# WSN Test Bed for Room Environment Monitoring Using I Sense

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***Abstract-*** WSN is emerging as leader in various monitoring fields due to its potential for many application scenarios. isense intelligent sensor monitoring service uses wireless sensors capable to measure temperature, light and form network. Gateway nodes collect sensed data from network area and store data in MYSQL data base for analysis and visualization through portal. This paper demonstrate I sense a sensor network test bid through which sensor application can be implemented using (NESCTINYOS) software on dedicated sensing devices . In the proposed work we have developed and deployed indoor room temperature monitoring using leach protocol as hardwire/test bid solution. The results reflect the validity of protocol as a test bid solution.

## I. INTRODUCTION

Simulation tools used in protocol development are overridden by accuracy of application to depicted real time application a testbed / hardware solution is proposed to mimic a live application. Indoor environment monitoring application utilize WSN [98] technology to gather and process data. Present day application monitoring depends on internet as researcher aspires for IOT [99]. Indoor environment system using zigbee [100] extended to IP based WSN [101] can be utilized for web based monitoring services. I sense intelligent sensor monitoring services is a web based sensor capable of measuring live temperature humidity light clubbed as group with similar sensors to form a network. A specialized sensor node gate way collect sensed/processed data from network and store in MYSQL data base for analysis and visualization through a portal. The developed protocol for an application can be submitted [program in NESC] compilation done by [TINYOS NESC] [102 & 103] software. Finally performance evaluation is accessed by downloading and executing on sensing devices which form test bed. In proposed work 4 TelosB motes [104] are configured as cluster in a network, there of them acting as member nodes and fourth acting as cluster head selected randomly as in leach protocol. The members are re-designated as cluster head based on remaining energy.The processed data by cluster head is transmitted to gateway node than to PC for visual performance analysis.

## II. ARCHITECTURE

The I sense architecture system for intended application for monitoring services consists of three subsystems Fig [1] for data gathering storing selectively presenting data to end user.

### *2.1. Subsystems with components*

The three subsystems with sensor network gateway and remote client components are data acquisition subsystem

- Storage subsystem
- Visualization subsystem

### *2.2. Data acquisition system*

This subsystem is formed by group of I sense motes as a network to collect environmental data. This is basically integrated system software.

### *2.3. Storage subsystem*

This subsystem is composed of gateway node and datacenter for receiving / acquiring data from DAS system and store data in data center.

### *2.4. Visualization subsystem*

This subsystem focuses on selectively presenting collected data to end user in numerical and graphic form. This is a web interface for communication between client and data center.

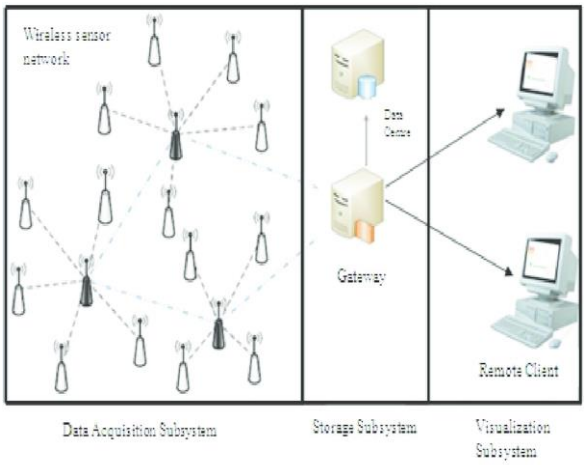


Fig 1

## III. IMPLEMENTATION DETAILS

It is composed of description of hardware, software (operating system data base)

### *3.1. Hardware TELOS B motes*

All requesters of WSN data collection programming communication computing and storage are integrated into single platform. Data gathering programming via USB, communicating by IEEE 802.15.4 complaint radio chip with antenna; MSP430 µC for computing 10KB RAM, 1MB external flash for storage with sensor suite for tow power application software consists of operating system and data base.

### *3.2. Operating system (TINYOS)*

It is open source dedicated energy efficient operating system developed by WC Berkely for sensor network. TINYOS provides working environment for sensor embedded in data collection NesC is network embedded system C is based event driven programming language for application built on TINYOS platform. It is extension of C programming. NISC has component and event based structure to facilitate development and implementation of WSN protocol. There are two components.

- Modules: - components with variable and executable code.
- Configurations: - components that wire other components together.

### *3.3. Data base*

I sense uses MYSQL data base for storing related information. It is most popular open source RDBMS used for web based applications. Administration of MYSQL is by php My admin free open source tool written in PHP with use of web browser.

## IV. SENSOR MONITORING SERVICES

I sense utilizes PHP server side script language for web development the web pages can an interactive due to java script it allows user to view following pages.

1. **Home Page: -** project description and access to functionality.
2. **Sensor Network page: -** Allows user to choose network view display and query a node in network. The figure 6.2 deployed at Nihon communication B'lore as leach configuration for room temperature sensing. Figure shows real time data.
3. **Query page: -** Select sensor start end time with date and finally choose sensor parameter.
4. **Service page: -** Initiate lab service to uploaded application.
5. **Download page: -** It has text, excel PDF format data download by time period and monitor.
6. **Feedback page: -** Allow user to communicate on portal experience.
7. Information page for password add pages for add/delete sensor from network.


Fig 2

## V. PROPOSED TEST BED SOLUTION

The test bed allows indoor testing of wireless sensor network remotely proposed test bed solution is for room temperature monitoring by sensor network configured as in leach protocol. The hard wired sensor network has (Telos B motes) member nodes and a cluster head member nodes collect temperature data and transmit to cluster head CH which aggregate data and send to gateway for server to display the data. Cluster heads are rotated based on energy left/current remaining in node for energy efficiency. The application is TINY OS based. The implementation steps are application upload compilation installation execution and display of results.

### *5.1. TINY OS*

The TINY OS based application can be uploaded by portal and 4 number of nodes are selected for compilation figure.

### *5.2. Compile*

Compile the successful compilation of the code on telsoB platform happens program do not return error message else compilation error will be displayed.

### *5.3. Install*

Application to sensor motes are installed through portal on successful compilation failure means sensor motes are currently in use elsewhere.

### *5.4. Execute and display*

The tested allow used to execute and display presently installed application with results viewed in browser window in real time. A sample of results is displayed figure 6.2.

## VI. EXPERIMENTAL SETUP AND RESULTS

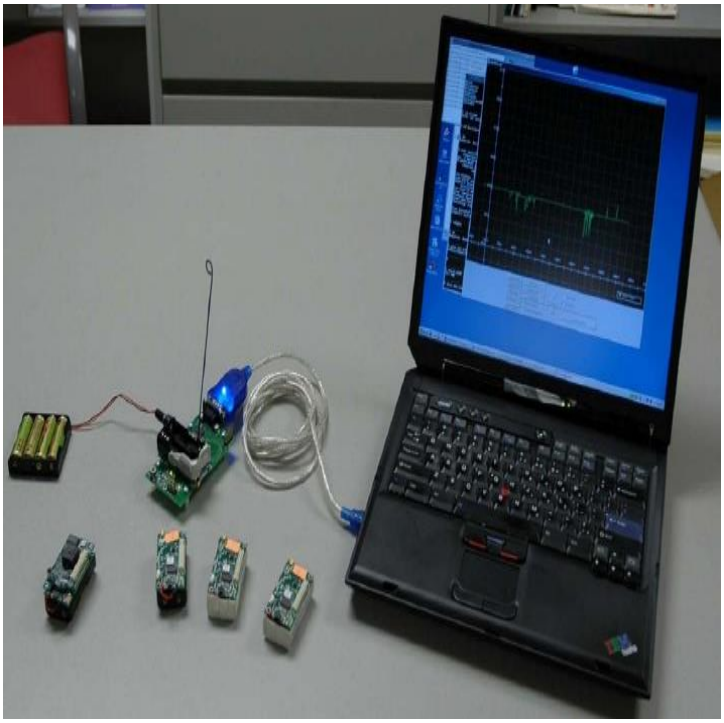

Fig 3

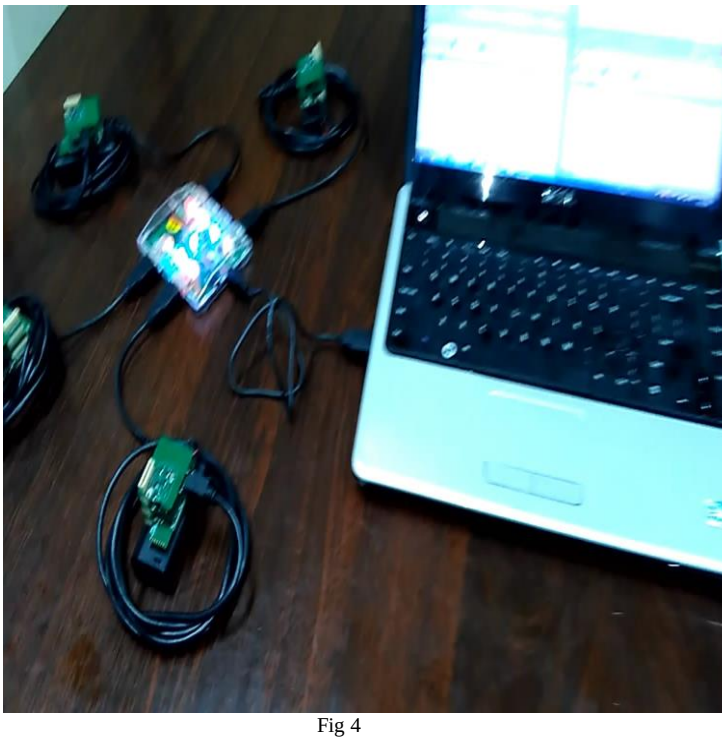

Fig 4

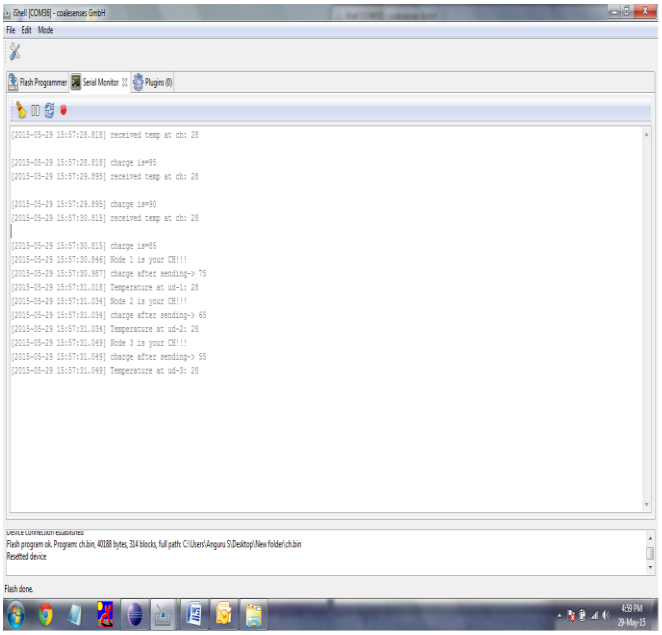

Fig 5

iShell [COM35] - coalesenses GmbH

File Edit Mode

Flash Programmer | Serial Monitor | Plugins (0)

```
[2015-05-29 15:57:28.818] charge after sending-> 90
[2015-05-29 15:57:28.818] Temperature at exe: 28
[2015-05-29 15:57:29.895] received temp at n1: 28

[2015-05-29 15:57:29.910] charge is=85
[2015-05-29 15:57:30.784] received temp at n1: 28

[2015-05-29 15:57:30.784] charge is=80
[2015-05-29 15:57:30.846] received temp at n1: 28

[2015-05-29 15:57:30.893] charge is=75
[2015-05-29 15:57:30.909] Node 2 is your CH!!!
[2015-05-29 15:57:30.924] charge after sending-> 65
[2015-05-29 15:57:30.940] Temperature at ud-2: 28
[2015-05-29 15:57:30.956] Node 3 is your CH!!!
[2015-05-29 15:57:30.987] charge after sending-> 55
[2015-05-29 15:57:31.002] Temperature at ud-3: 28
```

Table 1

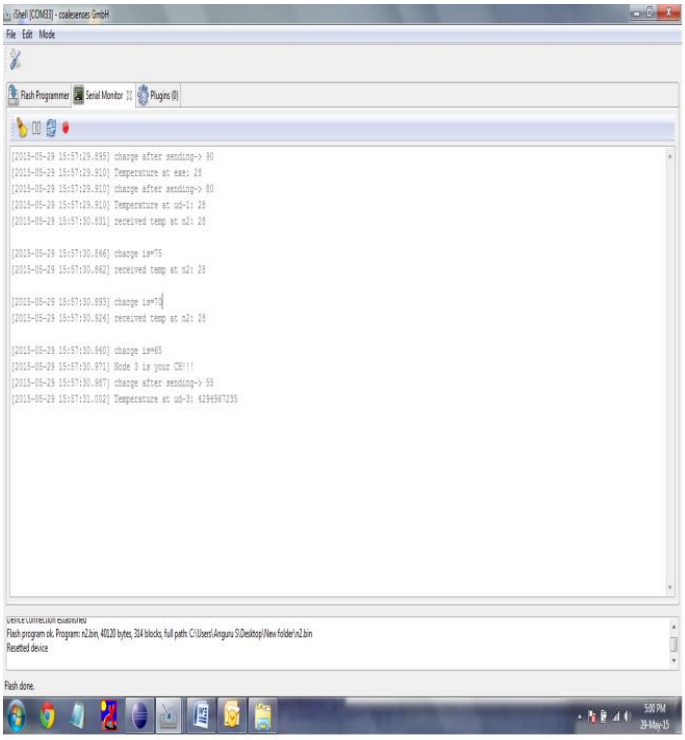

Fig 6

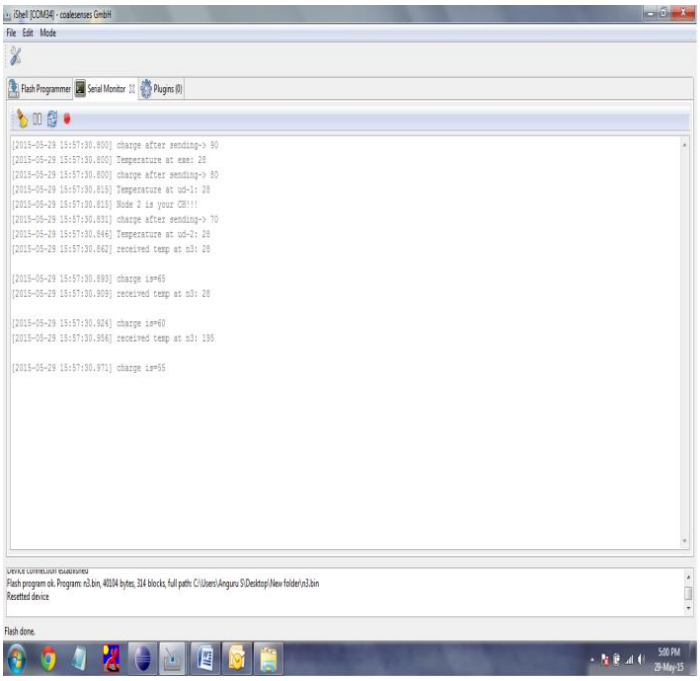

**Fig 7**

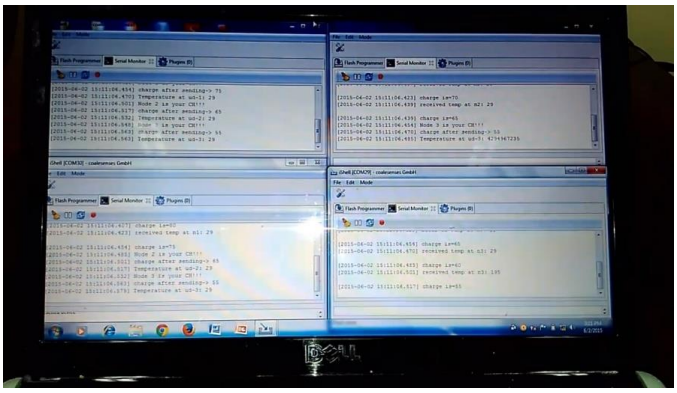

Fig 8

*A. Temperature Results & Remaining charge after Transmission*

- [2015-06-02 12:55:14.070] charge after sending-> 90
- [2015-06-02 12:55:14.179] Temperature at exe: 28
- [2015-06-02 12:55:16.628] received temp at n1: 29
- [2015-06-02 12:55:16.628] charge is=85
- [2015-06-02 12:55:18.625] received temp at n1: 29
- [2015-06-02 12:55:18.641] charge is=80
- [2015-06-02 12:55:18.656] received temp at n1: 28
- [2015-06-02 12:55:18.672] charge is=75
- [2015-06-02 12:55:18.703] Node 2 is your CH!!!
- [2015-06-02 12:55:18.734] charge after sending-> 65
- [2015-06-02 12:55:18.750] Temperature at ud-2: 28
- [2015-06-02 12:55:18.781] Node 3 is your CH!!!
- [2015-06-02 12:55:18.797] charge after sending-> 55
- [2015-06-02 12:55:18.797] Temperature at ud-3: 28
- 2015-06-02 12:55:16.628] charge after sending-> 90
- [2015-06-02 12:55:16.644] Temperature at exe: 29
- [2015-06-02 12:55:16.644] charge after sending-> 80
- [2015-06-02 12:55:16.660] Temperature at ud-1: 29
- [2015-06-02 12:55:18.641] received temp at n2: 29

- [2015-06-02 12:55:18.641] charge is=75
- [2015-06-02 12:55:18.641] received temp at n2: 28
- [2015-06-02 12:55:18.672] charge is=70
- [2015-06-02 12:55:18.688] received temp at n2: 28
- [2015-06-02 12:55:18.703] charge is=65
- [2015-06-02 12:55:18.719] Node 3 is your CH!!!
- [2015-06-02 12:55:18.750] charge after sending-> 55
- [2015-06-02 12:55:18.766] Temperature at ud-3: 4294967235
- [2015-06-02 12:55:18.578] charge after sending-> 90
- [2015-06-02 12:55:18.610] Temperature at exe: 29
- [2015-06-02 12:55:18.610] charge after sending-> 80
- [2015-06-02 12:55:18.610] Temperature at ud-1: 29
- [2015-06-02 12:55:18.610] Node 2 is your CH!!!
- [2015-06-02 12:55:18.625] charge after sending-> 70
- [2015-06-02 12:55:18.625] Temperature at ud-2: 29
- [2015-06-02 12:55:18.641] received temp at n3: 28
- [2015-06-02 12:55:18.672] charge is=65
- [2015-06-02 12:55:18.688] received temp at n3: 28
- [2015-06-02 12:55:18.719] charge is=60
- [2015-06-02 12:55:18.734] received temp at n3: 195
- [2015-06-02 12:55:18.766] charge is=55
- [2015-06-02 12:55:14.070] received temp at ch: 28
- [2015-06-02 12:55:14.070] charge is=95
- [2015-06-02 12:55:16.628] received temp at ch: 29
- [2015-06-02 12:55:16.628] charge is=90
- [2015-06-02 12:55:18.625] received temp at ch: 29
- [2015-06-02 12:55:18.625] charge is=85
- [2015-06-02 12:55:18.656] Node 1 is your CH!!!
- [2015-06-02 12:55:18.688] charge after sending-> 75
- [2015-06-02 12:55:18.703] Temperature at ud-1: 28
- [2015-06-02 12:55:18.734] Node 2 is your CH!!!
- [2015-06-02 12:55:18.766] charge after sending-> 65
- [2015-06-02 12:55:18.781] Temperature at ud-2: 28
- [2015-06-02 12:55:18.797] Node 3 is your CH!!!
- [2015-06-02 12:55:18.797] charge after sending-> 55
- [2015-06-02 12:55:18.812] Temperature at ud-3: 28

## VII. CONCLUSION AND FUTURE SCOPE

The proposed work presents room environment temperature monitoring system implemented using energy efficient leach protocol on I sense platform. The I sense architecture provides platform for sensor data collection storage visualization further due to its simplicity and efficiency it can host developed protocols for remote monitoring applications. The challenges of deployment and reprogramming of sensor nodes in WSN application can be dealt by test bed offering easy ways of programming over air. The node mobility algorithm [105][106] for monitoring sensors on move with server connectivity can be future scope of the work.

## VIII. REFERENCES

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