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Dynamic Communication of Wireless Sensor Network

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Abstract
The aim of present this paper is to the describes the design of a wireless sensor network and RFID communication based on ZigBee technology. It is mainly used for dynamic communication with various nodes. For communication and connected coverage here used various algorithms which improves the efficiency of the system.
Here temperature sensor are used for sensor nodes for observation and analysis of node communication with real time application. Verifying the dynamic communication between the nodes and overcome the collision problems between master and slaves.
To demonstrate the effectiveness of the proposed method in terms of balancing energy consumption and maximization of network lifetime, it compare approach with the shortest path and RANDOM algorithm with nearest neighbor approach. Simulation results demonstrate that the network lifetime achieved by the proposed method could be increased by nearly Twenty five percent more than that obtained by the RANDOM and by nearly Twenty percent more than that obtained by the Local Connect Then Cover (LCTC)
Index Terms—RFID, ZigBee, ARM 7, Temperature Sensor.

I. INTRODUCTION

Wireless Sensor Technologies are entering a new phase. Recent advances offer vast opportunities for research and development. This is the consequence of the decreasing costs of ownership, the engineering of increasingly smaller sensing devices and the achievements in radio frequency technology and digital circuits. WSN is one of the most significant technologies in the 21st century. The ubiquitous computing model is predicted to be dominant in the near future. In this new model, people are surrounded with microprocessors that process information gathered from the surrounded physical environment to provide them with new services and applications. Enablers of this computing models are small devices such as laptops, Mobile phones, microcontrollers and others. This model is strengthened with the use of the wireless sensor networking (WSN) technologies as it automate the procedures of gathering information about the physical world.

A WSN is defined as a network of a set of sensor nodes connected wirelessly. A pair of sensors can communicate with each other if the distance between them is more then they take the help of nearest node and pass their packets to master through nearest path. A WSN contains a set of targets that should be sensed. A sensor covers a target. It can be say that a WSN preserves coverage if each target can be sensed by at least one sensor.[1]

Wired *vs.* Wireless

WSN can operate in a wide range of environments and provide advantages in cost, size, power, flexibility and distributed intelligence, compared to wired ones. In a network, when a node cannot directly contact the base station, the message may be forwarded over multiple hops. By auto configuration set up, the network could continue to operate as nodes are moved, introduced or removed. Monitoring applications have been developed in medicine, agriculture, environment, military, machine/building, toys, motion tracking and many other fields. Architectures for sensor networks have been changing greatly over the last 50 years, from the analogue 4-20 mA designs to the bus and network topology of today. Bus architectures reduce wiring and required communication bandwidth. Wireless sensors further decrease wiring needs, providing new opportunities for distributed intelligence architectures [2].

Wireless Sensor Network Architecture

Sensing Unit: Sensing unit consist of various types of sensor which can be sense any physical quantity like Temperature, Gas, Light, PH and conductivity etc. which is useful to measure particular quantity without any wire connection. A sensor is a device, which responds to an input quantity by generating a functionally related output usually in the form of an electrical or optical signal. A sensor's sensitivity indicates how much the sensor's output changes when the measured quantity changes. For instance, if the mercury in a thermometer moves 1 cm when the

temperature changes by 1 °C, the sensitivity is 1 cm/°C. Sensors that measure very small changes must have very high sensitivities. Sensors also have an impact on what they measure; for instance, a room temperature thermometer inserted into a hot cup of liquid cools the liquid while the liquid heats the thermometer. Sensors need to be designed to have a small effect on what is measured; making the sensor smaller often improves this and may introduce other advantages.

Signal Conditioning: **Signal conditioning** means manipulating an analog signal in such a way that it meets the requirements of the next stage for further processing. Sensor output signal weak in nature for that signal conditioning is required it amplifies the signal and give it to analog to digital converter.

Analog to Digital Converter: It coverts analog signal into digital form and also add redundant bit in original signal to avoid errors for that quantization method is used.

Application Algorithm: An algorithm is an effective methods expressed as a finite list of well-defined instructions for calculating a function. Starting from an initial state and initial input the instructions describe a computation that, when executed, proceeds through a finite number of well-defined successive states, eventually producing "output" and terminating at a final ending state. The transition from one state to the next is not necessarily deterministic; some algorithms, known as randomized algorithms, incorporate random input. An application based algorithm are those to reached specific application using various software.

Transceiver: A **transceiver** is a device comprising both a transmitter and a receiver which are combined and share common circuitry or a single housing. When no circuitry is common between transmit and receive functions, the device is a transmitter-receive.

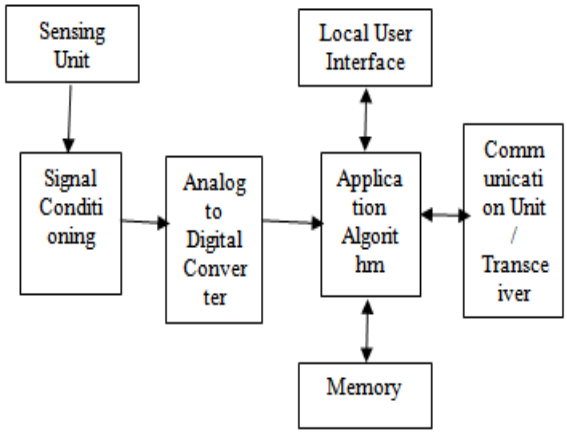

Fig. 1 Wireless Sensor Network Architecture

II. WORK UNDERTAKEN

This project benefits to make ZigBee based network for environment application .It have master and slave structure for the Application .The range of ZigBee is about 30 mtrs .So, the whole area cannot be covered by a single Master slave combination .For this we are covering the whole home system by a master and slave combination.

The system have a main PC master terminal which has the VB software on it .The PC master terminal is used to monitor the status of all the slaves which covers the whole area.

In Our system we have

1) 1Master PC terminal.
2) 2 Sub masters
3) 2 Slaves Terminal

The Idea is that if one slave goes out of range of the PC then the communication fails .So we are placing 2 slaves which will be placed in such way that they will be always in range of the PC master .The two slaves are under the PC based masters supervision .Therefore the PC master will communicate to the slaves via Wireless ZigBee module.

Micro-Controller Interfacing:

This work make the use of ARM7/TDMI-S which is a general purpose 32-bit microprocessor, which offers high performance and very low power consumption. The ARM architecture is based on Reduced Instruction Set Computer (RISC) principles, and the instruction set and related decode mechanism are much simpler than those of micro programmed Complex Instruction Set Computers. This simplicity results in a high instruction throughput and impressive real-time interrupt response from a small and cost-effective processor core. Pipeline techniques are employed so that all parts of the processing and memory systems can operate continuously. Typically, while one instruction is being executed, its successor is being decoded, and a third instruction is being fetched from memory.

The ARM7TDMI-S processor also employs a unique architectural strategy known as Thumb, which makes it ideally suited to high-volume applications with memory restrictions, or applications where code density is an issue. There are three analog sensors interfaced with the ARM microcontroller. ARM microcontroller has in build 10 bit ADC. The output of these 3 sensors is fed at the input of ADC. ADC will convert the analog signal into digital form and then the microcontroller will perform the necessary operation.

III. METHODOLOGY

Energy & data loss are main issues in any Network area in order to get better results related to these issues here use following algorithms

Communication o Nodes

In wireless sensor network node communication is main issue. Mostly sensor nodes are built in restricted area and there is no access from control room so there should be a dynamic communication between the nodes to send their data to master. When nodes are not in range of master then they cannot communicate with master and loss their communication in that case here some algorithms are design to overcome same problem.

Two main algorithms are nearest neighbor and cooperative communication.

NEAREST NEIGHBOUR PROTOCOL

In nearest neighbor algorithm if any node goes out of range from the master then it can take help of nearest neighbor node and through that node it can send data to master.

Here implementing the nearest neighbor protocol in which the Master will send the request on broadcasting mode. The slave which is nearest to master will receive and compare its own ID with the slave id on Slave. If they match then the slave will send the data to master which means that the slave is in range of master which is the nearest path to master.

If the slave ID does not match then the slave will forward the frame to other slaves which are in range. Any slave which is in range of this slave but out of range of master will receive the frame and will send the data to master via shortest path.

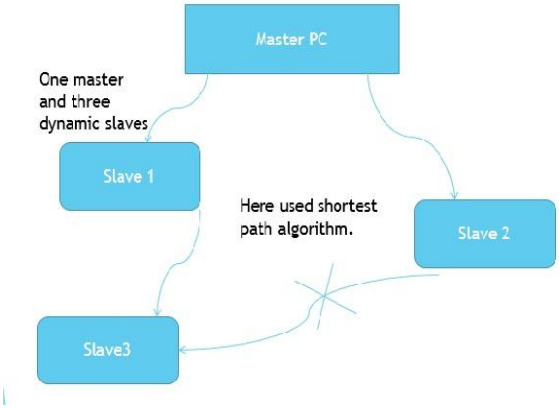

Fig 2. Nearest Neighbor Node Communication

COOPERATIVE COMMUNICATION

Here the cooperative communication technique to make sure that the slave is always in range of the master. These units are basically repeater unit which will enhance the data signal when the slave is not in range of the master.

The communication between multiple nodes possible using above method. Which helpful to communicate and exchange data between master and different slaves. Also this project reduce the power consumption when node is not in use that time they goes into sleep mode and reduce the power.

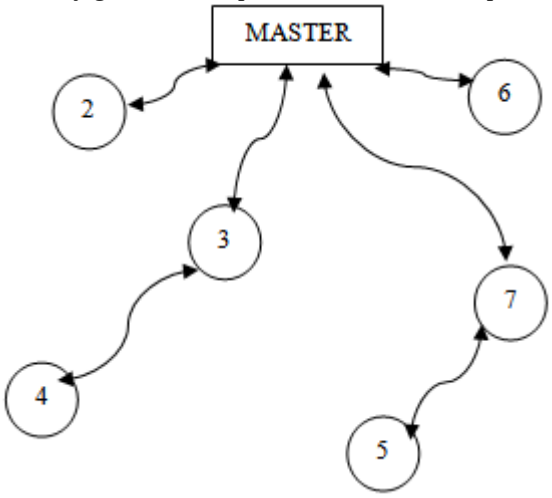

Fig. 3 Cooperative Communication

IV. EXPERIMENTAL RESULTS

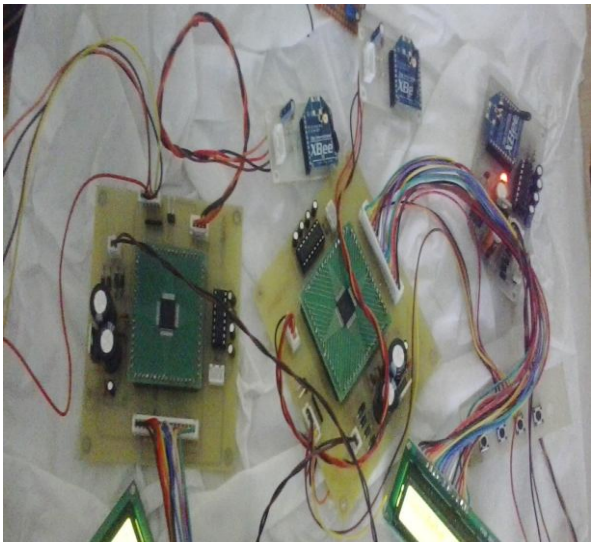

Fig. 4 Hardware Implementation

The above fig. 4 shows the hardware snap of project undertaken. Which contains two nodes along with one master. At execution time result will be display on LCD display as well as on VB6.0 window. One string is send to the display for identification which only a list of items. Temperature sensor shows the real time reading as per changes in temperature it varies the reading and display it on LCD.

Fig. 5 shows the cooperative communication between the sensor nodes it is a VB 6.0 window which shows the result. In third slaves when it goes from out of range then it communicate with its nearest node and data is transfer to master in above case slave three is going to out of range from master and slave one is in range of master also near to slave three then slave three transmit their data to slave one and it further forwarded to master.

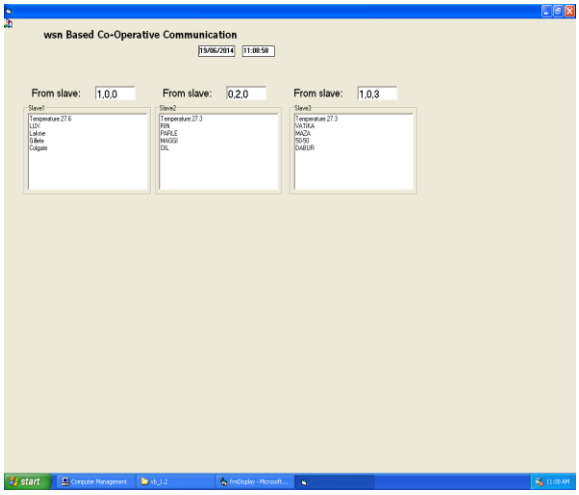

Fig. 5 Output window on VB6.0

Energy Analysis

Power requirement for system is 8V in this 3.3v is for ARM7 and reaming for other circuitry. Energy analysis of component is given below

Table No. 1 Energy comparison Table

Sr. No	Name of Component	Using previous method power consumption	Using real time energy efficient algorithm Power Consumption
1	ARM7	3.3V/ 06mA	3.3V
2.	LCD	8V/ 103mA	4.2V/ 10mA
3	ZigBee	200mA	50-100mA
4.	Temperature Sensor	62uW	20uW
	Total Power Consumption	**70%**	**50%**
Thus Battery life is improved hence the sensor network lifetime also increased			

From above comparison Battery life in first case is weak and in second case battery life is better so because of 50% power consumption battery life also increased so ultimately sensor network life also increased. Lifetime of network is better in this system using hardware implementation with the help of real time cooperative communication.

V. CONCLUSION AND FUTURE WORK

In sensor network connected coverage for both is achieve by various methods in that sensor network plays important role. Here is the survey of different approaches to solve the same problem for increasing power efficiency and dynamic communication between nodes.

During the study it is found that first to consider the types of sensors and their node placement, in wireless sensor network. According to both wireless technologies I studied different types of algorithm which overcome the cooperative communication problem and power optimization too. Using hardware it is possible to overcome all the issues related communication between two nodes using nearest neighbor and cooperative communication algorithm. ZigBee transceiver plays important role in this system which is interface with ARM 7 with RS 232 using this hardware get faithful outcome.

One of the important measures of WSN is the network lifetime. For the proposed model, whenever any sensor node runs out of energy, communication links between various sensor nodes and the base station will break. This is considered as the end of the network lifetime. Since the lifetime of each sensor node depends on energy consumption, it is important to preserve residual energy of these nodes in such a way that overall network lifetime is extended. In wireless sensor network where nodes operate on limited battery power. Efficient utilization of energy is very important. It efficiently route the data through transmission path from node to node.

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