

# **Voice Interfacing Automatic Moving Camera**

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This Report Presented in Partial Fulfillment of the Requirements of the Degree of  
Bachelor of Science in Electronics and Telecommunication Engineering

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**DAFFODIL INTERNATIONAL UNIVERSITY**

**DHAKA, BANGLADESH**

**18 January, 2014**

## **APPROVAL**

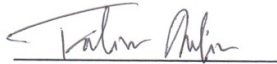
This Project titled “Voice Interfacing Automatic Moving Camera” submitted By Tanver Ahmed, Farzana Hoq Liza and Md. Ashequl Islam to the Department of Electronics and Telecommunication Engineering (ETE), Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Electronics and Telecommunication Engineering and approved as to its style and contents. The presentation has been held 18 January, 2014.

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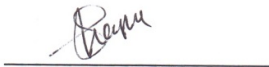
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## DECLARATION

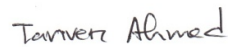
We hereby declare that, this project has been done by us under the supervision of **Dr. A.K.M. Fazlul Haque**, Associate Professor and Head, Department Of Electronics and Telecommunication Engineering, Daffodil International University, Dhaka. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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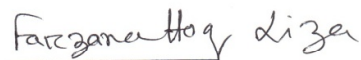
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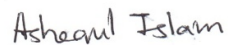
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## **ABSTRACT**

This thesis report aims to design and implement an automatic system which interfacing with motor by tracking the voice of the speaker. Here the total working procedure has been divided into two portions: Software and Hardware part. In order to the system operational, MATLAB software and ARDUINO microcontroller has been used for interfacing with the hardware parts. This proposed system first track down the speaker voice by using microphone and then move the camera towards the speaker. This algorithms have been used to detect the specific microphone and for the right angle movement of the stepper motor. This system can track down the microphone and as well as it can move the motor with camera towards the speaker. The speed and angel accuracy of motor depends on the delay time between motor rotation codes. The angel accuracy and sharpen the motor rotation has also been improved. Finally, it is found that shorten the delay may improve the speed and accuracy of motor rotation.

## TABLE OF CONTENT

	Page
Approval	I
Declaration	II
Acknowledgments	III
Abstract	IV
Table of contents	V-VI
List of Figures	VII
List of Tables	VIII
List of Graph	VIII
<b>CHAPTER 1</b>	1
Introduction	1
1.1 Backgrounds	1-2
1.2 Goal of the Research	2-3
1.3 Content of the Thesis	3
<b>CHAPTER 2</b>	4
<b>Theory</b>	4
2.1 Stepper Motor	4-5
2.2 TYPES OF STEPPING MOTORS	5
2.2.1 Unipolar Motors	6
2.2.2 Bipolar Motors	7-8
2.3 Unipolar Versus Bipolar	7
2.4 Size and Power of Stepper motor	8

2.5 Phases, Poles and Stepping Angles	9-11
2.6 STEP ANGLE	11
2.6.1 Step Angle Accuracy	11-12
2.7 Motor Driver	12-14
2.8 Speech analysis technique	14-15
2.8.1 Different type of speech recognition techniques	15
2.9. Working Procedure	16-17
2.10. How Microphone Works	17-19
<b>Chapter 3</b>	20
<b>    Software &amp; Hardware Development</b>	20
3.1 Interface	20
3.1.1 Interfacing with Hardware	20-21
3.1.2 Interfacing with Software	21
3.2 Types of work	21
3.2.1 MATLAB and ARDUINO Interfacing	22-26
3.2.2 Hardware Part	27-29
3.3 Arduino and Stepper Motor at a glance	30
3.3.1 About Arduino	30
3.3.2 Reason for using Arduino	31
3.3.3 MATLAB support package for Arduino	31
3.4 STEPPER MOTORS	32
3.4.1 Unipolar Stepper Motors	32
3.4.2 Bipolar stepper motors	33
3.4.3 Reason for using Bipolar Stepper motors	34

	35
<b>CHAPTER 4</b>	
<b>Simulation and Results</b>	35
4.1 Performance Analysis	35-44
<b>CHAPTER 5</b>	45
Conclusion	45
Appendix	46-50
References	51

**List of Figure:**

Figure-2.1: Unipolar stepper motor	7
Figure-2.2: Bipolar stepper motor	8
Figure-2.3: Positional accuracy of a stepper motor	12
Figure-2.4: Connection Diagram of L293D	13
Figure-2.5: Working Procedure	16
Figure-2.6 :Dynamic Microphone	18
Figure-2.7: Condenser Microphone	18
Figure-3.1: Arduino Configuration	22
Figure-3.2: Main program	23
Figure-3.3: Program for Microphone 1	24
Figure-3.4: Program for Microphone 2	25
Figure-3.5: Program for Microphone 3	26
Figure-3.6: Microcontroller (Arduino and Piduino)	27
Figure-3.7: Motor and Motor driver	28



Figure-3.8: Power Supply and Camera	28
Figure-3.9: Full Circuit Board with accessories	29
Figure-3.10:Unipolar stepper motor	33
Figure-4.1: Motor rotation for Anti-clockwise direction	38
Figure-4.2: Motor rotation for both clockwise and anticlockwise direction	39

**List of Table:**

Tabel-1: Motor rotation time in every step	36
Tabel-2: Motor rotation time in clockwise direction	37
Tabel-3: Motor rotation time in Anti-clockwise direction	37
Tabel-4: Comparison of clockwise and anti-clockwise rotation speed	42

**List of Graph:**

Graph-1	40
Graph-2	41
Graph-3	41
Graph-4	43

# Chapter 1

## Introduction

### 1.1 Backgrounds

The voice consists of sound made by a being. The human voice is specifically that part of human sound production. The goal of this project is to design a system that would automatically record meeting or any conversation by tracing the voice of the speakers. This system using microphone to detect voice. We divide it into two phases, Software and Hardware part. In software part, we develop a program which will trace speaker's voice by using microphone. This program develops in MATLAB software. Also we use Speech Recognition technique to develop for speech input to machine based on major advanced in statically modeling of speech. This speech recognition technique is also developing in MATLAB software. The whole system is control by voice. For this system Speech Recognition technique is an optional part. It will use only security purposes. The MATLAB coding which we develop is uses to trace only voice not an exact person voice and the Speech Recognition technique will only take the right person voice. So when a conversation or meeting is need to be securing then the system use Speech Recognition technique otherwise the program which we develop. For use with computers, analog audio must be converted into digital signals. This requires analog-to-digital conversion. For a computer to decipher the signal, it must have a digital database, or vocabulary, of words or syllables, and a speedy means of comparing this data with signals. The speech patterns are stored on the hard drive and loaded into memory when the program is run. A comparator checks these stored patterns against the output of the A/D converter. At the highest level, all speaker recognition systems contain two main modules feature extraction and feature matching. Feature extraction is the process that extracts a small

amount of data from the voice signal that can later be used to represent each speaker [1]. Feature matching involves the actual procedure to identify the unknown speaker by extracted features from his/her voice input with the ones from a set of known speakers [2]. This recognition system has two sessions. One is training session another is testing session. In the training phase, each registered speaker has to provide samples of their speech so that the system can build or train a reference model for that speaker.

In hardware part we used microcontroller, stepper motor, motor driver, USB cable, microphone, camera, power supply etc. Here we used Arduino Microcontroller, to connect it with computer by a USB cable and to rotating stepper motor we use DC power 12. Here we showed the camera rotation by voice using microphone. When software and hardware part adjust with each other, the program will try to detect voice. Among many microphones it will be detect the right microphone and the program will send a signal to Arduino microcontroller through the USB cable. Arduino microcontroller will also send a signal to the stepper motor and motor rotate with camera towards the specific microphone from where the voice comes. It is the basic of this project, each module discuss detail in later sections.

## **1.2 Goal of the Research**

The goal of this paper is making a simple electronic device which is capable of recording video session of a meeting or a conference. It eliminates the human effort, cost, and security issues (arising out of conventional method of human intervention). In accordance to our system an automatic voice tracking system and method of operations are provided that substantially eliminate or reduce disadvantages and problem associated with previously developed video conferencing systems. According to one embodiment of the present invention, an automatic voice tracking

system is provided. The system includes a camera which would be placed on a 360 degrees rotational base that could be placed at the center of the table. A microphone array includes a plurality of microphones. The microphone array is operable to receive a voice of a speaker and to provide an audio signal representing a voice. The camera controller is operable to receive the speaker position data and to determine an appropriate responsive camera movement. A microcontroller will control a motor to rotate the camera to face itself to the speaker. Also necessary control actions and needed to camera so that it automatically tracks the position of the speaker.

### **1.3 Content of the Thesis**

This thesis provides an overview of control machine using voice with the help of MATLAB software. This section is intended to give a short overview of the thesis, by describing the outline of each chapter.

- ❖ **Chapter 2.** Theory
- ❖ **Chapter 3.** Software and Hardware development
- ❖ **Chapter 4.** Simulation and results
- ❖ **Chapter 5.** Conclusions of the work and some ideas concerning further work in this field.

## **Chapter 2**

# Theory

As relevant to this thesis paper, this chapter intends to discuss about how the motors work, why motor driver is used, how the microcontroller work, how it interfacing with motor, voice recognition and relevant topics about this thesis paper.

## 2.1 Stepper Motor

A stepper motor is an electromechanical device which converts electrical pulses into discrete mechanical movements. The shaft or spindle of a stepper motor rotates in discrete step increments when electrical command pulses are applied to it in the proper sequence. The motors rotation has several direct relationships to these applied input pulses. The sequence of the applied pulses is directly related to the direction of motor shafts rotation. The speed of the motor shafts rotation is directly related to the frequency of the input pulses and the length of rotation is directly related to the number of input pulses applied [3]. Stepper motor is an electromagnetic actuator. It is an incremental drive (digital) actuator and is driven in fixed angular steps [4]. This means that a digital signal is used to drive the motor and every time it receives a digital pulse it rotates a specific number of degrees in rotation. It has some features they are given below

- ❖ Each step of rotation is the response of the motor to an input pulse (or digital command).
- ❖ Step-wise rotation of the rotor can be synchronized with pulses in a command-pulse train, assuming that no steps are missed, thereby making the motor respond faithfully to the pulse signal in an open-loop manner.

- ❖ Stepper motors have emerged as cost-effective alternatives for DC servomotors in high-speed, motion-control applications (except the high torque-speed range) with the improvements in permanent magnets and the incorporation of solid-state circuitry and logic devices in their drive systems.
- ❖ Today stepper motors can be found in computer peripherals, machine tools, medical equipment, automotive devices, and small business machines, to name a few applications.

## **2.2 Types of Stepping Motors**

There are three basic types of stepping motors, permanent magnet, variable reluctance and hybrid. This application note covers all three types. Permanent magnet motors have a magnetized rotor, while variable reluctance motors have toothed soft-iron rotors. Hybrid stepping motors combine aspects of both permanent magnet and variable reluctance technology. The stator or stationary part of the stepping motor holds multiple windings. The arrangement of these windings is the primary factor that distinguishes different types of stepping motors from an electrical point of view. From the electrical and control system perspective, variable reluctance motors are distant from the other types. Both permanent magnet and hybrid motors may be wound using either unipolar windings, bipolar windings or bifilar windings.

### 2.2.1 Unipolar Motors

Unipolar stepping motors are composed of two windings, each with a center tap. The center taps are either brought outside the motor as two separate wires (as shown in Figure-2.1) or connected to each other internally and brought outside the motor as one wire. As a result, unipolar motors have 5 or 6 wires. Regardless of the number of wires, unipolar motors are driven in the same way. The center tap wire(s) is tied to a power supply and the ends of the coils are alternately grounded. Unipolar stepping motors, like all permanent magnet and hybrid motors, operate differently from variable reluctance motors. Rather than operating by minimizing the length of the flux path between the stator poles and the rotor teeth, where the direction of current flow through the stator windings is irrelevant, these motors operate by attracting the north or south poles of the permanently magnetized rotor to the stator poles. Thus, in these motors, the direction of the current through the stator windings determines which rotor poles will be attracted to which stator poles. Current direction in unipolar motors is dependent on which half of a winding is energized. Physically, the halves of the windings are wound parallel to one another. Therefore, one winding acts as either a north or South Pole depending on which half is powered. Figure-2.1 shows the cross section of a 30 degree per step unipolar motor. Motor winding number 1 is distributed between the top and bottom stator poles, while motor winding number 2 is distributed between the left and right motor poles. The rotor is a permanent magnet with six poles, three north's and three south's, as shown in Figure-2.1 [5].

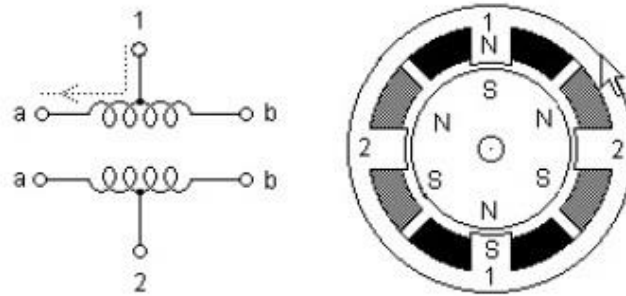


Figure-2.1: Unipolar stepper motor

### 2.2.2 Bipolar Motors

Bipolar stepping motors are composed of two windings and have four wires. Unlike unipolar motors, bipolar motors have no center taps. The advantage to not having center taps is that current runs through an entire winding at a time instead of just half of the winding. As a result, bipolar motors produce more torque than unipolar motors of the same size. The drawback of bipolar motors, compared to unipolar motors, is that more complex control circuitry is required by bipolar motors. Current flow in the winding of a bipolar motor is bidirectional. This requires changing the polarity of each end of the windings. As shown in Figure-2.2, current will flow from left to right in winding 1 when 1a is positive and 1b is negative. Current will flow in the opposite direction when the polarity on each end is swapped. A control circuit, known as an H-bridge, is used to change the polarity on the ends of one winding. Every bipolar motor has two windings, therefore, two H-bridge control circuits are needed for each motor. Figure-2.2 illustrates a 30 degree per step bipolar motor. Motor winding 1 is distributed between the top and bottom stator poles, while motor winding 2 is distributed between the left and right stator poles. The rotor is a permanent magnet with 6 poles, 3 south and 3 north arranged around its circumference. Like a unipolar motor, bipolar



motors can be single stepped with two different control sequences. Using + and - to indicate the polarity of the power applied to each motor terminal and 0 to indicate no power is applied [5].

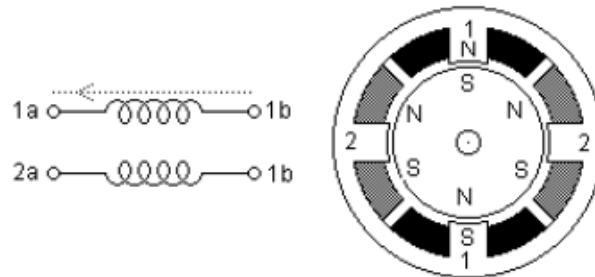


Figure-2.2: Bipolar stepper motor

### 2.3 Unipolar Versus Bipolar

Permanent magnet and hybrid stepping motors are available with unipolar, bipolar or bifilar windings; the latter can be used in either unipolar or bipolar configurations. The choice between using a unipolar or bipolar drive system rests on issues of drive simplicity and power to weight ratio. Bipolar motors have approximately 30% more torque than an equivalent unipolar motor of the same volume. The reason for this is that only one half of a winding is energized at any given time in a unipolar motor. A bipolar motor utilizes the whole of a winding when energized. The higher torque generated by a bipolar motor does not come without a price. Bipolar motors require more complex control circuitry than unipolar motors.

### 2.4 Size and Power of Stepper motor

In addition to being classified by their step angle stepper motors are also classified according to frame sizes which correspond to the diameter of the body of the motor. For instance a size 11 stepper motor has a body diameter of approximately 1.1 inches. Likewise a size 23 stepper motor

has a body diameter of 2.3 inches (58 mm), etc. The body length may however, vary from motor to motor within the same frame size classification. As a general rule the available torque output from a motor of a particular frame size will increase with increased body length. Power levels for IC-driven stepper motors typically range from below a watt for very small motors up to 10 –20 watts for larger motors. The maximum power dissipation level or thermal limits of the motor are seldom clearly stated in the motor manufacturer’s data. To determine this we must apply the relationship  $P = V \cdot I$ . For example, a size 23 step motor may be rated at 6V and 1A per phase. Therefore, with two phases energized the motor has a rated power dissipation of 12 watts. It is normal practice to rate a stepper motor at the power dissipation level where the motor case rises 65°C above the ambient in still air. Therefore, if the motor can be mounted to a heat sink it is often possible to increase the allowable power dissipation level. This is important as the motor is designed to be and should be used at its maximum power dissipation, to be efficient from a size/output power/cost point of view [3].

## **2.5 Phases, Poles and Stepping Angles**

Usually stepper motors have two phases, but three- and five-phase motors also exist. A bipolar motor with two phases has one winding/phase and a unipolar motor has one winding, with a center tap per phase. Sometimes the unipolar stepper motor is referred to as a “four phase motor”, even though it only has two phases. Motors that have two separate windings per phase also exist—these can be driven in either bipolar or unipolar mode. A pole can be defined as one of the regions in a magnetized body where the magnetic flux density is concentrated. Both the rotor and the stator of a step motor have poles. A two-phase stepper motor having 2 poles (or 1 pole pairs) for each phase on the stator, and 2 poles (one pole pair) on the rotor. In reality several more poles are added to

both the rotor and stator structure in order to increase the number of steps per revolution of the motor, or in other words to provide a smaller basic (full step) stepping angle. The permanent magnet stepper motor contains an equal number of rotor and stator pole pairs. Typically the PM motor has 12 pole pairs. The stator has 12 pole pairs per phase. The hybrid type stepper motor has a rotor with teeth. The rotor is split into two parts, separated by a permanent magnet—making half of the teeth south poles and half north poles. The number of pole pairs is equal to the number of teeth on one of the rotor halves. The stator of a hybrid motor also has teeth to build up a higher number of equivalent poles (smaller pole pitch, number of equivalent poles =  $360/\text{teeth pitch}$ ) compared to the main poles, on which the winding coils are wound. Usually 4 main poles are used for 3.6 hybrids and 8 for 1.8- and 0.9-degree types. It is the relationship between the number of rotor poles and the equivalent stator poles, and the number the number of phases that determines the full-step angle of a stepper motor. Algorithms are given below

$$\text{Step angle} = 360 / (N_{Ph} \cdot Ph) = 360 / N$$

Here,

$N_{Ph}$  = Number of equivalent poles per

Phase = number of rotor poles

$Ph$  = Number of phase

$N$  = Total number of poles for all phases together

If the rotor and stator tooth pitch is unequal, a more-complicated relationship exists.

## 2.6 Step Angle

The step angle, the number of degrees a rotor will turn per step, is calculated as follows:

$$\text{Step angle} = 360/S$$

$$S = m N_r$$

Here,  $M$  = number of phases

$N_r$  = number of rotor teeth

For this motor:

$$M = 4$$

$$N_r = 5$$

$$\text{Step angle} = 360/20$$

$$= 18 \text{ degree per step}$$

### 2.6.1 Step Angle Accuracy

One reason why the stepper motor has achieved such popularity as a positioning device is its accuracy and repeatability. Typically stepper motors will have a step angle accuracy of 3 – 5% of one step. This error is also noncumulative from step to step. The accuracy of the stepper motor is mainly a function of the mechanical precision of its parts and assembly. Figure-2.3 shows a typical plot of the positional accuracy of a stepper motor.

#### ❖ Step Position Error

The maximum positive or negative position error caused when the motor has rotated one step from the previous holding position.

$$\text{Step position error} = \text{measured step angle} - \text{theoretical angle}$$

#### ❖ Positional Error

The motor is stepped N times from an initial position ( $N = 360^\circ/\text{step angle}$ ) and the angle from the initial position

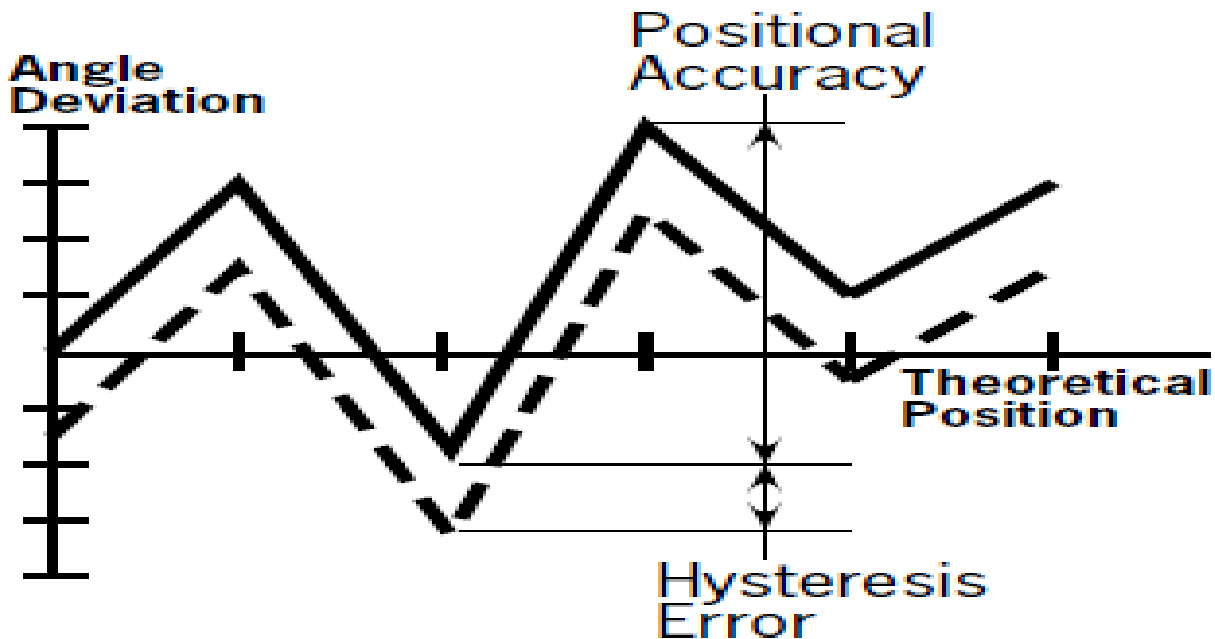


Figure-2.3: Positional accuracy of a stepper motor

## 2.7 Motor Driver

The L293 is an integrated circuit motor driver that can be used for simultaneous, bidirectional control of two small motors. The L293 is limited to 600 mA, but in reality can only handle much small currents unless the system has done some serious heat sinking to keep the case temperature down. The L293 comes in a standard 16-pin, dual-in line integrated circuit package [6]. Figure-2.4: Connection Diagram of L293D The L293 and L293D are quadruple high-current half-H drivers. The L293 is designed to provide bidirectional drive currents of up to 1 A at voltages

from 4.5 V to 36 V. The L293D is designed to provide bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V. Both devices are designed to drive inductive loads such as relays, solenoids, dc and bipolar stepping motors, as well as other high-current/high-voltage

## DIL-16 (TOP VIEW) N Package, SP Package

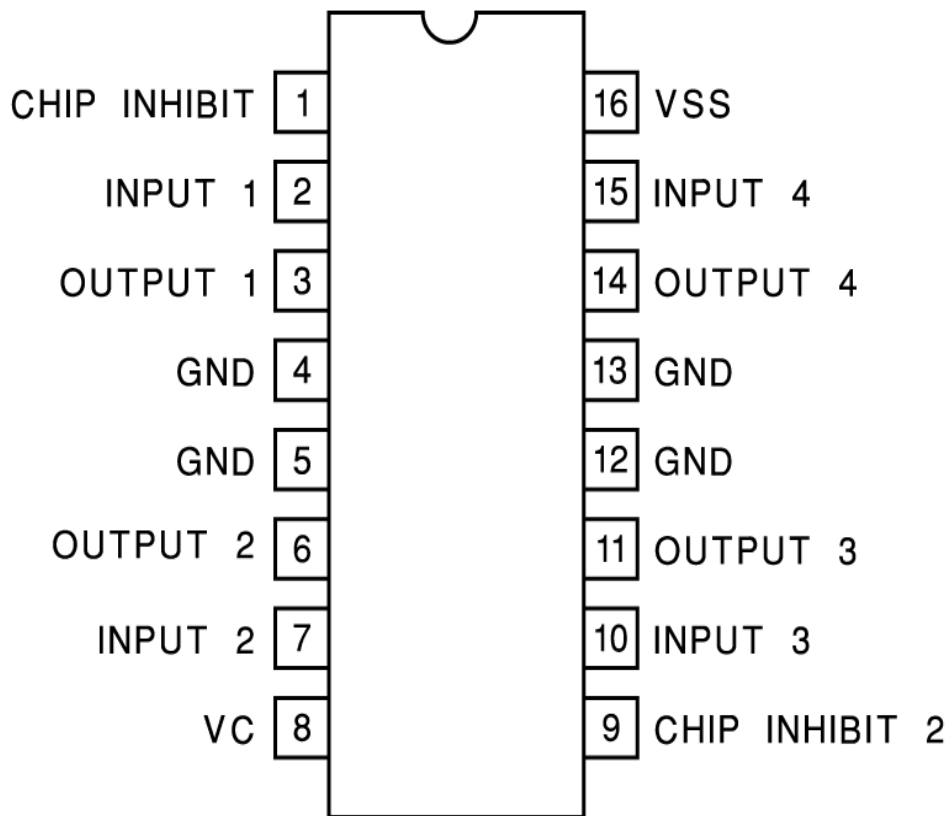


Figure-2.4: Connection Diagram of L293D

in positive-supply applications. All inputs are TTL compatible. Each output is a complete to tempole drive circuit, with a Darlington transistor sink and a pseudo- Darlington source. Drivers are enabled in pairs, with drivers 1 and 2 enabled by 1,2EN and drivers 3 and 4 enabled by 3,4EN.

When an enable input is high, the associated drivers are enabled, and their outputs are active and in phase with their inputs. When the enable input is low, those drivers are disabled, and their outputs are off and in the high-impedance state. With the proper data inputs, each pair of drivers forms a full-H (or bridge) reversible drive suitable for solenoid or motor applications [7].

It has some features given below

- ❖ Wide Supply-Voltage Range: 4.5 V to 36 V
- ❖ Separate Input-Logic Supply
- ❖ Internal ESD Protection
- ❖ Thermal Shutdown
- ❖ High-Noise-Immunity Inputs
- ❖ Functionally Similar to SGS L293 and SGS L293D
- ❖ Output Current 1 A Per Channel (600 mA for L293D)
- ❖ Peak Output Current 2 A Per Channel (1.2 A for L293D)
- ❖ Output Clamp Diodes for Inductive Transient Suppression (L293D)

## **2.8 Speech analysis technique**

Speech data contain different type of information that shows a speaker identity. This includes speaker specific information due to vocal tract, excitation source and behavior feature. Information about the behavior feature also embedded in signal and that can be used for speaker recognition the speech analysis stage deals with stage with suitable frame size for segmenting speech signal for further analysis and extracting [8].

### **2.8.1 Different type of speech recognition techniques**

Research into speech recognition began by reviewing the literature and finding techniques that had previously been used for speech/speaker recognition. It was found that six techniques are commonly used for speech/speaker recognition or have been used for this domain in the past.

These were:

- ◆ Dynamic Time Warping (DTW)
- ◆ Hidden Markov Models (HMM)
- ◆ Vector Quantization (VQ)
- ◆ Ergodic-HMM's
- ◆ Artificial Neural Networks (ANN)
- ◆ Long-Term Statistics



## 2.9 Working Procedure

This is the flow chart of this project. It describes below

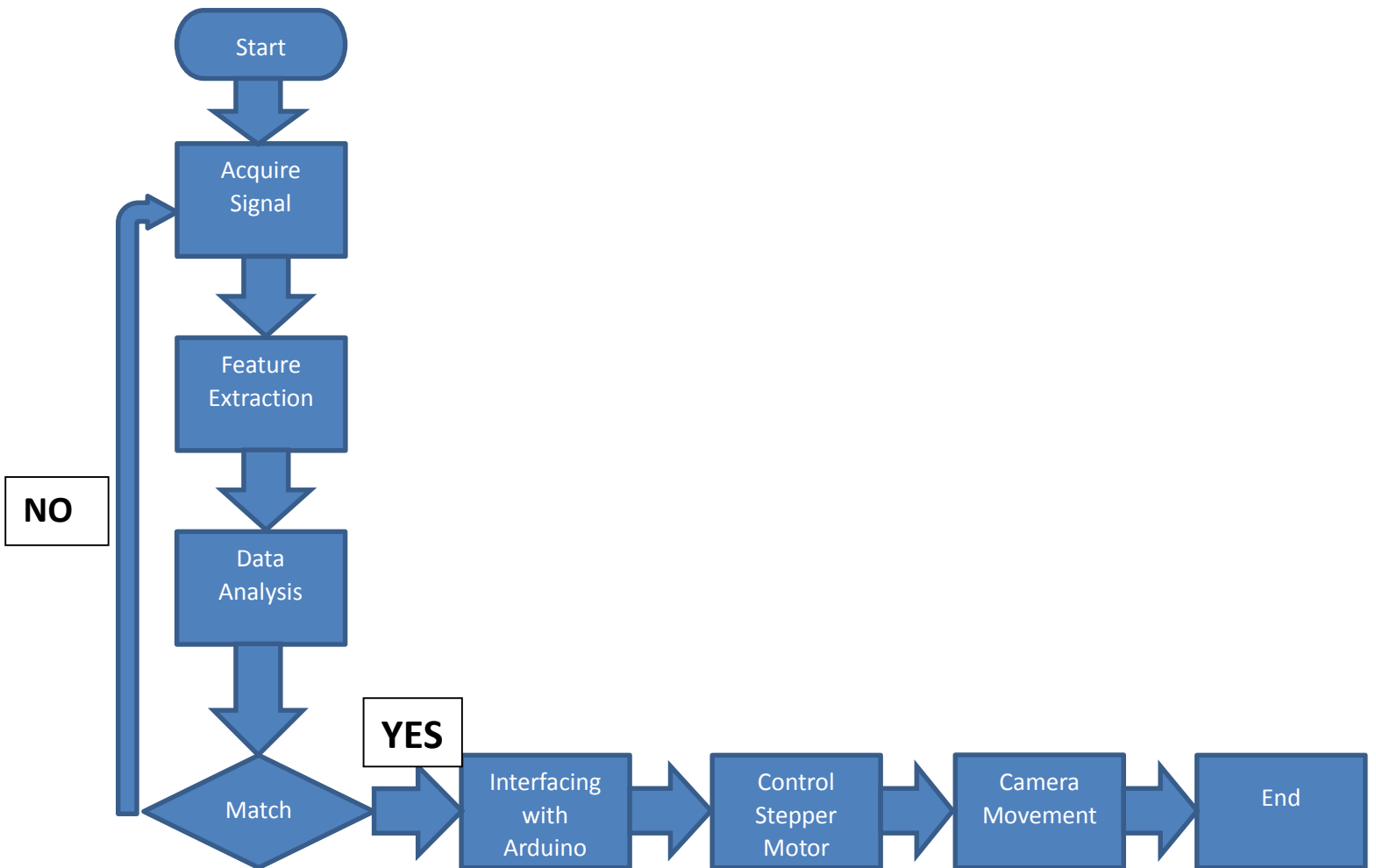


Figure-2.5: Working Procedure

The working procedure is given below:

- ❖ At first the program is start running
- ❖ This signal is acquire signal.
- ❖ Then this speech is feature extraction in the feature extraction part.
- ❖ Signal is analysis by the program.
- ❖ Then program tries to detect the specific microphone.
- ❖ If it does not match it try to acquire signal again.
- ❖ If match then it interfacing with Arduino.
- ❖ Arduino then interfacing with stepper motor and control the motor.
- ❖ Controlling motor also control the camera so camera move towards the speaker.

## **2.10 How Microphone Works**

A microphone is an example of a transducer, a device that changes information from one form to another. Sound information exists as patterns of air pressure; the microphone changes this information into patterns of electric current. The recording engineer is interested in the accuracy of this transformation, a concept he thinks of as fidelity. A variety of mechanical techniques can be used in building microphones. The two most commonly encountered in recording studios are the magneto-dynamic and the variable condenser designs.

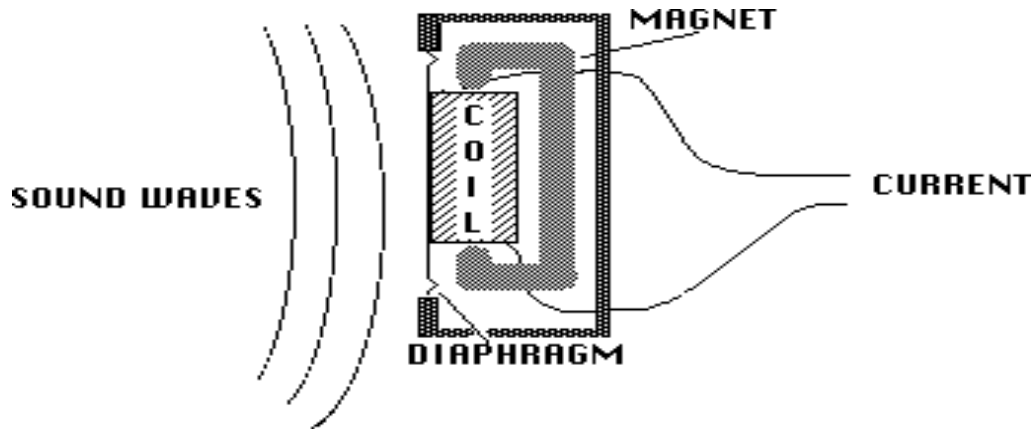


Figure-2.6: Dynamic Microphone

In the magneto-dynamic, commonly called dynamic, microphone, sound waves cause movement of a thin metallic diaphragm and an attached coil of wire. A magnet produces a magnetic field which surrounds the coil, and motion of the coil within this field causes current to flow. The principles are the same as those that produce electricity at the utility company, realized in a pocket-sized scale. It is important to remember that current is produced by the motion of the diaphragm, and that the amount of current is determined by the speed of that motion. This kind of microphone is known as velocity sensitive.

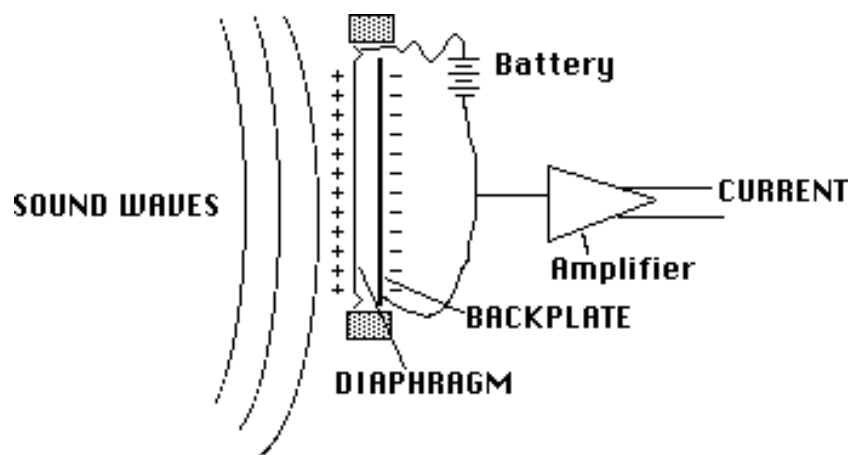


Figure-2.7: Condenser Microphone

In a condenser microphone, the diaphragm is mounted close to, but not touching, a rigid back plate (The plate may or may not have holes in it). A battery is connected to both pieces of metal, which produces an electrical potential, or charge, between them. The amount of charge is determined by the voltage of the battery, the area of the diaphragm and back plate, and the distance between the two. This distance changes as the diaphragm moves in response to sound. When the distance changes, current flows in the wire as the battery maintains the correct charge. The amount of current is essentially proportional to the displacement of the diaphragm, and is so small that it must be electrically amplified before it leaves the microphone.

A common variant of this design uses a material with a permanently imprinted charge for the diaphragm. Such a material is called an electret and is usually a kind of plastic. Plastic is a pretty good material for making diaphragms since it can be dependably produced to fairly exact specifications.(Some popular dynamic microphones use plastic diaphragms). The major disadvantage of electrets is that they lose their charge after a few years and cease to work.

# Chapter 3

## Software & Hardware Development

In this chapter we will discuss about the program code which we develop in MATLAB software. Also discuss about the hardware component. How we interfacing hardware and software based on the Arduino Microcontroller, how we can control stepper motor with camera by tracing the voice signal and everything else in details discuss in this chapter.

### 3.1 Interface

An interface is the point of interaction with software, or computer hardware, or with peripheral devices. A boundary across which two independent systems meet and act on or communicate with each other. In computer technology, there are several types of interfaces.

**Software interface** - the languages and codes that the applications use to communicate with each other and with the hardware.

**Hardware interface** - the wires, plugs and sockets that hardware devices use to communicate with each other.

#### 3.1.1 Interfacing with Hardware

Hardware interfaces exist in computing systems between many of the components such as the various buses, storage devices, other I/O devices, etc. A hardware interface is described by the mechanical, electrical and logical signals at the interface and the protocol for sequencing them (sometimes called signaling). A standard interface, such as SCSI, decouples the design and

introduction of computing hardware, such as I/O devices, from the design and introduction of other components of a computing system. Hardware interfaces can be parallel where performance is important or serial where distance is important.

### **3.1.2 Interfacing with Software**

A piece of software provides access to computer resources (such as memory, CPU, storage, etc.) by its underlying computer system; the availability of these resources to other software can have major ramifications—sometimes disastrous ones—for its functionality and stability. A key principle of design is to prohibit access to all resources by default, allowing access only through well-defined entry points, i.e. interfaces. The types of access that interfaces provide between software components can include: constants, data types, types of procedures, exception specifications and method signatures. In some instances, it may be useful to define public variables as part of the interface. It often also specifies the functionality of those procedures and methods, either by comments or by formal logical assertions and preconditions.

## **3.2 Types of work**

This system based on two type of development

- ❖ Software development
- ❖ Hardware development

### 3.2.1 MATLAB and ARDUINO Interfacing

Arduino and MATLAB interfaces with the following process which is given below

At first we use computer to interface with the Arduino by USB serial port. Computer interfacing with Arduino through COM Port 7.

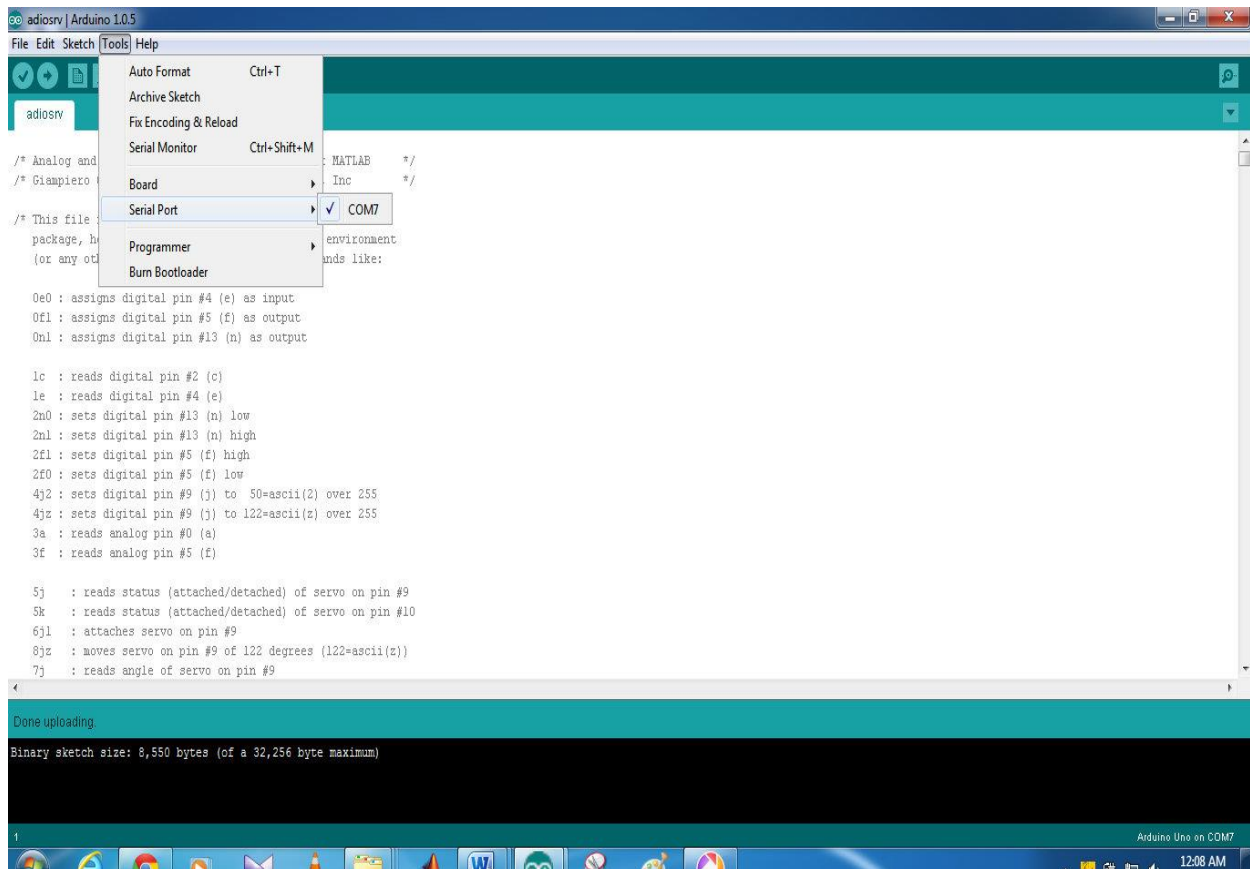


Figure-3.1: Arduino Configuration

Figure-3.1 shows an established connection between computer and Arduino through COM Port 7

Below In the given figure which is Figure-3.2 shows the main program which can control the entire system.

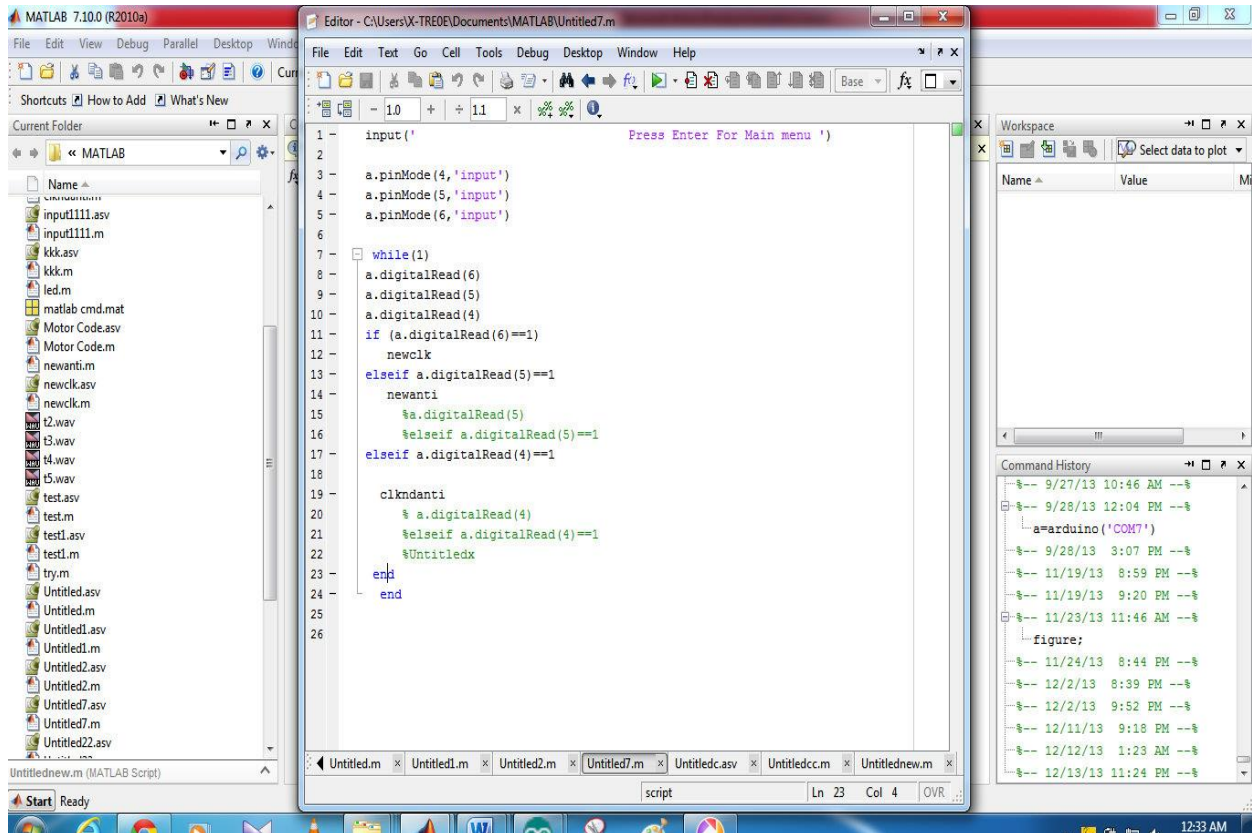


Figure-3.2: Main program

Here we have only one option which is a security system or the lock system for the program, which is

- ❖ Press Enter For Main Menu

When the Enter button is pressed the program starts running silently in the background. Then it always tries to find the input among the selected input. Until finding the input this program is running.



When speaker tries to talk through microphone, speaker press the microphone button first to Switch ON the microphone. Then program detect the specific microphone among them and then run another program for each of the microphones.

Here we use three microphones which is count as

- ❖ Input 4
- ❖ Input 5
- ❖ Input 6

For first microphone which is count as input 4 the below code is running

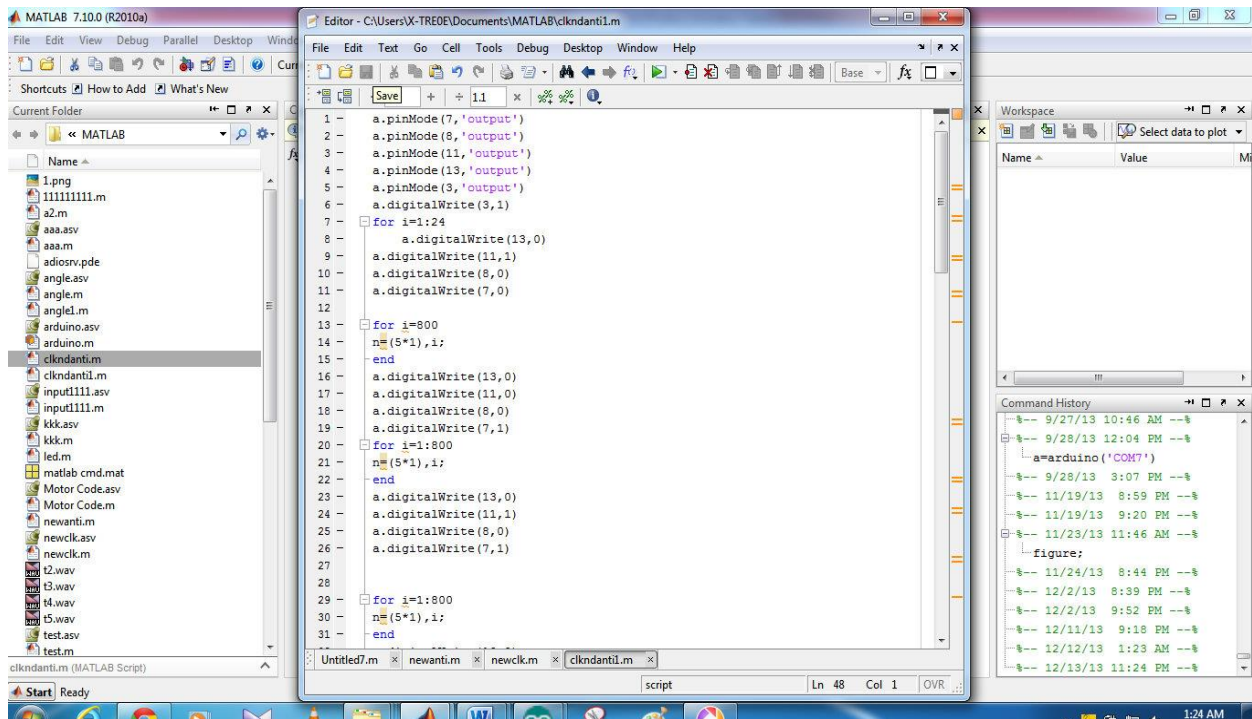
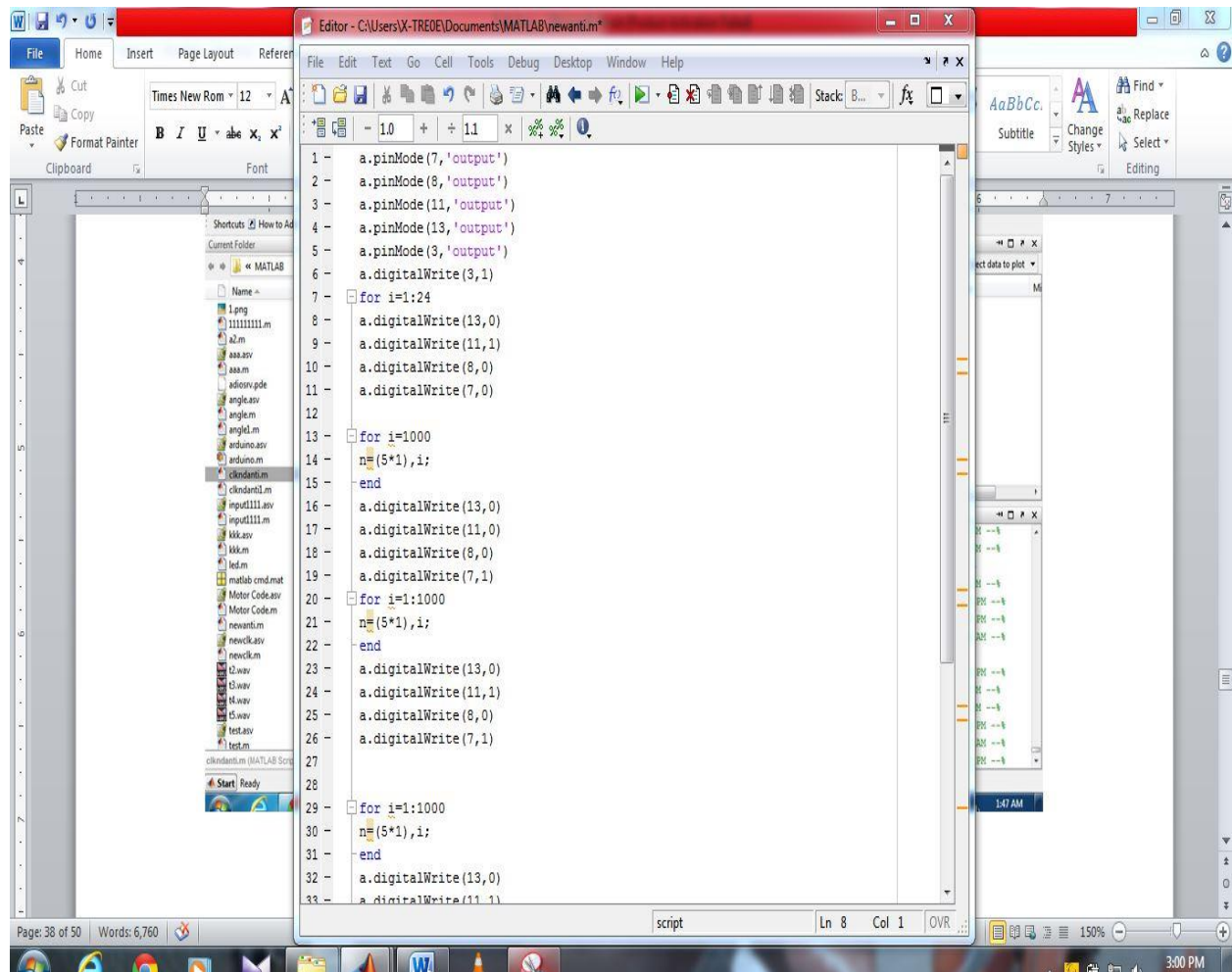


Figure-3.3: Program for Microphone 1

This code turn the motor where camera is attach towards the microphone 1 and the video is capture.

For second microphone which count as input 5 another code running which is given below



```
1 - a.pinMode(7, 'output')
2 - a.pinMode(8, 'output')
3 - a.pinMode(11, 'output')
4 - a.pinMode(13, 'output')
5 - a.pinMode(3, 'output')
6 - a.digitalWrite(3,1)
7 - for i=1:24
8 -     a.digitalWrite(13,0)
9 -     a.digitalWrite(11,1)
10 -    a.digitalWrite(8,0)
11 -    a.digitalWrite(7,0)
12 -
13 - for i=1000
14 -     n=(5*1),i;
15 - end
16 - a.digitalWrite(13,0)
17 - a.digitalWrite(11,0)
18 - a.digitalWrite(8,0)
19 - a.digitalWrite(7,1)
20 - for i=1:1000
21 -     n=(5*1),i;
22 - end
23 - a.digitalWrite(13,0)
24 - a.digitalWrite(11,1)
25 - a.digitalWrite(8,0)
26 - a.digitalWrite(7,1)
27 -
28 -
29 - for i=1:1000
30 -     n=(5*1),i;
31 - end
32 - a.digitalWrite(13,0)
33 - a.digitalWrite(11,1)
```

Figure-3.4: Program for Microphone 2

When this code is running that mean speaker from microphone 2 is talking so camera turn towards microphone 2

For third microphone when switch is on then this given code is running

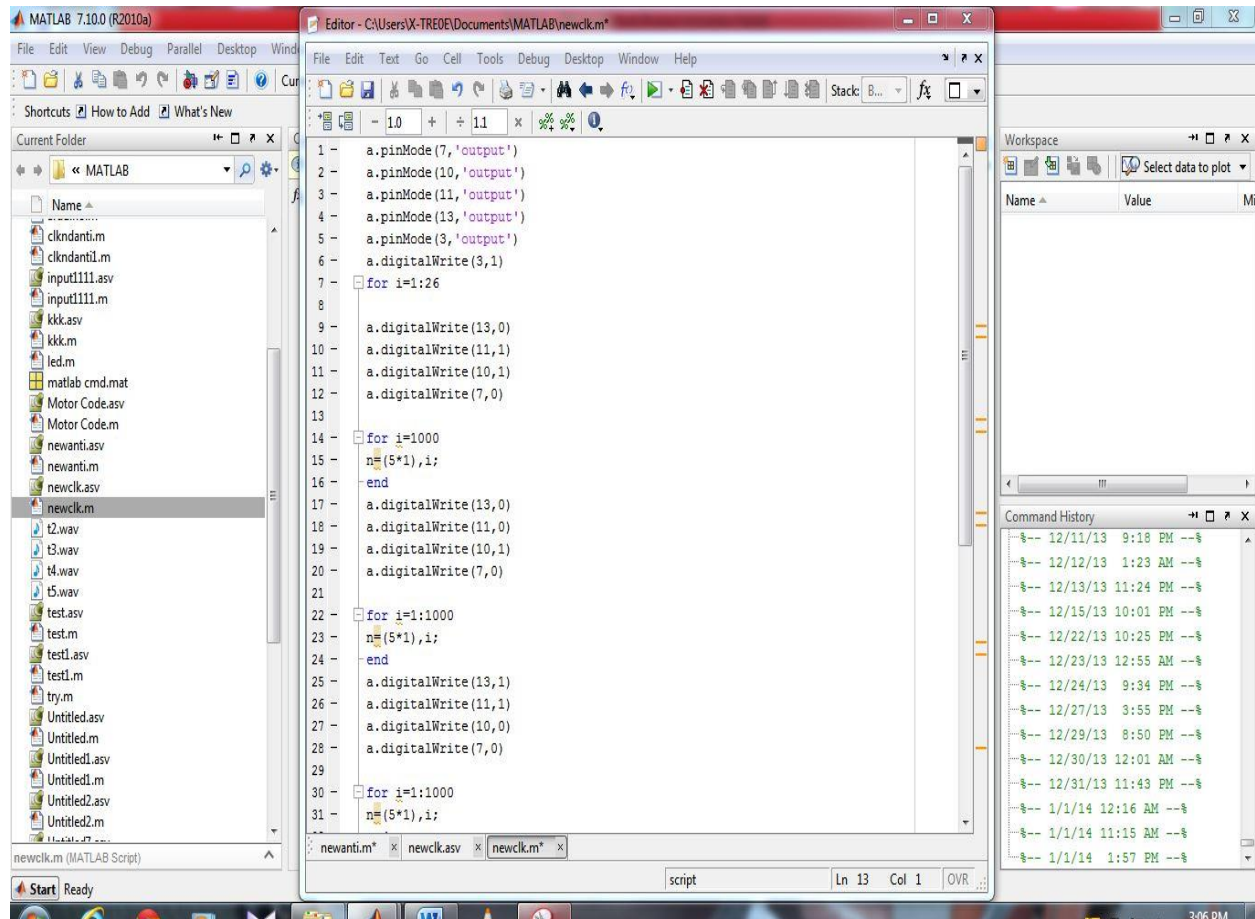


Figure-3.5: Program for Microphone 3

This code is running when microphone 3 is switch ON so then camera move its focus towards the microphone 3

### 3.2.2 Hardware Part

Here in hardware part we use used

- ❖ Arduino microcontroller Board
- ❖ Stepper motor
- ❖ Motor driver
- ❖ USB cable
- ❖ Microphone
- ❖ Camera
- ❖ Power supply

This instrument is given below

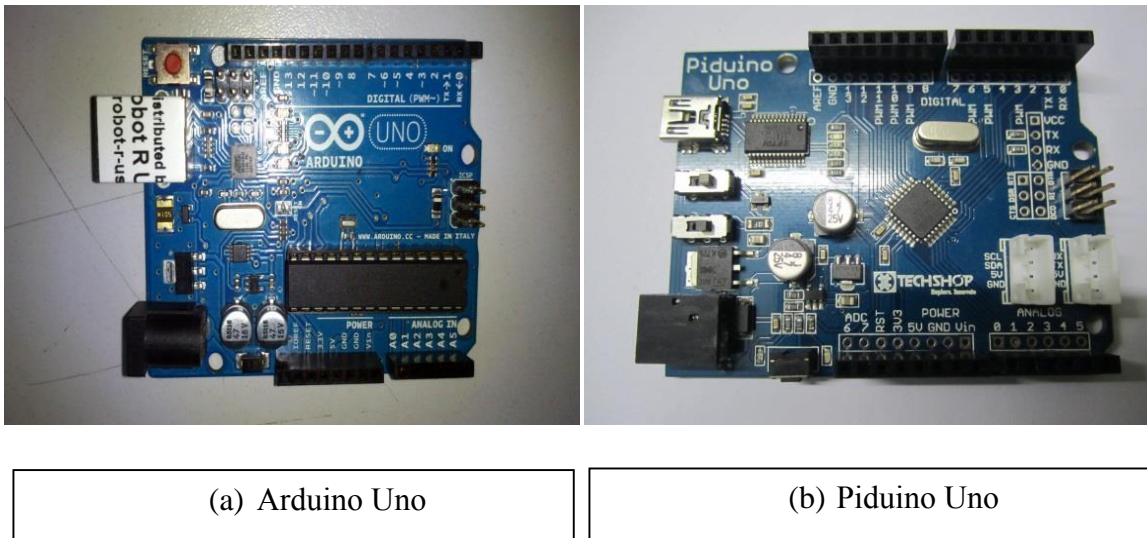
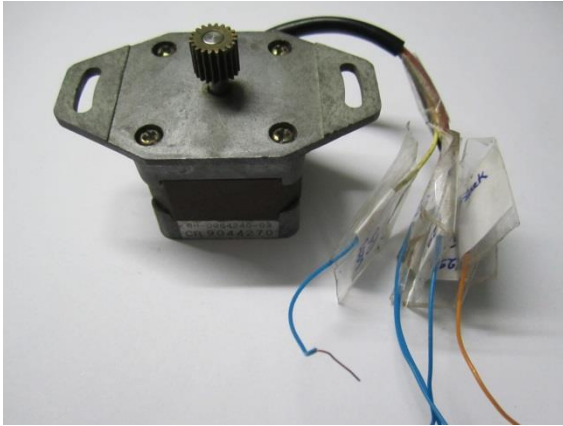
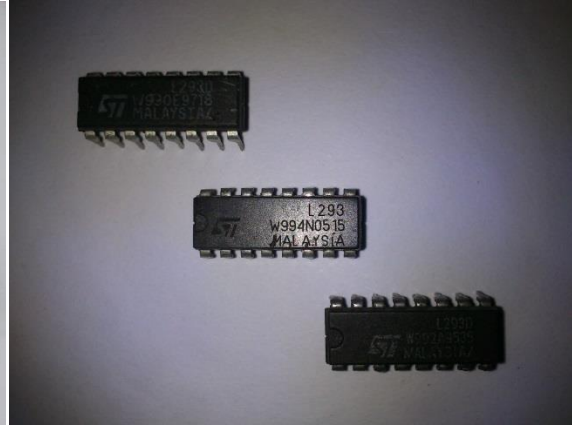


Figure-3.6: Microcontroller (Arduino and Piduino)



Stepper Motor



Motor Driver (L293D/L293)

Figure-3.7: Motor and Motor driver

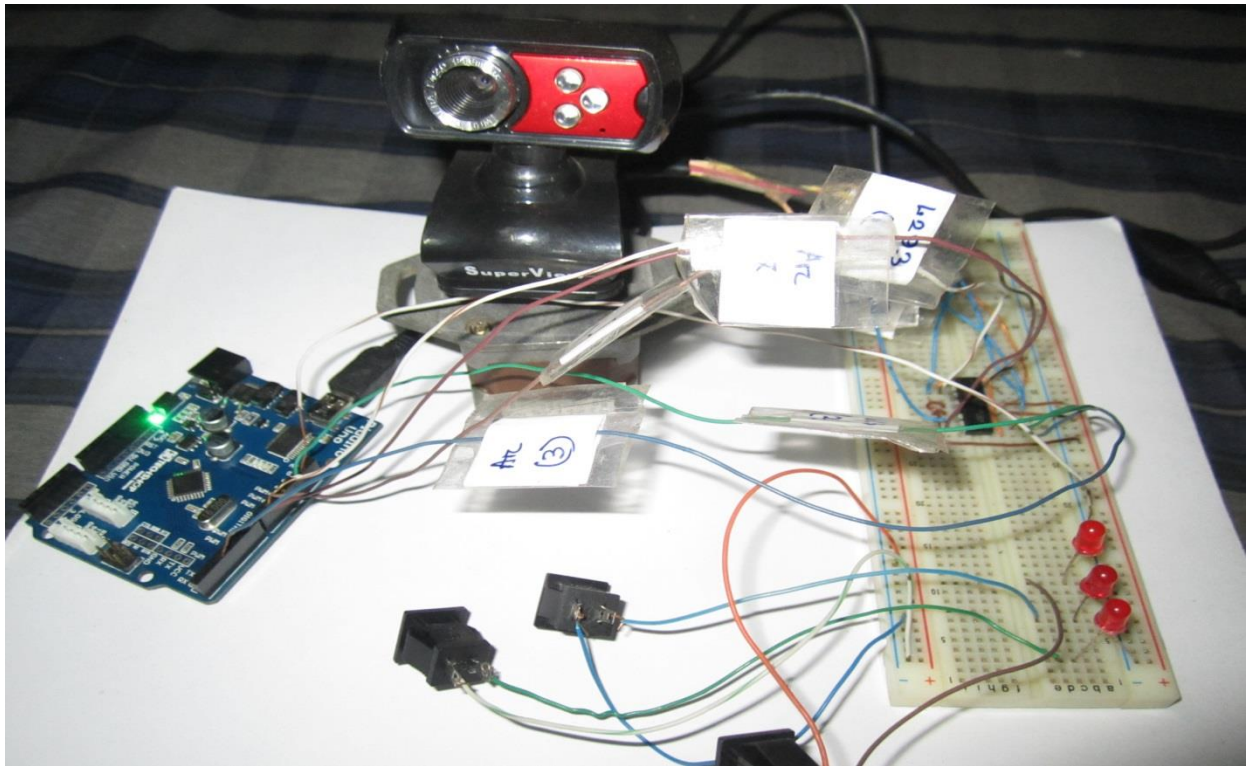


Power Supply



Camera

Figure-3.8: Power Supply and Camera



Total Circuit

Figure-3.9: Full Circuit Board with accessories

- 1) Here we use two types of microcontroller board(Figure 3.6)
  - ❖ Arduino Uno
  - ❖ Piduino Uno
- 2) We use Stepper motor which is operated in 12 volt and use L293 as a motor driver (Figure 3.7).
- 3) Also use Power supply which provide necessary power and a Camera which is attach with the motor(Figure 3.8).
- 4) Figure 3.9 shows the full circuit board with microcontroller, microphone and the camera which is attach to the motor.

### **3.3 Arduino and Stepper Motor at a glance**

Arduino microcontroller board plays the most important role in this project. This is use as an interface device between hardware and software part. So this chapter describe about the Arduino microcontroller and its working, Stepper motor working how it interface with motor and why we use Arduino Microcontroller and Stepper motor.

#### **3.3.1 About Arduino**

Arduino is a single-board microcontroller to make the use of electronics in multidisciplinary projects more accessible. The hardware consists of an open-source hardware board designed around an 8-bit Atmel AVR microcontroller, or a 32-bit Atmel ARM. The software consists of a standard programming language compiler and a boot loader that executes on the microcontroller. The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

### 3.3.2 Reason for using Arduino

Arduino is open source hardware and software based electronics. It not only simplifies our work with motor also it has many advantages. That's why we use it in this project.

- ❖ **Simple and easy:** Easy to use and free IDE, available in all popular pc operating system.
- ❖ **Easy code:** Access to many Arduino supplied C/C++ libraries and functions as well as a world of a third party contributed C/C++ libraries and functions.
- ❖ **An open source design:** For being open source many advanced programmer develop the software and everybody can use it.
- ❖ **An easy USB interface:** The chip on the board plugs straight into USB port and registers on computer as a virtual serial port. The benefit of this setup is that serial communication is an extremely easy (and time-tested) protocol, and USB makes connecting it to modern computers really convenient.

### 3.3.3 MATLAB support package for Arduino

Matlab support package for Arduino allows you to communicate with an Arduino uno over a serial port. It consists of a Matlab api on the host computer and a server program that runs on the Arduino. Together, they allow you to access Arduino analog I/O, digital I/O, and motor shield from the Matlab command line.



## **3.4 Stepper Motors**

A stepper motor is a motor controlled by a series of electromagnetic coils. The center shaft has a series of magnets mounted on it, and the coils surrounding the shaft are alternately given current or not, creating magnetic fields which repulse or attract the magnets on the shaft, causing the motor to rotate. This design allows for very precise control of the motor: by proper pulsing, it can be turned in very accurate steps of set degree increments (for example, two-degree increments, half-degree increments, etc.). They are used in printers, disk drives, and other devices where precise positioning of the motor is necessary.

There are two basic types of stepper motors,

- ❖ Unipolar steppers
  
- ❖ Bipolar steppers.

### **3.4.1 Unipolar Stepper Motors**

The unipolar stepper motor has five or six wires and four coils (actually two coils divided by center connections on each coil). The center connections of the coils are tied together and used as the power connection. They are called unipolar steppers because power always comes in on this one pole.

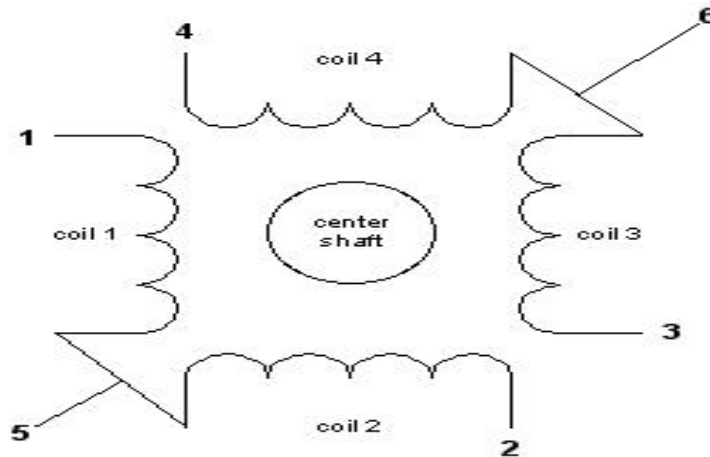


Figure-3.10.Unipolar stepper motor

### 3.4.2 Bipolar stepper motors

The bipolar stepper motor usually has four wires coming out of it. Unlike unipolar steppers, bipolar steppers have no common center connection. They have two independent sets of coils instead. You can distinguish them from unipolar steppers by measuring the resistance between the wires. You should find two pairs of wires with equal resistance. If you've got the leads of your meter connected to two wires that are not connected (i.e. not attached to the same coil). Like other motors, stepper motors require more power than a microcontroller can give them, so you'll need a separate power supply for it. Ideally you'll know the voltage from the manufacturer, but if not, get a variable DC power supply, apply the minimum voltage (hopefully 3V or so), apply voltage across two wires of a coil (e.g. 1 to 2 or 3 to 4) and slowly raise the voltage until the motor is difficult to turn. It is possible to damage a motor this way, so doesn't go too far. Typical voltages for a stepper might be 5V, 9V, 12V, 24V. Higher than 24V is less common for small steppers, and frankly, above that level it's best not to guess.

### **3.4.3 Reason for using Bipolar Stepper motors**

This thesis works on about the movement of motor with camera. So the goal of this project is to clearly move the motor around 360 degrees and rotate both sides. So we use bipolar stepper motor because bipolar stepper motor can rotate both sides only. According to our necessary we use bipolar motor and as our expectation it works well.

# Chapter 4

## Simulation & Results

This chapter shows the analysis and performance of the project. It shows the various type of comparison about the motor rotation, its clockwise and anticlockwise rotation, its return time and etc.

### 4.1 Performance Analysis

The motor which we work with in this project, has 4 phases and number of rotor teeth is 5. So according to the step angle theory

$$S=4*5=20$$

$$\text{So, Step angle} = 360/20 = 18$$

So this motor rotates 18 degree per step.

In every step it takes approximately 0.21sec. In table 1 it shows a comparison about the timing of rotation for 180 degree. This timing range is among 0.20 sec to 0.22 sec. So for 180 degree rotation it takes approximately 2.06 sec. If we calculate timing for 360 degree rotation according to this result it will be 4.12 sec, which is approximately similar to the real rotation timing.

Tabel-1: Motor rotation time in every step

Number of Step	Step Angle(Degree)	Time(sec)
1	18	0.20
2	36	0.20
3	54	0.20
4	72	0.21
5	90	0.22
6	108	0.20
7	126	0.21
8	144	0.20
9	162	0.20
10	180	0.22

Now we calculate the clockwise and anticlockwise rotation. According to the Matlab coding when system try to rotate the motor in any angle clockwise and anticlockwise it takes different time.

In Table-2 shows the clockwise rotation of the motor. Here only shows the first five steps of this motor where the rotation time is varying between 0.22 to 0.21. So for 90 degree rotation it takes approximately 1.08 seconds that means for 360 rotation it takes 4.30 seconds. In MATLAB code the value of  $i=1000$ , that means it represents the rotation speed.

Tabel-2: Motor rotation time in clockwise direction

Number of step	Step angle(degree)	Time(sec)
1	18	0.22
2	36	0.22
3	54	0.22
4	72	0.21
5	90	0.21

In Tabel-3 shows the anticlockwise rotation of the motor. Here 90 degree rotation shows where the time limit is varying from .19 to .20 seconds. So for 90 degree rotation it takes .97 seconds that means for 360 degree rotation it takes 3.88 seconds. Here the MATLAB code `i=1:1000`, it represents the motor rotation speed.

Tabel-3: Motor rotation time in Anti-clockwise direction

Number of step	Step angle(degree)	Time(sec)
1	18	0.19
2	36	0.19
3	54	0.20
4	72	0.20
5	90	0.19

Now if we compare Tabel-2 and Tabel-3, it shows that clockwise and anti-clockwise rotation time and speed. The clockwise rotation speed time is 4.30 seconds and anti-clockwise rotation time is 3.88 seconds. When motor rotates in clockwise direction it takes more time than anti-clockwise

direction. So compare to clockwise direction we speed up the anticlockwise direction, so that it can cover the lacking's of slow rotation. For covering up the lacking's we change the MATLAB code. The value of i is same for clockwise direction and anticlockwise direction which is 1000.

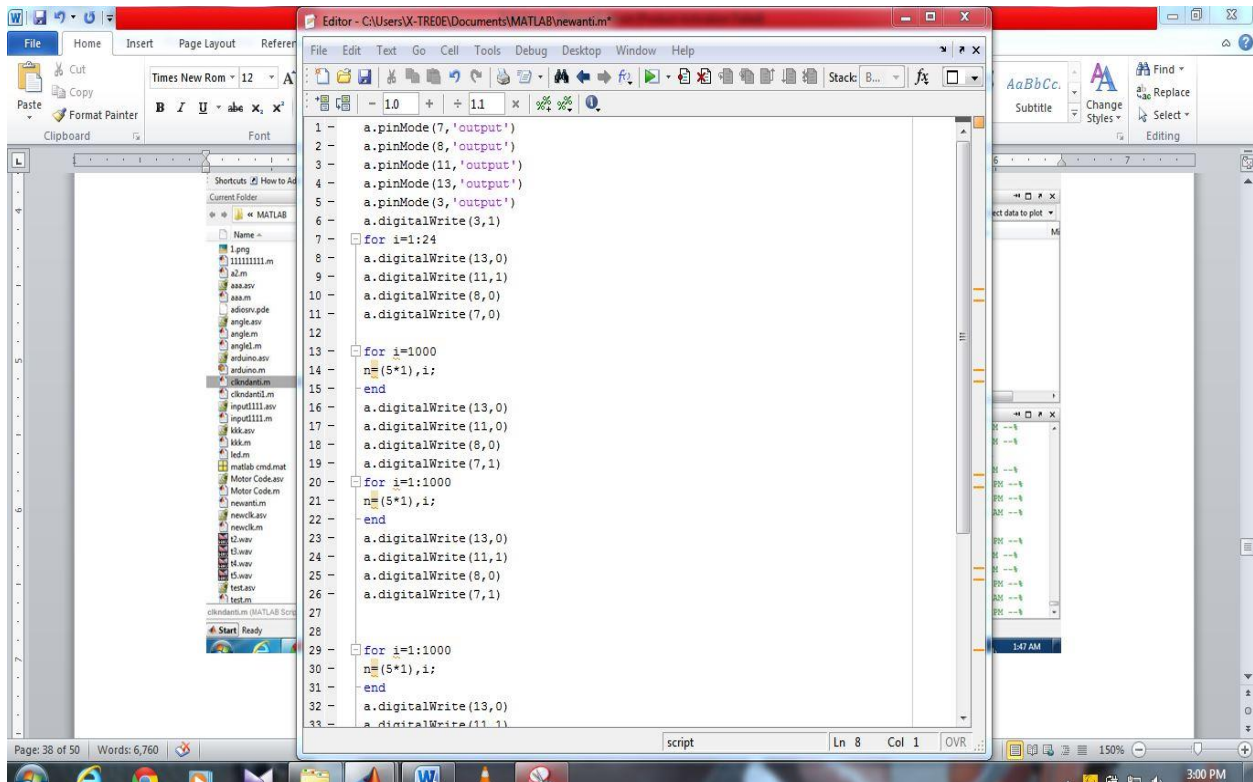


Figure 4.1: Motor rotation for anticlockwise direction

So when the motor rotate in both clockwise and anti-clockwise rotation under the same program it will be synchronized. So this time the rotation speed is average. If we follow the figure 4.2 we can see that the value of i given here is 800. So that it can maintain the both direction at the same speed approximately.

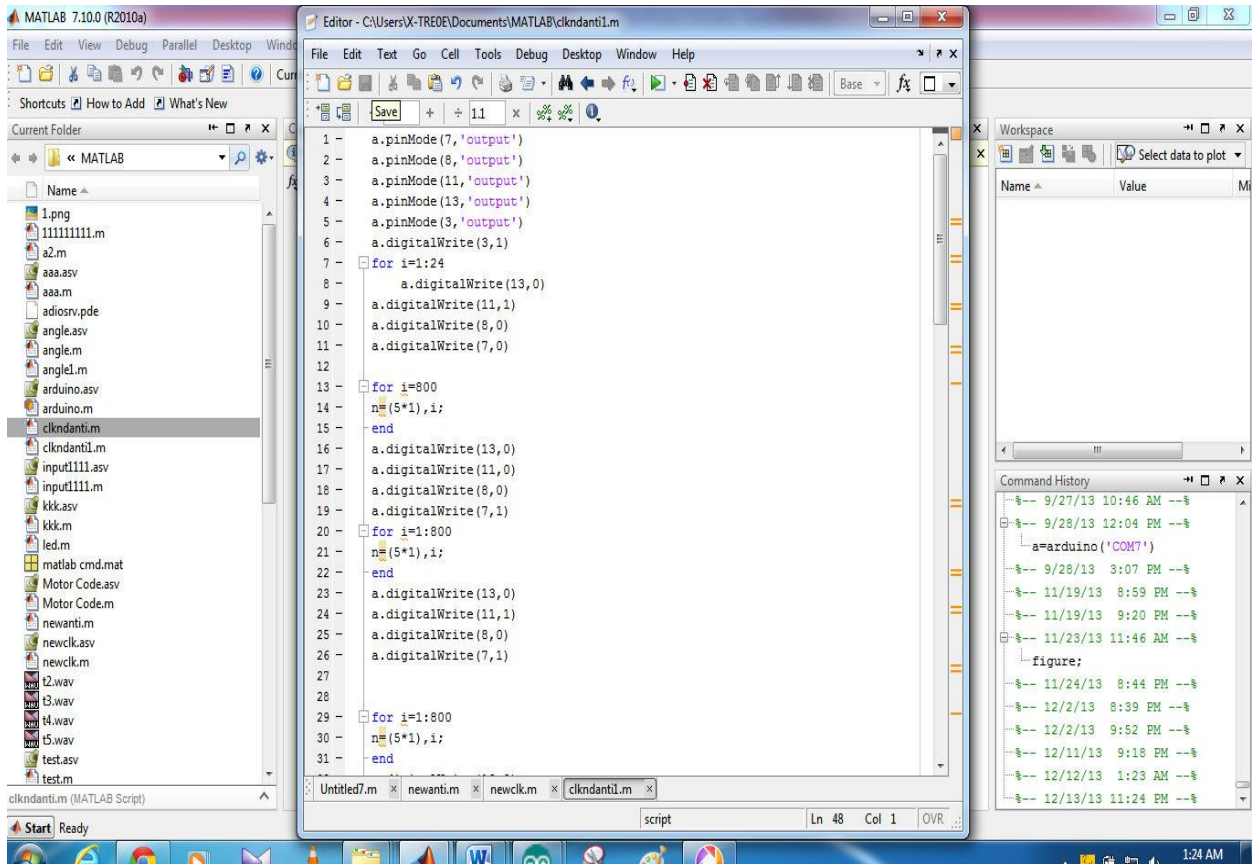
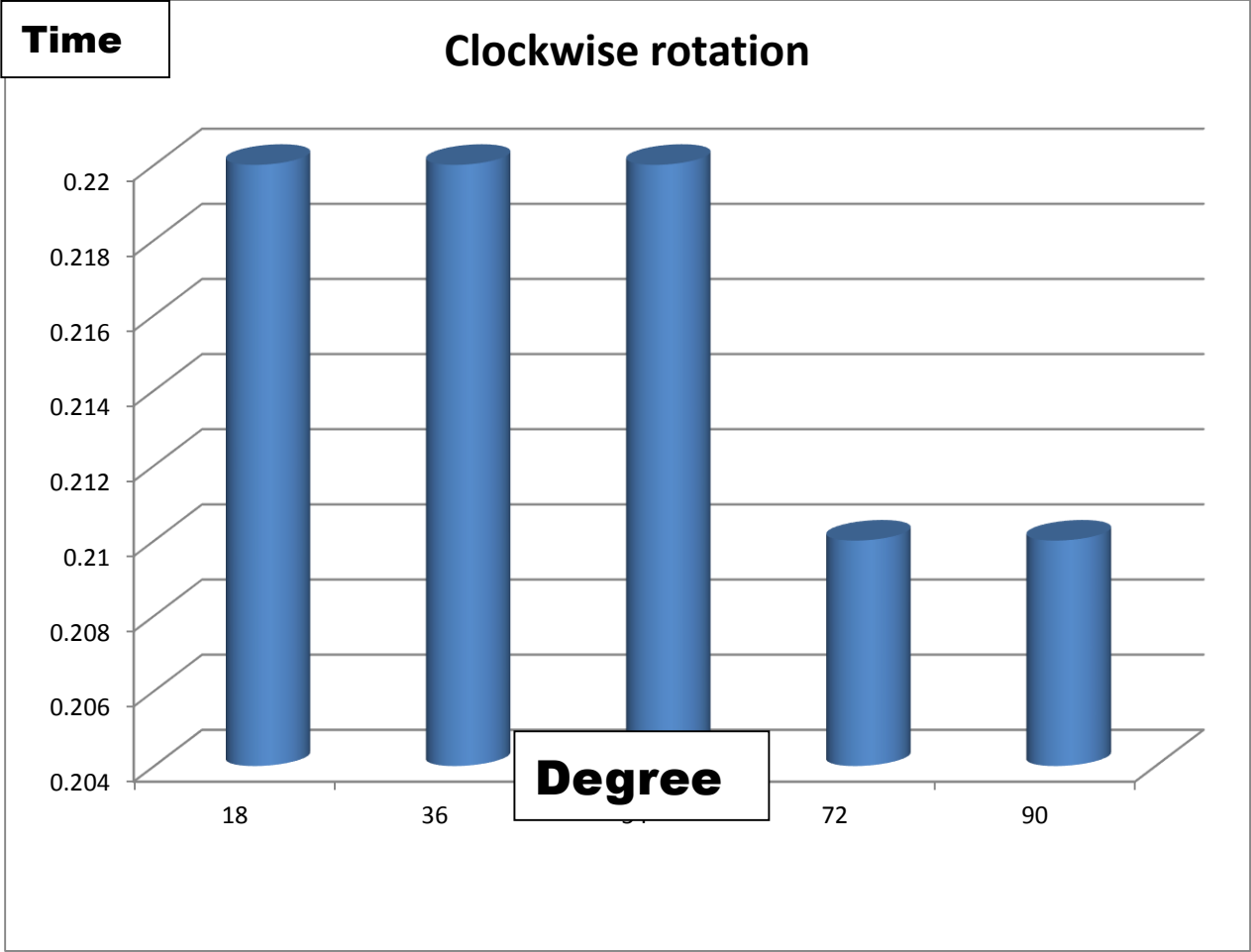


Figure 4.2: Motor rotation for both clockwise and anticlockwise direction

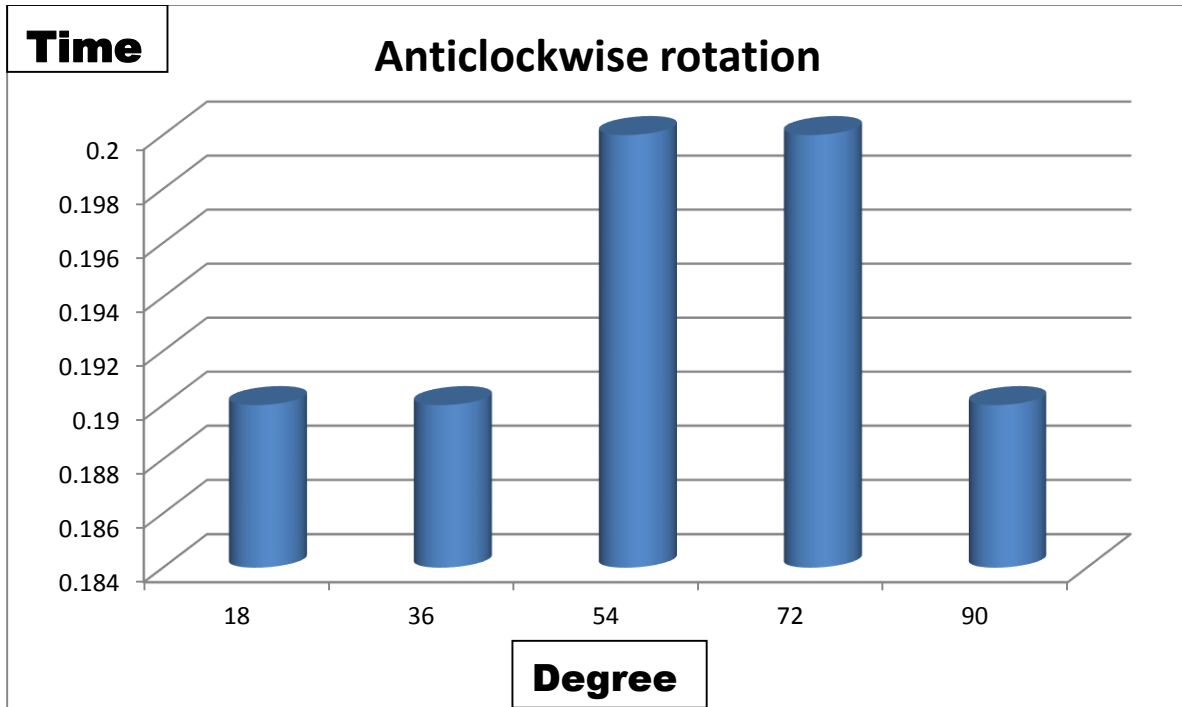
Graph-1 shows the clockwise rotation timing for 90 degree. Here we see that the rotation timing with degree. This motor rotates in 18 degree per step. In every step it takes a time. Here we calculate the 90 degree rotation. So every step angle it changes its time sometimes its unchangeable. First three steps its timing was same and then its change. This timing was changeable up to 360 degrees.



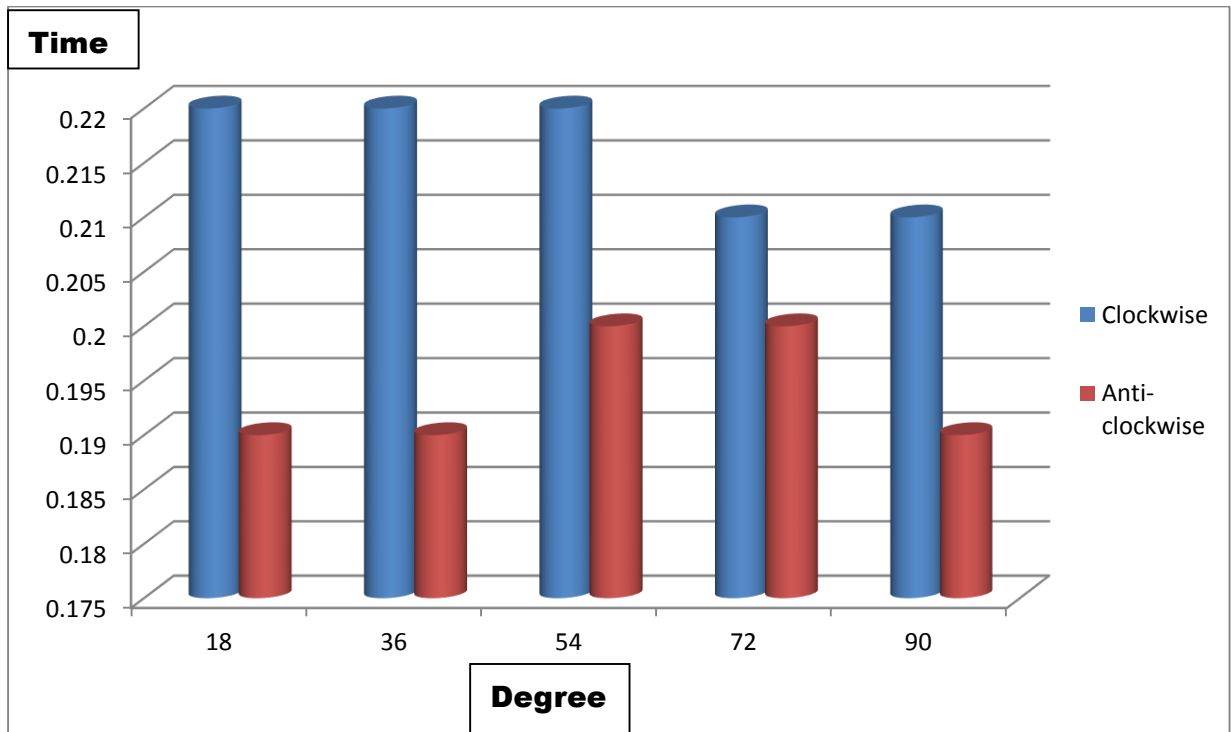


Graph-1

Graph-2 shows the anti-clockwise rotation timing vs. degree chart. Here anticlockwise rotation is faster than clockwise so its timing is faster. We can see that its timing range is .19 to .20 seconds. The angle is from 18 degree to 90 degree. Between this range timing is changeable and this time change is up to 360 degrees.



Graph-2



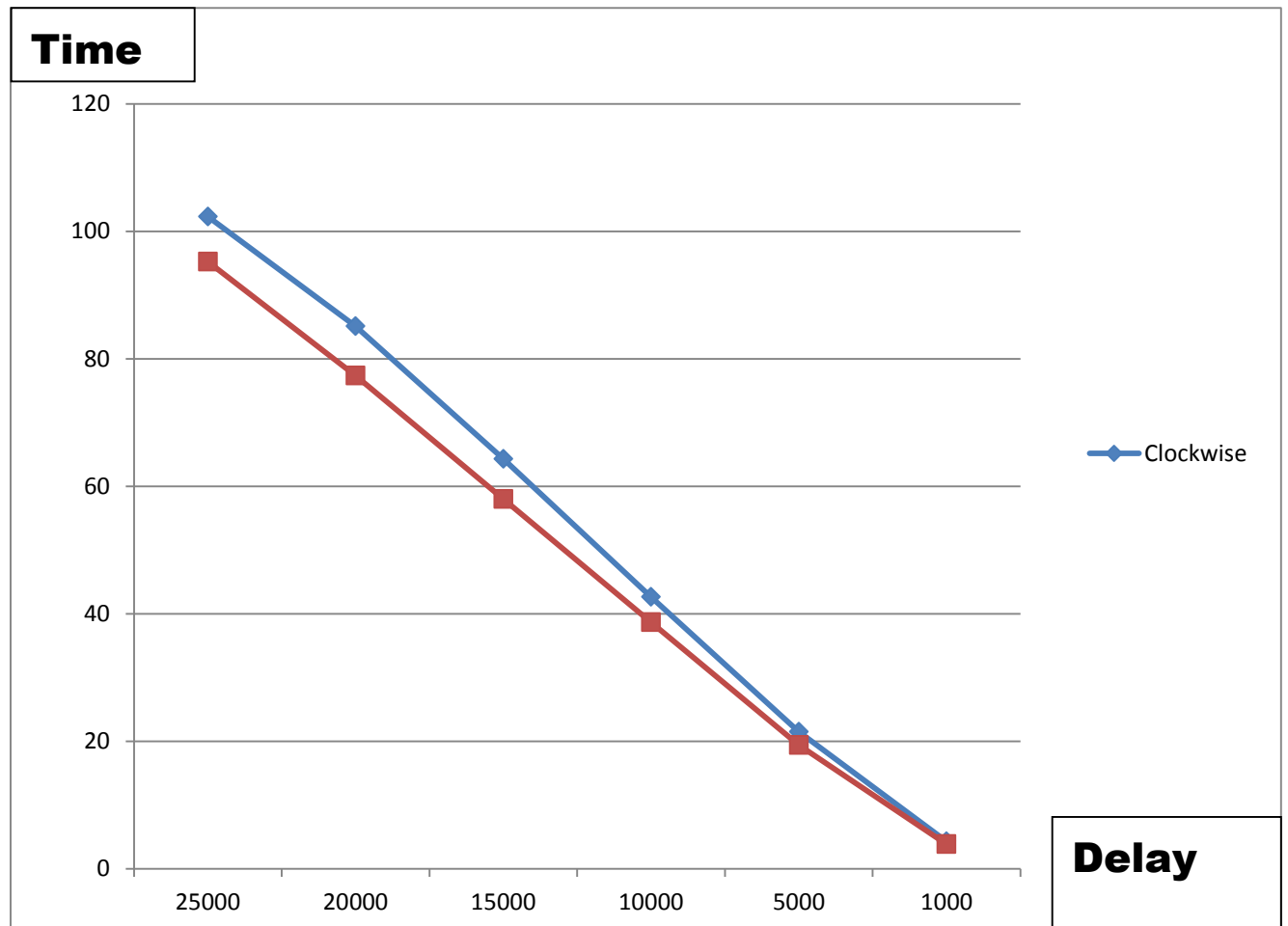
Graph-3

Here Graph-3 shows the both clockwise and anti-clockwise rotation timing. So it shows that clockwise rotation is slower than the anti-clockwise rotation. The anti-clockwise rotation is changing time in every step and it changes until 360 degree rotation.

Tabel-4: Comparison of clockwise and anti-clockwise rotation speed

Delay Time (i)	Clockwise Rotation Time for each step(18°) (Sec)	Anti-clockwise Rotation Time for each step(18°) (Sec)	Clockwise Rotation Time for 360 degree (Sec)	Anti-clockwise Rotation Time for 360 degree (Sec)
25000	5.4	4.3	102.33	95.23
20000	4.3	3.8	85.13	77.38
15000	3.12	2.77	64.29	58.02
10000	2.10	1.9	42.67	38.69
5000	1.1	0.94	21.5	19.38
1000	0.22	0.19	4.30	3.88

Here in this tabel-4 shows that the comparison of Clockwise and anti-clockwise rotation time and speed. This clockwise rotation time is start from 25000 delay time. At first when the experiment was start we work with this value but this time was slow for rotation. Slowly we tried to smooth the rotation of motor because of the perfect movement of camera. So we have to less the delay time between the motor movement code and its working. From 25000 we less the delay time to 1000 and we finally get a smooth movement of rotation. But anti-clockwise rotation is faster than clockwise rotation. Finally we get a 360 degree smooth movement of clockwise and anti-clockwise rotation.



Graph-4

Graph-4 represents the Delay vs. time for both clockwise and anti-clockwise movement. When delay was bigger the motor movement time is high. For smooth movement we need to be smaller the delay. We can see that graph that when delay is big the time was huge. But when delay time is smaller it the rotation of motor movement is smaller also. And finally we got a smooth movement for our motor by reducing the delay.

## **Chapter 5**

### **Conclusion**

In conclusion, a voice interfacing automatic moving camera has been developed and applied it in selected video conferencing where it can save the cost as well as human involvement. This system uses microphone to detect speakers' voice then track it and move the camera towards the speaker. MATLAB programming language is used to develop the program code which can control the detection of speakers' voice and movement of the camera. In the detection stage, the signal of microphone helps the program to perceive the system and in the control stage, the system can control the camera and move towards a specific speaker. Based on the program, the angle accuracy of the camera was detected perfectly. Finally, it is found that this program can successfully detect speaker's voice and control the movement of the camera.

# Appendix

```
input('                               Press Enter For Main menu ')

a.pinMode(4, 'input')
a.pinMode(5, 'input')
a.pinMode(6, 'input')

while(1)

a.digitalRead(6)
a.digitalRead(5)
a.digitalRead(4)

if (a.digitalRead(6)==1)
newclk
elseifa.digitalRead(5)==1
newanti
%a.digitalRead(5)
%elseifa.digitalRead(5)==1

elseifa.digitalRead(4)==1
clkndanti
% a.digitalRead(4)
%elseifa.digitalRead(4)==1
%Untitledx

end
end

a.pinMode(7, 'output')
a.pinMode(8, 'output')
a.pinMode(11, 'output')
a.pinMode(13, 'output')
a.pinMode(3, 'output')
a.digitalWrite(3,1)

for i=1:24

a.digitalWrite(13,0)
a.digitalWrite(11,1)
a.digitalWrite(8,0)
a.digitalWrite(7,0)

for i=800
n=(5*1),i;
end

a.digitalWrite(13,0)
a.digitalWrite(11,0)
a.digitalWrite(8,0)
a.digitalWrite(7,1)
```

```
for i=1:800
n=(5*1),i;
end

a.digitalWrite(13,0)
a.digitalWrite(11,1)
a.digitalWrite(8,0)
a.digitalWrite(7,1)

for i=1:800
n=(5*1),i;
end

a.digitalWrite(13,0)
a.digitalWrite(11,1)
a.digitalWrite(8,1)
a.digitalWrite(7,1)

for i=1:800
n=(5*1),i;
end

a.digitalWrite(13,1)
a.digitalWrite(11,0)
a.digitalWrite(8,1)
a.digitalWrite(7,0)
s=(5*1),i

end

a.pinMode(7, 'output')
a.pinMode(10, 'output')
a.pinMode(11, 'output')
a.pinMode(13, 'output')
a.pinMode(3, 'output')
a.digitalWrite(3,1)
```

```
for i=1:24

a.digitalWrite(13,0)
a.digitalWrite(11,1)
a.digitalWrite(10,1)
a.digitalWrite(7,0)
```

```
for i=800
n=(5*1),i;
end
```



```
a.digitalWrite(13,0)
a.digitalWrite(11,0)
a.digitalWrite(10,1)
a.digitalWrite(7,0)
```

```
for i=1:800
n=(5*1),i;
end
```

```
a.digitalWrite(13,1)
a.digitalWrite(11,1)
a.digitalWrite(10,0)
a.digitalWrite(7,0)
```

```
for i=1:800
n=(5*1),i;
end
```

```
a.digitalWrite(13,1)
a.digitalWrite(11,0)
a.digitalWrite(10,0)
a.digitalWrite(7,1)
```

```
for i=1:800
n=(5*1),i;
end
```

```
a.digitalWrite(13,1)
a.digitalWrite(11,0)
a.digitalWrite(10,1)
a.digitalWrite(7,1)
```

```
s=(5*1),i
end
```

```
a.pinMode(7, 'output')
a.pinMode(8, 'output')
a.pinMode(11, 'output')
a.pinMode(13, 'output')
a.pinMode(3, 'output')
a.digitalWrite(3,1)
```

```
for i=1:26
a.digitalWrite(13,0)
a.digitalWrite(11,1)
a.digitalWrite(8,0)
a.digitalWrite(7,0)
```

```

for i=1000
n=(5*1),i;
end

a.digitalWrite(13,0)
a.digitalWrite(11,0)
a.digitalWrite(8,0)
a.digitalWrite(7,1)

for i=1:1000
n=(5*1),i;
end

a.digitalWrite(13,0)
a.digitalWrite(11,1)
a.digitalWrite(8,0)
a.digitalWrite(7,1)

for i=1:1000
n=(5*1),i;
end

a.digitalWrite(13,0)
a.digitalWrite(11,1)
a.digitalWrite(8,1)
a.digitalWrite(7,1)

for i=1:1000
n=(5*1),i;
end

a.digitalWrite(13,1)
a.digitalWrite(11,0)
a.digitalWrite(8,1)
a.digitalWrite(7,0)

s=(5*1),i

end

a.pinMode(7, 'output')
a.pinMode(10, 'output')
a.pinMode(11, 'output')
a.pinMode(13, 'output')
a.pinMode(3, 'output')
a.digitalWrite(3,1)

```

```
for i=1:26

a.digitalWrite(13,0)
a.digitalWrite(11,1)
a.digitalWrite(10,1)
a.digitalWrite(7,0)
```

```
for i=1000
n=(5*1),i;
end
```

```
a.digitalWrite(13,0)
a.digitalWrite(11,0)
a.digitalWrite(10,1)
a.digitalWrite(7,0)
```

```
for i=1:1000
n=(5*1),i;
end
```

```
a.digitalWrite(13,1)
a.digitalWrite(11,1)
a.digitalWrite(10,0)
a.digitalWrite(7,0)
```

```
for i=1:1000
n=(5*1),i;
end
```

```
a.digitalWrite(13,1)
a.digitalWrite(11,0)
a.digitalWrite(10,0)
a.digitalWrite(7,1)
```

```
for i=1:1000
n=(5*1),i;
end
```

```
a.digitalWrite(13,1)
a.digitalWrite(11,0)
a.digitalWrite(10,1)
a.digitalWrite(7,1)
```

```
s=(5*1),i
```

```
end
```

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