MONITORING ENVIRONMENTAL VARIABLES OF MINING WORKERS

Dr. D. Vishnu Vardhan\textsuperscript{1}, Assistant professor in JNTUA college of engineering\textsuperscript{1}, Anantapuram\textsuperscript{1}

Vishnu.ece@jntua.ac.in\textsuperscript{1}

Shaik. Karimullah\textsuperscript{2}, Assistant professor in Annamacharya Institute Of Technology And Sciences\textsuperscript{2}, Rajamper\textsuperscript{2}

Munnu483@gmail.com\textsuperscript{2}

\textsuperscript{1}EmailId:siva.lachhannagari@gmail.com

Abstract:
In this paper we are monitoring humidity and temperature values of the environment with the help of DHT11 sensor and updated to PC and also displayed on the LCD at user side by using ZIGBEE technology. It is very much useful for mines to avoid threats caused by sudden changes in environment.

Keywords - Arduino, ZIGBEE, LCD, DHT11 Sensor.

INTRODUCTION
Workers in hazard areas like mining or chemical industry must handle extreme climatic and physiological hazards without specialized medical supervision. For this reason, the industry is constantly looking for improvements to existing occupational safety and health (OS&H) programs in order to enhance working conditions for people and equipment.

The proposed system will use to continuous monitor and measure the environmental variables of the workers in hazard areas. Extreme environment conditions are detrimental for human health. Therefore a continuous control of the workers’ vital signs is necessary.

EXISTING SYSTEM:
In this system humidity and temperature values are not monitored but just give alarm by using Bluetooth technology.

PROPOSED SYSTEM:
In the proposed system we are monitoring environmental variables of mining area and updated to PC by using ZigBee technology. We can observe the variable values continuously.

The two parameters which are going to measure are temperature and humidity of the mining area. Temperature sensor is used to measure temperature of mining area. Humidity sensor is used to measure humidity of mining area. These parameters are updated PC continuously.

BLOCK DIAGRAM:

\textbf{Transmitter section:}

\begin{center}
\begin{tikzpicture}
\node [draw] (A) {Power supply};
\node [right of=A, draw] (B) {DHT11 Sensor};
\node [right of=B, draw] (C) {Arduino};
\node [right of=C, draw] (D) {LCD};
\node [right of=D, draw] (E) {zigbee};
\end{tikzpicture}
\end{center}

\textbf{Receiver section:}

\begin{center}
\begin{tikzpicture}
\node [draw] (A) {zigbee};
\node [right of=A, draw] (B) {PC};
\end{tikzpicture}
\end{center}
HARDWARE REQUIREMENT:

ARDUINO:

The Arduino Micro Controller is an open source platform which has 6 analog pins, 14 digital pins, one serial port, one power jack and one usb jack for code dumping.

ATMEGA328P FEATURES:

- Elite steadiness, Low Power utilization with 8-Bit Microcontroller.
- Progressed Reduced Instruction Set Computer (RISC) Architecture which has the accompanying components as takes after
  - It has 131 Strong Instructions.
  - Most executable instruction is single clock cycle.
  - 32 sticks each with eight universally useful working registers
  - It accompanies completely static operation
  - At 20 MHz it has the throughput up to 20 Million Instructions Per Second (MIPS)
  - It has two cycles of multiplier on chip
  - It has senior non-fickle Memory Segments
  - It has 32 Kilo Bytes of In-scheme self-designed Flash program memory
  - It has 1K Bytes EEPROM
  - It has 2K Bytes Intramura static RAM (SRAM)
  - It has compose/eradicate cycles of 10,000 glimmer/100,000 EEPROM
  - The aggregate information maintenance capacity of around 20 years at 85°C/100 years at 25°C
  - facultative boot code area with self-determining bolt bits which has both In-System designed by on-chip boot loader program and genuine read while compose operation
  - The program can be bolted with the assistance of the product security
  - A portion of the fringe elements are as per the following
  - There are two 8-bit clocks/counters with independent re-scale and think about mode
  - There are two 8-bit clocks/counters with independent re-scale and think about mode
  - It has constant counter with isolated oscillator work
  - It has six PWM channels
  - It has 10-bit ADC in TQFP and QFN
  - An arrangement of 10-bit ADC in PDIP
  - A USART for serial communication
  - There are two-master slave SPI linkup’s
  - Designed guard dog clock with isolated on-chip oscillator
  - Special features of the µc are detailed:
    - It will get reset when power on.
    - It also has the internal Oscillator
    - Two separate sources are available.
    - An extra 6 sleep modes are available, stand-by mode is also available
  - The I/O and Babbage are
    - It has 28- I/O lines
    - 28-pin in PDIP, 32-lead in TQFP, 28-pad in QFN/MLF and 32-pad in QFN/MLF
  - Executing voltage are as follows
    - 1.8 - 5.5V for Atmega328P
  - Temperature range is
    - -40°C to 85°C
  - Speed grade is
    - 0 - 20 MHz at 1.8 - 5.5V
  - Low Power utilization at 1 MHz, 1.8V, 25°C for ATmega328P:
    - Active Mode: 0.2 mA
    - Power-down Mode: 0.1 µA
    - Power-save Mode: 0.75 µA (Including 32 kHz RTC)
**PIN ARRANGEMENT**

- **VCC**: Digital supply voltage.
- **GND**: Earth ground.
- **Port B (PB.7-PB.0)**:
  - It contains the data transmission from 8-bit two-way I/O port, these having internal pull-up resistors. It has the PIN range from PB.7-PB.0. These pins also have some external features such as XCTL1, XCTL2 and OSC1, OSC2 for oscillator Frequency and Asynchronous timer/Counter.
- **Port C (PC.5-PC.0)**:
  - It is a 7-bit two-way port I/O port which has in-built pull-up resistors the pin arrangement is from PC.5-PC.0. It has a tri-state condition which is used when reset condition becomes active the clock don’t run.
- **PC6/RESET**:
  - It is a programmable reset pin which is used to RESTART the program from the starting position. The Execution starts from the first line of the program.
- **Port D (PD.7-PD.0)**:
  - It is a 7-bit two-way port I/O port which has in-built pull-up resistors the pin arrangement is from PC.5-PC.0. It has a tri-state condition which is used when reset condition becomes active the clock don’t run.
- **AVCC**:
  - It is the Power Supply pin for A/D conversions, PC3:0 and ADC7:6. It should be linked with the VCC supply
- **AREF**: AREF is the analog reference pin for the A/D Converter
- **ADC7:6 (TQFP and QFN/MLF Package Only)**: In the TQFP and QFN/MLF package, ADC7:6 serve as analog inputs to the A/D converter. These pins are powered from the analog supply and serve as 10-bit ADC channels.

**DHT11SENSOR**
*(TEMPERATURE/HUMIDITY SENSOR)*

DHT sensor includes temperature sensor and humidity sensor in single module. It gives both digital and analog data output.

**Specification**

- Its Operating voltage is +5 V
• Its temperature range from 0 °C to 50 °C with the error of ± 2 °C
• Its Humidity ranges from 20 to 90%

**LCD (Liquid Crystal Display)**

LCD (Liquid Crystal Display) screen is a digital display module and discover a vast hodgepodge of employments. A 16x2 LCD show is fantastically basic module and is commonly used as a piece of numerous gadgets and circuits. These modules are supported more than seven elements and different multi segment LEDs.

• The fee enlist shops the summon directions given to the LCD. A summon is a direction given to LCD to do a predefined undertaking like introducing it, clearing its display, placing the cursor function, controlling showcase and so on. The statistics enlist shops the statistics to be shown on the LCD. The facts are the ASCII estimation of the character to be proven at the LCD. Snap to soak up more about inner structure of a LCD. There are numerous styles of LCD’s like 16x2 and 20x4. Here on this challenge we use 16x2 LCD. Here we use dot matrix LCD.

**pin diagram:**

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**POWER SUPPLY:**

It is a circuit which converts AC to DC. It is very essential circuit required for any electronic gadget like mobile, laptop, etc...

*Some Basic components used in Power Supply:*

**Transformers**

Transformer is an electrical component which transfers electrical energy from one circuit to another circuit by changing its voltage strength.

Here we are using step down transformer for reducing 230 V to 12 v.

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**Rectifier:**

Rectifier is an electronic component which converts AC to pulsating DC.

Here we are using four diodes as a bridge rectifier which has high efficiency.
It doesn’t change voltage strength.

**Capacitors:**
Capacitors are used to convert pulsating DC to smooth pure DC. It filters small AC components.

**Voltage regulators:**
Voltage regulator is used to regulate constant voltage. Here we are using 7805IC Which can output 5 V DC

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**ZIGBEE MODULE**
Zigbee standard is an IEEE 802.15.4.Zigbee is used to create PAN(Personal Area Network) and it suite for high level communication protocols. It used for home automation, in medical for data collection, it provides wireless communication for small scale projects. Zigbee requires less power and its data rate is low and it is close to wireless and hoc networks.

This device network has the characteristics of electric power-saving, reliability, low cost, large capacity and security, and it can be widely used in various fields of automatic control. This can be used at different applications like industry area, home automation, remote control, medical vehicles and agriculture applications

**How Zigbee Works (brief)**
The ZigBee standard has the capacity to address up to 65535 nodes in a single network. ZigBee Protocol defines in three types of nodes in general: they are coordinators, routers and end devices. for one network it requires one coordinator at least. All nodes are used to send data and receive data. These nodes play their specific roles. A sample zigbee network is as shown in figure.

**Zigbee Coordinators (Network Creator) -** are the most capable of the three node types. There is exactly one coordinator in each network and it is the device that establishes the network originally. This zigbee can store information about network and it’s security keys.

**Zigbee routers(multi-hop routing) -** it acts like an intermediate router in network and used for relaying data from other devices in network.

**Zigbee End Devices (Very low power) –** these zigbee end devices are low powered or battery powered devices. They are used to communicate with their parents i.e., either a coordinator or a router. But it does not relay data from other devices as the router does. It reduces the cost.

To provide for low cost implementation options, the ZigBee Physical Device type distinguishes the type of hardware based on the IEEE 802.15.4 definition of reduced function device (RFD) and full function device (FFD). The zigbee network to act as a network coordinator it requires atleast one FFD.
ZigBee uses two types of devices they are RFDs and FFDs. RFDs which stands for Reduced-Function devices and these RFDs are sensors that are used to communicate with FFDs (Full-Function Devices). These FFDs are complex nodes and can serve as a routers. ZigBee Coordinator gives instructions to the end devices. ZigBee networks must have a coordinator, which is a full function device that used to manages the network.

ZigBee technology provides different networking algorithms to provide large coverage area like static and dynamic star, cluster tree and mesh networking structures.

If the end device is far away from its coordinator, at that time it communicates through a router with the coordinators. The figure shows a mesh network. The term mesh is used because of the routers and coordinators have multiple communication path options. These ZigBee routers extends the network, Using local addressing and it is more than 65,000 (216) nodes, thereby reducing address overhead.

**Zigbee Applications**
- a. Home, building and industrial  
- b. Automation  
- c. Energy harvesting  
- d. Home control/security  
- e. Medical/patient monitoring  
- f. Logistics and asset tracking  
- g. Sensor networks and active RFID  
- h. Advanced metering/smart energy  
- i. Commercial building automation

Sensors are used for different applications to monitor different parameters. These zigbee is mainly used to collect the analog data from the sensors and transmitting it wirelessly. Some of the sensor application are lighting control, TV remote control, door control & remote temperature sensor.

**SOFTWARE DESCRIPTION:**

Arduino IDE:

The Arduino IDE software is a open source software, where we can have the example codes for the beginners. In the Present world there are lot of version in the Arduino IDE in which present usage is Version 1.0.5. It is very easy to connect the PC with Arduino Board.

**APPLICATIONS**

Used to monitor the environmental variables of workers and patients in hospitals.

**ADVANTAGES:**
- Low power consumption  
- More reliable  
- More compatible  
- Less cost

**RESULT:**

The monitored results of temperature and humidity of environment are displayed on LCD at user side as shown in below figure.

**CONCLUSION:**

In this system we are monitoring environmental variables of mining area and updated to PC by using zigbee module.

**REFERENCES:**


AUTHOR PROFILE:
1. Dr. D. Vishnu Vardhan received his BTech degree in ACE from RDM college of engineering and MTech from JNTU Kakinada. Currently he is working as assistant professor in JNTUA college of engineering, Anantapuram. His research areas includes embedded in embedded system, signal processing and VLSI system design.

2. Shaik Karimullah received his BTech degree in MeRITS college of engineering and MTech from Madina college of engineering. Currently he is working as assistant professor in Annamacharya Institute Of Technology and Sciences, Rajampet. His research areas includes VLSI system design.

3. E. Rachana studying final year in Annamacharya Institute Of Technology and Sciences, Rajampet and her research area Embedded system.

4. Ravindra Naidu studying final year in Annamacharya Institute Of Technology and Sciences, Rajampet and his research area Embedded system.

5. D. Rajasekhar studying final year in Annamacharya Institute Of Technology and Sciences, Rajampet and his research area Embedded system.