Safety and Maintenance of High Rise Structures Touches IoT Using Zolertia Motes

Darshan Patel G. R.

M. Tech Student(DCN), Department of Telecommunication Engineering,
Dr. Ambedkar institute of Technology, Bangalore-560056,

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Abstract - *The implementation of this project is improving the maintenance of any structures like buildings, bridges, excavations, tunnels, power plants, and airports. It encompasses damage detection, identification and prevention of structures from natural disasters like earth quake and rain. The main aim is to safety of the structures built by the civil engineers. Here smart sensors are directly connected to the motes hence data observing and data networking is easily done by wireless sensor network, through gateway data place in cloud, in this proposing system using Internet of things together with the wireless sensor network quick to notice send to application manager.*

Key Words: **Wireless Sensor Network (WSN), Internet of Things (IoT), Mote, Gateway, Cloud.**

1. INTRODUCTION

By spending many sensors modules for calculating different parameters of structural health, a scheme is designed such that it warnings the community as well as the save team like sending information to application manager or it may be directly send information to fire engine station or may to weather forecast department before and after the event has happened so that there will be less damage of life and their things.

The plan, creation, and development of savvy structures are one of a definitive difficulties to building analysts today. Since they shape the embodiment of framework insight, one of the centers of keen structures innovation revolves around creative sensors and sensor frameworks. This framework speaks to one of the essential applications for new sensor advancements. In reality, much consideration has been centered as of late around the declining condition of the maturing framework in the U.S., and additionally to the constraint of their reactions amid extraordinary occasions, (for example, wind and tremors).

Today modern world grow more complex and civil engineers built different kind of structures, but it not possible get the durability of those structures. Hence this proposed system will observe and maintain the structures and also look after safety. Over last 25 years different kinds of projects are done to achieve safety of the structures but some of them are failure because of their inheriting drawbacks. From last 10 years boom in structure monitoring and speedy identifying of damages in the structures affected from natural calamities. This project proposes the safety and maintenance of structures, it expands the durability of the structures by stable monitoring. It includes damage detection, damage identification from natural disasters. This project also proposes to overcome the general issue arises in structural health monitoring system.

2. OBJECTIVE

The main objective of this proposed system is to maintain and achieve stability and safety of the structures. Here productivity is more as compared to the conventional systems, this monitoring and safety system may easily adjusted to modern days. Old systems have some challenges like reliability, power consumption, node size, mobility, privacy and security. So in this proposed system has overcome from these challenges.
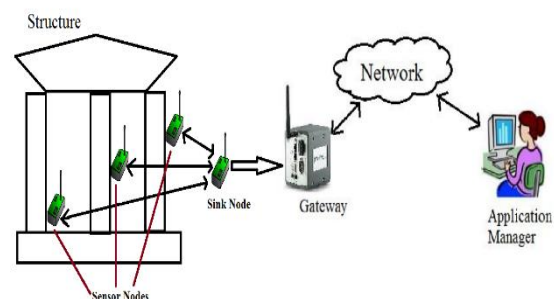
3. ARCHITECTURE AND METHEDOLOGY

Figure 1: Block Diagram of proposed system

This project is mainly stands on smart sensors modules. Sensors modules are connected to the motes, in the above figure 1 shown that how motes are placed in the structure.

Smart sensor module constitutes recognizing and alerting of abnormal vibration of the building due to natural disaster like an earth quake. This consists of two types of sensor to predict the abnormal vibration induced by an earth quake. Another smart sensor module predict the earth quake and rain then detects damage in the buildings after an earth quake or heavy rain, hence in this approach main principle is vibration analysis.

Damage detection includes identification of cracks in the wall and the moisture content in walls or wall bricks in real time structures. This paper also proposes tilts or

orientations of the walls or the structures are also identified using these smart sensors. Here strain gauge or load cell is placed in structure to measure the total weight of the structure, here it include both live loads and dead loads. The temperature sensor is used in this project, this sensor used in two ways for automation purpose and temperature detection purpose. If temperature is more in structure it may automatically switch ON the fans. In another way if temperature is more observes temperature sends data to the mote, in this project second way is used.

Using of these smart sensors reduce the power consumption in any real time structural health monitoring system the main issue is the time synchronization.

These sensors modules are attached to microcontroller this will receives data and process that data. After this data will send through transceiver like this data travels from one mote to next. After this data from all motes are collected by the sink node.

In Line of sight ZigBee operating distance up to 600mtrs and in Non-Line of sight operating distance up to 200mtrs.

Gateway is used here to establish the linkage between the sink node and cloud. This gateway translates 802.15.4(ZigBee) protocol to 802.3(Ethernet) or 802.11(WLAN). This gateway will help to connect to the internet access through Wi-Fi or Ethernet.

When measured data from mote is ready to send to cloud then gateway helps to send the data. Once data reached to the cloud then it is easy task to send data to application manager. The data stored in cloud may reach to the destination as application manager via email, text message or telegram.

4. ADVANTAGES

This project has many advantages, some of them are as follows

- Safety of structure is achieved – this is the main aim of this project so successfully improving the health of the structure.
- Cracks can be monitored in the initial Stage – before affecting any damages to the structure, this system will preliminarily proving the information to the application manages.
- Tilts can be identified easily – the orientations of the structures can be recognized in the initial stage so tilts also be monitored.
- Prevents the troubles from structures to public – it avoids the problems arriving from these structures because problems from the structures are identified in the initial stage so it helpful to public.
- Avoids a lot of wiring – the project components are tiny and incorporated side by side and they are

wirelessly operate so wirings are completely removed.
- Flexible to go through physical partitions – if any problems occurs in sensor modules, motes, gateway or in cloud. This will help to make physically divide the system into number of parts then it may easily detect the problem in the part.
- Self-Organizing And Self-Healing – if any motes are unsuccessful to operate then the data may take another route to reach the destination this refer as self-healing, and before only assigning the node ID, they configure their route to the destination.

5. DISADVNTAGES

This project also has advantages, some of them are as follows

- Comparatively low speed of communication – the data rate of ZigBee protocol is low so from one mote to another mote data transfers serially at the rate of 250kbps hence it is low speed of communication compare to other protocols.
- Costly at large – the motes and gateways are used in this project are tiny and embedded very closely and they were operate wirelessly so the cost of these components are high. This project is implemented to whole structure so the first initial install mentation cost becomes high.

6. APPLICATIONS

This project has numerous applications, some of them are as follows

- This system can be used for monitoring the health of Infrastructures – this project will continuously observe the strength structure so it will helps to improve the durability of the structure.

- Avoids loss of life – if any accidentally damages are happened to the structure this may effect on life of the people so in the initial stage only recognize the defectives and helps to remove the loss of life.

- Prevents damage to public property – this project can be implement to anywhere or any structure. In the same type this project can also be implement to the public properties like bridges, buildings, tunnel, dams, airports etc hence this will also help in avoiding the damage to public property.

- Helps in preserving the heritage of a country – this project is not only implement to the public properties but also can be implement to the old forts, old rare architectures, beautiful monuments etc so in this way this project will also help to preserving the heritage of a country.

7. RESULT

The several information received from the sensors modules at unlike time intervals deposited in ubidots cloud is shown below.
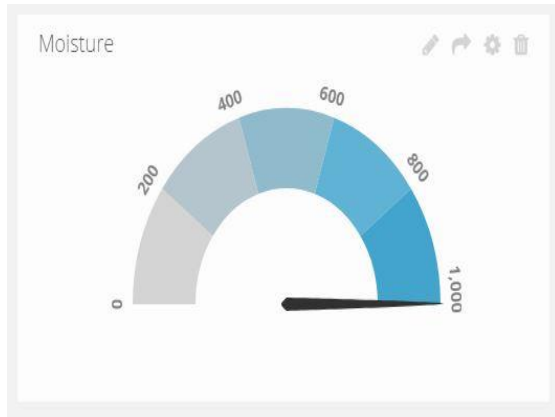

Figure 2: Moisture sensor data
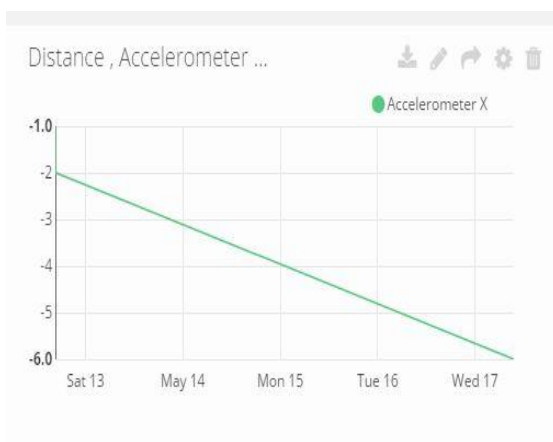

Figure3: Temperature sensor data

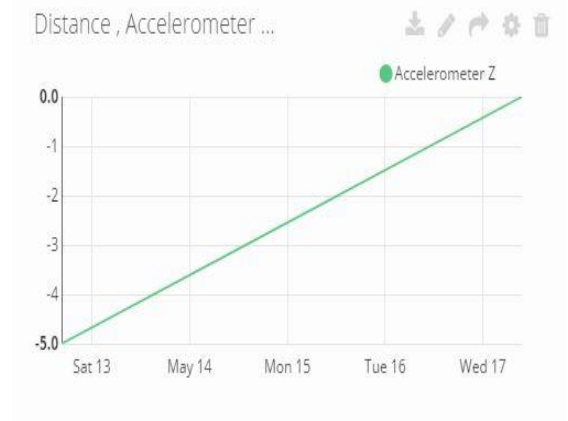**Figure 4: Accelerometer X-axis**

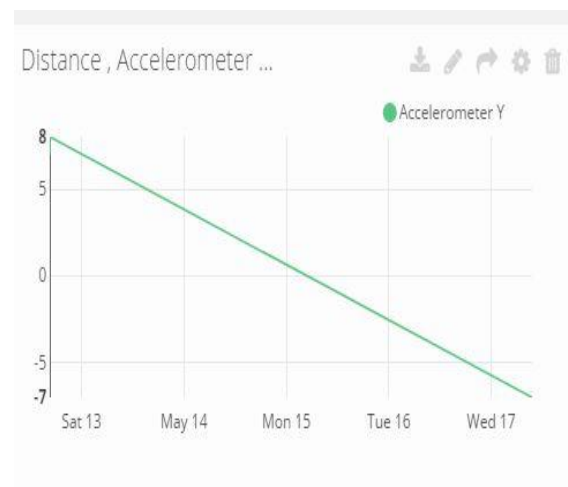**Figure 5: Accelerometer Y-axis**

Figure 6: Accelerometer Z-axis

8. FUTURE SCOPE

IoT and WSNs possible today due to technological advancement in various domains. This project bring a whole host of novel research challenges pertaining to energy efficiency, self-healing and self-configuring, etc. Existing partial solutions offer much hope for the future, but much work remains to be done.

9. CONCLUSION

In conclusion to this presentation, can say that the end of research on this project using Wireless Sensor Network and Internet of things is not within sight. Still many research is going on this structural monitoring conception, this project may create the smart infrastructure in future days.

10. REFERENCES

[1]   Wireless Multi-Sensor Monitoring System Utilizing IEEE 802.15.4. Communication Standards for Water Leakage Detection by Neda Noorani Department of

Electrical and Computer Engineering California State University of Northridge

[2] An Overview on Wireless Sensor Networks by Fabian Nack Institute of Computer Science (ICS), Freie University Berlin.

[3] Power Optimization in Wireless Sensor Network: A Perspective International Journal of Engineering and Technical Research (IJETR) ISSN: 2321-0869, Volume-3, Issue-5, May 2015.

[4] Power management in wireless sensor networks. International Journal of Advanced Research in Computer Science and Software Engineering Research Paper. ISSN: 2277 128X. Volume 4, Issue 4, April 2014.

[5] A Review on data collection method with sink node in wireless sensor network. International Journal of Distributed and Parallel Systems (IJDPS) Vol.4, No.1, January 2013 DOI: 10.5121/ijdps.2013.4106 67

[6] Application based Study on Wireless Sensor Network. International Journal of Computer Applications (0975 – 8887) Volume 21– No.8, May 2011.

[7] Wireless Sensor Networks: Architecture, Protocols. International Journal of Advanced Research in 2013, IJARCSSE All Rights Reserved Page | 303 ISSN: 2277 128X. Volume 3, Issue 1, January 2013.

[8] Dhivya. A, Hemalatha. M, structural health monitoring system – an embedded sensor approach, International Journal of Engineering and Technology (IJET), ISSN : 0975-4024 Vol 5 No 1 Feb-Mar 2013

[9] A Review on data collection method with sink node in wireless sensor network. International Journal of Distributed and Parallel Systems (IJDPS) Vol.4, No.1, January 2013 DOI: 10.5121/ijdps.2013.4106 67

AUTHOR

Darshan Patel G.R. currently pursuing Master of Technology in Digital Communication and Networking from Visveswaraya Technological University, Karnataka, India. He received a Bachelor of Engineering in Telecommunication Engineering from Visveswaraya Technological University, Karnataka, India. His research interests are in IoT, Wireless communication, Sensor network, ZigBee and Home Automations.