete wavelet transform However, high dimension features vectors may usually require time and power-consuming extraction procedures. To overcome these limitations, some researches attempted reducing the features vector size, in authors use five-features vector while suggests using only three time domain features.

II. PROPOSED SYSTEM ARCHITECTHURE

A localization service to estimate the position of the worker,that has to be shared in case of Emergency. Warning system devoted to exchange relevant information about human and environmental Conditions. A state estimation tool responsible for the evaluation of anomalous situations. Enhance worker safety by developing an IOT based wearable system. Monitor vital signs in real-time to ensure immediate response to health emergencies. Implement location tracking to enable quick

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identification of workers in distress. Integrate environmental sensors to detect hazardous conditions and alert workers. Provide a panic button for workers to request assistance in emergency situations. Establish a centralized control system for monitoring and managing multiple wearables.

To design and implement an innovative IoT-based wearable solution that ensures real-time monitoring and proactive safety measures for workers in industrial environments.

This system should address hazards commonly faced by workers, such as fall detection, hazardous gas exposure, heat stress, and other potential risks, while providing timely alerts and preventive actions to mitigate accidents and ensure the well-being of personnel."

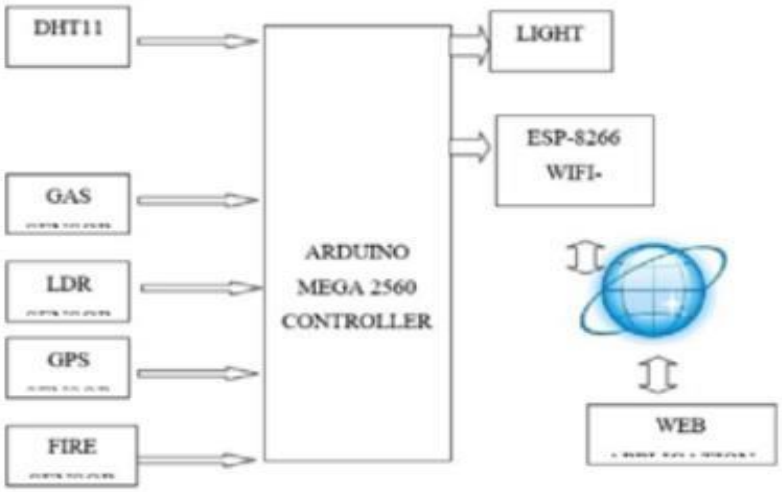

Fig 1: Block Diagram

Understand the specific safety needs in the industrial environment: types of hazards, work conditions, regulatory compliance, etc. Select and integrate sensors (e.g., accelerometers, gas detectors,temperature sensors) into wearable devices to collect relevant data on worker conditions and surroundings. Select Implement algorithms to process and analyze the collected data in real-time, detecting potential risks (e.g., falls, exposure to hazardous gases, heat stress) and anomalies. Develop a robust communication system (using IoT protocols like MQTT, HTTP, etc.) to transmit data from wearable devices to a central server or cloud platform for analysis. Design an alert mechanism to notify workers and supervisors in real time about potential dangers or emergencies through various means (e.g., mobile apps, alarms, SMS).

HARDWARE REQUIREMENTS

1. DHT11 HUMIDITY & TEMPERATURE SENSOR

DHT11 Temperature & Humidity Sensor features the temperature & humidity sensors are much complex with an calibrated digital signal output. the exclusive digital-signal acquisition technique and temperature & humidity sensing technology are used, it ensures high reliability and excellent long- term stability.

2.MQ-6 HAZARDOUS GAS DETECTING SENSOR

This gas sensor MQ6 detects the presence of combustible gas at concentrations from 300 to 10,000 ppm. These sensor's are simple analog interface which requires only one analog input pin from microcontroller. This flammable gas sensor detects the concentrations of combustible gas in the air and outputs its reading as an analog voltage.

3. GPS Module

The primary instrument in leveraging GPS technology is the GPS module, an electronic device that communicates with GPS satellites to provide geographical location data. It as armed with an SIM28 and serial communication configuration.

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4. ESP8266 Wi-Fi

This is an Node the Mcu is an open-source firmware and it's an development kit that helps us to Prototype our IOT product within a few Lua script lines.

5. Arduino Mega

The Arduino Mega is a microcontroller board based on the ATmega328 (datasheet). It has around 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button.

6. Fire Sensor

The Fire sensor is used to detect fire flames.The module make the use of Fire sensor and comparator to detect an fire up to a range of 1 meters. monitoring changes in the environment, such as smoke, heat, or flames. They play a crucial role in early fire detection, triggering alarms to alert occupants and authorities. Common types include smoke detectors, heat detectors.

7. ESP8266 Wi-Fi

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SOFTWARE REQUIREMENTS

1.ARDUINO IDE

Arduino is an Italian open-source hardware and software company, project, and user Community that will designs and manufacture.

Single-board microcontrollers and microcontroller kits 2for building digital devices.

2.ADAFRUIT IO

Adafruit IO is a platform designed to display, respond, and interact with your project's data. We also keep your data private and secure (we will never sell or give this data away to another company) for you.

III. CONCLUSION

In Conclusion, Reduced accidents and injuries through real-time monitoring of environmental conditions and worker health, leading to an overall improvement in workplace safety. Enhanced emergency response times with immediate detection and notification of incidents, minimizing the impact of accidents and ensuring timely medical assistance.

Better management of worker health and fatigue through continuous monitoring of vital signs, allowing for proactive measures to prevent exhaustion related incidents. Precise location tracking of workers within industrial facilities, enabling efficient evacuation procedures and quick identification of workers in need during emergencies.

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