REVIEW ON STRUCTURAL HEALTH MONITORING SYSTEM
USING WSN FOR BRIDGES
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ABSTRACT

Structural health monitoring (SHM) is processes which detects and monitor the destructive part of various structures like bridge, buildings, wind turbines etc. Structural health assessment is widely applied to various forms of infrastructures. SHM system elements include Structure, sensors, Data acquisition systems, Data management. These sensors provide real-time monitoring of various structural changes like stress and strain. SHM system developing hardware and software system to be used for distributed real-time monitoring. Health monitoring of bridges performed by simultaneous measurement of loads on the bridge and effects of these loads. Wireless sensor node uses develop MEMS technology and embedded processing technology for the device time integration. By using the central station, receive sensor data from the nodes. The project aims to minimize the cost of monitoring structures through developing low cost wireless networks of sensor boards, each equipped with an embedded computer.

Keywords: - structural health assessment method, ultrasonic sensor, accelerometer sensors, wireless nodes.

[1] INTRODUCTION

A Wireless Sensor Network is a network of small sensor nodes communicating among themselves using radio signals, and deployed in quantity to sense, monitor and understand the physical world. WSN provide a bridge between the real physical and virtual world. The basic philosophy behind WSNs is that, while the capability of each individual sensor node is limited, the aggregate power of the entire network is sufficient for the required mission.
In a typical scenario, users can retrieve information of interest from a WSN by injecting queries and gathering results from the so-called base stations, which behave as an interface between users and the network. Wireless sensors used in environmental monitoring, military surveillance, air pollution, water monitoring and machine monitoring.

[2] WIRELESS SENSOR SYSTEM STRUCTURE

Wireless sensor system structure for bridge application is shown in fig (2). The overall system is designed based on the wireless sensor technology with advantages of high transmission speed, adaptive equalization and large workload data.

This system includes two sensor nodes. It receives the information about the structure of bridge. The sensor data is transmitted to the central station in the 433MHz radio channel [1]. Ultrasonic sensor and
accelerometer sensor is used for receiving the bridge information correctly. Ultrasonic sensor is used to measure the level of water. Two sensor node and base station (central station) work at same frequency band. At a time only one sensor node communicate with the central station. Once the system is start, the central station waits for the PC to send command and each node is in the state of data collection.

After completing the data collection procedure, central station receives that data and send to the PC. By using the visual Basic program uploading data to static IP address. Develop the android application to send the condition and situation of the bridge structure to the people. The android application is developed using java programming language.

[3] WIRELESS SENSOR NODE

The wireless sensor node is consist the following parts: power management unit (power source), sensing unit, and signal processing unit, microcontroller and RF zigbee unit which is shown in figure (3) . The wireless sensor node uses embedded processing technology and MEMS technology for device integration. Each sensor node has A/D channels for external precision sensors that feature is high sensitivity noise is minimum and large dynamic range.

![Fig (3):-Block diagram of wireless sensor node [1]](image)

There are following few parts in the wireless sensor node

1. Sensing unit
2. Signal processing unit
3. Micro processing unit
4. RF zigbee unit

A] Sensing unit

Sensing unit is main part of the wireless sensor node. MEMS (Microelectronic mechanical system) accelerometer chip and external precision accelerometers are includes in the sensing unit. The advantages of the MEMS accelerometer model are low cost and low power, 2-axis
accelerometer with a full-scale range [1]. By using the accelerometer sensor measure the tilting angle of the bridge pillar.

**B] Signal processing module**

Signal processing module is include two main important parts which is signal conditioning and high resolution A/D (analog to digital) converter. Signal multiplexing, signal isolation, amplification, filtering part consist in the signal conditioning parts. This all functions make high quality sensor data. The data is in the form of analog signal. This analog signal transfer to the high resolution A/D converter, then a high precision A/D chip is convert the obtained sensor data into digital signal.

**C] Micro-processing and RF zigbee unit**

Micro-processing and RF zigbee unit is shown in figure (4). It is also called as local node. Local node includes accelerometer sensor, microcontroller, RF zigbee unit and MAX 232. It is also called as data transmitting module.

![Diagram of Local Node](image)

**Fig (4):-Local node [1]**

Microcontroller is a small computer on a single integrated circuit containing a processor core, memory and programmable input/output peripheral. Microcontroller are designed for embedded applications, used in personal computers and it is also used in automatically controlled products and devices.

RF (Radio frequency) zigbee unit adopts the medium power wireless module, which works at 433 MHz ISM (Industrial, scientific and medical) radio bands [1].

**D] Central Station**

Central station is main important parameter of the overall system. In figure (5) shows the parent node. It is also called as data receiving module.
Central station is sending the commands to the nodes, then waits and receives sensor data returned from nodes and send to the PC. By using VB program uploading data to static IP address and after developing the android application send the information all over the world.

[4] CONCLUSION

Thus, Structural Health Monitoring is used in the health assessment of bridges. Wireless sensor network integrated with sensor technology, embedded computing technology, modern networking and wireless communication technologies, distributed information processing technology. Ultrasonic sensor and accelerometer sensor is used to receive the bridge information. Local node and parent node are the important part of the system. Develop android application for getting real time information updating of bridges. The wireless sensor node uses existing MEMS technology and embedded processing technology. The advantages of the wireless sensor network is improvement in data transmission packet loss rate, High sensitivity, Ultra low frequency

Structural health monitoring system is used in military application, machine monitoring, medical monitoring, smart spaces, air pollution, water monitoring, agriculture etc.

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REFERENCES


