

A Review on Fabrication & Testing Of Digital Tachometer

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Abstract— The problems of using analog tachometer that is found in most cars and bike, such as inability to display exact speed reading, has lead to recent of digital tachometer. However, this digital tachometer, that read the rounding speed of engine, can only be found in the luxury and advanced cars due to high cost and higher damage risk. Thus, the low cost digital tachometer is proposed in this project. This project is an improvement to the previous project where instead of two digits display, the tachometer is proposed to have three or more than three digits display. At the end of this project, the main objectives of displaying the speed of the vehicle shaft rotating should be achieved. And from this project, it is hoped that all to use this digital tachometer.

Key words: Digital Tachometer

I. INTRODUCTION

A regenerative brake is a mechanism that reduces vehicle speed by converting some of its kinetic energy into another useful form of energy—electric current, compressed air, etc. This captured energy is then stored for future use or fed back into a power system for use by other vehicles. For example, electrical regenerative brakes in electric railway vehicles feed the generated electricity back into the supply system. In battery electric and hybrid electric vehicles, the energy is stored in a battery or bank of twin layer capacitors for later use. Other forms of energy storage which may be used include compressed air and flywheels. Regenerative braking utilizes the fact that an electric motor can also act as a generator. When a conventional vehicle applies its brakes, kinetic energy is converted to heat as friction between the brake pads and wheels. This heat is carries away in the airstream and the energy is effectively wasted. The total amount of energy lost in this way depends on how often, how hard and for how long the brakes are applied. Regenerative braking refers to a process in which a portion of the kinetic energy of the vehicle is stored by a short term storage system. Energy normally dissipated in the brakes is directed by a power transmission system to the energy store during deceleration.

II. LITERATURE SURVEY

In 1998, Andrew Huang [1] in his project took advantage of the integrated timing unit (ITU) feature of the SH-I to determine the duration between ignition pulses in the engine of his Toyota Corolla. From this number, it is easy to derive the number of RPMs. The signal from the engine is taken off the ignition diagnosis port, found near the driver's side shock absorber housing in the engine compartment. That signal is a 12V pp nominal square wave with ignition occurring in the rising edges. The two cautions when using this signal are that there are 400V spikes on the rising edge, and that grounding this signal is potentially very damaging to the igniter. An opto-isolator is used to help protect against the spikes, and the wire carefully routed and the ignition is

shorted to the ground. On the back end of the opto-isolator, a Transistor-Transistor Logic (TTL) buffer is used to provide a little extra protection in case the opto-isolator breaks down.

Steves[2] has created a tachometer that only made from the electronic kits. The display unit for the tachometer has only 2 digits and in the ordinary way it will display on hundreds and thousand of revolutions. 10 pulses per revolution is simply gave by the times 10 converters and enables the same equipment to display tens and hundreds of revolution without complicating the electronics. In the project, an infrared transceiver receiver is used which is mounted on a magnetic base and is angle adjustable to enable a good single to be established. To get more accurate reading, the x10 converter is used with the Sterling engine.

Sourabh Biyani [3] has built a tachometer and developed the speed measurement of the motor in Rotation per Minute (RPM) and displays it over 3 1/2 digit display. The infrared sensor is also used to get the pulses. However, to calculate the output from the sensor, IC 74C925 is used in this project. IC 4029B is also used with other circuit to reset and set the IC 74C925 to zero. When the IC is reset the count is initialized to zero and the counting continues for 10 second in the background. In front the counter displays the previously counted signal as it is now latches. Thus in every 10 second, the display changes if there is any change in the FWM of the rotating shaft. Simple tachometer design is used by Steve [2] while developing the object Avoiding Detector. An infrared (IR) LED is used that is oscillated at the frequency of 38kHz pointed at the propeller. When the propeller passes in front of the IR then the light is reflected back to the detector which brings the output voltage low. As the propeller blade passes away from the LED light is no longer reflected back to the sensor so the output voltage goes high. The pulse is counted over a certain time period, and then the number of counts is divided by the time. Since the sensor is counting two blades the number needs to be divided by two to get the engine speed.

Tan Van Nguyen [4] said that although we can use an analog tachometer, the digital one has less cost, better performances, less sensitive to temperature and easier to implements in a custom IC. Tachometer design by him is control the actuator for the heads of an optical-disk drive. But in his project, he also applies to other motor-control application.

Digital tachometer is also created by Eelke Visser [5]. For his tachometer, the display is updated every quarter of a second. To reduce errors the measurement is taken a tachometer is created by Josepino [6] by using PIC16F628. The sensor that can be used is optical sensor and magnetic or by using a switch. High voltage is informed since it can damage the PIC. If the input signal is more than 5 Volt, a driver as TTL, CMOS, Operational Amplifier (Op-Amp) or transistors is suggested as a solution. A digital tachometer is designed by Embed Engineer. High impedance, low power

analog circuit to produce a clean digital pulse is designed when a magnet or sensing cog passes by the sensor. The circuit operated from % Hz at 20mm to over 10 kHz at Irpm. For their project, a Microchip PIC16C932 was used to capture the pulses, measured the period between them and invert the data to obtain speed. The result for the tachometer was displayed on a directly-driven 4 digit LCD display and the system could be configured via DIP switches to the number of pulses per shaft rotation, and the desired output unit (RPM, Hz etc). An integrating mode could display accumulated shaft rotation instead of shaft speed.

In a Cypress Microsystem PSoC Design Challenge, there is one project that created 'A Non Contact Auto Ranging Digital Tachometer'. The project is for digital tachometer that can be used in measuring RPM of a rotational object. The components including the microcontroller, the digital and analog block are supplied by the PSoC device CY8C27223. The circuit for this project utilized an IRLED and a sensor to sense the rotation and LCD display to display the RPM. This digital tachometer can be used in robotic, machine tools and others. An author in his website mentioned that he decided to design a fully digital tachometer system to avoid the problems occur in his previous project such as the readings provided by the tachometer are not really accurate. Any tachometer simply measures the rate at which some events occurs and it done by counting the events such as contact closures, electrical pulses and others for a given period of time and then dividing the number of events by the time to get a rate. In this case, he had a rate of 1 pulse per engine revolution and using a tachometer that calibrated in events per minute, he could display revolutions per minute. In a spark ignition engine, tachometer typically.

Use different mechanism to obtain engine speed, knowing how many cylinders and assuming a 4-stroke engine, which takes two revolutions to complete a full cycle, then calculation for relationship of ignition pulses to revolutions can be done as follows.

$Pulses\ per\ Revolution = Number\ of\ Cycles\ (2-2)$ the first modification to his digital tachometer circuit that had been done is to increase the input pulse rate from 1 to 2 (or more) pulses per revolution.

In 1987, there is a team that design and build an electronic tachometer using optical sensing technology to measure the propeller RPM in a single engine aircraft with conventional front-mounted engine and propeller. This device is not intended to replace mechanical tachometer, but to enable pilots to calibrate them. An optical sensor is used in this project in order to provide a signal proportional to propeller RPM. After considering the merits of both alternatives, they had chosen to use passive sensor since there is two types of sensor namely active and passive. Phototransistor is used as passive sensor because it is more sensitive than photodiodes. There are several reasons why the passive sensor greatly simplifies the task of signal detection in this application. First, the infrared beam used by an active sensor would not reflect well off the surface of the black propeller blades. Secondly, the active sensor would be difficult to aim, since the beam would have to be at right angle to the propeller blade so that the sensor could detect the beam's reflection. Finally, the active sensor would have to work against the incoming sunlight, filtering out the

interference, whereas the passive sensor uses this situation to its advantages [10]. Bunnie, in 1998 [11] has decided to build a tachometer for the 1992 Toyota Corolla which is has recently purchased by him. The tachometer consists of Noritake GU128x 64-31 1 VFD module, a Hitachi SH-1 evaluation board, and some miscellaneous power conversion and signal conditioning circuitry. The Noritake GU128x 64-31 1 is a nifty device which has a fairly simple microprocessor interface. It has a bright, blue-green display which makes it excellent for night viewing, and it has a wide viewing angle. The display is quadruple-buffered for smooth graphic animation. He took advantage of the Integrated Timing Unit (ITU) feature of the SH-1 to determine the duration between ignition pulses in the engine of his Corolla. From this number, it is easy to derive the number of RPM's.

III. PROPOSED WORK

Existing project is reviewed in this chapter to get an idea about the project design, conception and any information that related to improve the project. There are many tachometer projects that have been done by other people with different concepts and design, in this literature review, a few concepts in designing tachometer is described. Consequently, a lot of information is gained to help low cost 3 digit digital tachometer design.

IV. CONCLUSION

Finally we conclude in recent a tachometer is device which measure the speed of a rotating object. A tachometer is a sensor device for measuring the rotation speed of object such as engine shaft. A rotating object can be a ceiling fan. It can be a car tyre, any industrial motor etc.

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It is expected that design can be modified for better accuracy and higher scalability.

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