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Building Collapse Avoiding System Using Wireless Technology

R. Senthil Kumar[1], Venkata Subbaiah Putta[2], S. Harshavardhan Naidu[3], K. R. Sugavanam[4] and A. Mohammed Ovaiz[5]

ABSTRACT

The objective of this project is to measure the health of the building structures, using the MEMS sensor placed around structure which was connected over the wireless network. Through the wireless network the recorded information is gathered. The MEMS sensor used here has the ability to capture the vibrations caused by the structure. Traditional method to monitor or observe the vibrations involves acoustic sensors, which requires continuous power supply and regular maintenance. MEMS technology is made use to replace the traditional sensors with miniaturized sensors, which reduce the need for an external source and provide a maintenance-free system. Due to the simplicity and versatility, this method can be applicable for a wide range of structures from small buildings to large structures such as bridges, subways, etc.

1. INTRODUCTION

The strength of a building depends on various factors such as the capability to withstand the stress and strain. Whenever the stress induced by the load exceeds capacity of the structure, the structure tends to collapse. Such conditions results in losses in terms of lives and economy. Initial calculations are made while designing a structure. Yet, in some cases it is necessary to monitor the capacity of the structures, which varies due to many external factors such as the loads and vibrations exerted over the structure. However the loads can be limited or restricted, which cannot be done on the vibrations occurring in the building due to its solid form.

2. RELATED WORKS

Vibration monitoring done in previous case [1] uses an acoustic sensor. These sensors uses a piezoelectric material to generate an acoustic wave, which charges by the imposition of the mechanical stress. Even though the system monitors the vibration, least or continuous vibrations are left out due to the piezoelectric effect. The structure must be a surface squarely or flatly perpendicular to receive the ample echo, which fails in case of structures with uneven or curved surfaces like in beams. Certain low density targets may absorb the sound energy completely or partially. Operating environments are often very noisy, and the acoustic emission signals are usually very weak. Thus, signal discrimination can be very difficult.

One more topology is the utilization of load cell along with a wired network for the structural monitoring [2], [3]. The wired network requires a network protocol which may not be feasible in terms of economy, for the monitoring system when the total surface is too small. The same mode of network protocol seems to be much complicated in terms of technology, for the case of a large structure [4], [5]. The system is known to consume a large amount of power when the system is used for continuous monitoring of the installed structures.

[1,3,4,5] Department of Electrical and Electronics Engineering, Vel Tech High Tech Dr. Rangarajan Dr. Sakunthala Engineering College, Chennai, Tamil Nadu, *Emails: rskumar.eee@gmail.com, krsugavanam@gmail.com, ovaiz.eee@gmail.com*

[2] Department of Electronics and communication Engineering, Vel Tech, Chennai, Tamil Nadu, India, *Emails: venky806@gmail.com, sapineniharsha@gmail.com*

3. PROPOSED SYSTEM

The proposed method shown in figure 1 uses the MEMS technology for the structural monitoring and a wireless network is implemented for monitoring.

The vibration values of structures like building or bridges are recorded using MEMS sensor.The values generated from the MEMS sensor is amplified and filtered using Signal conditioner.

The conditioned signal is then given to microcontroller unit which converts the analog values to digital values and save it in the database.

Several Vibration levels are being monitored continuously and the extreme vibration level of the building can be determined by the comparison of the normal vibration values.

The monitored Values are then transmitted through the RF module to the Base Station where the vibration level and Health of the building is monitored. The data transmission between the transmitter and receiver follows the sequence as shown in figure 2.

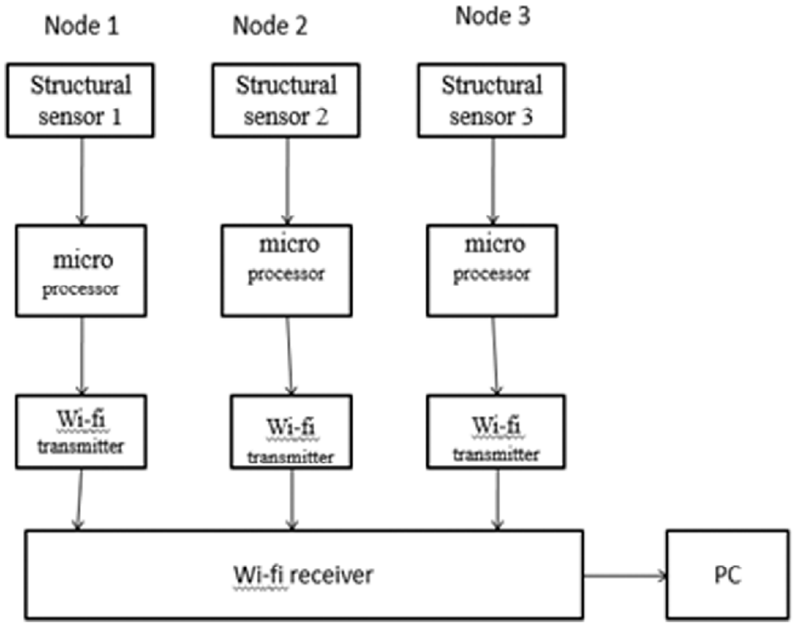


Figure 1: Block diagramofbuilding health monitoring system

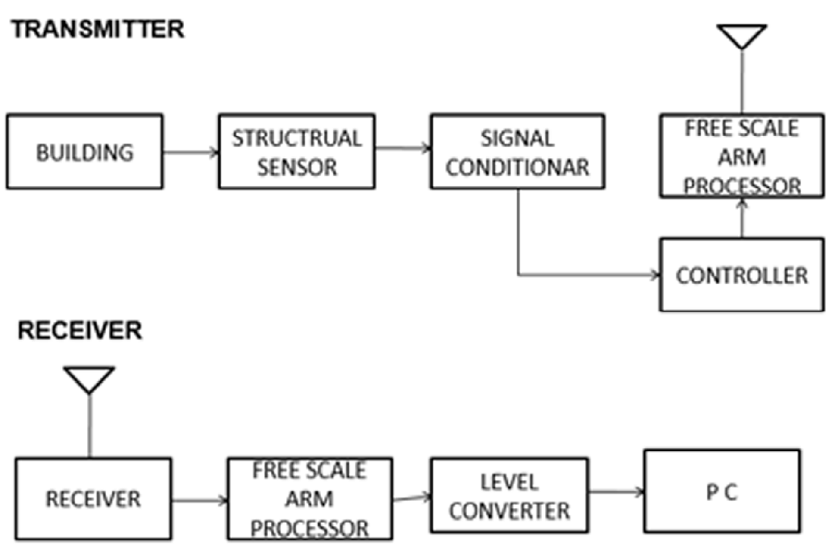
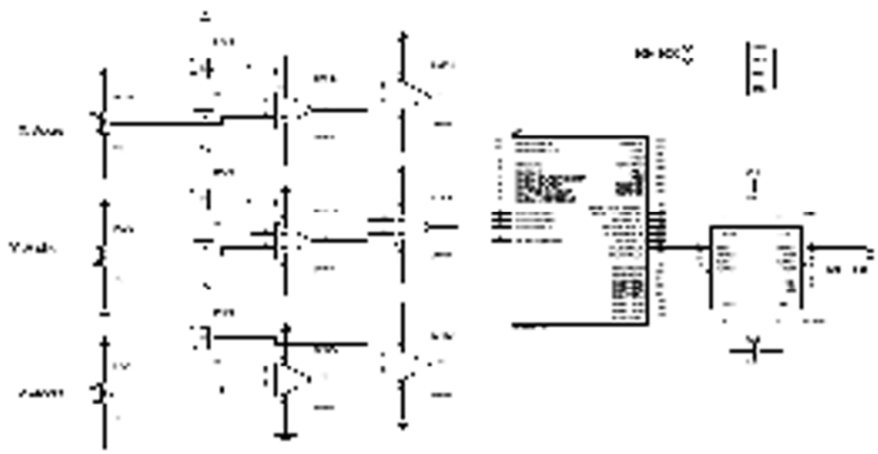
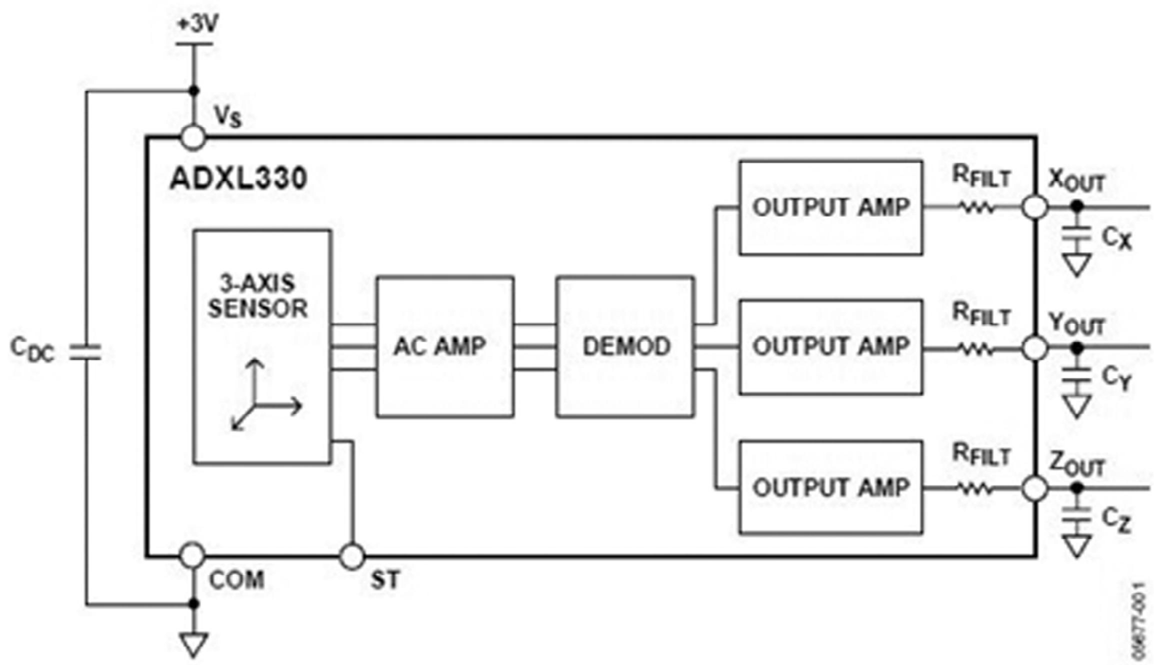


Figure 2: Transmitter and receiver of building health monitoring system

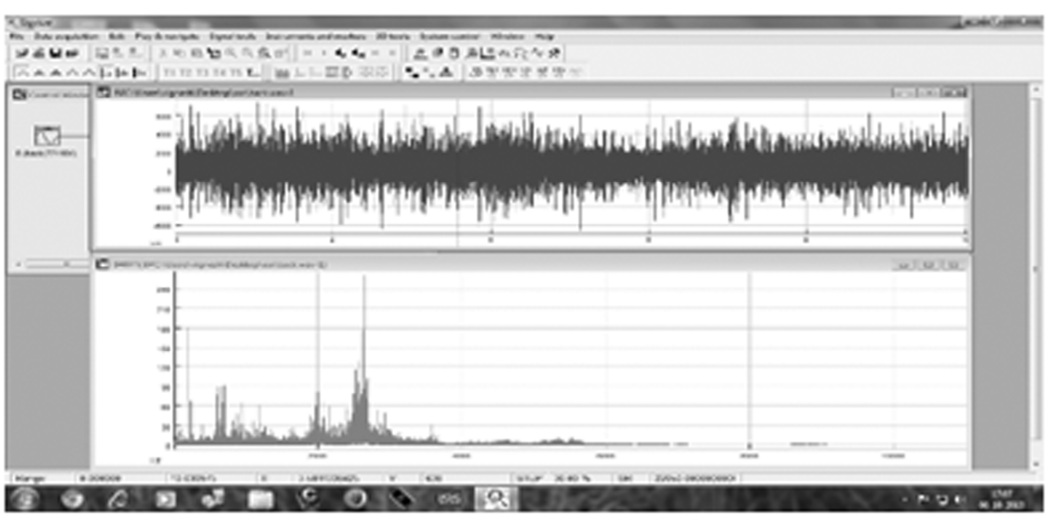
Circuit diagram

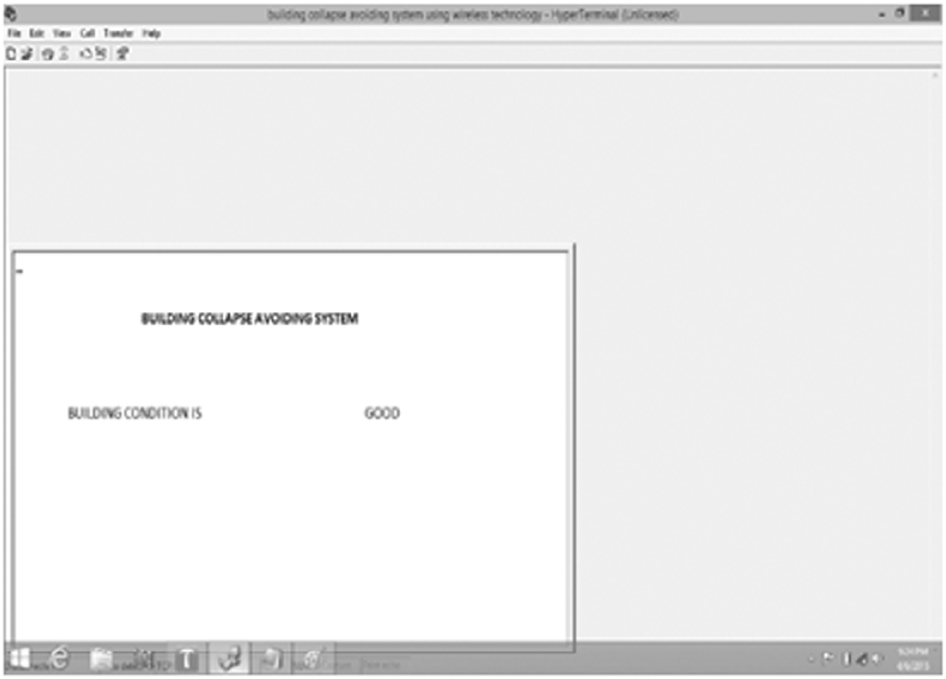


Mems Technology



Results





Application

- Building strength analysis
- Bridge strength analysis
- Subway strength analysis
- Railway track strength analysis

ADVANTAGE

- MEMS sensor consume less power, hence it is power efficient.
- It sense vibration in all 3 axis(X, Y, Z).
- More accurate than aquastic sensor analysis.
- Noise error ratio is lower than aquastic values.

4. CONCLUSION

We routinely use infrastructure-based wireless networks such as WiFi and mobile (cellular) networks.

In sensor networks, devices can talk to one another, forming a mesh topologyData is then relayed towards a sink.

Applications of sensor networks include structural monitoring, monitoring of hospital patients and the elderly, precision agriculture, detection of environmental threats (e.g., chemical agents, radiation), etc.

IEEE 802.15.4 provides a standard for very low-power, short distance, low data rate communications

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