Wireless Control of Stepper Motor Using RF Communication

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Abstract - This Project consists of Microcontroller Unit, stepper motor, and RF transmitter, RF receiver, the stepper motor, with which the directions and rate of speed can be changed through a set of instructions, already loaded into the Microcontroller using Embedded C programming. While the control system consists of a RF transmitter, RF receiver and a microcontroller that collects data from the transmitter through receiver to control the stepper motor. The intelligent control software, which has been developed Embedded C programming language. The stepper motor was fully controlled by the microcontroller according to the commands that are received by the microcontroller from the RF receiver. RF Communication ranges in between 30 KHz to 300 GHz. RF communication works by creating electromagnetic waves at a source and being able to pick up those electromagnetic waves at a particular destination. These electromagnetic waves travel through the air at near the speed of light. The wavelength of an electromagnetic signal is inversely proportional to the frequency; the higher the frequency, the shorter the wavelength.

Keywords – Microcontroller, Stepper Motor, RF transmitter, RF receiver, Embedded C, Communication, Frequency

I. INTRODUCTION

The RF module, as the name suggests, operates at Radio Frequency. The corresponding frequency range varies between 30 kHz & 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave. This kind of modulation is known as Amplitude Shift Keying (ASK). Transmission through RF is better than IR (infrared) because of many reasons. Firstly, signals through RF can travel through larger distances making it suitable for long range applications. Also, while IR mostly operates in line-of-sight mode, RF signals can travel even when there is an obstruction between transmitter & receiver. Next, RF transmission is more strong and reliable than IR transmission. RF communication uses a specific frequency unlike IR signals which are affected by other IR emitting sources. This RF module comprises of an RF Transmitter and an RF Receiver. The transmitter/receiver (Tx/Rx) pair operates at a frequency of 434 MHz. An RF transmitter receives serial data and transmits it wirelessly through RF through its antenna connected at pin4. The transmission occurs at the rate of 1Kbps - 10Kbps.The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter. Basically the RF modules are 433 MHz RF transmitter and receiver modules. The transmitter draws no power when transmitting logic zero while fully suppressing the carrier frequency thus consume significantly low power in battery operation. When logic one is sent carrier is fully on to about 4.5mA with a 3volts power supply. The data is sent serially from the transmitter which is received by the tuned receiver. Transmitter and the receiver are duly interfaced to two microcontrollers for data transfer.

II. TRANSMITTER MODULE

From the circuit, the power supply +5V is connected to the 40 pin of microcontroller and ground is connected to 20th pin. Here, we got two switches which are duly connected to microcontroller with pulled up to 5V and this two switches form the input command to the microcontroller. We also got an LCD display for displaying the data to be transmitted. We also have an arrangement for a computer key board to be connected for positive and negative part from clock and data pin which is connected as input to the microcontroller from the output of key board and that data is ultimately displayed in the LCD.

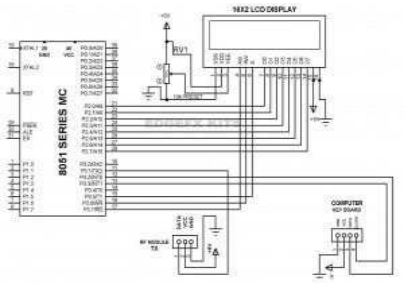

Fig. 1. Pin Diagram Of Transmitter Module

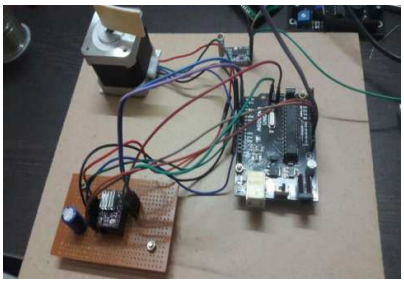

Fig. 2. A Final view of Wireless Stepper motor using RF Communication

III. HARDWARE

An Arduino microcontroller board can be thought of as a user-friendly, open-source input-output system. An input can range from anything from a finger pressing a button to a change in light intensity, and outputs can range from lighting up a simple LED light to send a message. Arduino makes several different boards, each with different capabilities. In addition, part of being open source hardware means that others can modify and produce derivatives of Arduino boards that provide even more form factors and functionality. There are several features of Arduino that truly make is stand out from the rest of the microcontrollers on the market. For example, the software is open source, so you can " look under the hood " so to speak, and is free to download, modify, and re-use (which is always a plus for more advanced developers). Even the basic plans for the Arduino are open source, so users can build their own without having to buy one. There are several companies that make the Arduinio boards, too, and you can buy full kits breadboards, wiring sensors, and more. Even fully assembled, Arduino is on the lower end of the cost spectrum, and is compatible with Windows, Mac, and Unix systems. Most importantly for beginners, perhaps, is the fact that the development environment for the Arduino is aimed at people with little to no microcontroller experience, but powerful and flexible enough for experienced users . There is a great deal of quality information out there to help even the most inexperienced user navigate the Arduino and put it to use in exciting and creative ways In short, it had made microcontrollers accessible to everybody, even those with a minimal computer background, regardless of age.

IV. RESULT

This project has been one of the most interesting and learning experience to all of us.. We have learned new ways of testing our project. Following results can be concluded from this project. The possibility of obtaining the direction of the motor either clockwise or anticlockwise has been achieved, as well as the speed of the motor at maximum has also been achieved. The signal is sent even blocking the signal by putting an obstacle in between the two sides i.e transmitting and receiving sides. The movements and of the motor in clockwise and anticlockwise directions are controlled in a specified manner. The direction and the speed can be viewed by attaching a weight at the end of the motor. In the end we must say that it was a successful project and we did our best to make it as best as possible.

V. CONCLUSION

This project is very useful as compared to existing system which are using DC motors which does not have , which will have high accuracy and precision, more over the stepper motor is controlled wireless which is more safe and advantage, this project further can be modified with IOT for controlling the machine from remote location. Thus the proposed paper proposes the control techniques for the stepper motor to achieve the precise control through the wireless network. LabVIEW based GUI technique is used in order to control the motor and to reduce cost to implement and make the control user friendly. The proposed system can be implemented any industrial applications to achieve high resolution stepping functions

VI. FUTURE SCOPE

This project has been described in four parts. The Stepper motor, The RF Module (both transmitter and receiver), the Ardunio UNO and the stepper motor driver. We have made this project at minimal speed. Therefore there lies a challenge in making the motor run at more higher rated speed and also dealing with the parameters associated with it. Developments are to be done to run the motor at different loads depending on the requirements needed. Another development that can be made in future to make this project more professional is to make it usable for more than one stepper motor. One can make it so that there can be an option in the programming to select one of the stepper motors if more than one motor is attached at the receiving end. Another development that can be made is that a digital display can be added to show the speed of the motor. At the current moment we can only see the speed by the increase in the movement of the speed. After the addition of the digital display one can see the actual speed of the motor.
This project can be made as a more professional project if one can provide more time and financial support.

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