

Lab view Based Portable Control Room using Zigbee

¹R. N. Patro, ²A. K. Bal, ³B. S. Swain, ⁴Prof. K. V. Murali Mohan
^{1,2,3} Dept. ECE (Embedded Systems), ⁴Head of Dept. ECE
HITS, JNTU, Hyderabad

Abstract— In Industries various sensors are being used which are to be monitored continuously and accordingly control also should be done. Manual control, wired communication and lack of storage database make the system ineffective.

The present concept is to develop a model based on embedded system for wireless sensor integration, data acquisition and control using a graphical system based on Lab-VIEW. The design can be termed as a portable control room. ZIGBEE is used for establishing wireless link. Industrial sensors like temperature, pressure, humidity, smoke, gas leakage, fire, voltage and current are interfaced with microcontroller. Output devices like relay, display unit, buzzer and actuators (DC motor, Stepper motor, Induction motor) are interfaced for controlling the system. PIC18F458 microcontroller is used for sensor and actuator integration. GUI using Lab-VIEW is developed as CAMAC (Computer Automated Measurement And Control) for ease of user interaction.

I. INTRODUCTION

The present model consists of two modules one is Industry module and other is control room module. In the Industrial module all the sensors and actuators like temperature, pressure, humidity, current, voltage, smoke, gas leakage, display device (LCD), buzzer, motors (DC, stepper, Induction), relay and ZIGBEE for communication are being connected. Receiver module is directly having a ZIGBEE connected with PC through RS232 interface. The PC is being loaded with Lab-VIEW software where a GUI is developed which acquires the data through ZIGBEE and sends the control signal accordingly.

II. DESCRIPTION

Industrial sensors are to be continuously monitored. These sensors may be Analog or Digital. Analog sensors need ADC to be digitized. Analog temperature sensor LM35 is used for measuring temperature. MPS3110 series Analog pressure sensor is used for sensing the pressure. Analog humidity sensor SYH-2 used for sensing the humidity of the air. MQ-9 and MQ-5 sensors used for detecting the smoke and gas leakage detection respectively. Flame detector with comparator LM358 used for detecting the fire in industries. Voltage and current are mainly monitored for better load management and protection system. For sensing the voltage of a given system Voltage Transformer (VT) and for current, Current Transformer (CT) followed with rectifier and voltage divider are being used. For sensing all these sensors more channel ADC is needed, again the scaling factor for each sensor will be different, so instead of interfacing external

ADC it's better to have a microcontroller having internal ADC. So PIC18F458 microcontroller is used for development.

For wireless communication link ZIGBEE is used which is a low power low cost device communicates through serial communication (RS232). PIC microcontroller supports UART for serial communication. The communication between ZIGBEE module and microcontroller is done through a TTL logic voltage converter IC (MAX232). The same is used for interfacing PC with ZIGBEE.

For controlling various devices relay units (SPDT) are interfaced and these relay are controlled through driver ULN2003. DC motor is being controller by the driver L293D. Stepper Motor is being controlled by driver L298N. Induction motor control is done through Opto-Isolator (MOC3010) and TRIAC (BT139). Speed control mechanisms of these actuators are managed by PWM (Pulse Width Modulation) Technique.

In the control room module PC with Lab-VIEW is designed for data logging and control. Graphical view of voltage, current, humidity, gas, temperature etc are being shown on PC with user defined set point option (user indicator).

The model can work on two different modes that are automatic and manual. In automatic mode according to the set point mentioned if any sensor exceeds its respective relay will be activated with a wireless voice alert indicating caution. In manual mode these relays to be operated manually.

The speed and direction of DC and Induction motor can be controlled through the knob and switches (user control) present on the PC model. Specific angle of rotation can be (forward or backward) managed for stepper motor by specifying the number of steps in Lab-VIEW.

Both the modules need power supply to be developed for the necessary hardware and peripherals connected. In general 230 VAC needed to be converted to 12/9/5/3.3 VDC which can be carried out by transformer, rectifier, voltage regulator, filter, indicator and switches consequently.

III. BLOCK DIAGRAM

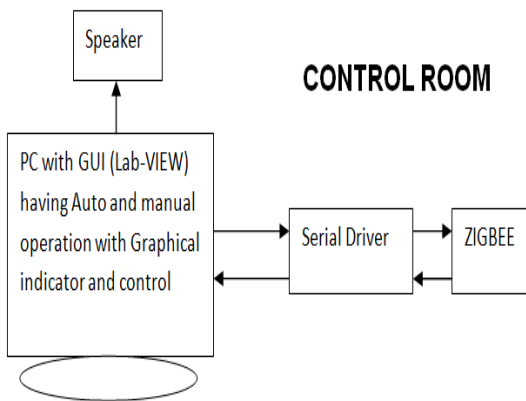


Fig-1 Block diagram of control room PC module

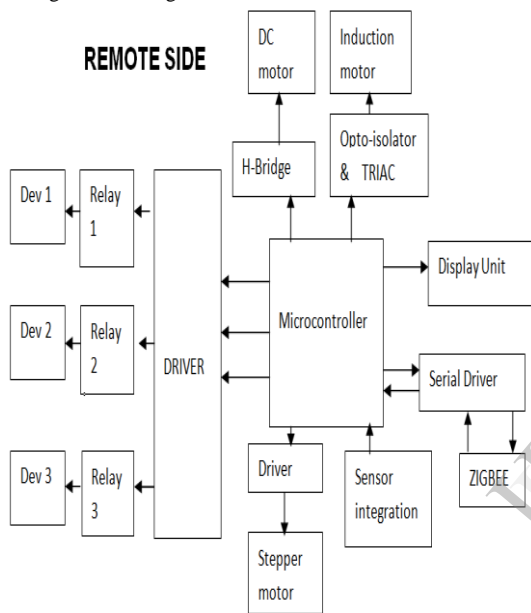


Fig-2 Block Diagram Of Remote Industry Module

IV. DATA FRAME AND COMMUNICATION PROTOCOL

Transmit frame from microcontroller to PC

Start	Temp.	Press.	Hum.	Curr.	Volt.	Smoke	Gas	Stop
X	XXX	XXX	XXX	XXX	XXX	XXX	XXX	X

Receive frame from PC to microcontroller
Sensor status

Start	Temp.	Press.	Hum.	Curr.	Volt.	Smoke	Gas	Stop
X	X	X	X	X	X	X	X	X

Actuator status

	DC motor		Stepper motor		Induction Motor		
Start	Dir	Speed	Dir	Step	Dir	Speed	Stop
X	X	XX	X	XX	X	XX	X

Start/Stop X- (A-Z); X- Single bit number vary (0-9).

Eg. Temperature XXX - 045 (45°C)

Dir X - 0 (Clock wise) – 1 (Anti Clock)

After reading the ADC, sensor values are being scaled, displayed on LCD and transferred along with

the transmit frame through ZIGBEE. In the receiver PC Lab-VIEW receives all the data and process according to the user input threshold values and generates two data packets with start and stop bits associated with it. It waits for two different receive frames that are sensor and actuator respectively. According to the received data the relay and the motors are being controlled. Start and stop bits are mentioned for data security.

V. FLOW CHART

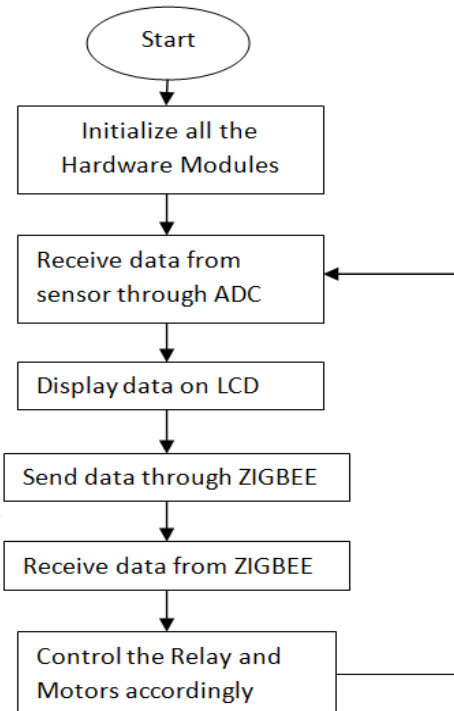


Fig-3 Flow chart of microcontroller software design

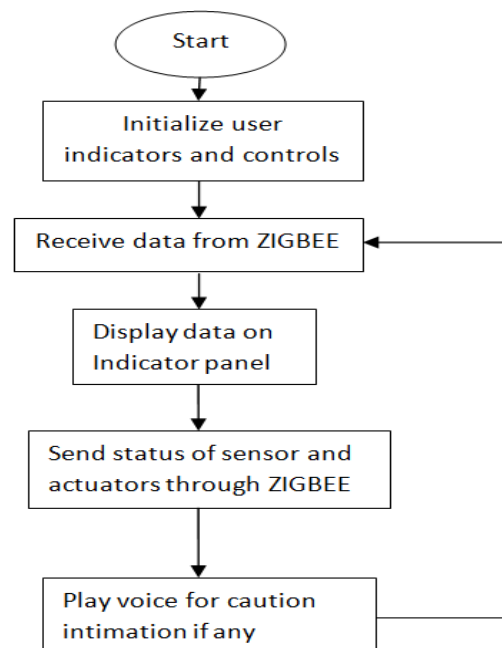


Fig-4 Flow chart of Lab-VIEW software design

VI. LAB-VIEW MODELLING

Lab-VIEW programs are called virtual instruments, or VIs, because their appearance and operation imitate physical instruments, such as oscilloscopes and millimetres. Lab-VIEW contains a comprehensive set of tools for acquiring, analyzing, displaying, and storing data, as well as tools to help you troubleshoot code you write.

Lab-VIEW software development steps:

1. Define the problem (scenario).
2. Design an algorithm and/or flowchart.
3. Implement the design.
4. Test and verify the implementation.
5. Maintain and update the implementation

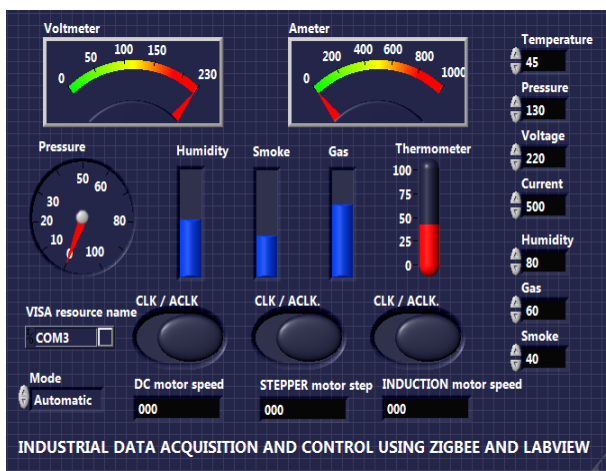


Fig-5 Lab-VIEW Front panel modeling

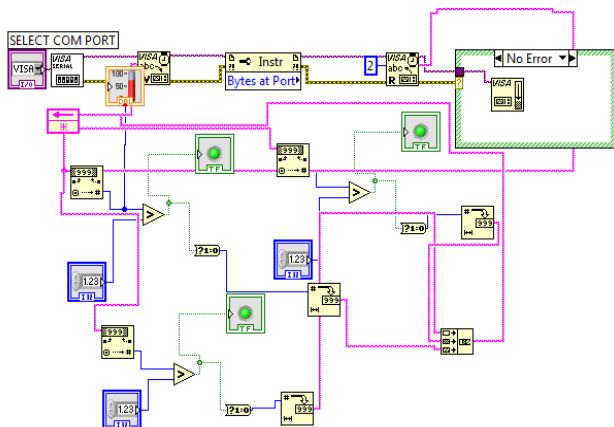


Fig-6 Lab-VIEW block diagram modeling

VII. REVIEW

A. Advantages

- Wireless remote access
- Data acquisition
- Database maintenance
- Reduced manpower
- Increasing automation
- Graphical user control
- Easy to handle
- Low maintenance cost
- Secured transaction
- Auto voice alert system

B. Disadvantages

- Proper handling
- Initial installation cost
- Trained operator

VIII. CONCLUSION

So installing this type of hardware setup various industrial sensor data can be continuously acquired wirelessly to a remote PC/Laptop through ZIGBEE network. In future it can be modelled for wide web access and control using internet. In case of urgency an authenticated person can monitor and also can control through the wireless access reducing the risk. Being on a remote place the operator can get the status of the industrial equipments with a voice alert. Reduced manpower increasing efficient wireless control make the system more effective and essential in the recent days.

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