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WIRELESS BASED INDUSTRIAL ENERGY CONSERVATION SYSTEM

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Abstract — Energy conservation is the practice of decreasing quantity of energy used for the same quality and same quantity of output. It may be achieved through efficient energy use, in which case energy use is decreased while achieving a similar outcome, or by reduced consumption of energy services. Energy conservation results in increase of financial capital, environmental value, national security, personal security and human comfort. The IoT is the network that contain embedded technology to communicate and interact with the external environment. It comprises hardware, embedded software, connectivity/communications services, and information services associated with the sensor data. Wireless sensor based control has drawn attention of many industries because of the reduced cost, easy mobility, easy maintenance, power management etc. Wireless Sensor based systems have been deployed in industries, army and in household for various applications such as monitoring, maintenance, security etc. In this paper we discuss the use of wireless sensor technology (RF) for energy conservation, in which the sensor are deployed to sense and monitor the environmental conditions and take decisions based on the inputs from the various sensors. This project helps people, companies and governments make better energy efficiency decisions by providing them with cost effective reliable instrumentation and information.

I.INTRODUCTION

Wireless sensor networks (WSN) have emerged as one of the most promising technologies for the future. Some of the potential application domains are healthcare, army, environment and agriculture, industry, transportation systems and security. Unlike other networks, WSN are designed for specific applications, and thus, they must satisfy a set of requirements that differs from one application to another. Therefore, researchers must address a variety of challenges to facilitate the widespread deployment of WSN technology in real-world domains. As a result, great efforts have been devoted to overcome the energy-saving problem and reliability. Industrial plants integrate sensors connected to the control station through wire and wireless methods for continuous sensing and monitoring the status of the system. In this context, wireless technology gives a suitable support to the industry offering advantages in terms of low installation cost, scalability, flexibility, lack of cabling, intelligent-processing capability, high mobility and ease of deployment compared to conventional wired solutions. These advantages are promising for industry, where a considerable growth in the near future is expected. The main contribution of the paper is related to the development of an efficient architecture in terms of power consumption and reliability, which involves both hardware and software design strategies. Moreover, the deployed WSN is easily scalable up.

II. SYSTEM ANALYSIS

2.1. Problem Definition

The growing global demand for energy and our planet's rapidly depleting natural resources present a major challenge to humankind, and it is vital that we take steps to address this challenge today. The majority of greenhouse gas emission are currently produced by the energy sector. This means that through efficient systems, we have the chance to significantly improve the global energy balance and make a major contribution to environmental protection.

2.2. Proposed System Feature

Numerous national studies and working groups have identified low-cost, very low-power wireless sensors and networks as a critical enabling technology for increasing energy efficiency, reducing waste, and optimizing processes. Research areas for developing such sensor and network platforms include microsensor arrays, ultra-low power electronics and signal conditioning, data/control transceivers, and robust wireless networks.

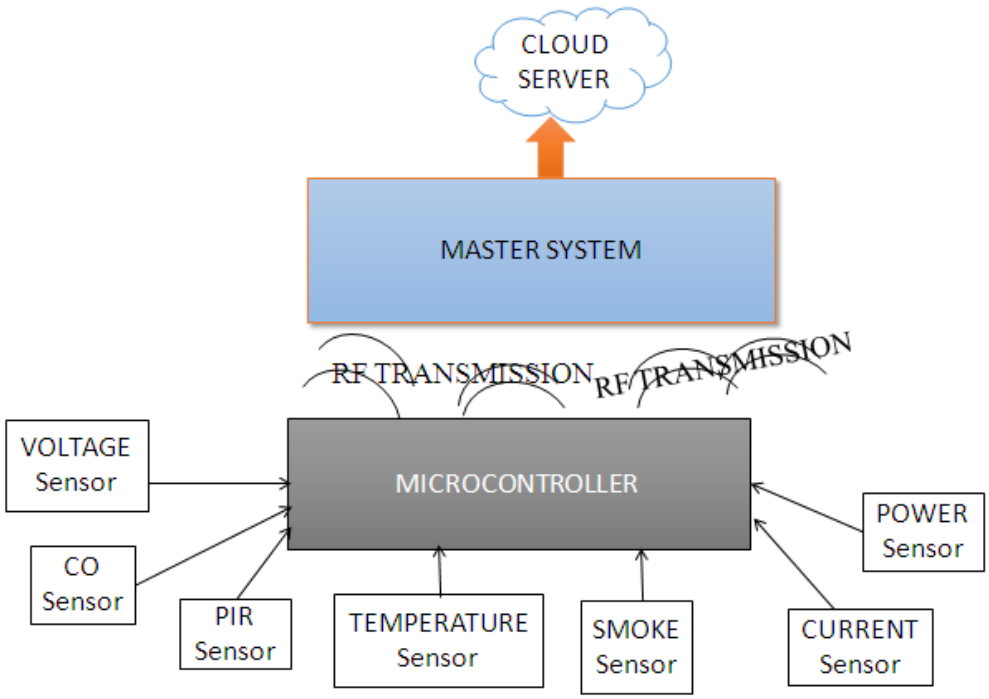
- Low-cost, flexible multi-sensor array platforms (CO2, NOx, CO, humidity, NH3, O2, occupancy, etc.) that enable energy and emission reductions in applications such as buildings and manufacturing
- Modeling investments (energy usage and savings to drive capital investment decisions) and estimated uptime improvements through pervasive gathering of equipment and process health data and its effects on energy
- Robust, self-configuring wireless sensor networks for energy management

• Quality-of-service for secure and reliable data transmission from widely distributed sensors

Wireless communications is poised to support technical innovations in the industrial community, with widespread use of wireless sensors forecasted to improve manufacturing production and energy efficiency and reduce emissions. Progress being made in wireless system components, as described in this paper, is helping bring these projected improvements to reality.

III. SYSTEM DESIGN AND IMPLEMENTATION

3.1 Proposed system



The above figure 2.1 shows the complete block diagram of this project. The project includes temperature, carbon monoxide, voltage, current, power and smoke sensors. In this system, various sensors are used to measure various parameters in the industry. The sensors are interfaced to a microcontroller which fetches data anytime . The number of microcontrollers is based on the size of the industry system. The microcontrollers send the real time data of various sensors to a Master system through wireless transmission .The Master then sends the data to the cloud. And also, the master is interfaced with GSM module to receive a message of real time data of various parameters of that day and danger alerts. For wireless transmission RF transmitters and receivers are used for effective communication (nearly 100 meters of distance) between the transmitter and receiver.

3.2.Proposed Home Automation System Functions

The proposed Wireless Based Industrial Energy Conservation System has the competences to regulate the succeeding components in users industries and monitor the following alarms:

1. Temperature
2. Carbon monoxide
3. Methane
4. Voltage
5. Current
6. Power
7. Infrared

IV.SYSTEM DESCRIPTION

4.1 Components Used

The various components that are used in this project are:

1. PIC Microcontroller (PIC 16F877A)

2. Methane Sensor (MQ2)
3. Carbon Monoxide Sensor (MQ5)
4. PIR Sensor
5. Potentiometer
6. Temperature Sensor
7. Proteus Software
8. Current Sensor
9. RF Transmitter and Receiver

4.2 PIC MICROCONTROLLER

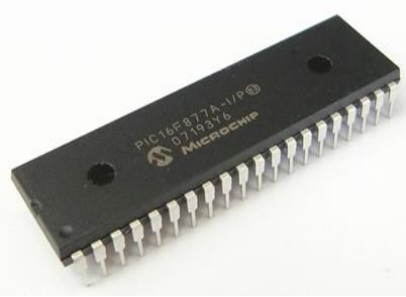


Figure 4.1 PIC Microcontroller

The PIC microcontroller PIC16f877a is one of the most renowned microcontrollers in the industry. This controller is very convenient to use, te coding or programming of this controller is also easier. One of the main advantages is that it can be write-erase as many times as possible because it use FLASH memory technology. It has a total number of 40 pins and there are 33 pins for input and output.

4.3 METHANE SENSOR (MQ2)

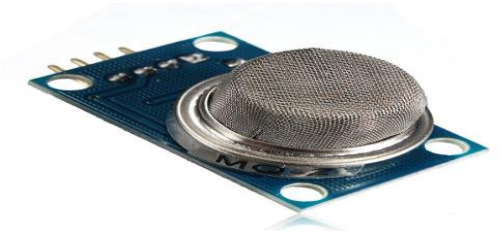


Figure 4.2 Methane Sensor (MQ2)

The Gas sensor (MQ2) module is useful for gas leakage detecting in home and industry. It can detect LPG, butane, alcohol, Hydrogen, smoke and so on. Based on its fast response time, measurements can be taken as soon as possible. Also sensitivity can be adjusted by potentiometer. MQ-2 has a protection resistor on board. The MQ-2 gas sensor is sensitive to LPG, i-butane, propane, methane, alcohol, Hydrogen and smoke. It could be used in gas leakage detecting equipments in family and industry. The resistance of the sensitive component changes as the concentration of the target gas changes. The MQ-2 is a flammable gas and smoke sensor detects the concentrations of combustible gas in the air and outputs its reading as an analog voltage. The sensor can measure concentrations of flammable gas of 300 to 10,000ppm.

4.4 CARBON MONOXIDE SENSOR (MQ5)

Figure 4.3 Carbon Monoxide Sensor (MQ5)

The Gas sensor (MQ5) module is useful for gas leakage detecting in home and industry. It can detect LPG, butane, alcohol, Hydrogen, smoke and so on. Based on its fast response time, measurements can be taken as soon as possible. Also sensitivity can be adjusted by potentiometer. MQ-5 has a protection resistor on board. The MQ-5 gas sensor is sensitive to LPG, i-butane, propane, methane, alcohol, Hydrogen and smoke. It could be used in gas leakage detecting equipments in family and industry. The resistance of the sensitive component changes as the concentration of the target gas changes. The MQ-5 is a flammable gas and smoke sensor detects the concentrations of combustible gas in the air and outputs its reading as an analog voltage. The sensor can measure concentrations of flammable gas of 300 to 10,000 ppm.

4.5 PIR SENSOR

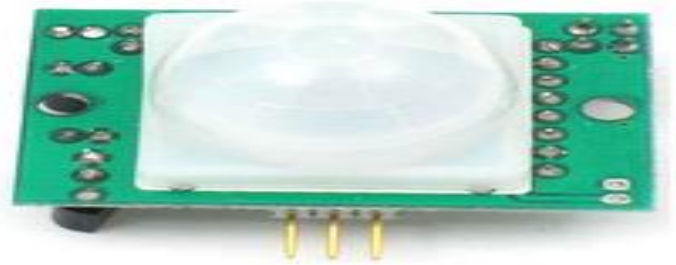


Figure 4.4 PIR Sensor

The term PIR is the short form of the Passive Infra Red. The term "passive" indicates that the sensor does not actively take part in the process, which means, it does not emit the referred IR signals itself, rather passively detects the infrared radiations coming from the human body in the surrounding area. The detected radiations are converted into an electrical charge, which is proportional to the detected level of the radiation. Then this charge is further improved by a built in FET and fed to the output pin of the device which becomes applicable to an external circuit for further triggering and amplification of the alarm stages. The PIR sensor range is up to 10 meters at an angle of +15°or -15°.

4.6 TEMPERATURE SENSOR

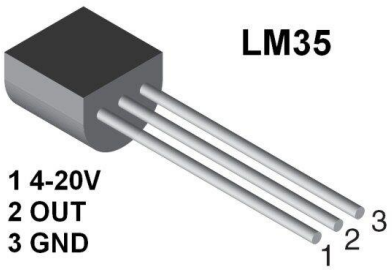


Figure 4.5 Temperature Sensor (LM-35)

Temperature sensor is a device which is designed specifically to measure the hotness or coldness of an object.**LM35** is a precision IC temperature sensor with its output proportional to the temperature (in °C).With LM35,the temperature can be measured more accurately than with a thermistor. It also possess low self heating and does not cause more than 0.1 °C temperature rise in still air. The operating temperature range is from **-55°C to 150°C**.The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy.

V.OUTPUT

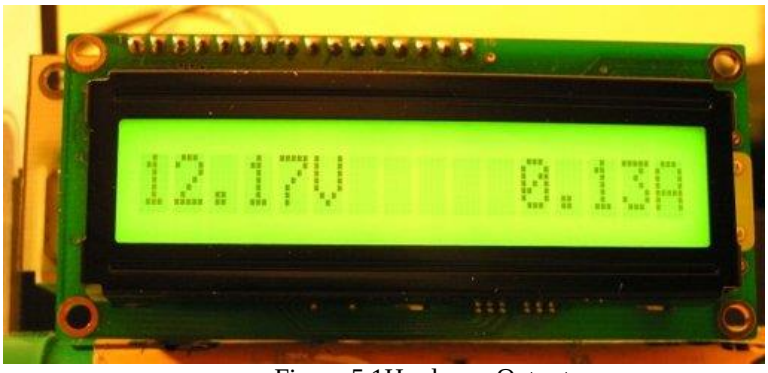


Figure 5.1Hardware Output

The above diagram shows the final hardware output. It shows the single module output of voltage and current of a dc load in a machines laboratory.

VI. FUTURE WORK

By means of this method as a framework, the system is expanded embrace varied different choices that might include home security feature like capturing the picture of an individual roving the house and storing it in the cloud. This can cut back the info storage than mistreatment the CCTV camera which can record all the time and stores it. The system is expanded for energy observance or weather stations. This type of a system with individual changes is enforced within the hospitals for disabling folks or in industries wherever human invasion is not possible or dangerous, and it also can be enforced for the environmental observance.

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