Industrial Monitoring and Control Applications Using IOT

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Abstract - Internet of Things (IoT) in industries has created a new revolution in industries. IoT in industry has given rise to the term "INDUSTRY 4.0" where systems are connected to each other over the internet and can communicate with each other to take necessary decisions (also called as M2M communication) through artificial intelligence. In this new era of technological developments remote control and monitoring of Industrial application via communication techniques such as ZigBee, RF, Infrared and Bluetooth has been widely used in Industries. However, these wireless communication techniques are generally restricted to simple applications because of their slow communication speeds, distances and data security. In addition, they are easily affected by noise and bad weather conditions such as snow, fog and rain. This paper illustrates a new solution adopted for the traditional Industrial monitoring and control through the implementation of Internet of things (IoT). To implement IoT we need a reliable protocol like TCP\IP that enables continuous monitoring and control of Industrial applications through GPRS enabled high quality communication at low cost and high security.

Index Terms – Artificial Intelligence, Internet of Things (IoT), GPRS, TCP/IP Protocol, Industrial applications.

1. INTRODUCTION

Industrial Internet of Things (IoT) is the best way of connecting industrial machineries and sensors, to each other, over the internet, allowing the authorized user of the industry to use information from these connected devices to process the obtained data in a useful way. IoT-connected applications typically support data acquisition, aggregation, analysis, and visualization. The IoT architecture includes latest technologies such as computers, intelligent devices, wired and wireless communication and cloud computing [1]. Previously Bluetooth and RF (Radio Frequency) technologies were used to control and monitor the industrial applications but were limited to short distance. The operator had to be in the range of the Bluetooth connectivity or in the Radio Frequency area [2]. There are some successful examples such as PLC SCADA based fault detection and protection system is implemented which provides the web based user interface for remote control and monitoring was developed and presented online to users [12]. Monitoring of various industrial parameters based on ZigBee protocol has been implemented to monitor the temperature, water level and various current and voltages ratings. Therefore these all mentioned examples for monitoring and control of various industrial applications has some limitations in form of long distance communication, data acquisition, fidelity and cost. Thus, there is a stringent requirement of a system that can monitor as well as control the industrial applications using a reliable protocol that enables a wireless communication over long distances. this paper designs and realizes the effective monitoring and controlling of Industrial application using the newly introduced concept of Internet of Things. The design presents many advantages as described below. First of all the different sensors employed in industry helps to detect the physical conditions and environmental abnormalities of required industrial applications to be accessed. Secondly the GPRS based communication between a user and Industrial application to be monitor and control is done successfully without any restriction of distances. There is also an arrangement of accessing the sensed data by the sensor remotely to any location, thus portability of the Industrial environment is also achieved. Also the control aspect of these industrial applications can be achieved by means of GPRS enabled GSM modem.

2. RELATED WORK

Different control technologies are used for monitoring and control of the systems, whereas the communication between a system and a user is generally realized online via wireless communication techniques such as RF, ZigBee and Bluetooth. Also, SCADA programs are utilized for developing user interfaces. However, SCADA programs do not provide adaptability for users because of their expensive libraries. RF, ZigBee and Bluetooth technologies are widely preferred in easy-to-use applications due to the short range between the sender and the receiver, and the small volumes of data

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transferred.The ZigBee, RF and Bluetooth wireless communication techniques are generally restricted to simple applications because of their slow communication speeds, distances and data security.

2.1 Internet of Things:

The goal of the Internet of Things is to enable things to be connected anytime, anyplace, with anything and anyone ideally using any network and any service. Internet of Things is all about physical items communicating each other, where machine to-machine (M2M) communications and person-tocomputer communications will be extended to "things". The foremost megatrends relevant for factories are globalization, progressing technological evolution, the dynamization of product life cycles, the aging work force and the shortage of resources.



Fig.1 Architectural Overview of industrial monitoring and control

IoT applications in the sense of this paper are solutions using IoT technologies capable to improve and easy adapt industrial manufacturing processes, enable new and efficient ways to monitor and control various industrial applications, reduce operational cost and energy consumption or improve human safety in industrial areas.

3. PORPOSED MODELLING

Industrial monitoring and control is a combination of architectures, mechanisms, and algorithms used in the industrial factory for monitoring and control the activities of industrial processes, motors, machines and devices employed in industry premises to achieve the goal. Though it sounds good enough to have a smart industrial environment in the near future but it will also have to face hurdles of handling big data as all the devices will communicate with each other and exchange their information over a common-platform. The present project is focused on Industrial applications that will be continuously monitored through a set of sensors that constitutes a sensor module. The sensor module collects the relevant data to determine whether the applications to be monitored are working well under certain threshold values.



Fig.2 Proposed System Architecture

The LCD displays the sensed data at control room in industry premises or where the control unit is actually placed as it is interfaced with microcontroller. With this implementation we can achieve continuous monitoring of 3 phase voltage supply(R, Y, and B) given to the industrial applications, room temperature in (°C), speed (in rpm) and vibration count of industrial applications such as motors.

After logging this data at industry control room, it is necessary to forward it to the Internet cloud to be accessed remotely. For that we use a GPRS activated GSM modem interfaced with microcontroller at its UART pins. Using the GPRS service of modem the sensed parameters are routed from microcontroller to Internet cloud through GSM modem using TCP\IP protocol.

3.1 System Hardware:

To accomplish the monitoring and control of industrial applications, consideration of following factors is important in system design.

1) Microcontroller: The microcontroller proposed for our system is ATmega32A which is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single cycle, the ATmega32A achieves throughputs clock approaching 1 MIPS per MHz allowing optimization of power consumption versus processing speed.

2) Current sensor: The AllegroACS712 provides economical and precise solutions for AC or DC current sensing in industrial, commercial, and communications systems. The device package allows for easy implementation. Typical application of this sensor is for controlling motor, and its overcurrent fault protection.



Fig.3 Current Sensor IC Schematic

3) 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's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy.



Fig.4 Full range centigrade temperature sensor

4) GSM Module: The TC35i GSM module operating in the GSM 900 MHz and GSM 1800 MHz frequency band is an extremely compact and super slim communication module especially designed for telemetry, telematics and telephony. It offers additional features such as SIM application tool kit and extended AT commands for the industrial environment. The physical interface to the cellular application is made through a ZIF connector. It consists of 40 pins, required for controlling the unit, transferring data and audio signals and providing power supply lines.



Fig.5 Block Diagram of Cellular Application

4. RESULTS AND DISCUSSIONS

The developed system is tested by installing the sensors at their respective places in industry premises and setting up a GPRS activated GSM module enabling the monitoring and control of industrial applications from remote locations using mobile terminals. The interconnectivity between GSM modem and Internet cloud helps to achieve continuous monitoring of industrial parameters, also their controlling is done using DTMF module and GSM modem. Figure 6 shows the LCD employed in industry which delivers the sensed room temperature and voltage supply from 3 phases(R, Y, B). As LCD is interfaced with the controller hence, it shows the sensed data only at the industry premises. Thus it helps to provide information about obtained voltage supply and existing room temperature to any user available in industry.



Fig.6 Sensed room temperature and 3 phase voltage supply in industry.

Initially there is no logging of data at cloud from controller through GSM modem until we click "connect" option. The important to be consider here is that we need to access the cloud address in a terminal browser that supports websocket. Web Socket is a computer communications protocol, providing fullduplex communication channels over a single TCP connection.

5. CONCLUSION

Earlier we used to monitor the things by using RFID system where it was only used for short distance communication. To reduce the manual overhead, the thing which we are introducing is automation of industries using internet of things which can overcome the RFID shorter distance problem. Using IOT in industries we can monitor and control the industrial machineries more easily. The key idea of the proposed work is to provide flexible and long distance connectivity between industrial environment and user. The advantages of the developed system are to have a continuous monitoring over industrial applications and also control them if going beyond their threshold conditions. Future work will focus on improvement of above proposed work and adding features to make a reliable smart Industrial monitoring and controlling system.

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