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Vibration Analysis of Electrical Machines

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ABSTRACT: The purpose of this project is to demonstrate the importance of vibration measurements in modern day motors or electrical machineries. In electrical machines like motors, transformers when in running condition, it produces vibrations. Due to hysteresis or mechanical movement, it may affect the smoothness of machines. Our aim is to monitor the vibrations and obstruct the failure rate of electrical machines.

KEYWORDS: vibration, transformer, movement, mems sensor, machine.

I. INTRODUCTION

In the previous days, for monitoring vibrations there were mechanical arrangements but the mechanical movements resulted in wear and tear which directly affected the monitoring output. In order to reduce this, scheduled maintenance was required. Hence we have designed a circuit in which the mechanical part is completely replaced by an electronic circuit. Detection of faults play important role in the quest for highly reliable operations. Reducing maintenance and production cost, improving uptime, product quality, advance safety and reducing risks are some of the essential drivers for deploying vibration analysis.

Monitoring and analysing the vibrations in different places of the motors the cause of the vibration can be discovered. It is also important to discover and solve these problems in time. If not, long term damages or immediate failure can occur which leads in immediate loss of production.

II. RELATED WORK

Our project is based on embedded signalling domain. The transformer converts 230V AC to 12V AC. The rectifier then converts this 12V AC to 12V DC, because the whole circuit works on 5V DC hence, voltage regulator converts 12V to 5V DC and this voltage is provided to the whole circuit. Capacitor stores this 5V and if any fluctuation occurred in the circuit then this capacitor provides constant 5V to circuit. Microcontroller fails to provide sufficient 5V to the Output, and therefore we have used pull up resistor to give 5V to the interfaced port (pin). LED acts as an indicator, it indicates if 5V is provided to the circuit or not. Glowing of LED is a symbol that 5V constant voltage is being provided. Max232 is a serial port RS232 is a protocol which is used as a communication standard between microcontroller and PC. If a complete circuitary is ON then it operates on 30mA current and in ideal state when no operation is being done it operates on 100uA current. All the process (data) is stored in flash ROM. The flash ROM is of 8kilo byte, for temporary data execution 1 kilo byte RAM is used and desired output is displayed on LCD screen in the form of x, y, z co-ordinates and vibration will be display on monitor in the form of graphical representation.

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HARDWARE SPECIFICATION:

A) PIC MICROCONTROLLER

A **16F688** PIC microcontroller is used in this project. This is an integral part in our project and is a 14 pin IC. The MEMS sensor, RS 232 and LCD are interfaced with the microcontroller. PIC controller is used because external peripherals are connected on board.

B) MEMS SENSOR

MEMS Sensor stands for Micro Electro Mechanical system. We are using MEMS sensor because of small size, low power and high level of functionality. It offers easy integration and reduces cost to emerging group of new users. The objective is to correlate observable vibrations with typical wear out mechanisms, such as bearings, gears, chains, belts, brushes, shafts, coils and valves.

C) RS232

RS232 is the standard for serial communication transmission of data. It formally defines the signals connecting between DTE that is, data terminal equipment such as computer terminal, and a DCE that is, data communication equipment such as modem. The standard defines the electrical characteristics and timing of signals, the meaning of signals and the physical size and pin out of connectors.

D) VOLTAGE REGULATOR

A voltage regulator is designed to automatically maintain a constant voltage level. A voltage regulator may be a simple "feed-forward" design or may include negative feedback control loops. It may use an electromechanical mechanism, or electronic components. Depending on the design, it may be used to regulate one or more AC or DC voltages. Electronic voltage regulators are found in devices such as computer power supplies where they stabilize the DC voltages used by the processor and other elements. In automobile alternators and central power station generator plants, voltage regulators control the output of the plant. In an electric power distribution system, voltage regulators may be installed at a substation or along distribution lines so that all customers receive steady voltage independent of how much power is drawn from the line.

E) MAX232

Max 232 is an ic(integrated circuit) that converts TTL(Transistor Transistor logic) logic signal in to its equivalent RS-232c level signal and Rs-232c level to its equivalent TTL level signal. This IC is very important in case when we need to make connection and transfer data between devices that works on different wave forms.

For example, Most of the microcontrollers 8051(89c51, 89c52), PIC (16f688), AVR works on TTL logic wave form. These microcontrollers have a build in UART(Universal Synchronous-Asynchronous Receiver & Transmitter) which can send and receive serial data. Since they work on TTL level so they transmit and receive data on TTL wave from. Whereas Standard PC(Personal Computers) works on RS-232 level wave form. Now if we need to transfer data from microcontroller to PC(Personal computer) we need to convert data from TTL to RS-232 level and if we want to send data from PC to microcontroller we have to convert data from Rs-232 to TTL. Max-232 is solution to this problem. There is wide range where we use max232 but its main purpose is explained above.

III. BLOCK DIAGRAM

Firstly, we will mount the MEMS sensor on the shaft or platform of an electric motor. We will provide AC mains supply to the motor. A rectifier is provided in the circuit which will convert this ac supply to 5v dc and provide this constant supply to all the peripherals of the circuit. Now, vibrations will be sensed by the sensor and will be displayed on the LCD in the form of (x,y,z) co-ordinates. Through RS232 and a USB serial port connector, these vibrations will be displayed on the monitor in the form of graphical representation.

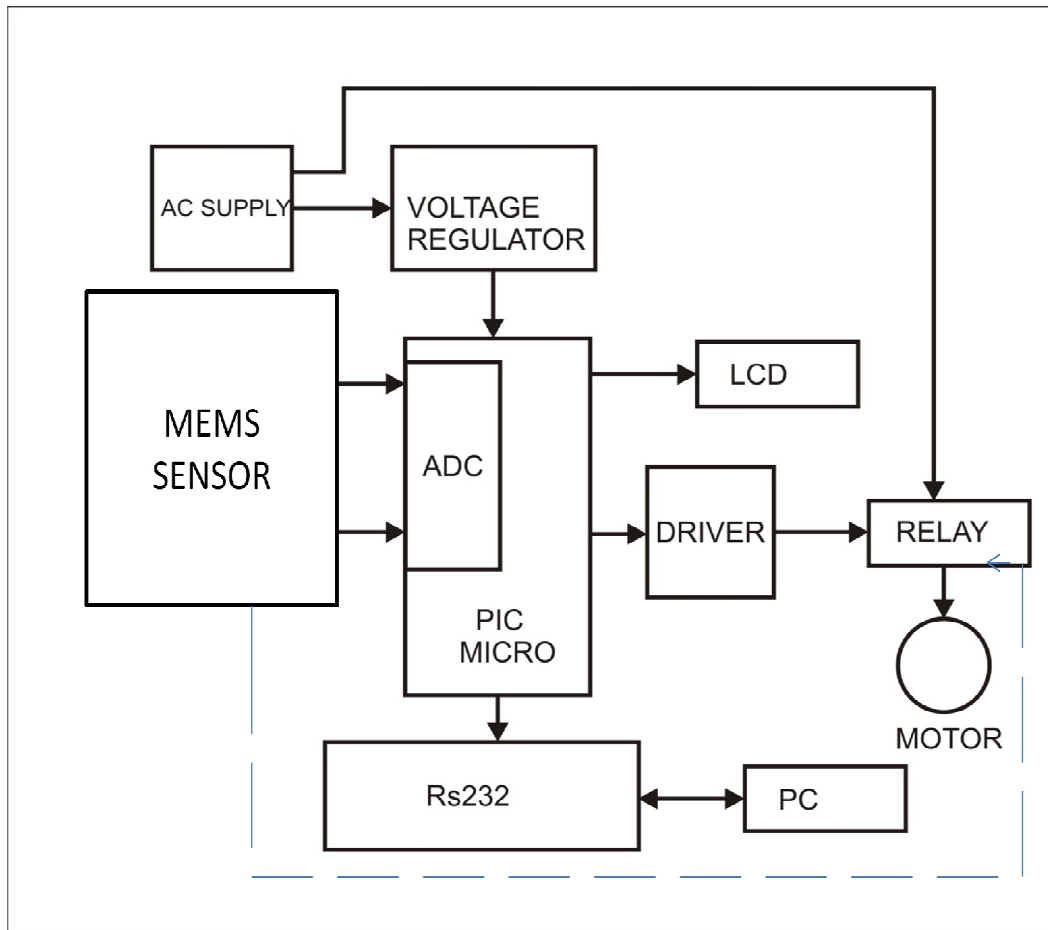


Fig.1: Block Diagram Of Circuit

IV. RESULT

In the following graph the vaibration shown in X,Y axis, where X axis shown in black color, Y axis shown in blue color and Z is Resulant of both X, Yaxis respectively Z axis shown in red color.

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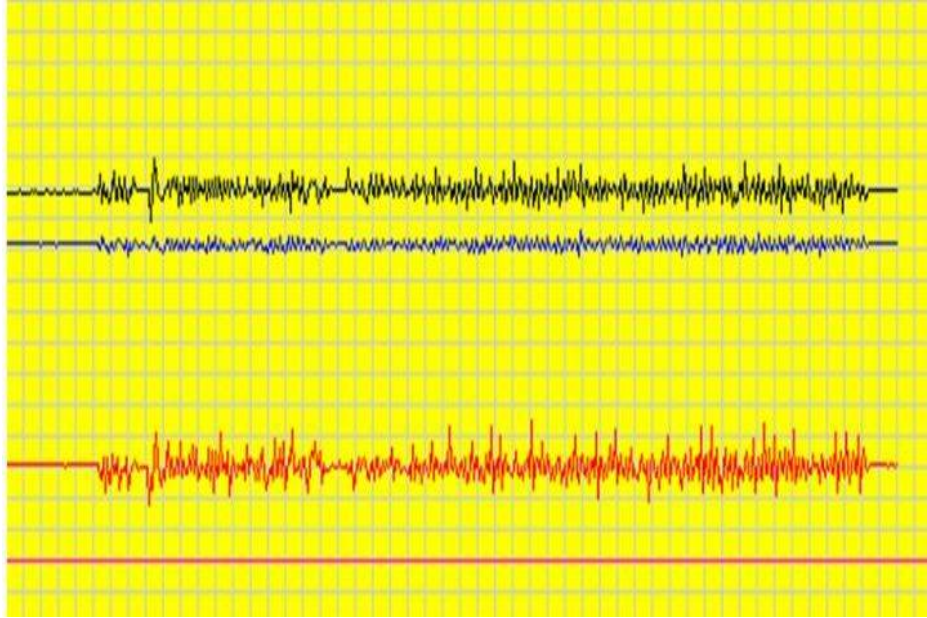


Fig.2: Normal vaibration of electrical machine



Fig.3: Abnormal vaibration of electrical machine

Hence, both the figures represents the vibrations that are measured on the motor. Fig (2) represents the normal vibrations of the machine whereas fig (3) represents the abnormal vibrations of the machines.

V. FUTURE SCOPE

Instead of MEMS, Multi MEMS sensor can be used to analyze vibrations alongwith pressure, temperature and other physical parameters. It can be used for mechanical and electrical applications in industries.

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VI. CONCLUSION

Vibration measurement being the most integral test, it will give the user an accurate idea of the machine's present condition. By monitoring a vibration we can analyse the life of the machines. Vibration analysis will be helpful for maintenance of the machines.

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