Contact-Less Tachometer

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***Abstract*—Tachometer is a device used to measure the speed of the any rotating object. The measurement is done in revolution per minute or RPM. In olden days tachometers were completely mechanical, but tachometers have changed due to development of modern technology. This paper mainly focuses on developing a contactless digital tachometer. It is built using microcontroller, an infrared system and LCD module. The infrared system senses the interruption in the beam of rays caused by rotating object and generates pulses which will be sent to the microcontroller and these pulses will be counted; this count will be displayed on the LCD in revolution per minute i.e. RPM. The system is economical and has wide applications in automobile industry and medical field.**

Keywords— LCD-Display,IR sensor, RPM,USB.

I. INTRODUCTION

In this modern era of industrialization most of the industries contain rotating objects such as motor, rotor etc for its proper monitoring its speed has to be measured and controlled. For such measurements, there are many methods and one of such method is use of tachometer. Tachometer is an instrument which measures the speed of any rotating objects in revolution per minute (RPM). There exist mechanical tachometers, where direct contact between motor and the tachometer is needed for measurement of RPM. This kind of tachometers requires regular maintenance and is complicated to use. These instruments suffer from wear and tear. Hence there is a requirement for a contactless digital tachometer which can be easily used with monitoring system. This paper is about contact-less digital tachometer designed using infrared methodology. The sensor unit used for measurement is IR sensor and the processing unit used is Arduino-Uno. The measured value is displayed using a LCD module. This kind of tachometer can employed in the region where speed is unit of measurement and size and precision is a factor. This model can be employed in vehicles and robotic arms. This is also used in aircraft, rails and traffic engineering to estimate traffic speed and volume.

II. LITERATURE SURVEY

In this paper the author has discussed about various researches that has been done in the development of contactless tachometer. Here author has used arduino-Uno board for controlling part. The IR sensor consists of LED and photodiode. Motor rotates in front of sensor, this interrupts the light and forms pulse which is given as input to microcontroller. Arduino takes average of 3 consecutive readings and displays it LCD. Also the system has arduino program for threshold value of motor speed and if the speed exceeds this value then the motor will be turned off. [2]

The paper focuses mainly on digital tachometer which gives output directly i.e. Numeric digital output. The author has made used of the infrared transmission technique; thus the system has a controller sensor and display unit the microcontroller used is At89c52 as the controlling unit. [1]

This paper presents a new approach for contactless speed monitoring and displaying. Here the tachometer contactless which measures the speed in RPM is designed with the help of microcontroller and diodes. The author uses At89s52 as a microcontroller. This is programmed in c program and complied using keil complier. [4]

This paper describes the basic construction of a low cost optical tachometer and analyzes its performance. The basic tachometer circuit consists of two stages. In the first stage monostable wired around IC NE555 is used, and in the second stage a digital counter based 4-digit counter IC 74C926 is used for the construction of the tachometer. A 5V regulated power supply circuit and an infrared light source circuit are also used. The instrument can measure speed upto 9999 RPM. [6]

The paper presents the design of a very flexible, low cost speed evaluation system. The system provides a fast dynamic response and a high accuracy over a wide speed range. The proposed design is suitable for a wide range of applications and can he integrated as part of an existing tachometer assembly. Hardware requirements and appropriate software

structures for a microcontroller implementation are discussed. [5]

This paper designs a tachometer which works on the principle of an induction machine. It must have windings on the stator as well as rotor. One of the winding is connected to the supply. When the rotor of this tachometer is coupled to the drive, the frequency of EMF induced in the rotor winding will depend on the speed of the rotor. Since the speed of the drive is very low, the frequency of the induced EMF is in the same range as that of applied voltage. This frequency can be easily measured using counters. [10]

In this paper a new approach to the digital measurement of angular velocity is presented. This new instrument performs the division by time that has been carefully avoided in the existing instruments. The accuracy and resolution of the transducer does not depend upon the number of revolution. The measurements can be made in a very short time, leading to up to 14,700 samples per second. [11]

III. DESIGN METHODOLOGY

The block diagram of the proposed methodology is shown in Figure1 below. It consists of controller, sensor, display and power supply.

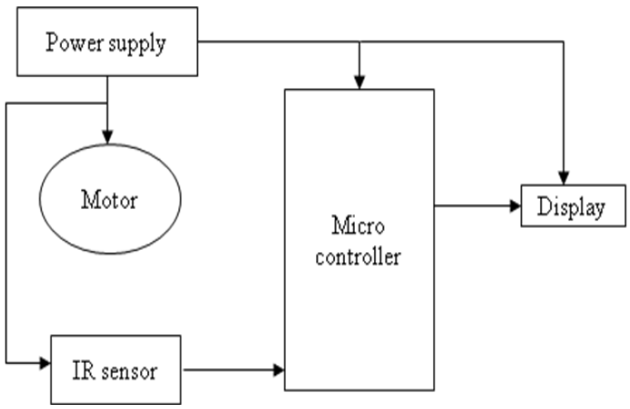

Fig. 1. Block Diagram of the system

The hardware components required for the above system is explained below:

- Arduino-Uno board
- IR sensors
- LCD display

A. *Arduino-Uno*

The Arduino-uno is microcontroller which is shown in Figure 2 based board on the atmega328.The board are equipped with set of digital and analog input/output pins that may be interfaced o various expansion boards or breadboard and other circuits. The boards feature serial communications interfaces including USB (universal serial bus) on some models which are also used for loading programs from PCs. The microcontroller is typically programmed using a dialect of features from the programming languages c and c++ in addition to using traditional compiler tool chains, the Arduino project.

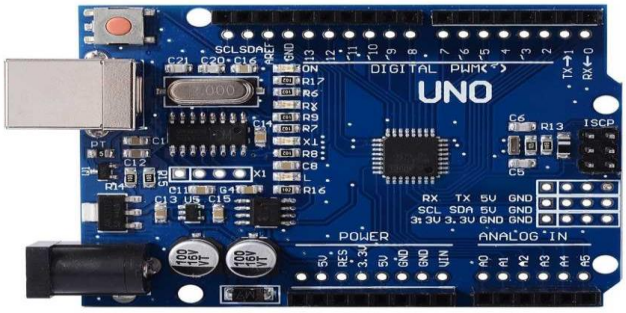

Fig. 2. Arduino-uno

B. *IR sensor*

An infrared sensor which is shown in Figure 3 is an electronic instrument which is used to sense certain characteristics of its surroundings by either emitting detecting infrared radiation. In infrared sensors are also capable of measuring the heat being emitted by an object and detecting motion.

Fig. 3. Infrared sensor

C. *LCD 16x2*

The LCD screen which is shown in Figure 4 is more energy efficient and can be disposed of more safely than a CRT can. Its low electrical power consumption enables it to be used in battery powered electronic equipment more efficiently than CRTs can be a 16x2 LCD display is used in the project which displays the count or number of rotation. LCDs are used in a wide range of applications including LCD televisions, computer monitors, instrument panels.

Small LCD screens are common in portable consumer devices such as digital cameras, watches, calculators, and mobile telephones, including smartphones. LCD screens are also used on consumer electronics products such as DVD players, video game devices and clocks. LCD screens have replaced heavy, bulky cathode ray tube (CRT) displays in nearly all applications. LCD screens are available in a wider range of screen sizes than CRT and plasma displays, with LCD screens available in sizes ranging from tiny digital watches to very large television receivers.

Fig. 4. Liquid crystal display (LCD)

D. Working

The system works mainly on infrared transmission principle. It has mainly controlling unit, sensing unit display unit and motor. The object of interest I.e. motor is placed in front of sensors. The sensor has IR LED and phototransistor the IR LED emits continuous beam of light rays. When motor starts rotating this light ray will be interrupted. The light ray will be rebound back and will be absorbed by the phototransistor. This interruption of light ray is continuous in each and every rotation. This interruption of light ray is continuous in each and every rotation. This results in pulse of light ray that is fed to the microcontroller. The microcontroller counts the number of pulses and that in turn is the number of rotations. This obtained value will be displayed on the LCD screen.

IV. RESULT

We have designed the circuit to work with least error. The testing is done and the designed tachometer is capable of determining the speed of the motor. The obtained result of the designed tachometer is shown in the LCD screen in the figure 5 below.

Fig. 5. Obtained result

We recorded the readings of both digital and analog tachometer for a particular voltage value and tabulated it as shown in Table 1.

It can be observed that for analog tachometer the value obtained was found to be in the range. But for digital tachometer a single value was obtained thus making it useful.

TABLE I. READINGS OBTAINED IN ANALOG AND DIGITAL TACHOMETER

Voltage (V)	Analog Tachometer (RPM)	Digital Tachometer (RPM)
60	2400-2500	2431
120	4500-4700	4722
220	11375-11650	11507

V. CONCLUSION AND FUTURE WORK

In this modern world all industries have motors whose speed has to be monitored properly. For this the speed has to be determined properly one such speed measuring device is tachometer. We have tried maximum in bringing up this contactless tachometer. This is low cost and gives proper output. Future scope of these tachometer is in medical field. Thus in future the system can still be minimized in size by using miniature component and by reducing noise it can be developed to be used medical field.

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