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Earthquake Detector Using Arduino

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***Abstract*: An earthquake is an unpredictable natural phenomenon which happens suddenly and cannot stop it but can be alerted from it. Accelerometer ADXL335 sensor is used to detect the pre-earthquake vibrations. When the vibrations occur, accelerometer senses and converts them into equivalent ADC values. Then these digital values are read by microcontroller Arduino. Then Arduino compares these values with threshold value that is already predefined. If Arduino finds the sample value is greater than the threshold value, then Arduino trigger the buzzer and displays a message showing the status of alert over the 16x2 LCD and a LED also turned on. Using GSM module, the SMS alert message is sent to the respective registered mobile number. Also two other sensors are used, for detecting fire and any gas leakage in the building can be sensed using flame and gas sensor respectively. If detected SMS alert is sent to the corresponding registered mobile numbers.**

***Keywords*: Accelerometer, GSM, Microcontroller, Arduino.**

1. Introduction

Earthquake is one of the natural occurrences due to earth's plate shifting, causes by the earth's core heat so that shifted results in a collision with the other earth's plate, and also it raises a fault between the plates [2]. Earthquake causes damages to lives and property. An earthquake is an unpredictable natural phenomenon which happens suddenly and cannot stop it but can be alerted from it. Here Accelerometer ADXL335 is used which is highly sensitive to detect the pre-earthquake vibrations. It is highly sensitive to shakes and vibrations along all the three axes**.** Accelerometer after sensing the vibration converts them in to equivalent ADC values. Then these values are read by Arduino and shown over the 16x2 LCD. First calibrate the Accelerometer by taking the samples of surrounding vibrations whenever Arduino Powers up. Then need to subtract those sample values from the actual readings to get the real readings hence it will not show alerts with respect to its normal surrounding vibrations. After real readings are found, Arduino compares these values with predefined max and min values. If Arduino finds any changes from the predefined values of any axis in both direction (negative and positive) then Arduino trigger the buzzer and shows the status of alert over the 16x2 LCD and also LED also turned on as well [4]. Sensitivity of the earthquake detector can be adjusted changing the predefined values in Arduino code. Using GSM module, the SMS alert message is sent to the respective registered mobile number [12]. Also two other sensors are used, for detecting fire and any gas leakage in the building can be sensed using flame and gas sensor respectively. If detected SMS alert is sent to the corresponding registered mobile numbers [5].

2. Objectives

The main objective is that it can detect the initial low frequency vibrations of earthquake and also can estimate the ground level shaking. While detecting the vibrations at early stages awareness can be provided as a preventive measure, hence evacuation can be carried out easily. The system is easily portable. Comparing to the existing model, the device is easy to carry and place anywhere. As its size is comparatively small, it is highly portable and it is light weighted. The hardware components used in the device are much effective and less complex. It is light weighted. Due to its optimal size and reduced complexity it is easy to handle.

3. Proposed System

For detecting the primary vibrations of earthquake along any of the three axes, accelerometer is used. Therefore, any vibrations occurring are sensed by accelerometer and are converted to equivalent ADC value [1]. These values are read by Arduino and are shown over the 16x2 LCD. The Accelerometer calibration is done by taking the samples of surrounding vibrations whenever Arduino Powers up. Then need to subtract those sample values from the actual readings to get the real readings. Thus it will not show alerts with respect to its normal surrounding vibrations [7]. Arduino compares these values with predefined min and max values after finding the real readings. If Arduino finds any changes as the values are more than or less than the predefined values of any axis in both direction (negative and positive) then the buzzer is triggered by Arduino and shows the alert status over the 16x2 LCD and a LED also turned on as well. The sensitivity of Earthquake detector can be adjusted by changing the predefined values in Arduino code [11]. Flame sensor is used for detecting as well as responding to the occurrence of a fire or flame. Gas sensor is a device which interacts with a gas to measure its concentration and detects the presence of gas in an area. When earthquake is detected an alert message is send via GSM to registered mobile phones [8].

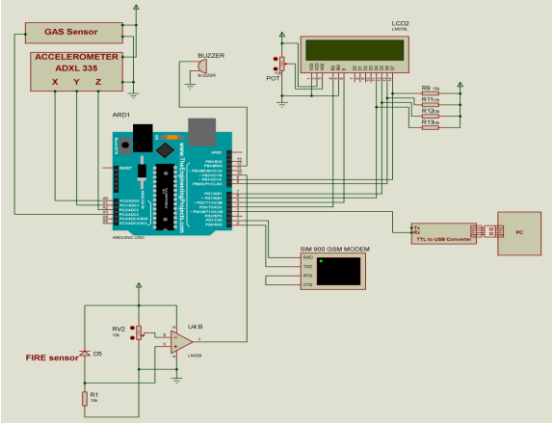

Fig. 1. Circuit Diagram

4. System Description

A. *Arduino UNO*

Arduino Uno is a microcontroller board; it is based on 8-bit ATmega328P microcontroller. The 14 digital input/output pins in the microcontroller can be used as input or output pins by using pinMode(), digitalRead() and digitalWrite() functions in Arduino programming [10].

B. *Accelerometer ADXL335*

Accelerometer sensor is highly sensitive to pre-earthquake vibrations and movements. The ADXL335 gives complete 3-axis acceleration measurement. It measures acceleration within range ±3 g in the x, y and z axis. Accelerometer sensor contains a polysilicon surface-micro machined sensor and signal conditioning circuitry.

C. *Flame sensor*

A flame sensor is very sensitive to fire or flame that's why this sensor module is used in flame alarms. This sensor detects flame wavelength within the range of 760 nm – 1100 nm from the light source.

D. *Gas sensor*

A gas sensor is a device which detects the presence of gas in an area and it interacts with a gas to measure its concentration. Each gas has a unique breakdown voltage i.e. the electric field at which it is ionized and sensor identifies gases by measuring these voltages. By measuring the current discharge in the device, the concentration of the gas can be determined [10].

E. *GSM*

GSM stands for global system for mobile communication. It is a mobile communication modem and it is widely used mobile communication system in the world. The GSM was developed at Bell Laboratories in 1970. It is an open and digital cellular technology; it used for transmitting mobile voice and data services and operates at the 850MHz, 900MHz, 1800MHz and 1900MHz frequency bands [8].

5. Result and Discussion

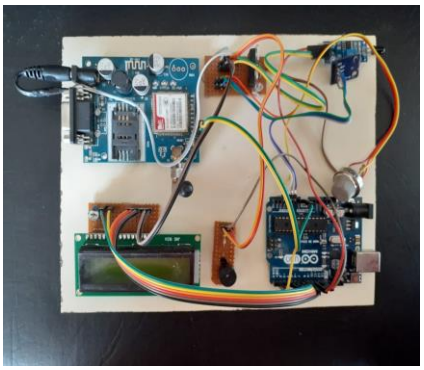

Fig. 2. Basic Prototype

Fig. 3. Sensor Readings

Fig. 4. Alert Message

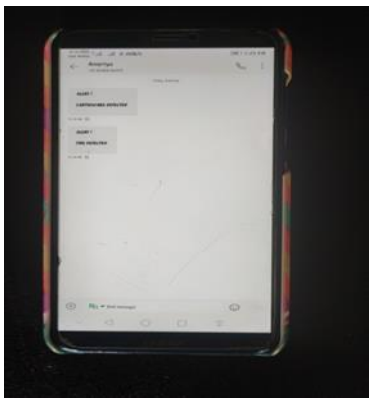

Fig. 5. SMS Alert

6. Conclusion

Thus to sum-up, the product is introduced with a view to reduce the destruction caused by earthquake, by alerting the people. It is economical such that its price affordable by every

individual. The device is presented as a modern technique to solve the automatic detection and classification problem of earthquake in a single step by using Arduino based earthquake detection. In this system the majority of cases offer real practical benefits in the event of an earthquake to safeguard lives and resources. The device is easy to carry and place anywhere since its size is comparatively small and it is light weighted. The hardware components used in the device are much effective and less complex. Also system's sensor accuracy is very much high so better scaling calculations can be done. Device components are more efficient therefore it has low power consumption. A fire sensor and a gas sensor are also attached to it for the detection of gas and fire from the surroundings, so this system has a multipurpose usability. Altogether this system is highly efficient.

7. Future scope

Early detection can ensure easy evacuation. Creating awareness can lead to make possible preventive measures so that a huge disaster can be avoided. Optimal size makes the system easier to handle. The future work involves improving our system's sensor accuracy and better scaling calculation, also improving our device portability, and therefore system can be attach to various suitable places inside the building.

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