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Integrating Step Motor Movement Half-Step and Full-Step by Labview

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Abstract: ***This paper represents the performance of placement control of step motor (Brushless DC electric motor) using LabVIEW. Step motors are Applicable in many industries and factories where accurate control of motor position is necessary. In this work, half step and full step manner of step motor control is implemented. The experiment outcome show that half step manner makes an angle of 0.6 degree per step (300 steps), considering full step makes 1.2 degree per step (150 steps). With LabVIEW the arrangement has friendly communication, better control result and uncomplicated control in both ways.***
Keywords: Step motor, Software of LabVIEW, drives, NIDAQ.

I. INTRODUCTION

Step motors can be described as DC motors that can progress in separate steps. They have many coils. Step motors are employed in various applications like textile machines, Gaming machines, medical imaging machinery, welding equipment,3D printing equipment, small robotics, Digital cameras etc. The motive behind this is the demand of step motor as it is used in various production applications and also in electronic instruments. There are three main type of step motors: Permanent Magnet step motors, Variable Reluctance step motors, Hybrid synchronous step motors. A hybrid step motor is a combination of the variable reluctance and permanent magnet type motors. The rotor of a hybrid step motor is axially magnetized like permanent magnet step motor, and the stator is electromagnetically energized like a variable reluctance step motor. Both the stator and rotor are multi toothed. A hybrid step motor has an axially magnetized rotor, i.e., one end is magnetized as a north pole, and the other end a south pole. Toothed rotor cups are placed on each end of the magnet and therefore the cups are offset by half a tooth pitch. In this paper, a control to make step motor revolve in two ways i.e., clockwise and anti-clockwise using LabVIEW. Half step and full step manner of step motor is done, and the motor revolves with 0.6 and 1.2 degrees correspondingly. The number of steps produced by the step motor is considered virtually that the user can see the motor revolving steps in required gradient.

LABVIEW (Laboratory virtual Instrument engineering workbench) may be a system design platform and development environment for a virtual programming language from National Instruments. The LabVIEW programming environment is simple to create small applications. In this paper LabVIEW software is used to design and implement step motor placement control. Thus, enhancing the overall operation experience of the operation of the stepper motor for the end user where the inspection and proper monitoring of the movement is feasible. The setup of the software of labview is user-friendly where the person can easily get habituated to it by easy learning visual graphics and easy-to-use options where one can easily understand the flow of information/data inside the circuit of the prototype simulation there by tracking of the project becomes quite simple.

The Integration of the step motor for various applications is made effective and efficient using this software along with negative feedback loop.

II. THEORITICAL BACKGROUND

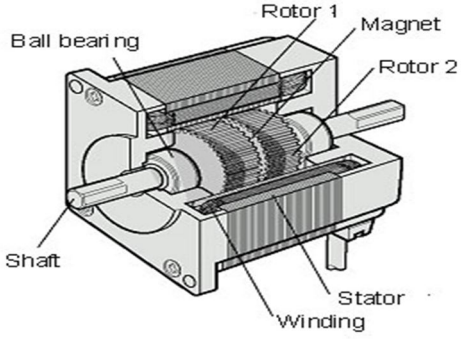

Fig .1 Step motor structure

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A automatic device used to correct the performance of a mechanism by means of an negative feedback with the help of encoder and it accurately applied for the systems in which the feedback and error-correction signal control mechanical position. In 1940 stepper motor used due to its key advantages like low rotor inertia, high accuracy in position control and the purpose of stepper motor is to position control with required no. of steps for example 200 steps in 360 degrees at 1.8-degree resolution per minute. But today stepper motor is widely used in many applications like robotics etc. At two sides of motor caps are incorporated with axial magnet which consists equal number of teeth and magnet is placed in order to magnetise it.

In this stator and rotor parts are present in which stator consists of 40 poles and each end of the cap of rotor has 50 teeth with all these note we can now calculate the step angle,

Step angle = (60-50) *360/60*50

III.HARDWARE IMPLEMENTATION

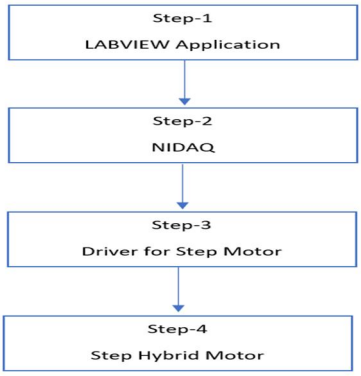

Fig .2 Flow chart of project hardware

Data Acquisition module: LabVIEW-based data acquisition involves writing software on top of appropriate hardware to acquire data from various sensors. Those data are then usually manipulated and filtered before being displayed and recorded for further analysis. National Instruments has designed the LabVIEW software. Originally it was focussed on taking measurements from various lab instruments, but its expanded drastically from its inception. This software application makes the operation of DC motor easy for various purposes. By using the arrow (push) symbolled button, we can control the dc motor as we want either start or stop or turn in required direction. The operation is self-operatory because the system reads the encoder input using LabVIEW front panel waveform graph. Speed module: This will display the value of the speed, which is displayed graphically on a scaled meter in Revolutions per minute.

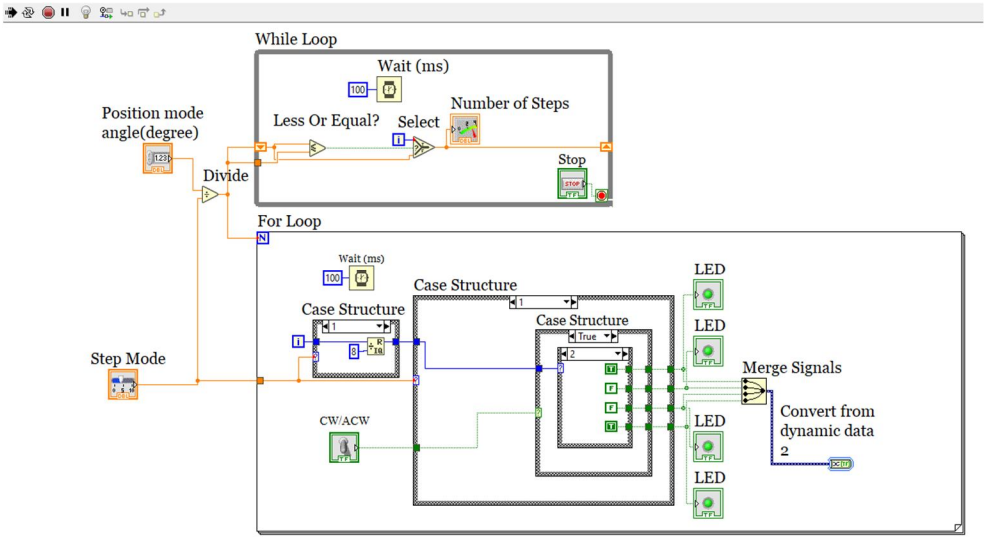

Fig .3 Logical Model LabVIEW block diagram

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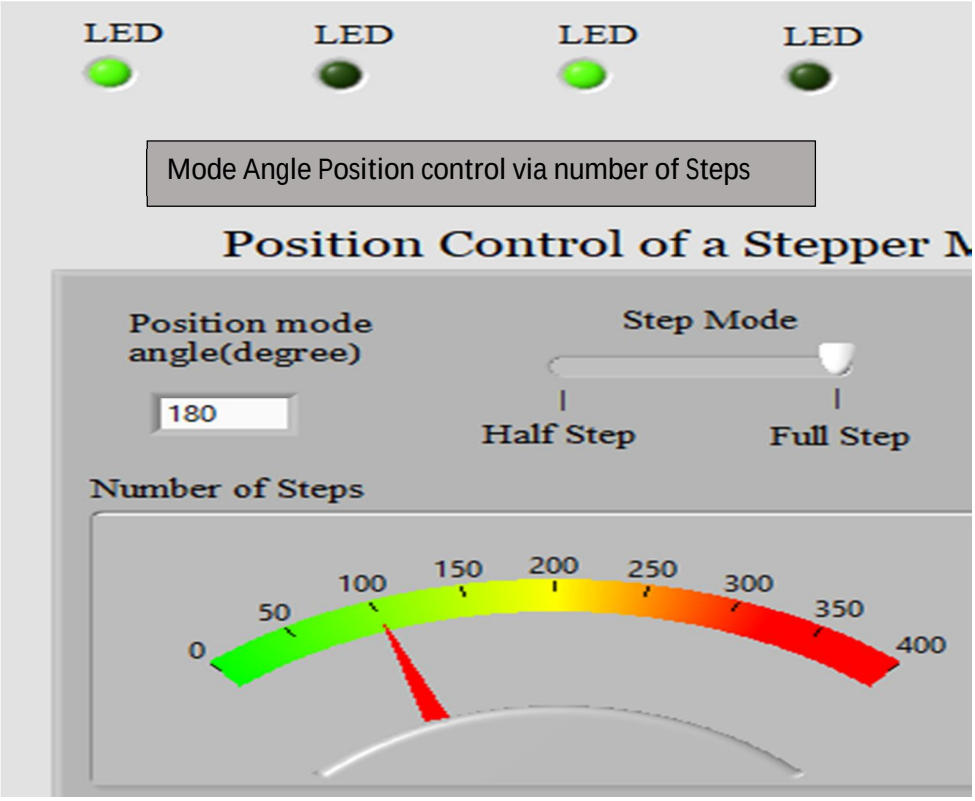

Fig .4 Frontend view of panel

IV. RESULTS

The placement control of a step motor is designed and implemented using LabVIEW. The technique is tested for various motor placements and step gradients. The motor is employed and controlled in both the directions i.e., clockwise and anti-clockwise directions. The placement manner angle is used to give the required step gradient. Half step and full step operation of step motor is accomplished. Half step mode will make an angle of 0.6 degrees per step (300 steps), considering full step makes 1.2 degrees per step (150 steps). Performance of entire system is shown in the figure. The step motor revolves with an integer number of steps with the help of ON/OFF pulse.

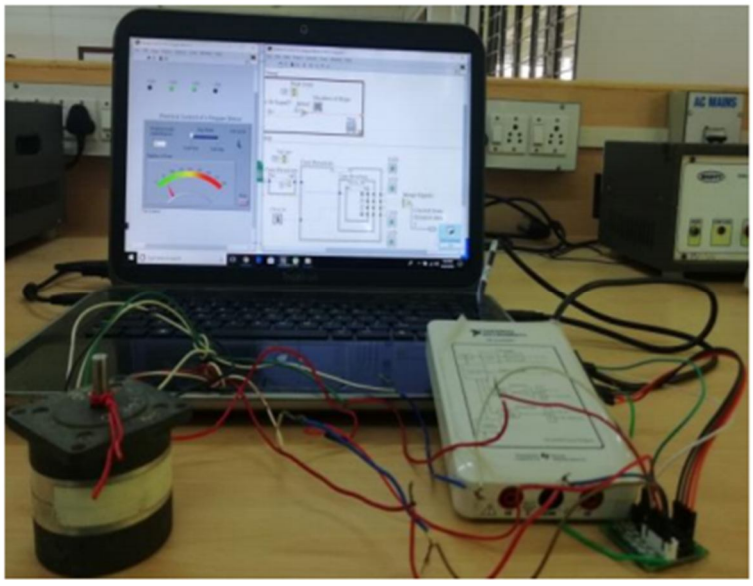

Fig .5 Total implementation

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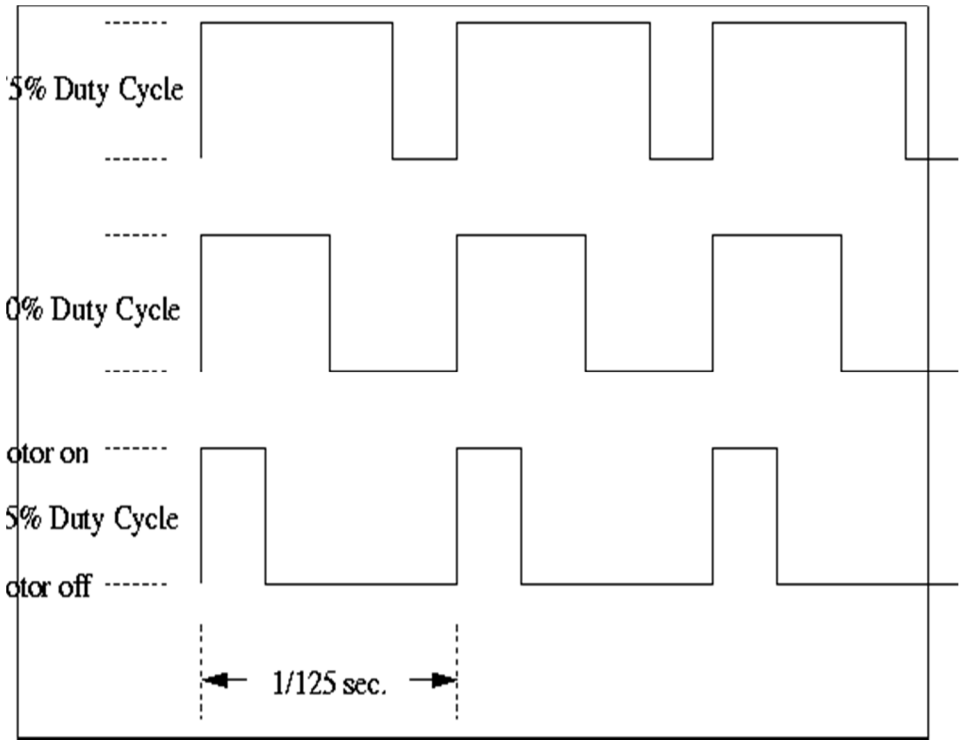

Fig .6 ON/OFF pulse of a Stepper Motor

Table I. Part of test data

Angle Mode	Full Step	Half Step	Duty cycle
0˚	0	0	0
45˚	25	50	90ms
180˚	100	200	90ms
360˚	200	400	90ms

V. CONCLUSION

LabVIEW is especially valuable for companies who want to ship complex system that need all embedded software, FPGA software, Client applications. For the same system, LabVIEW allows developing whole stack in a single high-level language cutting the total development cost and time significantly.

VI. FUTURE SCOPE

Apart from the small drawbacks of brushless dc motor the scope of the LabVIEW increasing immensely in present day to day life for instance SpaceX has used LabVIEW for monitoring Falcon rockets recently. Until there is scope for rapid prototyping or rapid automation or rapid software development, the interest towards this software in future will have a rising demand. And few other key principals are raw speed of development, compatibility with hardware and also graphical programming.

VII. ACKNOWLEDGEMENT

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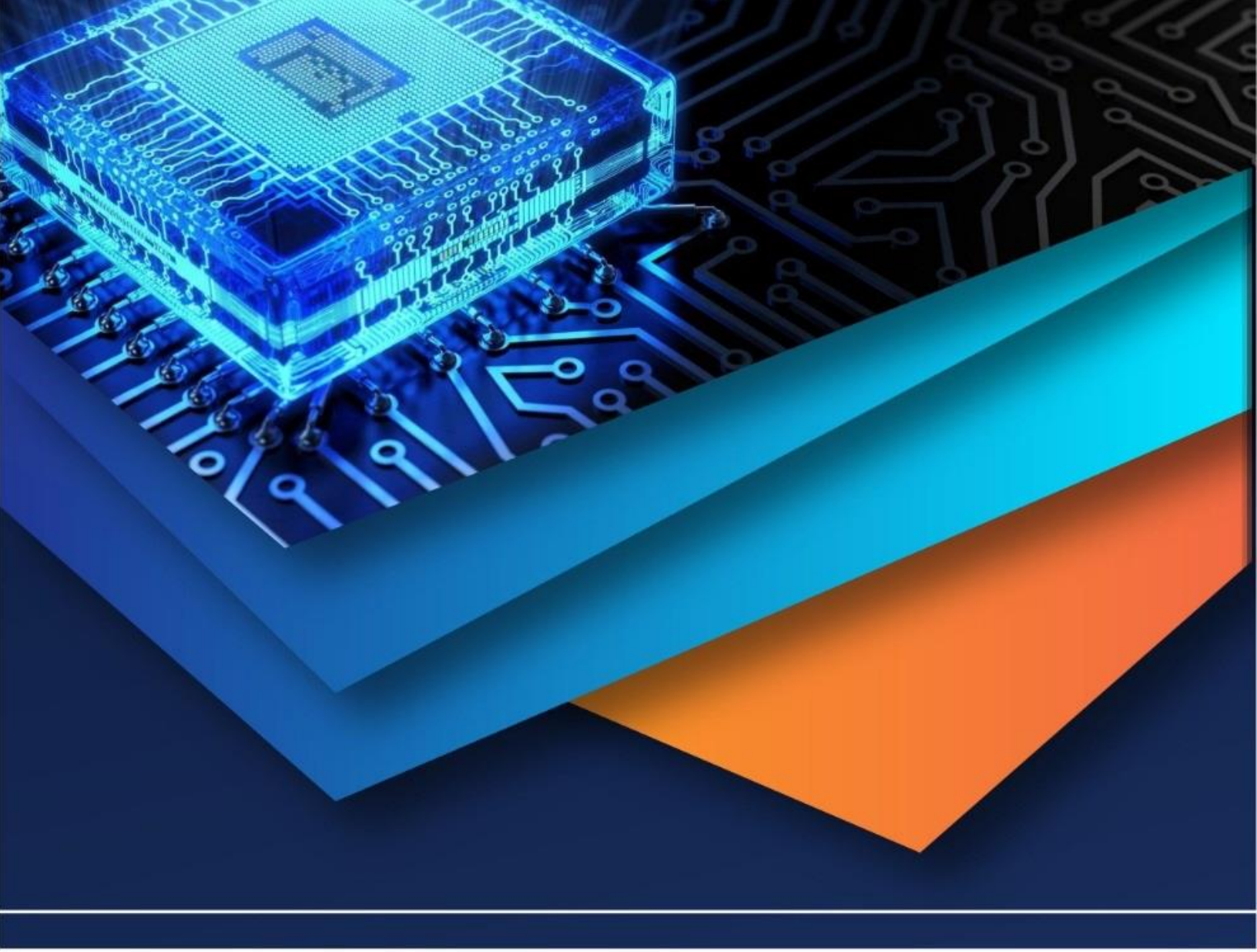

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