DESIGN AND CONSTRUCTION OF AN AUTOMATIC CONTROL FOR SLIDE DOOR.

BY

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A Thesis submitted to the Department of Electrical and Electronics Engineering in partial fulfillment of the requirements for the award of Bachelor of Engineering degree (B.Eng) in Electrical/Electronics Engineering, Federal University of Technology, Minna, Niger State, Nigeria.

November, 2011.

DECLARATION

Nwagu Henry declare that this work was done by me and has never been presented elsewhere the award of a degree. I also hereby relinquish the copyright to Federal University of chnology, Minna.

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CERTIFICATION

is to certify that this project titled "Design and Construction of a Automatic Control for e Door" was carried out by Nwagu Henry with matriculation number 2006/24416EE, and mitted to the Department of Electrical and Electronics Engineering, Federal university of hnology of Minna in partial fulfillment of the requirements for the award of Bachelor degree Engineering (B.Eng).

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DEDICATION

s project is dedicated to the glory of Almighty God who is my source of sustenance and gave

the ability, guidance and knowledge during and indeed after my studies.

ACKNOWLEDGEMENTS

want to give thanks to Almighty God for His grace upon my life. I sincerely thank my project ıpervisor, Engr. Dr. M.N. Nwohu for his guidance, help and inspiration. Apart from supervising ıy work, I learnt how to be hard working no matter the challenges in order to achieve a goal.

'his project would not have been possible without the confidence, endurance and support from ıy family members especially Mr and Mrs Nwagu who have always been my benefactors.

ABSTRACT

The aim of this project is to design an automatic control for slide door using laser light and light dependent resistor (LDR) as a motion sensor and the use of microcontroller in controlling the opening and closing of the door. The use of microcontroller is more desirable due to its high efficiency compared to other means of control.

When the laser light connected to the LDR is obstructed by a person, signals are sent to the microcontroller via 555 Timer which acts as a signal monitoring device. The microcontroller then sent its signal of 1 and 0 to the motor to open the door, 0 and 1 to close the door, and 0's to be at equilibrium state. The motor is being switched ON and OFF by the use of a relay.

This project can be further extended to other electrical appliances such as hand dryer, burglary alarm, etc.

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CHAPTER ONE

1.0 Introduction

As the world advances on daily bases into a large global technological village, development then becomes the utmost desire of every nation. This is as a result of man's ability to make things easier, safer and more reliable in life, by adjusting already existing things (advancement). This project follows the same trend as our manually operated doors are being automated so as to aid easy opening and closing of modern doors, which is much more reliable than manual door, hence it saves time and energy in opening and closing the door, as well as provide adequate security.

This project is based on the use of laser light as a motion sensor in opening and closing sliding doors, thereby performing the function of an Automatic control of a slide door. This automatic door opener is made by using readily available components and its functionality is based on the use of microcontroller to control the door and an electromagnetic relay at the output to trigger the DC motor to open and close the door with the help of transistors and light intervention in its electrical wiring. Automatic slide doors are very useful in commercial buildings like hotels, banks, theatres, professional offices, service stations etc.

1.1 Aim/Objectives

The aim and objective of this project is to design and construct an automatic control for slide doors using laser light and LDR as a motion detector and also to develop a simple low cost device aimed at easing the manual operation of modern slide doors.

1.2 Project justification

The manual operation of slide door demands the exertion of energy by the operator who should always be there to operate the door. However, this project work has risen to the challenge of replacing the unnecessary manual operation of slide doors and provides a relatively inexpensive alternative means of controlling slide doors.

1.3 Scope and Limitation

This project work is limited to prototype that demonstrates how an automatic slide door works, and can slightly be altered and used for automatic control of other systems like train crossing signaling, fingerling counter, burglar alarm, hand dryer etc. but this design is restricted to the control of automatic slide door, for easy exit or entry of the customer or any person via the door.

1.4 Methodology

The project was achieved using a laser light against an LDR (Light Dependent Resistor) as the motion sensor to detect human being approaching the entrance door, the resistance of an LDR varies with the intensity of light, and a microcontroller chip was used as the control that trigger the DC motor to roll both clockwise and anticlockwise direction to respectively indicate the opening and the closing of the door, while an electromagnetic relay was used as the DC motor driver.

The microcontroller perform the task of opening the door and generate a reasonable time delay and keep monitoring the motion sensing circuit to ensure that the person has passed through the door before finally closing the door.

1.5 Project layout

This project work is written in five chapters. Chapter one gives the general introduction, aim/objectives and methodology of the project work. Chapter two highlights the literature review which comprises brief historical background and theoretical background of the work. In chapter three, design and implementation is accomplished. Chapter four discusses testing, result and construction. The last chapter then summarizes the work done which includes conclusion and recommendation, while other documents are contained in the appendices and references.

CHAPTER TWO

Literature review

2.0 Historical background.

The first automatic door was invented by Heron of Alexandria, who was a great mathematician and mechanics inventor from Alexandria, Egypt [1]. He was one of the greatest inventors in ancient times. His strange inventions such as weight-automatic doors, automation theatre-puppet worked by string, were famous throughout ancient world [2].

Supermarkets were the first segment of retailers to use automatic doors. In 1930, George .W. Jenkins opened the first public market in winter Haven, Florida [3]. Shoppers get frustrated whenever they push or pull the door even with shopping cart in their hand i.e. a shopper approaching the exit or entrance door had no choice but to bring the shopping cart to the halt, while opening the door with one hand and push the shopping cart through with the other hand. Thereby resulting in congestion of shoppers waiting for chance to use the exit door.

Lew Hewitt and Dee Horton also build an automatic sliding door back in the mid-1950, when they realized that swing doors had difficulty operating in windy Corpus Christi. So Lew and Dee set out to invent the automatic sliding door to circumvent the windy conditions. Horton Automatics Inc. was formed in 1960, placing the first commercial automatic sliding door on the market and literally establishing a brand-new industry [4].

The first automatic door, activated by a foot sensor, was invented during the reign of the Chinese emperor Yang of Sui in approximately 610 AD – a bit earlier than the average person might expect, the emperor had one of these doors installed in his library. Hinges didn't come into common use until the 1200's, when they started to show up in examples of European architecture like the beautiful, intricately worked doors of the Notre Dame cathedral in France.

2.0.1 Types of automatic slide door

(A). Single smooth automatic doors open: For the narrow hall, the interval doors, interior doors.

(B). Double automatic doors open: For exterior doors, landing doors and other openings wide applications.

(C). Overlapping single smooth automatic doors open: Possession of a small narrow space for the door, and the need for larger openings of the occasion.

(D). overlapping double automatic doors: Less space for hidden doors, and openings to be a great occasion [6].

2.1 Theoretical background

This project work is made up of discrete electronic components whose desirable electrical characteristic has been put into use in the various modules of the work. In this section, a detailed description of the components will be stated as it relates to the project work.

2.1.1 Laser light

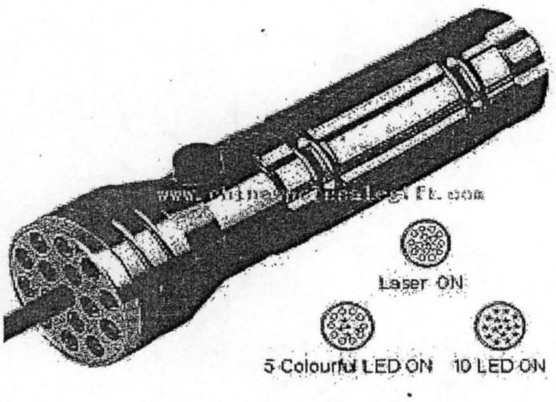


Fig. 2.1: Laser light

A laser is a device that emits light (electromagnetic radiation) through a process of optical amplification based on the stimulated emission of photons. The term "laser" originated as an acronym for Light Amplification by Stimulated Emission of Radiation. The emitted laser light is notable for its high degree of spatial and temporal coherence, unattainable using other technologies. Spatial coherence typically is expressed through the output being a narrow beam which is diffraction-limited, often a so-called "pencil beam." Laser beams can be focused to very tiny spots, achieving a very high irradiance. Or they can be launched into a beam of very low divergence in order to concentrate their power at a large distance. Lasers actually produce radiation in several modes having slightly different frequencies (wavelengths), there are even lasers that emit a broad spectrum of light, or emit different wavelengths of light simultaneously [7]

Laser light operates in two different modes, namely, pulse mode and continuous wave mode.

Pulse mode: Here the laser has its power output varying with time, thereby taking the form alternating ON and OFF periods. Pulse mode can also be realized by the use of other technique like gain switching.

Continuous wave mode (CW): The laser has its power output varying with time being constant. It is required for the population inversion of the gain medium to be continually replenished by a steady pump source. In some lasing media this is impossible. In some other lasers it would require pumping the laser at a very high continuous power level which would be impractical or destroy the laser by producing excessive heat. Such lasers cannot be run in CW mode.

2.1.2 Microcontroller

A microcontroller is a single chip that contains the processor (the CPU), non-volatile memory for the program (ROM or flash), volatile memory for input and output (RAM), a clock and an I/O control unit.

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 instruction set and pin-out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory pro-grammar. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller, which provides a highly flexible and cost-effective solution to many embedded control applications. The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next interrupt [8].

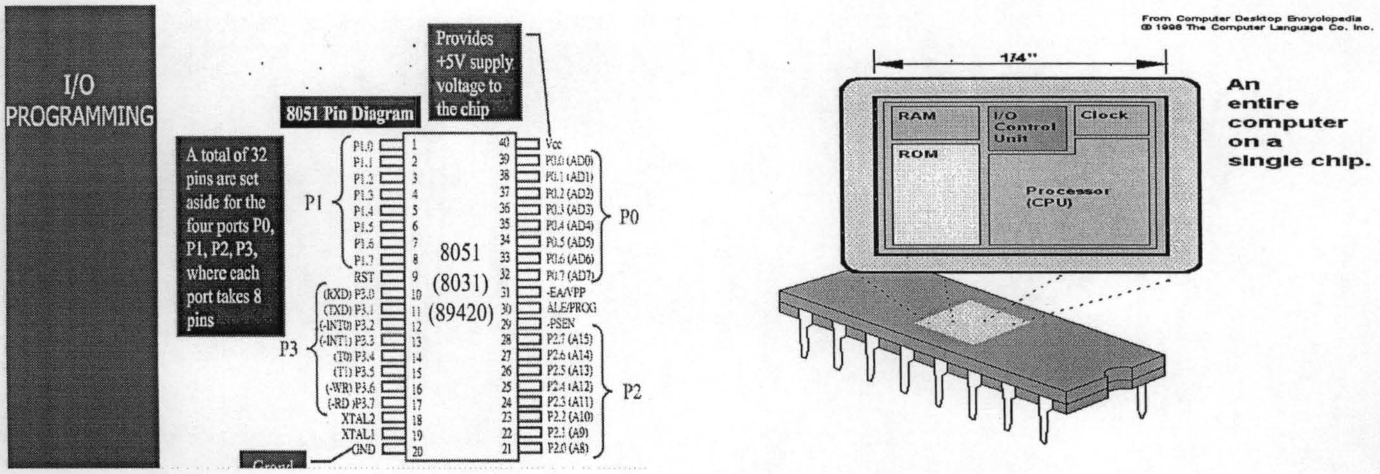


Fig. 2.2: Micro-controller

2.2.3 DC Motor

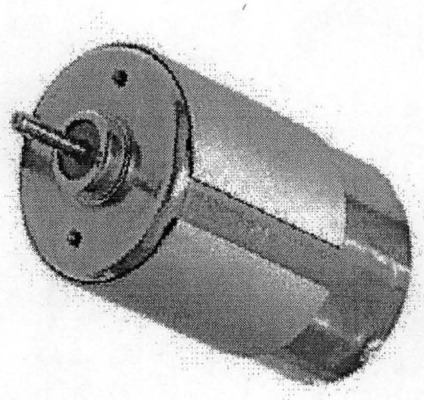


Fig. 2.3(a): DC Motor

Electric Motor can be defined as a machine which converts electric energy into mechanical energy. Its action is based on the principle that when a current carrying conductor is placed in a magnetic field, it experiences a mechanical force whose direction is given by Fleming's left-hand rule and whose magnitude is given by F =BIL Newton. When its field magnets are excited and its armature conductors are supplied with current from the supply mains, they experience a force tending to rotate the armature. Armature conductors under N-pole are assumed to carry current downwards, and those under S-poles, to carry current upward. These motors are particularly versatile because both their speed and direction can be readily controlled; speed by the voltage or duty cycle of their power supply, and direction by its polarity. DC motors also work as generators, Since generators slow down when they are heavily loaded, DC motors can be electronically braked, i.e. when the motor is disconnected from the battery it is off; when it is connected with the red wire to the positive terminal and black to negative it turns forward; and when the wires are reversed, the motor turns backward [9].

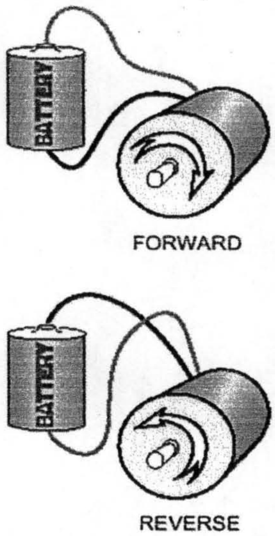


Fig. 2.3(b): Direction of rotation DC motor

2.2.4 NE555 Timer

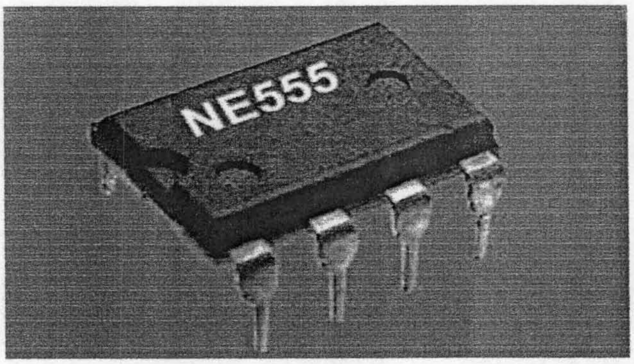


Plate I: NE555 Timer

The 555 monolithic timing circuit is a highly stable controller capable of producing accurate time delays, or oscillation. In the time delay mode of operation, the time is precisely controlled by one external resistor and capacitor. For a stable operation as an oscillator, the free running frequency and the duty cycle are both accurately controlled with two external resistors and one capacitor. The circuit may be triggered and reset on falling waveforms, and the output structure can source or sink up to 200mA. 555 timer has the following features: Turn-off time less than 2µs, Max. Operating frequency greater than 500kHz, Timing from microseconds to hours, Operates in both astable and monostable modes, High output current, Adjustable duty cycle, TTL compatible, Temperature stability of 0.005% per °C. It can be useful in Precision timing, Pulse generation, Sequential timing, Time delay generation, Pulse width modulation [8].

2.1.5 Capacitor

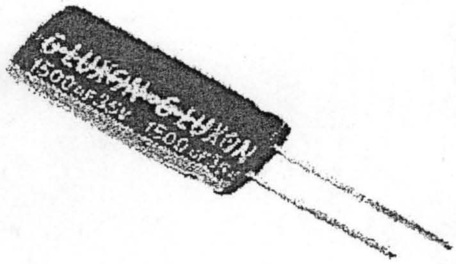


Fig. 2.4(a): Capacitor

A capacitor essentially consists of two conducting surfaces separated by a layer of an insulating medium called dielectric. The conducting surrounding will be in form of either circular plates or be a spherical or cylindrical shape. The purpose of a capacitor is to store electrical energy by stress in the dielectric, and it is measured in farad.

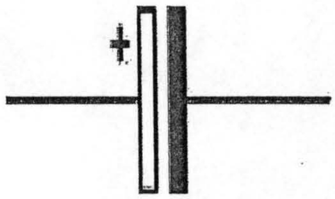


Fig. 2.4(b): Symbol of a Capacitor

2.1.6 LDR (Light dependent resistor)

A Light Dependent Resistor (LDR, photoconductor, or photocell) is a device which has a resistance that varies according to the amount of light falling on its surface. Different LDR's have different specifications and are fairly standard and have a resistance in total darkness of 1 MΩ, and a resistance of a couple of kilo ohm in bright light. Light dependent resistors are vital components in any electrical circuit that turned on and off automatically according to the level of ambient light, for example, solar powered garden lights and night security lighting. An LDR can even be used in a simple remote control circuit using the backlight of a mobile phone [10].

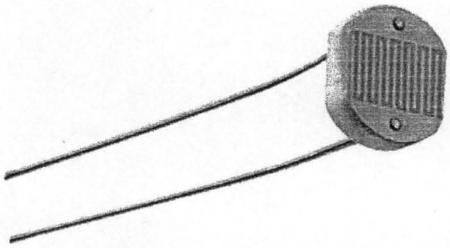


Fig. 2.5: Light Dependent Resistor

2.2.7 Diode

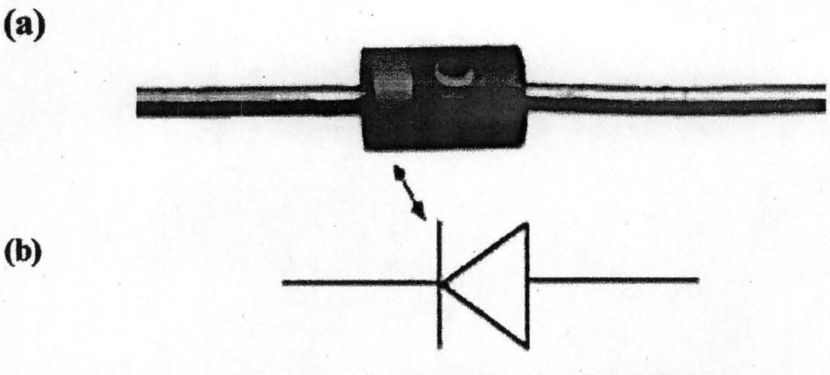


Fig. 2.6(a): A diode showing direction of current flow.

Fig. 2.6(b): Symbol of a diode.

A diode is an electrical device that conducts electricity in one direction, it neither conducts in a forward direction with zero resistance nor offers infinite resistance in the reverse direction. In the forward direction, the forward current does not start flowing until the voltage applied to the diode exceeds its threshold or knee voltage, while in the reverse direction, there is no infinite resistance because it will always have some reverse saturated current prior to breakdown [11].

2.2.8 Relay

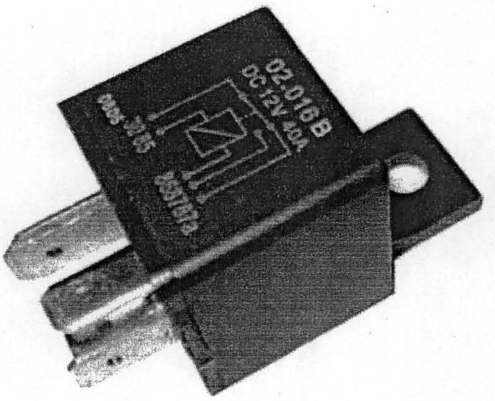


Fig. 2.7: A Relay

A relay is an electrically operated switch. Many relays use an electromagnet to operate a switching mechanism mechanically, but other operating principles are also used. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits, repeating the signal coming in from one circuit and re-transmitting it to another. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

A type of relay that can handle the high power required to directly control an electric motor is called a contactor. Solid-state relays control power circuits with no moving parts, but, rather using a semiconductor device to perform switching. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or fault. However, in modern electric power systems these functions are performed by digital instruments still called "protective relays"[11].

2.1.9 Transistors

Bipolar junction transistor consists of two back-to-back P-N junctions manufactured in a single piece of a semiconductor crystal. These two junctions give rise to three region called emitter, base, collector.

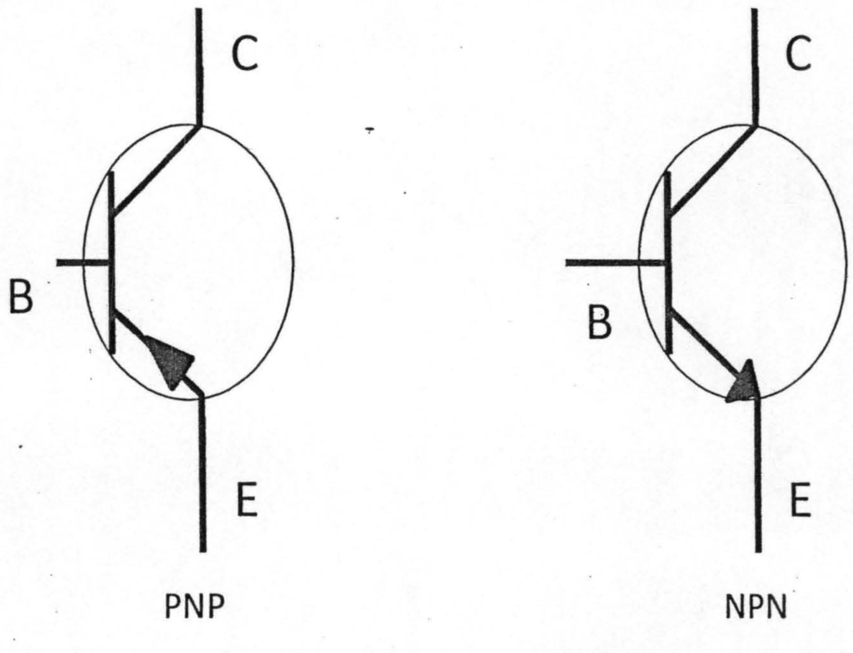
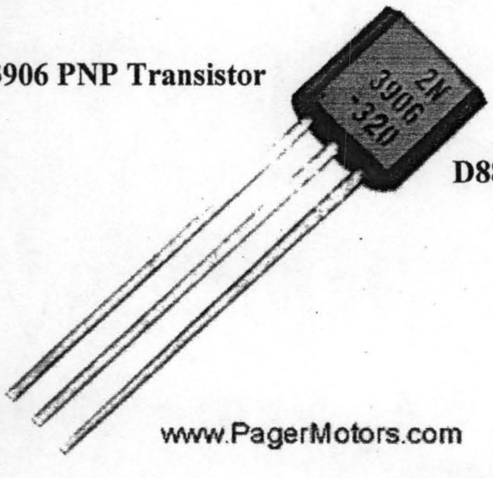


Fig. 2.8: Transistor Symbols

The emitter, base, and collector are provided with terminals which are labeled as E, B, and C respectively. The two junctions are: emitter-base (E/B) junction and collector-base (C/B) junction. But the symbol employed for PNP is different from that employed for NPN and the arrowhead is always at the emitter (not the collector), and in each case, its direction indicates the direction of current flow. For PNP transistor, arrowhead points from emitter to base meaning that emitter is positive with respect to base and also with respect to collector. For NPN transistor, it points from base to emitter meaning that base and collector as well are positive with respect to the emitter.The emitter is more heavily doped than any of the other regions and its function is to supply majority charge carrier (either electrons or holes) to the base. The base forms the middle section of the transistor, it is thin as compared to either the emitter or collector and is very lightly-doped, while the function of the collector (as indicated by its name) is to collect majority charge carriers coming from the emitter and passing through the base [12].

3906 PNP Transistor



D882 NPN Transistor

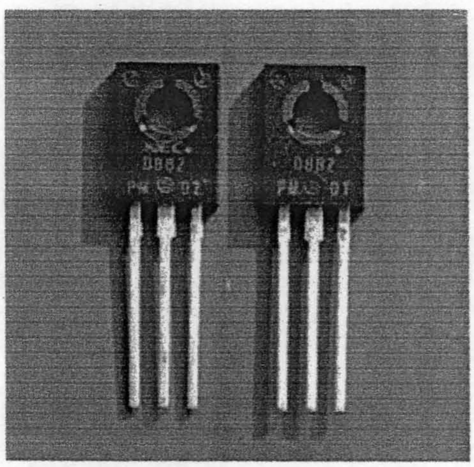


Plate II: Transistor

For the purpose of this project, two special transistors are used, they are 3906 PNP transistor and D882 NPN transistor (high current transistor) and their diagrams are shown above

2.2.10Voltage regulator

A voltage regulator is an electrical regulator designed to automatically maintain a constant voltage level. A voltage regulator may be a simple "feed-forward" design or may include negative feedback control loops. It may use an electromechanical mechanism, or electronic components. Depending on the design, it may be used to regulate one or more AC or DC voltages.

Electronic voltage regulators are found in devices such as computer power supplies where they stabilize the DC voltages used by the processor and other elements. In automobile alternators and central power station generator plants, voltage regulators control the output of the plant. In an electric power distribution system, voltage regulators may be installed at a substation or along distribution lines so that all customers receive steady voltage irrespective of how much power is drawn from the line [13].

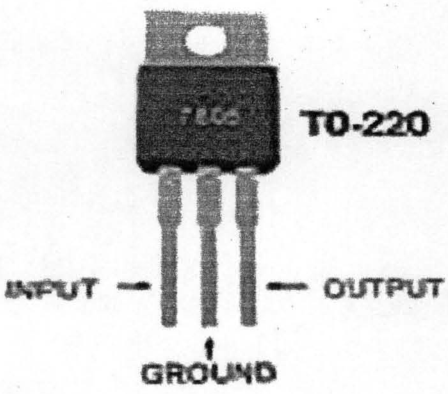


Fig. 2.9: Voltage Regulator

2.2.11 Resistor

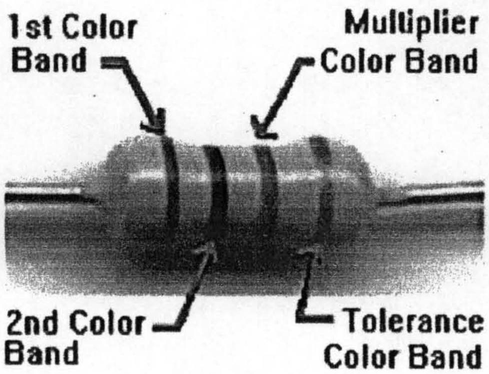


Fig. 2.10: Resistor

A resistor is a two-terminal passive electronic component that implements electrical resistance as a circuit element. When a voltage V is applied across the terminals of a resistor, a current I will flow through the resistor in direct proportion to that voltage. This constant of proportionality is called conductance, G. The reciprocal of the conductance is known as the resistance R, since, with a given voltage V, a larger value of R further "resists" the flow of current I as given by Ohm's law

$$I = \frac{V}{R} \qquad (1)$$

CHAPTER THREE

3.0 Design and implementation

In this section the design analysis of various stages and steps undertaken to achieve the project is presented in this chapter.

The design circuit was firstly simulated on multism (an electronic work bench application software) to ensure the designed circuit is working perfectly before proceeding to the breadboard construction (temporary construction). The breadboard construction temporarily tested the project and ensured that all the components used were in good working condition. Later, the circuit was transferred to the veroboard for permanent construction. The work space below showed how the project was being implemented on the multism environment.

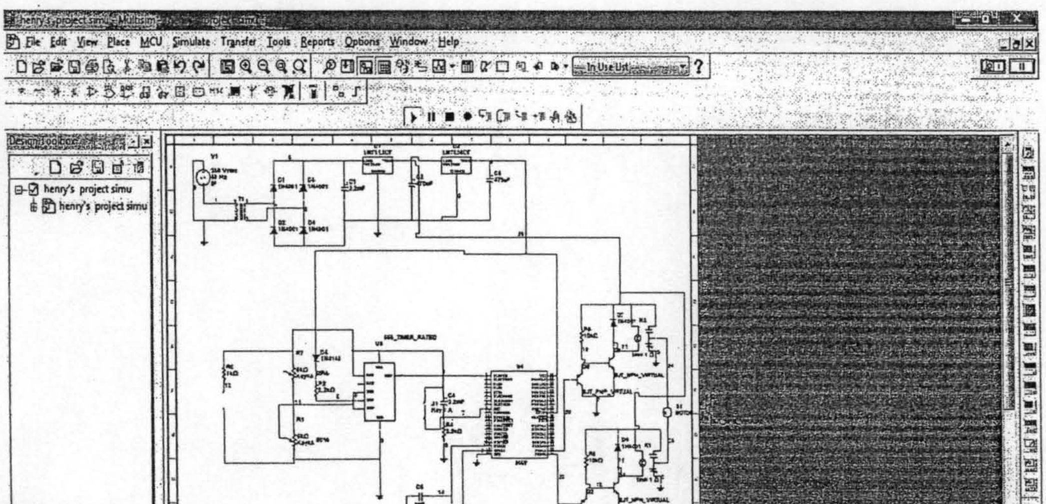


Plate III: Computer simulation workspace

3.1 Design analysis

This project is subdivided into four units as designated in the block diagram shown below

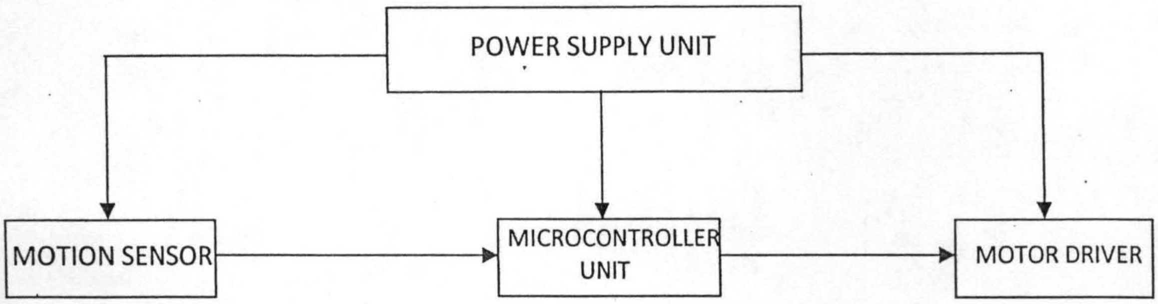


Fig. 3.1: Block diagram of the Circuit

3.1.1 The power supply unit

Most electronic devices and circuits require a DC source for their proper operation, a typical regulation and load. The power supply unit comprises the following listed below:

- A step down transformer
- A bridge rectifier
- Filtering capacitors
- Voltage regulators

3.1.1.1 Transformer

The main voltage of 230V is stepped down by a 230V/12V step down transformer i.e the primary voltage V_p is 230V while that of the secondary is 12V, hence the ratio of primary winding N_p to secondary winding Ns is given as:

$$\frac{N_S}{N_P} = \frac{12}{230} \quad \text{.......... (2)}$$

$$\frac{N_S}{N_P} = 0.05217 \quad \text{.......... (3)}$$

3.1.1.2 Bridge rectifier

A rectifier was employed by the use of a full – wave bridge diode rectifier consisting of four 1N4001A diodes, so as to convert the AC voltage to DC voltage which is required for the design.

3.1.1.3 Filtering capacitor

An electrolytic capacitor of value 2200µF / 25V is used to filter out the AC ripples that might still be present in the rectified DC voltage, while the essence of the 470µF capacitor is to ensure that we obtain a pure DC voltage at each stage of the voltage regulation, since the capacitor is a function of voltage dv. The quantity of electricity in a substance is also equal to the product of the current and time taken [14], thus,

$$Q = It \quad \text{.......... (4)}$$

The charge in a capacitor is equal to the product of the capacitance and the voltage difference between its plates;

$$Q = Cdv \quad \text{.......... (5)}$$

Combining equations (4) and (5), we have

$$Cdv = It \quad \text{.......... (6)}$$

$$C = \frac{It}{dv} \quad \ldots\ldots (7)$$

where Q is charge in coulombs, I is current in ampere, and t is time in seconds.

1.1.4 Voltage regulators

A 7812 voltage regulator was used to regulate the filtered DC signal to a fixed 12V to ed the relay and the DC motor while 7805 voltage regulator was used to regulate it to another ed 5V to power the motion sensor and the microcontroller chip.

Therefore, the rms voltage value is 12V, and then the peak value will be

$$V_{pk} = V_{rms}\sqrt{2} \quad \ldots\ldots (8)$$

$$V_{pk} = 12\sqrt{2} \quad \ldots\ldots (9)$$

he complete circuit of the power unit is shown below:

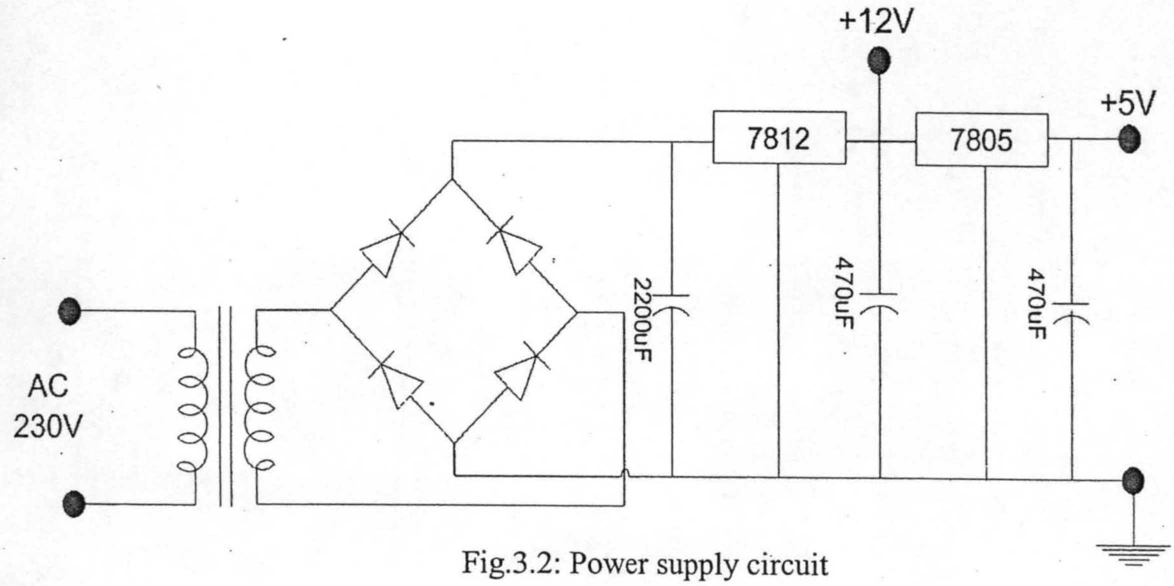


Fig.3.2: Power supply circuit

2 The motion sensing unit

In this unit, a laser light was used against an LDR (Light Dependent Resistor). The ›istance of an LDR varies with the intensity of light, the LDR was connected to a 555 timer at is neither monostable nor astable.. The NE 555 is designed to deliver an output any time pin is high, the IN4148 diode whose terminals are connected to the Vcc and a resistor is to prevent ıck flow of current to pin 7 and pin 6 which are looped with pin 2 to make the output remain gh as long as the pin 2 is high, and goes-low immediately pin 2 goes low. Pin 2 needs about 2V › be high, meanwhile pin 4 and 8 are connected to Vcc, pin 1 to ground alongside a 10k variable ›sistor which is used to set the light sensitivity and pin 3 receives the signal with an output oltage of 5V and is interfaced with the microcontroller, as shown below.

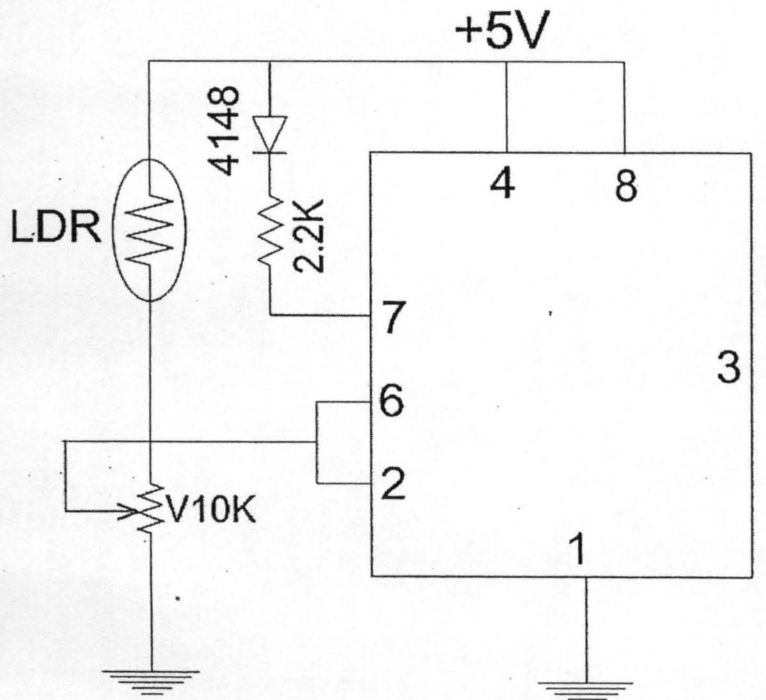


Fig. 3.3: Motion Sensor Circuit

.3 Microcontroller unit

This unit is sub divided into two i.e. the software part and the hardware part

.3.1 Software

This software is used to simulate the code to ascertain that the code is free from syntax rror and logic error, and finally helped in generating the HEX file which is burnt on the nicrocontroller chip to perform the control function when interfaced with other units, such as ending a 1 and 0 signal to open the door and then after a delay of 4seconds changes to 0 and 1 to lose the door within a period of 2seconds.

).3.2 Hardware

The microcontroller used is an AT89S52 microcontroller and has 40 pins. The output rom pin 3 of the 555 timer is connected to pin 1 of the microcontroller as its input. A reset outton to pin 9 enables the microcontroller to start from its initial state at any time it wants to start a new program, a crystal oscillator to pin 18, 19 and 20, pin 31 and 40 to Vcc, the essence of pin 3 to Vcc is to activate the internal memory of the microcontroller while pin 40 is to source for the 5V power supply required by the microcontroller for operation. While pin 21 and 22 help the microcontroller to send signal (instruction) to the transistor which acts as a switch and the circuit is as shown below:

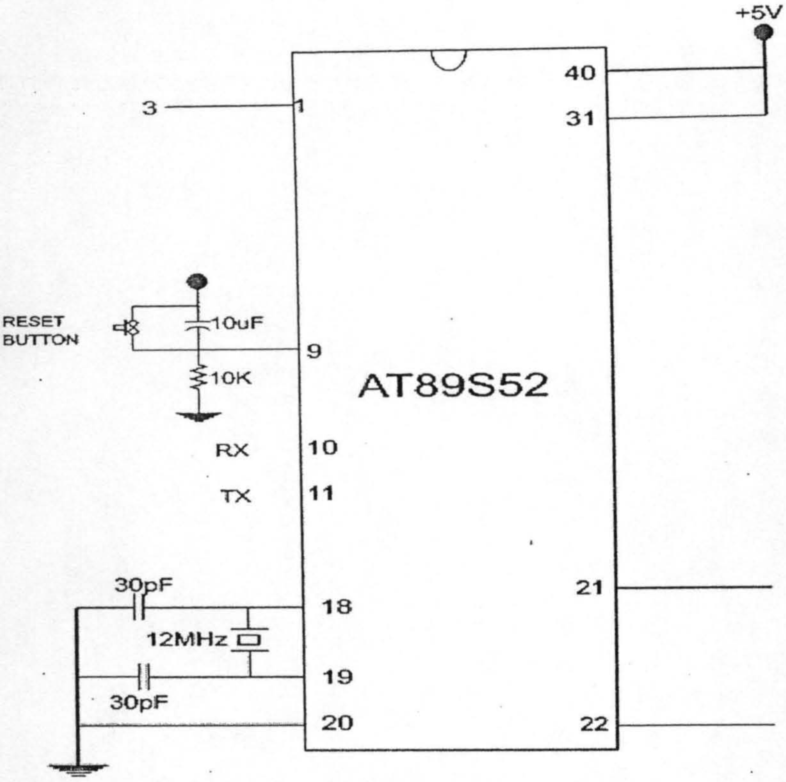


Fig. 3.4: Micro-controller circuit

One of the essential part of the microcontroller is the crystal oscillator that generates the clock pulse or frequency for the microcontroller to execute instruction, hence the 8051 microcontroller performs 12MHz pulses to execute one million instructions.

Therefore, 1 instruction = 12Hz

x instruction = 12MHz

Hence, $x = \frac{12,000,000}{12} = 1,000,000$ *instructions per pulse.*

.4 The motor controller unit

This unit consists of two pnp 3906 transistors, two npn D882 transistors (high current ansistor) and two relays. In this project, an electromagnetic relay was employed in driving the otor. Here, the signals from pin 21 and 22 of the microcontroller were each connected to the 906 transistors and the 3906 are further connected to the D882 transistor and then to the relay. he relay and DC motor require 12V for their operation, with the relay the microcontroller was ole to roll the motor clockwise for opening the door and anticlockwise for closing the door, ence the COMMON from each relays is connected to the DC motor, while a pulley on which ie prototype door is mounted is hinged on the rotating part of the DC motor, causing the door to pen and close.

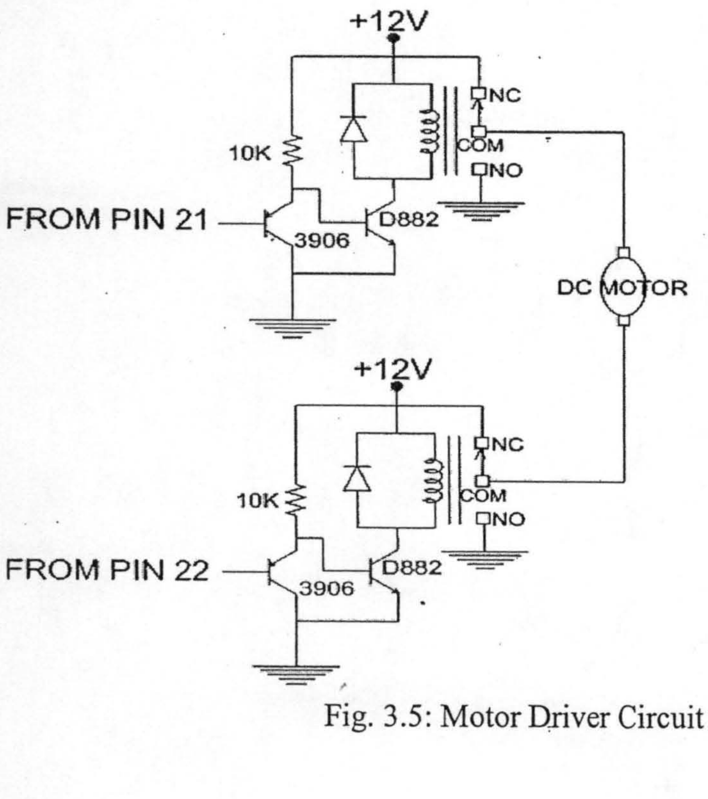


Fig. 3.5: Motor Driver Circuit

4.1 Principle of a relay

A relay is an electromagnetic device that when current flow through the coil, a magnetic eld is generated at the knob and attracts the terminal to itself. It has five terminals as illustrated elow:

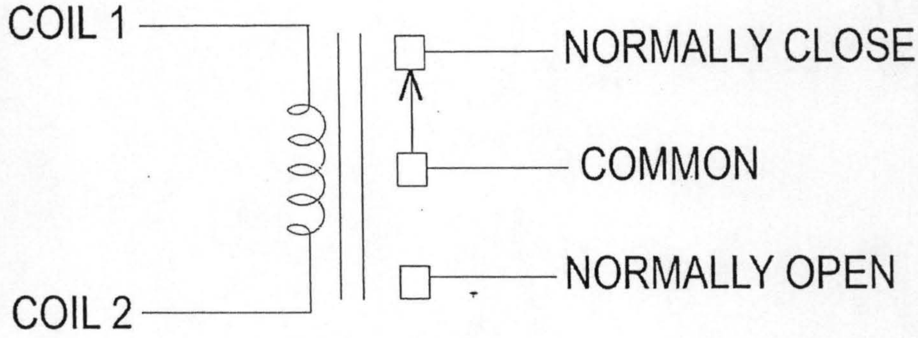


Fig. 3.6: Schematic diagram of Relay

The common is usually connected to the normally close and only when current flows through the oil the common disconnect from the normally close and connect to the normally open. The witching time is about 300 milliseconds that can hardly be noticed.

CALCULATION:

The resistance of the relay coil obtained from measurement is 374 Ω and the current drop at the relay coil can be calculated using ohms law.

$$V = IR \quad \text{(10)}$$

Hence: $$I = \frac{V}{R} \quad \text{(11)}$$

$$I = \frac{12}{374} = 0.03208\ A$$

$I = 3.2mA$

3.5 Implementation of design

The implementation was done on two stages-the temporary construction which was done on breadboard to confirm that the simulated circuit was physically realized and the permanent construction on veroboard.

3.5.1 Temporal construction

These involves the physical implementation of the simulated circuit on breadboard by the use of same components chosen for the simulation and connecting wires were used where necessary. Various tests were carried out during implementation to ensure that correct polarities of components were connected and continuity maintained. Shown below is a pictorial diagram of the temporal construction.

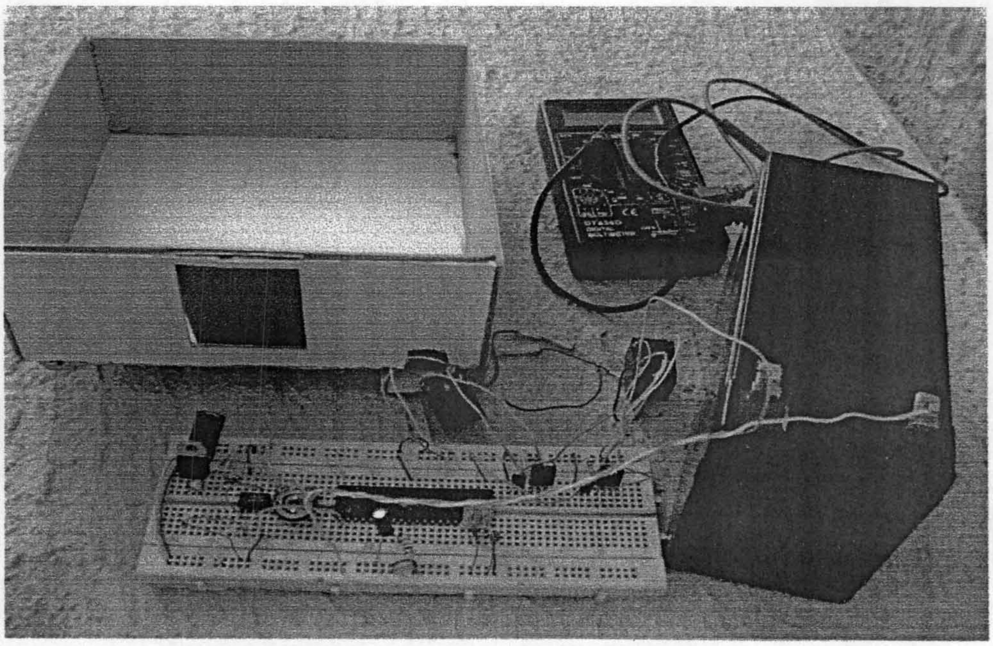


Plate IV: Temporal breadboard construction

3.5.2 Permanent construction

The exact circuit on the breadboard was transferred to a veroboard and was soldered. During soldering, care was taken to prevent accidental bridging of the electrical continuity. Below is a pictorial diagram of the permanent construction:

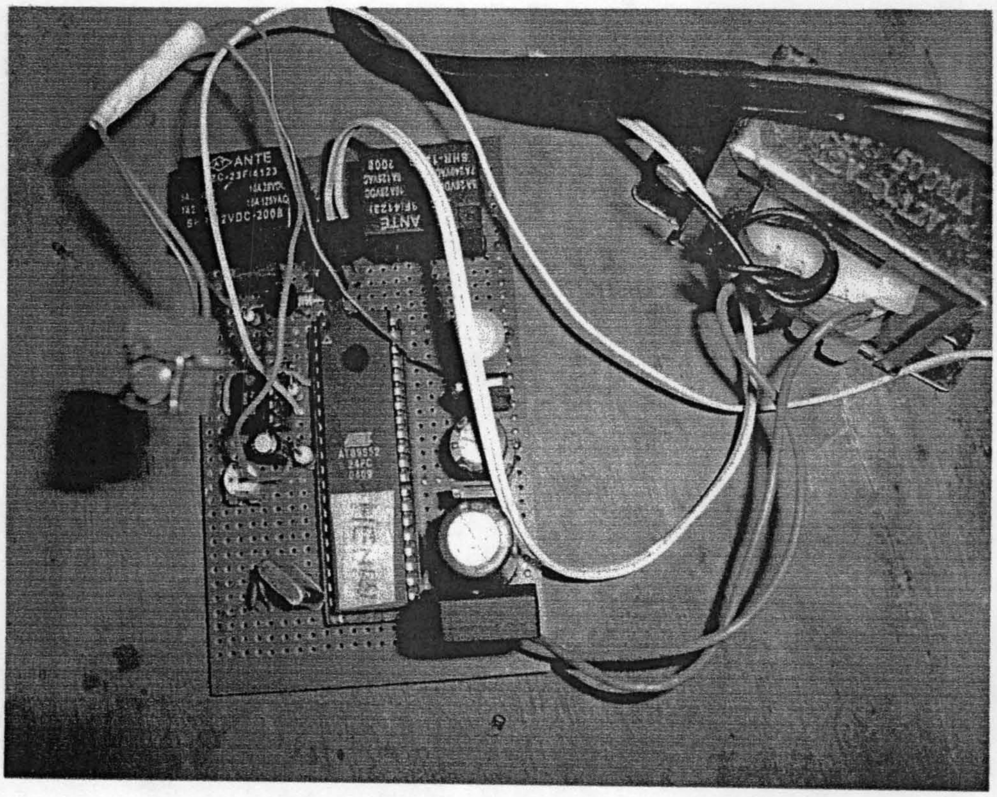


Plate V: Permanent Veroboard circuit

The permanent constructed work after testing was cased so as to make it look presentable and the diagram is as shown below:

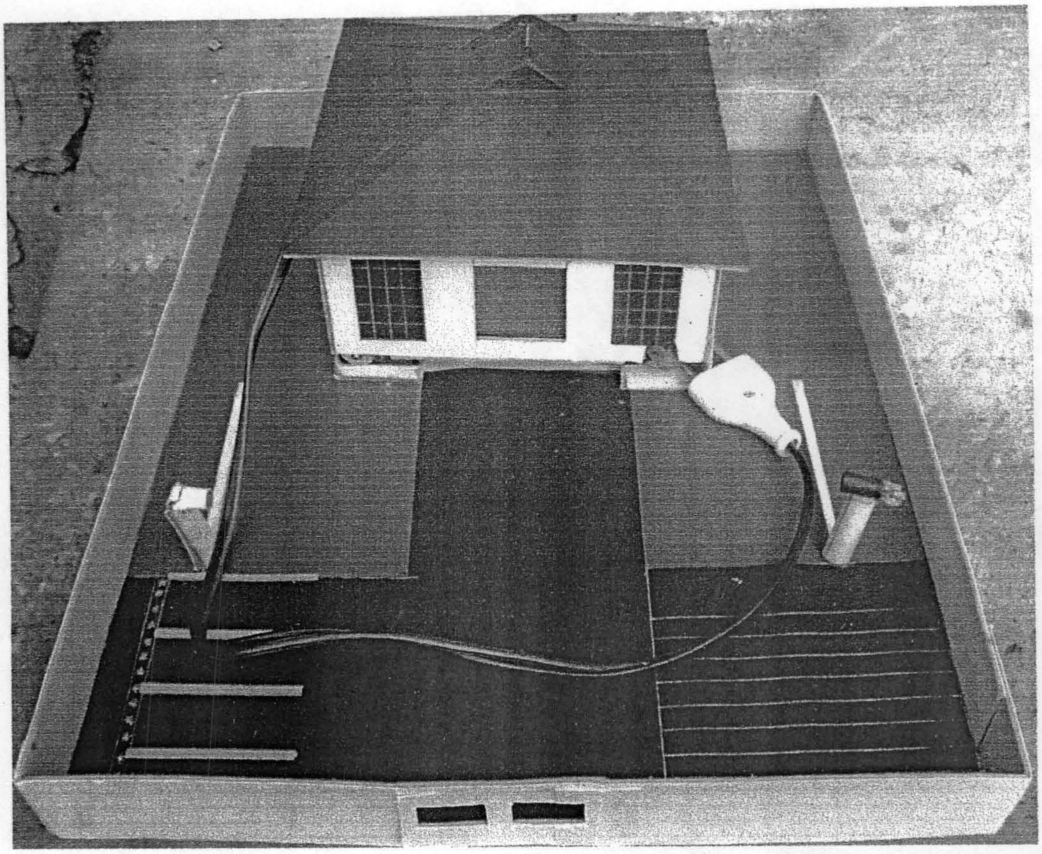


Plate VI: The cased devise

3.6 Precautions

Some of the precautions taken during the course of the construction include:

1. I ensure that correct polarities of components were connected and continuity maintained at all stages of construction.
2. At each unit of construction, reading was taken so as to prevent the components from damage.
3. At the permanent stage, soldering was carefully done on the veroboard to prevent accidental bridging of the electrical continuity.

3.7 Working principle

The principle of operation of this project is based on the fact that it requires a power supply of 5V to work (from motion sensor unit to the microcontroller unit) and a 12V dc voltage

The laser light is wired alongside the LDR in such a way that they depend on each other for operation, when the laser light is focused on the light dependent resistor (LDR), the resistance of the LDR becomes low but when the laser light is obstructed then the resistance of LDR goes high, which is obtained by setting the sensitivity from the variable resistor. The 555 timer monitors the change and sends signal to the microcontroller via pin 2 as the signal input and pin 3 as the signal output of the 555 timer. When the microcontroller receives the signal it controls the opening and the closing of the door by sending signal (1,0 to open the door, 0,1 to close it and 0,0 to remain at rest). It is the 3906 transistor that receives the signal from the microcontroller and switches on the D882 transistor, which is a high current transistor. Subsequently, D882 transistor switches on the relay which in turn causes the door to open and close at a particular time interval as directed by the microcontroller.

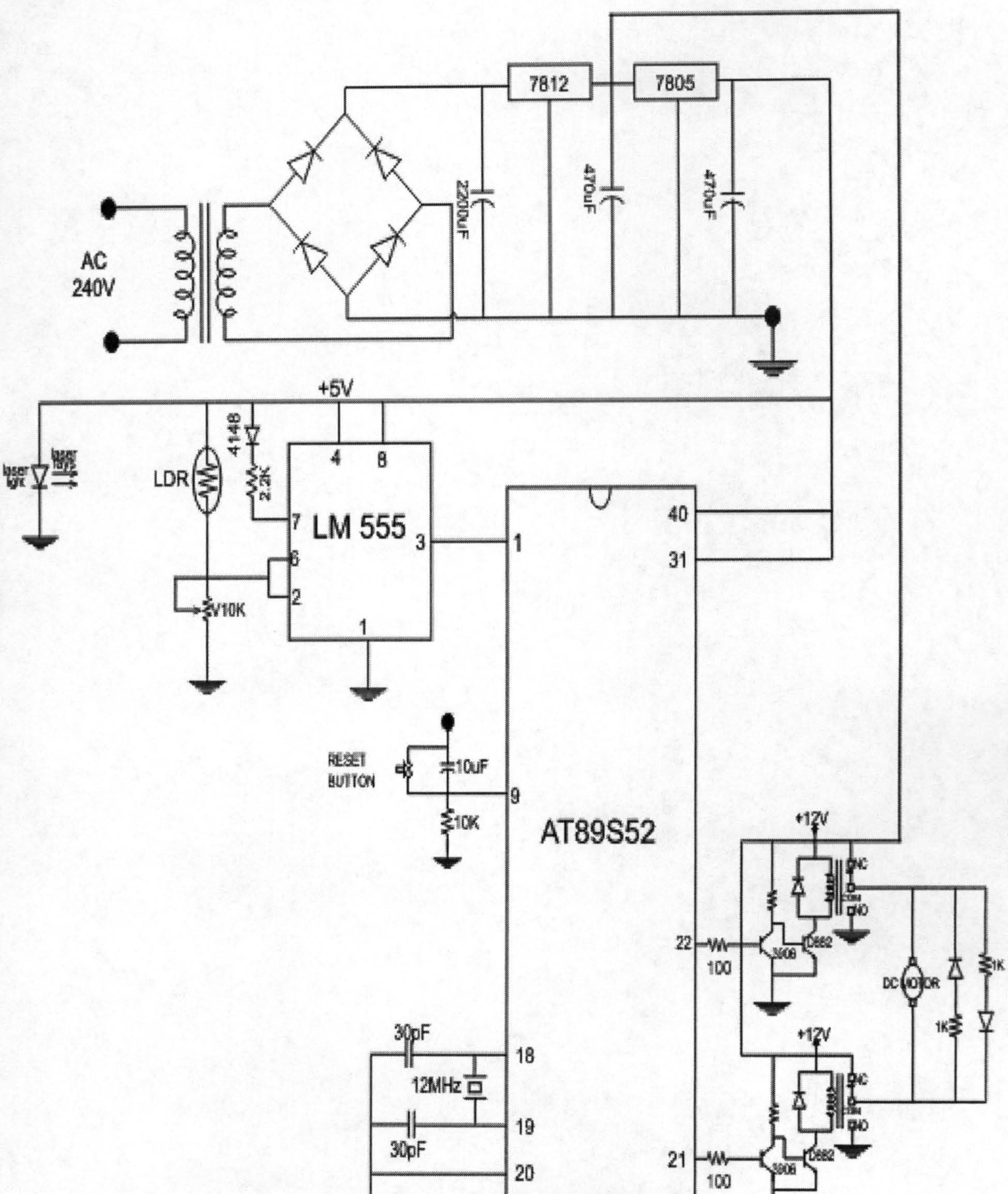


Fig. 3.7: Circuit Diagram of an Automatic Control for slide Door

CHAPTER FOUR

Test, result and discussion

The test carried out and result obtained in the course of the design and implementation of this work is divided into two broad categories, namely,

1. Simulation and results
2. Construction

4.1 Simulation and results

After the circuit has been simulated the following tests were carried out and the results obtained were recorded.

4.1.1 Transformer primary voltage

The measured primary input voltage when a multmeter is used was 230.03V. Using an oscilloscope, the waveform obtained as shown below.

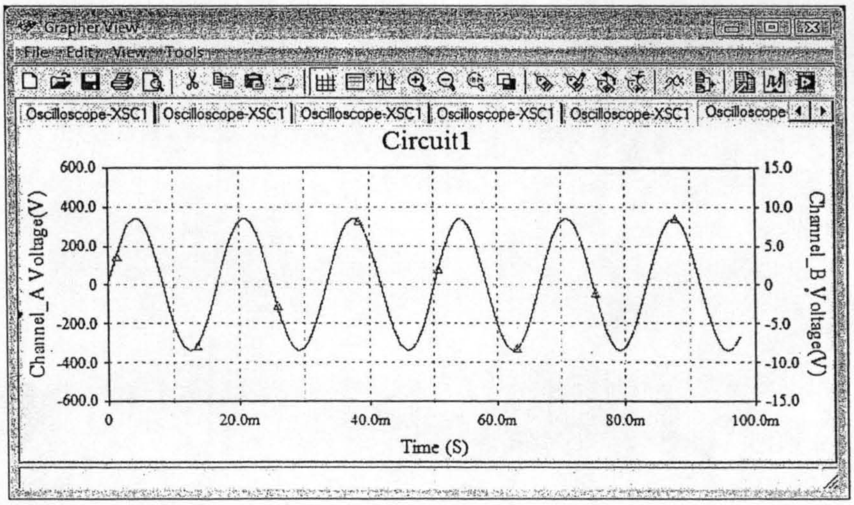


Plate VII: Waveform of Transformer Primary Voltage

4.1.2 Transformer secondary voltage

The measured step-down voltage using a multimeter was 12.05V. Using an oscilloscope, the waveform is as shown below:

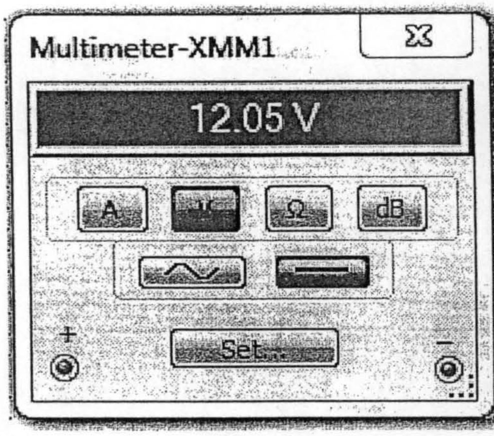


Plate VIII: Multimeter Reading for Secondary Transformer Voltage

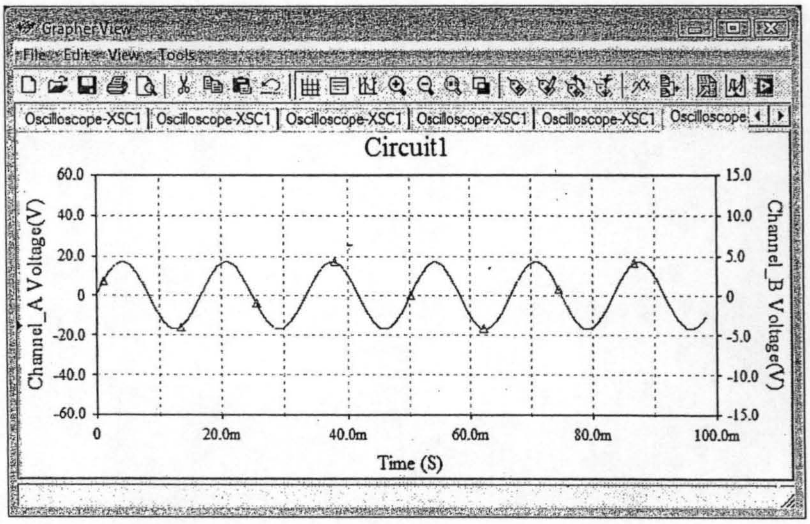


Plate IX: Waveform of Secondary Transformer Voltage

4.1.3 Rectified voltage

After rectifying, the voltage obtained was 12.05V. And using oscilloscope, Plate III was obtained.

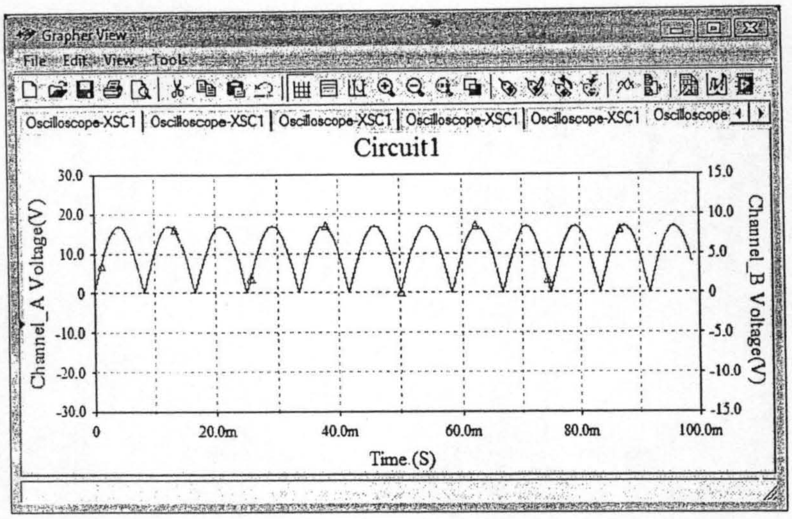


Plate X: Waveform of Rectified Voltage

4.1.4 Smooth voltage

Here is the signal obtained when the rectified voltage is smoothened.

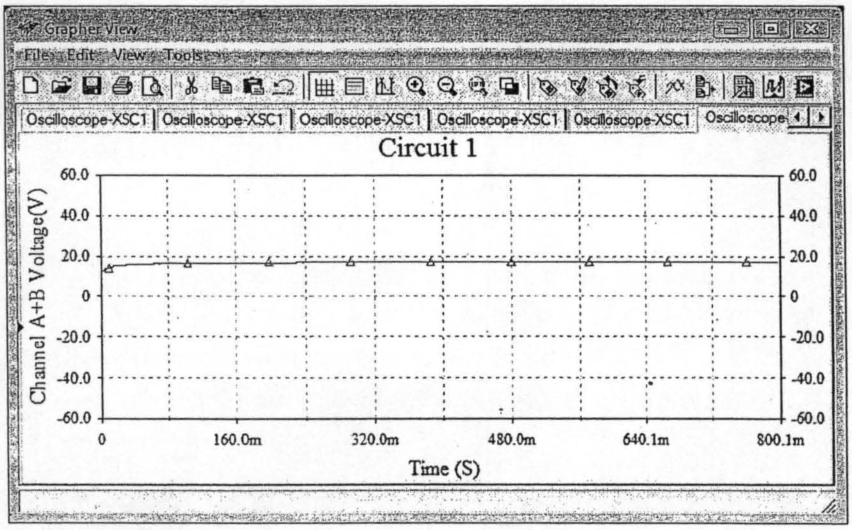


Plate XI: Waveform of a Smooth Voltage

4.1.5 Regulated output voltages

The voltage from the output of each regulator, when measured with a multimeter gave 11.9997V and 5.01V respectively.

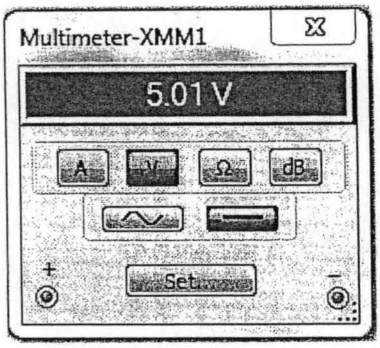


Plate XII: Regulated Output Voltage Reading

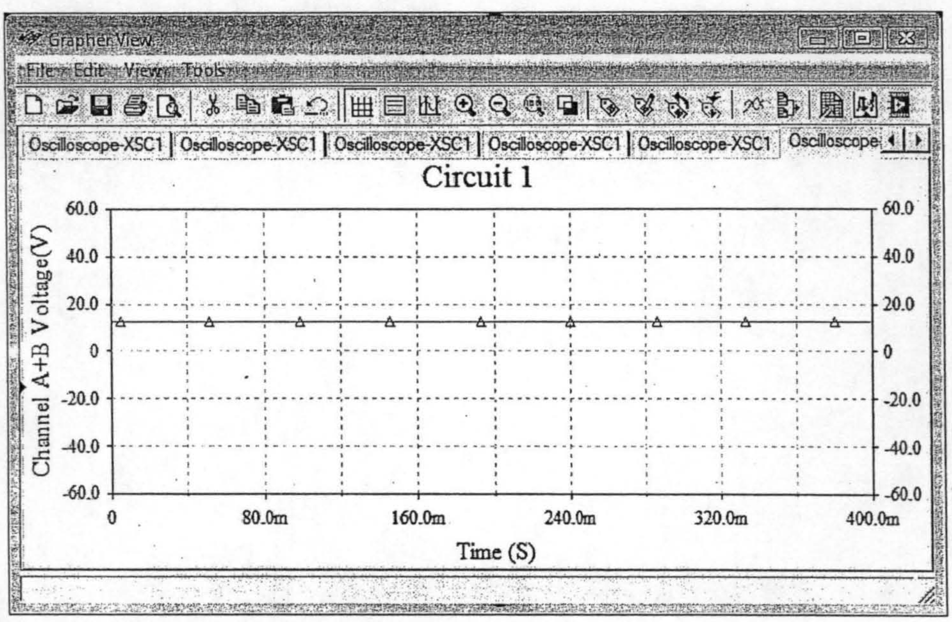


Plate XIII: Waveform of regulated Output Voltage

Table 4.1: Measured Voltages of Complete Circuit Diagram

S/N	DESCRIPTION OF MEASURED QUANTITY	VOLTAGE (V) OBTAINED FROM PHYSICAL TEST	VOLTAGE (V)OBTAINED FROM SIMULATION
1	Transformer stepped-down secondary voltage	11.9800	12.0500
2	Output voltage from 7812 regulator	12.0000	11.9997
3	Output voltage from 7805 regulator	5.05000	5.0100
4	Voltage at the micro-controller	5.05000	4.8200
5	Voltage at 555-timer out put	5.05000	4.8300
6	Voltage at the relay	I2.0000	12.0000
7	Rectified voltage	12.0000	12.0500

Table 4.2: Measured Current of Complete Circuit

S/N	DESCRIPTION OF MEASURED QUANTITY	CURRENT (mA) OBTAINED FROM PHYSICAL TEST
1	Current sourced by micro-controller	300.0000
2	Current	320.8000

Table 4.3: Logical Signal Expression of Micro-controller

S/N	DOOR DESCRIPTION	SIGNAL FROM PORT 22	SIGNAL FROM PORT 21	SIGNAL INTERPRETATION PORT 22	SIGNAL INTERPRETATION PORT 21
1	Open the door	1	0	High	Low
2	Close the door	0	1	Low	High
3	Door state of rest	0	0	Low	Low

4.1.6 Discussion of Result

It was observed from the result obtained in the "tests" that the values of voltage obtained by physical measurement differ from that obtained by simulation and also it was observed that the values at each stage differs by + or – 0.01 due to tolerance. Other logical signal expression were observed from the micro-controller i.e. it sent its signal of 1 and 0 (high and low) to open the door, 0 and 1 (low and high) to close the door and back to 0's to remain in its state of rest. The preliminary test carried out in the circuit was to determine the voltage at each stage of the circuit and the possible current which was also taken note of.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The aim of this prototype project "Design and Construction of Automatic Control for Slide door" using laser light and light dependent resistor as a motion sensor, is to ease the opening and closing of modern slide doors at a very low cost. The door is automatically controlled by the microcontroller at a reasonable time interval which depends on the distance of the door from its stopper.

5.2 Recommendations

Though the aim and objective of the project was achieved, but it is still open to further modifications to students who feel they can do better in areas of circuit design and research as stated below.

- An alarm can be added to the circuit design, so as to produce a sound once the connection between the laser and LDR has been obstructed.
- An OP-AMP can also be used as a comparator in place of 555 timer, to compare between two signal and once the difference between the signal is one or more signal will be sent to the microcontroller.
- Other Software programs apart from assembly language can also be used to write the instructions in the microcontroller.

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APPENDIX A

PROGRAM SOURCE CODE

```
ORG 0000H

MOTION EQU P1.3

MOTOR1 EQU P1.0

MOTOR2 EQU P1.1

SETB MOTOR1

SETB MOTOR2

CLR MOTION

HERE:   JNB MOTION, HERE

            CLR MOTOR1

            ACALL DELAY

            SETB MOTOR1

HERE1:  JB MOTION, HERE1

            ACALL DELAY

            ACALL DELAY

            ACALL DELAY

            CLR MOTOR2

            ACALL DELAY

            SETB MOTOR2

            AJMP HERE

DELAY:  MOV R1, #6
```

```
HENRY:  MOV R2, #195
HENRY0: MOV R3, #250
HENRY1: DJNZ R3, HENRY1
    DJNZ R2, HENRY0
        DJNZ R1, HENRY
    RET
        END
```

APPENDIX B

HEX FILE

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1000100093FD112011201120C2911120D29101106CF

0000200079067AC37BFADBFEDAFAD9FC2204

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