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MICROCONTROLLER BASED SPEED SYNCHRONIZATION OF MULTIPLE DC MOTORS IN TEXTILE APPLICATIONS

[1]RAKSHA A R, [2]KAVYA B, [3]PRAVEENA ANAJI, [4]NANDESH K N

[1,2]UG student, [3,4]Assistant Professor
Department of Electrical and Electronics Engineering
Jain institute of technology, Davanagere, Karnataka, India

Abstract*: Industrial environment in day to day life demands for the synchronization between multiple devices, so there needs to be a common synchronization between all these devices. Multiple Motors setup has vast application in industries. The application can be in textile mills, rolling mills, paper mills, steel industries and robotics. In textile mills many processes requires speed synchronization of more than one motor involved in the process. Rolling of cloths must be synchronized with the speed of weaving spindle to avoid damage and synchronization of motor speed is vital in conveyor belt driven by multiple motors. The synchronization is done by using microcontroller chip which controls the master slave, whose speed is followed by the other motors which all have to be synchronized. Heavy load variations may cause hunting or oscillatory behavior in dc machines. In this project wireless technology for speed synchronization are used by using Radio Frequency module. Conventional processes are synchronized through mechanical transmission system consists of pullers, line shaft gears etc. among the available software mechanisms master-slave synchronization is widely used technique. By implementing this concept the manpower and time can be saved. Finally this proposal provides higher efficiency and less maintenance operation in industrial sector.

***Keywords*: microcontroller, RF module, DC motor**

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1. INTRODUCTION

DC motors have been commonly used in many industrial applications such as steel rolling mills, electric cranes, electric vehicles and robotic manipulator due to wide, precise, simple and continuous control characteristics. Generally, a high performance motor drive system should have load regulating response and good dynamic speed. DC drives, because of their ease of applications, reliability, simplicity and favorable cost have been a backbone of industrial applications. In many applications motors should be precisely synchronized to give the desired performance.

Motor control constraints:

- Unpredictable and variable inputs
- Unknown parameters
- Non linearity in dc motors
- Propagation of noise
- Load dynamic changes

Need of speed synchronization:

The non-linearity in a DC motors is the major problem in applying a conventional control algorithm. Mainly, saturation and friction are the non linear characteristics of DC motor which degrade the performance of conventional controllers. To reduce these effects many advanced model based control methods such as model reference adoptive control and variable structure have been developed.

In textile mills where all the motors run at same speed to draw the clothes, so that balanced tension can be achieved to avoid the damage of cloths.

Thus, if a particular speed is set in the transmitter then all the other motor speed would me matched to the same speed of the main motor. However, it has controllable, highly efficient, cheap and higher current carrying capability of static power converters has brought major change in the performance of electrical drives.

2. BLOCK DIAGRAMS:

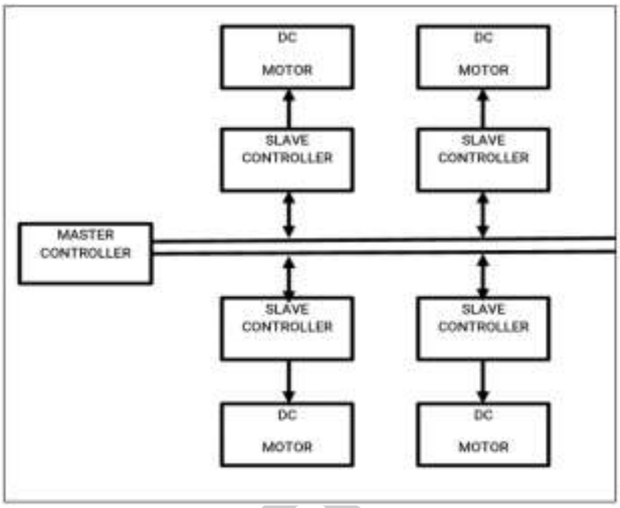


figure1: synchronized motor controller

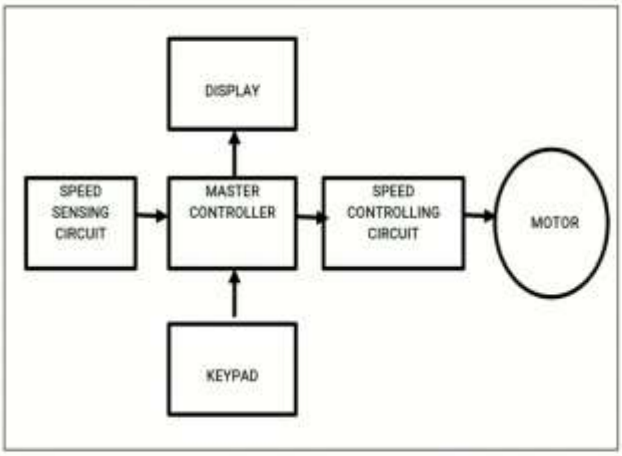


figure2: master system

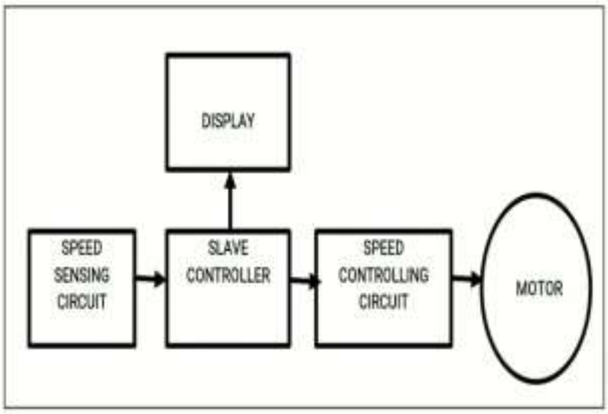


figure3: slave system

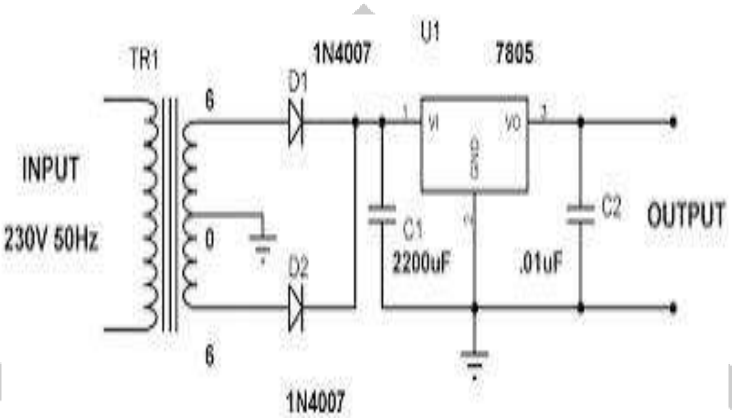
System description:
Synchronization between two motors is proposed in this project. The synchronization between multiple motor is done by using microcontroller.
In this method master controller is followed by two slave controllers. The required speed is set in master controller and it will communicate with two slave controllers. Speed sensing is done by sensors or detectors and speed controlling is achieved by using IGBT or SCR.
Required speed can be entered with the help of keypad to the master controller, then that will sends to the slave controllers then motors of slave achieves the particular speed of the master. Speed can be measured with help of sensor then the measured speed will be displayed on LCD.

3. METHODOLOGY:

230V, 50HZ AC supply is applied to the system, then by using step-down transformer 230V supply is stepped down to 12V ac supply and then by using rectifier it is converted to 12V DC supply. AC ripples are eliminated by using filter and that will be given to the input pin of 7805 regulator. This regulator gives the variable dc to constant 5V DC which is given to microcontroller.
In the transmitter side, required speed is entered using a keypad which is interfaced with the microcontroller.
The transmitter side motor is start rotating at entered speed and the speed is sensed by an IR pair and sensed speed will be displayed on LCD. Then the speed will be fed to the slave microcontroller. Microcontroller produces PWM signals according to the entered speed, finally the motor is adjusted to the required speed. By using opto coupler motor is interfaced with microcontroller which drives the motor.
When the transmitter is turned on, IR sensor senses the speed and is fed into the slave microcontroller wirelessly. Then all the slave motors run at the same speed of the master motor. At last, the synchronization between the all motors achieved.

4. COMPONENT DESCRIPTION:

➢ POWER SUPPLY SYSTEM:



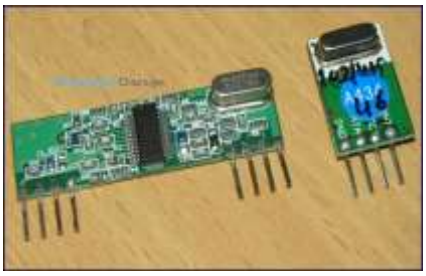
A system or device that supplies electrical energy to an output load or group of loads is known as power supply unit. Here power supply system is designed to produce fixed dc voltage of pre-determined value across load terminals irrespective of ac mains fluctuations.

The circuit constitutes following components

- Transformer
- Rectifier
- Filter
- Regulator

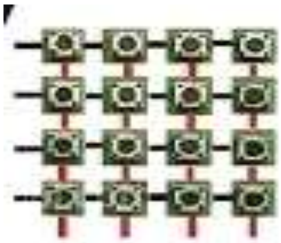
Transformer: It is used to step down the 230V Ac supply to 12V AC supply.
Rectifier: It is used to convert 12V AC supply to 12V DC supply.
Filter: It is used to remove the AC ripple contents.
Regulator: used to convert variable 12V DC to constant 5V DC.

➢ RF MODULE:



The RF module, as the name indicates operates at radio frequency. The frequency varies in between 30 kHz and 300 GHz. An RF module is a small electronic device used to receive or transmit radio signals in between two devices. The embedded system is often used to communicate with another device wirelessly. RF module consists of two pairs i.e., RF transmitter and RF receiver, which are operates at 434 MHz. It is widely used in many applications, since it is fairly inexpensive, grater efficient and to remove signal variations and noise.

- **KEYPAD:**

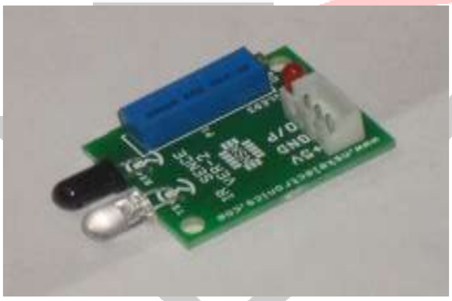


In our project we are using a keypad of 4*4 boards, consisting of 16 push buttons arranged in 4*4 matrixes to form standard alphanumeric keypad. Some embedded systems that require user input in the form of numbers i.e. decimal or hexadecimal can use this board as a solution. Typically, one port pin is used to read a digital input into the controller. When there are a lot of digital inputs that have to be read, it is not possible to allocate one pin for each of them. This is when a matrix keypad arrangement is provided to reduce the number of pin count. Hence, the number of pins that are required to interface given number of inputs decreases with increase in the order of matrix.

- **OPTO COUPLER:**

Opto coupler or opto isolator is a safety device that transfers electrical signals between two isolated circuits by using light signals. Opto couplers are mainly used in delicate systems. Opto isolator functions as a galvanic isolation component. That is it maintains the connection between two devices without any direct conduction. The main function of an opto-coupler is to block voltage transients and high voltages, so that a surge in one part of the system will not destroy or disrupt the other parts.

- **IR SENSOR:**



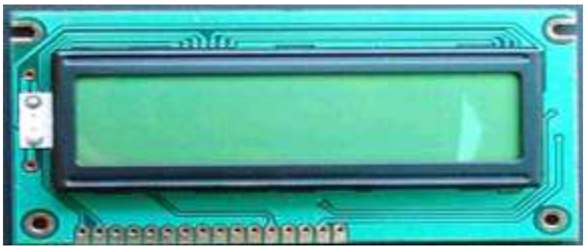
The main concept of IR (infrared) obstacle detection is to transmit the IR signal in a direction and a signal is received at the IR receiver when the IR radiation bounces back from a surface of the object.

- **DC MOTOR:**

fig: 12v 150 rpm Geared DC Motor

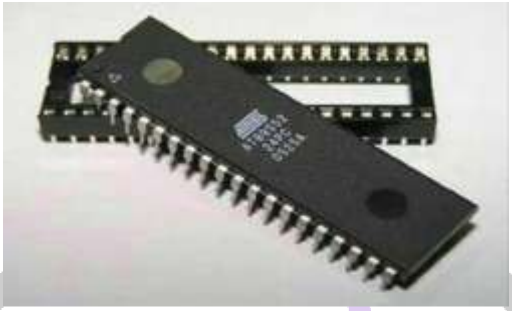
Here we are going to use 3 geared dc motor. The geared dc motor is a low cost and high quality motor. In order to ensure longer life and to reduce wear and tear, we use brass gears and steel pinions. DC motors have been commonly used in many industrial applications such as steel rolling mills, electric cranes, electric vehicles and robotic manipulator due to wide, precise, simple and continuous control characteristics. In many applications motors should be precisely synchronized to give the desired performance.

- **LCD DISPALY:**



LCD (liquid crystal display) is a device used for displays in notebook and other smaller computers. Compared to LED and gas display displays LCD’s consumes much less power, because it works on the principle of blocking light rather than emitting it. Here we used display measured speed of the dc motors.

- **MICROCONTROLLER:**

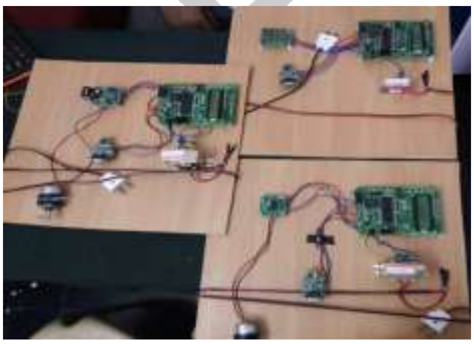


In this project we are using AT89S52 microcontroller chip. A microcontroller is a small computer on a single integrated circuit. In modern terminology it is a system on a chip. Microcontroller is a self-contained system with peripherals, memory and a processor that can be used in a embedded system.

Features

- Working voltage: 4.5V ~ 5.5V
- 12 clocks per machine cycle
- General 8052 family compatible
- 32K byte on chip program flash
- 1024 byte on-chip data RAM
- Three 16 bit Timers/Counters
- Four 8-bit I/O ports
- A serial I/O port
- One Watch Dog Timer
- Full duplex serial channel

5. EXPERIMENTAL SETUP:



The above experimental setup shows one transmitter module and two receiver modules. The control of a dc motor involves the design and implementation of microcontroller based control unit to use wireless RF communication. Transmitter and receiver pair works based on master slave method.

An RF transmitter module transmits the radio wave and modulates that wave to carry data. Transmitter module usually implemented along with the microcontroller which will provide data to the module which can be transmitted. RF transmitter is

provided with regulatory requirements which dictate the maximum allowable transmitter power output, band edge requirement and harmonics.
An RF receiver module receives the modulated RF signals from transmitter through antenna. Usually super regenerative receiver modules are widely used because of their low cost and low power design. RF receiver follows the RF transmitter speed upon by giving the input from the keypad. By conducting this experiment we can obtain the synchronization of speed between multiple motors in various industrial applications.

6. RESULT AND DISCUSSION:

Sl. no	Main motor speed in percentages (experimental values)	Receiving motor1 speed in percentage (experimental values)	Receiving motor 2 speed in percentage (experimental values)
1	30%	30%	30%
2	60%	60%	60%
3	90%	90%	90%
4	120%	120%	120%

Table: Speed synchronization of 3 motors

The above table shows the speed synchronization results of three motors. According to the transmitter side motor the receiver side two motors adjust its speed and the speed synchronization is done. It is observed that the measured synchronized speed in percentages were accurate with very slight variations, which were nullified once the motor speed was stabilized.

7. CONCLUSION:

In this experimental study, speed of two DC motors can be synchronized easily by adjusting set points. Master controller sets the required speed and interfaced with two slaves. Speed sensing is done by IR sensor. When the data from master controller is sent to the slave controller then that is taken as set point of speed. Hence when system is started the slave microcontroller is trying to achieve the required speed. The keypad entry flexibility provides us easy calibration of the system to compare the different operations. Motors can be synchronized easily by master slave control method. The measured speed will be displayed on the LCD. From this project we can successfully synchronize the speed of multiple dc motors through wireless RF communication in textile mills. The overall experiment is made simple by using wireless technology. Therefore this technique of synchronization can be used in textile industries.

REFERENCES:

[1] A.A.Thorat[1], P.D.Pange[2], V.S.Doijad[3] has proposed in the year 2014. The paper conveysPID (proportional based controller) and fuzzy logic controller (FLC)s. have been developed for speed controller of DC motor.

[2] Rajesh Singh[1], Saurabh Kumar[2], Ravi Kumar[3], and Vivek Kumar[4]. Has published. The paper describes the synchronisation, speed and direction control of DC motor using P.W.M (pulse width modulation).

[3] Dr. Steve C. Hsiung has proposed" THE USE OF PIC MICROCONTROLLERS IN MULTIPLE DC MOTORS CONTROL IN TEXTILE APPLICATIONS" in the year 2007, vol 23, number 0. This paper is designed with modern upgraded technology of PIC µc. Using simple with serial communication protocols in a microprocessor/controller.

[4]AnkurShukla[1], Ankitkumar[2], Anil kumarrajak[3], Vivekkumarsingh[4], Santosh S[5] has proposed in the year 2015. The paper describes the speed control and direction of D.c motor using Master-Slave.