ANDROID BASED A REAL TIME DATA ACQUISITION AND MONITORING SYSTEM USING ARM7 FOR INDUSTRIAL APPLICATIONS

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Abstract— In recent years there is a vast technology improvement in industrial control rooms for monitoring the entire field of Industrial plants. High end PLC's are being implemented for controlling the entire process of fields. But a problem is that even though automation takes the complete control of total plants few authentication and manual actions are needed from user side for completing the control action. Hence there is a must situation for users presence at all times in the control room for taking some timely needed control actions. Due to the static nature of control room environment, the user should always be static to monitor the process. In this project, we propose a system that promotes the control engineer to obtain the data values anywhere and everywhere within the control room. This new system is suited for acquiring the control parameters like temperature and level process variables of an existing temperature process controller. The main objective of this proposed work is to acquire both the temperature and level sensor values with the help of microcontroller device and transmit the signals via blue tooth device interfaced with ARM7 Microcontroller and thereby monitoring and storing the process variable parameters in a smart digital device running on an android platform.

Keywords-- Automation; Sensors; Relays; Bluetooth HC-05; Android Application;

1. INTRODUCTION

Automation is need of any industry to manage industrial machinery and processes, reducing the necessity for human interference. With technology growing at a quick rate, automatic machine status trailing system of fully automatic processes is today's need which will be utilized in a variety of the way to trace and show machine info or status in real-time with wireless technology like Zigbee/Bluetooth/GSM [1] .

Presently obtainable system aren't totally automatic, these need to monitored on time basis. Currently systems like SCADA are used for the purpose of automation however the problem is that such systems can't be controlled from remote location. additionally the shop floor information isn't offered to the higher authority persons like Manager, MD etc. In business environment some process are completely automatic for e.g. Sterlite trade is making the production of fiber optic cables, once the process started it runs unceasingly for months. In this processes some quantities like temperature, pressure, gas discharge, production achieved etc got to be controlled in period from remote location. There are few trained persons within the industry; they have to touch in each moment concerning the parameters like temperature, pressure, gas outflow, production

achieved etc. By concerning this a fully automation system is developed in a such a way that update and control the standing of that particular plant with the assistance of automaton mobile using Bluetooth communication. different sensors are mounted to induce the info from plant surroundings. The obtained different signals are given to ARM microcontroller and according to the necessity controller is programmed and produces the control signals to manage the operation .

Different researchers have been worked on industrial automation and controlling and suggested many methods using different technologies and also research is going on to improve more and more.

2. LITERATURE SURVEY

Vehbi C.Gungor et.al proposed [3] that different communications technologies supported by two main communications media, i.e., wired and wireless, can be used for data transmission between smart meters and electric utilities. G.M. Sultan Mahmud Rana et.al designed and implemented [4] a cost effective home security system using the GSM technology. The system is designed to detect burglary, leaking of harmful gas.

A. Ajith Kumar et.al suggested an article An Industrial Perspective on Wireless Sensor Networks-A Survey of Requirements, Protocols, and Challenges, focused on the use of WSN in industrial applications [5].The better and effective industrial communication is characterized by the fact that interaction and control must take place in real time, with hard time requirements [6]. By considering the above work and need of industries an industrial application oriented automation system is developed and implemented for sponsoring industry i.e."Yeshshree Press Comps Pvt. Ltd., Aurangabad" Upcoming challenges and future scope are discussed at the end of paper.

3. PROPOSED METHODOLOGY

The proposed work includes the gathering of information from different sensing elements like temperature sensor, Light sensor, Gas sensor etc are placed in the production working environment. Out of all some sensors provides the analog information and some provides digital pulses, analog signals undergo signal acquisition to convert it to digital. The controller used is ARM7 LPC2148 that belongs to ARM family. Relays are used for controlling and switching purpose. Controller takes the sensing element values and displays it on digital display and as conjointly at the same time send it to android mobile using Bluetooth. If sensing element value exceeds than predefined then user will control the process by passing the commands the through Android application specially designed for this purpose and action will be controlled mistreatment relay change.

4. BLOCK DIAGRAM DESCRIPTION

The entire system is divided into two parts. First part consists of collection of data from different sensors like LM35 temperature sensor, light sensor and gas(Co_2) sensor etc. These sensors are mounted at different desired location in the plant to measures the parameters like temperature, Light, Co_2 gas detect, production achieved etc in real-time and gives this data to ARM7 LPC2148.

In Second section microcontroller collects the all the sensor values and compare it with predefined values in the program. If the sensor values exceeds than predefined then it takes the necessary action to control the parameters by switching the relays i.e. ON/OFF. At the same time controller send the information to alert the user who is at remote location. User may send the control command using Android application to control the parameter if needed. LCD is used to display the parameter details.

By using Bluetooth HC-05 module we send sensor values serially. At remote end android application specially designed for this purpose receives these values and display it on the android screen. This app also includes control window by using that we send commands to control robot wirelessly.

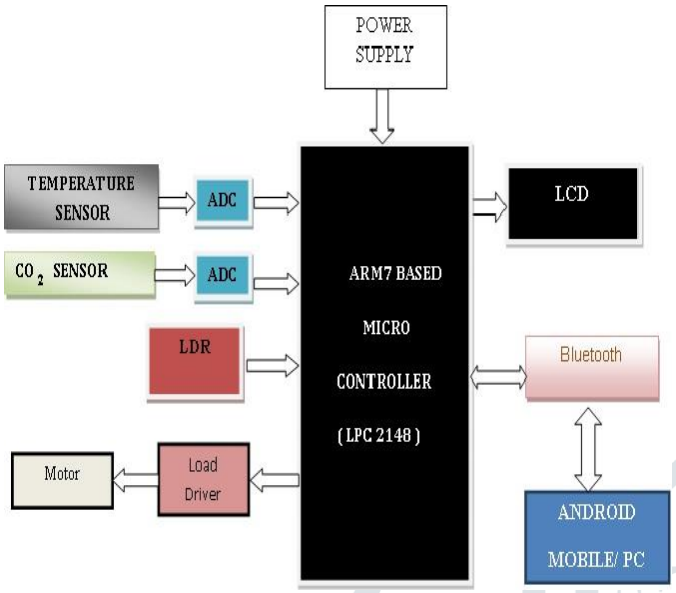

Fig 1. Block Diagram of proposed system

5. SYSTEM DESCRIPTION

A. Hardware Components

i. ARM7 LPC2148 Microcontroller

ARM7 LPC21487 is a 16-bit/32-bit ARM7TDMI-S CPU with real-time emulation and one of the most widely used micro-controller. LPC2148 is based on RISC processor that uses very few transistors than other complex processors. Because of few transistors it consumes low power and low cost. LPC2148 has 10-bit inbuilt A/D converter present because of this it's easy to interface analog sensors without the need of external A/D conversion hardware. It has Real Time Clock circuit with 32.768 KHz XTAL and Battery Backup. Support In- System Programming (ISP) and In-Application Programming (IAP) through On-Chip Boot-Loader Software via Port UART-0 (RS232), circuit to connect with standard 20 Pin JTAG ARM for Real Time Debugging. Has standard 2.0 USB as Full Speed inside, has Circuit to connect with Dot-Matrix LCD with circuit to adjust its contrast by using 16 PIN Connector. RS232 Communication Circuit by using 2 Channel. SD/MMC card connector circuit by using SSP. EEPROM interface using I2C. It has PS2 keyboard interface and general purpose I/O pins.

ii. LM35 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.

iii. HC-05 Bluetooth Module

HC-05 embedded Bluetooth serial communication module (can be short for module) has two work modes: order-response work mode and automatic connection work mode. And there are three work roles (Master, Slave and Loopback) at the automatic connection work mode. When the module is at the automatic connection work mode, it will follow the default way set lastly to transmit the data automatically.

iv. IR Sensor

IR detectors are specially filtered for Infrared light; they are not good at detecting visible light. IR detectors are digital out - either they detect 38KHz IR signal and output low (0V) or they do not detect any and output high (5V). When an object is close to the sensor, the light from the LED reflects off the object and into the light sensor. This results in a large jump in the intensity, and considered as object detected. When the object is far away from the sensor there is no reflection of back light hence it give high output.

v. LDR

A photo resistor or Light Dependent Resistor or CdS (Cadmium Sulphide) Cell is a resistor whose resistance decreases with increasing incident light intensity. It can also be referred to as a photoconductor. A photo resistor is made of a high resistance semiconductor. If light falling on the device is of high enough frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electron (and its hole partner) conduct electricity, thereby lowering resistance.

vi. MQ-6 Gas Sensor

This is a simple-to-use liquefied petroleum gas (LPG)sensor, suitable for sensing LPG (composed of mostly propane and butane) concentrations in the air. The MQ-6 can detect gas concentrations anywhere from 200 to 10000ppm. This sensor has a high sensitivity and fast response time. The sensor's output is an analog resistance. The drive circuit is very simple; all you need to do is power the heater coil with 5V, add a load resistance, and connect the output to an ADC.

B. Android App Development

This is the final step of our project where the movement of the robot is controlled by the Android application. To develop it we use the eclipse for coding (java) and Android SDK for development of the apps. In this we write two set of coding. One is Bluetooth adapter coding to connect Bluetooth shield with mobile Bluetooth. And next is sending commands to the Robot to move in user desired direction.

6. RESULTS AND DISCUSSIONS

In this work, the sensors are successfully implemented and interfaced with the ARM7LPC2148. The data or values received from the sensors were displayed on the 16X2 LCD display and also controlling the corresponding devices according to the plant operation on the basis of received data. The snapshots and figures show the optimized results.

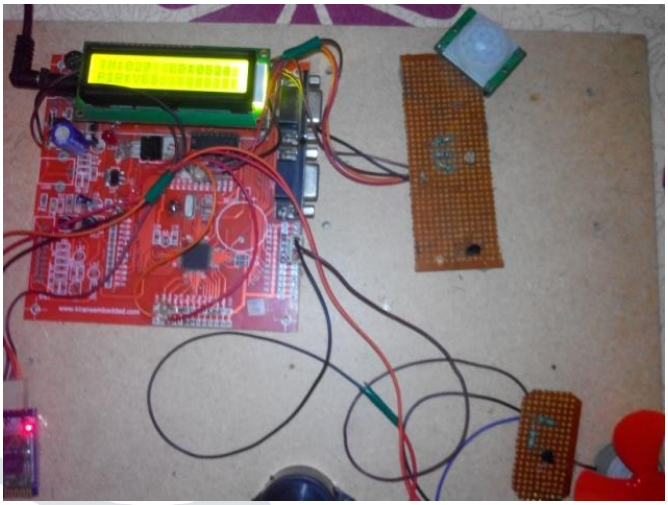

Fig 2. Complete Hardware setup

Figure 3 shows the values of temperature measured, light intensity and human presence on liquid crystal display(LCD).

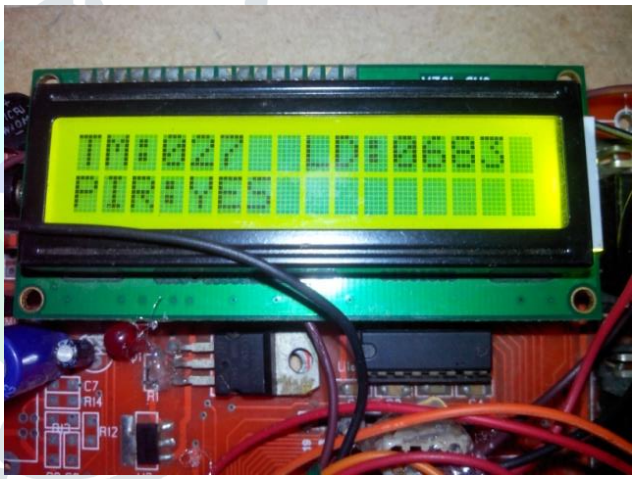

Fig 3. Temperature and light intensity measured and human detected by IR Sensor

Figure 4 show the snapshot of the android application showing sensor values and also comment box to send control commands to the robot section.

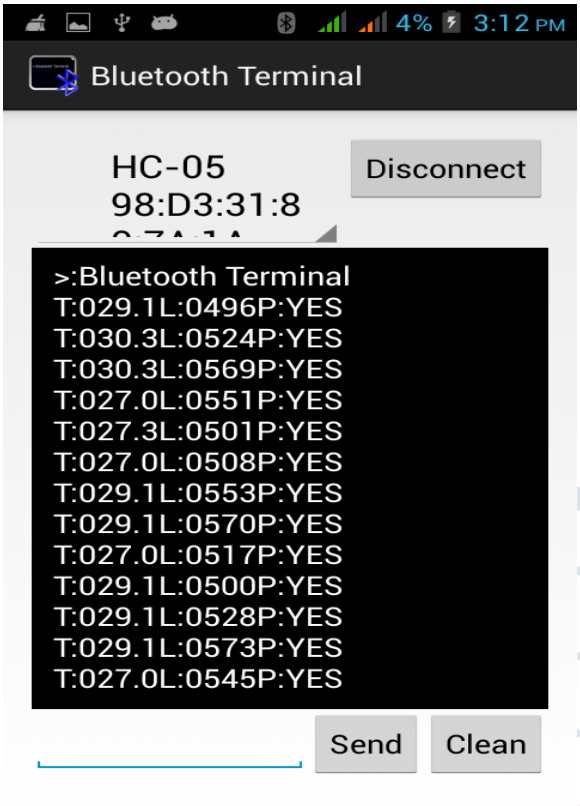

Fig 4. Android application showing values

7. CONCLUSION

This paper has presented a method to measure the environmental parameters using a mobile robot. Serial communication is done between ARM microcontroller, Bluetooth shield and sensors. Sensors will obtain the measurement and the data is send to the microcontroller. The ARM microcontroller processes the data and displays it on the Android App. Bluetooth technology can be used to perform various applications. The prototype of this project has been successfully completed where the mobile robot can move and measure according to the user instructions from the mobile phone. The idea of implementing Bluetooth technology is for safety purpose and is very useful especially in application where risk is a concern.

8. FUTURE ENHANCEMENT

In this paper we present initial experiments towards environmental monitoring with a mobile platform. Many interesting future extensions are feasible with our current setup. One such thing is uploading the system output (environmental parameter) in appropriate modes such as clouds. Also the use of Bluetooth shield can be altered by using a Wi-Fi or some other equipment with higher control range.

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