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Server room environment monitoring system using IOT

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ABSTRACT

This paper intends to provide information using wireless sensor technology which comprises of sensor interface device, wireless sensor network (WSN) and sensors. Realization of data gathered by sensors is displayed on mobile or window. A new method is proposed to design a reconfigurable smart sensor interface for industrial WSN in IoT environment, in which complex programmable logic device is adopted as the core controller. Then, challenging factors influencing the design and acceptance of M2Ms in the process control world are outlined, and the state-of-the-art research efforts world are outlined, and the state-of-the-art research efforts and design and acceptance of M2Ms in the adopted as the core controller. Performance of the proposed system is verified and good effects are achieved in practical application of IoT to server monitoring.

Keywords—*Sensors, Microcontroller, Wireless sensor network (WSN), Programmable logic device, Lcd, M2M, GSM and Cloud computing.*

1. INTRODUCTION

The Internet of Things (stylized Internet of Things or IOT) is the internetworking of physical devices, vehicles (also referred to as "connected devices" and "smart devices"), buildings, and other items embedded with electronics, software, sensors, actuators, and network connectivity that enable allows objects to be sensed and/or controlled remotely across existing network infrastructure

Things (IoT-GSI) defined the IoT as "the infrastructure of the information society Things (IoT-GSI) defined the IoT as "the infrastructure of the information society. The IoT. The IoT allows objects to be sensed and/or controlled remotely across existing network infrastructure, creating these objects to collect and exchange data. In 2013 the Global Standards Initiative on Internet of and economic benefit in addition to reduced human intervention. When IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such transportation and smart cities. Experts estimate that the IoT will consist of almost 50 billion objects by 2020.

Figure1. The Internet of things

opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and

1.1 CHARACTERISTICS OF INTERNET OF THINGS

The main characteristics of an IOT include

- Power consumption constraints for nodes using batteries or energies
- Ability to cope with node failures (resilience)
- Mobility of nodes
- Heterogeneity of nodes

Cross-layer is becoming an important studying area for wireless communications.

1.2 APPLICATIONS

1.2.1 Environmental Earth Sensing

There are many applications in monitoring environmental parameters, examples of which are given below. They share the extra challenges of harsh environments and reduced power supply.

1.2.2 Air Pollution Monitoring

Wireless sensor networks have been deployed in several cities to monitor the concentration of dangerous gases for citizens. These can take advantage of the ad hoc wireless links rather than wired installations, which also make them more mobile for testing readings in different areas.

2. LITERATURE REVIEW

2.1 ENERGYEFFICIENT SCHEDULING FOR CLUSTER-TREE WIRELESS SENSOR NETWORKS WITH TIME-BOUNDED DATA FLOWS: APPLICATION TO IEEE 802.15.4/ ZIGBEE

Cluster scheduling and collision avoidance are crucial issues in large-scale cluster-tree Wireless Sensor Networks. It presents a methodology that provides a TDCS mechanism based on the cyclic extension of RCPS/TC problem for a cluster-tree WSN, assuming bounded communication errors. The objective is to meet all end-to-end deadlines of a predefined set of time-bounded data flows while minimizing the energy consumption of the nodes by setting the TDCS period as long as possible. The scheduling tool enables system designers to efficiently configure all required parameters of the IEEE 802.15.4/ZigBee beacon-enabled cluster-tree WSNs in the network design time.[1]

2.1.1 Methodology

To improve the functionality and efficiency of industrial monitoring and control systems, the industries are looking toward WSN to provide sensing and actuating in hazardous and previously hard-to-reach areas where very specialized and costly procedures must be adhered.

WSN's can be classified into two types, infrastructure-based and ad hoc (infrastructure-less) networks. The former is less flexible since it relies on the pre-deployed and structured topology, but provides better support of predictable performance guarantees. The cluster-tree network is supported by the IEEE 802.15.4/ZigBee standards which are leading technologies for low-cost, low-power and low-rate WSNs.

2.1.2 Drawback

It is unrealistic to support hard real-time communications in a WSN due to communication errors resulting from the unreliable and time-varying characteristics of wireless channels.

3. EXISTING SYSTEM

3.1 INTRODUCTION

This paper intends to provide information using wireless sensor technology which comprises of raspberry pi, Arduino Nano, Zigbee, Wireless Sensor Network (WSN) and sensors. Realization of data gathered by sensors based on embedded raspbian Linux is displayed on Graphical User Interface (GUI). The system is developed using open source hardware raspberry pi and Zigbee which proves to be cost effective and having low power consumption. The sensors will gather the data of various environmental parameters and provide it to raspberry pi which act as a base station. Some sensors will directly process the data and provide it to the raspberry pi while some sensors will provide the data through Arduino Nano to raspberry pi using serial interface

3.2 SYSTEM ARCHITECTURE

Developing a WSN requires incorporation of hardware and software components. This system is utilized by Raspberry Pi as a base station, Zigbee for communication over WSN and integration of many more sensor nodes. The sensor node shown in the Figure 2. is the combination of microcontroller, Zigbee and sensors for monitoring purpose.

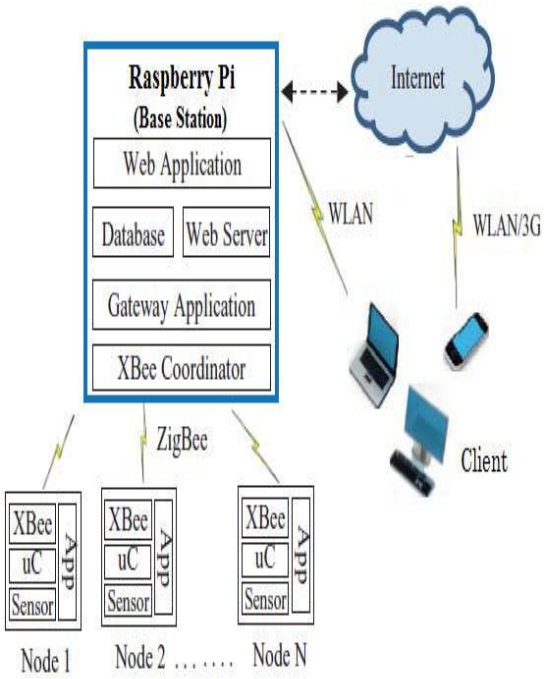

Figure 2. Overall system Architecture

3.3 ZIGBEE STANDARD

Zigbee provides low rate, low power and low cost wireless Networking. The IEEE 802.15.4 defines the Zigbee standard using MAC protocol. The Zigbee configured with the base station will act as coordinator whereas another one on the receiving side will act as router. It provides both AT and API mode serial When operate in Application Programming Interface (API) mode, the data entering and leaving the module is divided into frames that define operation.

3.4 PROBLEM STATEMENT

WSNs are typically employed to monitor hazardous or important areas. If users cannot access the monitored data then they cannot monitor events and anomalies within these physical environments. This would prevent them from making proper diagnosis, decisions, and actions that could benefit the state or livelihood of individuals or preserve the integrity of objects located within the observable environment.

A monitored environment and the user may be mobile and remote from each other, which would prevent users from being actually located near the observed physical environment. Another problem is when a set of users have to monitor several different physical environments located in widespread regions. It makes sense to gather all the data from these WSNs in a central repository and give shared access to the data to all users.

Emergency personnel suffer from the same predicament and rely heavily on legacy systems to retrieve weather and storm system information as well as broadcasting warnings to the public in crisis situations. Trained medical staff and health care professionals are in desperate need of new ways to diagnose and observe individuals that require only minimal in house and outpatient care due to their limited numbers.

4. PROPOSED SYSTEM

4.1 INTRODUCTION

The proposed work includes the collection of data from the devices using various sensors like temperature sensor, humidity sensor and light sensor. This signal from the sensors undergoes signal conditioning to convert the signals from analog to digital. The microcontroller used belongs to 18F452 family. It processes the data and displays the parameters on the LCD as well as provides it to the GSM module. The collected data are grouped together and stored in cloud storage by Machine to Machine (M2M) gateway using GSM Modem. From the cloud storage the data will be retrieved and used in various platforms like mobile, PC etc. The data received from the server using the scheduling algorithm. [2]

4.2 FUNCTION OF PROPOSED WORK

The structure of M2M communication based SCADA. The circuit is implemented using the de-signed block diagram. The graphical layout of circuit diagram is developed in EAGLE 6.2.5 software. The PCB is made using the graphical layout .The explanation of each block is as shown in figure 3.

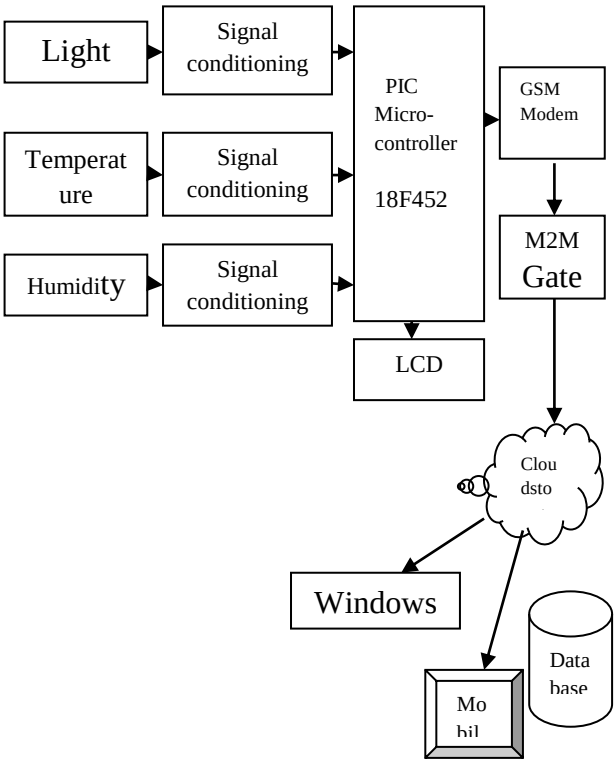

Figure 3. Block diagram Of Industrial Monitoring Using M2M

4.2.1 Sensors

Here the sensors used are basically analog sensors (like temperature, LDR and humidity) which detect or sense analog parameters and provide them to the Analog & Digital Converter i.e. ADC.

4.2.1.1 Temperature Sensor

LM358 is used as temperature sensor in the proposal. It is analog temperature sensor and also a voltage divider network in which the resistance varies according to the temperature and so does voltage across that resistor

4.2.1.2 Humidity Sensor

SL-HS-220 act as humidity sensor. This sensor module gives analog output voltage.

4.2.1.3 Light Sensor

For monitoring light, LDR (Light Dependent Resistor) is used. It is also a voltage divider circuit. When light across the LDR increases, the resistance of the circuit decreases and so the voltage across it varies.[3]

4.2.1.4 Analog to Digital

PIC18F452 used as ADC which contains 8 channels. This block gets the input from analog sensors in the form of parameters and converts the same into digital form. ADC provides high speed, high accuracy, reliability, minimal temperature and minimum power consumption.

4.2.1.5 Microcontroller

In this proposal 18F452 act as brain of the system. It processes the data and displays all the parameters on the LCD as well as provides it to the GSM module.

- 8 KB of In-System Programming (ISP) flash memory
- Operating frequency of 0 to 33 MHz
- 256*8 bit internal memory
- Full duplex UART serial channel
- Three 16 bit timers/counters

4.2.1.6 Cloud Computing

Cloud computing relies on sharing of resources to achieve coherence and economies of scale, similar to a utility (like the electricity grid) over a network. At the foundation of cloud computing is the broader concept of converged infrastructure and shared services.

A cloud is called a "public cloud" when the services are rendered over a network that is open for public use. Public cloud services may be free or offered on a pay-per-usage model. Technically there may be little or no difference between public and private cloud architecture, however, security consideration may be substantially different for services (applications, storage, and other resources) that are made available by a service provider for a public audience and when communication is effected over a non-trusted network. Generally, public cloud service providers like Amazon AWS, Microsoft and Google own and operate the infrastructure at their data center and access is generally via the Internet.

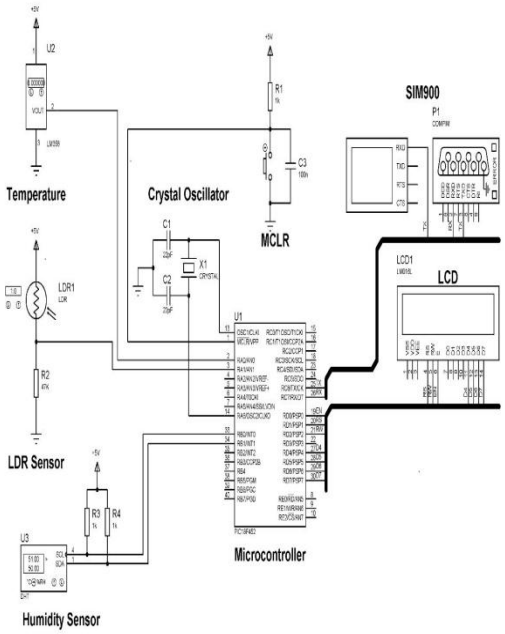

Figure 4. Circuit diagram of server room environmental monitoring system

4.3 METHODOLOGY

4.3.1 Machine to Machine

Machine to Machine (M2M) refers to technologies that allow both wireless and wired systems to communicate with other devices of the same type. M2M is a broad term as it does not pinpoint specific wireless or wired networking, information and communications technology. This broad term is particularly used by business executives. M2M is considered an integral part of the Internet of Things (IoT) and brings several benefits to industry and business in general as it has a wide range of applications such as industrial automation, logistics, Smart Grid, Smart Cities, health, defence etc. mostly for monitoring but also for control purposes.[4]

4.4 PIC MICROCONTROLLER

The PIC 18F452 is a 28/40 pin high performance flash based microcontrollers with 32 Kbytes of program memory and 1.5Kbytes of RAM. Also 256 bytes of EEPROM data memory is provided to store data. The 18F452 microcontroller operates from DC to 40 MHz clock/oscillator input with 16 bit instructions and two priority levels for interrupts. One of the main additional features of this microcontroller is its 8 * 8 single cycle hardware multiplier. This will make multiplication easier and faster than the software routines used in previous controllers like 16 F series.

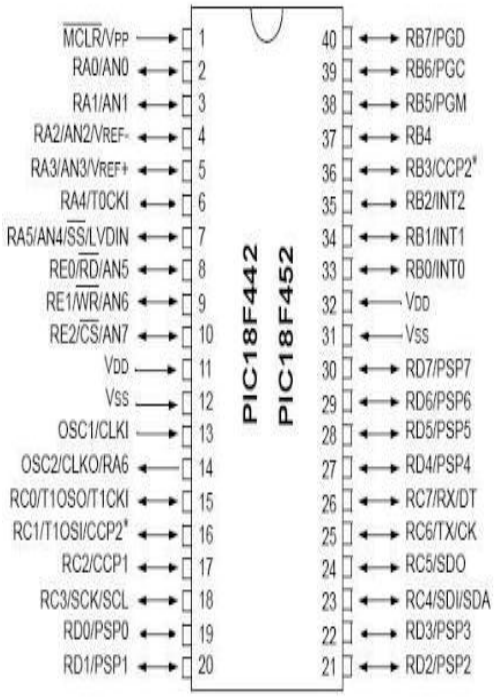

Figure 5. Pin Diagram

The I/O ports in the microcontroller is divided into 5 ports like 16 F series :- PORT A(6 pins), PORT B(8 pins), PORT C(8 pins),PORT D (8 pins) and PORT E(3 pins).

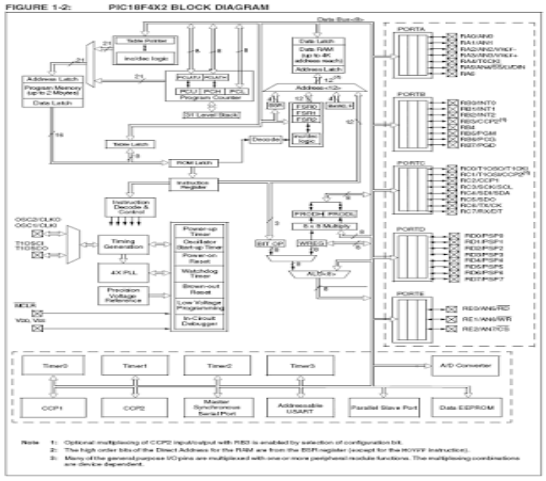

Figure 6. Architecture Diagram

4.5 PROTEUS

Proteus Design Suite is wholly unique in offering the ability to co-simulate both high and low-level micro-controller code in the context of a mixed-mode SPICE circuit simulation. With this Virtual System Modeling facility, you can transform your product design cycle, reaping huge rewards in terms of reduced time to market and lower costs of development.

Proteus Virtual System Modeling (VSM) combines mixed mode SPICE circuit simulation, animated components and microprocessor models to facilitate co-simulation of complete microcontroller based designs. The simulation takes place in real time (or near enough to it): a 1GMHz Pentium III can simulate a basic 8051 system clocking at over 12MHz. Proteus VSM also provides extensive debugging facilities including breakpoints, single stepping and variable display for both assembly code and high level language source.

5. SIMULATION RESULTS

5.1 CIRCUIT DIAGRAM OF SIMULATION

The reconfigurable smart sensor interface for industrial WSN in IoT environment was analyzed. The system can collect sensor data intelligently. It was designed based on M2M technology using the microcontroller and the application of wireless communication using GSM modem.[5]

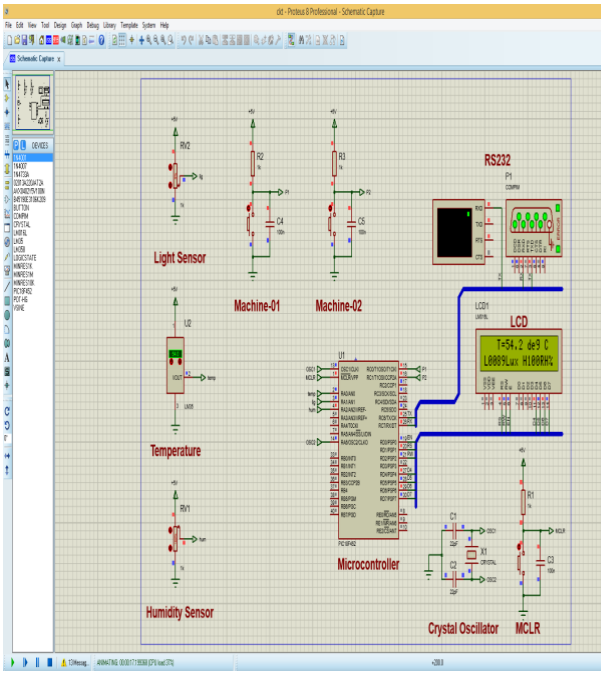

Figure 7. Schematic Circuit Diagram of Simulation

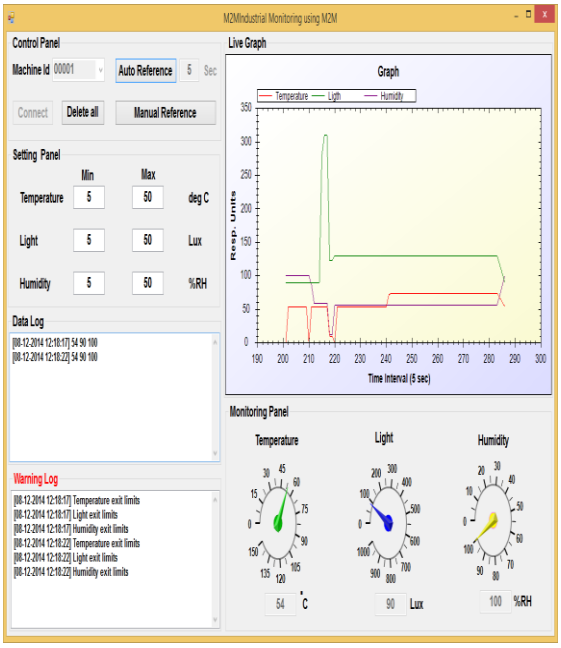

Figure 8. Output of the Simulation

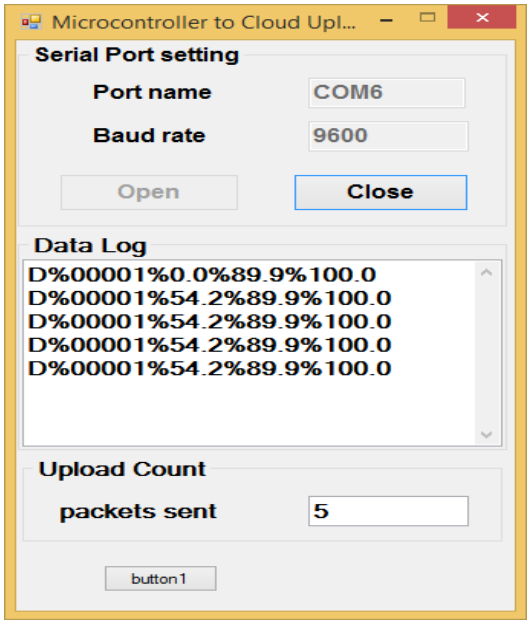

Figure 9. Monitoring Process of Data Packet Sent

6. CONCLUSION

The use of M2M communication is an advantage over the traditional Data Acquisition System (DAS) as the monitoring and controlling can be done without human intervention. As the system becomes fully automatic so the amount of error decreases and the efficiency of the system increases drastically. With the use of machine to machine technology and using GPRS connection the data can be viewed from any part of the world Even if the GPRS connection fails the system will be controlled at the factory/plant and even the data will be logged to analyze the problem later. The further improvement can be made by making the use of switches/routers to make a network make and also make system ore secure, the use of wireless camera can also be an added advantage for monitoring.

6.1 FUTURE WORK

We can implementing pollution monitoring systems will help to assess how bad air pollution is from day to day and save the environment from further pollution**.** We can also implement this in android watches, attached to other IoT concepts like home security, structural health, city energy consumption, smart lighting and so on . The information's that are collected by the sensors could be used by the authorities to take necessary action such as emergency warning messages and evacuation of people to safe places.

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