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An Enhanced Smart Wireless Sensor Network Based Intelligent Building Monitoring System

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Abstract—
This paper describes an application of Wireless Sensor Network in monitoring and controlling of energy in residential and commercial buildings. In this project, we design two electronic Nodes including Sensor Node, and Coordinator Node. In the application layer, user friendly software is designed to control and monitor all nodes in the wireless network through LAN with using C++ programming language. Each user can remotely connect to this network and view each input and output values of nodes and in the automatic mode, all nodes can communicate to remote device without management from the user side. In this paper we have discussed various aspects of this project.

Keywords – GSM, ARM 9, MEMS, ETHERNET.

I. INTRODUCTION

Smart environments represent the next evolutionary development step in building, utilities, industrial, home and transportation systems automation. Like any sentient organism, the smart environment relies first and foremost on sensory data from the real world. Sensory data comes from multiple sensors of different modalities in distributed locations . Wireless Sensor Network (WSN) is one of the most important technologies in the 21th century. With emerging of the Wireless Sensor Network and improvement in its communication and sensing abilities, a wide range of application is defined for it. Given the growth in energy consumption around the world, what's the best way to control it? Perhaps one of the best answers to this question is summarized in the Intelligent Energy Management (IEM) in the consumers' side. For an IEM system we need to knowledge, but how knowledge obtained? Data collection is the first step to knowledge and whatever data is a more comprehensive, decisions are more accurate. In the data collection layer, WSN can help you to obtain the best result because; user can install each node without wiringin short time and also choosing the best area to achieve most complete information without any restrictions.

WIRELESS SENSOR NETWORK

Wireless sensor network (WSN), which integrates sensor technology, wireless communication technology, embedded computing technology and distributed information management technology, has been under rapid development during recent years [1].A wireless sensor network is a collection of nodes organized into an interactive network. Each node consists of processing capability (one or more microcontrollers chips) and contain types of memory (for example NAND flash memories), with a Zigbee transceiver module and also, each nodes have a stable power source (e.g., batteries and solar cells), and the last part of a node, it is accommodate various sensors and actuators. The nodes communicate wirelessly and often self-organize after being deployed in an ad hoc method. Such systems can revolutionize the way we live and work therefore in this project we want to use WSN technology to control and manage energy in building
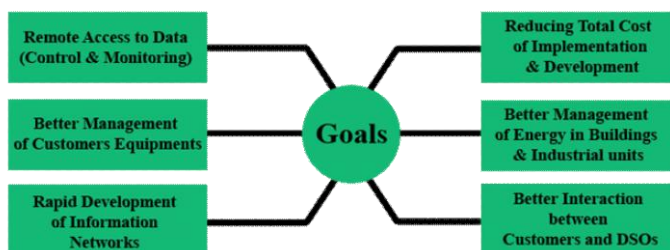
II. DESIGN AND IMPLEMENTATION

This wireless network consists of spatially distributed intelligent sensor nodes to monitor physical or environmental conditions. Also, in this project we have designed and built intelligent sockets and digital power meters interface based on

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WSN technology. Considering the system functions and overall structure of wireless sensor network, we adopt embedded system technology based on hardware platform at concentrator unit. The strength of embedded system is capable of collecting and processing a large number of signals [2]. Each of nodes in this network is passes their data through the wireless network to a concentrator device. In the concentrator unit, all received data from each node is decoded and then will be sent to transfer unit.

I) WIRELESS SENSOR NETWORKS

A WSN can be defined as a network of devices, denoted as nodes, which can sense the environment and communicate the information gathered from the monitored field (e.g., an area of home or industrial environment) through wireless communications. The data is forwarded, possibly via multiple hops, to a sink (sometimes denoted as coordinator or concentrator) that can be used locally or is connected to other networks (e.g., the Internet or other WSNs) through a gateway. The nodes can be fixed or moving and also, they can be aware of their location or not [3]. They can be homogeneous or not; due to the vast potential of sensor networks to enable applications that connect the physical world to the virtual world.

To design the concentrator unit, we use a Friendly ARM Mini2440 (ARM9) for control process unit of hardware and protocol operation. Also, we use the following communication protocols in the system:

1. ZigBee protocol which is used to develop and manage wireless sensor networks (this is a communication protocol between the local network equipments in a district)

2. TCP/IP protocol which is used data transmission between customers system and ARM9 through of Ethernet network using wired LAN Cable .

For better management of wireless energy network through
End-Users, two methods defined. First, through a human
machine interface (HMI) to viw l the system components
locally and the second method used for remote control
network (LAN) through a network.

IV.HARDWARE

Mini2440
The mini2440 is a practical low-cost ARM9 Single Board Computer (SBC) with a very high performance/cost ratio. With the Samsung S3C2440 microprocessor and the use of professional layout and quality peripheral chips, it is very robust. The Mini2440 uses a four-layer board design with gold immersion processing, and has high quality equal-length bus routing in timing critical areas. The production environment and quality control are the same as those of modern high-speed motherboards.

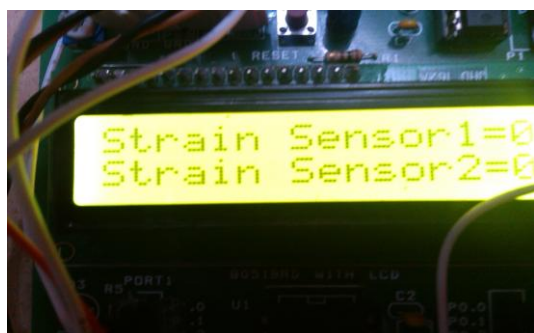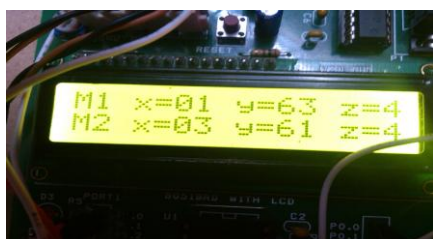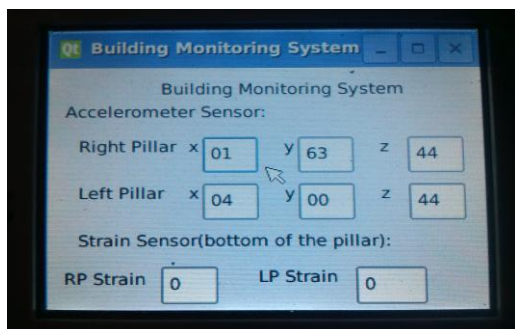Fig. Mini2440 Hardware Board with S3c2440 Processor

MEMS
Micro electromechanical systems (MEMS) are small integrated devices or systems that combine electrical and mechanical components. Their size range from the sub micrometer (or sub micron) level to the millimeter level and there can be any number, from a few to millions, in a particular system. MEMS extend the fabrication techniques developed for the integrated circuit industry to add mechanical elements such as beams, gears, diaphragms, and springs to devices.

GSM
GSM (Global System for Mobile communications) is an open, digital cellular technology used for transmitting mobile voice and data services.GSM (Global System for Mobile communication) is a digital mobile telephone system that is widely used in Europe and other parts of the world. GSM uses a variation of Time Division Multiple Access (TDMA) and is the most widely used of the three digital wireless telephone technologies (TDMA, GSM, and CDMA). GSM digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own time slot. It operates at either the 900 MHz or 1,800 MHz frequency band.

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V.PRACTICAL INTERFACE

VI.CONCLUSION

In order to efficiently monitoring and controlling the energy of buildings, in this paper we research and design a network\ based management system with embedded control platform. The system provides a high level communication between each node (e.g., sensor or socket node) with a sink node in the energy network. In conclusion, this system provides an intelligent-based monitor and control platform for the wireless sensor network for home and buildings

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