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Laser Balance with Microcontroller

José L. Hernández C[1], Brayan Reyes B[2], Hugo Cuamatzi V[3], Oscar A. Padilla A[4], J. Abraham Duran L[5], David M. Camacho L[6]

[1,2,3,4,5,6]*Universidad Tecnológica de Tlaxcala; El Carmen Xalpatlahuaya, Huamantla Tlaxcala, 90500, México*

Abstract - *This research proposes the design of a device to align, with the use of a laser controlled by a data acquisition card, which allows us to obtain a visualization software for the machinery. The objective is to build an alignment laser with more accessible tools and with the same efficiency as those that exist in the market. The prototype allows the alignment, the correct, the dependence of the rotating axes, the difficulty of misalignment due to vibration, premature wear and imbalances in the bearings of their axes or shafts. The laser system offers the benefits of precision, speed and efficiency for the alignment of the axes, with an own automatic system. This prototype is developed in the laboratories of the Technological University of Tlaxcala. The working group collaborates with experts in mechanical vibrations of the University for the design and construction of the prototype. To know if our hypothesis is real, compare the result with another high precision device, for example: Fluke 830, SKF TKSA 41. The prototype works correctly, compared to the statistical study, it was verified that its reliability is 95%.*

Key Words: **Sensor, control, system, rotating axes, alignment.**

1. INTRODUCTION

The present work refers to the design and implementation of a laser aligner, which can be defined as a system that helps the maintenance department, so that the machines that present mechanical problems in their rotating axes, are aligned with the prototype and thus not present problems during their use, reducing maintenance costs.

The main characteristic of this product is the high quality, reliability and the facility that it has to be able to use it because the mechanism of operation is simple, besides the elements for the manufacture of the prototype are of low cost.

The laser aligner is mainly composed of an emitter and a receiver, which will indicate the correct positioning of the centers of rotation of two or more axes, which are positioned in series or in parallel. That is to say, which centered movement of each one depends on the other axes, for the proper functioning of the machine. The development of elements that allow improving predictive techniques has a boom, with an impact on economies because of the savings it represents in the life of machinery, downtime, spare parts, energy, etc.

2. LITERARY SURVEY

Laser alignment is defined as a series of techniques that allow the correct alignment of rotating axes. The first investigation that was associated with the laser is the effect of stimulated emission proposed by Albert Einstein in 1917, consisted in a theoretical explanation of how electrons can emit light at a wavelength spiced from an external intervention [1]. German physicists Rudolf Walter Ladenburg and H. Kopfermann, in 1928 experimentally tested stimulated emission or also known at that time as negative absorption [2]. In later work, Landenburg studied the properties of Neon gas by passing through electric discharges [3], however, Landenburg never achieved a favorable level of electric shock to cause emission stimulated with this gas.

2.1 Definition of the problem

During the maintenance process, a common problem has been found which is the de-aligning in the motor shafts, which must be attended with the necessary equipment, specifically with a laser aligner from which the main fault can be corrected which is misalignment in the rotating shafts. This affects the machine since in some cases small failures can be generated in the production process, but if it is not attended to, it can generate large losses of materials and even equipment, however severe the failure may be within the industry.

3. METHODOLOGY/APPROACH

The Laser Balance with Microcontroller is responsible that the rotating axes are correctly aligned, thanks to a laser emitter module KY-008 and a signal receiver that is a photoresistor (LDR). In addition, three ultrasonic sensors that help us visualize three distances, two of them between the shaft and the case (A, B) and the other to see the distance between the case A and B, the data of the sensors can be displayed on a TFT LCD touch screen.

3.1 Laser light.

The KY-008 module, 5mw, 5v. Is a laser light-emitting circuit, designed to work with Arduino projects and circuits, emits a red high-power beam (650nm), its head is made of bronze to give it greater resistance and a very good heat dissipation. Produced by the laser, it is designed with 3 connecting pins, two power (VCC and Gnd) and one pin separator without assigned function (NC) [4]. Below we can see the image of the laser in Figure 1.

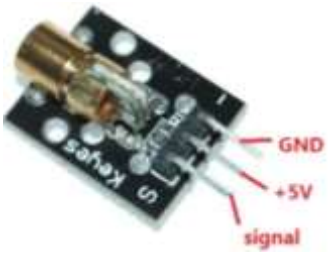

Fig -1: Module KY-008.

The module KY-008 located in the case A. was used to project linear laser light to a mirror, likewise the mirror causes the light to be reflected and be detected by a photoresist.

3.1 Photoresist (LDR)

The LDR (Light Dependent Resistor) or photoresistor is a resistance that varies its resistance as a function of the light that hits its surface. The greater the intensity of the light that falls on the surface of the LDR, the lower its resistance and the less light it incurs the greater its resistance [5]. Next, we can see the photoresist image in figure 2.

Fig-2: Photoresist (LDR).

Located in case A of the prototype. It was used to detect the light coming from the laser and send the signal to a microcontroller (Arduino for it to process it and send a signal to verify when the rotating axes are correctly aligned.

3.3 Ultrasonic Sensor

The HC-SR04 sensor is a low cost distance sensor. Its operation consists of emitting an ultrasonic sound by one of its transducers, and expecting the sound to bounce off of some object present, the echo being a sensor by the second transducer. The distance is proportional to the time it takes for the echo to arrive [6]. Next, we can see the image of the ultrasonic sensor in figure 3.

Fig-3: Ultrasonic sensor.

With the help of the ultrasonic sensors it was possible to measure the distances between case A and case B. Also the distances between the axis to be aligned and case A or B.

3.4 Arduino

Arduino is an open-source electronic prototype platform based on flexible and easy-to-use hardware and software. Arduino can "feel" the environment by receiving inputs from a variety of sensors and can affect their surroundings by controlling lights, motors and other artifacts. The microcontroller on the board is programmed using the "Arduino Programming Language" (based on Wiring) and the "Arduino Development Environment" (based on Processing). Arduino projects can be autonomous or can be communicated with running software on a computer (for example, with Flash, Processing, MaxMSP, etc.). [7] An Arduino image is shown below in Figure 4.

Fig-4: Arduino.

The Arduino microcontroller helped us to process the data sent by the ultrasonic sensors, the photoresistor, control the laser and project the data collected by the sensors on a TFT screen.

3.5 TFT Screen.

This 3.2 "TFT display with touchscreen allows data to be viewed and entered into Arduino boards, and it also provides storage capacity for data or programs from the Arduino board with its SD socket, compatible with FAT 16. Blue color Measures: 9.5 x 6.5 cm. Number of colors: 262 K. Working voltage 3.3 V. 16-bit interface HX8532 chip It is used for other development systems with parallel interface (AVR, PIC, 8051, ARM, etc.) [8]. image of the screen in figure 5.

Fig-5: Display de 3.2" TFT with touch screen.

The screen was used to observe the data obtained by the ultrasonic sensors, as well as to activate the laser module.

4. RESULTS AND DISCUSSIONS.

The results obtained in the construction of a laser aligner with microcontroller are very satisfactory since it was possible to verify that a laser aligner could be made more economical than those that exist in the market. Next, we can see the image of the prototype built in figure 6.

Fig-6: Final Prototype.

After having carried out tests with the prototype, we deduce that there are limitations.

• The distance between the CASE- (A and B), must be equal to 20cm.

• Measurements must be made in places where sunlight is not direct, as it affects the photoresistor by directly altering the measurement results.

The advantage of the prototype is that the user manual projected on the screen has two English and Spanish languages. Next, we can see the image of the language options in figure 7.

Fig-7: language options.

5. CONCLUSION

With this prototype of laser aligner, we can align some rotating axes in industrial machines. Similar to the Fluke 830 aligners, SKF TKSA 41. This work leaves many teachings as it includes several topics studied throughout the major.

6. FUTURE SCOPE

The communication that exists between the sensors and the microcontroller (Arduino), is by means of a cable, and this causes the prototype operator to be less than 2 meters away. Therefore to generate an alignment of rotating axes, in places difficult to remain for a long time, it is intended that the communication between the sensors and the micro controller is by means of bluethoot module, which guarantees that the data obtained by the sensors in CASE- (A and B) are sent to the case micro controller (CASE-C). This improvement will help us that the operator can be up to 10 m away without the need for cable intervention.

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BIOGRAPHIES

Jose Luis H. Corona. Candidate for a PhD from the Autonomous University of Tlaxcala, Research Professor in the area of Industrial Maintenance, Desirable Profile before the PROMEP, responsible for the CA of Industrial Maintenance at the Technological University of Tlaxcala.

Brayan Reyes Bonilla. Graduated from the Technological University of Tlaxcala in 2017 as T.S.U, performing professional practices ISI Automotive de Mexico S.A. de C.V. as a Maintenance technician. Next to graduate as Industrial Maintenance Engineer.

Hugo Cuamatzi Vasquez. Graduated from the Technological University of Tlaxcala in 2017 as T.S.U, performing professional practices OSIRIS TEXTIL S.A. de C.V. as a Maintenance technician. Next to graduate as Industrial Maintenance Engineer.

Oscar Adolfo Padilla Arenas. Graduated from the Technological University of Tlaxcala in 2017 as T.S.U, performing professional practices CLERPREM S.A.P.I de C.V. as a Maintenance technician. Next to graduate as Industrial Maintenance Engineer.

Jose Abraham Duran Lopez. Graduated from the Technological University of Tlaxcala in 2017 as T.S.U, performing professional practices BANTHYMEX S.A. de C.V. as a Maintenance technician. Next to graduate as Industrial Maintenance Engineer.

David Miguel Camacho Lara. Graduated from the Technological University of Tlaxcala in 2002 as T.S.U, performing professional practices PORCELANITE S.A. de C.V. as a Maintenance technician. Next to graduate as Industrial Maintenance Engineer.