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ADVANCED TECHNIQUES OF DISASTER MANAGEMENT USING WIRELESS NETWORK

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Abstract

A wireless sensor arrangement is intended for monitor buildings to review earthquake dent the sensor nodes use custom developed capacitive micro electromechanical system strain, 3-D acceleration sensor increase and a low power readout function specified integrated circuit for a sequence life of up to 12 years. The strain sensors are mounted at the pedestal of the building to compute the arrangement and plastic hinge activation of the building after an earthquake. They compute periodically or on- require from the base station. The accelerometers are mounted at every floor of the building to evaluate the seismic reaction of the building during an earthquake. They trace during an earthquake event using a combination of the local acceleration data and remote triggering from the base station based on the increase of velocity data from several sensors across the building. Low power network architecture was implemented over an 802.15.4 MAC in the 900-MHz band. A custom patch antenna was intended in this frequency band to obtain robust relatives in real-world circumstances. The modules have been validated in a full-scale laboratory association with virtual earthquakes.

Keywords: Micro Electromechanical System, Strain Sensor, Acceleration Sensor, Earthquake, Remote tiggering, Base station, Patch antenna, Virtual earthquakes.

1. Introduction

Buildings can gradually mount up damage through their outfitted lifetime, owing to seismic events, unforeseen foundation settlement, material aging, design error, etc. intermittent monitoring of the construction for such dent is therefore a key in tread realistically planning the protection required to assurance and sufficient level of wellbeing and serviceability. conversely, in order for the setting up of a enduringly install sense system in buildings to be efficiently feasible, the sensor module should be wireless to decrease setting up expenses, have to activate with a low power utilization to reduce service costs of replacing batteries, and utilize low cost sensor that can be mass produced such as MEMS sensors. The ability of MEMS and wireless network for monitor civil structure is well predictable. The obtainable efforts address all of the exceeding necessities. The concentration in sensing machinery for a range of use has been rising, and new kinds of sensors have been developed by micro electro mechanical system (MEMS) apparatus. Environmental information such as brightness, temperature, sound, vibration, and a picture of a definite position in a building is evaluated by wireless network. In section II a brief details of proposed work compare with existing work is given. Section III discusses the concepts related to proposed mechanisms. In section IV the experimental setup and simulation results are shown. Concluding remarks are presented in Section V.

2. Related Work

A. Wireless Communication

Wireless communication is the commune of information amid two or more point that is not linked by an electrical performer. The general familiar wireless technologies use radio, with radio wave distance can be undersized, such as a hardly any meters for television, as far as thousands or yet millions of kilo meters designed for deep-space radio communication. This includes a range of types of fixed, mobile and convenient application. The convenient applications like cellular telephones, personal digital assistants (PDAs), GPS units, wireless mice, keyboards, headphones, radio receivers, satellite television, broadcast television and cordless telephones. A bit fewer general method of achieve wireless infrastructure comprise the use of erstwhile electromagnetic wireless technology such as light, magnetic, electric fields and sound. Today the primary usage is LTE, LTE- Advanced, Wi-Fi, and Bluetooth etc as shown in figure 1.

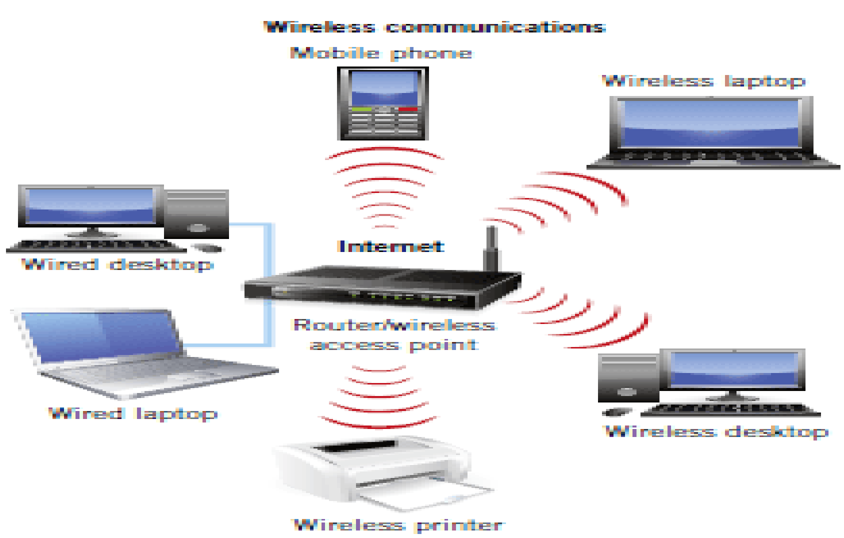


Fig. 1.Wireless communication.

Basically concentrating on following applications such as to always examine the building be able to gradually accumulate harm throughout their outfitted lifetime, due to seismic measures, unexpected establishment completion, material aging, plan fault, etc. intermittent monitoring of the arrangement for such harm is consequently a key in pace in logically forecast the safeguarding needed to assurance an adequate level of protection and examine- facility. Conversely, classify for the installation of a permanently installed sensing system in buildings to be economically the proposed block diagram as shown in figure 2.

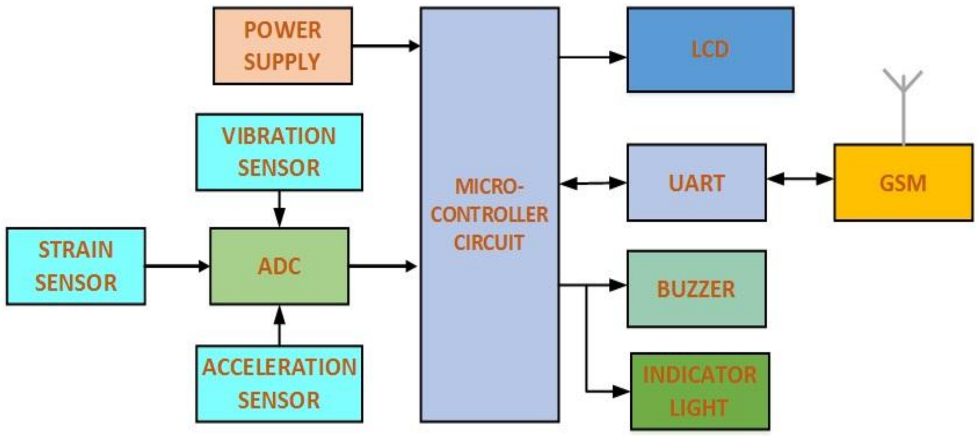
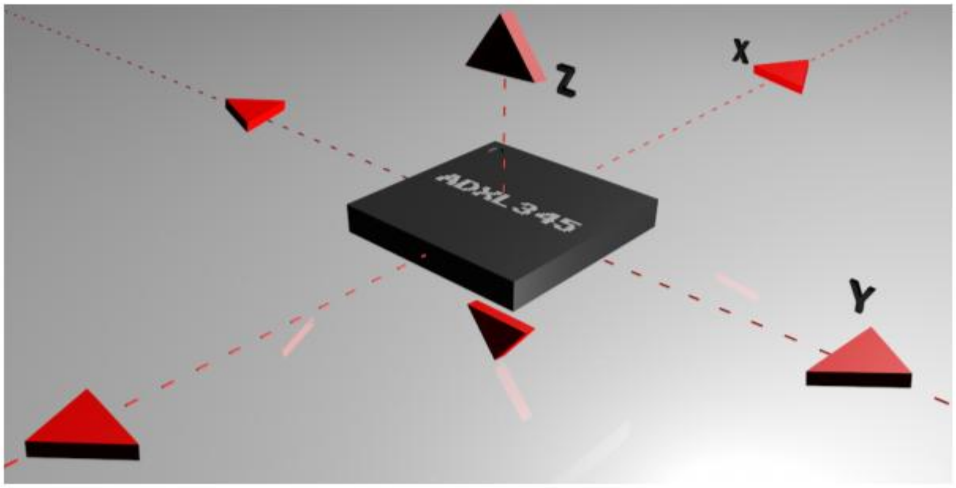


Fig. 2. Block Diagram of Proposed System.

B. Acceleration Sensor

Accelerometers are strategy so as to assess acceleration, which is the rate of change of the velocity of an objective. They assess in meters per second squared. A particular G-force intended for us at this point on planet Earth is equal to 9.8 meter per second squared, but this does vary somewhat with altitude as shown in figure 3.



Axes of measurement for a triple axis accelerometer

Fig. 3. Acceleration Sensors.

The ADXL345 is a low-power, 3-axis MEMS accelerometer modules with both I2C and SPI interfaces. The Ad fruit Breakout boards for these modules feature on-board 3.3v voltage regulation and level shifting which makes them simple to interface with 5v microcontrollers Accelerometers are electromechanical devices that sense either static or dynamic forces of acceleration. Static forces include gravity, while dynamic forces can include vibrations and movement. Accelerometers can measure acceleration on one, two, or three axes. 3-axis units are becoming more common as the cost of development for them decreases as shown in figure 4.

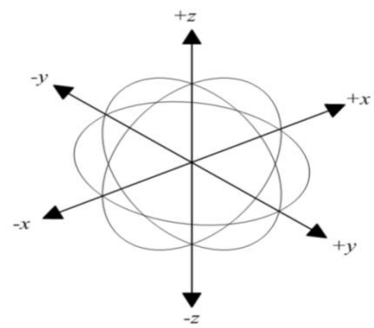


Fig. 4. Accelerometer axis.

C. Strain Sensor

In sort to transfer force into electrical signal, rapport of sensor called “strain gauge” in the direction of load cell. A load cell is finished by bond strain gauges in the direction of spring matter. Powerfully sense the strain, strain gauges in bond to the location on the spring matter; the table is in the direction of trace the weight versus deflection data which are recorded as shown in figure 5.

Fig. 5. Strain sensor.

D. Vibration Sensor

Despite the advance refined in vibration monitor and investigation apparatus, the range of sensors and the technique they be mount on a machine stay critical factor in influential the achievement. Capital save by install substandard sensors is not a discreet speculation ever since the sequences provide about the machine of interest a lot is not accurate or reliable. Unfortunate eminence sensors can easily give false data or, in a few cases, origin a dangerous machine condition to be completely disregarded as shown in figure 6.

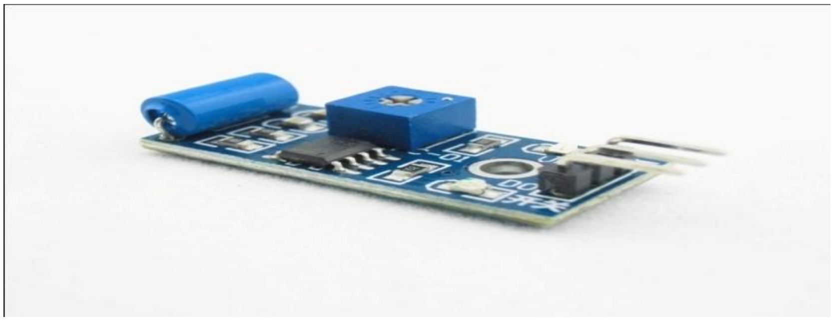


Fig. 6. Vibration sensor.

3. Simulation Results

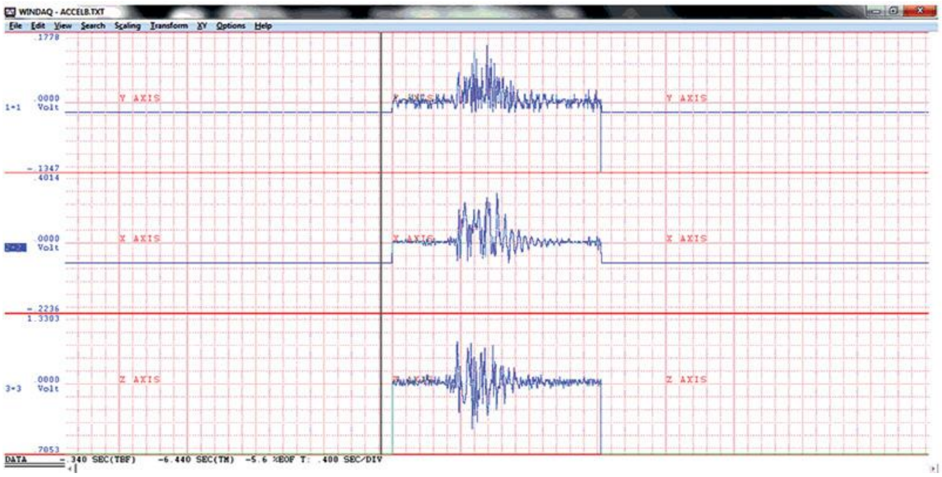


Fig. 7. Acceleration sensor output result.

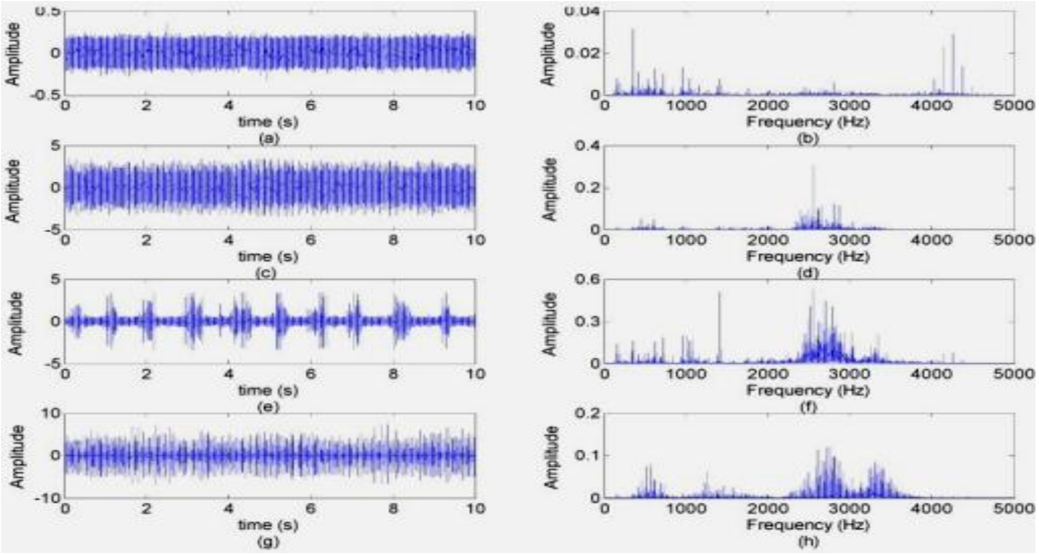


Fig. 8. Vibration sensor output result.

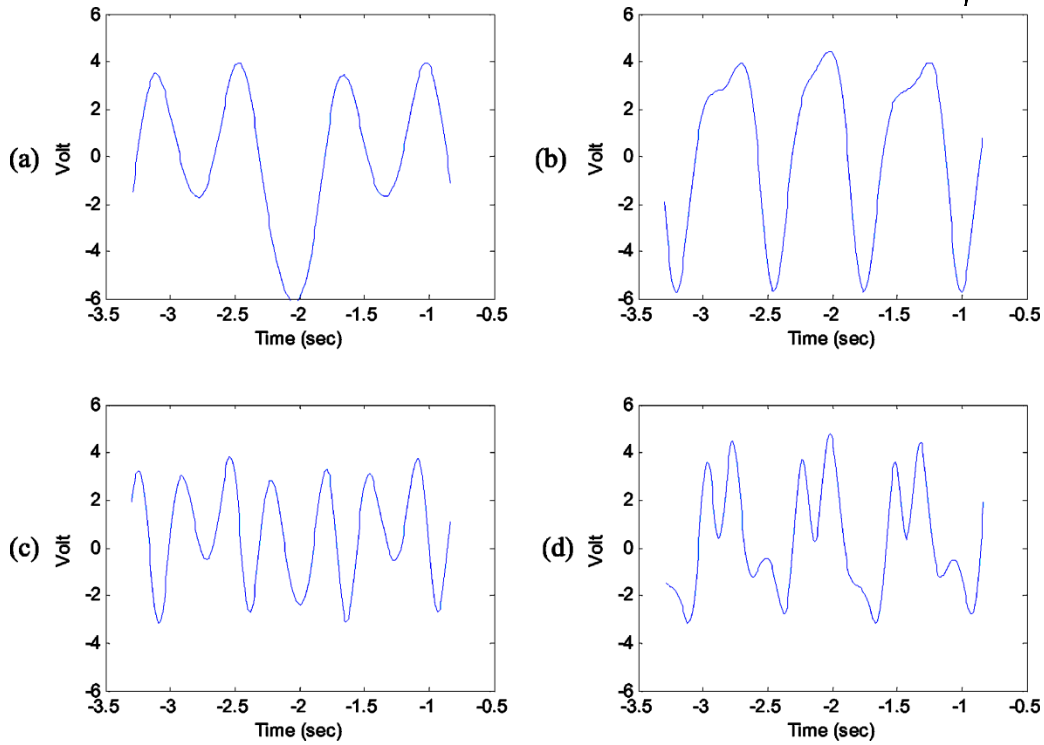


Fig. 9. Strain sensor output result.

4. Experimental Setup

5. Conclusion

The presented wireless system for building monitoring takes benefit of the distinctive features of custom-developed MEMS sensors and state formally ASIC collective with an optimized arrangement and module construction, to grasp a clarification which offer extended succession lifetime and potentially low cost in mechanized, installation and protection, while provide high-class sensor statistics at the exact time.

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