EFFICIENT ARCHITECTURES IN PASSIVE WIRELESS NODES IN GPRS ENVIRONMENT

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Abstract— The evolution of embedded intelligence in passively powered wireless nodes has led to the expansion of the application space for passive Radio Frequency Identification (RFID) and Internet of Things (IoT). This article presents recent advancements in energy efficient designs in wireless passive communication nodes and its related applications.

Key Words: *Microcontroller, GPRS, RFID, Sensors.*

Introduction

Internet of Things (IoT) is a rising technological phenomenon that enables the connections of the physical and the computing worlds forming the next link in the chain of ubiquitous communication. The human to human-thing to thing-thing (also known as (machine-to-machine) (M2M)) communication paradigms is part of the IoT information revolution. This new IoT network paradigm is an intelligent way of connecting existing devices with new devices through radio sensing or identifying technologies such as Radio Frequency Identification (RFID) or sensor networks. Each device node collects, transmits and processes sensor data and transmits back to the central node through various Terminal nodes are an important part of the IoT network in providing efficient services. These nodes typically represent sensors. Deployment of wireless sensor based IoT networks for environmental monitoring is limited due to the active life span of the on-board non-rechargeable power source of the terminal node. The number of sensors required may be very large for such an application. The sensors are battery powered, and there is overhead involved for the periodic maintenance of the battery-assisted sensors.

There has been much research into prolonging the limited lifetime of wireless sensor networks (WSNs) through efficient circuit, architecture and communication techniques. In summary, the use of such an IoT network is strictly limited by the battery life of the terminal nodes. It is a major challenge to manage the maintenance cost of replacing batteries of such numerous nodes especially in hard-to-service areas. Hence the energy management of the terminal node of the IoT is an important factor in extending the lifetime of the sensors. Passive RFID tags are battery-free nodes that use simple logic to respond with a unique code or data, when queried by an interrogator for the purpose of identifying objects. The concept of remotely feeding a tag on the power from an external RF source has led to the emergence of the widely known passive RFID technology. Passive RFID technology is becoming increasingly common in different environments such as home, office, industry, hospitals, library, etc enabling quick and anytime access to real-time data on uniquely identifiable passive nodes throughout their entire lifetime. The integration of passive RFID with WSNs is a rising phenomenon to improve the sensing capabilities free of battery lifetime constraints. Passive RFID based sensor nodes are part of the wireless passive sensor networks (WPSNs) that mainly deal with the collection or storage of data, and transmission of that data back to the interrogator [7]. The interrogator primarily collects and processes the data sent by the nodes. The existing status of the development of key technologies such as RFID, Sensor, Smart embedded technology, Nanotechnology of IoT implementations around the world are in application, exploratory, experimental and research stages. Currently there is no unanimous system built for the IoT with respect to privacy, security and standardizations. Hence, it might take a while to standardize the integration of the evolving smart RFID technology into the IoT framework. This article emphasizes on the need to integrate passive smart RFID technology with IoT to enable new applications. This article focuses on the evolution of energy efficient smart RFID based terminal nodes in such passive communication systems.

I. The Hardware System

Micro controller: This section forms the control unit of the whole project. This section basically consists of a Microcontroller with its associated circuitry like Crystal with capacitors, Reset circuitry, Pull up resistors (if needed) and so on. The Microcontroller forms the heart of the project because it controls the devices being interfaced and communicates with the devices according to the program being written.

ARM7TDMI: ARM is the abbreviation of Advanced RISC Machines, it is the name of a class of processors, and is the name of a kind technology too. The RISC instruction set, and related decode mechanism are much simpler than those of Complex Instruction Set Computer (CISC) designs.

Liquid-crystal display (**LCD**) is a flat panel display, electronic visual display that uses the light modulation properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock.

II. Design of Proposed Hardware System

This new IoT network is an intelligent way of connecting existing devices with new devices through radio sensing or identifying technologies such as Radio Frequency Identification (RFID) or sensor networks. Each device node collects, transmits and processes sensor data and transmits back to the central node through various network interfaces.

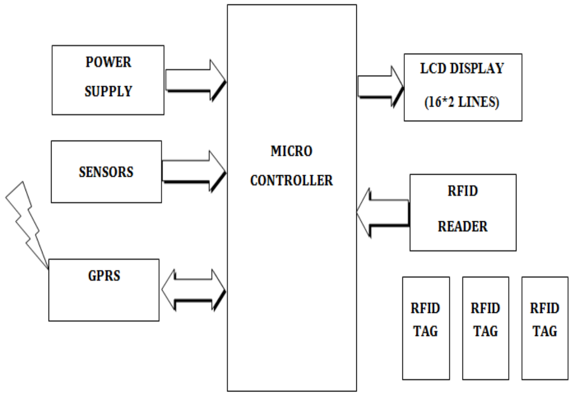

Fig.1. Block diagram

III. Board Hardware Resources Features

GPRS:

GPRS technology enabled much higher data rates to be conveyed over a cellular network when compared to GSM.GPRS technology offering data services with data rates up to a maximum of 172 kbps, facilities such as web browsing and other services requiring data transfer became possible. GPRS and GSM are able to operate alongside one another on the same network, and using the same base stations. However upgrades are needed. The network upgrades reflect many of those needed for 3G, and in this way the investment in converting a network for GPRS prepares the core infrastructure for later evolution to a 3G W-CDMA / UMTS.

Rfid

Many types of RFID exist, but at the highest level, we can divide RFID devices into two classes **active** and **passive**.

Active tags require a power source i.e., they are either connected to a powered infrastructure or use energy stored in an integrated battery. In the latter case, a tag's lifetime is limited by the stored energy, balanced against the number of read operations the device must undergo. However, batteries make the cost, size, and lifetime of active tags impractical for the retail trade. Passive RFID is of interest because the tags don't require batteries or maintenance. The tags also have an indefinite operational life and are small enough to fit into a practical adhesive label. A passive tag consists of three parts: an antenna, a semiconductor chip attached to the antenna and some form of encapsulation. The tag reader is responsible for powering and communicating with a tag. The tag antenna captures energy and transfers the tag's ID(the tag's chip coordinates this process). The encapsulation maintains the tag's integrity and protects the antenna and chip from environmental conditions or reagents.

CONCLUSION

A combination of effective energy harvesting circuits, passive communication system standards along with innovative architectural solutions will be necessary for a low power passive node to be successfully adopted for IoT and passive RFID applications. Low power computation intensive designs play an important role in embedding intelligence into the passive nodes in order to realize IoT. The evolutionary perspective of recent advancements in the computational aspect of wireless passive nodes applicable to an IoT framework was presented in this article. The combination of smart passive RFID with IoT illustrates the potential of extending the application space to passive biomedical sensing, environmental monitoring, defense, supply chain logistics, transportation, health care, etc. Innovative research and sustained development of both the smart passive RFID technology and the IoT are necessary for the favorable advancements in ubiquitous networking

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