The Effect of Simplifying the Deployment of Reflect Sensor Systems to Measure Rotational Motion Parameters

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ABSTRACT:
This article describes the design and construction of simple encoding that could perform rotary motion around a symmetry axis. The rotating drum for each 20 degree with a pair of black line is the line to help to identify these infrared reagents is achieved. Single-phase program to encompass the all kinds of sensors placed a digital reading of (0 -1) bit numbers in a logical and original software (Code vision) written in C that upon crossing the black line by the first sensor output voltage from the other sensors to be read and stored a Number in base 2.

Read each passage through the black line with the previous number (Known variable 1) is compared and if the first variable is equal to the angle of second variable does not change. But if the first variable of the second variable is smaller for the positive angle and a variable number of integer variables the second is further To be a negative angle.

KEYWORDS: Angular velocity, Rotational, Infira Red sensors, AVR Micro controller, Encoder

1. INTRODUCTION
One of the advantages of the addressed project (with performance range of 3-5V) in comparison to other similar projects, e.g. ADXL family sensors (with 2.5-5.25V range), include a roughly equal (with a couple of one-tenths difference) accuracy and a considerably cheaper price. This project enjoys the ability to measure the value of deviation in two directions of horizontal and vertical axis, controlling balance state and establishment of vertical motion quite easily; it measures the static and the dynamic velocities equally well, and has relatively high velocity in comparison to the mercury and heat sensors. The two figure pulse output with variable PWM, which may directly be measured by micro is considered as one of its other significant features.

Meanwhile, analog to digital output to convert the signals received from embedded sensors to digital and making the same identified by the micro is deemed as one of its other capabilities. Applying IR identifiers (TCRT5000 Model) instead of on2179 provides the possibility to identify the line in more remote distances.

Identification of the mobile location and angle of the surface on which the above-said is placed, as well as measuring the dynamic accelerations, e.g. vibration, and static accelerations, e.g. gravity, are performed easily.

2. FUNDAMENTALS OF ROTATIONAL MOTION
Angular velocity (ω): particle angular displacement changes trend (θ) relating to the time (t) is defined as average angular velocity. In fact, in case we indicate angular changes and time changes with Δθ and Δt, respectively, then we have: ω= Δθ/Δt. Therefore, in case of limiting the abovementioned term when Δt approaches zero, then the resulted term shall be real-time angular velocity. Considering the derivative definition, in fact, it may be expressed that angular velocity is equal to the time derivative of angular motion (θ).

2.1. Total Angle of Rotation
Total angle of rotation of a rotating object in certain time “t” shall be calculated by taking benefit from average angular velocity. The average angular velocity
by taking benefit from the $\omega = (\omega_0 + \omega t)/2$, while the taken angle shall be $\theta = \omega_0 t$.

Eventually we have: $E=1/2(I\omega t^2 + \omega_0 \omega t)$, which is similar to the direct line motion relation.

2.2. Phase in Periodic Motion

Phase shall mean the angle stipulating the mobile location on the path in comparison to the origin of location at any time. $\theta$ phase may be examined in Radiant under three states mentioned below:

1. In case mobile object motion is located at the origin at the time origin, the phase value is: $\theta = \omega_0 t$.

2. In case at the time origin, the mobile object is placed at a certain point where the carrying radius makes a positive angle of $\theta_0$ with the carrying radius of the location of origin, then the phase shall be: $\theta = \omega_0 t + \theta_0$. $\theta_0$ shall be the value of the phase at the origin of time (primary phase). In such state, it is said that the mobile object is in phase advance for $\theta_0$.

3. In case at the time origin, the mobile object is placed at a certain point where the carrying radius makes a negative angle of $-\theta_0$ with the carrying radius of the location of origin, then the phase shall be: $\theta = -\omega_0 t$. In such state, it is said that the mobile object is in transposition phase for $\theta_0$.

2.3. Rotational Harmonic Motion Equation

In case "S" shows the distance taken in any of the aforementioned three states, then $S=R\theta$ shall be the equation of rotational motion. In case, as the "S" distance is appropriated to the "$\theta$" phase and has a direct relation to the same, each of the phase relations may be considered to be in the state of the equation of such motion itself.

2.4. Rotation of Rigid Object around Optional Axis

In the most general state of ration of rigid object around an axis which is not fixed and has rotational motion is discussed here. In such a state, in order to examine the rigid object’s motion we act as follows: we consider two coordination systems, of which one is located outside the fixed object and the other to be located on the rigid object and rotates with the same. A frame is considered to indicate the direction of rigid object at the space with respect to the static frame; however, regarding the rigid object, three perpendicular axes may be chosen in a way that the multiplication of the moments of inertia becomes zero. It should be expressed that the moment of inertia of rigid object, in its general form, shall be as a matrix in which the members of the main diameter, main moment of inertia and other elements are called the multiplication of moments of inertia. Therefore, a third frame shall be considered whose three axes are the main axes of the rigid object. Doing so the equations of the rigid object motion are set and the way of motion and balance of the rigid object are discussed. Evidently, in such a state the quantities shall be considered as a tensor. For instance, the value of linear motion is expressed as $L = Io\theta$, where "I" is the tensor of inertia which may be indicated as a square matrix, while "$\theta$" is as a columnar matrix. The motion equations are not provided due to the mathematical complexities.

3. IMPLEMENTATION OF BALANCE AUTOMATIC SETTING APPENDIX

The AVR microcontrollers family has a relatively extensive range, while still such big family is developing. All the AVR microcontrollers have three general families of ATTiny, AT90S and ATMega, where there is a central unit in all of the same, so that it manages all the micro activities and perform all the required operations on the data; this unit is called as "MCU".

ATmega micro series have been used in the following project, as in addition to the capabilities of AT90S and ATTiny, it enjoys more capabilities. Atmega32 has an all-purpose 8-bit register, which protects the program codes without reading the same. In order to control the velocity of the engine used to rotate the rotating object, the respective settings are performed in Codevision software by PWM (8- and 16-bit timer counters) by taking benefit from receiving pulse of signal, and the velocity is then controlled. PWM is the abbreviation of Pulse Width Modulation, which does not control the velocity manually, but it is the average of the sent voltages by IC L298 engine drive, which has performed such settings automatically. The single-input ADC (Analogue Digital Conversion) channel has been used, which provides the digital value for such voltage within the 0-5V range by receiving analogue voltage. This interior ADC converter has a 10-bit accuracy and its maximum sampling velocity shall be 15,000 samples/seconds. In such a state, the time of conversion shall take between 65 and 250 micro seconds.

There are sensors to determine the value of rotation acceleration, finding distance, measuring linear velocity and angular velocity. Of the highly applied of these include the ADXL family sensors, Gyroscopes, Ultra Sonic and Laser Range Finder, of which ADXL and Laser Range Finder have relatively high accuracy and high costs for acceleration measuring and distance finding, respectively. This is while the current project
takes benefit from any and all the facilities of the various abovementioned sensors at a whole, and has a certain advantage in comparison to the other similar projects that it enjoys higher facilities with quite lower prices. It is easily available and measurable and may be increased with accuracy; concerning the point of location, the acceleration, velocity, angle and other variables dependent on its motion, the required information may be achieved in a more accurate form.

The given project in the article, titled “system of automatic setting the balance with the possibility of recognizing the environmental conditions” is a project based on which the angle of rotation, angular velocity and value of deviation. In order to do so, a rotating object has been designed and made which enjoys the ability of rotary motion along with the horizontal and vertical directions. There has been designed and made a drum of plexy, while passes through black and white lines with various lengths per 20 degrees. There has been applied certain number of infra red identifiers formed of an infra red LED as the sender with the ability of direct bias and a phototransistor as receiver in reversed bias state. In case of reflection of infra red light and hitting of the same to the phototransistor, the output current is made and considering the Ohm’s Rule \(V=RI\), this current is converted into a certain voltage within the 1-4.5V range. In order to identifying the sensor output voltage to the microcontroller, the IC LM324 comparing device has been used, in a way that it compares the respective voltage with 2.5V and the output is converted to the digital zeros and ones. In case the R1, R2 resistors are chosen correctly, then the VOUT voltage shall have explainable changes together with low noise considering the light received by the receiver.

Encoders are made according to the consumptions requirements to produce certain number of various signals. Therefore, their range of performance for the changes is not significantly high for the value of rotation and measuring the angular velocity and also they do not have relatively good accuracy, and in comparison of the same to the project addressed in this project, it may be concluded that by increasing the number of IR sensors applied, the error coefficient may be minimized while the measurement accuracy may be increased.

The big deficiency of Encoders is that under zero power startup state, the delivered current by the power supply would not be zero, and there is the possibility of generating considerable heat followed by potential damages imposed to the driver’s IC.

4. CONCLUSION

This project has been applied to measure the angular velocity and deviation in two vertical and horizontal axes directions, control the balance state and it has been tried that the advantages of the same and comparison to the similar projects and applying modern methods to improve the performance considering the current requirements are focused.

The scientific part of the article is the registration before the Industrial Ownership Administration with No. 61685.

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REFERENCES


