# The Rotational Speed of the Drive Motor Control With Arduino UNO and Card

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***Abstract:*** *In this study, various commercially available brand that is used on hard disks 4-pin (3 solenoid) the speed of the brushless DC motor, using the Arduino uno Board has been checked.These motors consists of stator coils and the rotor magnets distributed in a fixed 3 different. Motor connection step 3 the ends of the coil and the coil is formed by mixing common. Special drive circuits can be controlled at speeds of 5400 rpm with these engines. In our study, we prepared application circuit and software to 3030 rpm Speed has been obtained. The control signal controlled by software through the Arduino uno card prepared. Darlington transistor BDX53 series with the outputs of the Arduino board provides the energizing of the coil by triggering the ends.Motor steps, in the form of a half step has been checked. Accordingly, the first coil is energized by time (step) motor enerjilenen were expected to arrive at the position of the coil of the rotor. Then both energized by a coil of the rotor and the second inductor is positioned between the first and second of the two. After a while, just to energize the second coil of the second coil and the rotor movement is provided. This situation applies to the third coil. Coils step-by-step sequence to turn the rotor energized by full by is provided. The speed of the motor determines the duration of the step. The other step is a step so fast how fast it is powered if the motor is turning. Initially, the duration of the step shaft 40 is second. Each step shortened the duration of the step of the coil is provided to increase the engine speed. This is analogous to the transition of the gear in the car we use in daily life. Four separate application acceleration (gear) was carried out at the level of. In first gear the engine up to a speed of 30 kilometers per second is picking up. The final gear is picking up a speed of 6 milliseconds.*
***Keywords:*** *HDD motor, stepper motor, Arduino Uno, control*

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## I. Introduction

The aim of this study Arduino Uno step motor brand that is used on various hard disks on the market micro control card and Driver Card and make a check with the adjustment of the speed. The brand for this Maxtor 40 GB capacity, 5400 RPM hard disk rotation speed with a nominal engine is used.

## II. Headings

**2.1. Engine Hard Disk**

Brushless DC motor used in the system performed, Maxtor 40GB hard drive running at 5400 rpm brand ejected from the speed of the step motor, and Figure 1 (A) is seen. This motor is composed of the coil 3, and the common ends of the coils is taken to be output as the fourth three. Again, the engine connection diagram Figure 1 (B) is seen.
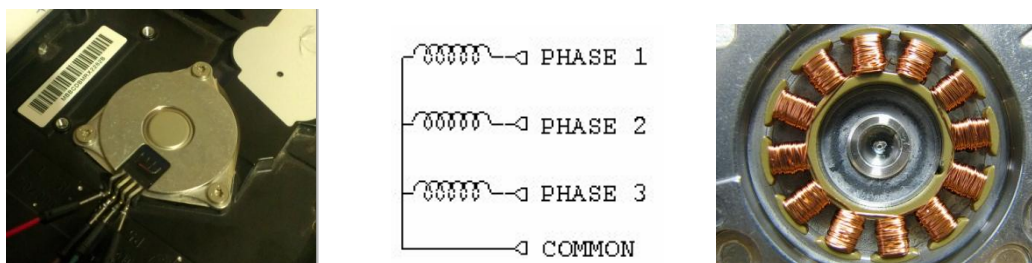


***Figure 1*** *(A) The motor image of the HDD (B) HDD motor connection (c) internal of the motor of the HDD image (Liberty,2015)*

The stator of the motor used in hard disk and the stator coil this coil is in a group of 3 spread regularly around the groups (figure 1C). Fixed in the rotor of the stepper motor is close to the magnet (Figure 2-a). Permanent magnet rotor, the coil moves in the direction of the closest group enerjilenen. When the coil is energized with groups, follows the order of the magnetic rotor coil enerjilenen. Thus, rotation of the engine is

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provided. Engine speed determines the speed of the coil groups enejilenme. Brushless DC motor drive circuit and the trigger signal of the graph of Figure 2-B and-C observed ( their jianwen, 2003).
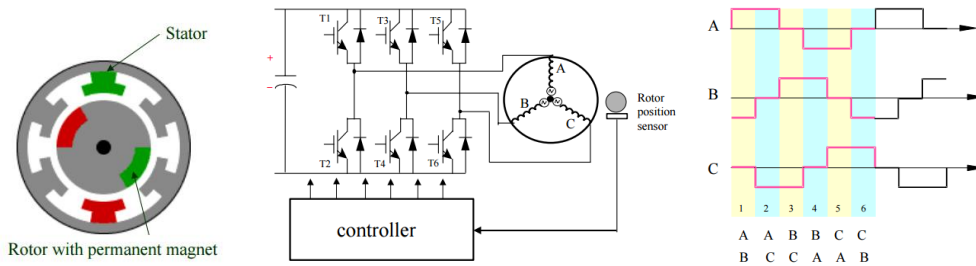


*Figure 2: (a) view of the internal structure of the brushless DC motor (B) drive circuit (c) trigger signal (Jianwen).*

## 2.2. Arduino Uno R2

Hard disk the Arduino platform was used for the production of a control signal of the engine. Arduino uno R2 the Arduino platform has been used as the card [1]. Figure 3 shows the Arduino uno card.
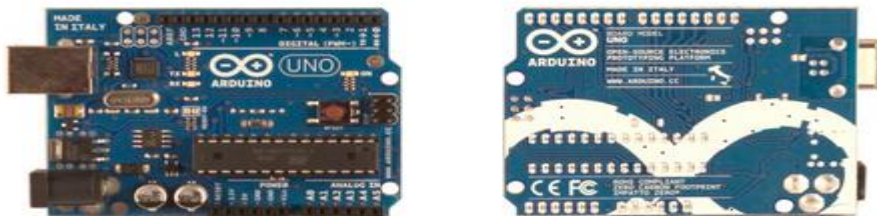


*Figure 3: Arduino Uno R2 card*

Arduino Uno microcontroller on a card, uses a atmega328 microcontroller. This controller has input-output pins 14. This can be used as PWM output pins, six of. Six analog inputs, a 16 MHz crystal oscillator, a USB connection, power supply inputs, input a reset button and ICSP connection. A mikrokontrollor-on tube equipment in which accommodates. With USB interface can be connected easily with the computer [1]Arduino; basically on microcontroller (atmel), around devices, sensors, components, ports, and a card that consists of the user controlling what does he want by communicating with them. Advantages from other platforms, cheap, easy-to-access, user support, and it is simple. This simplicity has been achieved especially thanks to the Arduino programming language. Normally, C, basic, assembly with any work you have done with the code we are writing, when you write shorter and simpler code will allow you to do with Arduino [2,3,4,5] Writing code in the programming language named processing Arduino is used. This programming language uses the syntax of C and C languages. Those that are familiar with writing code in these languages Processing they shall not be compelled [15-20]

## 2.3. BDX 53

The control signals from the Arduino board to the Arduino to control the flow of last hard disk engine must be upgraded. Darlington transistor bdx53 in this circuit is prepared for the driver. And Internal connection diagram of the transistor BDX53 shape are presented in Figure 4 [6]
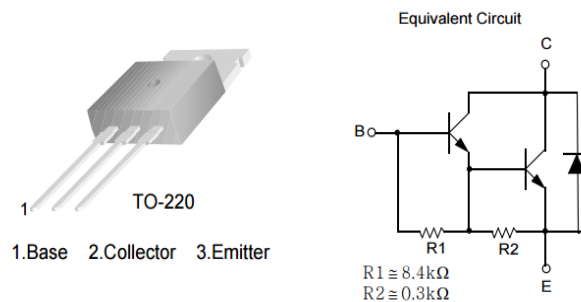


*Figure 4: BDX53 Darlington transistors and complementary circuits*

### 2.4. Optical Sensor

Hard drive is detected so that the rotational speed of the engine shown in Figure 5, The optical sensor has been used. As can be understood from the illustration of this sensor consists of two parts. The first portion of the light source of the spread of the infrared beam IR diodes. The other part is the part which senses the light photo transistor (Figure 5). A conductive portion of the conductive transistor between the two devices when it comes to light. Together optical transistor cuts off a portion of an electrode when the light has passed e outgoing IR photo transistors and the insulator came to light.
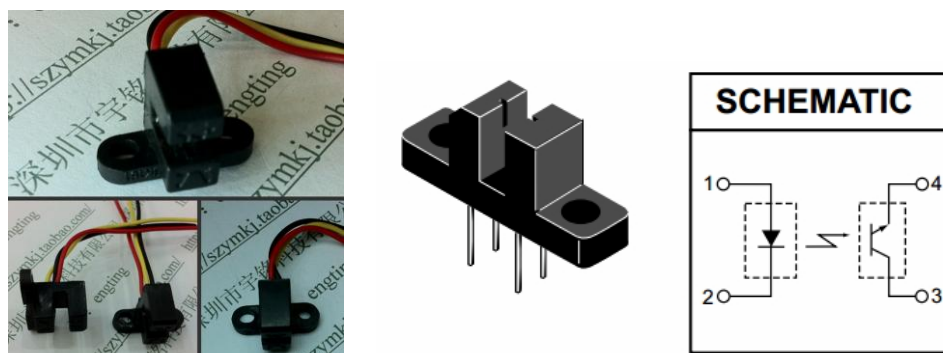


*Figure 5: view of the optical sensor and the connection diagram (PicProje, 2014)*

What photo collector collector VCC voltage is applied through a resistor to be connected continuously, the collector of transistor as the output signal can be taken. Accordingly, the photo-transistor insulator, when the signal would come from the tip because the tip of the collector emitter VCC receives the signal chassis. Light is right when the photo transistor, the transistor becomes conductive and the output signal drops to a value of the chassis. Thus, the signal and the change in engine speed can be detected [7,8,9,10]

# III.   Research Findings

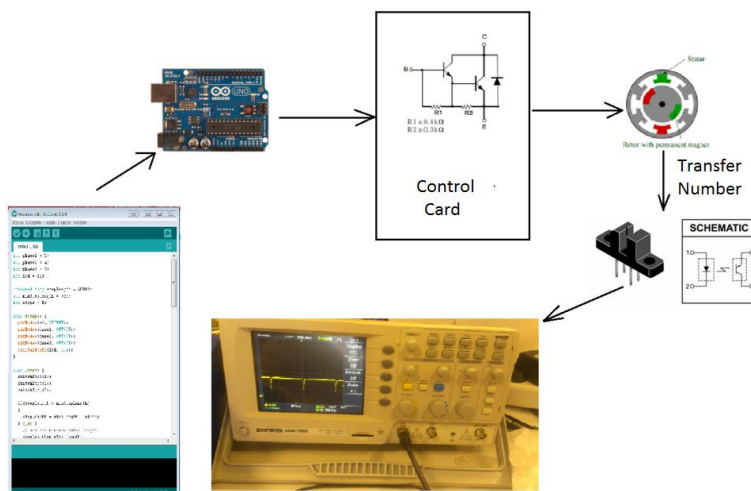The work that is performed in the block diagram in Figure 6 is seen.



*Figure 6: block diagram of the hard disk motor control with Arduino*

As can be understood from the above block diagram of the performed application; writing code Arduino control board and brushless DC motor as the speed measurement consists of three parts.

### 3.2. Control Circuit

Arduino is 40 mA maximum current value of the control signals [1].Arduino controlled with the motor coil draws a current of approximately 4 in. A drive circuit for driving the coils from the output of the Arduino board we need to. BDX53 transistor using the circuit seen in Figure 9 for this we have designed [11,12,13,14]. In this circuit the positive voltage on the tip of the motor are taken directly from the common source of supply, via the transistor control signals are directed by the ends of the chassis. Arduino input of the transistor to be conductive with a signal received from the transistor to the conduction pass through the resistance coil of the

motor and is provided with enerjilener comparing to. View the status of the output signals to the coil and which is visible in the lower left so I can watch you power LED indicators have been added. The triggering of the LEDs with the transistor and the active coil of the Group is to look burned (Figure 9).
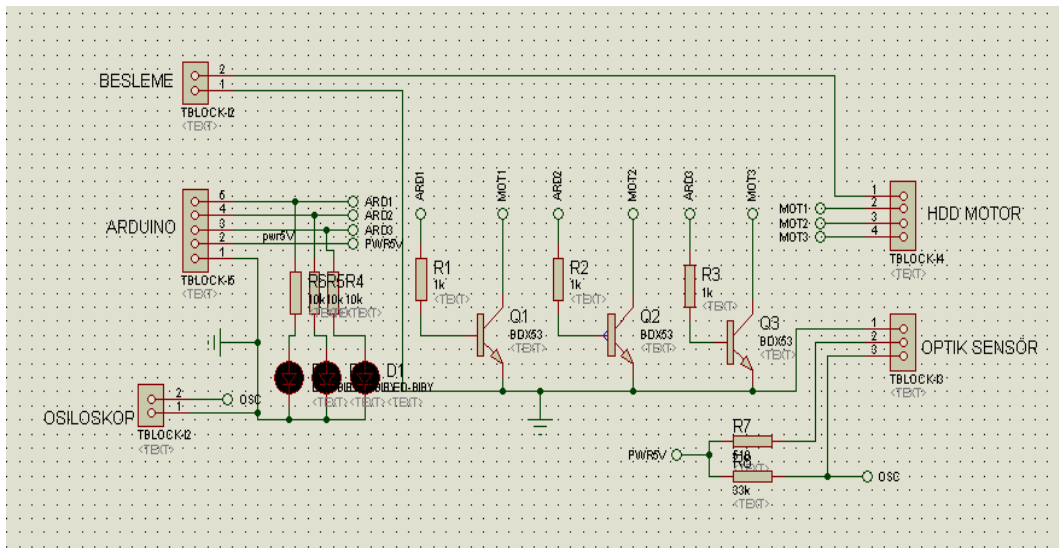


**Figure 9:** *control circuit diagram*

### 3.3. Measurement Of The Engine Speed
Hard disk magnetic plates together to measure the engine speed in a way that would is connected to the optical sensor. The three connection connectors and the optical sensor assembled state are presented in Figure11.
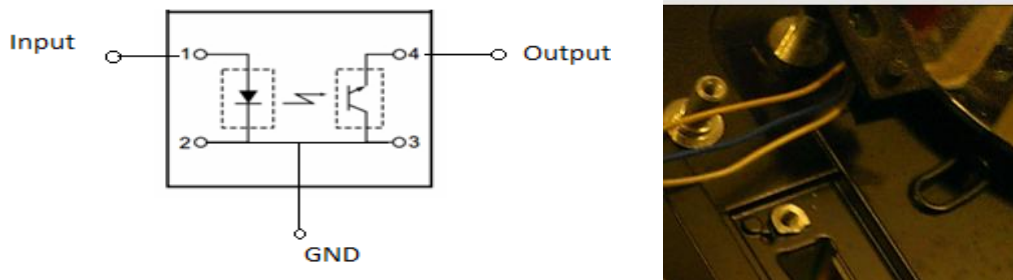


**Figure 11:** *optical sensor connection diagram installing the engine and hard disk*

What is the connection that the shape of the LED optical sensor Figure 12-A. is observed. Located in the control circuit above, resistors R7 and R8 optical sensor Laden and was used for photo transistor to be energised. The optical sensor to detect rotation of the magnetic plate so as to pass IR light from the inside of the magnetic disk has a hole in one end (Figure 12-b). For each round of the engine, this goes through the perforated area of the optical sensor. Infrared (IR) optical LED Light by passing through the hole in the elevator is undergoing the transistor to conduction, and the output zero level, the signal level decreases.
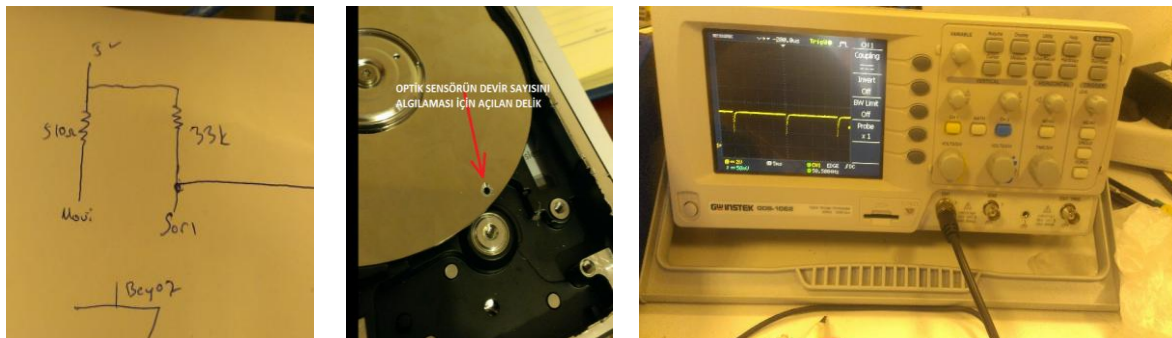


**Figure 12:** *(A) The optical sensor circuit connection (b) The number of cycles to detect a hole punched on the magnetic disk*

The output signal of the optical sensor being monitored by the oscilloscope when connecting the oscilloscope image in Figure 13 is obtained. When the picture is carefully examined, the magnetic moment of the disk between the optical sensor, the optical sensor is reflected light, because the insulating state is at the level VCC and the output voltage. When it comes to the hole on the inside of the magnetic disk sensor, photo light fall off and on the transistor the transistor is conductive. Therefore, the output voltage falls to zero volt level. This change in signal is measured with the oscilloscope monitored the number of cycles.

## IV. Conclusion

A brushless DC motor which is the motor program and the electronic circuit of the HDD to be adjusted by controlling the number of cycles of the step to enable it. December 1 is the first step with the length of 40000 39950. Gear and the motor is picking up speed in this range at intervals of 5 milliseconds (step the waiting time has been shortened). 2. gear, the step interval is 20000, with range of 39950. In this range, each step of the motor 300 msn accelerates time. 3. gear, the step interval is the range of 3000 to 20000 with MSN. In this interval, 50 milliseconds in each step of the motor, the speed is picking up.840 milliseconds and 3000 milliseconds is the range of that last gear. In this range, the motor accelerates in each step of 1 millisecond. However, when it comes to a value of 840 milliseconds, the speed of the motor remains constant. The last step in the program is the range of this value is also the smallest (minStepLength).Once we get to 840 milliseconds lower the value, the location can not get miknatislanar motor coils in such a short time. The transition step is very fast because it is a signal magnetic field from the motor miknatislanama step exactly to the other, this situation causes the rupture of the magnetic field of the motor. The number of rotations of the motor of HDD is decreasing. At high revs the engine speed can be accelerated by increasing the applied voltage to the motor. Exist in a continuous energy state at low revs to the engine coil and the engine is caused by overheating of the driver circuit. Four different speed intervals (gear) you have, the less the acceleration time, the engine stable operation without departing from increasing. Sudden acceleration in the residue konumlanam motor since the motor and breaking the synchronization of the rotor and the motor stops. For this reason, in the speed range the acceleration time is important for work efficiency to be as low as possible.

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