International Journal of Global Engineering (IJGE) E-ISSN: 2456-3099

VOL 2 ISSUE 4 (2018) PAGES 82 - 95

Received: 20/03/2018. Published: 15/04/2018

ANDROID BASED CLOSED LOOP SPEED CONTROL OF DC MOTOR VOICE RECOGNITION BY USING WI-FI

T.Manjula, Mr.M.Sudhakaran,
UG Student, Ganadipathy Tulsi's Jain Engineering College, Kaniyambadi, Vellore,
Associate professor, Ganadipathy Tulsi's Jain Engineering College, Kaniyambadi, Vellore

Abstract

The DC motors are widely used for variable speed drive system in industrial applications such as industrial automation, electric traction, aircraft, military equipment, hard disk drives because of their high efficiency, silent operation, compact, reliability and low maintenance. Due to the advancement of wireless technology, there are several connections are introduced such as GSM, Wi-Fi, ZIGBEE and Bluetooth. Each of the connection has their own unique specifications and applications. Among these wireless connections, WI-FI technology often implemented. The speed control was implemented using WI-FI technology to provide communication access from smart phone. Communication plays a major role in day today's life and can be used as a better tool in control system. It deals with wireless communication and voice recognition and is used to control the motor speed. Microcontroller enables a person to work around independently using a touch screen and voice recognition applications which is interfaced with motors. This can also be controlled through simple voice commands. In addition to this IR sensor is used to sense the motor speed and in turn speed of the motor can be received via WI-FI to the android mobile.

Keywords : Android Mobile, ESP8266 WI-FI Module, L293D, PIC16F883, DC Motor, IR Speed Sensor.

1. INTRODUCTION

DC motor in different steps is easy compared to AC motors. By the open loop control the DC motor can be operated at any intermediate speed by changing the voltage, armature current etc. But in open loop (Prediction based) control accuracy in speed cannot be obtained. There will not be any feedback to the controller to indicate the change in speed due to load. This disadvantage restricts the use of open loop speed control DC motor in applications where constant speed is essential. To avoid this disadvantage a closed loop technique is implemented where the output measured speed is fed back to the speed controller. In closed loop controller the speed can be maintained by adjusting terminal voltage according the speed difference caused by the load torque. i.e., a fine control of speed can be obtained using closed loop speed control. Android is a software stack for mobile devices that includes an operating system, middleware and key applications. Android boasts a healthy array of connectivity options including Wi-Fi, Bluetooth and wireless data over cellular connection. Voice recognition is carried out by android mobiles in which internal voice recognition is used to pass voice commands to motor which is paired with Wi-Fi Serial Modules which in turn the recognized voice as a string. Microcontroller receives the command

International Journal of Global Engineering (IJGE) E-ISSN: 2456-3099

VOL 2 ISSUE 4 (2018) PAGES 82 - 95

Received: 20/03/2018. Published: 15/04/2018

voice output from the android mobile and there are certain predefined conditions in controller. If it satisfies the condition then it sends the signal to driver circuit. Using this we can also find the voltage and current taken by the DC motor. DC motor is sensed by the speed sensor. The sensed output (**speed, temperature, voltage and current rating**) is given back to the android mobile via WI-FI.

2. BLOCK DIAGRAM

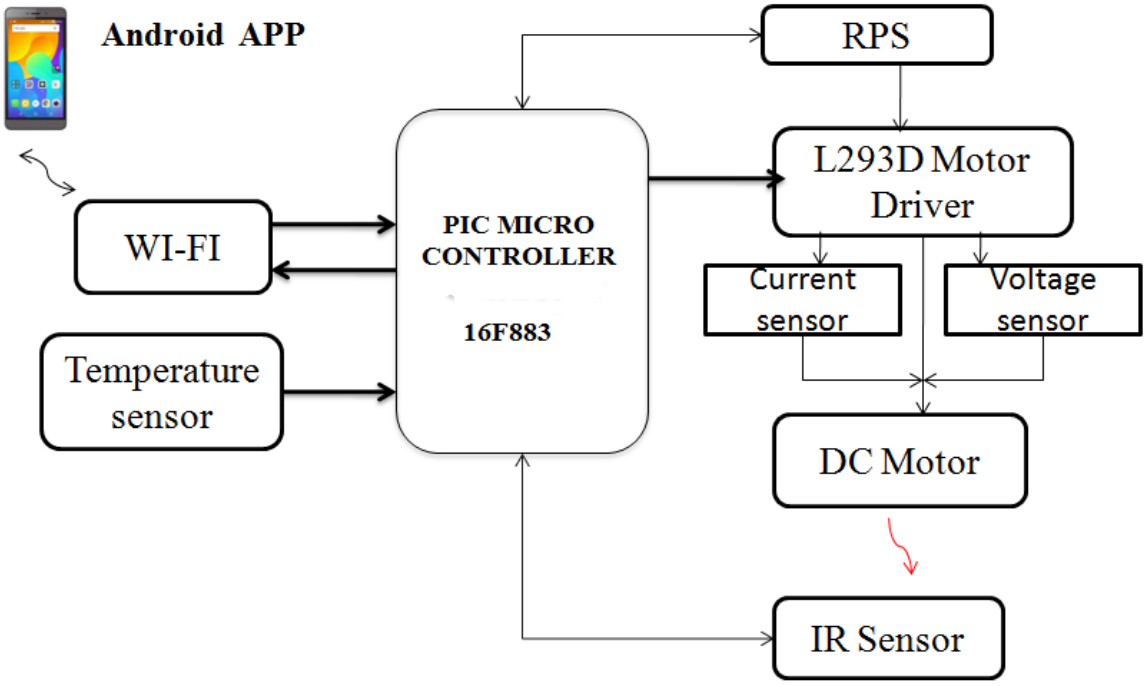

Figure 1 Block diagram for speed control of DC motor voice recognition via Wi-Fi

3. WORKING

At firstly, Voice is given to the android mobile. The mobile is used with an installed voice recognition application. It is an Android application. This application has the feature of sending voice commands and also has the ability of receiving speed from the speed sensor. Voice command is given to android mobile application. This application sends the voice to the ESP8266 Wi-Fi module interfaced with PIC16F883 microcontroller. Voice command is converted into industrial, scientific and medical (ISM) radio bands of about 2.4 GHz frequencies and transmitted to the microcontroller. It converts the given input signal to pulsating signal with the help of programming performed in the microcontroller. The pulsating signal is converted into the driving signal using driver circuit. The driver circuit has IC L293D. It operates two DC motors simultaneously upto 46V and 4A. The motor rotates as we given command through the android mobile. And also by using temperature sensor temperature value can be detected and DC sensing unit is

International Journal of Global Engineering (IJGE) E-ISSN: 2456-3099

VOL 2 ISSUE 4 (2018) PAGES 82 - 95

Received: 20/03/2018. Published: 15/04/2018

used to sense the voltage and current taken by the DC motor. Speed is sensed by the IR sensor. It is a wireless sensor and it is directly connected to the PIC microcontroller. The speed of the motor can be displayed by android mobile via Wi-Fi.

4. HARDWARE COMPONENTS

A. POWER SUPPLY

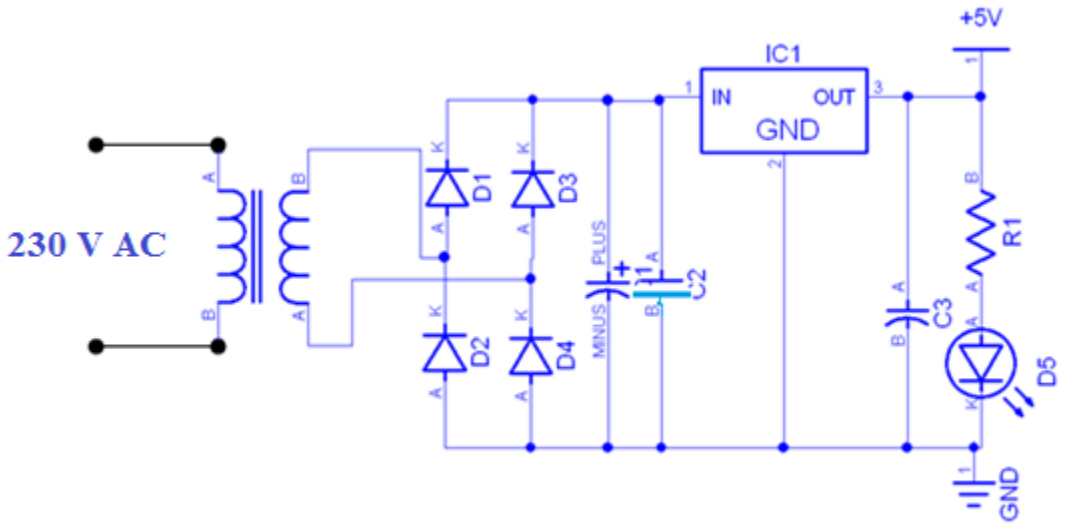

Figure 2 Power supply circuit diagram

B. ESP8266 WI-FI MODULE

ESP8266 is an impressive, low cost WIFI module suitable for adding WIFI functionality to an existing microcontroller project via a UART serial connection. The feature list is impressive and includes: 802.11 b/g/n protocol Wi-Fi Direct (P2P), soft-AP Integrated TCP/IP protocol stack. The ESP8266 requires 3.3V power–do not power it with 5 volts. The ESP8266 needs to communicate via serial at 3.3V and does not have 5V tolerant inputs.

C. MICROCONTROLLER

In this project uses PIC Microcontroller of 16F883 contains 28 pins with 3 ports of Port A,B,C. It has 14 analog inputs and 14 digital I/O's. Operating frequency is 20MHz crystal oscillator frequency. Then it converts given input signal into pulsating signal (PWM). The reason for using PIC has variety of choices (8-bit to 32-bit), low cost, low power, reasonable size, convenient packaging, through hole, surface mount.

D. MOTOR DRIVER

International Journal of Global Engineering (IJGE) E-ISSN: 2456-3099

VOL 2 ISSUE 4 (2018) PAGES 82 - 95

Received: 20/03/2018. Published: 15/04/2018

The L293D is an integrated monolithic circuit in a 15-lead Multiwatt and PowerSO20 packages. It is a high voltage, high current dual full-bridge driver designed to accept standard TTL logic levels and drive inductive loads such as relays, solenoids, DC and stepping motors. Two enable inputs are provided to enable or disable the device independently of the input signals. The emitters of the lower transistors of each bridge are connected together and the corresponding external terminal can be used for the connection of an external sensing resistor. An additional supply input is provided so that the logic works at a lower voltage.

E. TEMPERATURE SENSOR

The LM35 is an integrated circuit sensor that can be used to measure temperature with an electrical output propositional to the temperature. Output voltage is linearly propositional to the Celsius (centigrade) temperature.

F. DC SENSING UNIT

I) VOLTAGE SENSOR

A voltage sensor is going to be able to determine and even monitor and measure the voltage supply. It is then able to take those measurements and turn them into a signal that one will then be able to read. The signal will often go into a specialized electronic device for recording, but sometimes, an observer will be present to manually read the sensor output.

II) CURRENT SENSOR

A **current sensor** is a device that detects electric current in a wire, and generates a signal proportional to that current. The generated signal could be analog voltage or current or even a digital output. The generated signal can be then used to display the measured current in an ammeter, or can be stored for further analysis in a data acquisition system, or can be used for the purpose of control.

G. DC MOTOR

In this project we are using the DC shunt motor which is 12V DC motor. It has 1 pole with thick shunt winding connected parallel to the armature. The DC motor runs at various speed through the logic states from the L293D IC then the transistor BC547 acts as a switch which operates the relay to drive the motor as per the given speed. DC shunt motor has many wide applications. In industrial, Lathes, Drills, Boring Mills, Shapers , Spinning, and weaving machines etc.

F. IR SPEED SENSOR

IR Sensor is a speed sensing device used to sense the speed of the DC Motor and received back to the android mobile via Wi-Fi for user purpose.

International Journal of Global Engineering (IJGE) E-ISSN: 2456-3099

VOL 2 ISSUE 4 (2018) PAGES 82 - 95

Received: 20/03/2018. Published: 15/04/2018

5. SOFTWARE

A. Proteus

Proteus is software for microprocessor simulation, schematic capture, and printed circuit board (PCB) design. It is developed by Labcenter Electronics. Proteus (Processor for text Easy to use) is a fully functional, procedural programming language created in 1998 by Simone Zanella. Proteus incorporates many functions derived from several other languages: C, BASIC, Assembly, etc. It is especially versatile in dealing with strings, having hundreds of dedicated functions; this makes it one of the richest languages for text manipulation. Proteus was initially created as a multiplatform (DOS, Windows, UNIX) system utility, to manipulate text and binary files and to create CGI scripts. The language was later focused on Windows, by adding hundreds of specialized functions for: network and serial communication, database interrogation, system service creation, console applications, keyboard emulation, ISAPI scripting.

B. CCS COMPILER

A compiler is a computer program (or set of programs) that transforms source code written in a programming language (the source language) into another computer language (the target language, often having a binary form known as object code). The most common reason for wanting to transform source code is to create an executable program.

C. LANGUAGE

- Embedded C
- JAVA

D. ANDROID APPLICATION

- **ECLIPSE SOFTWARE**

  It is an Integrated Development Environment features to ease Java programming (and others, e.g. C/C++) Eclipse IDE + ADT (Android Development Tools) advantage of Reduces Development and Testing Time Makes User Interface easier and make Description Easier. The programming languages (officially supported), C/C++ (possible but not supported).The supported tools are ADB (Android Debug Bridge) which is act as an interface between emulator and connected device and DDMS (Dalvik Debug Monitor Service) acts as a port forwarding services between IDE's and emulator.

International Journal of Global Engineering (IJGE) E-ISSN: 2456-3099

VOL 2 ISSUE 4 (2018) PAGES 82 - 95

Received: 20/03/2018. Published: 15/04/2018

6. MODELLING

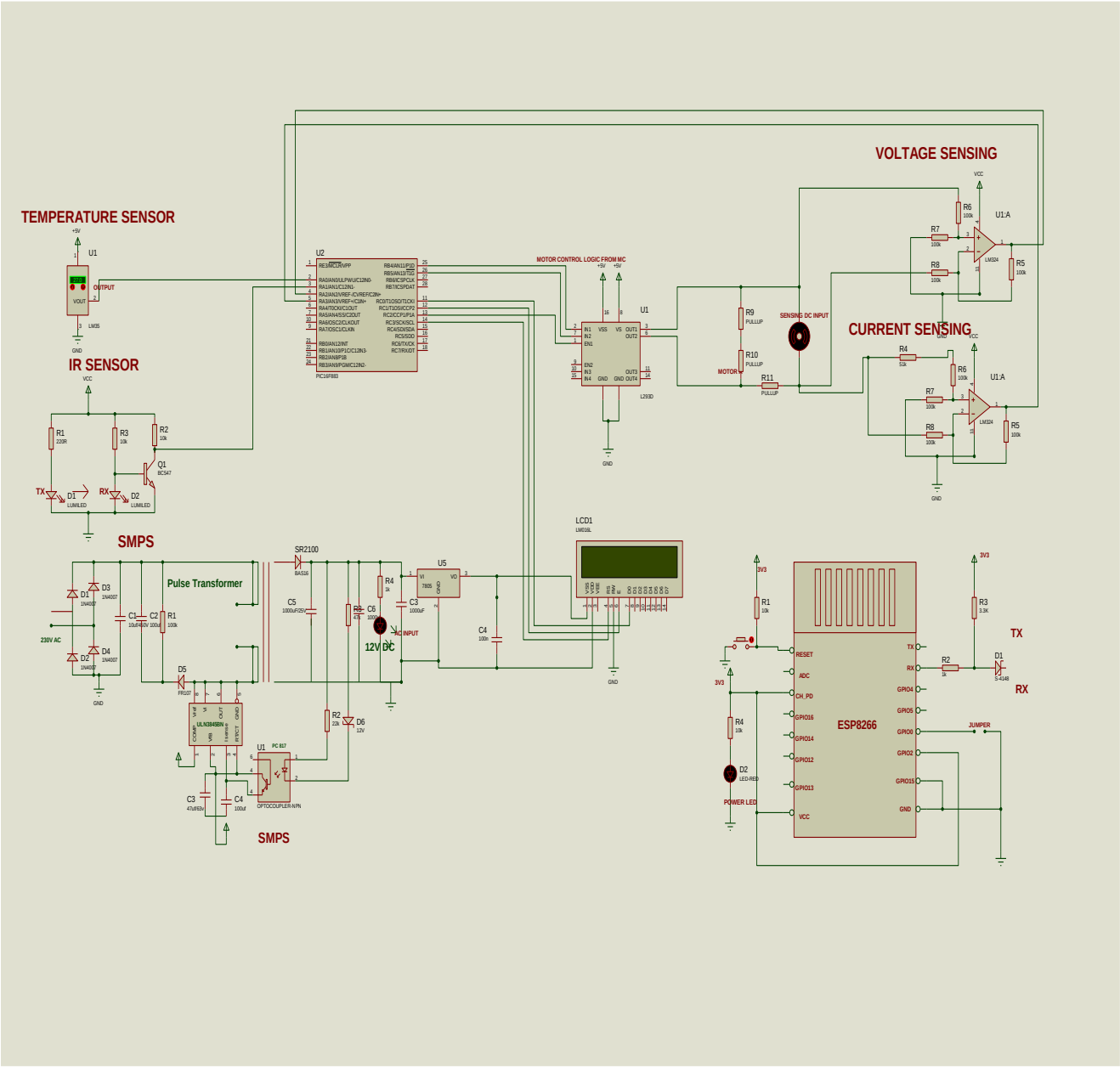

Figure 3 Circuit diagram for Speed Control of DC motor Voice Recognition by using Wi-Fi

International Journal of Global Engineering (IJGE) E-ISSN: 2456-3099

VOL 2 ISSUE 4 (2018) PAGES 82 - 95

Received: 20/03/2018. Published: 15/04/2018

7. SIMULATION SETUP

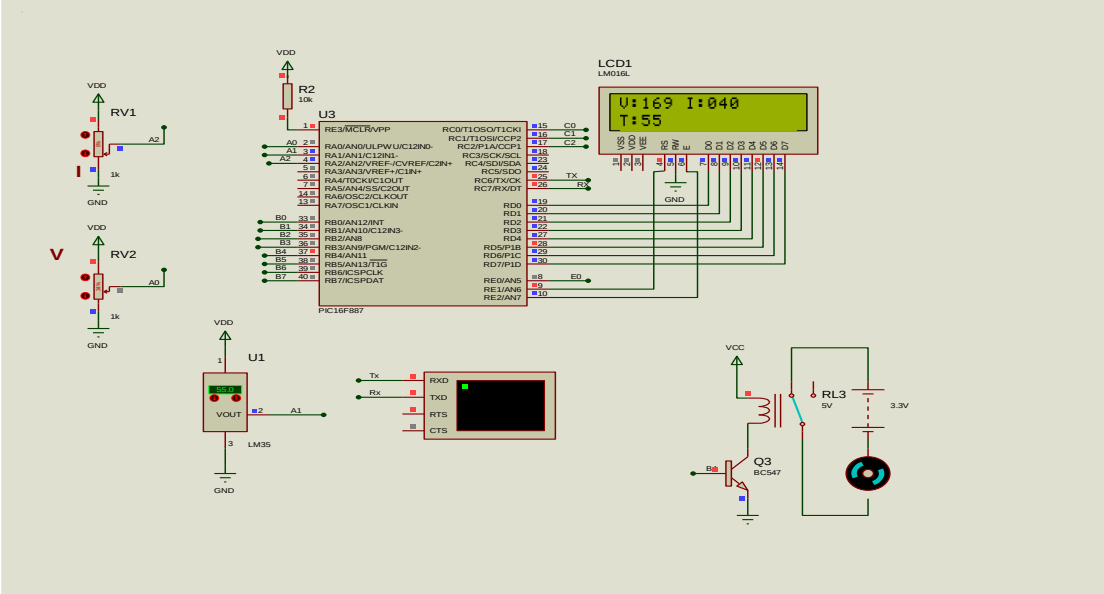

Figure 4 Motor forward condition

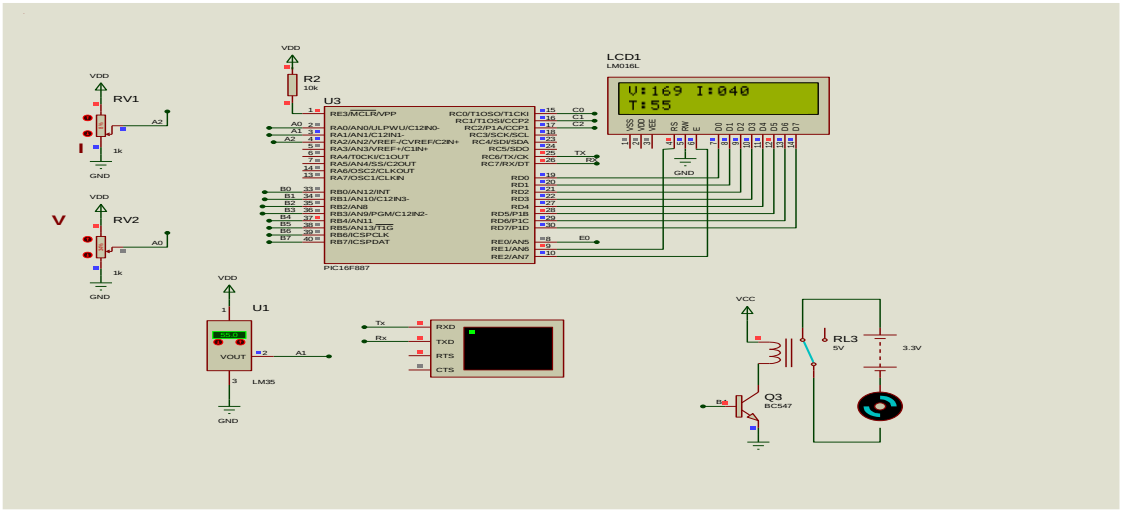

Figure 5 Motor reverse condition

International Journal of Global Engineering (IJGE) E-ISSN: 2456-3099

VOL 2 ISSUE 4 (2018) PAGES 82 - 95

Received: 20/03/2018. Published: 15/04/2018

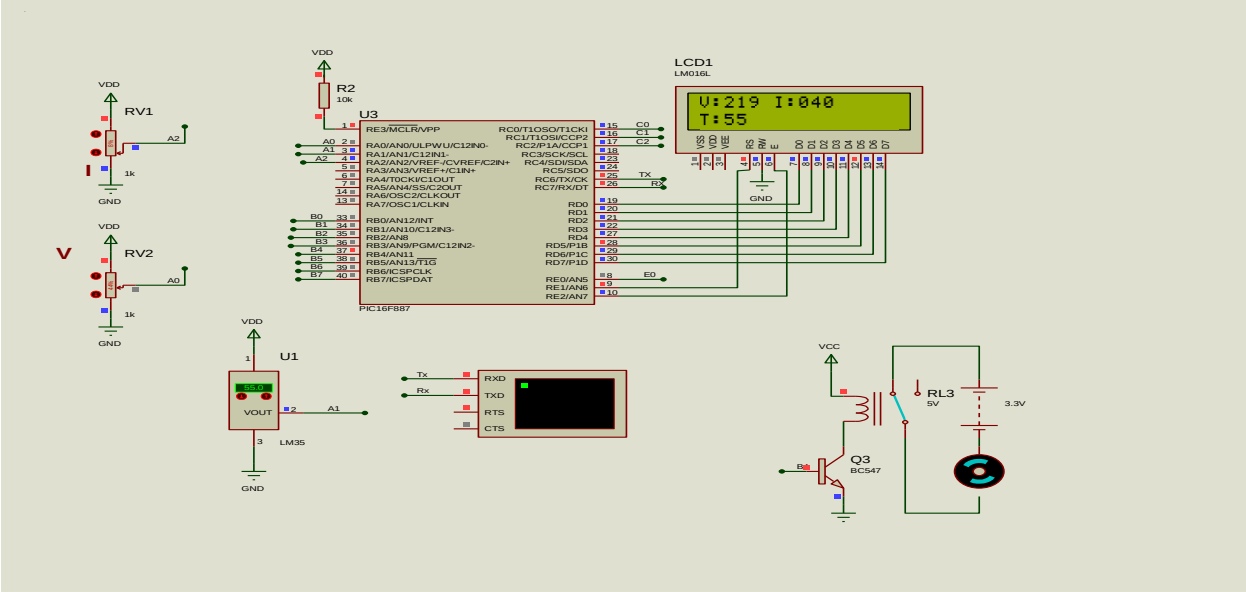

Figure 6 System voltage, current, temperature indication

8. APPLICATION INSTRUCTION

- First the ESP8266 module is paired with the mobile. Then apply the password for pairing.
- Create the "HOTSPOT" and enter the IP Address as per the page creation.
- Click on "SELECT DEVICE" icon to select paired WI-FI module.
- By giving the command "400rpm" it sends the data to WI-FI module connected with the circuit.
- When microcontroller detects "S" the motor rotates "400rpm" and senses the speed of the motor and gives back to the Application via WI-FI.
- By giving the command temperature it sends the data to WI-Fi module connected with the circuit. When the microcontroller detects "T" the temperature value indicated via WI-FI to the android mobile. Similarly voltage and current values are indicated in the android mobile by commanding the simple voice commands.

International Journal of Global Engineering (IJGE) E-ISSN: 2456-3099

VOL 2 ISSUE 4 (2018) PAGES 82 - 95

Received: 20/03/2018. Published: 15/04/2018

9. HARDWARE OUTPUT

A. HARDWARE SETUP

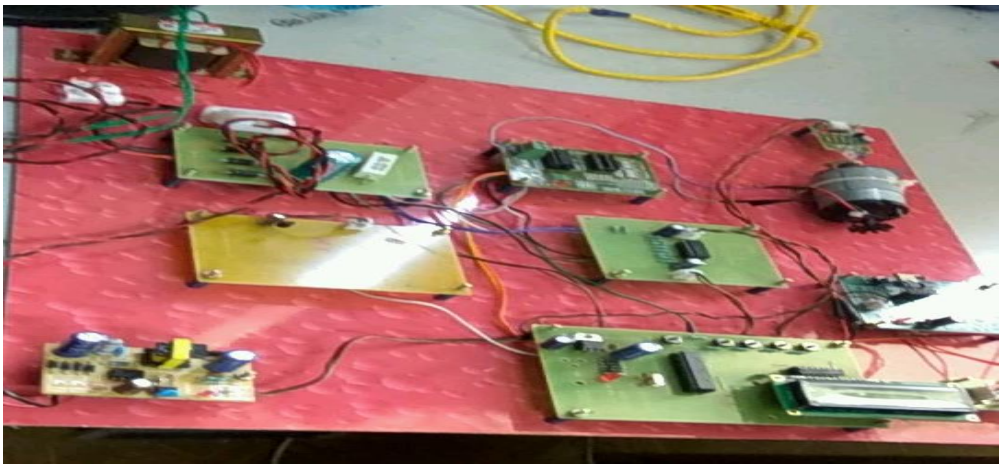

Figure 7 Hardware setup

B. MOTOR RUNS AT FORWARD CONDITION

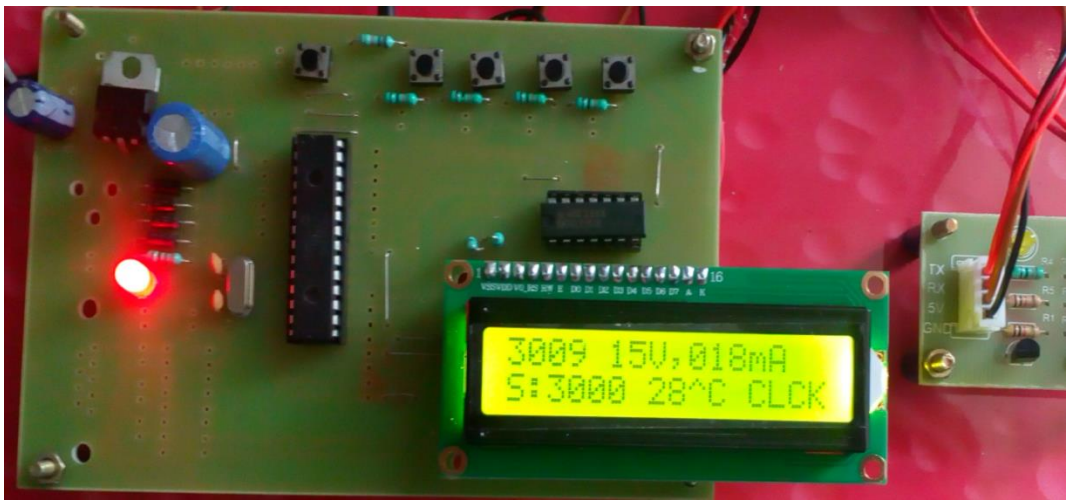

Figure 8 Indication of Clockwise rotation

By using the Android Mobile, We can command the voice signal as **"**FORWARD**"** to run the motor. Then the DC Shunt Motor will rotate at Clockwise direction which is shown in LCD display.

International Journal of Global Engineering (IJGE) E-ISSN: 2456-3099

VOL 2 ISSUE 4 (2018) PAGES 82 - 95

Received: 20/03/2018. Published: 15/04/2018

C. MOTOR RUNS AT REVERSE CONDITIION

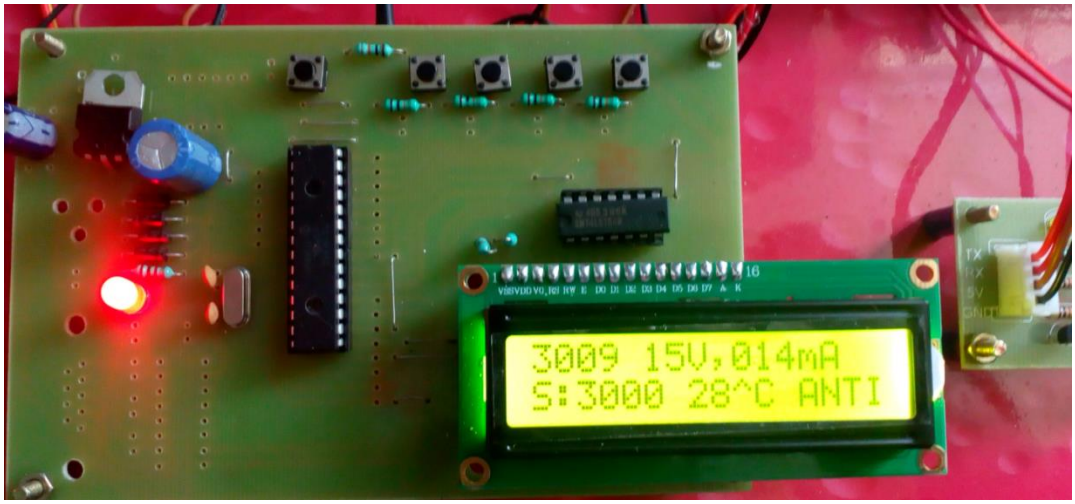

Figure 9 Indication of Anti-clockwise direction

The same way by commanding the voice signal as **"REVERSE"** to run the motor. Then the DC Shunt Motor will rotate at Anti-clockwise direction which is shown in LCD display.

D. MOTOR RUNS AT 4000 rpm

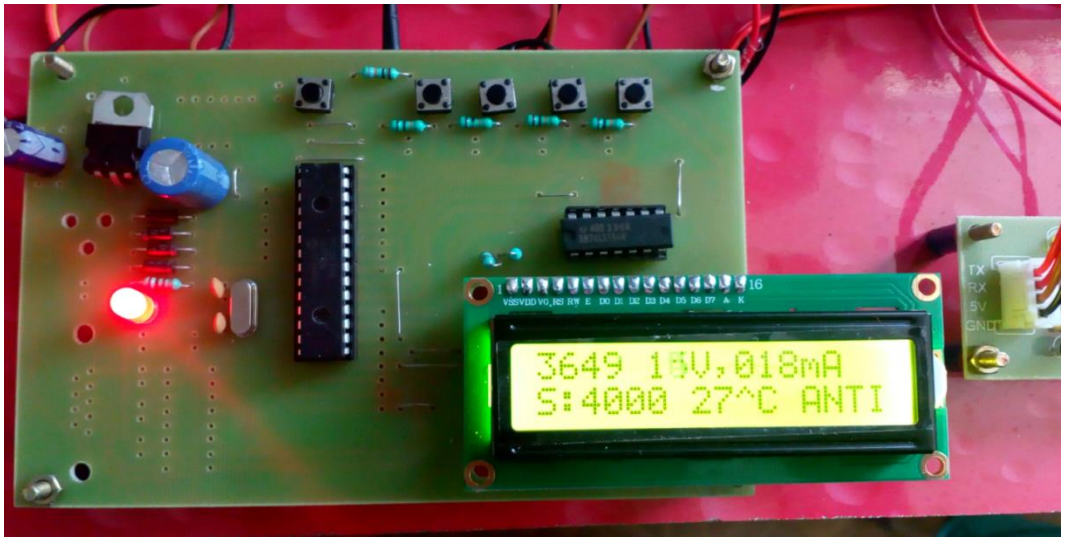

Figure 10 Indication of Motor speed at 4000 rpm

Speed control is the major process of this project. Hence commanding the voice as 4000rpm through Wi-Fi by using the Android Mobile the motor will run at given condition. In this project the starting range of setting speed is 300rpm upto 6000rpm.

International Journal of Global Engineering (IJGE) E-ISSN: 2456-3099

VOL 2 ISSUE 4 (2018) PAGES 82 - 95

Received: 20/03/2018. Published: 15/04/2018

E. MOTOR RUNS AT 5000 rpm

Also we can cross check the DC Motor at various speeds. By commanding the voice signal through the Android Mobile as 5000rpm to run the motor which is shown in LCD display. The speed changes will be depend upon the logic states with the help of driver circuit L293D. And also frequency will be changes for one cycle of revolution because the speed is directly proportional to the frequency.

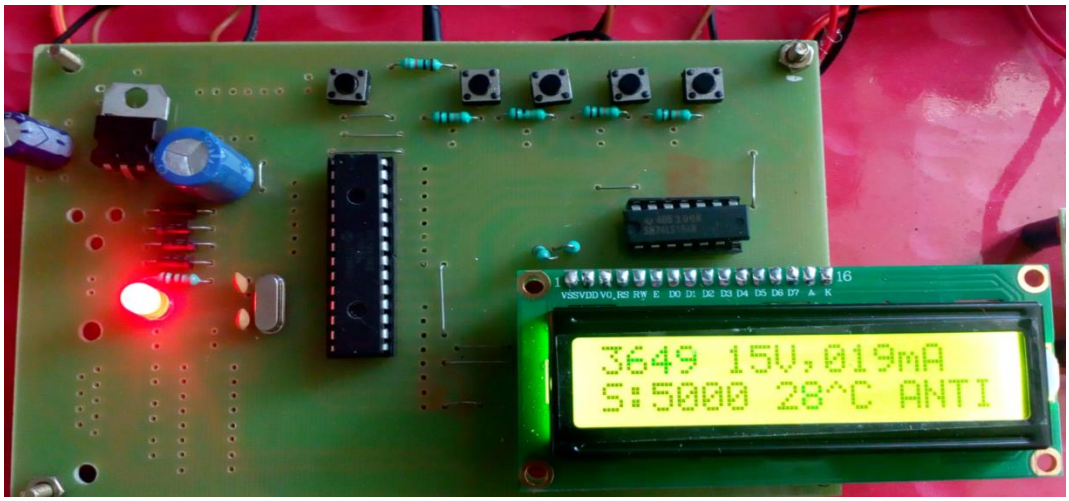

Figure 11 Indication of Motor Speed at 5000 rpm

F. VOLTAGE AND CURRENT DETECTION

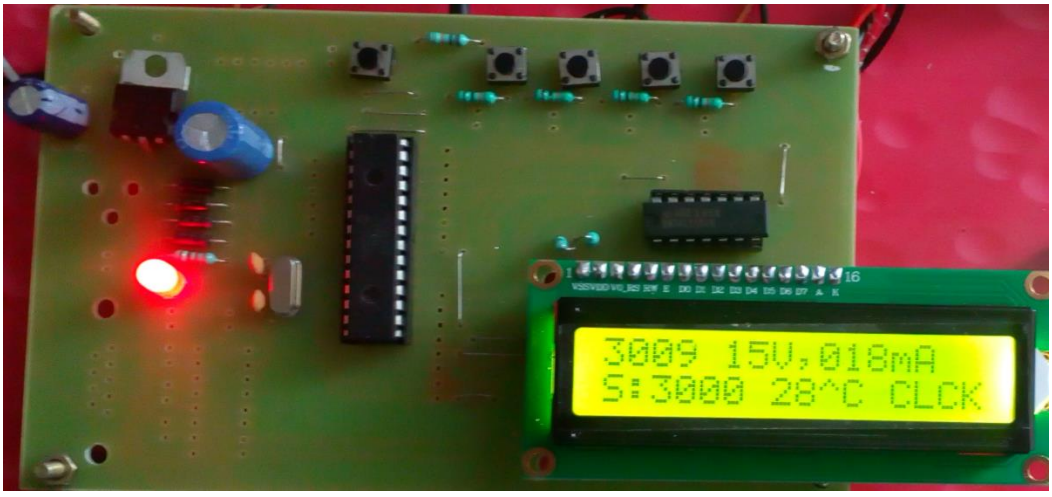

Figure 12 Indication of DC Motor Voltage

International Journal of Global Engineering (IJGE) E-ISSN: 2456-3099

VOL 2 ISSUE 4 (2018) PAGES 82 - 95

Received: 20/03/2018. Published: 15/04/2018

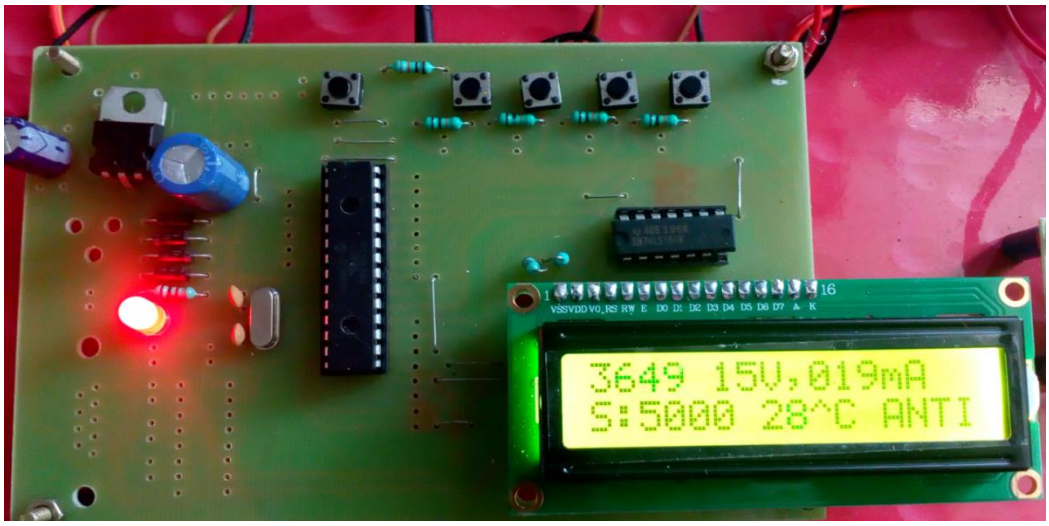

Figure 13 Indication of DC Motor Current

Figure 12 shows the DC motor voltage by voltage divider rule is 15V and Figure 13 shows the DC motor current by current division rule is 19mA.

G. TEMPERATURE SENSOR

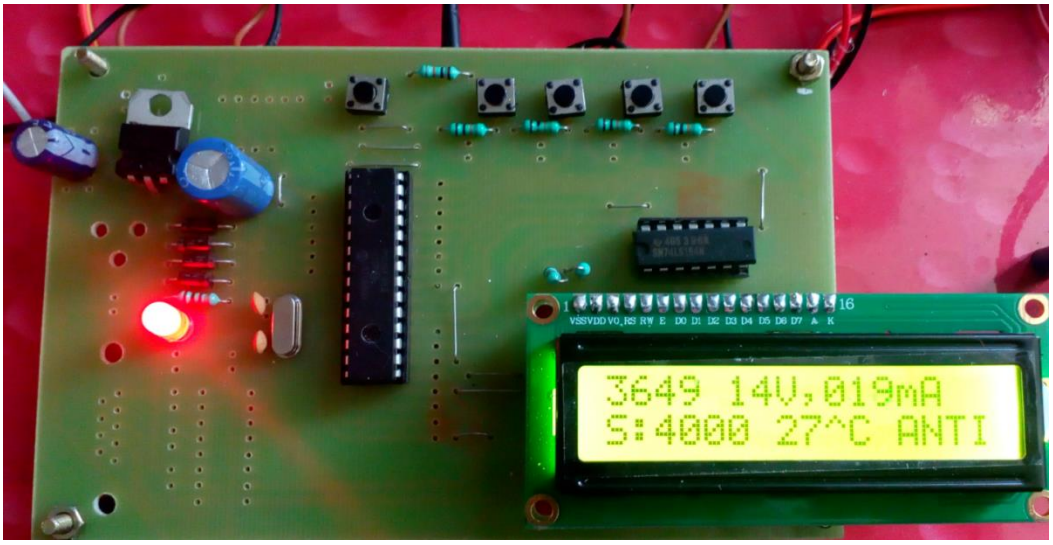

Figure 14 Indication of temperature

10. CONCLUSION

In previous system, the DC motor speed will be controlled using various techniques. But the speed control will not be easy. The system will run the DC motor at fixed speed, to change the speed complete setup will be altered. There is no advanced system to monitor the speed of the DC motor. The speed value cannot be changed and load is not efficient. Cannot operate in explosive and hazard conditions and

not easy to adopt. In general projects, Android mobile can be used as a remote. For application regarding home automation field, it is used as an ON/OFF process and in addition to that the speed can also be varied. In this project Android mobile acts as a microphone. The command is given to the mobile and speed of the motor can be varied and in turn the speed of the motor is displayed in Android application. In Future work, the similar process is applied in AC motors to pump the water for irrigation purpose which is useful to "Farmers", to improve the agricultural field.

REFERENCES

[1] Ajai.T.Kochupurackal, Abin.Shaju, Ajil.Aleyas, swathy.Mohanan 2017, "Voice Integrated Speed and Direction Control For DC Motor", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 6, No.3, pp.1925-1930.

[2] B.Gokul, K.Karthi, A.Thiyagaseelan, V.Santhosh 2016, "Android Based Closed Loop Speed Control of Dc Motor Using Voice Recognition via Bluetooth", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering(IJAREEIE) Vol. 5, No.3, pp-1379-1385.

[3] Noorul S. Mubina, Bharathi P 2015, "Smart Home Automation Control Using Bluetooth And GSM", International Journal of Informative & Futuristic Research (IJIFR), Vol.2, No. 8, pp.2620-2624.

[4] S. Anita, S. Jothi 2015, "Implementation of Android Voice Recognition for Smart Home Application Using Wi-Fi", International Journal of Innovative Science and Modern Engineering (IJISME), Vol. 3, No.5, pp. 9-13.

[5] D. Brunelli, M. Maggiorotti, L. Benini, and F. L. Bellifemine 2014, "Analysis of Audio Streaming Capability", IJSER International Journal of Scientific & Engineering Resear Vol.5, No.1,pp. 2229-5518.

[6] Ritika Pahuja, Narender Kumar 2014, "Android Mobile Phone Controlled Wi-Fi Robot Using 8051 Microcontroller", International Journal of Scientific Engineering and Research (IJSER), Vol. 2, No. 7, pp. 14-17.

[7] R.A.Ramlee,M.H.Leong,R.S.S.Singh,M.M.Ismail,M.A.Othman,H.A.Sulaiman,M.H.Misran, M.A.Meor Said 2013, "Bluetooth remote home automation system using android application", International Journal of Engineering And Science (IJES), Vol. 2, No.1, pp. 149-153.

[8] Radhakrishna Karne, Chakradhar.A 2013, "An Enhanced Dc Motor Control Using the Speech Recognition System", International Journal of Soft Computing and Engineering (IJSCE), Vol. 3, No. 4, pp. 172-173

[9] M.Prathyusha, K.S.Roy, Mahaboob Ali 2013, "Voice and Touch Screen Based Direction and Speed Control of Wheel Chair for Physically Challenged Using Arduino", International Journal of Engineering Trends and Technology (IJETT) ,Vol. 4, No. 4, pp. 1242-1244.

[10] Sabedin A. Meha, Besnik Haziri, Loreta N. Gashi 2011,"Controlling DC motor speed using PWM from C# Windows application", 15th International Research and Expert Conference, "Trends in the Development of Machinery and Associated Technology", Vol. 2, No.1, pp.195-198.

[11] Sandeep Kumar and Mohammed A Qadeer 2009, "Universal Digital Device Automation and Control", in IEEE, Vol.3, No. 4, pp. 490-494.

[12] Wijetunge S.P., Wijetunge U.S., Peiris G.R.V, Aluthgedara C.S. and Samarasinghe A.T.L.K. 2008, "Design and Implementation of a Bluetooth based General Purpose Controlling Module", in IEEE, Vol.5, No. 2, pp. 206-211