VibraSense: Intelligent Vibration Analysis and Alert System for Object Protection

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Abstract- This research paper presents a novel approach to analyze the technical seismicity of an object, which involves studying its free vibration caused by random processes in the universe. The main goal is to develop a device that can accurately measure vibrations and alert users in the event of high amplitude free vibrations that could potentially damage the object or anything placed on it. In order to achieve this objective, a specialized circuit needs to be designed to amplify and filter the sensor signal, allowing for the accurate measurement of vibrations and the differentiation between normal and high amplitude free vibrations. This requires the careful selection of appropriate sensors and the design of a circuit that can effectively process the sensor data.

Introduction

This document highlights the various injuries and faults that can occur in industrial settings due to the failure or accidents of products, often resulting from improper analysis of the vibrations produced. While controlling and analyzing these vibrations through mechanical means can be a complex task, it can be simplified by utilizing electronic sensors, processing and filtering data as needed, and displaying the results in a useful manner. By adopting this approach, it is possible to gain a better understanding of the root causes of industrial injuries and faults and to develop more effective strategies for preventing them. Through the use of advanced electronic sensors and data processing techniques, it becomes possible to analyze the vibrations produced by various equipment and products, and to identify potential issues before they lead to significant damage or accidents

Principle

This project report outlines the development of a device that utilizes a vibrational sensor based on the piezoelectric effect to detect vibrations. The device is equipped with an LCD screen that displays the measured values of the detected vibrations. Furthermore, the device has been programmed to trigger an alert to the user in the event that the amplitude of the detected vibrations exceeds a predetermined threshold. The piezoelectric sensor used in this device is a highly sensitive and responsive component, capable of detecting even small vibrations with **Fig.**

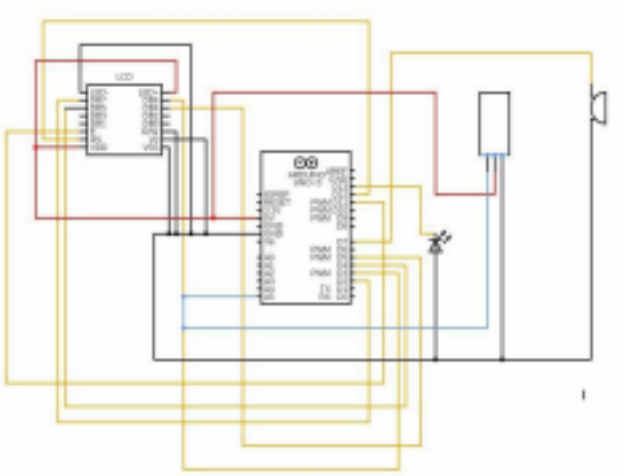


fig 1: Circuit Diagram

great accuracy. The LCD screen provides a clear and concise display of the detected vibrations, making it easy for users to monitor and track the performance of their equipment or products. The alert feature ensures that users are immediately notified in the event of any dangerous or potentially damaging vibrations.

Experimental Method

The various equipments that are used for the project are given below:

- Vibration sensor
- Arduino UNO R3
- 16x2 LCD Display

- Breadboard
- Jumper Wires

The final circuit is as shown in the figure below:

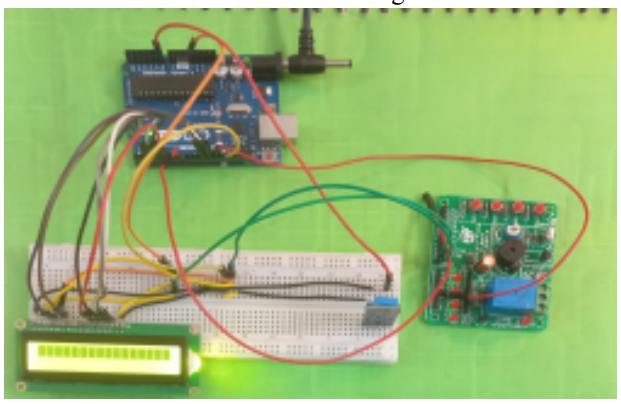
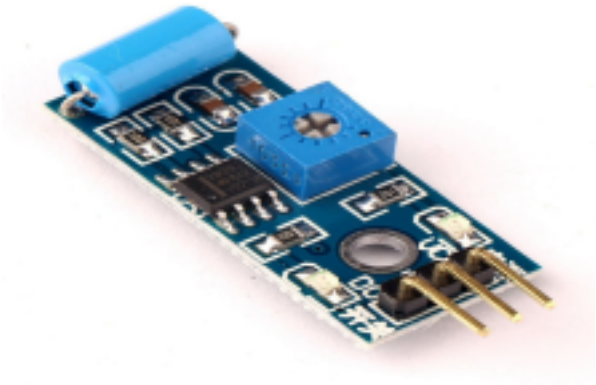


fig. 2: picture of final circuit

The detailed description of the equipment used are as shown below:

A. Vibration Sensor:

A vibration sensor is an electronic device that is used to detect and measure vibrations or oscillations in a system. It is commonly used in electrical projects to monitor the health and performance of machines and equipment. The sensor works by converting mechanical vibrations into electrical signals that can be analyzed and interpreted by a microcontroller or other electronic device. Vibration sensors are available in various types, including piezoelectric, capacitive, and magnetic sensors. They are commonly used in applications such as industrial machinery, automotive systems, and aerospace equipment. In an electrical project report, the vibration sensor's specifications, working



Vibration Sensors

B. 16x2 LCD Display:

A 16x2 LCD Display will take the input from the arduino board and the output will be displayed on the LCD. It will display the flow rate and the volume of the fluid that has passed through the Hall Effect Water Flow Sensor. The LCD Display has a total of 16 pins. The LCD pin 2 and 5 is connected to the 5V Vcc supply while the pins 1, 3, 5 and 16 are grounded. The remaining pins are connected to the Arduino digital pins. The LCD pins 4, 6, 11, 12, 13, and 14 are connected to the arduino pins D7, D6, D5, D4, D3 and D2 respectively.

16*2 LCD display

C. Arduino UNO R3:

Arduino UNO R3 is a microcontroller board which is widely used in the electronics domain for performing microprocesses. The Arduino will collect the data as input signals from the sensor. It will convert the analog pulses from the sensor into digital signals and will process the data by executing the code written in Arduino IDE. The output will be displaced on the LCD Display. The connections to the Arduino pins are already discussed above.

Result And Conclusion

1. The device has mostly succeeded in its goal of detecting vibration, although in some circumstances it fails due to the sensor's low sensitivity.
2. Varied materials have varied properties, machines or car ignition, and concrete buildings do not have the same strength, so devices can be made more universal by taking into account other factors that we do not know at this level.
3. Data filtering is a difficult task, as is determining the reason for vibration in multivariate waves.
4. Value of the sensor saturates at a certain level; it is not going over 1023 value.
5. It can be used in multiple areas for detecting vibrations, geological surveys or security alarms, alert alarms are other utilities that can be achieved from similar setup.

Acknowledgement

The authors would like to thank and acknowledge the contribution of teaching assistants and Prof. Arup Lal Chakorborty for their constant support and guidance throughout the duration of the project. The authors would also like to acknowledge the support provided by the lab assistants in acquiring the equipment and providing space to conduct the experiment.