Smart Helmet

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Abstract— EXISTING METHOD: In the existing method the atmospheric conditions inside the coal mines are monitored inside the coal mines by using sensors but the sensed data cannot be sent to the control room every time it monitors the conditions due this method there is no safety to the people to move inside the mines since the conditions inside the coal mines will not be constant every time. PROPOSED METHOD: In the proposed method we are using zigbee as a wireless technology which is used to send the sensed data to the control room on web page in PC every time it measures the data so that they can also continuously monitor the conditions inside the coal mines so that if any dangerous gases gets evolved inside the they can do an immediate action for protecting the people present inside. The system uses a compact circuitry built around S3C2440 (ARM9) microcontroller Programs are developed in Embedded C. Flash magic is used for loading programs into Microcontroller.

Key words: Smart Helmet

I. WORKING

In this project, a continuous monitoring system, which monitors the environmental parameters such as humidity level, the presence of poisonous gases (methane and carbon monoxide) and it also measures the temperature in the coal mines. The different sensors such as methane sensor, carbon monoxide sensor, humidity sensor and temperature sensor are placed in the helmet of the miners. It will sense and gives the values to the microcontroller. The controller compares the input values with the threshold values. If any abnormal condition occurs, it gives us an alert through the buzzer. During mine accidents, most of the miners die due to lack of or delay in rescuing operation. This system uses Zigbee technology for wireless transmission. The temperature is sensed by the temperature sensor and transmitted to the monitoring system through wireless transmission. It is received by the receiver and displayed in the PC. During coal mining consider if the emission of methane is high, the methane sensor fixed in the helmet sense the gas and gives it to the microcontroller. It compares the input value to the threshold value, due to the high value of methane level over the threshold level it alert the miner.

II. BLOCK DIAGRAM

A. *Power supply*

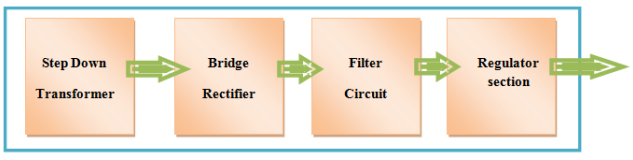
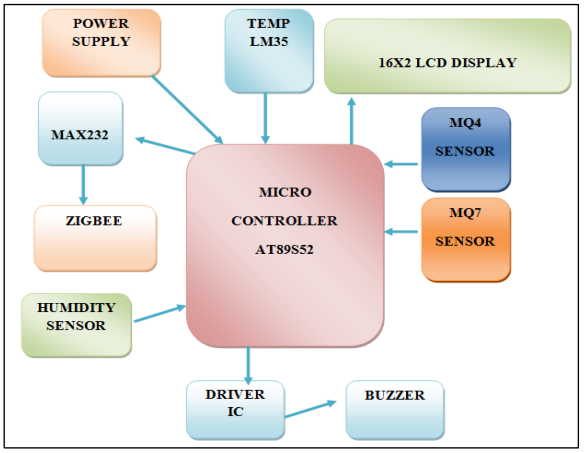


Fig. 1: Block Diagram of Power supply

B. *Transmitter*



C. *Receiver*

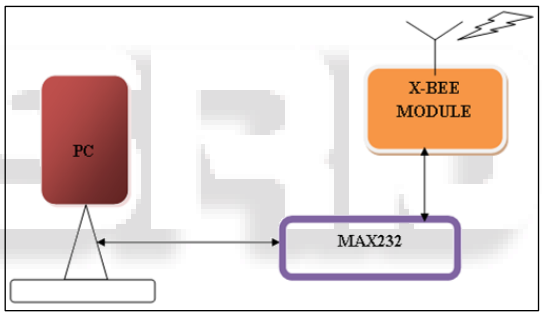


Fig. 2: Block diagram of Transmitter and Receiver

The Helmet section consists of different types of sensors. AT89C52 is used as the Processor. Inputs to the micro controller are various poisonous gases, humidity and temperature of the mines. Miners health is in danger mainly because of the emission of Toxic gases, insufficiency of oxygen and mine disasters. In this project we have designed a continuous monitoring system, which monitors the environmental parameters such as temperature level, humidity and poisonous gases (methane and carbon monoxide). This system uses Zigbee technology for wireless transmission as shown in Fig.1. The parameters are detected continuously by various sensors, if any abnormal condition occurs the miner will get an alert through the buzzer present on the helmet. The values of different sensors are continuously transmitted by wireless transmitter to the remote monitoring unit which is placed outside the mine and received by the receiver module (PC). MQ-7 is the carbon monoxide sensor used which has the sensing element SnO2. MQ-4 is used as the methane gas sensor which has the sensing element SnO2. LM35 is used as a temperature sensor. Buzzer gives an alert in emergency situation. ZigBee is used for wireless communication. The receiver section receives the data and displays it in the computer of the control room as shown in Fig.2.

III. HARDWARE COMPONENTS

A. AT89C52 Microcontroller

The AT89C52 is a low-power, high-performance CMOS 8-bit microcomputer with 8Kbytes of Flash programmable and erasable read only memory (PEROM). The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel AT89C52 is a powerful microcomputer, which provides a highly flexible and cost-effective solution to many embedded control applications.

B. LM35 Sensor (temperature sensor)

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±1⁄4°C at room temperature and ±3⁄4°C over a full −55 to +150°C temperature range. Low cost is assured by trimming and calibration at the wafer level. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies. As it draws only 60 µA from its supply, it has very low self-heating, less than 0.1°C in still air. The LM35 is rated to operate over a −55° to +150°C temperature range, while the LM35C is rated for a −40° to +110°C range (−10° with improved accuracy). The LM35 series is available packaged in hermetic TO-46 transistor packages, while the LM35C, LM35CA, and LM35D are also available in the plastic TO-92 transistor package. The LM35D is also available in an 8-lead surface mount small outline package and a plastic TO-220 package

C. Humidity sensor

Humidity sensors are gaining more significance in diverse areas of measurement and Control technology. Manufacturers are not only improving the accuracy and long-term drift of their sensors, they are improving their durability for use in different environments, and simultaneously reducing the component size and the price. Following this trend, Swiss-based Sensation AG has introduced a new generation of integrated, digital, and calibrated humidity and temperature sensors using CMOS "micro-machined" chip technology. The new products, SYH2 and SYH-2S, are a single chip relative humidity and temperature multi sensor module with a calibrated digital output which allows for simple and quick system integration. Conventional sensors determine relative air humidity using capacitive measurement technology. For this principle, the sensor element is built out of a film capacitor on different substrates (glass, ceramic, etc.). The dielectric is a polymer which absorbs or releases water proportional to the relative environmental humidity, and thus changes the capacitance of the capacitor, which is measured by an onboard electronic circuit. Humidity is an important factor in personal comfort and in quality control for materials, machinery etc. Now we are using SYH2 and SYH-2S humidity sensors in most of the circuits.

D. Carbon monoxide sensor (MQ-7)

Various types of sensors are available in the market in which semiconductor sensors are considered to have fast response. MQ-7 semiconductor sensor is mainly used for detecting carbon monoxide (CO). MQ-7 gas sensor composed of micro Al2O3 ceramic tube and Tin Dioxide (SnO2). Electrode and heater are fixed into a crust. The heater provides required work conditions for the work of sensitive components. The conductivity of sensor is higher along with the gas concentration rising. When the sensor, heated by 5V it reaches at high temperature, it cleans the other gases adsorbed under low temperature. The MQ-7 have 6 pins in which 4 of them are used to fetch signals and other 2 are used for providing heating current

E. Methane gas sensor (MQ-4)

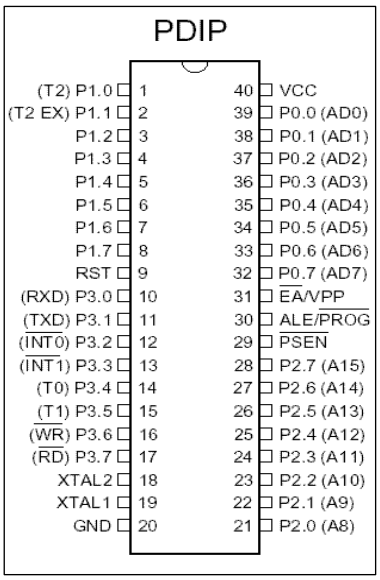
MQ-4 gas sensor composed of ceramic tube and Tin Dioxide. Electrode and heater are fixed into a layer. The heater provides required work conditions for the work of sensitive components.SnO2 is used as a sensing element. When the target combustible gas present, the conductivity of sensor is higher along with the gas concentration rising. The MQ-4 sensor has 6 pins in which 4 of them are used to fetch signals and other 2 are used for providing heating current

IV. MICROCONTROLLER 89S52

A. Features

- 8K Bytes of In-System Reprogrammable Flash Memory
- Endurance: 1,000 Write/Erase Cycles
- Fully Static Operation: 0 Hz to 24 MHz
- 256 x 8-bit Internal RAM
- 32 Programmable I/O Lines
- Three 16-bit Timer/Counters
- Eight Interrupt Sources
- Programmable Serial Channel
- Low-power Idle and Power-down Modes

B. Pin Diagram - AT89S52



C. Pin Description

VCC - Supply voltage.
GND - Ground.

1) Port 0:

Port 0 is an 8-bit open drain bi-directional I/O port. As an output port, each pin can sink eight TTL inputs. When 1s are written to port 0 pins, the pins can be used as high-impedance inputs. Port 0 can also be configured to be the multiplexed low-order address/data bus during accesses to external program and data memory. In this mode, P0 has internal pull-ups. Port 0 also receives the code bytes during Flash programming and outputs the code bytes during program verification. External pull-ups are required during program verification.

2) Port 1:

Port 1 is an 8-bit bi-directional I/O port with internal pull-ups. The Port 1 output buffers can sink/source four TTL inputs. When 1s are written to Port 1 pins, they are pulled high by the internal pull-ups and can be used as inputs. As inputs, Port 1 pins that are externally being pulled low will source current (IIL) because of the internal pull-ups. In addition, P1.0 and P1.1 can be configured to be the timer/counter 2 external count input (P1.0/T2) and the timer/counter 2 trigger input (P1.1/T2EX), respectively.

a) Port Pin Alternate Functions

P1.0 T2 (external count input to Timer/Counter 2), clock-out
P1.1 T2EX (Timer/Counter 2 capture/reload trigger and direction control

3) Port 2:

Port 2 is an 8-bit bi-directional I/O port with internal pull-ups. The Port 2 output buffers can sink/source four TTL inputs. When 1s are written to Port 2 pins, they are pulled high by the internal pull-ups and can be used as inputs. As inputs, Port 2 pins that are externally being pulled low will source current (I IL) because of the internal pull-ups. Port 2 emits the high-order address byte during fetches from external program memory and during accesses to external data memory that use 16-bit addresses (MOVX @ DPTR). In this application, Port 2 uses strong internal pullups when emitting 1s. During accesses to external data memory that use 8-bit addresses (MOVX @ RI), Port 2 emits the contents of the P2 Special Function Register. Port 2 also receives the high-order address bits and some control signals during Flash programming and verification.

4) Port 3

Port 3 is an 8-bit bi-directional I/O port with internal pullups. The Port 3 output buffers can sink/source four TTL inputs. When 1s are written to Port 3 pins, they are pulled high by the internal pullups and can be used as inputs. As inputs, Port 3 pins that are externally being pulled low will source current (I IL) because of the pullups. Port 3 also serves the functions of various special features of the AT89C51. Port 3 also receives some control signals for Flash programming and verification.

a) Port Pin Alternate Functions

- P3.0 RXD (serial input port)
- P3.1 TXD (serial output port)
- P3.2 INT0 (external interrupt 0)
- P3.3 INT1 (external interrupt 1)
- P3.4 T0 (timer 0 external input)
- P3.5 T1 (timer 1 external input)
- P3.6 WR (external data memory write strobe)
- P3.7 RD (external data memory read strobe).

D. RST

Reset input. A high on this pin for two machine cycles while the oscillator is running resets the device.

E. ALE/PROG

Address Latch Enable is an output pulse for latching the low byte of the address during accesses to external memory. This pin is also the program pulse input (PROG) during flash programming. In normal operation, ALE is emitted at a constant rate of 1/6 the oscillator frequency and may be used for external timing or clocking purposes. However, that one ALE pulse is skipped during each access to external data memory. If desired, ALE operation can be disabled by setting bit 0 of SFR location 8EH. With the bit set, ALE is active only during a MOVX or MOVC instruction. Otherwise, the pin is weakly pulled high. Setting the ALE-disable bit has no effect if the microcontroller is in external execution mode.

F. PSEN

Program Store Enable is the read strobe to external program memory. When the AT89C52 is executing code from external program memory, PSEN is activated twice each machine cycle, except that two PSEN activations are skipped during each access to external data memory.

G. EA/VPP

External Access Enable (EA) must be strapped to GND in order to enable the device to fetch code from external program memory locations starting at 0000H up to FFFFH. However that if lock bit 1 is programmed, EA will be internally latched on reset. EA should be strapped to VCC for internal program executions. This pin also receives the 12V programming enable voltage (VPP) during Flash programming when 12V programming is selected.

H. XTAL1

Input to the inverting oscillator amplifier and input to the internal clock operating circuit.

I. XTAL2

Output from the inverting oscillator amplifier

V. Experimental Setup

Hardware setup of the system is shown in the fig.4 and Zigbee Transmitter and Receiver is shown in fig.5

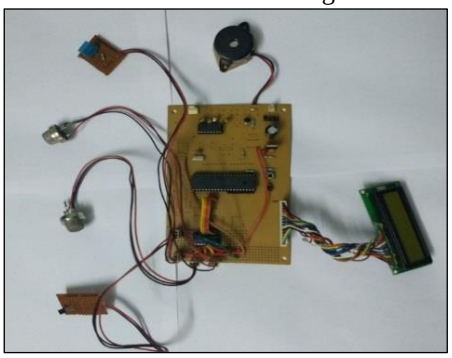


Fig. 4: Hardware setup of the system

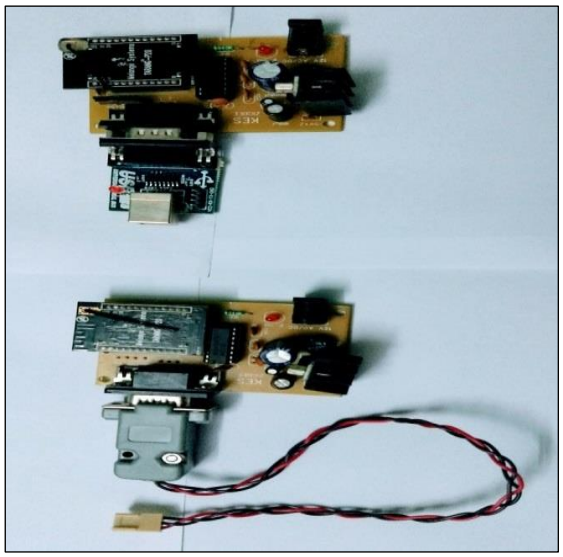


Fig. 5: Zigbee Transmitter and Receiver

VI. ADVANTAGES

- Safety monitoring of the environment
- Improved sevices in the coal minning
- Providing wireless connection security
- Faster check out /in
- Prevent from high temperature ,humidity and harmful gases
- Quick searching and able to give warning
- economical

VII. CHALLENGES

The main challenge is accuracy, system errors of less than 1 degree C can be difficult to achieve

VIII. CONCLUSION

Thus this system will enhances the security system for underground coal miners. A larger area and more depth inside hazardous underground mines are now can be covered and potential accidents can be controlled effectively. The sensor and Zigbee module can be preferably installed over the helmet of mine worker. Proper monitoring can help to take appropriate actions more rapidly and smartly if any abnormal situation occurs. The system also can be easily extended with ZigBee wireless image transmission facility in future.

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