DC MOTOR SPEED CONTROL USING GSM

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ABSTRACT

The Global System for Mobile Communication (GSM) is a wide-area wireless communication system that provides voice, data, and multimedia communication services via digital radio transmission. A GSM system manages communication between mobile phones (stations), base stations (cell sites), and switching systems. Each GSM radio channel is 200 kHz broad and is further divided into frames of 8 time slots. GSM stands for Group Special Mobile at first. The GSM system consists of mobile phones (stations), radio towers (base stations), and interconnecting switching systems. GSM (SMS) Controlled DC Motor is an automatic control system that can receive a set of command instructions in the form of a short message service and conduct the required operations such asstart, stop, and speed control. We will use a dedicated modem/mobile at the receiver module, i.e., with the robot itself, and send commands via SMS service asneeded. The mobile unit dedicated to the motor drive is linked to an intellectual device known as a microcontroller, which is in charge of reading the received commands in the form of SMS from the mobile unit and performing the corresponding predefined tasks such as motor start, stop, motor direction, and speed control at various levels, and so on. This paper will go over DC Motor SpeedControl Using GSM.

Keywords: *Global System; Mobile Communication; Wireless; Digital, Radio; Transmission; Voice; Telephone; Channel; Frames; Radio Towers; DC Motor; Start; Stop; SpeedControl.*

INTRODUCTION

Motors are commonly employed in industrial control, automation, and household appliances. It includes anything from domestic washing machines to fans, hand- held power tools, vehicle window lifts, traction control systems, and industrial drives. Without a control system, a motor application is incomplete. The developments of the microprocessor and microcontroller simplifies the control system. This control system regulates the motor's switch, speed, and direction. [1]A control signal is produced by a switch that is directly connected to the control circuit. To control and monitor the motor, the user must be present at the location where the switch is positioned. A cell phone is employed as a control switch in this system. Control signals are wirelessly transmitted to the control circuit by sending text messages via short message service (SMS), which is part of the Global System for Mobile Communications (GSM). By including a GSM moduleinto the motor's control circuit, the user can transmit text messages containing commands from any mobile phone to that GSM module. [2] The text instruction will be received by the GSM module and sent to the microcontroller to be processed and turned into the necessary control signal. Controlling a motor by SMS is extremely convenient and provides mobility because the user may control and monitor the motor from anywhere as long as there is service. Furthermore, sending text messages is regarded

fairly cheap cost, and most people own mobile phones, making it one of life's fundamental demands. [3]

DC Motor Speed Control:

The rotational speed of a DC motor is generally proportional to the applied voltage, whereas the torque is proportional to the current. Variable voltage sources, resistors, or electronic controls can be used to control speed. A wound field DC motor's direction can be altered by reversing either the field or armature connections, but not both. This is often accomplished using a unique set of contactors known as direction contactors. By introducing a series resistor or an electronically controlled switching device made of thyristors, transistors or historically mercury arc rectifiers, the effective voltage can be changed. The average voltage applied to the motor is adjusted in a chopper circuit by rapidly switching the supply voltage. The speed of the motor fluctuates as the "on" to "off" ratio is changed to change the average applied voltage. [4]

Components for GSM based Speed control DC Motor:

- GSM module
- DC motor
- PWM
- PIC MCU

Motors are commonly employed in automation, industrial control and as home electrical appliance. It categorizes anything from fans to washing machines to hand-held power tools, traction control systems and car window lifts to industrial gadgets. A motor application is incomplete without a controller system. The invention of the microcontroller and microprocessor simplifies the control systems. The control system's primary task is to control the motor's speed, switch and direction. A control signal is generated by connecting the switch directly to the control circuit. A user should be present at the spot where the switch is installed to control and monitor the motor. The mobile phone was employed as a control switch in this project. By delivering an SMS (Short Message Service), whichis a component of the GSM (Global System for Mobile Communications) control signals are transmitted to control circuit. [5]

GSM (SMS) Controlled DC/AC Motor is an automatic control system that may receive a set of command instructions in the form of a short message service and conduct the required operations such as start, stop, and speed control. We will use a dedicated modem/mobile at the receiver module, i.e., with the robot itself, and send commands via SMS service as needed. The GSM modem, which is dedicated to the motor driver, is interfaced with an intellectual device known as amicrocontroller, which is in charge of reading the received commands in the form of SMS from the mobile unit and

performing the corresponding predefined tasks such as motor start, stop, motor direction, and speed control at various levels, etc. [6]

A dc motor's speed is regulated by varying the voltage delivered to the motor. For many decades speed control has been achievable through the use of adjustable power resistors and adjustable transformers. These techniques have been employed in sewing shops, drilling machines, and a variety of other applications. The issue with those speed control technologies has been that they are large, expensive, inefficient and difficult to regulate from a remote place. The high peak to peak current in particular, results in low motor efficiency and the resulting highbrush temperature limits motor lifetime. Significant benefits are realized when operating in DC mode. The motor's RMS and peak to peak current are lower, lowering iron losses and brush temperature. Operating in DC mode allows for reduced motor size and increased motor lifetime. Furthermore, the magnetic constriction of the motor core and torque ripple are minimized, as is the 100Hz noise. In this project, we will operate our DC motor. This project provides GSM (SMS) to anyone who wishes to regulate the speed of a DC motor. By implementing the approach, the speed of the DC motor is regulated by sending SMS. The microcontroller is used to control the system. [7]

Global System for Mobile Communications:

The Global System for Mobile Communication (GSM) is a digital cellularcommunication standard that is universally recognised. GSM, or the Global technology for Mobile Communications, is a digital cellular communications technology that has swiftly acquired acceptance and market share globally, despite its origins in Europe. GSM includes several advanced services and capabilities, in addition to digital transmission, such as ISDN compatibility and worldwide roaming in other GSM networks. GSM's sophisticated features and design have established it as a paradigm for future third-generation cellular systems like UMTS. [8]

REVIEW OF LITERATURE

DC motors are classified into three types: series motors, shunt motors, and compound motors. Internally and externally, all three types of dc motors are nearly identical. The fundamental distinction between the motors is the arrangement of the field coil and armature coil circuits. The three most frequent speed control methods are flux adjustment, usually by field current control, resistance adjustment connected with the armature circuit, and armature terminal voltage adjustment (Fitzgerald A.E etal, 1996). [9]

The goal of this project is to create a speed control system for a DC motor utilisingGSM technology. This system will be able to turn ON and OFF the DC motor regardless of distance, as well as adjust the speed of the DC motor. We can remotely access the operations of a DC electric motor using GSM technology. Lighting, security, telecommunications, access and safety, information and entertainment systems, and thermal comfort systems are all included in the DC electric motor control system for Industrial Applications (Moazzem I. etal 2012). [10]

Aside from switching and speed control of the DC electric motor, the system is used for automation of industrial applications, giving the user auxiliary control and allowing the user to execute any operation from a distant location, making this system truly global (Thomas E.K., 2000). 2. A microcontroller is used to control a compound DC electric motor using DTMF in band signaling. A DTMF signaling mechanism will be initiated in order to realize real-time control/feedback. The user initiates speed control "from full Off to full-On" usinga mobile phone capable of generating DTMF. [11]

Objectives:

- This ensures worker safety in the workplace.
- This is a simple way for controlling the speed of a DC motor.
- It can be controlled from a long distance.
- This technology has the potential to save us time and energy.
- It lowers the cost of wiring.

RESEARCH METHODOLOGY

This study's overall design was exploratory. The GSM-based DC motor speed control system is designed to be fast and efficient, with better precision. The proposed project is built with an Arduino UNO microcontroller and Embedded C. To control industrial appliances remotely using a GSM-based system that meetsthe demands and expectations of the user. For ex. We can increase its memory capacity to make it a smart machine. [12]The study introduces a low-cost, secure, ubiquitously accessible, auto-configurable, remotely controlled method for motor automation. The approach outlined in the paper achieved the goal of remotely controlling industrial appliances using a GSM-based system while meeting user needs and criteria.

The GSM technology competent solution has proven to be controlled remotely, toprovide industrial security, and to achieve the goal of controlling multiple industrial appliances remotely using an SMS-based system that meets user needs and expectations. When compared to earlier systems, the GSM technology capable solution has proven to be remotely operated, provides industrial security,

and is cost-effective. [13]

RESULT AND DISCUSSION

DC motors are essential components of industrial and commercial systems. Motors play an important role in a variety of machines. Thus, using SMS message commands to operate motors over GSM allows users to control equipment from anywhere in the world. To build this system, we use an At mega microcontroller circuit, a GSM modem, a DC motor, an LCD display, and the necessary wiring. In configuration/settings mode, the user can first configure a number from which to receive commands.

Following that, the system monitors SMS messages received over the GSM modem. When it receives the message, it checks to see if it came from a registered number. Otherwise, the message is denied. If the number is correct, one system reads the message to verify the command. When the system received the necessary commands, it activated the DC motor to achieve the user-specified motion and speed. As a result, the system can control DC motors over longdistances. [14]

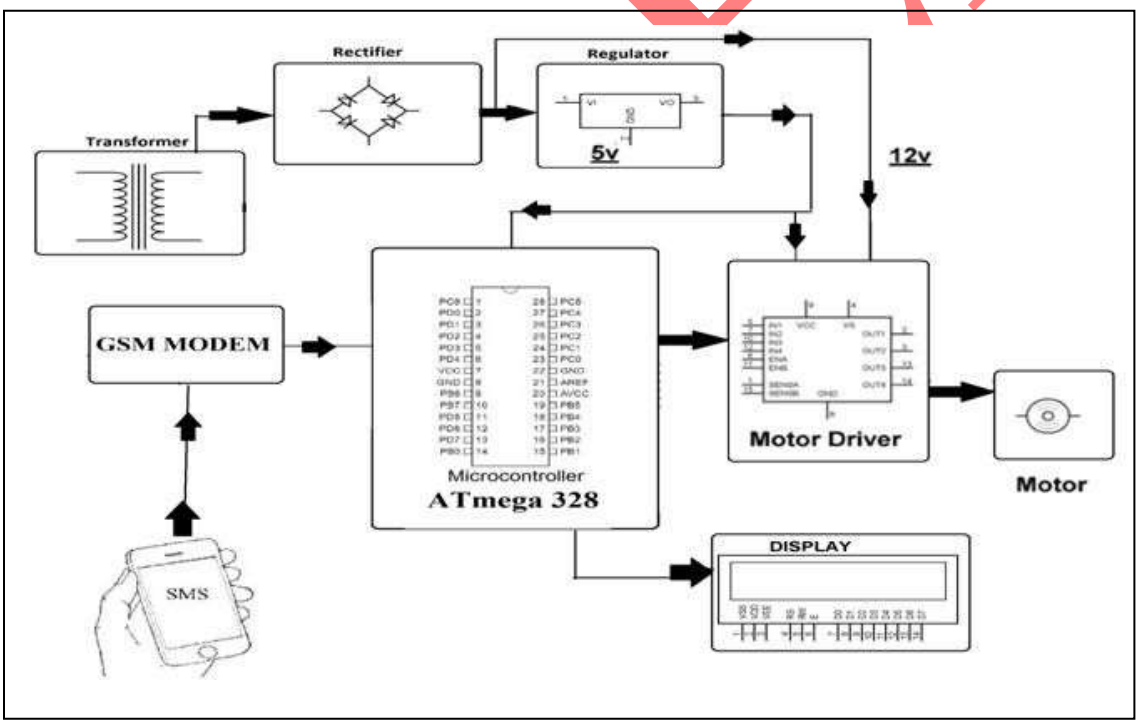

Figure 1: Block Diagram

Hardware Specifications:

1. Transformer
2. Rectifier
3. Regulator
4. GSM Modem
5. At mega Microcontroller
6. Motor
7. LCD Display
8. Resistors
9. Capacitors

Software Specifications:

1. Arduino Compiler
2. Programming Language: C

The Global System for Mobile Communication (GSM) is a wide-area wireless communications system that provides voice, data, and multimedia communication services via digital radio transmission. [15]

A GSM system manages communication between mobile phones (stations), base stations (cell sites) and switching systems. Each GSM radio channel is 200 KHz broad and is further divided into frames of 8 time slots. GSM was first known as Group Special Mobile. Mobile telephones (mobile stations), radio towers (base stations) and interconnecting switching systems comprise the GSM system. A GSM radio system is depicted in this diagram.

This diagram depicts the GSM system, which includes mobile communication devices that communicate with other mobile telephones, public telephones or theInternet via base stations (BS) and a mobile switching centre (MSC). This figure depicts how the MSC links to customer databases. This example demonstrates that mobile devices in the GSM system can comprise mobile phones as well as data communication devices such as laptop computers. [16]

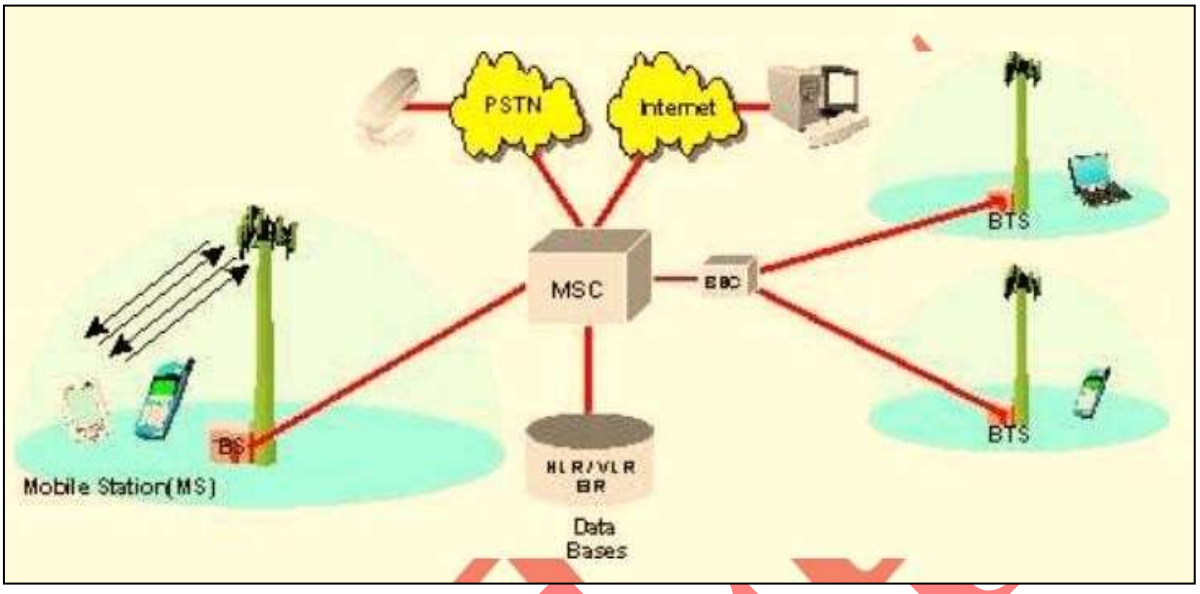

Figure 2: Global System for Mobile Communication - GSM System Diagram

The GSM system employs a single type of radio channel, as seen in this diagram. Each GSM radio channel has a frequency bandwidth of 200 KHz and a data transfer rate of around 270 kbps. Each radio communication channel is divided into eight time slots (0 through 7 in this example). This graphic depicts that a simultaneous two-way voice communication session necessitates at least one radio channel communicating from the base station to the mobile station (referred to as the forward channel) and one channel communicating from the mobile station to the base station (referred to as the reverse channel). This example also demonstrates that certain radio channel capacity is utilised to carry speech (traffic) information, while others are used to transfer control messages.

This project includes the following components: a microcontroller SIM 800 GSM module, an LCD display, a proximity sensor, a BLDC motor, an Arduino UNO kit, and a power supply kit. The power supply kit is used to lower the voltage requiredby the Arduino kit, which requires a 5V DC source. The UART (Universal asynchronous receiver transmitter) microcontroller connects GSM to Arduino.The LCD (16:2) is linked to an Arduino digital pin. The entire procedure will be exhibited on an LCD screen.

The microcontroller module is linked to the speed control mechanism. The pulse width modulation technique is used to modify the pace. PWM is a basic and frequently used method for controlling the speed of a brushless DC motor. GSM stands for Global System for Mobile Communications. The GSM SIM 800 was used. We may send and receive SMS messages via the microcontroller by utilising AT's command. [17]

Figure 3: ARDUINO UNO [22]

The Arduino is the most popular programmable microcontroller. It has a 5 volt operating voltage, 14 digital input output pins, 6 PWM output pins, and 6 analog inputs. It is also possible to provide a USB connection. [18]

It serves as the overall system's brain. It has a faster clock speed of 16 MHz and a more powerful RESET circuit. It has a ceramic resonator with a frequency of 16 MHz [19]

The results obtained are discussed as follows:

Figure 4: The Control System with the Motor

The microprocessor generates a fixed-frequency pulse, which is supplied to the transistor's base. A transistor serves as a switch in this case. The motor's output voltage is determined by the amount of time the transistor is turned on. The longer the transistor is turned on, the higher the voltage produced. For back e.m.f. protection, a freewheeling diode is utilised.

Table 1 depicts the variation in DC voltage across the load as a function of PWM duty cycle modification. A low voltage changeable speed controller for a pump is used here to increase flow at greater pressures. The motor parameters are 48 volts, 1800 rpm, 78 amps DC motor powered by rectified alternating current. [20]

Table 1: Motor terminal voltage at various duty cycles

Reference Speed Setting	Reference PWM Duty Cycle	Input voltage (AC)	Voltage dropped across the Load (DC)
0	0 milli-sec (off)	230 volts	0.00 volt
1	0.2 milli-sec	230 volts	45.60 volts
2	0.4 milli-sec	230 volts	46.30volts
3	0.6 milli-sec	230 volts	47.20 volts
4	0.8 milli-sec	230 volts	47.68volts
5	1.0 milli-sec (max.)	230 volts	47.95volts

According to table 1, the reference pulse width modulation (PWM) fluctuates when the reference speed setting changes. The voltage dropped across the applied load (48 volts DC Motor) increases when the reference PWM duty cycle increases consecutively due to a change in the speed setting from one level to another at 230 volts input to the system. The duty cycle, on the other hand, is a function of the motor's speed since it affects the voltage dropped across the load at different speed settings.

The PWM technique can be used to control the speed and direction of a DC motoras needed. The duty cycle is changed in this case to adjust the speed of the motor.Duty cycle is the ratio of 1s and 0s in a cycle. A duty cycle has 256 (0-255) levels intotal. The duty cycle is calculated by adding the ON and OFF times of an average voltage of a PWM pulse. The average output voltage of the motor is 5V. Also, when the motor is ON for 50% of the time and OFF for 50% of the time, the output voltage seen is 2.5V, which is exactly half of the output voltage. The table below shows the average motor output voltage for various percentages of ON time and OFF time. Also, the levels used to stay ON for the entire time. [21]

Table 2: Comparison of average output voltages for different percentages of ON time and OFF time

Sr. No.	ON time(%)	OFF time(%)	Average Output Voltage (V)	Levels required in duty for ON time execution
1.	100	0	5	256
2.	75	25	3.75	192
3.	50	50	2.5	128
4.	25	75	1.25	64

CONCLUSION

It is clear that controlling a motor via SMS provides numerous benefits to the consumer. Controlling the speed of a motor by instructing the MCU will reduce manual labor. This technique will also help to reduce the cost of wiring. The method is fairly simple to implement as long as a specific motor is controlled by PWM, which can be changed with a dual H Bridge driver and coding the duty cycle to accept the appropriate speed keyed by the SMS. This technology is also appropriate for use in businesses and homes.

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