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# Design and Implementation of DC Motor Control using SCADA System

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**Abstract**: Supervisory Control and Data Acquisition (SCADA) systems are widely used in industrial control processes. SCADA focuses on the supervisory level, it is a purely software package that is positioned on top of hardware to which it is interfaced. The main purpose of this paper is to implement the hardware components for the controlling DC motor process and to interface between master station and control unit for controlling the data. It also concentrates on the design in terms of their architecture and their interface to the process hardware due to increasing usage of a different level of control system which has a different voltage. The Pulse Width Modulation (PWM) used as switching to control the speed of the DC motor.

**Keywords:** Supervisory Control and Data Acquisition (SCADA), DC motor, Pulse Width Modulation (PWM).

## I. LITERATURE REVIEW

### SCADA system

SCADA is the technology that enables a user to collect data from one or more distant facilities and or send limited control instructions to those facilities[1]. It is mainly implemented by SCADA software to apply for controlling and monitoring of a system. SCADA system consists of one or more remote terminal units (RTUs) or programmable logic controllers (PLCs) connected to a several devices i.e sensors, actuators, switches, motors, lamps, etc. It applies interfacing sever protocol when needed between the SCADA software and the hardware process

### DC MOTOR CONTROL SYSTEM

The idea was first implemented in university tun Hussein onn Malaysia.The idea caught our minds and we decided to develop this project which can control the speed of dc motor and increase usage of different voltage level for manufacturing system. “speed control of dc motor” by Menaka Dubey explains the modeling and analysis of dc motor with classical method of speed control.

## II. INTRODUCTION

Supervisory control and data acquisition (SCADA) is an industrial control system which is used in many modern industries like energy, manufacturing, power, water transportation, etc. SCADA systems organize multiple technologies that allows to process, gather and monitor data at the same time to send instructions to those points that transmit data. In today’s world, almost anywhere you can observe SCADA systems, whether it’s a waste water treatment plant, supermarkets, industries or even in your home. SCADA systems range from simple to large configurations. Most of the SCADA applications use human machine interface (HMI) software that permits users to interact with machines to control the devices. HMI is connected to the motors, valves and many more devices. SCADA software receives the information from programmable logic controllers (PLCs)or remote terminal units (RTUs), which in turn receive their information from the sensors or inputted values which we have given manually. SCADA in a power system is used to collect, analyze and monitor the data effectively, which will reduce the waste potentially and improve the efficiency of the entire system by saving money and time. The main objective of this paper is to design SCADA interface and implement the hardware component for controlling the DC motor with various speed. Through SCADA, user able to control and monitor the motor speeds in real-time.

## III. WORKING

Consider a microcontroller is generating the control signal with comparison of feedback signal and reference signal (desired speed) to regulator block is to compares the current feedback signal and reference current signal generated from microcontroller and finally generate a signal for Dc drive.

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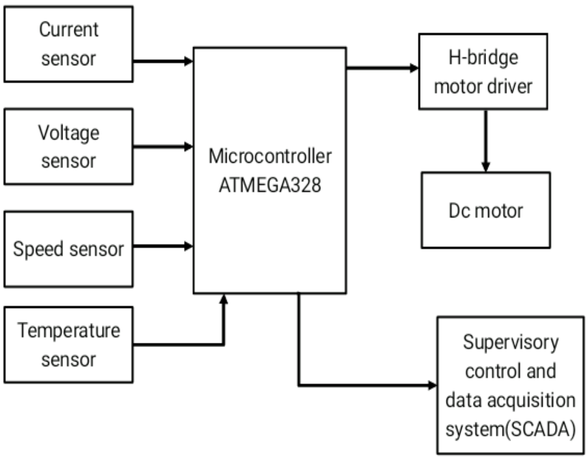
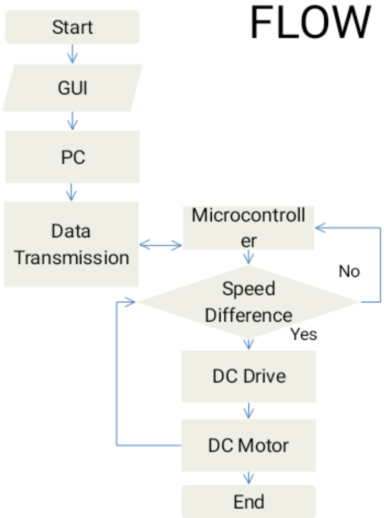
BLOCK DIAGRAM




Now DC drive run the DC motor at reference speed. Figure2showstheconfigurationoftheoverallSCADAsystem. This system is divided into three stages which are master station, control unit and motor control. The master station communicates with microcontroller through RS-232cable. OmronCQM1HmicrocontrollerisusedasacontrolunittocommunicatewithSCADA. TheSCADAsystemconsistsoftwowindowswhichdevelopusingGraphicalUserInterface(GUI).Firstwindowisthecoverpageandthesecondis Definitionwindow.TheDefinitionwindowwillshowstheinteractionbetweenthewholesystems.Throughthiswindow,usercanmonitorandcontrolthespeedoftheDCmotor.AddressofthePLCmustbeassigntotheSCADAsystem.SCADAwillcontinueupdatethewindoweverycycle.

FLOW CHART




The hardware part is consisting of voltage relay circuit.It forms by electronicscomponentssuchasrelay,resistoranddiode.Thecircuitactsasaswitchwhichinterfacesbetweenmicrocontroller andHbrige motor driver.Thisisduetodifferentvoltagelevelsbetweenmicrocontroller andHbridge motor driver.Motor driveroperatedat5VDCandmicrocontrolleroperatedat24VDC.Theoutputofthemicrocontrollerisconnectedtotheinputoftherelaycircuit.Therelaycircuitwillstepdownthevoltageto3.6VDCandtheoutputconnectedtotheinputofthemotordriver.Therelaycircuitdesignedin6parallelarrangementswhichrepresent6-bit.

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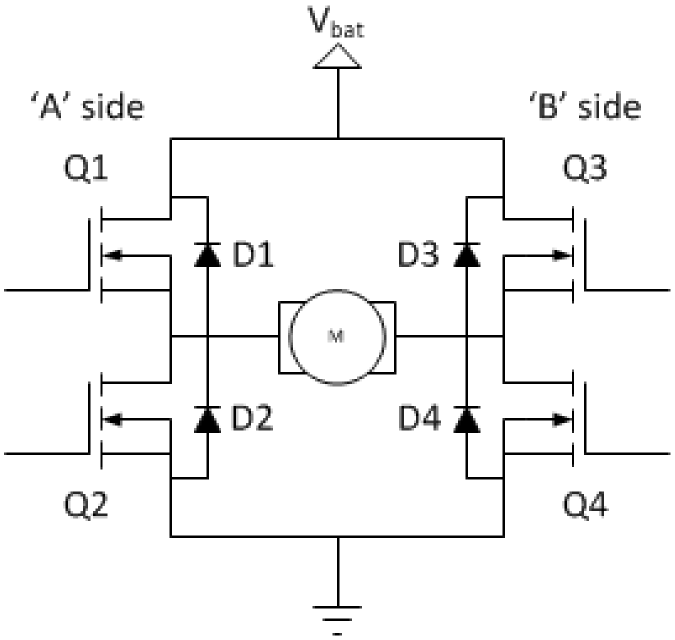
## IV.H-BRIDGE MOTOR DRIVER

In general an H-bridge is a rather simple circuit, containing four switching element, with the load at the center, in an H-like configuration:

The switching elements (Q1-Q4) are usually bi-polar or FET transistors, in some high-voltage applications IGBTs. Integrated solutions also exist but whether the switching elements are integrated with their control circuits or not is not relevant for the most part for this discussion. The diodes (D1-D4) are called catch diodes and are usually of a Schottky type.The top-end of the bridge is connected to a power supply (battery for example) and the bottom-end is grounded.In general all four switching elements can be turned on and off independently, though there are some obvious restrictions.Though the load can in theory be anything you want, by far the most pervasive application if H-bridges is with a brushed DC or bipolar stepper motor (steppers need two H-bridges per motor) load. In the following I will concentrate on applications as a brushed DC motor driver.




The basic operating mode of an H-bridge is fairly simple: if Q1 and Q4 are turned on, the left lead of the motor will be connected to the power supply, while the right lead is connected to ground. Current starts flowing through the motor which energizes the motor in (let's say) the forward direction and the motor shaft starts spinning.If Q2 and Q3 are turned on, the reverse will happen, the motor gets energized in the reverse direction, and the shaft will start spinning backwards.In a bridge, you should never ever close both Q1 and Q2 (or Q3 and Q4) at the same time. If you did that, you just have created a really low-resistance path between power and GND, effectively short-circuiting your power supply. This condition is called 'shoot-through' and is an almost guaranteed way to quickly destroy your bridge, or something else in your circuit.While modeling DC motors is a complicated topic, one that you can read on extensively here, for this article, let's just start with a very simple model! This model will not be useable for control applications, where you try to electrically compensate for the effects of mechanical components. The main assumption in the model introduced here is that the mechanical time-constants in your system are much higher than the electrical ones, in other words we can consider the shaft speed to be constant for our analysis.

A DC motor is an energy conversion device: it takes electrical energy and turns it into mechanical energy. When operated as a generator, it does the opposite: converts mechanical energy into electrical.

In this very simple motor model, the mechanical parameters are completely ignored. On the electrical side, the motor basically contains a number of inductors, that move in a magnetic field. The inductors themselves of course have an inductance, and some internal resistance. Their movement in the field will generate a voltagecalled generator voltage and denoted by Vgacross the inductors.

## V. ADVANTAGES

1. Due to timely recognition of faults, equipment damage can be avoided.
2. Continuous monitoring and control of distribution network is performed from remote locations.
3. Saves labor cost by eliminating manual operation of distribution equipment.
4. Reduce the outage time by a system monitoring and generating alarms so as to address problems quickly Reduces the labour cost by reducing the staff required for meter reading.
5. Facilitates the view of historian data in various ways.

## VI. APPLICATION

1. Industrial drives.
2.Critical Medical loads
3.Electric vehicles
4.Conveyors belts
5.Robotics

## VII. CONCLUSION

ThispaperhasillustratedaimplementationofcontrolunitusingSCADAtocontrolthespeedofDCmotor.Motor driver usedtoproducethePWMswitchingsignaltodrivetheDCmotor.Itprovidedflexibilitywhichiseasetoprogrammedandreducethesizeofthehardware.Thissystemisdesignedforthemanufacturingsystemduetoincreasingusageofdifferentvoltagelevel.

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