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GSM based speed control of DC motor for Conveyor System

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ABSTRACT

The rapidly advancing mobile communication technology and the decrease in cost make it possible to implement GSM(Global System for Mobile communication) technology in electric drives such as motors. This project deals with development of DC motor's speed and direction control using GSM. The speed of motor is controlled through arduino, such as the user sends the message of required rpm(revolution per minute) using mobile to arduino through GSM then accordingly arduino will change duty cycle using PWM method. Once motor acquires required speed it gives acknowledgement to the user by sending text message to user's mobile. The PWM method using GSM helps in achieving distant wireless control efficiently with minimal cost.The motor is interfaced to Conveyor belt, the speed and direction of conveyor belt also changes as per the speed of motor. Thus the desired speed which is texted by the user, controls the motor remotely and instantaneously.

Keywords— GSM Technology, Distant Communication, PWM method, conveyor belt.

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I. INTRODUCTION

DC motors plays an important role in industrial as well as other commercial systems. Motors are a major part of various machinery. So controlling of motors over GSM allows user to control machines from anywhere in the world using SMS message commands.Atmega microcontroller circuit along with GSM modem, a DC motor and a motor driver is used to make this system. This system first allows user to configure a number from which itreceives commands in configuration/settings mode. After that the system listenstoSMS messages received on the GSM modem. Then on receiving the message it checks if it was received from a registered number. If not, the message is rejected. If the number is valid one, system then reads the message to check the command in it. On receiving proper commands the system operates the DC motor to achieve the user desired motion along with speed. The system thus allows to control DC motors over large distances. The motor is interfaced to conveyor belt, the speed and direction of DC motor then be visually interpreted.

II. LITERATURE SURVEY

The following journals have been helpful to carry out the research regarding speed and direction of DC motor. The important highlights taken from them are mentioned below:

1.Vishal Hinchanlal, Speed control of DC motor using GSM technology, International Journal for Science and Computational Engineering; Volume-1, Issue-1,DEC-2015, E-ISSN-2455-5878.

From this paper the following things are emphasized by the author: The GSM based DC motor speed control system which is fast and efficient with improved accuracy can be designed. The proposed project can be implemented with ARDUINO UNO microcontroller using embedded C-language.
The control of industrial appliances remotely using GSM based system satisfying user needs and requirements are also possible.

2.Sawant Kumar, Vikrant, S.K. Dubey, GSM based DC motor control, International Journal of Advanced

Technology in Engineering and Science, Volume No. 02, Issue No. 05, May 2014.

From this paper the following information is put forth by the authors: The authorsstated that; controller device of GSM based DC motor was effective and less space consuming in the project work undertaken, GSM technology based automatic control system is designed to monitor and controlspeed of associate degree Induction motor/DC motor and conjointly performs necessary operation like begin, stop, reverse the rotation text as and when needed.

III. HARDWAREIMPLEMENTATION

The hardware components are an integral and vital part of any system design. The GSM based speed control of DC motor system requires GSM as a fundamental component in its system architecture. Along with that Atmega based Arduino UNO is also required as a necessary and vital tool.

1.Arduino UNO:

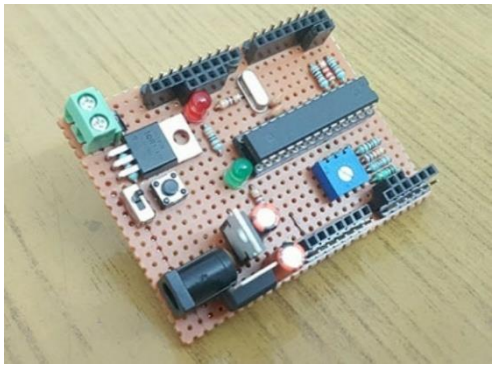

Fig. 1. Arduino PCB

The arduino is most used microcontroller which is easily programmable. It has operating voltage of 5 volt. It has 14 digital input output pins of which 6 pins are PWM output and 6 analog input. The one of the PWM output is given to the motor driver. It can be also provide USB connection. Itis a brain of whole system. Its clock speed is of 16 MHz and is also a stronger RESET circuit. It contains 16 MHz ceramic resonator.

2. GSM SIM800 module:

Fig. 2. GSM module SIM800

GSM stands for Global system for mobile communication. GSM module SIM800 used in this project has standard operating frequency of 800MHz. The GSM module along with nearby modem forms a mobile station. It uses AT(attention) commands to process the SMS message signal.

3. 12V Power Supply:

The power supply used here is dual source power supply. It is a linear power supply giving 12V output. It is necessary for driving the conveyor belt system. In this project 12V output of power supply is given to GSM modem and motor driver respectively.

4. L293D motor driver:.

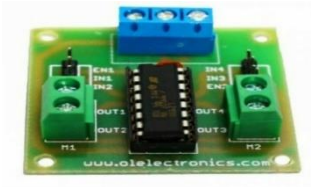

Fig. 3. L293D motor driver

The motor driver used here in this project is of L29xD series. The signal generated by arduino to drive the motor is very weak, the signal strength is increased by this motor driver to drive the motor.In short, it amplifies the signal of arduino and feeds it to motor.

5. 12VDC motor:

Fig.4. 12V DC motor

The DC motor is a electrical drive. This electromechanical component is used to couple it's shaft for conveyor belt system in this project.It's speed is evaluated along with the average voltage at its output in this project.

6. Mobile phone:

Mobile is acting here as a triggering circuit, since it control the speed of motoras required. The mobile sends message to GSM module and GSM then acknowledges the mobile about the speed of motor. Andin this way the cycle continues. The mobile phone along with GSM module forms a mobile station.

7. Conveyor System:

The conveyor system is interfaced at the output of motor. The belt changes it's speed and direction with the confluence of the motor attached. This conveyor belt system gives a perfect way to visually analyse the speed of motor.

IV. SOFTWARE IMPLEMENTATION

The software is implemented in Arduino IDE (Integrated Development Environment). Here in this project programming for speed control of motor is done along with its direction control. Computational language: C, is used to write a program using attention commands which is a necessary part for GSM implementation in any system. The output of this can be sensed in the serial port of arduino IDE. After uploading the program the mobile phone receives SMS about the system readiness. And likewise after that speed can be assigned manually by simply texting the message which is thereby received by GSM module. The module feeds this signal to Arduino which then processes the data according to the written program in IDE and executes in serial port, which is then picked up by motor driver so as to act upon this signal for controlling speed and direction of DC motor. And this is how the program is incorporated by software implementation. Below flowchart gives the sequence of events regarding the SMS flow execution in GSM.

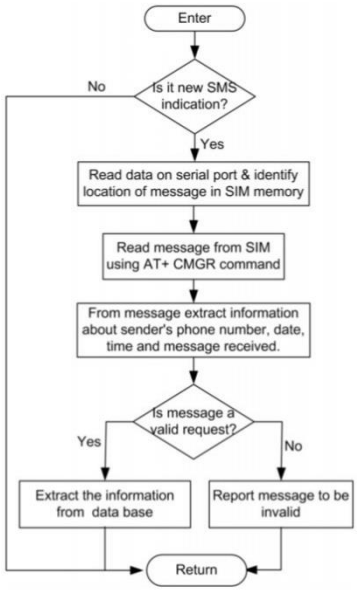

Fig. 5. Flowchart for execution of SMS in GSM.

V. SYSTEM OVERVIEW

Construction of Hardware: The hardware design for this system is simple. It uses GSM module SIM800 as a fundamental component along with Arduino microcontroller. But most importantly, in order to power the system, a power supply which is 12V dual power supply is used. The output of this power supply is given to GSM module along with motor driver L293D. The Arduino is powered through power delivered by L293D motor driver which is approximately 5V. Also the Tx of Arduino is attached to Rx of GSM and Tx of GSM is attached to Rx of Arduino. The Arduino is further connected to motor driver circuit. The motor driver finally is connected to DC motor of Conveyor belt.

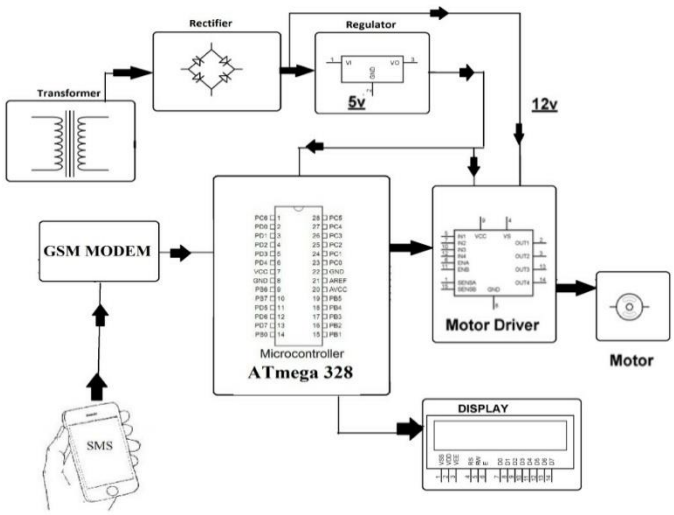

Fig.6. Block diagram of GSM based speed control of DC motor

Working- The working of this system can be explained below: the motor is a vital element for working of a conveyor system. Sometimes the speed and direction of conveyor belt is required to control. That is in fact the speed and direction of motor is necessary to control in order to facilitate the working of conveyor system. The working mechanism is explained below-when the program is uploaded in arduino, the mobile phone receives message about the 'ready' status of the system. Likewise the speed can be manually texted in the form of rpm which is SMS backed to the GSM system. The SMS texted by user or mobile phone is picked by GSM which sends it further to arduino. The arduino processes this information and sends the output signal in the PWM form to motor. But for motor to act, it requires maximum strength in the form of current and voltage to function. This added strength for weak arduino signal is provided by motor driver which is interfaced in between the arduino and the DC motor. The motor receives signal in the form of pulses. Here the PWM or pulse width modulation phenomenon is induced by arduino alongside driver for motor to control it's speed and direction. The motor is further attached to conveyor belt which is driven by the whole action performed by the motor with which it is attached.

VI. EXPERIMENTAL RESULTS

The speed and direction of DC motor can be controlled as and when required using the PWM technique. Here the duty cycle is altered to change the speed of motor. Duty is a proportion of 1's and 0's in a cycle. There are total 256(0-255) levels in a duty cycle. The total duration of ON time and OFF time of an average voltage of a PWM pulse

gives the duty cycle. The average output voltage at the output of motor is 5V.Also when motor is 50% time ON and 50% time OFF, then the output voltage observed is 2.5V which is exactly half of the output voltage i.e., 5V. The following table gives information regarding average motor output voltage for different percentages of ON time and OFF time. And also about the levels used to stay for totalON 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

Table. 1. Comparison of average output voltages for different percentages of ON time and OFF time.

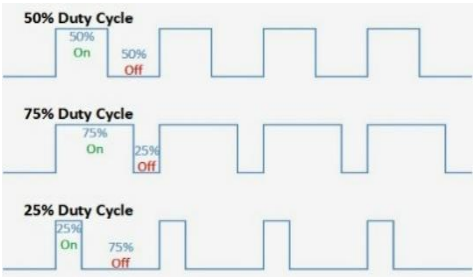

Fig. 7. Duty cycle for different percent of ON time and OFF time

VII. CONCLUSIONS

Based on the observation for different ON time and OFF time it can be concluded that the desired speed and direction control of DC motor can be effectively done by simply texting the SMS using mobile phone. Also the circuit requires less space and can be used in space constrained applications. The Conveyor Systemwhich is attached to the motor also experiences speed and direction variations instantaneously; regardless whether the users is around or not. Also in future this technology of speed control can be incorporated in many devices especially smart devices where control is required to be done remotely and instantaneously.

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