WIRELESS COUPLING OF INDUCTION MOTORS USING RF

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Abstract—In case of textile and paper mills numerous motors are used simultaneously on a conveyor belt which pulls out the products like clothes and papers. It is necessary that all the motors should run at same speed to prevent the damage of clothes. If motors do not run at same speed then it can cause a lot of damages. Now-a-days this is the main problem in the industries. To avoid this type of situation the motors should be synchronized wirelessly to reduce the error to zero which occurs due to different speed of motors. Here one motor acts like a transmitter and others are act like receivers because if a specific speed is given to the transmitter then other motors will coordinate with the same speed. Transmitter and receivers will communicate with radio frequency. Alternating current (AC) motors are operating based on the basis of the pulse width modulation (PWM) control. All motor has a closed loop feedback mechanism which provides the revolution per minute (RPM) reference by a shaft mounted keypad arrangement. These outputs are given to the controller. The microcontroller gives the pulse width output which automatically adjusted to maintain the direct current (DC) signal to the motor. In this way the entered speed percentage matches to the running RPM. In different stages of the operation motors rotate at different speeds. So that when the speed changes for the transmitting motor then the speed changes for the receiving motors. Using this wireless synchronizing motor speed technology the operation is going to be simple and the manpower and time are also going to be saved.

***Keywords— Embedded system components; Power supply Circuit; Microcontroller; TRIAC and Opto-coupler; Wireless RF; Induction Motor*;**

I.INTRODUCTION

Now–a-days, a lot of accidents occur in industries because of the differential speed of the motors which are used simultaneously on conveyor belt. Induction motors are most commonly used in the industries as compared to the dc motors and synchronous machines. These are having the advantages like cheap in cost, maintenance is low, staring torques are high, reliable, efficient, and sturdy. So that the speed of multiple induction motors should be synchronized for transport the products like material factories, steel plants, paper mills and textile mills, etc. Basically textile mills have lot of motors for different works like rolling and dragging, etc. If there occurs any differential speed error then it can cause the damages of tons of products. By the help of a mathematical model which support an electromagnetic shaft with external control element can be synchronized at a constant speed of motors using a common rotor circuit[1]. This gives the information about Synchronized speed of motors by using the method of direct torque control (DTC) utilizing the stator flux regulation (SFR) [2]. Permanent magnet synchronous motor (PMSM) can control the error of differential motor speed present in the model and measure the noise [3]. PWM can be implemented in AC motor. It supports the washout electromagnetic interference (EMI) and the low order noise. This method can chaoize both the carrier frequency and pulse position which works better than the chaotic speed synchronization in the PWM [4]. When SRF apply on the PMSM with direct torque controller then it gives the chaos in result [5]. Here finding the approximate synchronized speed and voltage of the transient resistance induction machine torque controller is used based on the predictive and deadbeat controller of torque and flux [6]. When the acceleration, deceleration, true speed of motors change and angle of synchronization between minimum two axis of motors required to be same then multi-motor techniques are used

[7]. Induction motors are used to synchronize the speed of motors [8]. Using the MATLAB-SIMULINK

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programming the speed of the motors are synchronized [9]. Result of integrated controller like the adductive sliding mode controller (ASMC) and ring coupling synchronization controller have been used to track the error, synchronize the error and convert the error to zero of the speed of multiple induction motors [10]. Coupling synchronization controller is designed for synchronization of multiple motors and reduces the complexity of controllers [11]. Second order sliding mode controller has been used for dual motor system which synchronize the motor speed and track the error [12].

II. RELATED WORK

Electromagnetic shaft synchronized system are more relevant one than the traditional synchronized system. This system has multiple motors and all are connected to 3-phase wounded coils on still core. This system works based on the principle of electromagnetic transformation of energy. It causes the low synchronized capability of system motors to maintain the same speed with large load present in the different ends of shaft. External control winding is used to control the speed of electromagnetic shaft system. The three-phase inductive rheostat element in the common rotor circuit of the electromagnetic shaft system is divided into two parts. One of the parts is main winding. It connected to the rotor winding and represents the mutual induction between main coils. Synchronization capability of the system depends on the main winding. The second part is the external winding. It creates the additional magnetic field to control the main magnetic field. This is present in the core of three-phase inductive rheostat element. The speed of the system is controlled by this variation of flux. Switching block is having a group of TRIACs. Using this switching block we achieved the control on speed. The control block controls the switching blocks. When the magnetic field is strong then TRIACs allow the current to flow from main winding to external winding in one direction. When the magnetic field is low then it allows the current flow in opposite direction. All these are shown in figure: 1.

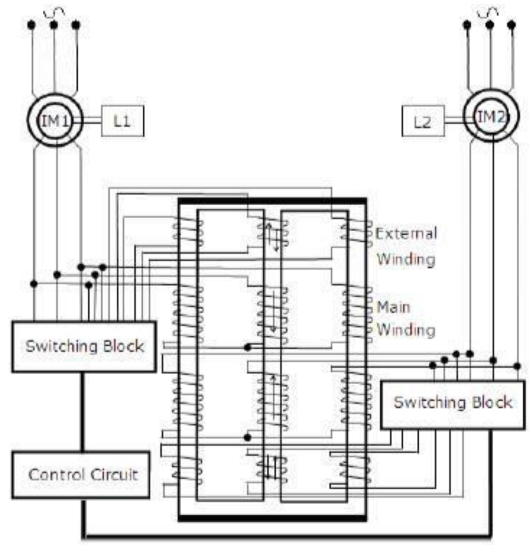

FIGURE 1: Electromagnetic shaft synchronization system with external windings for speed control.[1]

By the help of a mathematical model which supports an electromagnetic shaft with external control element can be synchronized at a constant speed of motors using a common rotor circuit.

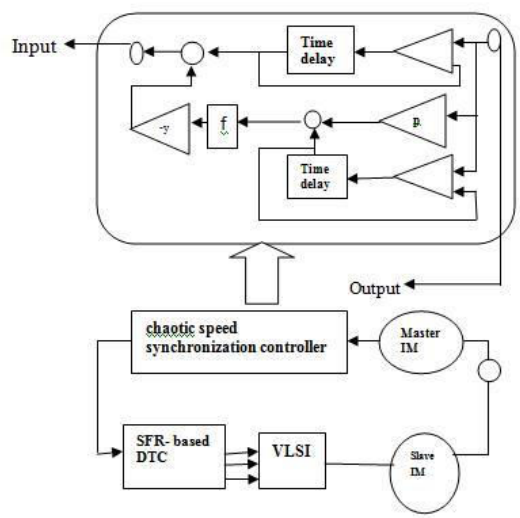

FIGURE 2: Block diagram of chaotic speed synchronization control scheme.[2]

In figure 2**,** gives the information about Synchronized the differential speed of motors by using the method of direct torque control (DTC) utilizing the stator flux regulation (SFR).

III. PROPOSED WORK

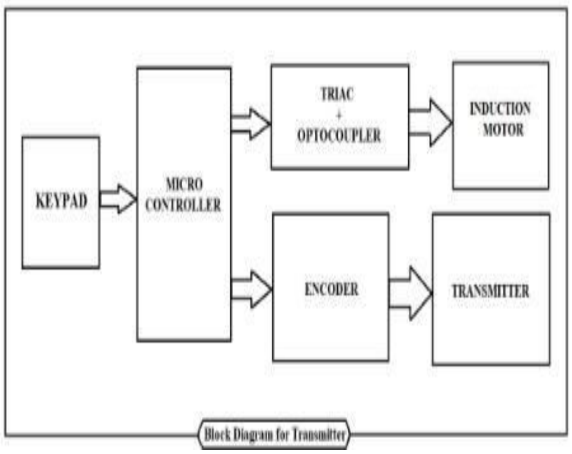

FIGURE 3: Block diagram of transmitter

In figure 3, it can be observed that the keypad will help the controller to get the instructions about the user requirements. According to ADC protocol, microcontroller will receive data from user and will instruct opto-coupler to switch TRIAC in order to run induction motor using PWM Signal. The same PWM signal will be passed to encoder and get transmitted to the receiver side for decoding purpose.

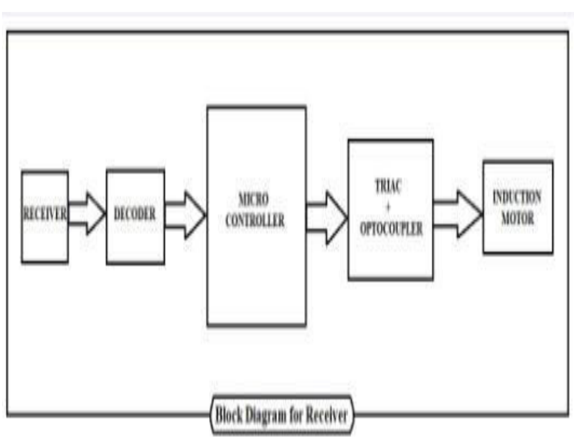

FIGURE 4: Block diagram of receiver

In figure 4, it can be seen that after decoding the signal at the receiver side the signal will fed into the controller for switching of TRIAC for the same speed of rotation.

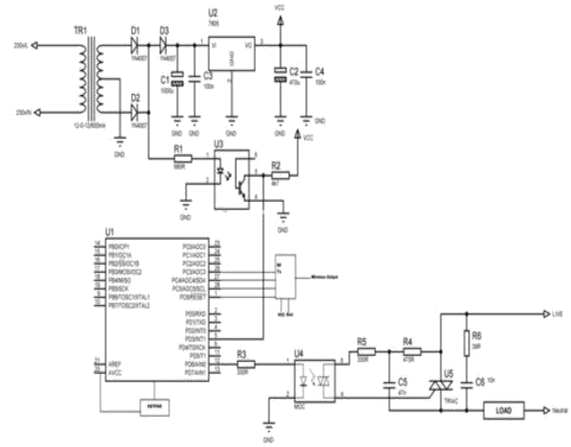

FIGURE 5: Circuit diagram of transmitter

In figure 5, the output of the power supply circuit is connected to the TRIAC which helps in a smooth connection when there is a large change of voltage level. As there is the presence of opto-coupler the microcontroller will act as per the user requirements. The output of the TRIAC then connected to the microcontroller which acts as per the instructions given by the user and according to that the motor speed can be controlled. Then the RF transmitter will send the signal to the receiver side for the synchronization purpose.

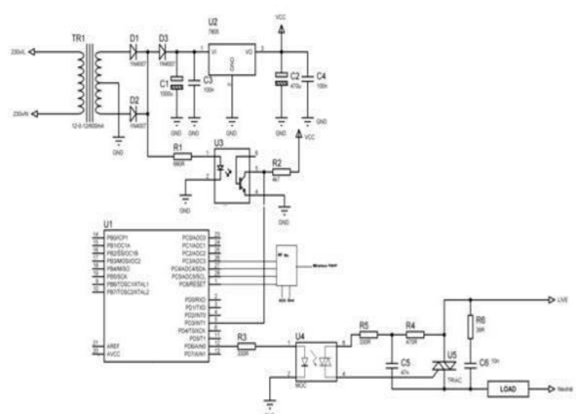

FIGURE 6: Circuit diagram of receiver

In figure 6, the receiver will receive the data through RF receiver. Here also after the use of a power supply circuit the data will send to the TRIAC due to the same voltage level fluctuation problem and then according to the received data the speed of motor can be synchronized.

IV. RESULTS

This project results in speed synchronization very efficiently of multiple induction motors. So it is a best alternative towards future for removing belt system in industries to couple motors. It also gives the privilege of wireless synchronization, robust transmission and low power circuit for automation.

V. CONCLUSION

Speed synchronization of numerous induction motors is necessary for the belt system of the industries. Wireless communication between the motors is a best alternative way to prevent the losses. Here using the technology of wireless synchronizing motor speed is eliminated the differences of speed or differential speed error of the motors. It help to do the work smoothly in industries with less loses and zero error.

This requires low power consumption and high maintenance. If we work on the maintenance side it gives high profit to the industries. This technology also works on DC system.

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