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"SPEED SYNCHRONIZATION OF MULTIPLE BLDC MOTORS IN TEXTILE INDUSTRY USING ATMEGA 328 MICROCONTROLLER"

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ABSTRACT: *Multiple motor setup has vast application in industries. The application can be in textile mills, paper mills and robotics. In these all application the synchronization is must between the motors to perform certain task. Speed synchronization is very essential in these all operation to avoid damage to the product. 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.*

Keywords: *Speed synchronization, textile mills, paper mills, microcontroller chip, master slave.*

INTRODUCTION:

The economic constraints and new standards legislated by governments place increasingly stringent requirements on electrical systems. New generations of equipment must have higher performance parameters such as better efficiency and reduced electromagnetic interference. System flexibility must be high to facilitate market modifications and to reduce development time. All these improvements must be achieved while, at the same time, decreasing system cost. Brushless motor technology makes it possible to achieve these specifications. Such motors combine high reliability with high efficiency, and for a lower cost in comparison with brush motors. In this project motors are wirelessly synchronized to make the differential speed error among multiple motors to zero. One motor acts here as transmitter and rest of all as receivers. So if a particular speed is set in the transmitter then automatically rest of the motors speed would be matched to the same speed of the master slave. A display unit connected with the module will display the full speed in RPM and the observer can enter the required percentage with help of a keypad to obtain the required speed for rest of the motors. Drawbacks of using conveyor belt for speed synchronization, such as the master slave [main motor] will be the hardest to start, stop and maintain smooth motion on the whole process. Due to wireless connection between the motors the motors can be kept in any position it is not necessary as earlier old concept of conveyor belt that the motors should be kept only on parallel series or mixed with each other.

Hardware Requirements: Crystal, RF MODULE, LEDs, Resistors, Capacitors, Diodes, Transformer, Voltage Regulator, IR sensor, MOSFET, Keypad, Transistor, OPTO-isolator, BLDC fan ATMEGA328 Microcontroller.

SYSTEM DESIGN:

PWM Based Automatic Closed Loop Speed Control of DC Motor: Many industries like textile industries, automation industries, and paper mills etc, conveyer belts are often used. These conveyer belts are used to transfer the raw material or the produced material from one place to another. For a feasible operation, the conveyer belt must run at exact speed at all locations. This means motors should run at a synchronized speed.

This demonstrates a prototype to achieve synchronization of multiple motors such that the motors can run exactly at the same speed, as desired by the user. The speed is set for the master motor at the desired rate. Here a RF communication method is used to transmit this speed to the other slave motors, so that those motors can run at the same speed. For each motor, a speed sensing unit is attached to sense the speed. The speed controls of the motors are achieved by each microcontroller connected with a MOSFET.

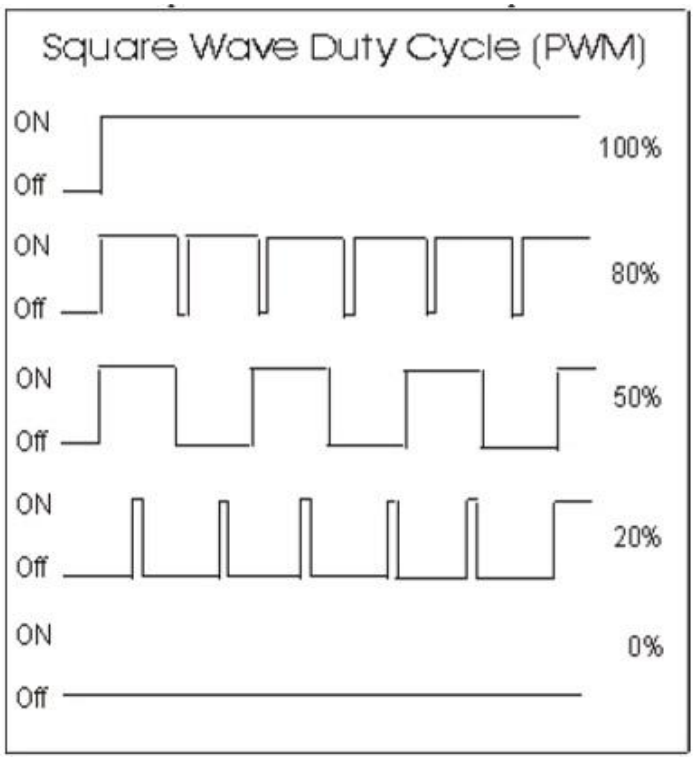

Fig.1: Pulse waveform

I. Difference Between 8051 microcontroller and Arduino ATMEGA 328

Sr No	Parameter	8051	ATMEGA 328
1	Operating Voltage	+5 volt to 6.6 volt	+5 volt to 20 volt
2	Memory	Flash=8kb Ram =256 Bytes	Flash=32Kb Ram= 2Kb
3	Speed of Execution	Less	More
4	Architecture	CISC	RISC

BLOCK DIAGRAM:

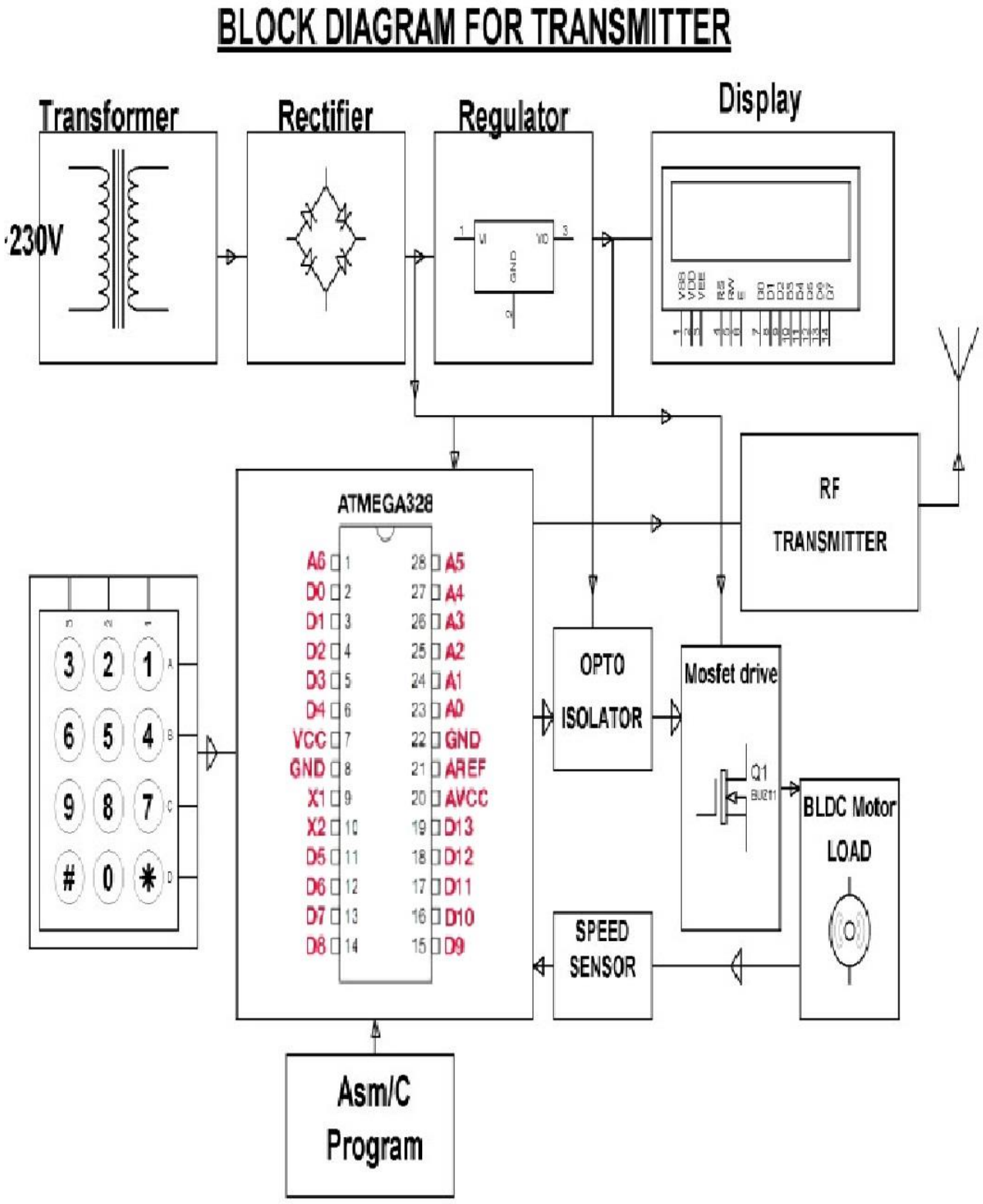

Fig.2: Transmitter

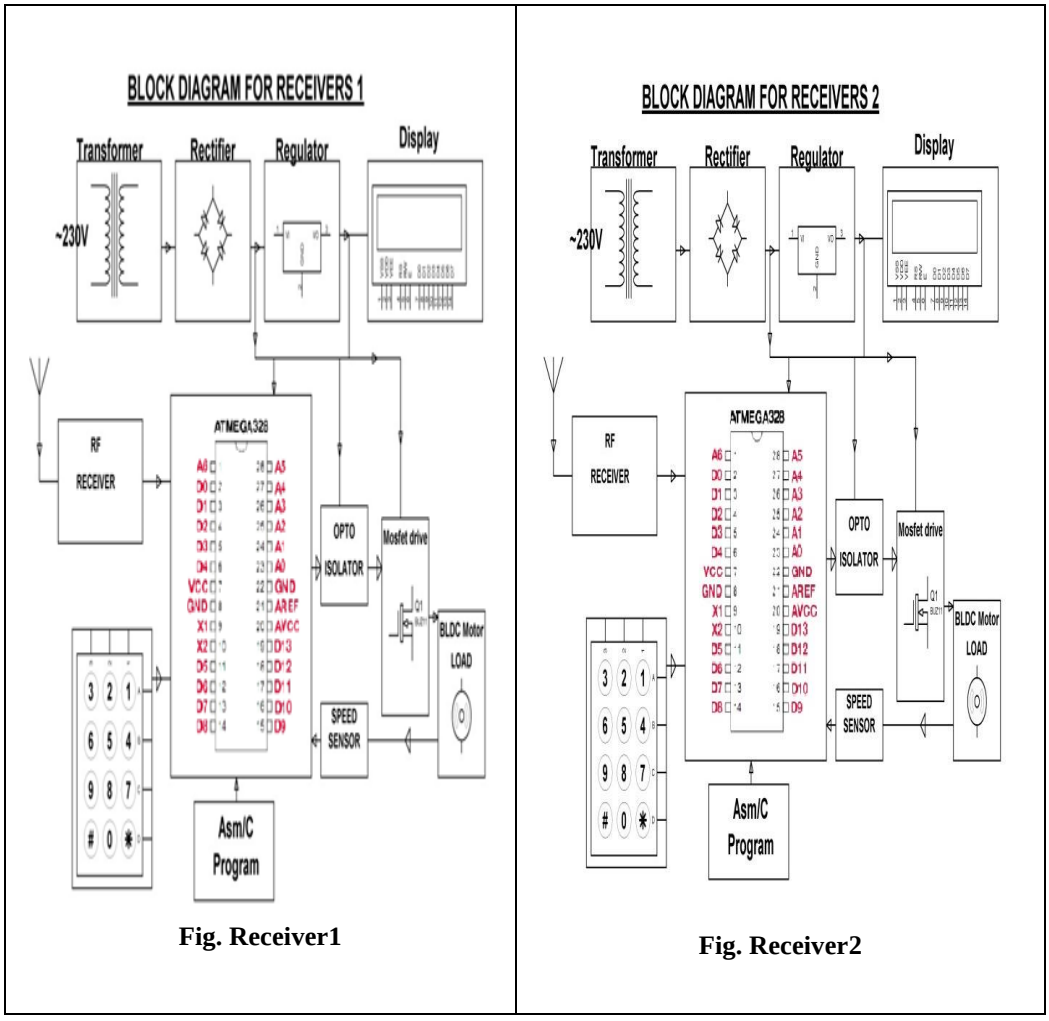

Fig. Receiver1 **Fig. Receiver2**

Fig.3:Receiver

PROJECT DESCRIPTION:

The aim of this project is synchronization of multiple motors using wireless technology. This project uses radio frequency to synchronize motor speeds. This is applicable to many industries like textile mills, steel plants, and paper plants wherein all the motors used on conveyor are desired to be synchronized. For example, in textile mills where multiple motors work simultaneously on a conveyor belt to draw clothes, it is essential that all the motors there should run at same speed, so that balanced tension is achieved to avoid clothes getting damaged. In this project motors are wirelessly synchronized to make the differential speed error among multiple motors to zero. One motor acts as transmitter and all the rest as receivers. Thus, if a particular speed is set in the transmitter then all other motors speed would be matched to the same speed of the main motor. The mode of communication is radio frequency. BLDC motors used operate on the basis of PWM control .Each motor has a closed loop feedback mechanism providing RPM reference by a shaft mounted IR sensor arrangement whose output is fed to the controller in the circuit. A display unit displays the full speed and one can enter the desired percentage with help of a keypad to obtain the required speed for all the motors .The pulse width output from the microcontroller would be automatically adjusted to maintain the DC power to the motor such that the entered speed percentage matches the running RPM. The above operation is carried out by using one opto isolator and a MOSFET for driving the BLDC motor duly interfaced from the microcontroller In various stages of operations motors have to rotate at different speeds, so if we change the speed in transmitting motor then rest of the motors are adjusted accordingly. The whole operation is made simple by using this technology. Manpower and time is also saved in this system.

The future works include giving intelligence to the whole system like if any of the motor senses any fault, the whole system will shutdown.

II. SPEED SYNCHRONIZATION OF THREE MOTORS :

SR No.	Main motor speed in percentages (experimental values)	Receiving motor1 speed in percentages (experimental values)	Receiving motor 2 speed in percentages (experimental values)
1	20%	20%	20%
2	40%	40%	40%
3	60%	60%	60%
4	80%	80%	80%
5	100%	100%	100%

The above table represents the speed synchronization results of three motors. According to the main motor the second motor and third motors adjust its speed and the speed synchronization is done. It is observed that the synchronized RPM's were accurate with very slight variations, which were nullified once the motor speed was stabilized.

Features: Real time DC motor speed setting, Display of DC motor speed on LCD, Contact less speed monitoring, Dynamic speed setting feature, and PWM based speed adjustment.

Advantages:

- Higher efficiency and reliability ,
- Lower acoustic noise due to absence of brushes,
- Smaller and lighter ,
- Greater dynamic response,
- Better speed versus torque characteristics ,
- Higher speed range.

Applications:

1. Brushless motors fulfill many functions originally performed by brushed DC motors, But cost and control complexity prevents brushless motors from replacing brushed motors completely in the lowest-cost areas.
2. Nevertheless, brushless motors have come to dominate many applications particularly devices such as computer hard drives and CD/DVD players.
3. Small cooling fans in electronic equipment are powered exclusively by brushless motors. They can be found in cordless power tools where the increased efficiency of the motor leads to longer periods of use before the battery needs to be charged

CONCLUSION:

We can tabulate different-different speeds of motor as we keep on giving input from the Keypad and same speed change can be observed and displayed at the receiving motors. From this project we can successfully control the speed of multiple motors wirelessly through RF communication. Whatever the percentage of speed that we enter at transmitter unit of system same can be observed at the receiving motors

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