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A Review on Speed Synchronization of DC Motors For Power Looms

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Abstract: The synchronisation of the motor's speed is important in many sectors. The differential speed mistake causes a lot of power consumption in textile businesses. The goal of this project is to use wireless technology to synchronise several motors. In textile factories where numerous motors work simultaneously on a conveyor belt to draw textiles, it is critical that all of the motors run at the same speed in order to achieve balanced tension and avoid damaging the clothes. During speed acceleration and load changes, a new control strategy for real-time speed synchronisation of numerous induction motors is established in this study. The goal of the control technique is to stabilise each motor's speed tracking while synchronising it with the motions of other motors so that differential speed inaccuracies between several motors converge to zero. The industrial environment necessitates the synchronisation of different devices present in the sector on a daily basis. As a result, all of these motors should be synchronised in some way. Even if a single motor has a higher RPS than the others, the loss may be greater. So, taking all of these aspects into account, we built a system that can drive many DC motors at the same speed, or RPS, without any approximation.

Keywords: Speed Synchronization: DC Motor: Arduino: Power Looms.

I. INTRODUCTION

The synchronization of the motor's speed is important in many sectors. The differential speed mistake causes a lot of power consumption in textile businesses. The goal of this project is to use wireless technology to synchronize several motors. In textile factories where numerous motors work simultaneously on a conveyor belt to draw textiles, it is critical that all of the motors run at the same speed in order to achieve balanced tension and avoid damaging the clothes. Motors are wirelessly synced in this work to eliminate differential speed error between many motors. One motor serves as a transmitter, while the others serve as receivers. Pulse Width Modulation (PWM) control is used to regulate brushless direct current motors (BLDC). The pulse width output from the Arduino would be automatically changed to keep the DC power to the motor constant so that the entered speed percentage corresponded to the current Rotation Per Minute. The aforesaid procedure is carried out utilizing an electronic speed controller to drive a BLDC motor that has been properly interfaced with the Arduino.

Different types of motors are used in various initiatives, such as preparing mills and so on. The main challenge is to maintain the different speeds (RPM) of numerous motors, i.e., speed control for each motor. To solve the difficulty of controlling the speed of multiple motors, we created a single controller that can change the speed of multiple motors at the same time from a single location. It reduced the need for many controllers to control the speed of various motors. The speed (RPM) of a motor with a changeable power supply is measured in this project. The goal is to maintain a consistent output speed regardless of whether the flow of speed at the input has risen or reduced [1].

The industrial environment necessitates the synchronization of different devices present in the sector on a daily basis. As a result, all of these motors should be synchronized in some way. Even if a single motor has a higher RPS than the others, the loss may be greater [2]. The design of a speed synchronization controller for networked integrated motor transmission is the subject of this research (IMT)[3]. Because the speed-torque connection for both dc motor and regeneration applications in either direction of rotation may be adjusted to virtually any useful shape, dc motors are used in industrial applications. DC motors have a speed that can be smoothly reduced to zero, followed by acceleration in the opposite direction without the need for power circuit switching. The pulse width modulation (PWM) control method for DC motor armature voltage is the best of the various control methods.

Because of their static and dynamic performances in real-time applications, DC motors are still employed in the industry today. However, the synchronization necessary between the drives must be performed in a reliable and safe manner. To achieve the tight time among the available software mechanisms, the coordinator should not only generate the references to each drive, but also share feedback information from the individual control loops. Master slave synchronization is a widely used technique to achieve the tight time among the available software mechanisms [4].

Unmanned aerial vehicles (UAVs), unmanned ground vehicles (UGVs), and unmanned underwater vehicles (UUVs) all make use of multiple motor drives. For navigation in this application, all motors must be synchronized. If a UGV is

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immobilized in the field because one of the motors is damaged, the user can replace the motors. The altered motor will not respond correctly if a correct motor is not available. As a result, the overall control will not function as intended. This work described the first steps in optimizing and automatically synchronizing nonidentical motors. The initial configuration is that the higher order controller provides the reference signal, and the motor should follow, with all motors having similar control characteristics such as rise time and setting time.

II. BLOCK DIAGRAM

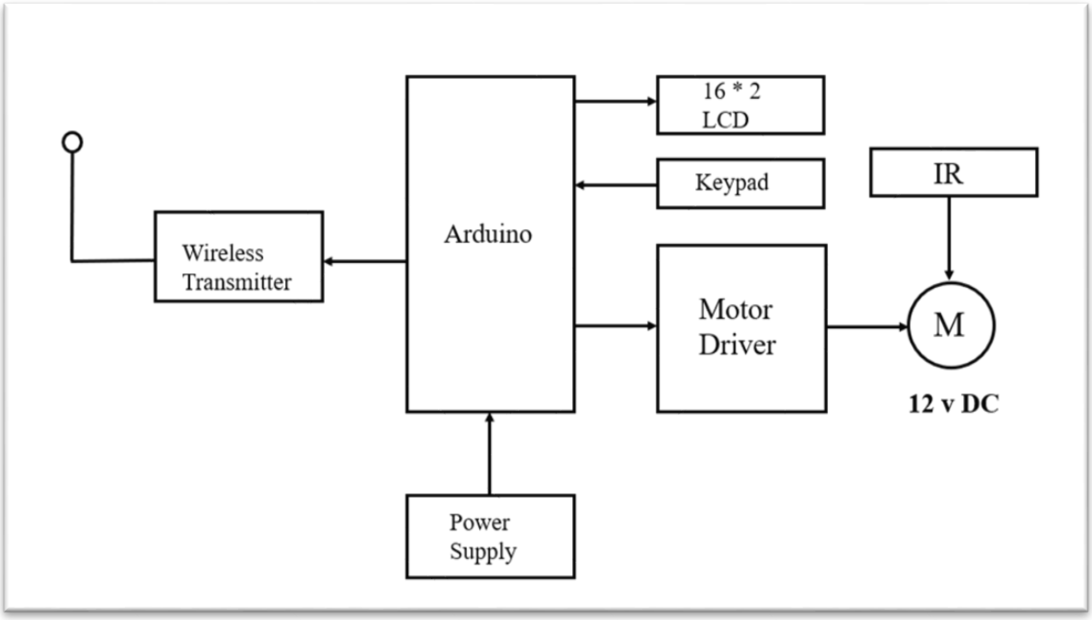

Fig. 1 Block Diagram of Transmitter

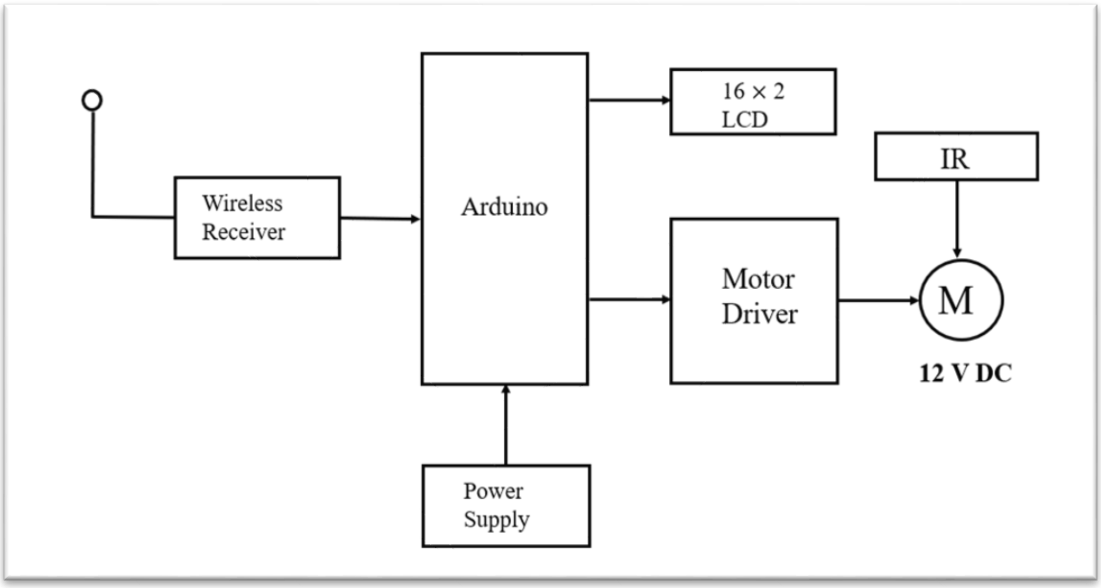

Fig. 2 Block Diagram of Receiver

In above fig. 1 & 2, 12V DC power supply is applied to the system. In the transmitter side, required speed is entered using a keypad which is interfaced with the Arduino. The transmitter side motor is start rotating at entered speed and the speed is sensed by an IR sensor and sensed speed will be displayed on LCD. Then the speed will be fed to the slave Arduino. Arduino produces PWM signals according to the entered speed, finally the motor is adjusted to the required speed. Then all the slave motors run at the same speed of the master motor. At last, the synchronization between the all motors achieved.

1.Arduino:

Many single board computers (SBCs) are available, including Arduino, Raspberry Pi, PIC, and others. Arduino was chosen above the other SBCs because of its capabilities and affordable cost. Arduino's programming was written in a simplified C language, and it has its own circuitry board for input and output interfacing. It may also function as a serial monitor when linked to a PC via serial connection. This capability can be highly useful because it can display results or sensor values without the necessity for a connection to an output display like an LCD. We used the Arduino UNO Rev 3 in this study, which includes 6 analogue pins, 14 digital pins, 32 kB of memory, and a clock speed of 16 MHz.

2.Motor Driver:

In an integrated circuit, the L298N Motor Driver module contains an L298 Motor Driver IC, a 78M05 Voltage Regulator, resistors, capacitors, a Power LED, and a 5V jumper. Only when the jumper is inserted will the 78M05 Voltage Regulator be enabled. The internal circuitry will be powered by the voltage regulator when the power source is less than or equal to 12V, and the 5V pin can be utilised as an output pin to power the microcontroller. When the power supply is greater than 12V, the jumper should be removed and a separate 5V should be provided through the 5V connector to power the internal circuitry.

3.IR Sensor:

An infrared (IR) sensor is a type of electrical gadget that detects and measures infrared radiation in its surroundings. In the year 1800, an astronomer named William Herchel made an unintentional discovery of infrared light. He found that the temperature just beyond the red light was the highest while measuring the temperature of each hue of light (separated by a prism). Because the wavelength of IR is longer than that of visible light, it is invisible to the human eye (though it is still on the same electromagnetic spectrum). Infrared radiation is emitted by everything that emits heat (anything with a temperature over roughly five degrees Kelvin).

4.Display:

A 16x2 LCD display is a relatively basic module that can be found in a variety of devices and circuits. A 16x2 LCD can display 16 characters per line on each of its two lines. The 224 distinct characters and symbols can be displayed on the 16 x 2 intelligent alphanumeric dot matrix display.

III. CONCLUSION

The speed of two DC motors may be readily synchronized in this experimental investigation by altering set points. The required speed is determined by Arduino, which is connected to two slaves. The IR sensor is used to detect speed. When data from the Arduino is transferred to the motor driver, it is used as a speed set point. As a result, when the system is turned on, the motor driver tries to reach the required speed. We can easily calibrate the system by comparing the different actions thanks to the keypad entry flexibility. The speed control method makes it simple to synchronize motors. On the LCD, the measured speed will be displayed. We can successfully coordinate the speed of many dc motors in textile mills using this project's wireless RF connection. The use of wireless technology simplifies the overall experiment. As a result, this synchronization technology can be applied to the textile industry.

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