International Journal of Scientific Research Engineering & Technology (IJSRET) ISSN: 2278–0882
IEERET-2014 Conference Proceeding, 3-4 November, 2014

Habitat Monitoring

Surabhi Sharma
9th Sem ECE (Dual Degree)
surabhisharma0792@gmail.com

Abstract— Wireless sensor technology has contributed to present world with its wide applications that benefited large number of fields. This paper is about applying wireless sensor technology to real world habitat monitoring. Study shows that how computational engineering service as well electronics equipments helps in development in life science research. A set of system design was developed using hardware design of nodes, design of sensor networks, and the capability of remote data access and management.

I. INTRODUCTION

As an introduction to the topic , we should first understand the objective and analyze the concept of wireless sensor technology to study the objective. After that we go through some challenges encountered in order to successfully apply the sensor nodes and then to the conclusion. Instrumenting natural spaces with enormous micro sensors can help in data collection and managing the data. The integration of local processing and storage allows sensor nodes to perform complex functions as well as to perform application specific and sensor specific algorithms. Nodes have the ability to adapt their operation over time in response to change in the environment , the condition of the sensor network itself.

Many sensor network services are useful for habitat monitoring : tracking, localization, data aggregation, and energy efficient multihop routing.

In order to define better wireless technology capable of recording, storing and transmitting microhabitat data, a complete system of communication protocol, power management and sampling mechanism is essentially required.

Our goal is to develop a sensor network architecture for the domain of monitoring applications. Wireless sensor networks organize themselves in such a manner that the data stored in it can be retrieved later and notify operates that network needs servicing.

A key difference between wireless sensor networks and traditional probes is that WSN permits real time data access without repetitive visits to sensitive habitats while in data logger, it is not successful until logger is not present at the site in future.

II. GREAT DUCK ISLAND

College of Atlantic (COA) have many in situ sensor research programmes on several remote islands with fine infrastructure and logistic development. COA defines field testing for habitat monitoring. Great Duck Island (GDI) located(44.09N, 63.15W) is a 237 acre island located 15 km south to Mount Desert Island, Maine. Great Duck Island consists nearly 5000 pair of Leach's storm petrels nesting in discrete "patches" with the major habitat types found on the island. After studying about Leach's Storm Petrels, COA in interested to find the answers for major queries. These are :

1. What are the difference in the microenvironment with and without large number of nesting petrels ?
2. What is the variation across petrel breeding sites ? Which of these conditions yields an optimal microclimate for breeding and hatching. ?
3. What environment changes occur in the burrow during the 7 month breeding season ?(April-October)

Burrows are usually 2-6 cm within the surface and range from 50cm to 1 m in length with the internal diameter of about 5cm. One sensor node is sufficient enough for one burrow but it should be small is size so that one petrels and node can co-exist without disturbing the passage. Burrows occur in different patches with each patch include atleast 50 burrows and majority of these burrows are populated with sensors. The sensors should operate reliably and predictably.

III. NETWORK ARCHITECTURE

The network architecture has a basic component as sensor nodes that perform general purpose computing and networking in addition to application specific sensing. The sensors transmit their data through sensor networks known as *gateways*. It transmits data from the sensor patch to the remote base station that provides WAN connectivity. We use high quality sensors with sophisticated signal processing which provides robustness against component failure. Sensor nodes provides bidirectional communication with the other nodes in the system.

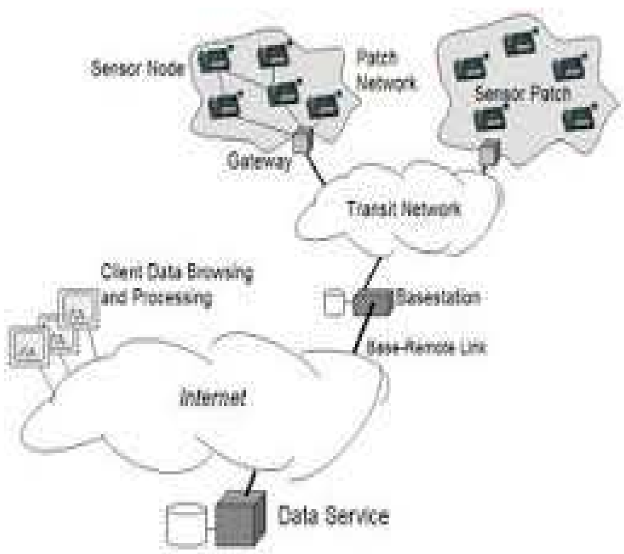

FIG 1 ***System architecture for Habitat Monitoring***

Individual sensor nodes and communicate and coordinate with one another easily. The sensors can typically form a multihop network by forwarding each other's message and increasing vital connectivity. Data communicates using energy efficient communication protocols. To provide data to remote users, the base station uses WAN connectivity and reliable data storage. Each stage has some sensors which is used for data storage at the time of power outage and therefore they provide data management services.

IV. APPLICATION STRATEGIES

A. ENERGY BUDGET :

Many habitat monitoring applications uses mica which works on AAbatteries which have a 2.5 ampere hours (AH). These batteries would be able to supply 2700 Mah at 3 volts. Now the application specifies that how this energy budget is distributed among different stages. It is well noticed that different sensor nodes perform different functions which would have different level of energy requirement. But some limited power sensing nodes are also available in the network architecture. The I/O pins of the microcontroller should be out in pull-up state so that they can contribute to about 100µA of leakage current.

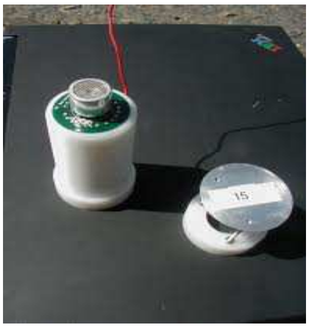

FIG2 : MICA MOTE USED FOR ENERGY BUDGET

B. SENSOR BOARD DESIGNING:

To monitor burrow petrel activities we require thermopile known as passive infrared detector manufactured by Melexis as it have low power requirement with good efficiency and furthermore it does not interfere with burrow ongoing activities. Thermopile is used to convert the temperature difference to electric potential by its thermo electric effect.

Mica Weather Board provides sensors which detects change in environment conditions and these sensors detects humidity, pressure, temperature, barometric pressure etc. In addition to sensors, Mica Weather Board also includes I^2C Analog to Digital converter. ADC is used to provide good efficiency and flexibility with low power budget. The Mica includes 51 pins expansion connector which have the ability to stack sensor board design on each other. We design and implement sensor board with all its sensor nodes and components integrated into single package so that minimizing the size of board would help to fit into the size of burrow petrel.

V. GATEWAY STRATEGY

The environment conditions of these islands are diverse. They can experience direct sunlight as well extreme cold and hot temperatures due to which heavy rainfall could occur. So waterproofing should be taken care of at the time of installation of gateways. Using different gateway strategy would directly affect the transit network system and to avoid the effect we use method of single hop mote to mote network.

The mote to mote method connects note to gateway as well mote to sensor patch and these motes are connected to each other through Yagi Uda antenna with 900Mhz and height more than 1200 feet. The mote method does not require bidirectional link in the architecture.

VI. BASE STATION SYSTEM

In order to define the proper connection to patches to the base station, system should be connected to internet through wide link. In GDI experiment connection to internet is done through satellite and DirecTV System. The statellite is connected to computer as well as laptps to manage the database as well as sensor nodes. The base station currently usues SQL database. The database stores time stamped readings from individual sensors. The base station needs to run as a turnkey system as it has to b unattended for a particular duration.

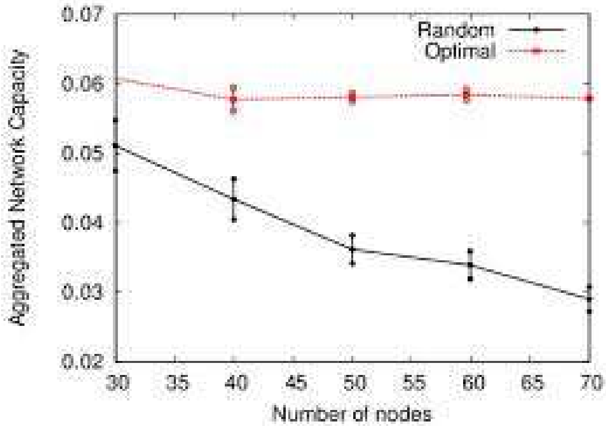

FIG 3 : VARIATION OF ENERGY WITH SENSOR NODES

It is expected that many user interfaces would be used on the top of the sensor nodes. It is kept in mind that installation should be in a manner coordinates with RF propagation. And therefore board mounted miniature whip antenna is used. Sealing of electronic equipments could be done by sealing or packaging of the equipments such that base station is not affected by environmental conditions.

VII. CONCLUSION

We have presented the use of wireless sensor networks, network architecture and application specific sensors for study of habitat monitoring. Here we are collaborating our research with the research of College of Atlantic on Great Duck Island. Sensor networks are not separated from environment, infect they are a part of it and are well affected by environment. Hence sensor nodes should be properly taken care. Sensor nodes used in the system architecture is of good energy constraints and ultimately delivers a verified database to user.

We believe that GDI can be a perfect domain for other applications which as well require health monitoring. We have analyzed environmental data from one of the first deployment of WSN in outer world. Our experiment with sensor network developed a habitat monitoring kit which would help in development of other habitat environment. User's now will be able to use mote's operation easily and effectively.

VIII. REFERENCES

[1] Emerson Jose Verissimo, “Wireless Sensor Networks for Habitat Monitoring,” November 13, 2007.
[2] Joseph Polastre and Robert Szewczyk, David Culler and John Anderson, “An Analysis of a Large Scale Habitat Monitoring Application,” IEEE Trans. Electron Devices, vol. ED-11, pp. 34-39, Jan. 1959.
[3] Alan Mainwaring, Joseph Polastre and Robert Szewczyk, David Culler, John Anderson, ”Wireless Sensor Network for Habitat Monitoring,”
[4] D. Estrin, L. Girod, G. Pottie, and M. Srivastava, “Incrementing the world with wireless sensor Networks”, In International Conference on Acoustics,Speech, and Signal Processing (ICASSP 2001), Salt Lake City, UT, May 2001.
[5] WANG, H., ESTRIN, D., AND GIROD, L. Preprocessing in a tiered sensor network for habitat monitoring. *EURASIP JASP Special Issue on Sensor Networks 2003*, 4 (Mar. 2003).