An Effective Way of Monitoring Environmental Parameters in Coal Mines

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Abstract:

A smart helmet has been developed that is able to detect of hazardous events in the mines industry. In the development of helmet, we have considered the three main types of hazard such as air quality, helmet removal, and collision (miners are struck by an object). The first is the concentration level of the hazardous gases such as CO, SO2, NO2, and particulate matter. The second hazardous event was classified as a miner to check the fire in the mines while moving inside the mines. Fire Sensor was then used to successfully to check the fire. The third hazardous event is defined as an event where miners are struck by an object against the head with a force exceeding a value of 1000 on the HIC (Head Injury Criteria).

I.INTRODUCTION

The most important part of any type of industry is safety. In the mining industry safety and security is a first aspect of all. To avoid any types of unwanted conditions, every mining industry follows some basic precaution. Communication is the most vital key factor today, to monitor different parameters such as temperature, increasing humidity level, and carbon monoxide gas continuously using sensors such as LM35, gas sensor MQ2 and humidity sensor to take necessary actions accordingly to avoid any types of hazardous conditions and gives an alert using buzzer. To achieve safety in underground mines, a suitable communication system must be created between workers, moving in the mine, and a fixed base station. The wired communication network technology system will be not so effective.

Under the mines due to uncomfortable situation the installation cost as well as maintenance cost is high for wired communication networks. For the successfully wireless data transmission, in this work a low cost zigbee is utilized in routers.

II. PROPOSED METHOD

- Gas sensor, which is utilized to identify Air contamination from coal mines. It is fundamentally because of emanations of particulate issue and gasses incorporate methane (CH4) and carbon monoxide (CO).
- Fire sensor, which is utilized to recognize fire breakouts.
- Ultra sonic sensors are used to protect miners head from rock and landslides.

Keeping in mind the end goal to clarify the whole framework, the framework is separated into three units. Crash sensor, which is utilized to distinguish and recognize whether any items fall over the excavator and this is accomplished through accelerometer. Air quality sensor, which is utilized to identify Air contamination from coal mines. It is predominantly because of outflows of particulate issue and gasses incorporate methane (CH4) and carbon monoxide (CO).Fire Sensor to identify the fire from Coal mines. Information handling unit the miniaturized scale controller which is utilized to get every one of the information from the most importantly sensor and finishes up whether require any hint to remote unit or the client wearing it.

Remote transmission and cautioning unit is utilized to exchange the information acquired from the preparing unit. It is accomplished through Ethernet.
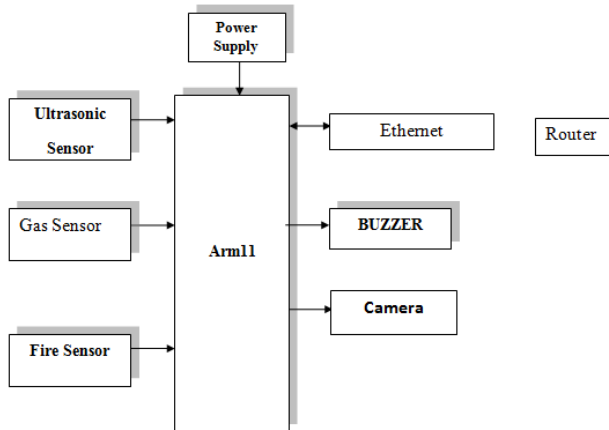

Fig Block diagram (Helmet section)

A. ARM ARCHITECTURE

ARM is a 32-bit RISC processor design created by the ARM company. ARM processors have an extraordinary mix of elements that makes ARM the most well known installed engineering today. To begin with, ARM centers are extremely basic contrasted with most other broadly useful processors, which implies that they can be made utilizing a similarly modest number of transistors, leaving a lot of space on the chip for application particular full scale cells. A commonplace ARM chip can contain a few fringe controllers, an advanced flag processor, and some measure of on-chip memory, alongside an ARM center. Second, both ARM ISA and pipeline configuration are gone for limiting vitality utilization — a basic prerequisite in portable implanted frameworks. Third, the ARM engineering is exceedingly secluded: the main required part of an ARM processor is the number pipeline; every other segment, including reserves, MMU, coasting point and other co-processors are discretionary, which gives a considerable measure of adaptability in building application-particular ARM-based processors. At long last, while being little and low-control, ARM processors give elite to implanted applications.

RASPBERRY PI BOARD

Fig. Raspberry Pi Board

The Raspberry Pi is a Mastercard estimated single-board PC created in the UK by the Raspberry Pi Foundation with the goal of advancing the instructing of fundamental software engineering in schools. The Raspberry Pi has a Broadcom BCM2835 framework on a chip (SoC), which incorporates an ARM1176JZF-S 700 MHz processor, Video Core IV GPU, and was initially dispatched with 256 megabytes of RAM, later moved up to 512 MB. It does exclude an implicit hard circle or strong state drive, however utilizes a SD card for booting and tenacious stockpiling.

Raspberry Pi Basic Hardware

Fig. Raspberry Pi Basic Hardware

B. Ethernet

Ethernet is a group of PC organizing advances for neighborhood (LANs) economically presented in 1980. Institutionalized in IEEE 802.3, Ethernet has to a great extent supplanted contending wired LAN innovations. Frameworks conveying over Ethernet separate a flood of information into singular parcels called outlines. Each edge contains source and goal locations and blunder checking information with the goal that harmed information can be identified and re-transmitted.

C. GAS DETECTOR

A Gas locator additionally called a smoke alert is a gadget that identifies smoke, normally as a marker of flame. Business, modern, and mass private gadgets issue a flag to a fire alert framework, while family unit identifiers, known as smoke cautions, for the most part issue a neighborhood perceptible or visual caution from the indicator itself.

D. FIRE SENSOR

There are a few sorts of fire locator. The optical fire finder is an indicator that utilizations optical sensors to identify blazes. There are additionally ionization fire finders, which utilize current stream in the fire to identify fire nearness, and thermocouple fire identifiers.

Infrared Flame Detector Infrared (IR) fire locators work inside the infrared ghastly band. Hot gasses radiate a particular ghostly example in the infrared area, which can be detected with a warm imaging camera (TIC) a sort of thermo realistic. False alerts can be caused by other hot surfaces and foundation warm radiation in the range and in addition blinding from water and sunlight based vitality.

E. Ultrasonic transducer

Ultrasonic transducers will be transducers that change over ultrasound waves to electrical signs or the other way around.

Those that both transmit and get may likewise be called ultrasound handsets; numerous ultrasound sensors other than being sensors are to be sure handsets since they can both sense and transmit. These gadgets take a shot at a rule like that of transducers utilized as a part of radar and sonar frameworks, which assess qualities of an objective by translating the echoes from radio or sound waves, individually. Dynamic ultrasonic sensors produce high recurrence sound waves and assess the reverberate which is gotten back by the sensor, measuring the time interim between sending the flag and getting the resound to decide the separation to a protest. Uninvolved ultrasonic sensors are essentially receivers that identify ultrasonic commotion that is available under specific conditions, change over it to an electrical flag, and report it to a PC.

F. LINUX Operating system

Linux or GNU/Linux is a free and open source programming working framework for PCs. The working framework is a gathering of the fundamental guidelines that tell the electronic parts of the PC what to do and how to function. Free and open source programming (FOSS) implies that everybody has the flexibility to utilize it, perceive how it works, and changes it.

G. QT EMBEDDED FRAME WORK

Qt is a cross-stage application system that is generally utilized for creating application programming with a graphical UI (GUI) (in which cases Qt is delegated awidget toolbox), and furthermore utilized for creating non-GUI projects such ascommand-line devices and consoles for servers. Qt utilizes standard C++ however makes broad utilization of an uncommon code generator (called the Meta Object Compiler, or moc) together with a few macros to advance the dialect.

III. Working Principle

In this venture, we are giving the total portrayal on the proposed framework engineering. Here we are utilizing Raspberry Pi board as our stage.

It has an ARM-11 SOC with incorporated peripherals like USB, Ethernet and serial and so on. On this board we are introducing Linux working framework with essential drivers for every fringe gadget and client level programming stack which incorporates a light weight GUI in view of XServer, V4L2 API for associating with video gadgets like cameras, TCP/IP stack to speak with arrange gadgets and some standard framework libraries for framework level general IO operations. The Raspberry Pi board furnished with the above programming stack is associated with the outside system and a camera is associated with the Raspberry Pi through USB transport.

IV. Results and discussions

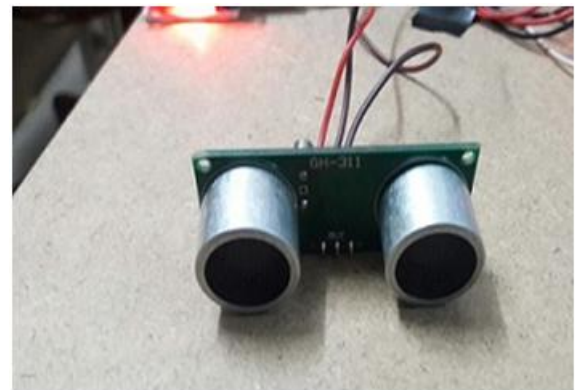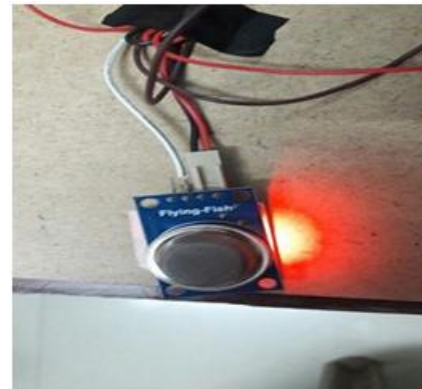
Fig. Fire sensor and raspberry pi hardware implementation

Fig. Gas sensor and Ultra sonic sensor

Fig. Output representation

The critical levels of the hazardous gases such as CO in the mines industry has been indicated through alerting unit. The helmet object collusion test was done successfully with an off the-shelf Ultrasonic s distance sensor. The Ultrasonic sensor designed from first principles was working device.

It was discovered, after the system was integrated, that the transmitted signals reflects off the dummy object and kept reflecting off the helmet's surface until it reached the receiver. The signal at the receiver side was close to the same amplitude as the signal received when the helmet was closed from the object. The test results for this test were not added as the system constantly triggered the alert signal. It gave the results that were expected and needed for the test to be successful.

V. ADVANTAGES
- Easy to implement and
- Low power consumption and Monitoring of parameters is done by using web technology.
- Remotely track critical system parameters.

VI. APPLICATIONS
- To provide safety and security to coal miners.
- This can be implemented on large scale basis.
- It is a stable and reliable system.

VII. CONCLUSION
The project "SMART HELMET FOR MINERS" has been successfully designed and tested. It has been developed by integrating features of all the hardware components and software used and tested. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced ARM Cortex A8 Processor board and with the help of growing technology the project has been successfully implemented.

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