Automizing DC and Induction Motors Based System Through GSM Technology

Muhammad Waseem Khan, Arsalan Arif

Abstract— The main objective of this paper is to control the speed of AC & DC motors, through cell phone by using Dual Tone Multiple Frequency (DTMF) technique. Microcontroller is the central part of this paper which is controlling all the process i.e. Direction of DC motor, check for over voltage, under voltage and over load of both the motors. In case any problem happens among the given conditions, motor will be stops automatically, display the problem on LCD & switch on the concerned LED and also inform the owner through SMS.

Index Terms— Power, DC Motor, AC Motor, GSM (SIM 900), Microcontroller, LCD.

1 INTRODUCTION

Developments of high performance motor drives are very essential for industrial applications. A high performance motor drive system must have good dynamic speed command tracking and load regulating response. Also it can be controlled easily and reliably.

Our objective is to design a system which does not only control the speed of both (AC&DC) motors but also monitor and protect the motors from any damage. Moreover this system having the advantage to control the motors from cell phone by using GSM technology.

The purpose of a motor speed controller is to take a signal representing the demanded speed, and to drive a motor at that speed. The controller may or may not actually measure the speed of the motor. If it does, it is called a Feedback Speed Controller or Closed Loop Speed Controller, if not it is called an Open Loop Speed Controller. Feedback speed control is better, but more complicated, and may not be required for a simple system design. Here we are using open loop speed controller, which is independent of speed, speed can only be controlled using keypad of cell phone. Keypads controls the speed of both motors and direction for dc motor.

2 IMPORTANCE OF PAPER

2.1 Background

Motors have variable characteristics and are used extensively in variable-speed drives. DC motor can provide a high starting torque and it is also possible to obtain speed control over wide range. Why do we need a speed motor controller? For example, if we have a motor in a robot, if we just apply a constant power to each motor on a robot, then the poor robot will never be able to maintain a steady speed. It will go slower over carpet, faster over smooth flooring, slower up hill, faster down hill, etc. So, it is important to make a controller to control the speed of DC motor in desired speed. DC and AC motor play a significant role in modern industrial. These are several types of applications where the load on the DC motor varies over a speed range. These applications may demand high-speed control accuracy and good dynamic responses. In home appliances, washers, dryers and compressors are good examples. In automotive, fuel pump control, electronic steering control, engine control and electric vehicle control are good examples of these. In aerospace, there are a number of applications, like centrifuges, pumps, robotic arm controls, gyroscope controls and so on.

2.2 Objective of Paper

The main core of this paper is to design a speed control system of AC/DC Motor by using microcontroller. This system will be able to control the AC/DC motor speed at desired speed regardless the changes of load and also checking for any problem occur during running of motors and indicate the problem to the owner by sending SMS.

2.3 Scope of Paper

In order to achieve the objective of the paper, there are several scope had been outlined. The scope of this paper includes using, assembly to program microcontroller, build hardware for the system, also using GSM technology and interface the hardware to microcontroller and different electronics components like LCD etc…

2.4 General Block Diagram

A general block diagram representing whole idea of the project, DTMF and microcontroller are the main parts of the project which are controlling whole process.

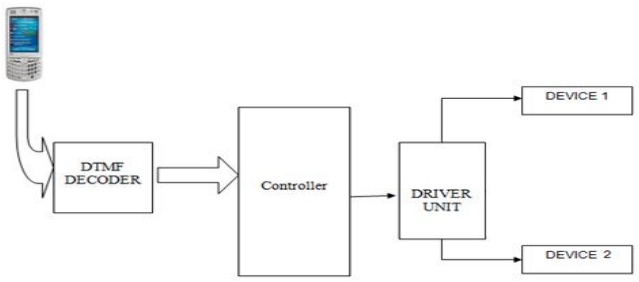

Fig. 1(a) General Block Diagram

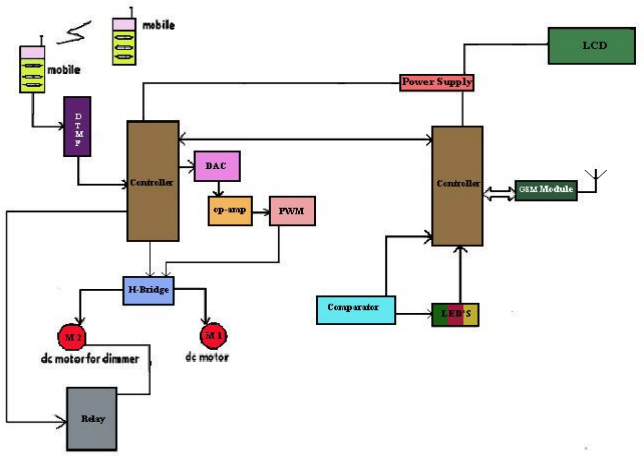

Fig. 1(b) Block Diagram

Before implementing the hardware, block diagram should be made to identify the path on which work will be continued. As shown in the above figure that microcontrollers are the central part of the project which is used to send the information to the owner about the fault occur and also display it on the LCD. More over it also identify the instruction taken from DTMF to operate the motors. Where H-bridge control the direction of DC motor and also control the speed of AC motor by controlling the DC motor for dimmer. Where comparator gives the instruction to control the speed of DC and AC motor.

To control the motors by taking the instructions from the DTMF decoder; we have three motors in circuit . Two motors are DC and one motor is AC. The other DC motor is used to control (operate) the dimmer which ultimately control the AC motor.

For motor protection i.e. checking for over voltage, under voltage and over load. In case any problem occurs among the given conditions then controller will be informed, which do four things in reaction.

- Stops the motor.
- Display the accident on LCD.
- Turn ON the appropriate LED.
- Generate (send) SMS to inform the owner.

3 FIGURES AND TABLES

Figure given below consist of LCD microcontroller and three LED's which gives the indication about the over voltage, under voltage, over load. Here in the given circuit Red LED indicates about the over voltage, Green LED indicates about the under voltage and Yellow LED indicates about the over load. In case any accident happed among the given conditions motor will be stop and will send SMS to the owner as explained above.

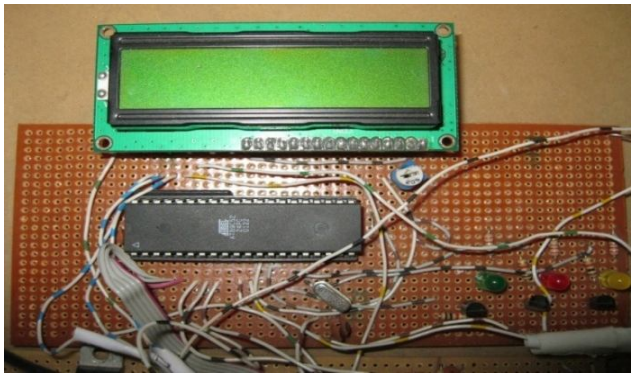

Fig. 2 Protection Circuit

Circuit given below consist of regulator, GSM and adjustable regulator used to operate the GSM module (sim-900),which is interfaced with the controller shown in the figure. This is the module used for sending SMS to inform owner or operator about the problem occur during operation.

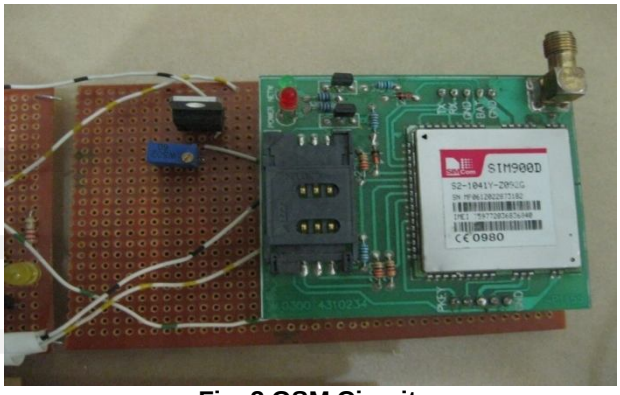

Fig. 3 GSM Circuit

The figure shown below consists of DC motor and dimmer, this is the DC motor which is used to operate (control) the AC motor by varying the dimmer according to the signal provide or instruction given.

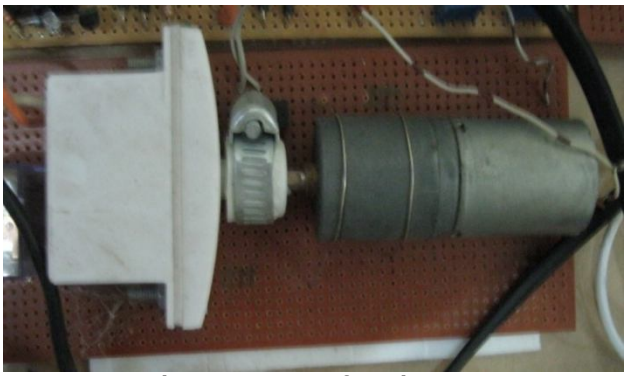

Fig. 4 DC Motor for Dimmer

The figure given below consist of regulator, DTMF, controller, DAC 0800 & LM741, The DTMF attached with the cell phone, which decode the signal and send it to the controller which

later on convert it to the analog signal through DAC, and finally it amplifies through Op-Amp LM741 for further process.i.e. Signal will be sanded to the PWM controller.

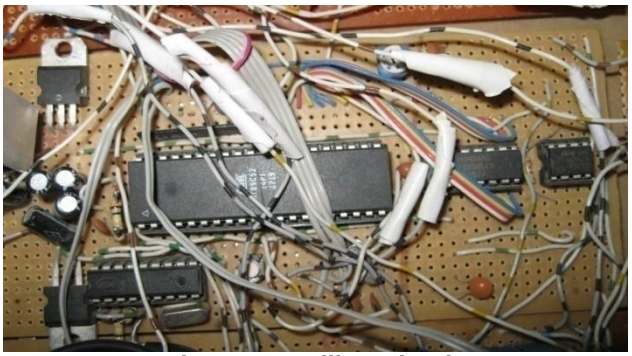

Fig. 5 Controlling Circuit

Figure given below consist of regulator, H-bridge and two IC's of 494 used for comparing. We set the reference value in TL491, it is adjustable regulator which helps to keep the desired speed of the motor. For AC motor initially speed will be 25%, if we increase the speed it becomes 50%, if further speed is increased the speed attain will be 75% and at the end on further increasing the speed it becomes 100%.where for DC motor initially speed will be 50% and by increasing its speed once, it becomes 100%.

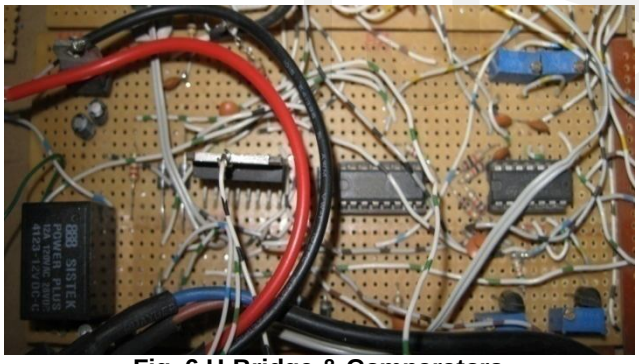

Fig. 6 H-Bridge & Comparators

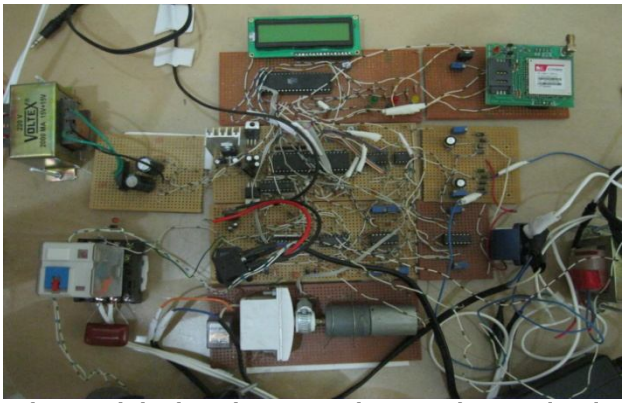

Fig. 7 Original Project Complete Hardware Circuit

H-Bridge

An **H bridge** is an electronic circuit that enables a voltage to be applied across a load in either direction. These circuits are often used in robotics and other applications to allow DC motors to run forwards and backwards. H bridges are available as integrated circuits, or can be built from discrete components.

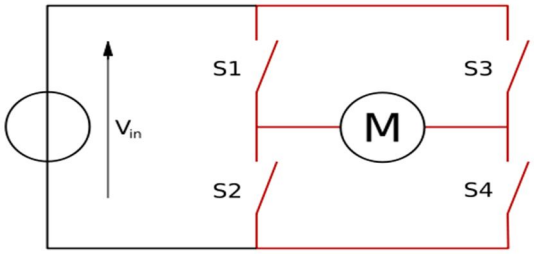

Fig. 8 H-Bridge

Relay

A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off, so relays have two switch positions and most have double throw (changeover) switch contacts as shown in the diagram. Relays allow one circuit to switch a second circuit which can be completely separate from the first. For example a low voltage battery circuit can use a relay to switch a 230V AC main circuit. There is no electrical connection inside the relay between the two circuits; the link is magnetic and mechanical.

Relay Construction and Working Principle

The coil of a relay passes a relatively large current, typically 30mA for a 12V relay, but it can be as much as 100mA for relays designed to operate from lower voltages. Most ICs (chips) cannot provide this current and a transistor is usually used to amplify the small IC current to the larger value required for the relay coil. The maximum output current for the popular 555 timer IC is 200mA so these devices can supply relay coils directly without amplification.

Relays are remote control electrical switches that are controlled by another switch, such as computer in power train control module. Relays allow a small current flow circuit to control a higher current circuit. Several designs of arrays are in use today,3-pin,4-pin,5-pin and 6-pin,single switches or dual switches.

All relays operate using the same basic principle. The example in figure below uses a 4-pin relay. Relays have two circuits:

1) Control circuit(in right side)
2) Load circuit(in left side)

The control circuit has a small control coil and the load circuit has a switch. The coil controls the operation of the switch.

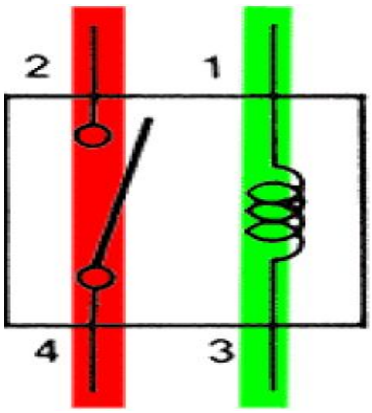

Fig. 9(a) Design Of Relay

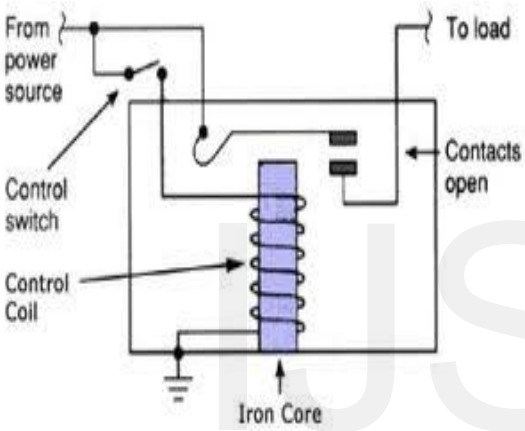

Fig. 9(b) Design Of Relay

ON Condition

Current flowing through the control circuit coil creates a magnetic field and causes the switch to close .The switch is a part of load circuit and is used to control an electrical circuit that is connected to it and hence current flows. This is energized state.

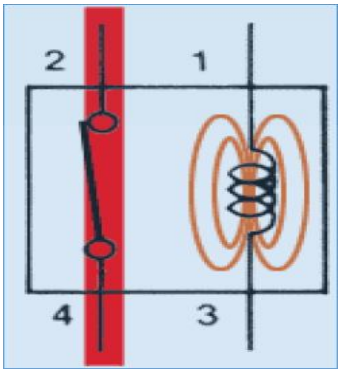

Fig. 10 On Condition Of Relay

OFF Condition

When current flows through the control circuit, the relay becomes de-energized. The switch opens as there is no magnetic field and hence no current flows through the load circuit.

Architecture of GSM

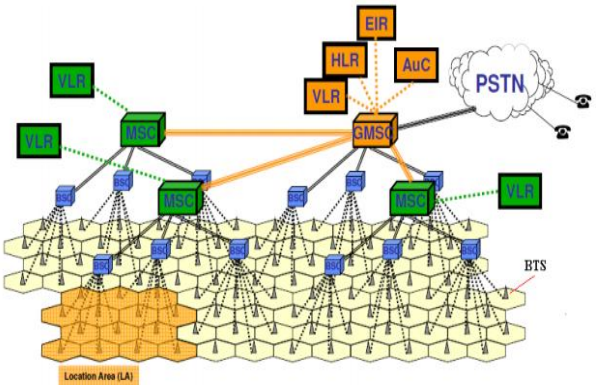

Fig. 11 Architecture of GSM

The GSM divides the infrastructure into the following three parts.

- Network Switching Subsystems (NSS)
- Base Station Subsystem (BSS)
- Network Management Subsystem (NMS)

If we count the Mobile Station (MS) or cell-phone will be the 4rth element.

Any telecommunications network requires some kind of NMS. A part of NMS is generic for any telecom system. The billing and messaging are two examples. The core of the NSS is the MSC (Mobile Switching Center) which is basically a PSTN switch with mobility management related enhancement/add-on. The BSS is entirely new (compared to PSTN) that are required for wireless access and mobility.

DC Motor Control		AC Motor Control	
Control	Keypad	Control	Keypad
Selection	1	Selection	2
50% Speed	1	25% Speed	1 (4Steps)
100% Speed	2	25% Speed Decrease	2 (4Steps)
50% Speed Decrease	1 (2Steps)	Stop	5
Stop	5	Main Menu	3
Direction	6		
Main Menu	3		

Table. 1 Keypad Codes for Motors

4 CONCLUSION

The speed of AC & DC motor has been controlled successfully by using PWM controller; we get our aimed to control the speed of motors through GSM technology, and also controlling the direction of DC motors. Moreover we also get our aim to protect the motors from over load and electricity variations i.e. over voltage or under voltage, also informed us about the over voltage, under voltage and over load through LCD, LED'S and also displaying the information on the owner cell.

ACKNOWLEDGMENT

In the name of Allah, the Most Gracious and the Most Merciful Alhamdulillah, all praises to Allah for the strengths and His blessing in completing this research paper. After that a special thanks to my beloved parents "Muhammad Yaseen" family members, for their continuous support and encouragement. I forever indebted to my parents for their sacrifice from the beginning until the accomplishment of this research, my work is also supported by my supervisor "Arsalan Arif" and "Sarhad University of Science & IT". Whose guidance, careful reading, constructive comments, support and advise has enabled me to gain a profound understanding throughout the whole process of this research.

REFERENCES

[1] Merican society of electrical engineers.

[2] 8051 microcontroller BY Muhammad Ali Mazidi ISBN: 978-81-317-5899-1

[3] Electronic devices and circuit theory BY Robert L. Boylestad, ISBN 978-81-317-2529-0

[4] Power electronics by Ashfaq Ahmad

[5] Electrical and electronic Technology Book

[6] Electric Motor Control By Stephen L Herman

[7] "GSM World statistics". GSM Association. 2010. Retrieved 2010-06-08.

[8] "GSM Technical Data". Cellular.co.za. Retrieved 2010-08-30.

[9] "Two Billion GSM Customers Worldwide". 3G Americas. June 13, 2006. Retrieved 2007-01-08.

[10] Discussions and Guidance from my Teachers.