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Antigavity Electromagnetic Levitation With Position Control System

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ABSTRACT

As the magnetic levitation system is usnstable and non-liner in nature, but its gain more attention in many applications. Absolute position sensing and Electromagnet coil is the key aspect in designing. The stability can be achieved by the proportional integral differential control The position sensing is done by the hall sensor. The measure flux density is used to drive the coil to generate force which lifts the permanent magnet. The position of the levitating object can be controlled by using the hall effect sensor input. This can be done by giving stepping with respect to hall voltage variation, this can be achieved by using micro controller programming. Filtering, analog to digital control voltage regulation and disturbance also considered in design. This paper proposed that the position can be controlled and varied.

Key Words: Electromagnet, Hall Sensor, Frame Micro controller, PID Controller, PWM.

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I. INTRODUCTION

For past decades the technology of the magnetic levitation technology is studied experimentally and therotically.The suspension of object without any visible contact or gravity is gained attentaion since 30's hurley and Wolfle (1997). .Recently, many works have been reported in controlling a Yang et al. (2004); Choi and Park (1999); Hol et al. (2006).

Actually study of magnetic levitation system is applied in various application. As its provides the friction free force it crates the thinking for the traction, medical and the machine and in robust application. The application in traction is made it to construct the high speed trains and elevators and trolley bus. It also provides the alternative and clean enthronement by using the superconductor and plasma, But the limitation of this method is, it needs the maintained temperature for superconducting state.

This paper proposed the design of control system. In control system use of hall effect sensor for position sensing and power transistor as driver Outline of this paper.

II. OPERATIONAL DISCRIPTION

Figure shows architecture of the system, in this as soon as we push the permanent magnet towards electromagnet the hall voltage is varying and sinusoidal in nature. This signal is given to the ADC which convert t it to digital signal.This digital input is given to the PID controller. This compare the reference input to the set point generate the error signal and provide the differential and proportional input to PWM.

PWM signal is generated by PID controller is drive the MOSFET in cut off and saturation region. The duty-cycle of this square wave determines the average current that is required to levitate the object into the air.

After suspension of the permanent magnet in air, by varying the duty cycle the position of the levitating magnet can be vary.so for this SW1 and SW2 can provided as up and down position respectively.

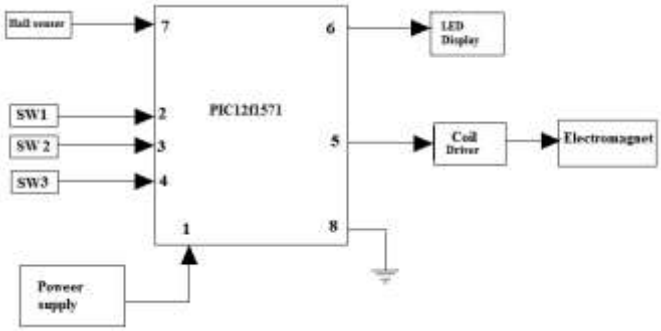

Fig 1. Architecture of the system

III. SYSTEM HARDWARE

Various component selection and there factors to be considered is discussed in this section

3.1 ELECTROMAGNET

The design of the coil is based on the trail and error we use different coils for the levitation also change the diffent AWG. From this Trail and error, we get the gauge of range 24- 26 AWG and the also gets the turns of range 800-900.for this we use reference Values.

3.2 Microcontroller

The selection of the Microcontroller consist of the factor like it consist of functions like oscillator circuit, PWM, PID, ADC and DAC circuit Quick response.

We select the PIC 12F1571 microcontrollers combine the capabilities of 16-bit PWM generation. These devices has three 16-bit PWMs with independent timers. The core independent peripherals (16-bit PWMs, Complementary Waveform Generator), Enhanced Universal Synchronous Asynchronous Receiver Transceiver (EUSART) and Analog (ADCs, Comparator and DAC) enable closed-loop feedback and communication for use in multiple market segments. Also has the watchdog timer and comparator. PID control is implement through the microcontroller programing.

3.3 HALL EFFECT SENSOR

Hall effect sensors are devices that measure the Hall voltage, and provides proportional output that determine the amount of magnetic flux incident to the sensor. The first conclusion about using a Hall effect sensor for position detection is that the object to be detected must have some magnetic properties in order for the device to register it. This was achieved in the design by attaching a permanent magnet to the object to be levitated. This not only provided the field needed to measure position, but also enhanced the performance of the electromagnet by adding some extra pull.

sensor was mounted at the bottom center of the coil.

By selecting the saturating end of the detection field to be the area closest to the coil, the lower part of the field is then free to be used. Finally adjustment of the gain on the sensor attenuated this offset to a point where the compensator could overcome it.

3.4 Power transistor

Power transistor used is MOSFET. MOSFET has the grat power handling capacity and fast switching response.we use IRF540 MOSFET IC.

3.5 VOLTAGE REGULATOR

Voltage regulator provides the fixed out put . we use MC7805 voltage regulator IC.

IV. RESULT

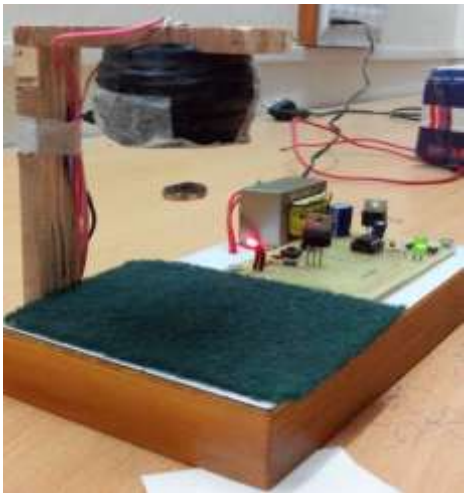

Fig 2 shows the stable levitation of permanent magnet

V. CONCLUSIONS

This system is successfully implemented and studied the various aspect of levitation. The stable levitation can be achieved by varying the current of electromagnet. and position is varied by varying the duty cycle of the PWM

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