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ELECTRONIC ENGINEERING

Design and Construction of Seismograph for Earthquake Measurement System

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Abstract— **The measurement of vibration of the earth by using the appropriate sensor is an essential part of the Meteorology and Hydrology. This research work aims to explore a seismic wave monitoring device which can record and monitor the ground motion with a low-cost PC based seismic data system. The constructed device can be used for the purpose of replacing conventional analog seismic recorders. The Seismograph for Earthquake Measurement System based on Microcontroller is designed and constructed. This system is divided into three main parts: (1) Movement Sensing Amplifier (2) Data logging circuit and (3) Interfacing circuit. Movement sensing amplifier consists of the Hall Effect sensor and signal conditioning circuit. To sense the ground vibrations, a magnet and magnetic field sensor is used. In order to measure ground motions, the seismograph must remain steady when the ground moves. To obtain this steady state, the pendulum assembly is used, in which a weight is suspended from a long wire secured to a suitable wall-mounted fixing point. Typically, a magnet is attached to the weighted end of the pendulum and a magnetic field sensor is fixed to a rigid base in close proximity to the magnet. The sensor reacts to change in the strength of the magnetic field in response to earth movement. These changes are detected by electronic circuitry and suitably processed for display or recording purposes. Data logging circuit requires data acquisition and storage. The analog output of the Hall Sensor, GH-700, is connected to a microcontroller, PIC16F877A, through an ADC for digital signal conversion and data logging. An LCD display is also connected to the microcontroller to display the current measurement value. The resulting digital value is then stored in the external EEPROM. The data can be transferred to a PC with RS-232 serial communication using software.**

Keywords— **Microcontroller, Sensor, LCD, EEPROM, serial communication**

I. Introduction

Earthquakes are one of the most powerful natural forces that can disturb our daily lives. An earthquake is the rapid vibration of the earth created by a sudden movement of large sections of rock. Earthquake generates seismic waves which can be detected with a sensitive instrument called a Seismograph. Seismic waves are the waves of energy caused by the sudden breaking of rock within the earth or an explosion. They are the energy that travels through the earth. Although seismographs are widely used to monitor naturally occurring earthquakes, they can be used to monitor any shaking of the earth, including movement caused by man's activities.

II. Aims and Objectives

Most seismographs were analog type equipped with a moving pendulum to record earthquake motion on paper, but most of those now in use are digital type that converts earthquake motion to electrical output is then digitized by an ADC and record on an IC card etc. The objectives of this research are:

1. To measure the seismic waves from an earthquake
2. To study the vibration sensor
3. To study the PIC16F877A microcontroller, EEPROM, LCD, RS-232 serial communication
4. To design an advanced long-lasting, inexpensive and highly reliable devices
5. To construct and test Seismograph for earthquake measurement system using PIC16F877A microcontroller with cost effectiveness
6. To test the proposed seismograph system
7. To calibrate the proposed seismograph system

III. Methodology

The block diagram of earthquake measurement system is shown in Fig.1. This system is divided into three main parts. They are: Movement Sensing Amplifier Data logging circuit and Interfacing circuit.

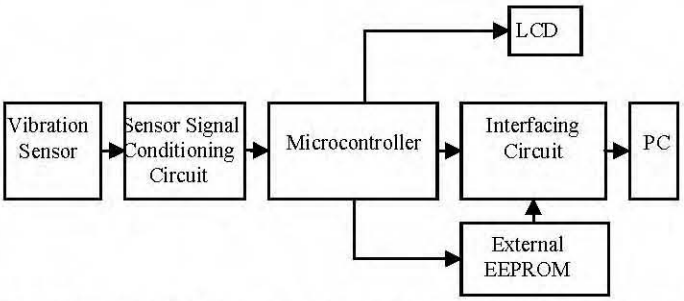

Fig. 1 Proposed Block Diagram of Seismograph for Earthquake Measurement System