Wireless Sensors Network Based Energy Management System

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Abstract - *This paper aims at presenting the concept of wireless sensor network based energy management system. In an Industry it is always important that the energy must be conserved and used very efficiently. So in order to save energy and avoid wastage, a system with different sensors to sense the energy parameters and thereby carrying an effective action must be used. This system determines the movement of person through sensor. If there is some movement then this system gives proper result regarding physical calculation. Like if room temperature goes above our set temperature then automatically AC will start to maintain our set values. Like this the system will sense different physical parameter through different sensors and gives output automatically. With the help of visual basic software we can set our reference set point for particular sensor. And also we can observe it on PC.*

Keywords – Design and Working Principle, Wireless Sensor Network, Zigbee, MAX 232, Smart Card.

I. Introduction

The studies in wireless communication technologies have led to great progress in wireless sensor networks.

WSN's are the wireless sensors that are used to sense the parameters in the environment. They have a limited data gathering and processing capability.

The Zigbee (IEEE 802.15.4 standard) technology is wireless communication technology. It has low-power consumption and low-cost characteristics, which emphasizes to use Zigbee in energy management system. ZigBee technology is simple to use and can be easily incorporated into a wide range. So Zigbee can be used for the communication between Master and Slaves.

Lighting control is very necessary to reduce costs and energy consumption by turning off lights when they are not required. The simple light control system turns off lights at a specified time when the building is assumed to be empty, and turns lights back on when there is movement of person. This is a start, but with today's offices where people are increasingly working longer, more flexible hours, additional controls are needed. Sensors are useful for collecting information in the environment, which helps to carry the required action like switching the light on or off.

This paper designs smart Industrial energy management system by sensing parameters, wirelessly communicating and carrying out the required action. The basic concept is to save different forms of energy like light. The system is also helpful in preventing the industry from gas and fire threats.

A monitoring window is designed in VB. The VB monitoring window can be used to insert set point of the parameters like temperature, gas, light.

Here different sensors are used for energy management. Earlier there were different types of systems which monitor different parameters such as fire, gas, human, light, and temperature separately. This project deals with smart energy management system. Its aim is to control and monitor with the help of only one system automatically.

II. Design and Working Principle

The system works on Master and Slave principle. The system is designed to work using Master request and Slave response protocol. The master requests for information from the slaves by sending frames. The system can be designed for one master and multiple slaves.

In this system the Master sends the request to the all the slaves. In the request frame the master mentions the slave ID .The request frame is received by all the slaves which are in range .The slave who are in range receive the incoming frame and store it in its internal RAM memory .Then they check for the slave ID .If the incoming slave ID matches with their own slave ID then they Accept the frame and send the parameter back to the master. If the ID does not match then the slave discards the frame. This is how the system works with **Collision avoidance protocol**.
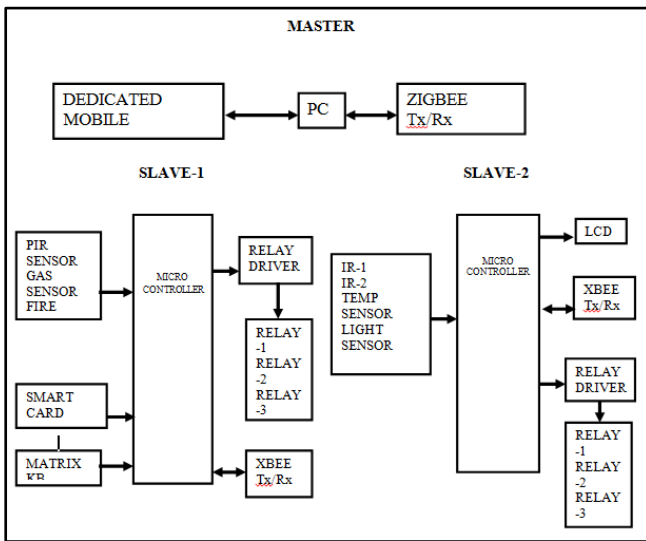
III. Block Diagram

Figure1 – Block Diagram of Proposed System

IV. Wireless Sensor Network

WSN's are spatially distributed autonomous sensors used to monitor physical or environmental conditions, such as temperature, sound, light, etc. and to pass their data through the network wirelessly to a main location.

Few to several hundreds or thousands of nodes are present in WSN. Each node is connected to one sensor. Each sensor network node has several parts viz., a microcontroller, a radio transceiver with an internal antenna.

WSNs have been applied in many fields, such as the military, environment monitoring, and healthcare monitoring. Nowadays, WSNs are gradually being used in the Home & Industrial or Industrial & Industrial for energy management services.

V. MAX 232

Max 232 IC is a driver IC to convert the µC TTL logic (0-5) to the Max 232 logic (+-9v). Many devices today work on Max 232 logic such as PC, GSM modem , GPS etc. so in order to communicate with such devices we have to bring the logic levels to the Max 232 logic (+/-9v).

Any one pair can be used in the project either 7,8,9,10 pair or 11,12,13,14 pair. If there is requirement of 2 serial ports then Depending on the requirement of the project both the pair can be used in the same project.

The µC works on TTL logic (0-5 v). So to convert the TTL logic to 232 logic 4 capacitors are connected to the RS232 IC. These capacitors are called charge pumps used to convert the TTL voltage to the +/- 9 v swing required by the 232 IC.
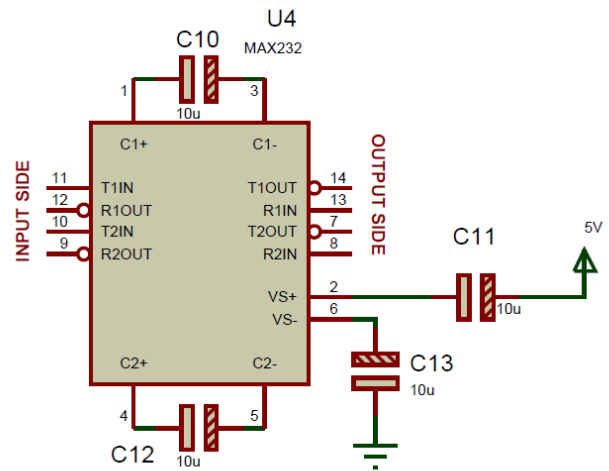

Figure2 – Circuit Diagram for MAX232

VI. Zigbee

Zigbee is a specification for a suite of high level communication protocols. It works on the IEEE 802.15.4 standard. It consumes very less power. Thought it consumes less power it can cover a range of almost 100 meters, which is much greater when compare to Bluetooth.

It incorporates the standard, adding the logical network, security and software to it. It supports up to 3 network topologies namely star, mesh and cluster tree. Developers need only have to focus on application while the µC/Microprocessor/RF Transceiver makers and Zigbee alliance take care of the RF transmitter, RF receiver, RF channel and its protocol. There are 3 types of traffics that can be used.

Standard	ZigBee/IEEE 802.15.4	Bluetooth	IEEE 802.11 b/g
Working frequency	868/915 MHz,2.4GHz	2.4GHz	2.4GHz
Range (m)	30-75+	10-30	30-100+
Data rate	20/40/250 kbps	1Mbps	2-54Mbps
Power consumption	~1mW	~40-100mW	~160mW-600W

Table1 – Comparison of different wireless technologies

VII. Smart Card

Smart Card is a concept used for the secure login to the system. Without inserting the smart card the system will not start. A smart card has a Memory IC onto it. The password used for secure login is been stored in the memory IC. S when this smart card in connected to the system, the system asks for the password to be entered using the keypad. The entered password is compared with the password stored in the memory IC. If both the passwords match then the system starts or else the system prompts 'Wrong Password'.
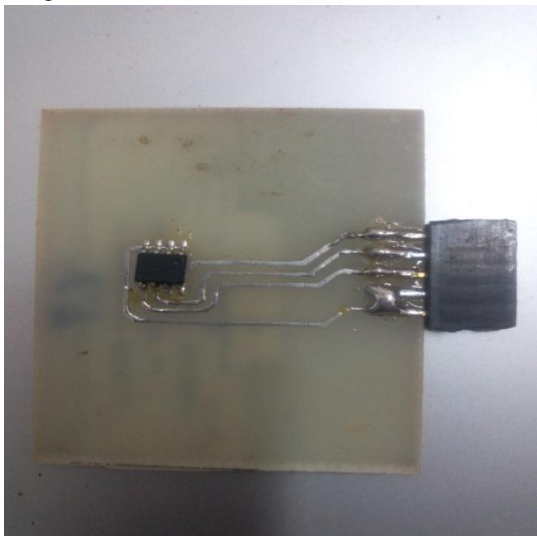Different memory IC's can be used in order to design a smart card.

Figure3 – Smart Card

VIII. Benefits of the Proposed System

1. Using the Smart Card the threat of misusing the system can be minimized and only a single authorized person can have complete access to the system.

2. With Collision avoidance protocol, there is no loss of data between master and slave and also there can be a communication between them without any collision.

3. Using WSN, the sensors can communicate wirelessly through a network.

4. Using the Zigbee module, a large area can be covered with less power consumption.

5. Using the GSM module, measured parameters can be sent to the authorized person via SMS in his absence.

6. The system provides a complete and fair energy management of the industry.

7. Using MAX232 TTL logic can be converted to the MAX 232 logic. With this on board programming of the IC can be made possible.

8. Using VB software a monitoring window can be implemented on the PC.

IX. Conclusion

The proposed system can be efficiently used to manage different energy parameters and avoid its wastage by using WSN's for sensing different parameters and carrying out the required action.

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