

# A Smart Helmet for Coal Mine Worker to Provide High Security and Safety

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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, SO<sub>2</sub>, NO<sub>2</sub>, and particulate matter. The second hazardous event was classified as a miner removing the mining helmet off their head. An IR sensor was developed unsuccessfully but an off-the shelf IR sensor was then used to successfully determine when the helmet is on the miner's head. 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). An accelerometer was used to measure the acceleration of the head and the HIC was calculated in software. The layout of the visualization software was completed, however the implementation was unsuccessful. Tests were successfully done to calibrate the accelerometer. PCB's that were designed and made included a breakout board and a prototype board. A whole software implementation was done based on Contiki operating system in order to do the control of the measuring of sensors and of calculations done with the measured values. This paper presents the undertaken design detailing solutions to issues raised in previous research..

## Keywords

air quality; mining; safety; wireless sensor networks; ZigBee..

## 1. Introduction

The Internet has turned into an essential piece of the lives of a large number of individuals, and this number is always expanding. The system scope is expanding, the quantity of contraptions that can be associated with this system is expanding. The Internet is likewise changing affected by new innovations and ideas. Today there is an inclination

to the Internet of Things, the Internet of Services, distributed computing, and Web administrations. The new innovation has the ability to supply all the more ongoing thusly. This data conveys area, climate, and movement, nearby business and visits a store recurrence. This likewise gives new administration arranged industry opening. There is a developing enthusiasm for utilizing IOT innovations in different enterprises. Various mechanical IOT ventures has been connected in ranges, for example, nourishment preparing industry, ecological checking, security reconnaissance, farming, and others. In the meantime, the quantity of IOT distributions is rapidly developing. In this, we would interface be able to website page and server through door. The Common Gateway Interface (CGI) is a standard for interfacing outer applications with data servers, similar to HTTP or Web servers. A plain HTML record that the Web daemon recovers is static, which implies it exists in a consistent express: a content document that doesn't change. A CGI program, then again, is executed continuously, so it can yield dynamic data. The greater part of the general population thought of controlling machines and numerous other IR remote or a wired things running from PC to a switch board, however imagine a scenario in which you are not at things like knobs, tubes and switches and so forth utilizing a Site and all of a sudden you reminded that you have left something ON yet you don't know and you can't backpedal.

So to tackle this issue Now get to your completely mechanized Site from anyplace on the planet that the energy of web. The Internet permits one PC (called a customer) to control equipment (like engines or transfers) introduced on another PC (server). At the end of the day, one can remotely control or screen gadgets. Since the Internet is quite recently just the medium for PCs to "convey" to each other, it empowers you to perform applications like robotizing your enterprises (e.g. turn on/off air-conditioning) and information procurement (e.g. measure temperatures).

An inserted framework is a mix of programming and equipment to play out a committed errand. A

portion of the principle gadgets utilized as a part of inserted items are Microprocessors and Microcontrollers.

Microchips are ordinarily alluded to as broadly useful processors as they basically acknowledge the data sources, process it and give the yield. Interestingly, a microcontroller acknowledges the information as contributions as well as controls it, interfaces the information with different gadgets, controls the information and along these lines at long last gives the outcome.

The undertaking "A SMART HELMET FOR COAL MINE WORKER TO PROVIDE HIGH SECURITY AND SAFETY" utilizing lpc2148 Microcontroller and pic c microcontrollers a restrictive venture that can be utilized to outline an underground link blame sign and location.

## 2. Project Design

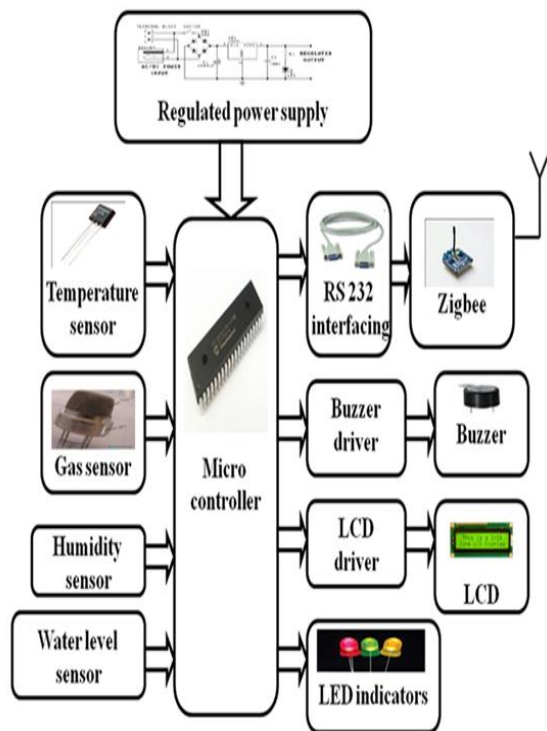


FIG 1: Block diagram of tx section

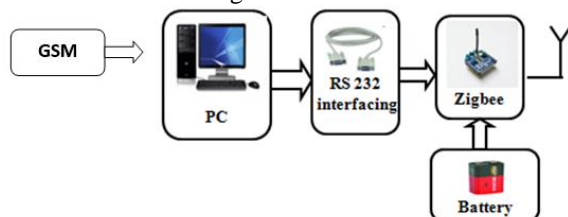


FIG 3.2: Block diagram of rx section

The Arduino is a family of microcontroller boards to simplify electronic design, prototyping and experimenting for artists, hackers, hobbyists, but also many professionals. People use it as brains for their

robots, to build new digital music instruments, or to build a system that lets your house plants tweet you when they're dry. Arduinos (we use the standard Arduino Uno) are built around an ATmega microcontroller — essentially a complete computer with CPU, RAM, Flash memory, and input/output pins, all on a single chip. Unlike, say, a Raspberry Pi, it's designed to attach all kinds of sensors, LEDs, small motors and speakers, servos, etc. directly to these pins, which can read in or output digital or analog voltages between 0 and 5 volts. The Arduino connects to your computer via USB, where you program it in a simple language (C/C++, similar to Java) from inside the free Arduino IDE by uploading your compiled code to the board. Once programmed, the Arduino can run with the USB link back to your computer, or stand-alone without it — no keyboard or screen needed, just power.

In order to maximize performance and parallelism, the AVR uses a Harvard architecture — with separate memories and buses for program and data. Instructions in the program memory are executed with a single level pipelining. While one instruction is being executed, the next instruction is pre-fetched from the program memory. This concept enables instructions to be executed in every clock cycle. The program memory is In-System Reprogrammable Flash memory. The fast-access Register File contains 32 x 8-bit general purpose working registers with a single clock cycle access time. This allows single-cycle Arithmetic Logic Unit (ALU) operation. In a typical ALU operation, two operands are output from the Register File, the operation is executed, and the result is stored back in the Register File— in one clock cycle.

Six of the 32 registers can be used as three 16-bit indirect address register pointers for Data Space addressing — enabling efficient address calculations. One of these address pointers can also be used as an address pointer for look up tables in Flash program memory. These added function registers are the 16-bit X-, Y-, and Z-register, described later in this section. The ALU supports arithmetic and logic operations between registers or between a constant and a register. Single register operations can also be executed in the ALU. After an arithmetic operation, the Status Register is updated to reflect information about the result of the operation. Program flow is provided by conditional and unconditional jump and call instructions, able to directly address the whole address space. Most AVR instructions have a single 16-bit word format. Every program memory address contains a 16- or 32-bit instruction.

The Global Positioning System (GPS) is the only fully functional Global Navigation Satellite System (GNSS). The GPS uses a constellation of between 24 and 32 Medium Earth Orbit satellites that transmit precise microwave signals, which enable GPS receivers to determine their location, speed,. GPS was developed by the United States Department of Defense. Its official name is NAVSTAR-GPS.

Although NAVSTAR-GPS is not an acronym, a few backronyms have been created for it. The GPS satellite constellation is managed by the United States Air Force 50th Space Wing.

Global Positioning System is an earth-orbiting-satellite based system that provides signals available anywhere on or above the earth, twenty-four hours a day, which can be used to determine precise time and the position of a GPS receiver in three dimensions. GPS is increasingly used as an input for Geographic Information Systems particularly for precise positioning of geospatial data and the collection of data in the field. Precise positioning is possible using GPS receivers at reference locations providing corrections and relative positioning data for remote receivers. Time and frequency dissemination, based on the precise clocks on board the SVs and controlled by the monitor stations, is another, use for GPS. Astronomical observatories telecommunications facilities and laboratory standards can be set to precise time signals or controlled to accurate frequencies by special purpose GPS receivers.

Similar satellite navigation systems include the Russian GLONASS (incomplete as of 2008), the upcoming European Galileo positioning system, the proposed COMPASS navigation system of China, and IRNSS of India.

Following the shooting down of Korean Air Lines Flight 007 in 1983, President Ronald Reagan issued a directive making the system available free for civilian use as a common good. Since then, GPS has become a widely used aid to navigation worldwide, and a useful tool for map-making, land surveying, commerce, scientific uses, and hobbies such as geocaching. GPS also provides a precise time reference used in many applications including scientific study of earthquakes, and synchronization of telecommunications networks.

According ancient Greek scripts BIOMETRICS means study of life. Biometrics studies commonly include fingerprint, face, iris, voice, signature, and hand geometry recognition and verification. Many other modalities are in various stages of development and assessment. Among these available biometric traits Finger Print proves to be one of the best traits providing good mismatch ratio and also reliable. Registering the attendances of students have become a hectic work as sometimes their attendance may be registered or missed. To overcome this problem i.e. to get the attendances registered perfectly we are taking the help of two different technologies viz. EMBEDDED SYSTEMS and BIOMETRICS.

Firstly discussing about Biometrics we are concentrating on Fingerprint scanning. For this we are using FIM 3030N high voltage module as a scanner. This module has in-built ROM, DSP and RAM. In this we can store up to 100 users fingerprints. This module can operate in 2 modes they are Master mode and User mode. We will be using Master mode to register the fingerprints which

will be stored in the ROM present on the scanner with a unique id.

When this module is interfaced to the microcontroller, we will be using it in user mode. In this mode we will be verifying the scanned images with the stored images. When coming to our application the images of the students will be stored in the module with a unique id. To register their attendance the students have to scan their image which is then verified with the image present in fingerprint module and their attendance is registered for that day.

This scanner is interfaced to 8051 microcontroller through max232 enabling serial communication. By using this controller we will be controlling the scanning process. After the scanning has been completed the result is stored in the microcontroller. By simply pressing a switch we can get the list of absentees for that day.

This project uses regulated 5V, 500mA power supply. 7805 three terminal voltage regulator is used for voltage regulation. Bridge type full wave rectifier is used to rectify the ac output of secondary of 230/12V step down transformer.

This project is implemented using following software's:

- Express PCB – for designing circuit
- ARDUINO C compiler - for compilation part
- Proteus 7 (Embedded C) – for simulation part.

#### **Express PCB:**

Breadboards are great for prototyping equipment as it allows great flexibility to modify a design when needed; however the final product of a project, ideally should have a neat PCB, few cables, and survive a shake test. Not only is a proper PCB neater but it is also more durable as there are no cables which can yank loose.

Express PCB is a software tool to design PCBs specifically for manufacture by the company Express PCB (no other PCB maker accepts Express PCB files). It is very easy to use, but it does have several limitations.

It can be likened to more of a toy than a professional CAD program.

It has a poor part library (which we can work around)

It cannot import or export files in different formats

It cannot be used to make prepare boards for DIY production

Express PCB has been used to design many PCBs (some layered and with surface-mount parts. Print out PCB patterns and use the toner transfer method with an Etch Resistant Pen to make boards. However, Express PCB does not have a nice print layout. Here is the procedure to design in

Express PCB and clean up the patterns so they print nicely.

Proteus is software which accepts only hex files. Once the machine code is converted into hex code, that hex code has to be dumped into the microcontroller and this is done by the Proteus. Proteus is a programmer which itself contains a microcontroller in it other than the one which is to be programmed. This microcontroller has a program in it written in such a way that it accepts the hex file from the pic compiler and dumps this hex file into the microcontroller which is to be programmed. As the Proteus programmer requires power supply to be operated, this power supply is given from the power supply circuit designed and connected to the microcontroller in proteus. The program which is to be dumped in to the microcontroller is edited in proteus and is compiled and executed to check any errors and hence after the successful compilation of the program the program is dumped in to the microcontroller using a dumper.

### 3. Results and Discussions

The Project schematic diagram of ‘‘ A SMART HELMET FOR COAL MINE WORKER TO PROVIDE HIGH SECURITY AND SAFETY’’

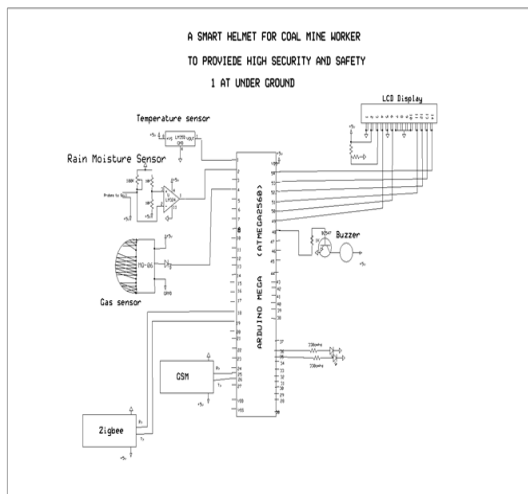


Fig 2: Schematic Diagram tx of Proposed Design

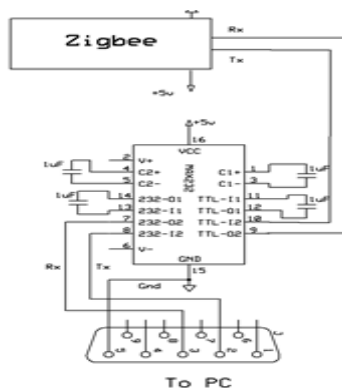


Fig 2: Schematic Diagram 2 of Proposed Design

### 4. Advantages and Disadvantages

#### Advantages:

- There No need of the human should monitor the street light whether the light is ON/OFF so main advantage is we can control via network using of the wireless technology.
- Seeing the status we can control of that lights
- We can use these type projects at home automation

#### Disadvantages

- 1 .Wi-Fi/Internet Connection is fluctuating which may create problems.

#### Applications:

- This project can be used for multiple areas for high security and access system
- Can be applied in the Industrial application
- Corporate offices, colleges,homes,etc
- Military application system.

### 5. Conclusion

The proposed framework can likewise be utilized to refresh existing customary light posts making it a genuine possibility to effectively deal with an arrangement of sensors relevant in various fields including checking of vitality utilization, other Smart City application and shrewd matrices which needs to diffuse sensors and actuators to understand a productive administration of the framework under control.

### 6. References

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