GSM Basesd Earthquake Detection And Warning System(Simulation Approach)

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Abstract- *The vibration amplitude may be measured as a displacement, a velocity, or acceleration. Vibration amplitude measurements may either be relative, or absolute. The basic scheme of vibration measurement is outlined first. Descriptions are given of transducers devices which transform physical variables into equivalent electrical signals and of vibration pickups. The increasing demands of higher productivity and economical design lead to higher operating speeds of machinery and efficient use of materials through lightweight structures. How we can measure vibration or earthquake signal of any device is describe in this system. When an earthquake occurs, both compression P wave and transverse S wave radiates outward the epicentre of the earth. The P wave, which travels fastest, trips the sensors, placed in the landscape. It causes early alert signals to be transfer ahead, giving humans and automated electronic system a warning to take precautionary actions. So that before the damage begins with the arrival of the slower but stronger S waves, the public are warned earlier. Thus early alert message is received by the people in terms of location, time and other parameters. Eventually, many of the human lives can be saved. The software used here is MATLAB where the three angle axis of the sensor can be sensed and detected when the sensors are interfaced with this software.*

Keywords- Earthquake, Accelerometer, ADC,PIC Microcontroller, Warning signal.

I. INTRODUCTION

Earthquake is commonly said to be a natural disaster which is also known as tremor or temblor. The sudden shake in the surface of the earth, which shutters down the buildings and kills thousands of human lives. Thereby by predicting the surfaces shake earlier by means of sensors that may warn public earlier. By the theory that the S waves are the first attack wave from the surface and then the P waves attack the surface latter that brings the strongest shake then the S wave. Hence the public is warned earlier in few minutes or seconds before. The sensor network is the network where the sensors are spatially distributed to monitor the physical and environment conditions normally.

Here we want to develop cost effective system for measurement of earthquake signal. With the help of this system we can measure any vibration present at the input side with the help of accelerometer sensor.

We are measuring Acceleration with the help of accelerometer. Acceleration which is getting on output graph is proportional to voltage with respect to input displacement. Accelerometer measures signal in three direction such as X-axis, Y-axis, Z-axis . When a transducer is used in. conjunction with another device to measure vibrations, it is called a vibration pickup. A seismic instrument consists of a mass-spring-damper system mounted on the vibrating body.

II. LITERATURE SURVEY

Analytical approach towards advanced wireless earthquake simulation alarm system. [1] An accelerometer is an instrument that measures the acceleration of a vibrating body. Accelerometers are widely used for vibration measurements and also to record earthquakes. Accordingly, our review knowledge of seismicity, Earth's structure, and the various types of seismic sources is mainly the result of analysis and interpretation of seismograms .[1] The more completely we quantify the signal of Earthquake, the more we understand the Earth's structure, seismic sources and the Causing processes. The information about tilt measurement system based on accelerometer sensor[3]. By computing the acceleration signal, tilt vibration and shocks can be detected. Then the velocity and displacement information can also be determined from measured acceleration.

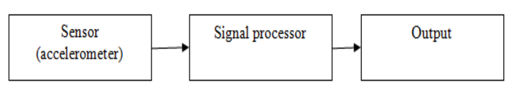

Figure 1. Elements of a vibration measurement system

A measurement system consists of three basic parts as illustrated in Figure . The sensor, in this case MEMS accelerometer is a device that converts a physical input into an output, usually voltage or PWM[3]. The signal processor performs signal conditioning and signal analyzer on the sensor output. Finally, the computer is used to display sensor data for real time monitoring and subsequent processing[3]. From the literature reviews it is seen that MEMS accelerometer is used as sensor to detect tilt, vibration and shock in various applications such as in health or medical products, consumer products, civil engineering, military, automotive and condition monitoring for machine failure. Therefore, it can clearly be seen that every application needs a specific system for specific objectives.

III. BLOCK DIAGRAM

The general Block diagram of Earthquake detection and warning system is shown in fig-2.

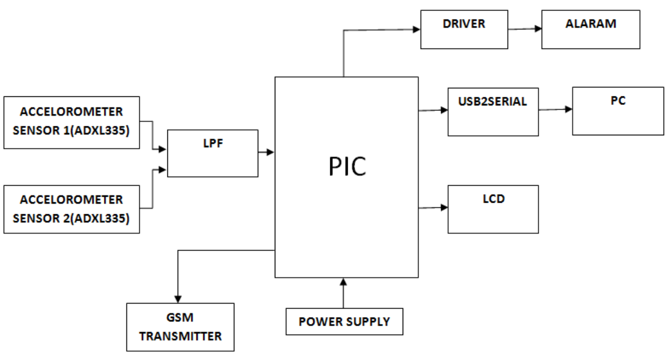

Figure 2. The general Block diagram of Earthquake detection and warning system

Working

A prototype and simulated model for earthquake detection and warning system is performed in the present. The first device is Accelerometer sensor which converts nonelectrical signal into electrical quantity which is in the range of (0-1.76V).The ADXL335 is a small, thin, low power, complete 3-axis accelerometer with signal conditioned voltage outputs. The user selects the bandwidth of the accelerometer using the CX, CY, and CZ capacitors at the XOUT, YOUT, and ZOUT pins. Bandwidths can be selected to suit the application, with a range of 0.5 Hz to 1600 Hz for the X and Y axes, and a range of 0.5 Hz to 550 Hz for the Z axis. The output of Accelerometer is given to the low pass filter.

Ground vibrations, or seismic waves, are most commonly caused by earthquakes. However, there are numerous other sources for these vibrations, including volcanoes, large explosions and impacts. These vibrations spread out from their source as seismic waves and are measured by a world-wide seismographic network of seismometers and accelerometers. Accelerometers come in a variety of designs, and they can detect a wide range of different vibrations. One of the most popular versions of the accelerometer is a piezoelectric sensor. This sort of sensor contains a material (such as crystal quartz) that gives off an electric charge when it detects changes in pressure. By measuring the amounts of electric charge that piezoelectric accelerometers give off it becomes possible to determine the amount of vibration going on in the connection. Accelerometer having input up to 10000g shock survival. And output voltage range is 0.1 to 2.8 V (Analog form). It requires very less supply voltage that is 1.8 to 3.6 V.

Output of Accelerometer is given to the LPF which passing only low frequency component and block high frequency component. Acceleration deflects the moving mass and unbalances the differential capacitor resulting in a sensor output whose amplitude is proportional to acceleration. In low frequency applications (up to 20 kHz), passive filters are generally constructed using simple RC (Resistor-Capacitor) networks. We can calculate frequency with the help of these formulae 1/ (2II×32K×C). In this system we are using 10-bit ADC which is in built in the circuit. It also includes an onboard temperature sensor to monitor ambient temperature. Controller consists of one analog to digital converter each of 10 bit successive approximation method.. Therefore total number available ADC inputs are 14.Conversion time of this ADC is 2.44us. And ADC having output in terms of binary form like logic 0 or logic 1. Alarm value is set as per our Requirement.. When output that means Seismic signal value is greater than set value then Alarm will give Buzzer if not it will not provide any sound.

IV. RESULTS

Figure 3 shows the result of the simulated system which a earthquake signal also called as seismic data or vibration of the system. This data is not separated from noise. For noise free data we have to do addition in to filtrations process. When because of earthquake particular area is affected then seismic data reaches at maximum level in the graph. According to area of affection it reaches its peak value. When area is less affected then it reaches at small peaks. Following graph consists of 256 digitals levels because here we are using 8-bit ADC. And Alarm value is set as per our Requirement. When output that means Seismic signal value is greater than set value then Alarm will give Buzzer if not it will not provide any sound.

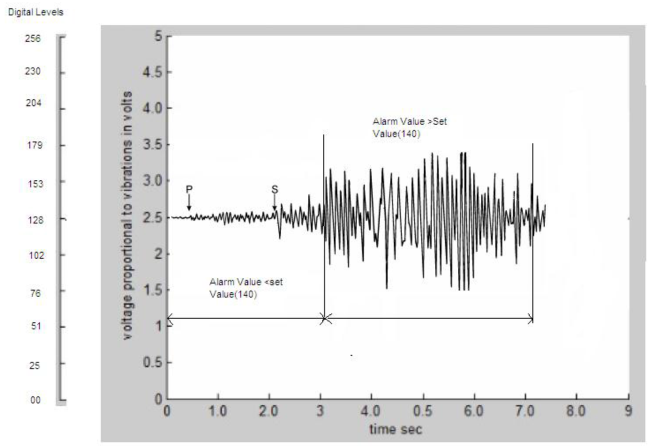

Figure 3. Shows the signal at earthquake occurs

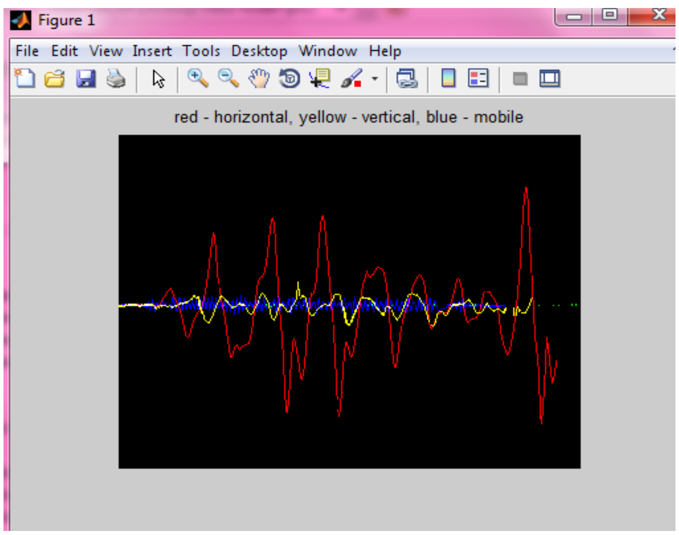

Figure 4. Results of earthquake signal with respect to horizontal movement, vertical movement and no vibration

Above graph that is Fig-4 shows that all signal are combine here in one graph this is done in MATLAB programming. In the above figure all signals are combining in MATLAB. Red color is used for horizontal movement, yellow color is used for vertical movement, blue color is used for mobile vibration and white color is used for no vibration. White signal is very feint it is behind of all signal. In practical application we cannot implement this because practically when signal is coming from transmitter side is of same color so we cannot identify the waveform of the different vibration signal. This graph is used for analysis purpose.

V. ADVANTAGES OF THE SYSTEM

1. Speed and sufficient reliable for recognition system. Good performance system with complex background.
2. The radial form division and boundary histogram for each extracted region, overcome the chain
3. shifting problem, and variant rotation problem.
4. Fast and powerful results from the proposed algorithm.
5. Simple, fast, and easy to implement.
6. No Training is required.
7. To minimize loss of property and lives
8. To aid rescue operations,
9. To assist recovery from earthquake damage

VI. CONCLUSION

In previous days seismometer and geophone were used to measure earthquake signals but their requirements for maintenance is more due to seismometer contains more mechanical rotary part. It also covered in case for improvement of performance and that are expensive. Hence the cost of that device is more as compare to this system. Seismometer and geophone is not compatible with the computer hence we cannot process that device with the help of computer. We can increase the resolution of the signal for that we have to use more number bit ADC but the disadvantage is that the speed will decrease. By putting number of system at the different places we can form one network like many transmitter and single receiver. By related work, earthquake detection and warning system as mentioned above has completed accelerometer development, prototype development of simple strong motion seismograph, debugging of transmission system, development of controlling circuit and assembly,etc. This work is tested in laboratory by generating simulated signal. With the further study of this project, earthquake detection and warning system will be practical and apply to actual lifeline earthquake safety controlling engineering.

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