International Journal of Multidisciplinary Engineering in Current Research - IJMEC
Volume 9, Issue 02, February-2024, http://ijmec.com/, ISSN: 2456-4265

ADVANCED SAFETY ENHANCEMENT SYSTEM FOR MINING PERSONNEL UTILIZING INTERNET OF THINGS TECHNOLOGY

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Abstract : Revolutionizing safety measures in the mining industry, a groundbreaking protective cap employing artificial intelligence is now available. This technological marvel is designed to provide timely warnings to workers in the face of potential dangers. The development of these advanced protective caps meticulously considers air quality, head protector evacuation, and collision hazards, offering a comprehensive solution to safeguard mining personnel. The integration of artificial intelligence into protective caps signifies a paradigm shift in enhancing the safety landscape for mining workers. By adeptly managing air quality concerns, ensuring preparedness for head protector evacuation, detecting and investigating fires, and mitigating collision hazards, these intelligent caps set a new standard for comprehensive safety in mining operations. This innovative solution underscores a commitment to leveraging technology for the well-being of workers, solidifying its place as a pioneering advancement in the mining industry's ongoing pursuit of enhanced safety measures.

Keywords: Arduino, IOT, Border Security System, Temperature sensor.

I. INTRODUCTION

In these days solid affiliation business centers, the affiliations face creating necessities to additionally foster way efficiencies, investigate ordinary recommendation, and meet corporate monetary targets. Given the making period of different present-day frameworks and the extraordinary business-producing business center, reasonable and unimportant expense business robotization structures are depended upon to work on the capability and execution of such structures[2], [3]. all around, business computerization structures are perceived through spurring out exchanges. in any case, the wired computerization structures require outrageous verbal trade interfaces with be mounted and much of the time remained mindful of, and in this manner, they are not regularly done in business plants by their huge expense [4]. as such, there's a true necessity for savvy distant robotization structures that award huge cash related hold saves and reduce air-

DOI: https://doi-ds.org/doilink/02.2024-71566312

poison floods through upgrading the association of current plans. WSNs, the conviction of insignificant cost implanted business robotization structures have become practical [5]. In the one's turns of events, distant little sensor community focuses are related on endeavor gear and reveal the cutoff points basic for each gadget'sefficiency fundamentally settled on several appraisals like vibration, temperature, strain, and power quality. this information is then to some degree transported off a sink community that evaluations the information from every sensor. Any end loads are told to the plant workers as a perplexed warning framework. This awards plant staff to fix or abrogate contraptions, sooner than their sufficiency drops or they flop. Consequently, miserable device screw-ups and the related fix and substitution expenses might be stayed away from, simultaneously as consenting to genuine natural guidelines. The accommodating considered IWSNs brings two or three benefits over customary disturbed out the business following and control structures, which unite self-affiliation, quick blueprint, flexibility, and intrinsic wily dealing with limit. In such a manner, WSN plays a basic breaking point in making an unequivocally dependable and self-recuperating present-day gadget that quickly reacts to consistent occasions with genuine activities. in any case, to comprehend the imagined current applications and, therefore, take the upsides of the support benefits of WSN, productive dispatch shows, which can manage the right disagreeable conditions presented through such frameworks, are required. The imaginative improvement inside the worldwide has during that time-shifted direction and measures to show sports associations are being made to allow let free to encounters and guide for giving clients [6]. this is a delayed consequence of the staggering name for assets reasonable in helping industrialists with achieving put forward targets and foster applications for the supporting of time transportation of materials and set out a chance for expanded data [7]. The significance of introducing a pleasantly unprecedented model wi-fi Sensor social class (WSN) in business take a stab at programming can't be over-featured; as needs are, this experience tends to the great master in intersection the distance among the accessibility of OK after information offering all due appreciation to cultivate the current turns of events and the standard methodology for endeavors. WSN is a progression wherein basically confined focuses help each other in sending loads of information through the local vehicle to the spot for moving unendingly. The WSN joins focuses that can send and get messages in a cross fragment plan and a middle that can fill in as a switch and can also hand-off messages for its neighbour. through thusly, Wi-Fi group encounters will notice their course to the predetermined occasion spot, using transitory focuses with reliable correspondence procedures. WSN programming sways from one locale to another. different fields including fire, equipped power establishments, contamination, machine success, and regular parts following fuse gifted creating insubordination inside the execution of this time in checking sports incorporate them. In many preposterous areas, clear controlling is utilized because in reality the area, at the indistinct time as new flooding-based thoroughly time, offers the open door and advantages, especially in gigantic affiliations.

DOI: https://doi-ds.org/doilink/02.2024-71566312

II. LITERATURE REVIEW

In 2017, Nike Patil and Brijesh Iyer proposed wearables that would monitor soldiers' fitness and location using the Internet of Things. Since Arduino is connection focused (it has a USB port), they have not described how the conversation is established between the client and server sides.

To track and record vital signs like a patient's temperature, heart rate, and electrocardiogram in real time, R. Shaikh et al. [2012] proposed using an ARM processor. Using wireless technologies like ZigBee and GSM, we can update doctors in real-time so they can take swift action when necessary. ZigBee-based wireless body area sensor networks (WBASNs) continuously monitor patient status and location.

To compile statistics about soldiers on the battlefield, G. Raj et al. [2014] proposed an RF-based totally module. To ease and authenticate the information processing, V. Ashok [2016] has proposed an OTP-based system. Integrating the wireless sensor community and cloud computing has been proposed by Jassas et al. [2015] to facilitate rapid and timely data analysis.

To monitor the whereabouts of the troops, S. Dixit and A. Joshi [2014] proposed a wholly Google Maps-based approach. But most of these systems are stymied due to factors like high costs of implementation, delays in responses, and cumbersome design.

The LM35 temperature sensor, Pulse fee sensor, and oxygen degree detector sensor proposed by S. Rajeswari and R. Kalaiselvi [2017] can be used to monitor service members' health status in real-time. Positioning and navigation in real-time via GPS. A wrist multi-sensor device for continuous monitoring of health status and alert, integrating biomedical sensors for heart rate, 1-lead ECG, blood pressure, oxygen blood saturation, and skin temperature measurement, is processed and accumulated using Arduino (ATmega328P). The use of GSM and GPS in a monitoring device can help keep teachers and parents up-to-date on a child's whereabouts via a short message service.

A variety of sensors that can be worn or carried around easily and that weigh in at a reasonable amount for their size and weight have been developed for use in tracking human physiological parameters, and their authors have discussed these developments. Health monitoring on the go is possible with the help of the many biomedical and physiological sensors included in the frame Sensor network (BSN), such as a blood pressure sensor, electrocardiogram (ECG) sensor, and electrodermal interest (EDA) sensor. In this paper, we advocate for the use of a machine capable of real-time health monitoring of soldiers, which makes use of interconnected BSNs. In their final draught, the authors included a device that could monitor the whereabouts of the infantrymen in real-time. If the infantrymen have accurate GPS coordinates, they should be able to send a distress signal to the command post. It could potentially provide real-time delivery of soldiers' sensed and processed parameters. The military can use body sensor networks to manipulate units and display fitness parameters, such as heart rate, temperature, and so on, for individual service members. Using GSM, the parameters of the troops have been transmitted wirelessly.

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To ensure the safety of infantrymen, the authors proposed the use of sensors to reveal information about the soldiers' fitness status and the ammunition they were carrying. To aid in providing infantrymen health status and location records to the control unit, a GPS module has been used for location monitoring and an RF module has been used for high-speed, short-range data transmission, allowing for wireless communications between soldiers.

The authors analyzed how especially ill patients were treated. The focus of this paper is on keeping track of patients' health after they have been released from a hospital or clinic located far away. From the comfort of their offices, doctors can now remotely monitor vital signs like temperature, heart rate, and electrocardiogram (ECG) from their patients. The ZigBee transceiver continuously monitors the patient's vitals and sends the data about their health to a central server. A "Soldier fitness and function monitoring device" using a Barometric stress sensor, GPS, GSM, and WBASNs has been proposed (heartbeat sensor, temperature sensor). The ATmega328p microcontroller was used to create the prototype. The soldier's health status has been learned using only pure conditional statements, with no machine learning or human education involved. GSM has been used as the primary means of communication despite its obvious disadvantages in high-altitude areas, where establishing network connectivity may be a difficult task. After normal time intervals, GSM transmits a message with the soldier's health status. In their paper titled "IoT-based health monitoring via LoRaWAN," the authors propose sending data from medical sensors to an evaluation module via low-cost, low-strength, and comfortable communication via a LoRaWAN (extended variety, big location network) network. In rural areas, where cellular community coverage is both lacking and not allowing records of transmission, blood pressure, glucose, and temperature have been measured. When the LoRaWAN Gateway is installed outside at a height of 12 meters, the expected coverage area is 33 square kilometers. The power requirements of this monitoring device are said to be at least ten times lower than those of various lengthy-range cell solutions, such as GPRS/3G/4G.

III Project Introduction

Aim: The goal of this project is to design a high-tech helmet that will keep miners safe.

Existing framework:

In the end, safety caps worn by miners only serve to protect the wearer's head from accidental blows. There is no technology built into the security protective caps that may alert other miners to a colleague's perilous situation. More recently, gathering technology has played an increasingly important role in the field of mining applications. Information regarding mine technology can be found online, albeit in a very tiny volume.

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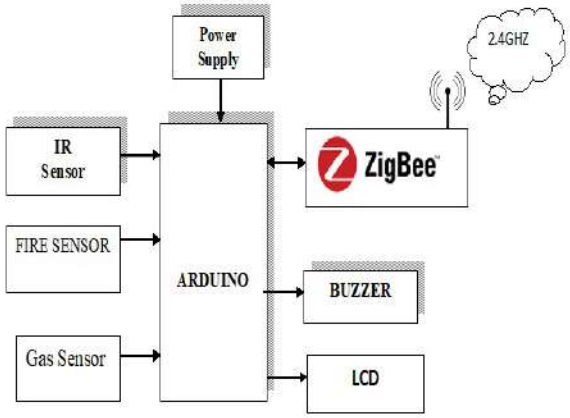
Proposed framework:

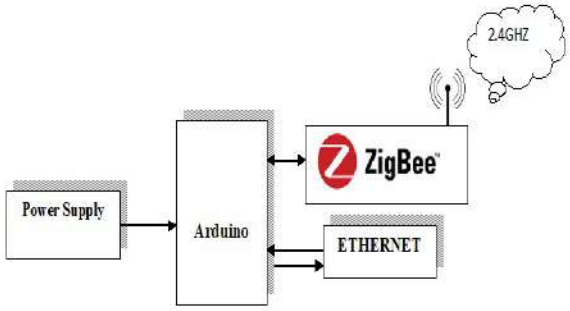
To make the entire structure more understandable, it has been broken down into three sections. It is possible to detect whether or not objects have been dropped on top of the digger by using an accelerometer-based impact sensor. To tell the difference between air pollution from coal mines and other sources, scientists use sensors to measure air quality. Particulate matter and gas emissions, such as methane (CH4) and carbon monoxide, are mostly to blame (CO). The Coal Mine Fire Detection Sensor is designed to detect fires in coal mines. The data processor is a mini-controller that collects data from the device's main sensor and decides whether or not to send a signal to the device's remote location or the user's body. The information gathered by the handling unit is sent to a remote transmission and warning unit for dissemination. Ethernet is used to complete the task.

BLOCK DIAGRAM

Helmet Section



Monitoring Section



Block Diagram of Monitoring Section

Hardware: Arduino, Esp8266, Fire Sensor, IR Sensor, Gas Sensor.

Software: Implanted Linux OS, Ethernet Protocol, Qtopia GUI

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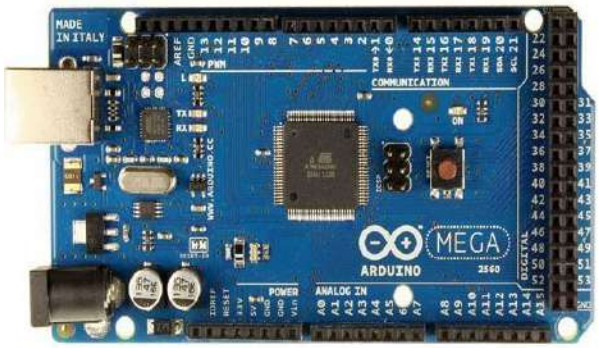
IV. ARDUINO



Overview:

Arduino Uno is a microcontroller board subject to the ATmega328P (datasheet). It has 14 pushed data/yield pins (of which 6 can be used as PWM yields), 6 crucial data sources, a 16 MHz finished resonator (CSTCE16M0V53-R0), a USB affiliation, a power jack, an ICSP header, and a reset button. It contains all that normal to help the microcontroller; on a fundamental level interface it to a PC with a USB affiliation or power it with an AC-to-DC connector or battery to start. You can meddle with your Uno without anguishing significantly overachieving something incorrectly, most fundamental result conceivable you can exchange the chip for a couple of dollars and start again.

"Uno" recommends one in Italian and was picked to stamp the presence of Arduino Software (IDE) 1.0. The Uno board and structure 1.0 of Arduino Software (IDE) were the reference types of Arduino, direct made to ceaselessly current releases. The Uno board is the first in the advancement of USB Arduino sheets and the reference model for the Arduino stage; for an expansive once-over of current, past, or old sheets see the Arduino report of sheets.

NodeMCU

NodeMCU is an unimportant expense open-source IoT stage. It at first included firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems and stuff that depended upon the ESP-12 module. Sometime later, support for the ESP32 32-cycle MCU was added. NodeMCU joins "center" and "MCU" (small scale controller unit). The articulation "NodeMCU" thoroughly talking suggests the firmware rather than the connected progression packs.

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Fig : NODEMCU Module

V. Zigbee Technology

When it comes to wirelessly link sensors, instruments, and control systems, ZigBee is the gold standard. It has been speculated that ZigBee, a specification for communication in a WPAN, is the "Internet of things." In theory, if both your coffee maker and toaster are ZigBee-enabled, they will be able to exchange information with one another. ZigBee is an easy-to-implement framework for establishing low-power, secure wireless networks worldwide. ZigBee and IEEE 802.15.4 are low-rate wireless networking technologies that can replace the expensive and easily-damaged cable traditionally used in industrial control systems. Equipment used to regulate flow or process can be located anywhere in a facility while still maintaining two-way communication with other nodes. And because the network doesn't mind where a sensor, pump, or valve is physically located, it can be relocated if necessary. By offering a straightforward networking layer and standardized application profiles, the ZigBee RF4CE standard paves the way for the development of multi-vendor, interoperable solutions in the realm of consumer electronics.

This technology has far-reaching benefits; ZigBee uses include:

Automation for the home and workplace
Robotics and automated production
Constant medical observation
Ultra-low power sensor technology
Temperature and humidity regulation in a building
Not to mention the plethora of different control and monitoring applications

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Figure 1: ZigBee Applications

Low-power, low-duty-cycle, low-data-rate devices are ZigBee's intended audience. The ZigBee network example is depicted in the following figure.

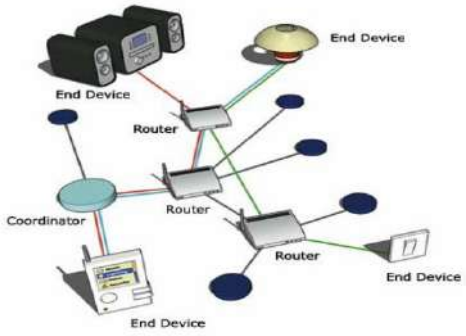

Figure 2: ZigBee Network

VI. LCD

Introduction

LCD (Liquid Crystal Display) is such a level board show which uses liquid significant stones in its fundamental kind of movement. LEDs have an enormous and moving approach of utilization cases for customers and relationships, as they can be ordinarily found in phones, TVs, PC screens, and instrument sheets.

LCDs were an imperative ricochet the degree that the movement they removed, which breaker light-passing on the diode (LED) and gas-plasma shows. LCDs allowed colleagues to be inside and out more thin than the cathode bar tube (CRT) movement. LCDs eat up generously less power than LED and gas-show shows since they seek after the norm of obstructing light as opposed to releasing it. Where a LED radiates light, the liquid huge stones in an LCD pass on an image using establishment enlightenment.

As LCDs have replaced progressively organized hotshot drives, LCDs have begun being removed by new introduction enhancements, for instance, OLEDs.

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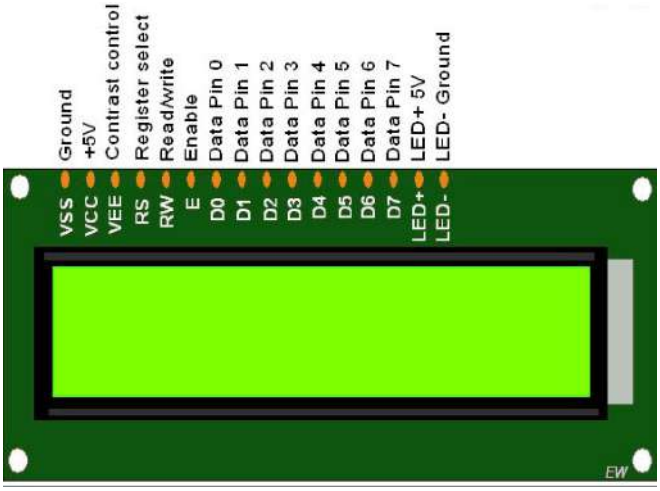

VII. SOFTWARE TOOLS

Arduino IDE compiler:

Arduino is an open-give contraptions stage subordinate by and large upon smooth to utilize stuff and programming utility. Arduino sheets can see inputs - slight on a sensor, a finger on a button, or a Twitter message - and flip it into a result - inducing an engine, turning on a LED, dissipating a few locales on the web. You could put together your board by sending a firm of mentioning to the microcontroller at the board. To do such a ton of that you utilize the Arduino programming language (set up all around concerning Wiring), and the Arduino programming (IDE), pondering Processing.

All through the long Arduino has been the mind of loads of liabilities, from standard devices to complex clinical contraptions. Overall neighborhood creators - understudies, informed subject matter experts, arranged specialists, originators, and coordinated prepared experts - have amassed unusual this open-convey stage, their responsibilities have brought whatever amount of a dazzling level of open limit that can be of astonishing help to understudies and specialists the same.

Arduino has become brought into the world on the Ivrea correspondence setup Institute as an ideal contraption for second prototyping, prepared towards school understudies without an obvious past in stuff and programming. As fast as it displayed at a miles more broad district, the Arduino board began changing back to adjust to new dreams and unwanted conditions, segregating its give from smooth eight-cycle sheets to stock for IoT

Programs, wearable, three-d printing, and installed conditions. All Arduino sheets are without a doubt open-convey, attracting clients to total them excitedly and in the end change them to their extraordinary dreams. The thing program, additionally, is open-supply, and its miles making through the responsibilities of clients from one side of the world to the next.

The typical augmentations of the Arduino IDE utility are

1. Much less steeply-regarded

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2. The clean smooth programming regular parts
3. Extensible programming program application utility and equipment

VIII. Conclusion

In this research endeavor, we developed an advanced helmet aimed at safeguarding mining workers from potential hazards. Establishing and implementing a system that can ensure the well-being of both construction sites and miner personnel, with the ability to take corrective measures as necessary, is of paramount importance. The proposed approach serves the dual purpose of enhancing security measures and addressing specific mining-related challenges.

The resulting system is robust and lightweight, utilizing readily available and uncomplicated components. The intelligent mine safety helmet prototype created through this project can identify various potential dangers encountered in mining, such as the buildup of carbon monoxide gas. A key feature of the technology is its utilization of an infrared detector, which promptly alerts the wearer to potential falling objects, enhancing head protection.

To promote increased interpersonal interaction and extend the signal's reach and intensity, additional antennas can be installed. Modifications can also be implemented to enhance the processing speed of sensors, data processing, and overall system performance. Consideration can be given to integrating the infrared detector seamlessly into the protective gear to avoid conflicts and enhance overall functionality.

Several avenues for system improvement are identified, including:

1. Expanding the array of tools used to assess an employee's performance.
2. Incorporating a pulse and blood pressure monitoring system in future enhancements.

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DOI: https://doi-ds.org/doilink/02.2024-71566312