WSN Based Parameters Monitoring and Control for Specialized Mining Equipment

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ABSTRACT: The mining machines are very large and movable. It's very difficult to monitor the various parameters and also controlling the speed & direction of the motor by using cables. Therefore in the wired communications cost is high &it is very complex to measure the parameters due to various physical conditions.

Wireless control and monitoring system for a motor is realised using the zigbee communication protocol for safe and economic data communication in mining field. The various parameters of motor are measured by sensor and it's transmitting via zigbee also Speed, direction of the motor is controlled through the ATMEGA16 Microcontroller. All the processors & controllers are interconnected to PC through zigbee network. The personal computer will continuously monitoring and control all the data from remote location. The parameter is update on database through the internet for data can be exchanged among the computers which are longer distances through the internet connection. People from the remote location use the IP address for accessing the information.

KEYWORDS: Zigbee, WSN, Motor.

I. INTRODUCTION

Mining equipment is a continuous operation and moving machine among the largest terrestrial vehicles. It   mine coal, gravels sand from ground also Materials may be removed by scraping or digging them above ground or drilling into underground. Mining equipment driven by electrical motor and its need special controlling cables.

Cables are damage due to mining equipment continuous operation so it affects the cost of spare and also affects availability of machinery. The wireless control and monitoring system eliminate those problems it measure parameter of motor and it sent through wireless communication using Zigbee. Zigbee is a high-level communication device. It's a low power consumption limits transmission distances to10-120 meters line-of sight, it also act as a transmitter and receiver. The transmitter and receiver section which are controlled by ATMEGA16 microcontroller MPU unit. Measured values are primary control by control room user display in computer. Computers are connecting to the Web server through the internet. The data can be exchanged among the computers which are longer distances through the internet connection to the Web server. This feature facility provides us to transmit the data to the longer distance this will maintain the database of the information. By typing IP address on the web browser the user get a web page on the screen this page contains all the information about the status of the derive.

II. DESIGN METHODOLOGY

Wireless control and monitoring system for mining equipment is realized using the Zigbee communication protocol for safe and economic data communication in mining where the wired communication is either more expensive or impossible due to physical conditions. The motor will be start/ stop, speed high/low, direction clock/ anti clockwise via Wireless due to the computer interface developed with Zigbee also possible to monitor operation .Moreover, a database is built to execute online measurements and to save the motor parameters received by data acquisition system. Therefore, control monitoring, and protection of the system are realized in real time.

Controlling abilities of the system are increased and also hardware and the necessities of other similar equipment for data communication are minimized. The system is fully controlled by the Personal Computer. All the processor and

controllers are interconnected to personal computer through Zigbee. The Personal Computer will continuously monitor all the Data from remote processing unit. If any error is found in a system the personal computer takes necessary action.

III. BLOCK DIAGRAM

Mining equipment parameters like current, voltage and speed are measure by IR and LTC2990 sensor and it sent data wirelessly to controller circuit via zigbee node it act as a transmitter. Another zigbee node act as a receiver it receive data and it connect to ATMEGA16 for control operation.

ATMEGA16 is data through control room PC via RS232 cable. The personal computer is a user controllable unit it control entire system operation by user. It control motor start/stop, direction and speed condition from control room pc. Computer update system parameters on data base regularly for Web based access.
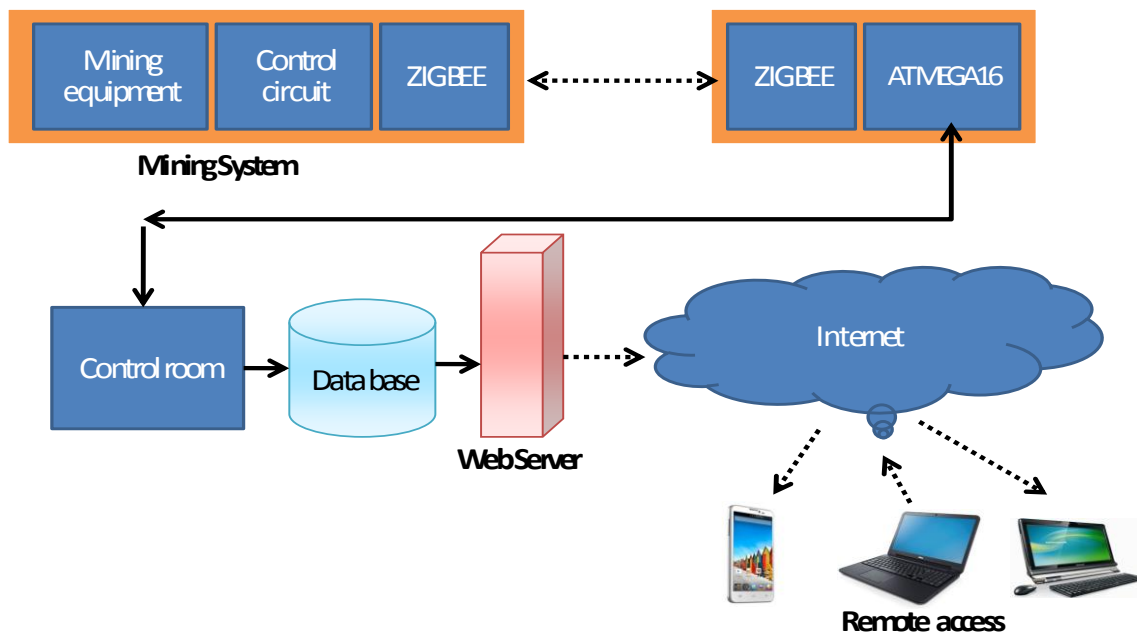

Fig.1 Block diagram

DC Motor: A DC motor is designed to run on DC electric power, which will operate in the ratings of 12v DC and supports 0.6A. A DC motor is electric motor powered from direct current (DC). The stator is stationary in space by definition and therefore it's current. The current in the rotor is switched by the commutates to also be stationary in space. This is how the relative angle between the stator and rotor magnetic flux is maintained near 90 degrees, which generates the maximum torque.

ATMEGA16: The ATmega16 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. Executing powerful instructions in a single clock cycle, the ATmega16 achieves throughputs approaching 1 MIPS per MHz allowing the system designed to optimize power consumption versus processing speed.

The AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one

single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers.

The ATmega16 AVR is supported with a full suite of program and system development tools including: C compilers, macro assemblers, program debugger/simulators, in-circuit emulators, and evaluation kits.

Zigbee Protocol: ZigBee is a synonym of IEEE 802.15.4 protocol, which is a hot research topic in short-distance wireless communication technology. Its main advantages are dissipating low-power, lower complexity, self organization, being low-cost,
It is widely used in industry, home and building automation, automatic control, monitoring and control of agricultural area, hospital and other fields.
Zigbee Frequencies:
- Operates in Unlicensed Bands
- ISM 2.4 GHz Global Band at 250kbps
- 868 MHz European Band at 20kbps
- 915 MHz North American Band at 40kbps

LTC 2990: The LTC2990 is used to monitor system temperatures, voltages and currents. Through the I2C serial interface, the device can be configured to measure many combinations of internal temperature, remote temperature, remote voltage, remote current and internal VCC.
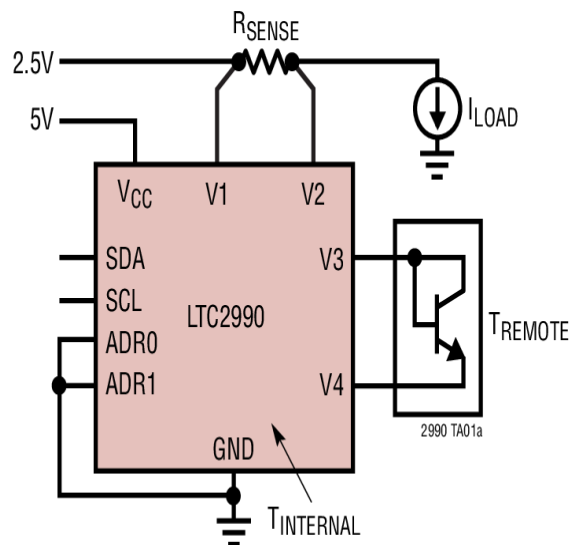

Fig.2 LTC2990

The LTC2990 monitors voltage, current, internal and remote temperatures. configured through an I2C interface to measure many combinations of these parameters. Single or repeated measurements are possible. Remote temperature measurements use a transistor as a temperature sensor, allowing the remote sensor to be a discrete NPN (ex. MMBT3904) or an embedded PNP device in a microprocessor or FPGA. The internal ADC reference minimizes the number of support components required. The first tag in a pair is the start tags, and the second tags the end tag.

Power supply: The board takes 5V input power supply is a device that supplies electric power to an electrical load. The term is most commonly applied to electric power converters that convert one form of electrical energy to another through it may also refer to devices that convert another form of energy to electrical energy.

Web page*:* Web page is a web document that is suitable for the web browser. A web browser displays a webpage on a monitor or mobile device. The web page is what displays, but the term also refers to a computer file, usually written in HTML or comparable mark up language.

Web browser coordinate the various web resource elements for the written Page, such as style sheets, scripts and images, to present the web page.

Typical web pages provide hypertexts that include a navigation bar or a sidebar menu to other web pages via hyperlinks, often referred to as links.

On a network, a web browser can retrieve a web page from a remote web server. On a high level, the web server may restrict access to only a private network such as a corporate internet or it provides access to the World Wide Web. On a lower level, the web browser uses HTTP to make such requests.

IV. RESULT AND DISCUSSION

Using PROTUES 8 software for simulation of monitoring motor parameters and control its operation.
MODULES:
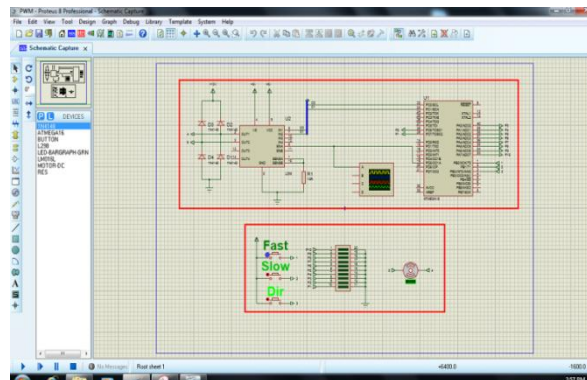### A. Motor runs at high speed

Fig. 3 Motor runs at high speed

In the fig 3, it shows the display of motor speed condition. When we are going to close the fast switch at that time motor rotate at high speed and LED indicate the speed level.
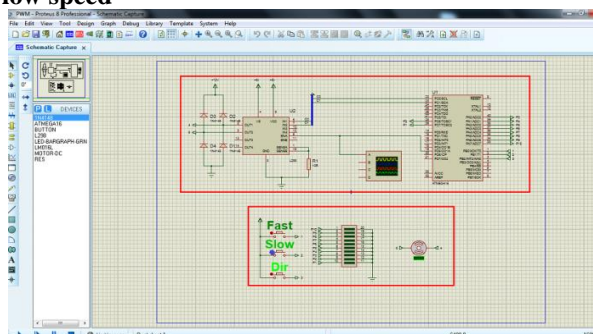
B. Motor runs at low speed

Fig. 4 Motor runs at low speed

In the fig 4, it shows the display of motor speed condition. When we are going to close the slow switch at that time motor rotate at low speed and LED indicate the speed level.
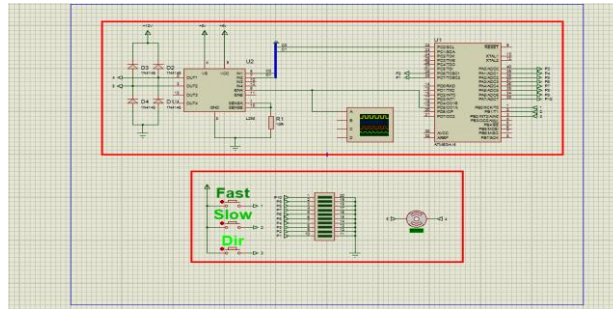
C. Motor rotate Clockwise

Fig. 5 Motor rotate clock wise

In the fig 5, it shows the display of motor direction. When we are open the direction switch at the time motor rotate clock wise.

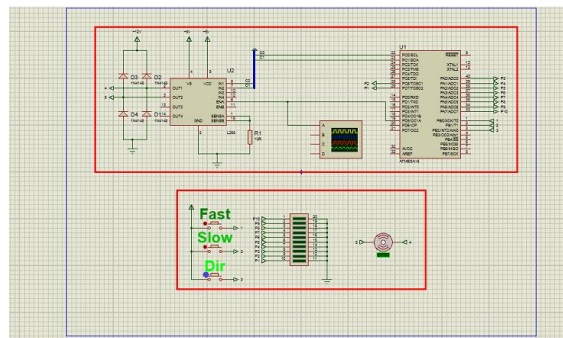### D. Motor rotate Anticlockwise

Fig. 6 Motor rotate anti clock wise

In the fig 6, it shows the display of motor direction. When we are close the direction switch at the time motor rotate clock wise.
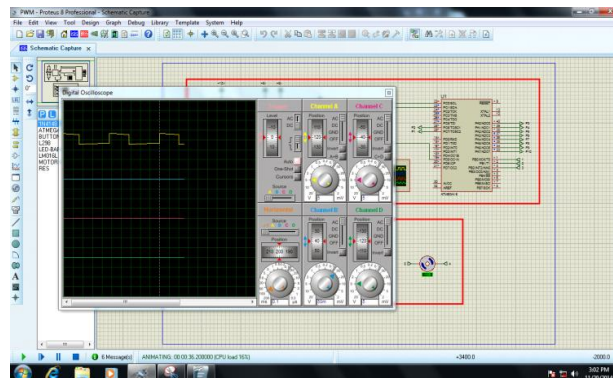
E. Monitoring motor condition

Fig.7 monitoring motor condition

In the fig 7, it shows the display of motor voltage level. It helps to change the motor speed.

VI. CONCLUSION

In this simulation is carried out of wireless monitoring and control. The monitoring parameters are speed, voltage and direction of the mining equipment. Controlling motor start/stop, direction and speed is exceeds by using PROTUES 8 software.

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BIOGRAPHY

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