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SCADA Based Monitoring and Controlling Using ZIGBEE

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***Abstract*- Almost all the Industrial Data Acquisition and control systems today use connection oriented concepts for interfaces. However, the variety of physical shapes and functional commands that each cable or wire based system has also raises numerous problems: the difficulties in locating the particular area affected by the industrial parameter, the complexity in operation of the system, the maintenance issue and so on. The control of sensitive industrial parameters by using SCADA-based wireless technology has gained significant industry and academic attention lately for the usability benefits and convenience that it offers users. The control of the temperature of a room containing chemicals and toxic gases the existing research has failed to provide a flexible solution for controlling such conditions by connection-oriented systems.**

They have used cables and bulky equipment which require large amount of space, high degree of the maintenance and are easily detoriated by moisture and excessive heat. Additionally, the Data acquisition and control techniques used so far have imposed considerable computational burden and have not provided a consistent and accurate results expected by the employees and their industries.

***Keywords*- SCADA, Zigbee, Monitoring, Controlling.**

I. INTRODUCTION

Data Acquisition and Control Systems have gained much larger importance in the Industrial field because of the rapid Technological advancement and Security reasons. Whether it is an Industrial workshop,

Defence go-down or experimental lab of the power plant accurate monitoring of the parameters is the need of the day. It could be the temperature, humidity, gas or light detecting sensor waiting for our command to provide us with information about the measured parameter of the particular area where they are installed.

Advantage of the system is that the engineer or worker not only can obtain accurate data about the industrial parameters in remote area, but also there is no need to be physical present over there. The amount of computation required to process the data detected by sensors is much greater than that of the mechanical devices. Many of those approaches have been implemented to focus in detection of the single parameter such as temperature, gas, humidity or light by dedicating the entire system to only one parameter.

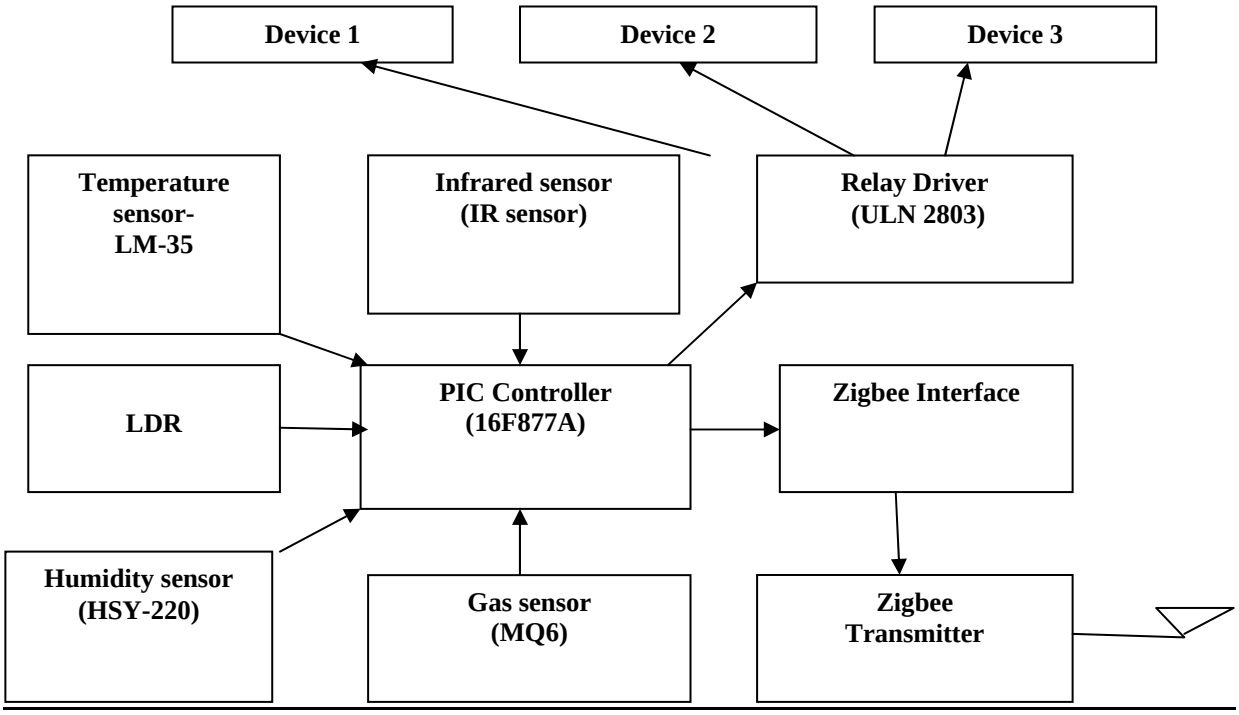

FIG. 1 Block Diagram of Transmitter

II. TRANSMITTER

The Temperature sensor LM-35 is used for detecting the physical parameter temperature of the particular device or the place where the product is stored or manufactured. It produces an output voltage which is proportional to Celsius temperature. It is a three pin device out of which the middle pin is used to measure the output voltage. It transmits the data to microcontroller.

The Light Dependent Resistor(LDR) are used in places where there is need to control the Intensity and level of light especially for protecting photo films and frames. An LDR is made of semiconductor material. It has a high resistance because the vast majority of the electrons are locked into the crystal lattice and unable to move. Therefore in this state there is a high LDR resistance.

As light falls on the semiconductor, the light photons are absorbed by the semiconductor lattice and some of their energy is transferred to the electrons. This gives some of them sufficient energy to break free from the crystal lattice so that they can then conduct electricity. This results in a lowering of the resistance of the semiconductor and hence the overall LDR resistance. This data is given to microcontroller.

The GAS sensor MQ-6 can be used both in home and industry. It has a very high sensitivity to gases such as LPG, Iso-Butane, Propane. Sensor is composed of micro AL2O3 ceramic tube, Tin Dioxide (SnO2) sensitive layer, measuring electrode and heater are fixed into a crust made by plastic and stainless steel net. The enveloped MQ-6 have 6 pin , 4 of them are used to fetch signals, and other 2 are used for providing heating current.

The most important objective of Infrared sensor is the Intrusion detection. This circuit uses an infrared (IR) beam system to transmit the infrared signal that is of 38 to40 KHz signal when interrupted by any device it will sounds an alarm and simultaneously it will be given to the microcontroller for further process. When the beam is broken a relay is tripped which can be used to sound a bell or alarm. Distances over 25 yards (8 to 10 meters) can be monitored.

Humidity sensor HSY-220 is mostly used in places where there is need to control the humidity such as food preservation industries, clothing etc. This capacitive atmospheric humidity sensor consists of a non-conductive foil, which is covered on both sides with a layer of gold. The dielectric constant of the foil changes as a function of the relative humidity of the ambient atmosphere and,accordingly, the capacitance value of the sensor is a measure for relative humidity.

PIC-Microcontroller 16F877A is a 40-pin IC. It consists of five ports and built in A-D converter. Microcontroller converts the analog signals to digital signals and then gives it to the Zig-bee Transmitter via Zig-bee Interface. This is the monitoring function of the project in the transmitter section. The controlling function comes into picture when the obtained value crosses the set parameter value of the sensors. Then the Microcontroller commands the Relay driver(ULN 2803) to operate the respective device in accordance.

Zig-bee is a technological standard created for control and sensor networks. It operates in personal area network's(PAN's) and device-to-device network's. In the transmitter section the Zig-bee transmitter is interfaced with the Microcontroller by using MAX232. All the data collected by the sensors is given to Zig-bee transmitter via Microcontroller for wireless transmission. IT transmit's the data in the form of packets and reduces the cost of wiring and cables. In accordance with the industrial purposes it provides a very good alternative.

The relay ULN 2803is an Integrated circuit chip with a high voltage/high current Darlington transistor array.It takes signals from TTL, CMOS, PMOS which operate at low voltages and currents.It is a relay of sorts for itself, switching on or off higher signal on the opposite side.

III. RECEIVER

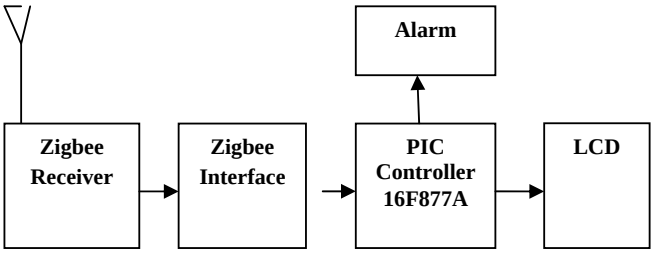

Fig.2 Block Diagram of Receiver

The receiver circuitry of the project is quite simple. The data transmitted by the Zig-bee Transmitter is received by the Zig-bee receiver. This data is then given to PIC-Microcontroller via Zig-bee interfacing. The data is then displayed on the LCD screen. If the parameter value crosses certain range of limit then controlling action is performed by the controller. Initially it performs the operation of alarming the Buzzer. The Buzzer alarm makes the operator alert.

Buzzer or beeper is a signalling device, usually electronic, typically used in automobiles, household appliances such as a microwave oven, or game shows. It most commonly consists of a number of switches or sensors connected to a control unit that determines if and which button was pushed or a preset time has lapsed, and usually illuminates a light on the appropriate button or control panel, and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound. The word "buzzer" comes from the rasping noise that buzzers made when they were electromechanical devices, operated from stepped-down AC line voltage at 50 or 60 cycles.

LCD is used to display the numerical values of the parameters which are detected by the sensors. LCD creates images on a flat surface by shining light through a combination of liquid crystals and polarized glass. The technology differs from CRT because a CRT uses a beam of electrons projected through a large glass tube to create images.

The topologies according to which the Zig-bee can be connected are star, cluster tree, mesh etc. The devices which are connected to Zig-bee can be Full Function Devices(FFD's) or Reduced Function Devices(RFD's). Zig-bee operation takes place in two states: Active, Sleep. Active state is used for receiving the data and Zig-bee is in sleep mode when the data reception does not takes place.

IV. SOFTWARE DESCRIPTION

The Pic-Basic Pro Compiler is the easiest way to program the fast and powerful Microchip Technology PIC-micro microcontrollers. Pic-Basic Pro converts BASIC programs into files that can be programmed directly into a PIC-micro MCU.

The Pic-Basic Pro Compiler features: BASIC commands, direct and library routine access to pins on PORTA, C, D, E, as well as PORTB, arrays, real IF..THEN..ELSE and interrupt processing in BASIC.

The Pic-Basic Pro Compiler gives direct access to all of the PIC-micro MCU registers - I/O ports, A/D converters, hardware serial ports, etc. - easily and in BASIC. It automatically takes care of the page boundaries and RAM banks. It even includes built-in commands to control intelligent LCD modules.

The Pic-Basic Pro Compiler instruction set is upward compatible with the BASIC Stamp II and Pro uses BS2 syntax. Programs can be compiled and programmed directly into a PIC-micro MCU, eliminating the need for a BASIC Stamp module. These programs execute much faster and may be longer than their Stamp equivalents. They may also be protected so no one can copy code.

The Pic-Basic Pro Compiler is a DOS command line application (it also works in Windows) and runs on PC compatibles. It can create programs for any of Microchip's PIC-micro microcontrollers and works with most PIC-micro MCU programmers, including our EPIC Plus PIC-micro Programmer.

The Pic-Basic Pro Compiler can also be used inside Microchip's MPLAB IDE. This allows programs to be edited and simulated within Windows. More information is on the MPLAB page.

Pic-Basic Pro Compiler now has limited support for the 12-bit core microcontrollers and BASIC source-level debugging.

If maximum compatibility is need with the BASIC Stamp I, or would like to save a little money, or just don't need all the extra features in PicBasic Pro, please take a look at standard PicBasic Compiler.

V. APPLICATIONS

(a)Electric Power Generation, Transmission and Distribution
(b) Water and Sewage
(c) Buildings, Facilities and Environments
(d) Mass transit
(e) Manufacturing and Traffic signals
(f) Being an automated system less manpower is required

VI. RESULT AND CONCLUSION

The importance of monitoring and controlling Industrial parameters lies in building efficient SCADA based wireless technology. Its applications range from providing security through intrusion detection to measuring important parameters such as Temperature, Light Intesity etc. Given the amount of literature on the problem of Data Acquisition and control and the promising recognition rates reported, one would be led to believe that the problem is nearly solved. Sadly this is not so. A main problem hampering most approaches is that they rely on several underlying assumptions that may be suitable in a controlled lab setting but do not generalize to arbitrary settings.

Several common assumptions include assuming absence of dust particles in the atmosphere of the room and ambient lighting conditions. In addition, recognition results presented in the literature are based on each author's own collection of data, making comparisons of approaches impossible and also raising suspicion on the general applicability. To ameliorate these problems there is a need for the establishment of a standard database for the evaluation and comparison of techniques. SCADA-based wireless technology has gained significant academic and commercial interest lately with the goal of allowing workers and engineers to control sensitive industrial parameters with Zigbee modules. We are presenting an intelligent gesture interface for reliably commanding sensors and relays through a user-defined language.

VII. FUTURE SCOPE

Data can be sent in a bi-directional way. The ultimate goal of this project is to develop a technology to aid in the further development of bi-directional communication between a PC and a remote robot. A user should be able to send data in a full duplex mode i.e. transmit and receive simultaneously. Data can be broadcasted. Broadcasted data can be sent which will enable data to reach multiple recipients.

We can use SCADA to manage any kind of equipment. Typically, SCADA systems are used to automate complex industrial processes where human control is impractical — systems where there are more control factors, and more fast-moving control factors, than human beings can comfortably manage.

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Controlling of large Data Acquisition System using an Industrial SCADA system using Stefan Koestner,Member,IEEE,on behalf of the LHCb Online Group