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Implementation of RSSI to Increase the Carrier Signal for Movable and Fixed WSN

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***Abstract*- Nowadays Wireless Sensor Networks (WSNs) play a vital role to improve the communication. Here the node localization is one of the basic problems in wireless sensor networks. Because the RF signal is affected by the environmental factors such as fading, path loss, multipath component and etc. Due to these factors the transmitted data are lost. In some application we generally prefer accurate data transmission. To achieve this we measure the RSSI between the distant nodes. This measured RSSI value is used to implement the TPC algorithm and adaptive channel coding technique for achieving lossless transmission. The RSSI (Received Signal Strength Indication) values and distance between the nodes is the origin of Wireless Sensor Networks (WSNs).**

***Index Terms*- Wireless Sensor Networks (WSNs), Received Signal Strength Indication (RSSI), Transmission Power Control (TPC), Adaptive Channel Coding Technique.**

I. INTRODUCTION

A Wireless Network that transmits from computer to computer instead of using a central base station to which all computers must communicate, this peer-to-peer mode of operation can greatly extent the distance of Wireless Network .It can change location and configure itself based on the applications. A Wireless Sensor Network has an ability to monitor physical and environmental conditions, and also operate devices and control them along with it provide efficient and reliable communication. Wireless Sensor Nodes or *motes* are responsible for sensing the information from the source. To achieve reliable communication these requirements such as Quality of Service (QoS), Types of service, Fault Tolerance, Life Time, scalability and Maintainability are needed.

II. RSSI MEASUREMENT

A. SYSTEM ANALYSIS

In this project is finding RSS between transmitter and receiver. Let we consider the threshold value is -45.0 for 1meter distance between the two transceiver nodes. If the measured RSSI is less than the threshold level, then the receiver node will automatically send the trigger signal to transmitter for increasing the carrier signal strength by using TPC (Transmission Power Control) algorithm. It is applicable for both Fixed node and Movable node.

B. BLOCK DIAGRAM

1).FIXED NODE

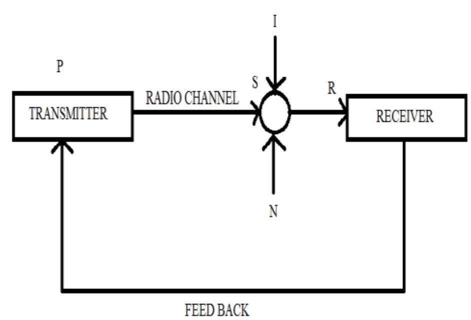

Figure: 1-1 fixed wireless sensor nodes

From the figure 1-1, the distance between the sensor nodes are constant. 'P' packet arrived from the transmitter, 'n' is the channel noise and 'I' is the interferences, 'S' meant sender 'R' meant receiver. The noise and interference can be eliminated by using adaptive channel coding technique.

2).MOVABLE NODE

For movable node, the distance between the transceiver nodes are varies. The receiver node is identified by its unique ID. This task is completed by event driven protocol. This is shown in the below figure: 1-2

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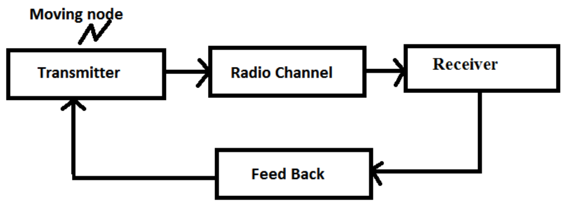

Figure: 1-2 movable wireless sensor node transmission

C. RSSI CALCULATION

RSSI mean Received Signal Strength Indication. It is used for measuring the signal power on the radio link, usually in the units of dBm, while a message is being received. It is also used for estimating node connectivity and node distance (although the relation between distance and RSSI is noisy and not straightforward), among other things. Another usage of RSSI is to sample the channel power when no node is transmitting to estimate the background noise, also known as noise floor.

$$RSSI = -(10*n*\log10(d) + A) \text{ ----- (1)}$$

Where

RSSI is the RSSI value received (dBm)

n is the path-loss exponent

d is the distance

A is the RSSI value at a reference distance

i. Power Loss Model

The path loss of a wireless link can be represented by the difference between the transmit power P_{tx} and receive power P_{rx}.

$$\textbf{Path Loss} = P_{tx} - P_{rx} \text{ ---------------- (2)}$$

In this expression, we are grouping a variety of effects, including multipath fading, shadowing, and path loss, under the general term "Path Loss" which reducing the transmitted power down to the received signal strength.

ii. Path Loss Exponent

The path loss exponent has to be determined experimentally. The path loss variable ranges from around 2 to 4, where 2 is the free-space value (no obstruction, line of sight) and 4 represents a very lossy environment.

N	Environment
2.0	Free space
1.6 to1.8	Inside a building, LOS
1.8	Grocery store
1.8	Paper/cereal factory building
2.09	A typical 15m×7.6m conference room with table and chairs
2.2	Retail store
2 to 3	Inside a factory, no line of sight
2.8	Indoor residential
2.7 to 4.3	Inside a typical office building, no line of sight

Table 1-1 various path loss exponent values

iii. Mobility

In a dynamic environment nodes can move around (even shifting a node by inches can cause destructive interference due to multipath).As a result, the optimal transmit power should have a cushion above the tight bound.

$$P^{TxOpt} = \textbf{Path Loss} + P^{thresh} + M^{thresh} \text{ --------- (3)}$$

The term M^{thresh} is the transmit power cushion added to the minimum threshold so that the device can tolerate some mobility without re-triggering transmit power updates too often. The difference between A and B is set to 3dBm for our experimental algorithm. M^{thresh} provides a buffer in which the mobile node can move around without re-triggering the protocol too often.

D. APPLICATIONS

- Target Tracking
- Security surveillance
- Object Localization
- Habitat Monitoring.

III. IEEE 802.15.4 PROTOCOL

A. XBEE

Xbee is the brand name for Digi International. It is a feature rich RF module which makes a good solution wireless designer. It is implemented in IEEE802.15.4 and Zigbee module. It can communicate with Micro Controller by using UART serial communication. Xbee has digital

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input/output pins which is used to read a digital value by a sensor and we can transmit the sensed value to long distance up to 300feet (100m).It is a standard design for point-to-point and star communication on over air baud rate is 250kbps.Xbee module has available in two forms such as Through hole and surface mount. It can operates in AT and API commands.

B. XBEE AND ZIGBEE IMPORTANCE AND POWER CONSUMPTION

In this thesis the experiments will be done based on the XBee protocol which is considered one of the most common protocols in personal WSN of low bandwidth, low cost, high level of security and low power consumption. An example of a module which includes ZigBee protocol is Cross BowMicaZ. The inability to customize proprietary communication protocols or develop custom software makes the area of research for additional power consumption reduction narrowed. Cross BowMicaZ provides the ability to customize the communication protocol, but it has some disadvantages relating to the size, range and different hardware for different network functions. In this thesis, we use Digi's Xbee modules with ZigBee protocols for our experiments. Those modules are small in size, have variant coverage range up to 80 km and the ability to use the same hardware for all node types (Coordinator, Router, End node).

C. XBEE OPERATION MODES

XBee has five modes of operation; the basic one is idle mode. This is the mode when the module is not receiving, transmitting, commanding or sleeping. This mode can consume a significant amount of energy compared to active mode where data is being sent or received. One solution is to put the XBee in sleep mode. However, sleep mode depends on the type of application; whether it is event-driven or periodic application. Moreover, sleeping requires a light scheduling algorithm in order to wake up the nodes in the network in harmony.

a) Idle mode

In Idle Mode, the mode shifts into other modes of operation when serial data is received in the ID buffer then changes to transmit mode. When valid RF data is received through the antenna, it switches to receive mode. It changes to sleep mode based on sleep register conditions. When a command mode sequence is issued, then it changes to command mode.

b) *Transmit and receive modes*

In Transmit Mode, the module packetizes the data and ensures the 16-bit address is n in order to establish a route to the destination. When the module cannot find the destination address, it runs the network address discovery. If the module with the destination address is not known, then the packet will be discarded. Route discovery will take place in order to establish a route to the destination and retransmit the packet. If route discovery fails to establish a route, then the packet will be discarded. In Receive Mode, If a valid RF packet is received, the data is transferred to the serial transmit buffer.

c) Command Mode

Commands are used to modify or read the module parameters. The key point is how to let the module understand that the incoming serial character is a command and not data to transmit. In order for the module to understand the command mode, an enter mode code "+++" must be sent to the module with respect to the guard time before and after the code. In details:

- No character is sent for one second.
- Three Characters "+++" are input to the module within one second.
- No character is sent for one second.

If the procedure is issued correctly, then the module responds with OK out on DOUT pin.

d) Sleep Mode

XBee modules, like many other communication or microcontroller devices can put themselves into sleep mode to save the power which is mainly consumed in sensor node by the transceiver. But the most important trade-off is that during sleep no activities can be handled and the device is nearly turned off until it wakes up. ZigBee mesh networking is specifically designed to handle communication in the network where many nodes might be in such a type of very low-power state. When an end device is asleep, one of the parents stores the data and forwards it when the end device wakes up. ZigBee network gets this feature without any additional components or code required to manage the process.

XBee end devices support two different sleep modes:

- Pin Sleep.
- Cyclic Sleep.

Pin sleep allows an external microcontroller to determine when the XBee should sleep and when it should wake by controlling the Sleep_RQ pin. In contrast, cyclic sleep allows the sleep period and

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wake times to be configured through the use of AT commands. The sleep mode is configurable with the SM command.

IV. RESULT AND DISCUSSION

By using Visual Basic 6.0, we can see the result of RSSI value, optimum transmitted power, distance between the sensor nodes and the data from the sensing node. This can be illustrates the given figure 4-1 and figure 4-2.

A. EXPERIMENTAL RESULTS

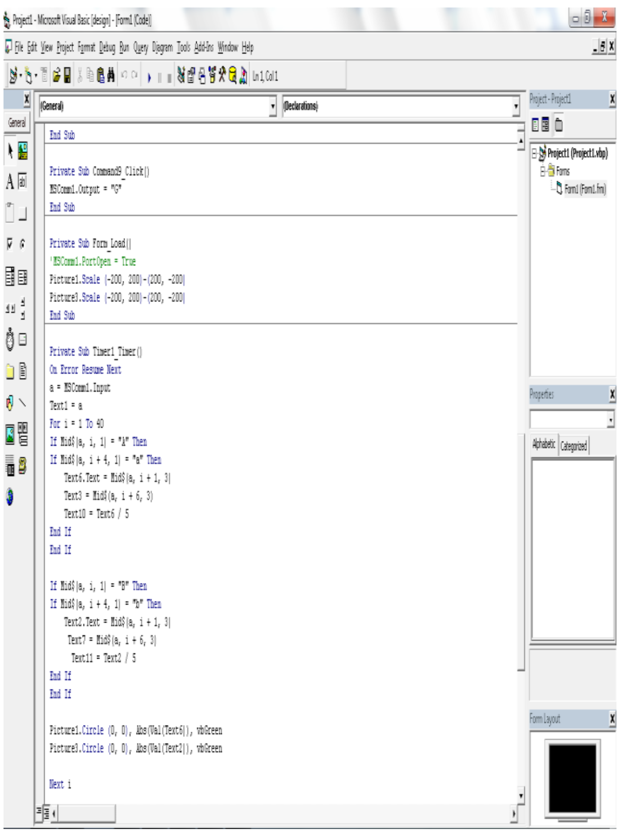

Figure 4-1 Visual Basic 6.0 – Program window

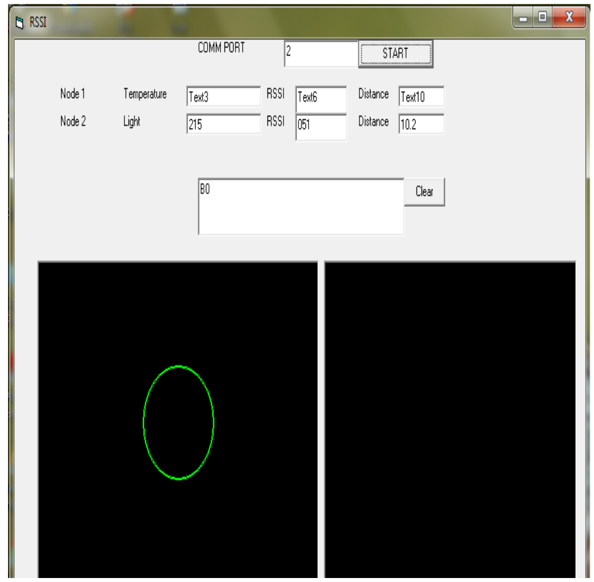

Figure 4-2 illustrates the measured RSSI value in visual Basic 6.0

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V. CONCLUSION

In this work, we intensively studied and designed different architectural aspects and requirements for designing WSNs. From its experimental results, we can transmit the data without any loss for both fixed and movable wireless sensor nodes. This is achieved by measuring RSSI value between the distant nodes. If the measured RSSI value is below the threshold (-45.0dBm for 1m) mean it automatically increase the carrier signal by implementing TPC algorithm. This is capable to cover short distance communication. Measured RSSI value can displayed on the Visual Basic software.

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REFERENCES

[1] SavareseC, Rabaey J M, Beutel J. *Locationing in Distributed Ad-Hoc Wireless Sensor Network* M Proc.of the 2001 IEEE Int.lConf.on Acoustics, Speech, and Signal. Salt Lake: IEEE Signal Processing Society, **2001**, 4:2037-2040

ISSN: 2278 – 909X

[2] He T , Huang C D , Blum B M , et al . *Range-free localization schemes in large scale sensor networks* M Proc.of the 9th Annual Int.lConf.on Mobile Computing and Networking. San Diego:ACMPress,2003:815.http://www.cs.virginia.edu/~th7c/paper/APIT_CS-**2003**-06.pdf

[3] BahlP, Padmanabhan V N.RADAR: *an in-building RF-based user location and tracking system M Proc.of the IEEE INFOCOM*. TelAviv: IEEE Computer and Communications Societies, **2000**: 775-784

[4] A. Nafarieh and J. How. "A Testbed for Localizing Wireless LAN Devices Using Received Signal Strength," *Communication Networks and Services Research Con- ference*, Halifax, 2008, pp. 481-487.

[5] G. Eason, B. Noble and I. N. Sneddon, "On Certain Integrals of Lipschitz-Hankel Type Involving Products of Bessel Functions," *Philosophical Transactions of Royal Society*, London, Vol. A247, April 1955, pp. 529-551.

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