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Laser Based Vibration Sensor Through Mobile

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Abstract
Machine condition monitoring has gained momentum over the years and becoming an essential component in the today's industrial units. A cost-effective machine condition monitoring system is need of the hour for predictive maintenance. The paper presents the design and implementation using vibration sensor, and also this system operated through smartphones. Vibration analysis plays a major role in detecting machine defects and developing flaws before the equipment fails and potentially damages. The concept of this project was to detect faulty equipment in industry machine so that before damaging the whole machine faulty equipment can be replace and improve the durability of machine.

Keywords: Vibration sensor, LDR sensor, Smartphone, Raspberry Pi**.**

1 Introduction

Vibration measurement using different signal processing with suitable set-up data is a powerful tool to identify and predict failure. Conducting different vbration analysis techniques could lead to improve Machine efficiency and availability. Monitoring the vibration characteristics of a machine can provide the information of its health condition, and this piece of information can be used to detect problems that might be incipient or developing. There are two ways for analysis with contact and without contact here this project is based on non-contact analysis. Non-contact analysis based on laser-based vibration sensor. Usually in the contact type vibration sensing, the sensor is

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attached to the machines or instruments in order to detect the vibration amplitude and frequency.

Due to accessibility issues or the fact that the contact sensor adds mass to the instrument or machine and might change its vibration characteristics, the addition of a contact sensor is sometimes not practical in situations where precise vibration measurement is needed or in toxic and hazardous environments. nonetheless, non-contact analysis is more affordable, requires less human labour, and produces better findings.

In industry, machine monitoring necessary so that every machine can function properly and do not affect the production of plant. This project gives the solution for this problem by checking vibration level of machine if vibration level increases it will give alert so that faulty equipment can replace on time and production of plant can go on.

2 Research Methodology

Non-contact vibration using a laser for structural cable health monitoring [1]. To measure cable vibration, a non-contact remote sensing laser vibrometer is utilized. It is now necessary for someone to gather vibration data. In the future, it will be upgraded to Bluetooth connectivity so that it may be managed from a secure location. The accuracy of the project can be increased by increasing the frequency. It can be modified in such a way that all parameters such as vibration, force, and damping ratio can be observed in a single device at the same time.

In the development of laser vibrometer [2]. the author has used the optical triangulation principle, with the laser source, target, and detection system forming the three vertices of a triangle. The laser beam strikes the target, and the backscattered light is collected by the detection system. the frequency range between 0-1KHz so it can be increased to 0-1GHz so that reading appear can be accurate.

Next the development of non-contact structural health monitoring system for machine tools[3]. A real time structural health monitoring (SHM) is a paramount for machining processes during machining, vibrations are always brought forth because of mechanical disturbances from various sources such as engine, a sound and noise etc.

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The purpose of SHM is to avoid wasteful activities to optimize profitability of products and services to improve the information obtained about the condition of the machine tools being used. Development of non-contact structural health monitoring system for machine tools.

Machine condition monitoring has gained momentum over the years and becoming an essential component in the today's industrial units. Basic block diagram of proposed system is shown in Fig. 1.

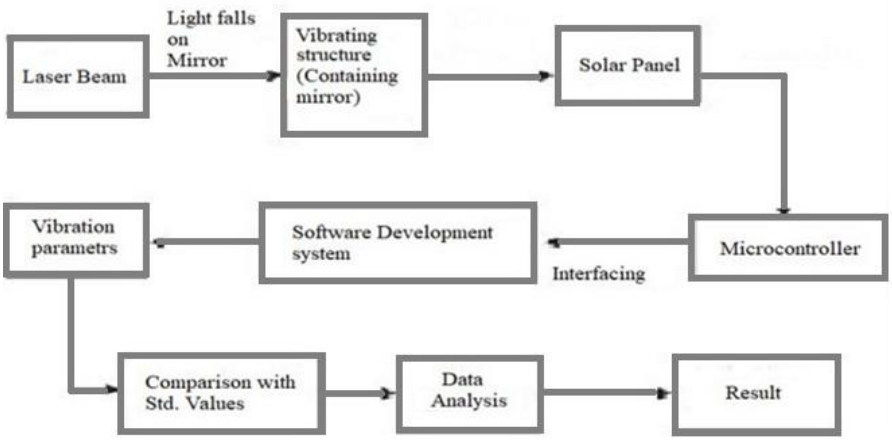

Figure 1. Basic circuit connection

Predictive maintenance urgently requires a system for monitoring machine status that is both affordable and effective [4,5]. Vibration that causes no damage is likewise highly helpful [6]. Simultaneous multidimensional measurements are feasible [7]. Additionally, cable-stayed bridges are incredibly efficient [8]. In the modern world, sensors play a significant role [9, 10].In this paper, we have developed a machine condition monitoring system using smart phone, thanks to the rapidly growing smart-phone market both in scalability and computational power. In spite of certain hardware limitations, this paper proposes a machine condition monitoring system which has the tendency to acquire data, build the fault diagnostic model and determine the type of the fault in the case of unknown fault signatures. Results for the fault detection accuracy are presented which validate the prospects of the proposed framework in future condition monitoring services.

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Results and Discussions

The basic circuit connection is shown in Fig. 2.Vibration sensor is implemented using a laser and LDR sensor in Fig. 3 which are fixed on a wooden board in straight formation. A tube is placed in front of LDR to block noise light.

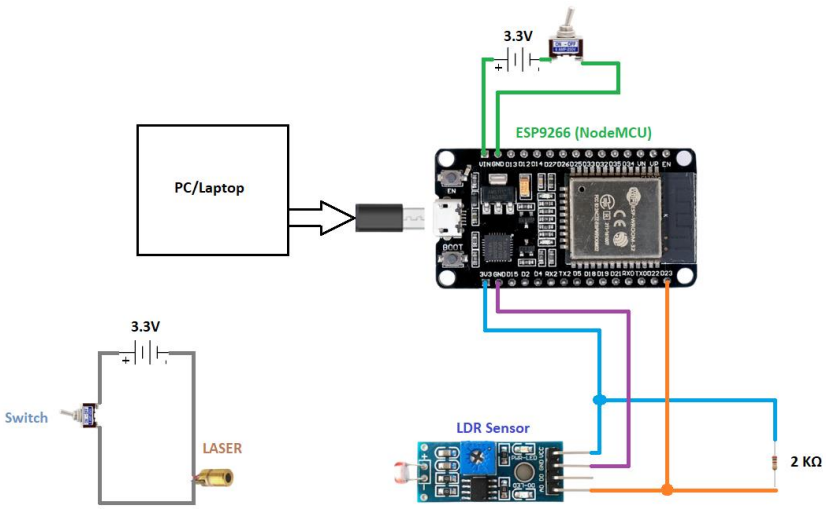

Figure 2. Basic circuit connection

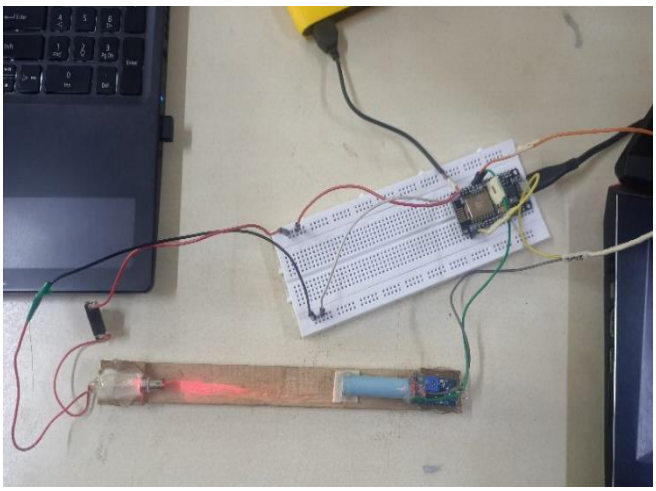

Figure 3. Basic physical circuit connection

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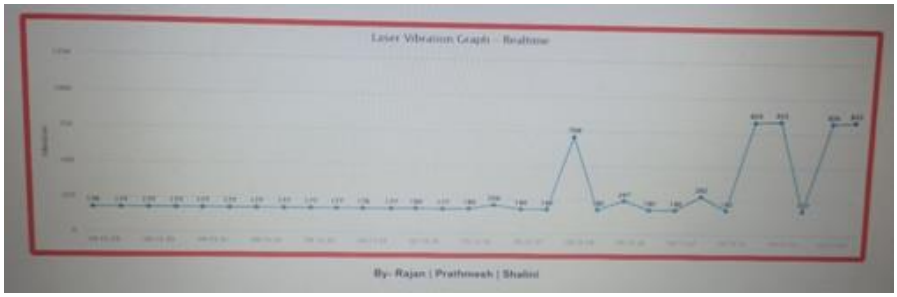

Figure 4. Laser based vibration sensor output

The data of Fig. 3 is sent to Raspberry Pi, which is then displayed on default monitor. The Raspberry Pi Code also host a local website which is used to plot value graph and display it.

Table 1. Reading Value Obtained on Serial Monitor

IP address	Sensor	Output
14:44:26.567	Vibration sensor	176
14:44:26.567	Vibration sensor	176
14:44:26.567	Vibration sensor	176

The default monitor that shows real-time value which is represented in Table 1 as it shows at very fast speed. The high-speed value recording makes this system accurate and it makes monitoring easier.

3 Conclusions

In this paper, a vibration sensor that is used to detect vibrations in machine parts or structures was deployed using a Laser and LDR sensor. The approach used in this paper was non-contact based because of use of laser which is an upper hand compared to other methods present in market to measure vibrations. With further evolution in light sensing devices and sensors this project can gain many advantages over other methods. With present generation technology and components this system is already accurate and can detect very slight changes in vibrations.

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