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DC MOTOR CONTROL USING INFRA-RED

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"I here by admit that the paper is my own work except some of the parts which have been cited accordingly"

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PROJECT ABSTRACT

Infra-Red controller are popular technology in this era because its can control any devices such as motors, car locked security and home appliances. The purpose of this project is to make an Infra-Red controlled the DC Motor which it can switch on or off and control the motor in forward or reverse direction using the data bit in binary. This project is divided into Transmitter Circuit, Receiver Circuit and DC Motor Circuit. The advantage of this project is Transmitter Circuit can transmit an address and data bit to receiver more than 7 meter by using the suitable oscillator frequency and this controller system is designed to create the high security system for the DC motor system which it include the address (password) bit system. It can be done by using the Encoder IC and Decoder IC [1]. The Decoder IC will process the data from Encoder IC when both of the IC has a same address. When the address is acceptable then data at Decoder IC can control the DC Motor circuit. The DC motor circuit is created by H-Bridge concept which it can control in forward and reverse direction [2] with different speed. This circuit controlled by Receiver Circuit which sending data from Decoder IC and each data can switch 'ON' DC Motor Circuit in forward or reverse direction and switch 'OFF'. For a safety situation, the direction of the DC Motor is known when the LED lighted for example green LED for forward and red LED for reverse direction [3]. This circuit can usable as Sliding Door controller, gate controller, conveyor controller and resident house air flow.

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ABSTRAK PROJEK

Alat kawalan sinar merah merupakan teknologi yang popular dewasa ini kerana ia mampu mengawal peranti seperti motor, alat kekunci keselamatan kenderaan dan perkakasan rumah. Tujuan projek ini adalah untuk membina sebuah model yang mana Alat kawalan sinar merah mengawal Motor Arus Terus dan ia boleh dihidupkan dan dimatikan serta boleh dikawal arah pusingannya iaitu arah hadapah dan balikan menggunakan bit-bit binari. Projek ini terbahagi kepada Litar Pemancar, Penerima dan Motor Arus Terus. Antara kelebihan projek ini ialah Litar Pemancar mampu menghantar bit alamat dan maklumat pada jarak yang jauh iaitu melebihi 7 meter dengan menggunakan frekuensi pengayun yang sesuai dan sistem kawalan ini dilengkapi dengan sistem keselamatan (bit alamat) untuk Motor Arus Terus. Ia boleh dilaksanakan dengan menggunakan Litar Bersepadu Pengekod dan Penyahkod. Litar Bersepadu Penyahkod akan memproses bit maklumat daripada Litar Bersepadu Pengekod apabila kedua-duanya mempunyai bit alamat yang serupa. Apabila bit alamat lulus penerimaan, kemudian bit maklumat boleh mengawal Litar Motor Arus Terus. Litar Motor Arus Terus ini dibina berdasarkan konsep Tetimbang-H di mana ia boleh dikawal arah pusingan di sertakan kawalan kelajuannya. Litar ini dikawal oleh Litar Penerima di mana ia menghantar bit maklumat daripada litar bersepadu Penyahkod dan setiap satunya boleh menghidupkan dan mematikan Motor Arus Terus pada arah pusingan hadapan dan balikan. Bagi keselamatan, arah pusingan Motor Arus Terus boleh diketahui dengan pemasangan LED di mana LED hijau menandakan motor berpusing arah hadapan manakala LED merah menandakan motor berpusing arah balikan. Litar ini adalah perbagai guna di mana ia boleh juga dijadikan alat kawalan pintu gelonsor, kawalan pintu pagar dan alat kawalan sistem pengudaraan rumah.

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CHAPTER I

INTRODUCTION

In this project, there are two combination circuits which Infra-red circuit controlled the DC Motor circuit (see Figure 1). The Infra-red circuit is divided to Transmitter and Receiver circuits. These two circuits used the Motorola's IC, where the MC145026 for Encoder and MC145027 for Decoder. The Transmitter of Infra-red circuit can transmits bit of address and data more than 7 meters away. To make it success this Infra-red used the suitable oscillator frequency which has a high frequency for example 56 kHz. The Infra-red circuits have a bit of address and data. The bit of address as a password and bit of data used to controlled the DC Motor circuit like to switch off or on in forward and reverse direction and the speeds can be adjusted manually from the DC Motor circuit.

The DC Motor circuit basically can switch on or off. The circuit are designed in H-bridge concept which the transistor as a switch to turn the motor in forward or reverse direction. This circuit is including the sign to shows the direction of motor rotation which used the LED (for examples green LED shows motor in forward and red LED shows motor in reverse direction). The LED will connect through the 2-bit data signal

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from decoder. This DC Motor circuit also can run in difference speed which it is controlled by the resistance.

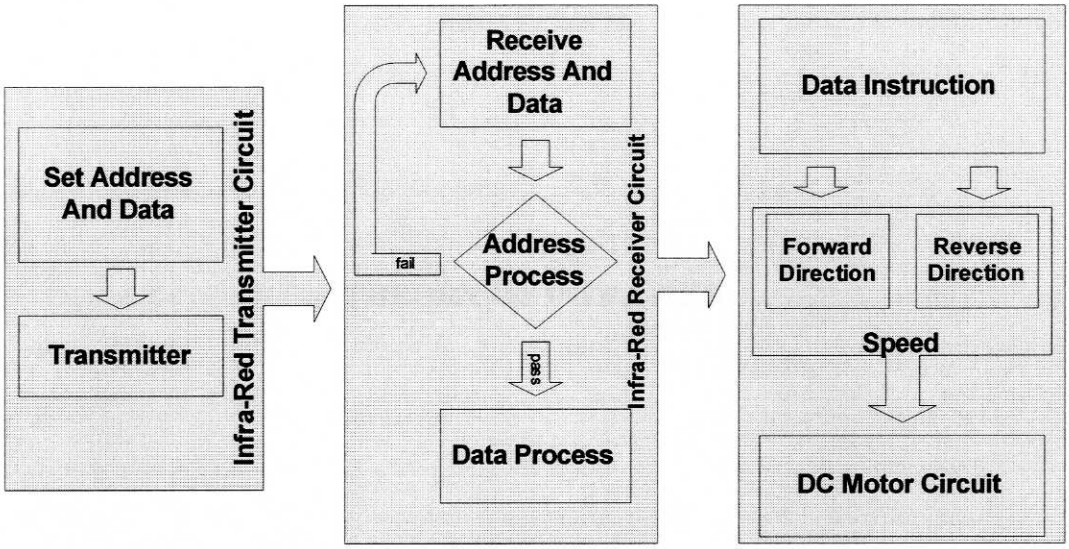

Figure 1: DC Motor Control Using Infra-Red Process Flow

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CHAPTER II

THEORY OF INFRA-RED

2.1 Introduction

Infra-red is an energy radiation with a frequency below our eyes sensitivity, so we can not see it. Infra-red is interesting, because it is easily generated and doesn't suffer electromagnetic interference, so it is nicely used to communication and control, but it is not perfect, some other light emissions could contains infra-red as well, and that can interfere in this communication. The sun is an example, since it emits a wide spectrum or radiation.

Why Remote Control ?

There are a lot of advantages when using the Remote Control like the Infra-red. Remote Control can be design by the Transmitter circuit.

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Because it is much more convenient not to have to get nearly to the parts, and it is more secure. With remote control we can;

- Controlled the conveyor
- Open secure access gates
- Call the lift car
- Controlled the fan direction or switch ON and OFF.
- Controlled the Residence House air flow.
- Controlled the Commercial building air flow.

in long distance transmitting.

2.2 Basic Principles

Most short range remote control links use signals transmitted by one of three methods such as radio, sound (in the ultrasonic region: 25 kHz plus) or infra-red radiation. Infra-red is the most popular medium because it does not interfere with existing radio systems, causes no discomfort to animals (as ultrasound can), and is relatively cheap.

Infra-red radiation is just outside the visible part of the spectrum but can also be focused and reflected. For most control purposes, it is produced by infra-red light emitting diodes (LED) which look like ordinary LED and required a series protection resistor in the same way.

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2.3 How Infra-red Work

All Infra Red (IR) remote controls use some kind of IR signal. The remotes transmit pulses of IR light to send the signal to the receiver. This IR LED transmits light in the different frequency range. These high frequencies were chosen so that other light sources would not interfere with the receiver's ability to correctly receive the transmitted signals. These signals are transmitted by the IR LED in some type of binary code. It turns out that for most consumer electronics this coding is the same. The binary signal varies in length for both time and bit length. There are really only three different ways to code these signals. This coding is usually based on varying the length of pulses, varying the length of spaces between pulses or altering the order between spaces or pulses. This coding holds information such as the address to the machine that is using the remote and the command that the machine must follow. The address is very important because without it the signal would be processed by another IR receiver in the area. The three ways is as given below;

i. Pulse-Width-Coded Signals vary the length of pulses to code the information (Refer Figure 2). In this case if the pulse width is short (approximately 550us) it corresponds to a logical zero or a low. If the pulse width is long (approximately 2200us) it corresponds to a logical one or a high.

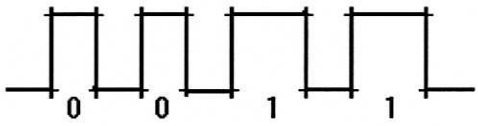

Figure 2: Pulse-Coded Signal

ii. Space-Coded Signals vary the length of the spaces between pulses to code the information (Refer Figure 3). In this case if the space width is short

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(approximately 550us) it corresponds to a logical zero or a low. If the space width is long (approximately 1650us) it corresponds to a logical one or a high.

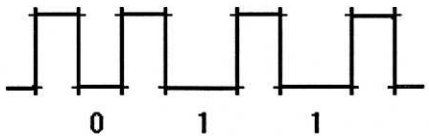

Figure 3: Space-Coded Signal

iii. Shift-Coded Signals vary the order of pulse space to code the information (Refer Figure 4). In this case if the space width is short (approximately 550us) and the pulse width is long (approximately 1100us) the signal corresponds to a logical one or a high. If the space is long and the pulse is short the signal corresponds to a logical zero or a low.

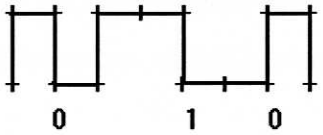

Figure 4: Shift-Coded Signal

2.4 Encoder

An encoder is a device that generates a unique binary code in response to the activation of each individual input. Most encoder accepts an input code and produces a HIGH or a LOW at one and only one output line. In other word, that the encoder identifies, recognizes or detects a particular codes. The opposites of this decoding process are called encoding and are performed by logic circuit called encoder. The

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encoder has a number of inputs, only one of which is activated at a given time and produces an N-bit output code, depending on which input is activated.

2.5 Decoder

Decoder is a device whose output is activated only when a unique binary combination code is presented on its input. Many MSI decoders have several output, each one corresponding to only one of the many possible input combination. Decoder also is a logic circuit that accepts a set of input that represents a binary number and activates only the output that corresponds to that input number. Decoder circuit looks up at its input, determines which binary number is present there and activates the one output that correspond to the number; all other output remain inactive.

2.6 Infra-Red Formula

Frequency, (nu), is the number of wave cycles that pass through a point in one second. It is measured in Hz, where 1 Hz = 1 cycle/sec. Wavelength, λ (lambda), is the length of one complete wave cycle. It is often measured in cm (centimeters). Wavelength and frequency are inversely related:

$$V = C / \lambda \qquad (2.1)$$

Where c is the speed of light, 3×10^{10} cm/sec

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CHAPTER III

THEORY OF DC MOTOR

3.1 Introduction

The DC motor is popular in a number of drive applications due to its simple operation and control. The starting torque of DC motor is large, which is the main reason for using it in several traction applications. A special form of DC motor can also be used with either ac or dc supply. A large number of appliances and power tools used at home, such as circular saws and blenders are DC machine.

The DC motor has two basic parts which the rotating part that is called the armature and the stationary part that includes coils of wire called the field coils. The stationary part is also called the stator. Figure 5 shows a picture of a typical DC motor, Figure 6 shows a picture of a DC armature and Figure 7 shows a picture of a typical stator.

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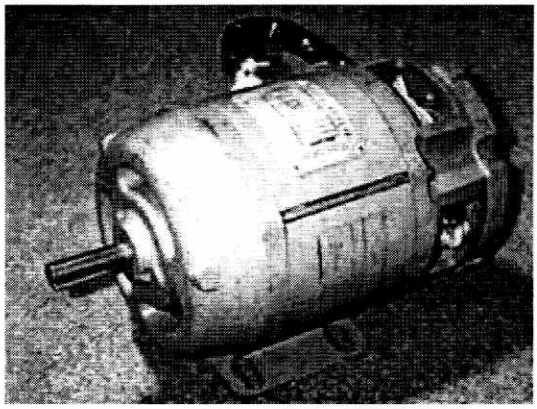

Figure 5: DC Motor. [4]

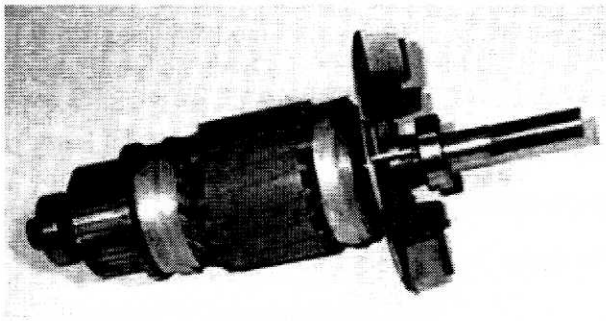

Figure 6: The Armature Of A DC Motor. [4]

From the picture in Figure 6, the armature is made of coils of wire wrapped around the core, and the core has an extended shaft that rotates on bearings. The ends of each coil of wire on the armature are terminated at one end of the armature. The termination points are called the commutator, and this is where the brushes make electrical contact to bring electrical current from the stationary part to the rotating part of the machine.

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Figure 7: The Stator. [4]

The picture in Figure 7 shows the location of the coils that are mounted inside the stator. These coils will be referred to as field coils in future discussions and they may be connected in series or parallel with each other to create changes of torque in the motor. The size of wire in these coils and the number of turns of wire in the coil will depend on the effect that is trying to be achieved.

3.1.1 Magnetism

We all know that a permanent magnet will attract and hold metal objects when the object is near or in contact with the magnet. The permanent magnet is able to do this because of its inherent magnetic force which is referred to as a "magnetic field". In Figure 8, the magnetic fields of two permanent magnets are represented by "lines of flux". These lines of flux help us to visualize the magnetic field of any magnet even though they only represent an invisible phenomenon. The numbers of lines of flux vary from one magnetic field to another.

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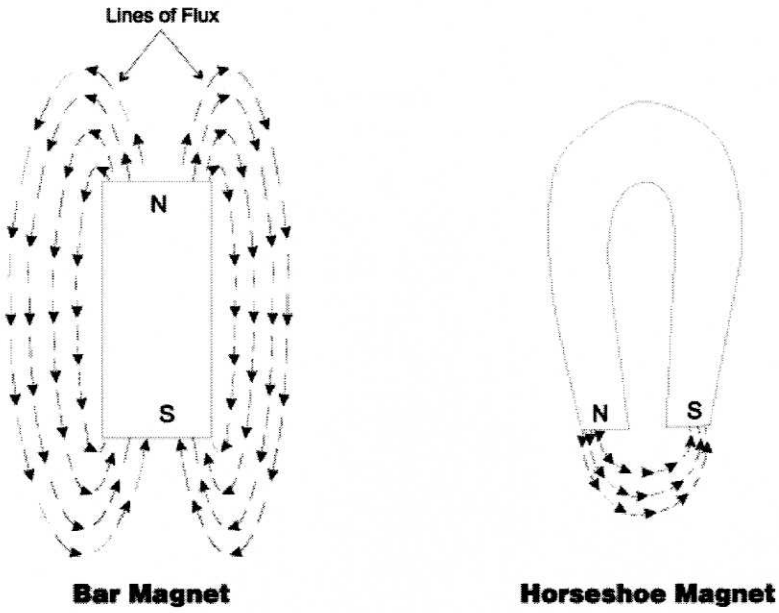

Figure 8: Flux. [5]

Type of magnetic field is produced around an electrical conductor when an electric current is passed through the conductor as shown in Figure 9 (left). These lines of flux define the magnetic field and are in the form of concentric circles around the wire. Some of you may remember the old "Left Hand Rule" as shown in Figure 9 (right). The rule states that if you point the thumb of your left hand in the direction of the current, your fingers will point in the direction of the magnetic field.

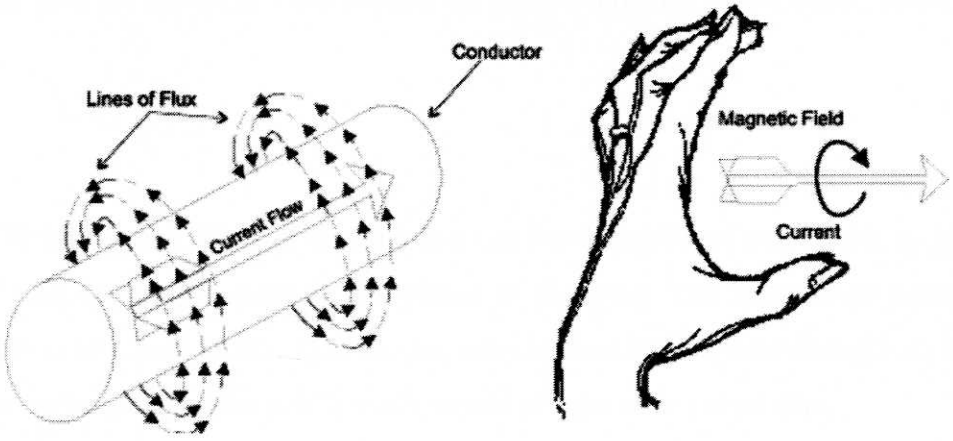

Figure 9: The Flow Of Electrical Current. [5]

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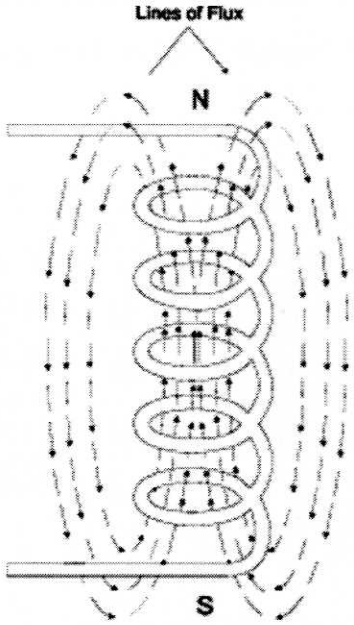

Figure 10: The Magnetic Lines. [5]

When the wire is shaped into a coil as shown in Figure 10, the flux lines produce by each section of wire join together to form one large magnetic field around the coil. As with the permanent magnet, these flux lines leave the north of the coil and re-enter the coil at its south pole. The magnetic field of a wire coil is much greater and more localized than the magnetic field around the plain conductor before being formed into a coil.

This magnetic field around the coil can be strengthened even more by placing a core of iron or similar metal in the center of the core. The metal core presents less resistance to the lines of flux than the air, thereby causing the field strength to increase. This is exactly how a stator coil is made, a coil of wire with a steel core.

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