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SPEED SYNCHRONISATION OF MULTIPLE MOTORS BY USING ARDUINO

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Abstract

In this project, a new control approach for real-time speed synchronisation of multiple motors with single microcontroller. During speed acceleration and load changes is developed, the control strategy is to stabilise speed tracking of each motor while synchronising its motion with other motor's motions so that differential speed errors among multiple motors converge to zero.

In industry many processes required speed synchronization of more than one motors involved in the process. Speed control of motor is very important especially in the fields including industrial applications, robotics, textile mills, etc. In all these application motor speed synchronization is invigorating in conveyor belt driven by multiple motors. Sudden changes in load cause hunting and oscillatory behaviour in DC machine. This behaviour can be harmful to the process. There are so many methods which are used for controlling the DC machines. In earlier days speed synchronisation was achieved by Master-Slave technology. In our project for PWM generation microcontroller (Arduino 2560) is used. The ADC is available in microcontroller chip which create feedback loop. This ADC checks the voltage level of the motor and accordingly the voltage level of the motor can be maintained at a fixed level. A driver circuit is used to drive the motor. Hence, a closed loop motor speed control circuit is designed and the total amount of power delivered to the motor is varied depending on load conditions. In this technique, the regulation of motor's speed is achieved by changing the voltage of the motor which is adjusted by the duty cycle of PWM.

Index Terms: *Speed synchronisation, Arduino, etc.*

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1. INTRODUCTION

There are distinctive sorts of motors utilized as a part of ventures, preparing mills and so forth. The fundamental issue is to keep up the distinctive speed (RPM) of various motors i.e. control over the speed for each motor.

To overcome the problem of control over speed for different motors we designed a single controller which can vary the different motor's speed at a time from one place. It decreased the use of different controllers to control the speed for different motors. In this project we are dealing with speed (RPM) of motor which has a variable water supply. Our aim is to provide a constant flow of water at output side of motor whether the flow of water at input has increased or decreased. Pumping of motor is controlled using motor speed controller, accordingly to the change in flow which in turn increases or decreases the motor speed. There is a facility of relay used to switch off the motor when the water flow goes below the minimum level to prevent from burning or damage.

2. METHODOLOGY

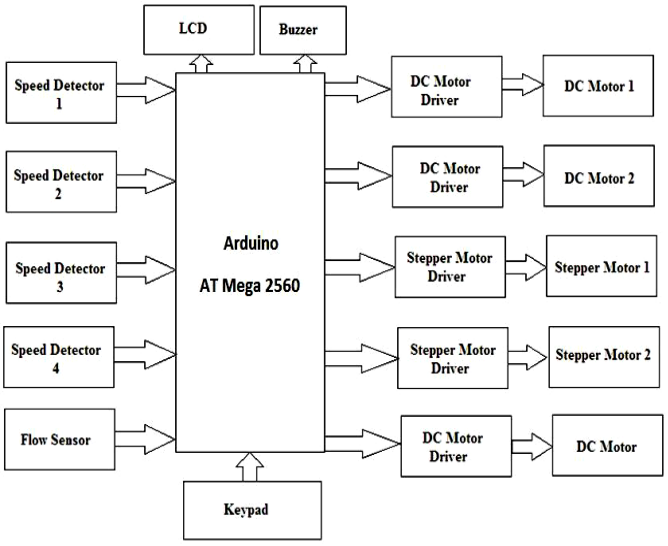

Fig-1: Block Diagram

3. HARDWARE COMPONENTS

1 Arduino AT Mega2560 controller
2Speed sensor
3 DC Motor and Stepper Motor
4 DC Motor and Stepper Motor Driver
5 Keypad
6 LCD
7 Buzzer

3.1 Arduino AT Mega2560 controller

The Arduino Mega 2560 is a microcontroller board in light of the ATmega2560. It has 54 digital i/o pins (of which 14 can be utilized as PWM outputs), 16 simple data sources, 4 UARTs (equipment serial ports), a 16 MHz crystal oscillator, an ICSP header, a power jack, a USB connection, and a reset key. It contains everything expected to support the microcontroller; just associate it to a PC with a USB link or power it with an AC to DC connector or battery to start. The Mega is perfect with most shields designed for the Arduino Demeaned or Decimal

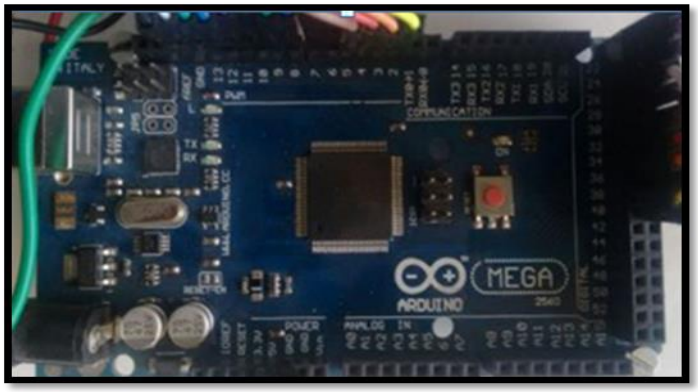

Fig- 2: Diagram for Arduino AT Mega2560 controller

Table- 1: Arduino AT Mega2560 controller Parameters

Parameter Name	Value
Microcontroller	AT Mega 2560
Operating voltage	5 V
Input Voltage (Recommended)	7-12 V
Input Voltage (limits)	6-20V
Digital I/O Pins	54 (of which 14 provide PWM output)
Analog Input pins	16
DC Current per I/O Pin	40mA
DC Current for 3.3 V Pin	50Ma
Flash Memory	256KB o which 8Kb used by bootloader
SRAM	8KB
EEPROM	4KB
Clock Speed	16MHz

ADVANTAGES OF ARDUINO

- Automatic (Software) Reset
- USB Over Current Protection
- Physical Characteristics and Shield
- Compatibility and easy to use

3.2 DC MOTOR SPECIFICATION- (Model#25GA370D12)

Table-2: DC motor specification

Voltage	12.0VDC
Output Speed	200 +/- 10% RPM
Output current	=< 50 mA
Rotation Output	CW / CCW
Noise	No Gear Noise
No-Load Current	No Gear Noise
Rotation	CW
Motor POWER	0.370W

3.3 STEPPER MOTOR SPECIFICATION (Model no. SM-42BYG011-25)

Table-3: Stepper motor specification

Make by	NEMA
Voltage	12V
Current	0.33A
Step angle	1.8° (200 steps for one rotation)
Shaft	Ø 5 mm
Length	40mm

3.4 DC MOTOR AND STEPPER MOTOR DRIVER (L293D) SPECIFICATION

Table-4: DC motor and stepper motor Driver (l293d) specification

Wide Supply Voltage Rang	4.5 V to 36 V
Separate Input-	Logic Supply
Internal -	ESD Protection
Output Current -	1 A Per Channel (600 mA forL293D)
Peak Output Current-	2 A Per Channel (1.2 A for L293D)

4. HARDWARE IMPLEMENTATION

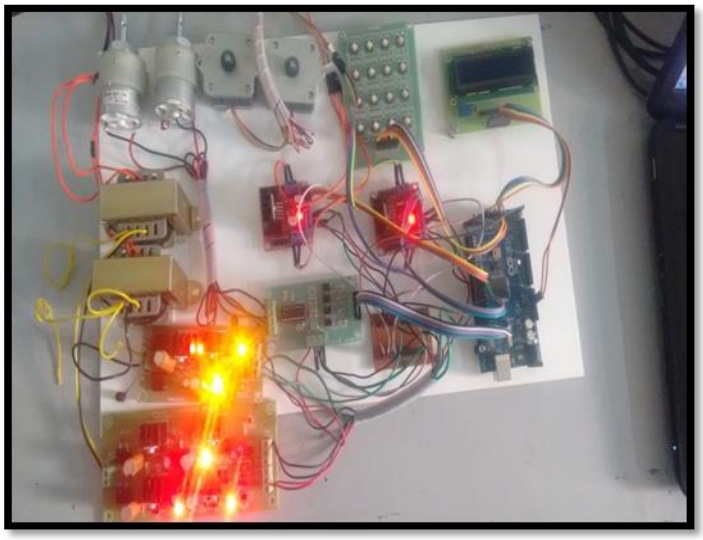

Fig-4:Hardware implementation

5. HARDWARE RESULTS

Initially the dc motors and stepper motors are at standstill position. When values of speed is entered using keypad, both the dc motors starts to rotate at synchronous speed of 200rpm. The entered value is observed in Arduino/Genuine Mega 2560 software as seen in below figure…
The synchronous speed is further changed from 200 rpm to 80rpm as indicated in below figure

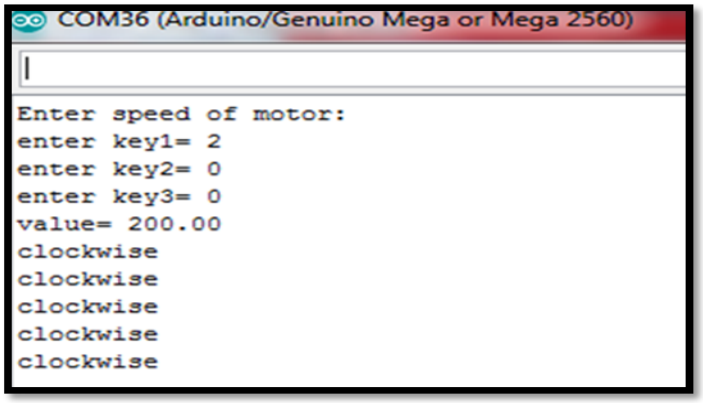

Fig-5: Output of Speed Synchronization

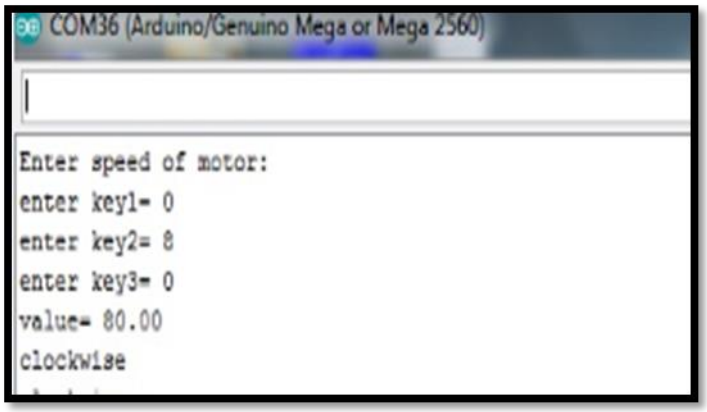

Fig-6: Output of Speed Synchronization

6. CONCLUSION

In earlier day's each motor in process industry was controlled by using separate microcontroller. So time required for achieving speed synchronization is more and circuit is very complex. Instead of that using single microcontroller (Arduino AT mega2560) we can achieve speed synchronization of motors easily and also complexity of circuit is reduced

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