CONSTRUCTION OF A MICROCONTROLLER BASED GATE

By

MBA STEPHEN .A

EE/2007/263

DEPARTMENT OF ELECTRICAL/ELECTRONIC ENGINEERING FACULTY OF ENGINEERING CARITAS UNIVERSITY, AMOJI-NIKE ENUGU.

August 2012.

TITLE PAGE

CONSTRUCTION OF A MICROCONTROLLER BASED GATE

BY

MBA STEPHEN .A

EE/2007/263

BEING A PROJECT SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF BACHELOR OF ENGINEERING (B.ENG) DEGREE IN ELECTRICAL/ELECTRONIC ENGINEERING CARITAS UNIVERSITY, AMOJI-NIKE ENUGU.

AUGUST 2012

APPROVAL PAGE

This project has been approved by the department of Electrical/ Electronics Engineering, Caritas University Enugu, in partial fulfillment for the award of bachelor of engineering degree (B.Eng.) in Electrical/ Electronic Engineering.

Engr. Ochi V.A Date

Supervisor

Engr. Ejimofor C.O

Head of Department Date

External Supervisor Date

DEDICATION

This work is specially dedicated to the great Almighty and Ever-living God, if not for His mercy and favour, all my efforts would have been in vain.

ACKNOWLEDGEMENT

My awesome thanks to GOD Almighty whose grace has sincerely contributed to my guidance and protection throughout the past seasons.

I wish to acknowledge the dean of faculty of engineering, Engr. Professor Ojobo, the head of the department of Electrical/Electronics, Engr. C.O Ejimofor, my project supervisor, Engr. V.A Ochi who worked so hard to ensure that I do not dwell in mediocrity, my lecturers, Prof. Ochiagha, Engr. P.N Mbah, Engr. Ezeh and my course adviser/senior lecturer Engr. E.C Aneke, for their immense contribution and encouragement.

I am most grateful to my parents Mr. and Mrs. A. Mba for their moral and financial support.

TABLE OF CONTENTS

CHAPTER TWO

CHAPTER THREE

CHAPTER FOUR

CHAPTER FIVE

LIST OF FIGURES

Figures

LIST OF TABLES

ABSTRACT

Microcontroller based automate controller is a project design of a system that is used in operating a gate automatically. The system opens the gate automatically when a human being or car is about to enter a compound or exit a compound. The system works by sensing the light rays from the head lamp of the vehicle. The light ray is sensed and signal is used in operating the gate. Different blocks of circuit are put together to ensure that the system works perfectly as desired. The blocks include; the power supply unit, the control unit, the sensor unit, and drive unit. The power supply unit powers on the entire system, it supplies appropriate dc signal to where it is needed. The supply unit is made up of a 12volts step down transformer, a bridge rectifier circuit, a filter capacitor and a voltage regulator IC. The control unit receives signal from the sensor section to control the remaining part of the system. The control section is the logical part of the system and decides the state of the entire system depending on the signal from the sensor unit. The control section carries its operation with use of a microcontroller ATMEL89S52. The sensor unit receives signals from the headlamp of the vehicle or the human being and sends signals to indicate that a human being or car is present. This is achieved with the use a light dependent resistors. The drive unit is a DC motor which carries the gate to a specific direction as indicated by the microcontroller.

CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND OF THE PROJECT

In the past, many systems that are designed by man are normally operated manually. This mode of operation is accompanied with many defects or disadvantages. Some of the disadvantages involve stress undergone by the operator; the operator is also exposed to health hazards when carrying out his or her duties. These health hazards might be in terms of electrocution, skin burn or bruises.

To overcome the above mentioned disadvantages that are associated with manual operation of systems, the recent systems are designed with mechanisms that enable them to carry out the required operations automatically. To this effect, the system carries out the required operation by them. The mechanism of the system can only be altered during servicing of the machine. With automatic operation of systems, the stress involved with handling the systems are reduced drastically.

The automatic gate control system is one of the systems that operate automatically. The system simply detects the presence of object at the front of the gate and then, opens the doors of the gate automatically. It incorporates sensors that are mounted at strategic positions and which has the capability of detecting objects. These systems are used in public offices where people often make use of the doors.

1.2 AIMS AND OBJECTIVE OF THE PROJECT

The main aim of the design is to practically obtain a system that opens and closes a given gate automatically, when there is presence of cars or persons. The system is designed in such a way that it has sensors that senses the presence of people.

1.3 SCOPE OF THE PROJECT

The design and implementation of microcontroller based automatic gate controller utilizes the characteristic operation of both passive and active electronic components such as resistors, capacitors and integrated circuits. The circuit is designed in a prototype forms and it is only meant for indoor demonstration of how the system works. The system also uses a programmable integrated circuit in its control unit. Meanwhile, this project, microcontroller based automatic gate control has sub units such as:

- Power supply unit
- The control section

- The gate drive section
- The sensor unit

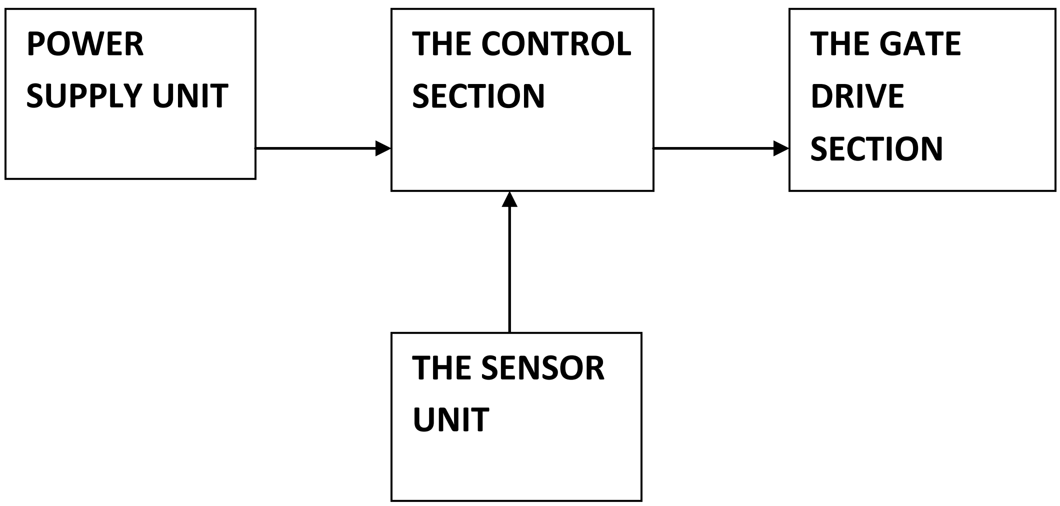


Fig: 1.1. The block diagram of microcontroller based automatic gate control

1.4 DEFINITION OF TERMS

- **Voltage regulation:** this is simply, the control of voltage as needed by the design. Voltage regulation ensures that a specific and steady voltage supply is provided for the system operation.
- **Electromagnetic switch:** this is the contact making that exists between terminal of electronic components. These switches are carried through a process known as electromagnetic induction. Examples of devices that can perform this action is the **relay.**
- **Erasable programmable read only memory (EPROM):** this is a type of memory device which can be programmed. The device also has program erasing ability if it is to be reprogrammed.

1.5 PROJECT REPORT ORGANIZATION

Five chapters were covered in the course of design and development of this project. The chapters and their contents are as follows:

Chapter one is the introductory chapter that gives the background of the project, aim and objective, the scope and organization of the project.

Chapter Two handles the literature review; information on previous work relevant to the topic.

In chapter three, I discussed the practical system analysis of the project. Also discussed is the requirement analysis, which is all the information, gathered from a wide research on microcontroller over/under voltage protective system.

Chapter four deals with the design procedure, construction steps, packaging and cost of components.

Chapter five contains the test result, summary, conclusion and recommendations for further work.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 INTRODUCTION

The need for automatic doors has been on the increase in recent times. The system described here incorporates the use of microcontroller as a controller in achieving the purpose of this project. As affirmed by Shoewu and Baruwa [1], the microcontroller has revolutionalized the electronics industry and has had a remarkable impact on many aspects of our lives. Almost all areas of technology have started taking advantage of the inexpensive computer control that microprocessor can provide. Some typical applications include electronic games, CD players, automatic braking systems, industrial process controls, electronic measuring instruments, automobile emission controls, microwave ovens, traffic controllers, and a rapidly growing number of new products.

The automatic door described here automates the entrances to public buildings such as banks, shopping malls, office buildings, airports, residential homes, automobile terminus, and public car parks. It uses the microcontroller convenience to avoid the stress of manually opening and closing the entrance doors. The technology used eliminates door monitoring and manning by human beings. The door uses the state-of-theart entry system, the doors have to perform gyrations-open, auto-reverse, stop, fully close and fully stop.

The automatic door is not a security device and should not be constructed as one. It provides a convenient access and intelligent feature that makes it distinct from all other door which brings it so close to security device.

2.2 REVIEW OF AUTOMATIC DOORS

The automatic door operation is accomplished when the open or initiate command is transmitted from the activation device to the control box. A wide variety of devices can be used to activate the doors including wall switches, motion or proximity sensors, infrared beams, or any device that switches using dry contents. Krutz [2] asserted that a microcontroller based control board controls the hold open time and functionality of the doors. Hold open times can be set 1-99 seconds by means of the control board and opening times can be adjusted from 1.5 to 5 seconds by changing air regulator pressure and air flow controls.

McGlen [3] said that series operator can be easily mounted to any conventional door frame header and the face of the door. Easy to use templates and an extensive installation and owner‟ s manual are included with the units allowing for simple installation.

Private door openers [4] revealed that the control box is microcontroller based to insure maximum reliability and flexibility for the end user. The system has been designed to be easy to set up and operate.

2.3 REVIEW OF SENSORS

LIGHT DEPENDENT RESISTORS (LDR)

Floyd, [5] defines light dependent resistor (LDR) as a device which has resistance which varies according to the intensity of light falling on its surface. He further explained that light dependent resistors are vital component in any electric circuit which is to be turned on or off automatically according to the level of ambient light-for example, solar powered garden lights, and night security light.

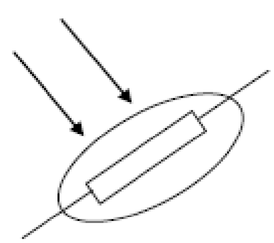


Fig. 2.1: A typical light dependent resistor.

Neal [6] interfaced a simple LDR sensor circuit to a microcontroller to control a light/dark detector. According to him, there are two basic circuits using the LDR, the first is activated by darkness, the second is activated by light. The two circuits are very similar and just require an LDR, some standard resistors, a variable resistor and any small signal transistor.

According to Floyd [5], LDR‟ S or light dependent resistors are very useful especially in light/dark sensor circuits. Normally the resistance of an LDR is very high, sometimes as high as 1MΩ, but when they are illuminated with light resistance drops dramatically.

When the light level is low the resistance of the LDR is high. This prevents current from flowing to the base of the transistors. Consequently the light emitting diode (LED) does not light. However, when light shines onto the LDR its resistance falls and current flows into the base of the first transistors and then the second transistor, the LED lights.

A key feature of this device is that its operation is light dependent, that is, the device is activated only when it is powered ON in the absence of ambient light or in a sufficiently dark environment making it a light dependent automatic-off timer for electrical appliances. The light dependent automatic-off timer uses a light dependent resistor (LDR) as its light sensor.

2.4 REVIEW OF THE ATMEL AT89S52 MICROCONTROLLER

According to Mazidi [8], the AVR Atmel Corporation, in 1981 introduced an 8-bit microcontroller called the AT89S52.This microcontroller had 256 bytes of RAM,8K bytes of on-chip ROM, three timers, one serial port and four ports (each 8-bit wide) all on a single chip. At the time, it was also referred to as a “system on a chip”. The AT89S52 is an 8-bit processor, meaning that the CPU can work on only 8 bits of data at time. Data larger than 8 bits has to be broken into bits pieces and be processed by the CPU. The AT89S52 has a total of four input and output ports, each 8 bits wide. Although the AT89S52 can have a maximum of 64k bytes of on-chip ROM, many manufacturers have put only 4k bytes on the chip.

The AT89S52 became widely popular after Atmel allowed other manufacturers to make and market any flavour of the AT89S52, they are pleased with the condition that they remain code-compatible with the AT89S52.This has led to many versions of the AT89S52 with different speeds and amounts of on-chip ROM marketed by more than half a dozen manufacturers. It is important to note that although there are different flavours of the AT89S52 in terms of speed and amount of on-chip ROM, they are all compatible with the original AT89S52 as far as the instructions are concerned. This means that if you write your program for one, it will run on any one of them regardless of the manufacturer.

FEATURE	QUANTITY
ROM	8K bytes
RAM	256 bytes
Timer	3
I/O pins	32
Serial port	2
Interrupt Sources	8

Table 2.1: Features of the AT89S52 microcontroller

2.5 REVIEW OF DOOR CONTROL

Shoewu and Baruwa [1], in an endeavour to design and construct a microprocessor based automatic gate, employed the use of the following devices to achieve automatic gate control;

- PNP and NPN transistors

- Diode

- Motor

The PNP and NPN transistors are arranged in such a way that a pair (PNP and NPN) controls the opening of the gate through the motor and the other pair reverse the polarity of the motor by rotating it in the opposite direction to close the gate. There is a time interval of 10 seconds between the opening and the closing of the gate. The arrangement of the diode serves to protect the transistors from reverse – bias polarity and the resistor serve to improve switching time.

The motor is used to control the opening and closing of gate, the electric (DC) motor used is one that has the ability to rotate in both directions simply by reversing the polarity.

The researcher after embarking on diligent study of various literatures was informed about the attempt by several individuals, and groups of individuals to develop an automatic door opener. It reveals the distinct difficulties and problems encountered by them. One of the intriguing efforts is the one made by two indigenes- Shoewu and Baruwa specifically on the software and the motor control system. Considerable setbacks were noticed, besides there were limitations on the sensor units being triggered erratically, the researcher wishes to work towards overcoming such limitations.

CHAPTER THREE

3.0 SYSTEM ANALYSIS

3.1 INTRODUCTION

The parts of this system are represented in blocks to help identify in specifics, the operation carried out by each section in order to choose the corresponding components. Below is the block diagram of the system;

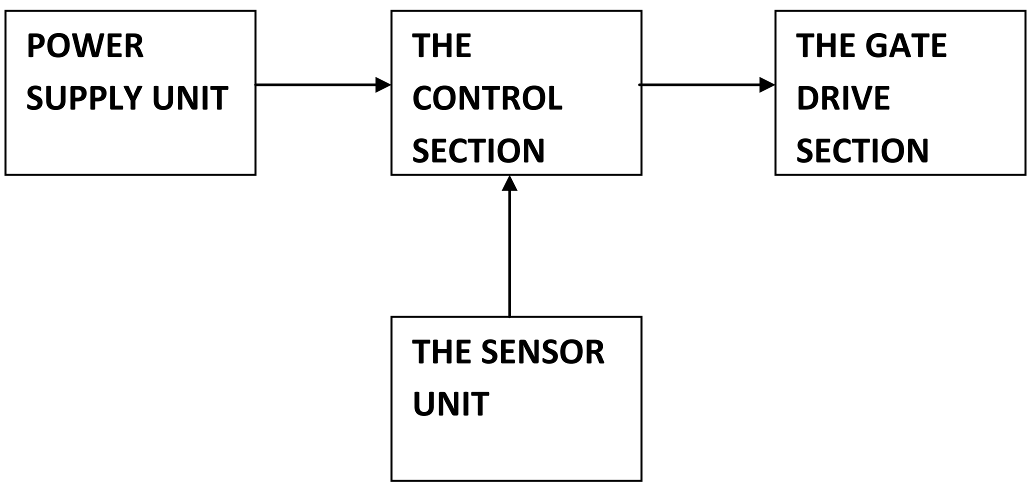


Fig: 3.1. The block diagram of microcontroller based automatic gate control

The block diagram of the system is described as follows;

3.2 THE POWER SUPPLY UNIT:

This section of the system ensures that appropriate voltages are delivered to the different sections of the section and as needed by those units. The power supply unit also has the ability of delivering enough current to the circuit for the proper operation of the system.

The power supply unit of the system determines the power dissipation of system. From my design, the power supply unit is provided by a 12volts battery which has a maximum current of 2.1amps.

From the specification given, it can deduced that the battery has a power of

2.1x12=25.2 watts

This shows that the system will utilize a maximum power of 25.2 watts.

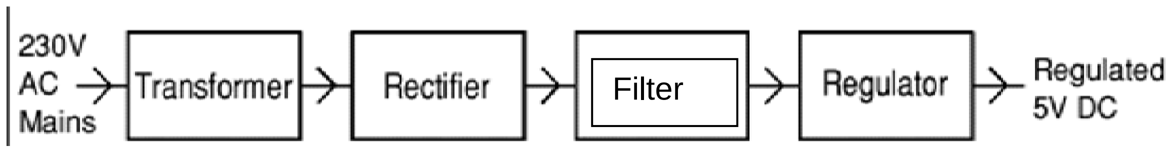


Fig 3.2 Block diagram of power supply unit

3.3 THE CONTROL SECTION:

This section of my design uses an integrated circuit(IC) to achieve the desired aim. The IC used is a digital IC and also, it is an EPROM IC. It is this section of my design that controls every other action carried out by the system. The input of the system and also the output are interfaced to this section.

This unit is programmed to carry out functions as needed by the designer. The functions carried out by this unit are dependent on the objective of the system. This section uses at89s52 to achieve the designed purpose.

3.4 THE SENSOR UNIT:

The sensor unit is the input of the system which is fed to the control section. It is this section of the system that detects the presence of cars or persons and sends its output to the control section. This section uses a light dependent resistor and an infrared circuit to carry out the desired operation.

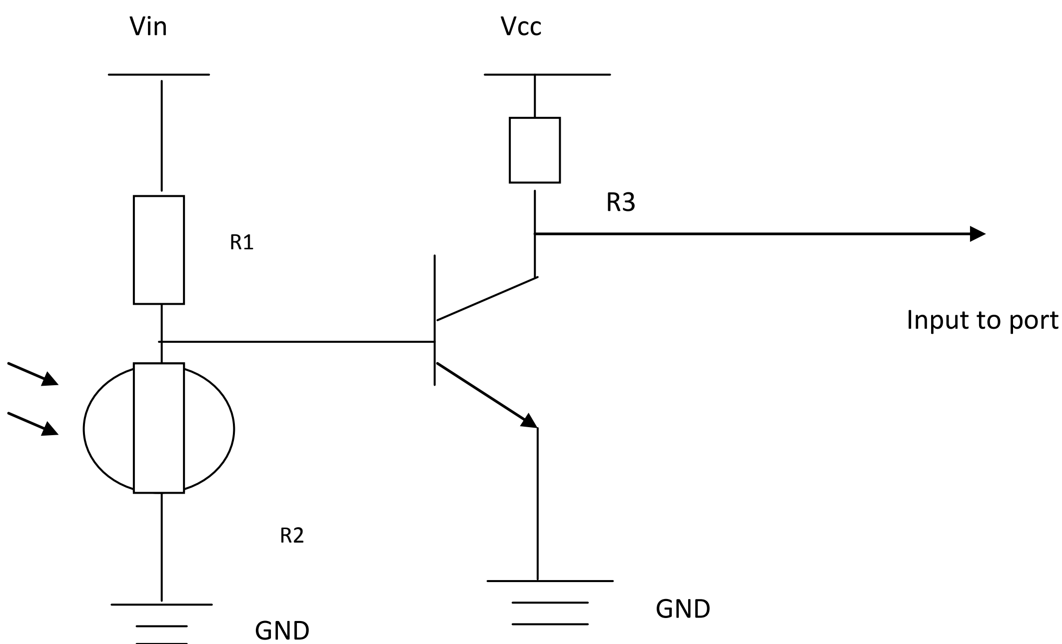


Fig: 3.3 Input Sensor Design

3.5 THE GATE DRIVE UNIT

This is the output of the entire system. This unit is dependent on the input and the control section. The gate drive unit moves the gate from one position to the other depending on the sensor unit. I used a combination of resistor, transistor, relays and motor to achieve this unit. The transistor is used to drive the relay, while the relay makes appropriate contacts for the motor to rotate.

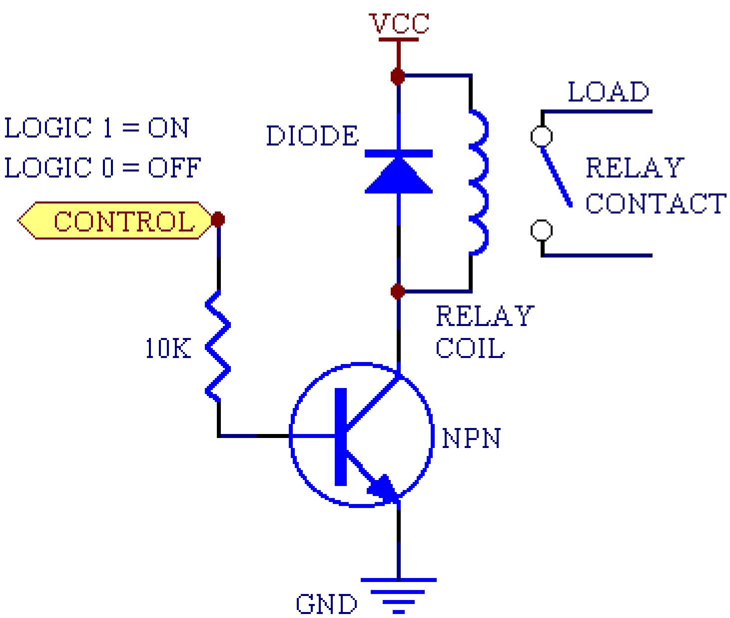


Fig: 3.4 Diagram of gate drive unit

3.6 DESCRIPTION OF COMPONENTS USED IN THE DESIGN

3.6.1: Voltage Regulators

A Voltage Regulator (also called a "regulator") has only three legs and appears to be a comparatively simple device but it is actually a very complex integrated circuit. A regulator converts varying input voltage and produces a constant "regulated" output voltage. Voltage regulators are available in a variety of outputs, typically 5 volts, 9 volts and 12 volts. The last two digits in the name indicate the output voltage in the table below.

Table 3.1: Voltage Regulators output Voltages

Name	Voltage
LM7805	+ 5 volts
LM7809	+ 9 volts
LM7812	+ 12 volts
LM7905	- 5 volts
LM7909	- 9 volts
LM7912	- 12 volts

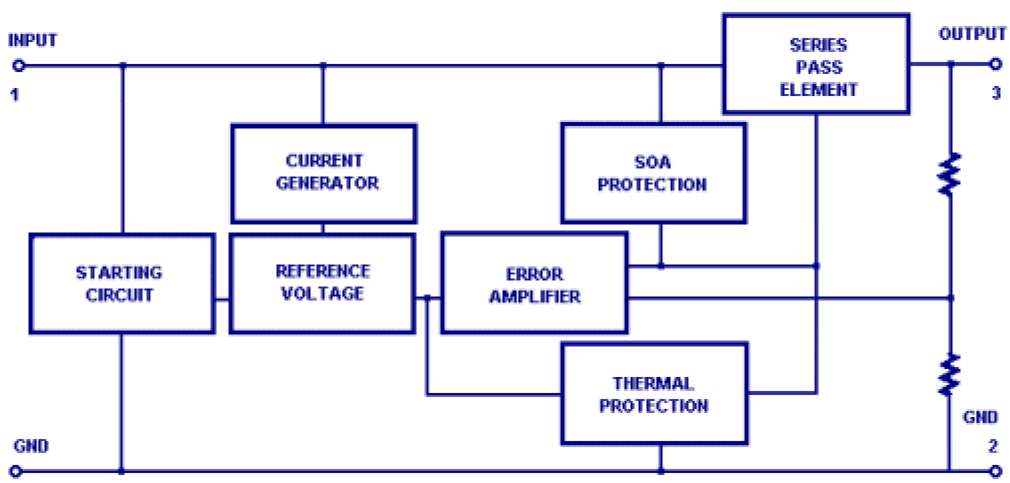


Fig.3.5 LM7805 Integrated Circuit Internal Schematic

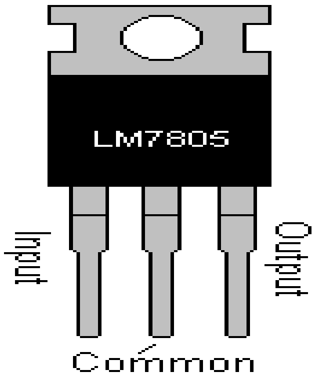


Fig.3.6 Diagram of 7805

3.6.2: Transistors

Transistors can be regarded as a type of switch, as can many electronic components. They are used in a variety of circuits and you will find that it is rare that a circuit built in a school Technology Department does not contain at least one transistor. They are central to electronics and there are two main types; NPN and PNP.

Most circuits (e.g. this project design) tend to use NPN. There are hundreds of transistors that work at different voltages but all of them fall into these two categories.

3.6.2.1: Types of Transistor

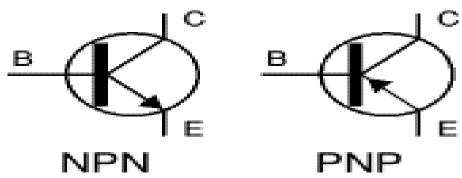


Fig.3.7 Transistor circuit symbols

There are two types of standard transistors, NPN and PNP, with different circuit symbols. The letters refer to the layers of semiconductor material used to make the transistor. Most transistors used today are NPN because this is the easiest type to make from silicon. This page is mostly about NPN transistors.

The leads are labeled base (B), collector (C) and emitter (E). These terms refer to the internal operation of a transistor but they are not much help in understanding how a transistor is used.

A Darlington pair is two transistors connected together to give a very high current gain.

In addition to standard (bipolar junction) transistors, there are field-effect transistors that are usually referred to as FETs. They have different circuit symbols and properties and they are not covered by this page.

3.6.2.2: Transistor currents

The diagram shows the two current paths through a transistor. The small base current controls the larger collector current. When the switch is closed, small current flows into the base (B) of the transistor. It is just enough to make LED B glow dimly. The transistor amplifies this small current to allow a larger current to flow through from its collector (C) to its emitter (E). This collector current is large enough to make LED C light brightly.

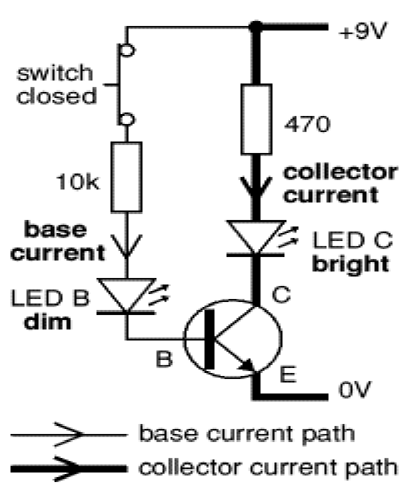


Fig.3.8 Current path of a Transistor

When the switch is open no base current flows, so the transistor switches off the collector current. Both LEDs are off. A transistor amplifies current and can be used as a switch.

This arrangement where the emitter (E) is in the controlling circuit (base current) and in the controlled circuit (collector current) is called common emitter mode. It is the most widely used arrangement for transistors.

Functional model of an NPN transistor

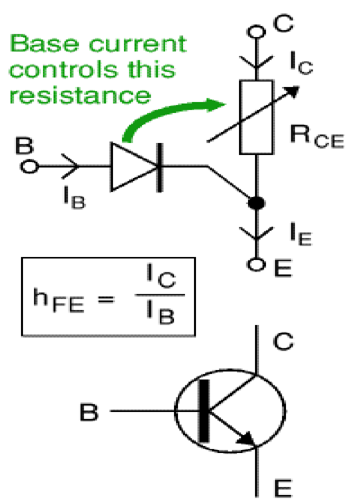


Fig 3.9 Model of NPN Transistor

The base-emitter junction behaves like a diode. A base current I_B flows only when the voltage V_{BE} across the base-emitter junction is 0.7V or more. The small base current I_B controls the large collector current Ic. $Ic = h_{FE} \times I_B$ (unless the transistor is full on and saturated) h_{FE} is the current gain (strictly the DC current gain), a typical value for h_{FE} is 100 (it has no units because it is a ratio) The base current IB controls the collector-emitter resistance RCE:

I_B = 0 R_{CE} = infinity   transistor off

I_B small R_{CE} reduced   transistor partly on

I_B increased R_{CE} = 0   transistor full on ('saturated')

Additional notes:

A resistor is often needed in series with the base connection to limit the base current I_B and prevent the transistor being damaged. Transistors have a maximum collector current Ic rating. The current gain h_{FE} can vary widely, even for transistors of the same type!

A transistor that is full on (with R_{CE} = 0) is said to be 'saturated'. When a transistor is saturated the collector-emitter voltage V_{CE} is reduced to almost 0V. When a transistor is saturated the collector current Ic is determined by the supply voltage and the external resistance in the collector circuit, not by the transistor's current gain. As a result the ratio Ic/I_B for a saturated transistor is less than the current gain h_{FE}.

The emitter current $I_E = Ic + I_B$, but Ic is much larger than I_B, so roughly $I_E = Ic$.

3.6.3: Light Dependent Resistor (LDR)

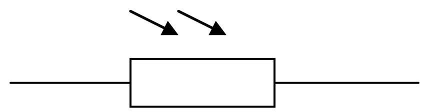


Fig 3.10 Light Dependent Resistor Symbol

LDRs or Light Dependent Resistors are very useful especially in light/dark sensor circuits. Normally the resistance of an LDR is very high, sometimes as high as 1000 000 ohms, but when they are illuminated with light resistance drops dramatically.

3.6.4: Electromechanical Relay

Electromechanical relays are perhaps the most widely used today. They are made of a coil, an armature mechanism, and electrical contacts. When the coil is energized, the induced magnetic field moves the armature that opens or closes the contacts. See Figure 3.10

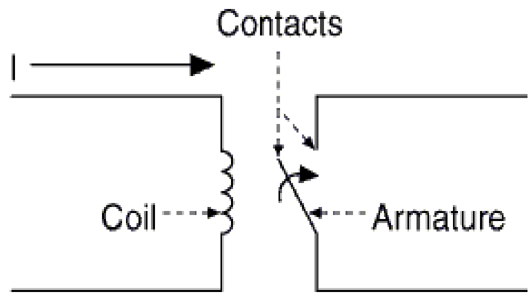


Fig 3.11 Electromechanical relay

3.6.5: Diodes

The **term diode** usually implies a small signal device with current typically in the milliamp range. A **semiconductor diode** consists of a PN junction and has two(2) terminals, an anode(+) and a cathode(-). Current flows from anode to cathode within the diode.

Diodes are semiconductor devices that might be described as passing current in one direction only. The latter part of that statement applies equally to vacuum tube diodes. Diodes however are far more versatile devices than that. They are extremely versatile in fact.

Diodes can be used as voltage regulators, tuning devices in radio frequency tuned circuits, frequency multiplying devices in radio frequency circuits, mixing devices in radio frequency circuits, switching applications or can be used to make logic decisions in digital circuits. There are also diodes which emit "light", of course these are known as light-emitting-diodes or LED's. As we say diodes are extremely versatile.

Schematic symbols for Diodes

A few schematic symbols for diodes are:

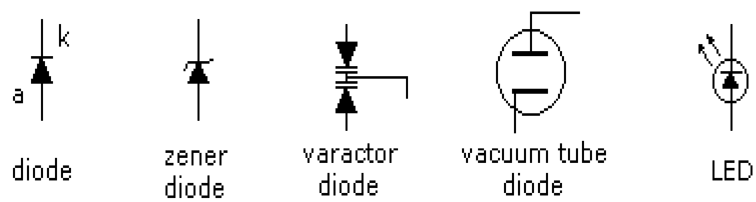


Fig.3.12 schematic symbols for diodes

Current through the coil creates a magnetic field that moves the armature between the contacts.

Electromechanical relays support a wide range of signal characteristics, from low voltage/current to high voltage/current and from DC to GHz frequencies. For this reason, you can almost always find an electromechanical relay with signal characteristics that match given system requirements. The drive circuitry in electromechanical relays is galvanically isolated from the relay contacts, and the contacts themselves are also isolated from one another. This isolation makes electromechanical relays an excellent choice for situations where galvanic isolation is required.

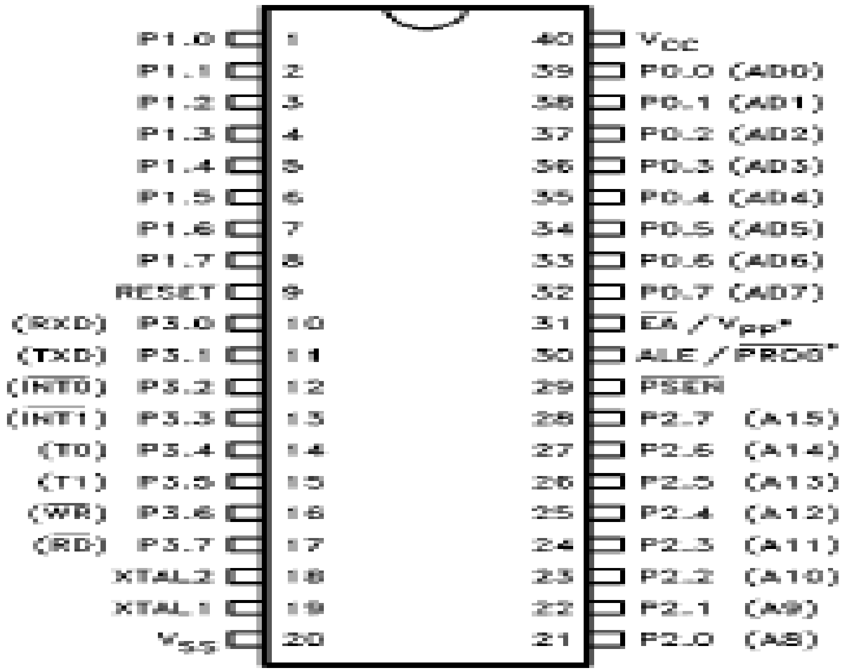
The contacts on electromechanical relays tend to be larger and more robust than some other relay types. The larger contacts give them the ability to withstand unexpected surge currents caused by parasitic capacitances present in your circuit, cables, etc. An unfortunate tradeoff, however, is that the larger contacts require larger package sizes so they cannot be placed as densely on a switch module.

While the mechanical construction of electromechanical relays allows for much flexibility in switching capability, they have one important limitation: speed. When compared to other relays, electromechanical relays are relatively slow devices -- typical models can switch and settle in 5 to 15 ms. This operating speed may be too slow for some applications.

3.6.6: Microcontroller unit:

The AT89S52 is a low power, high performance cmos 8-bit microcomputer with 4Kbytes of flash programmable and erasable read only memory (PEROM). The device is manufactured using Atmel`s high density nonvolatile memory technology and is compatible with the industry standard MCS-51 instruction set and pinout. The on-chip flash allows the program memory to be reprogrammed in system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with flash on a monolithic chip, the Atmel AT89S52 is a powerful microcomputer, which provides a highly flexible and cost effective solution to many embedded control application.

The AT89S52 is designed with static logic for operation down to zero frequency and support 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 hardware reset



Pin (PDIP)

.

Fig. 3.13 Pin configuration of AT89S52

3.6.6.1: Features of AT89S52

- Programmable serial channel
- Compatible with MCS-51TM product
- 4Kbytes of in-system Reprogrammables flash memory - Endurance: 1,000 write/Erase cycles
- Fully static operation:0Hz to 24MHz
- Three-level program memory lock
- 128 x 8-bit internal RAM
- 32 programmable I/O lines

- Two 16-bit timer/counters
- Six interrupt sources
- Low-power idle and power-down modes.

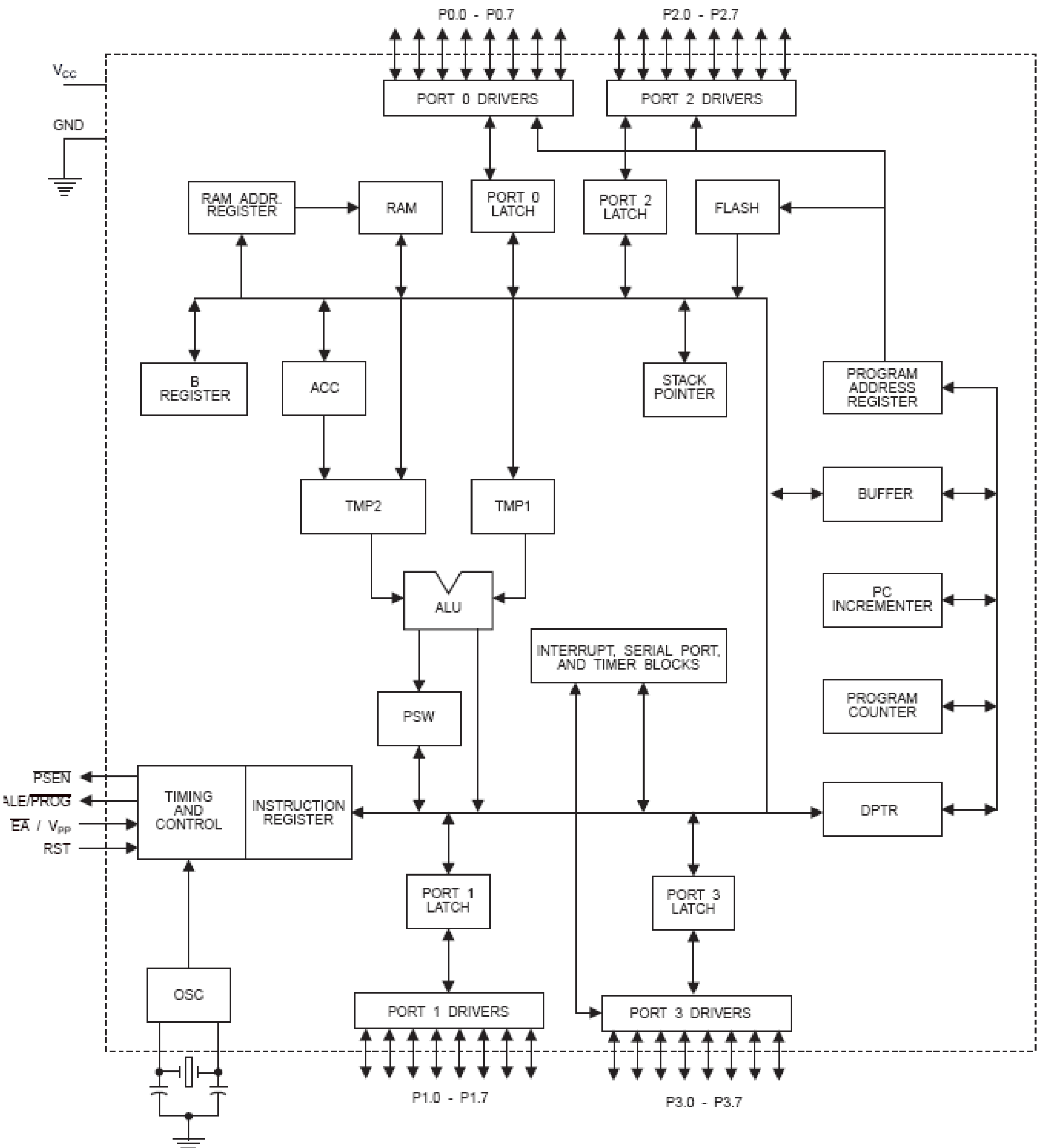


Fig. 3.14 Block diagram of AT898S52 internal circuitry

3.6.6.2: Pin description

- **VCC:** Supply voltage.
- **GND:** Ground.
- **Port 0:**

Port 0 is an 8-bit open-drain bi-directional I/O port. As an output port, each pin can sink eight TTL inputs. When 1s are written to port 0 pins, the pins can be used as high impedance inputs. Port 0 may also be configured to be the multiplexed low order

Address/data bus during accesses to external program and data memory. In this mode P0 has internal pull-ups. Port 0 also receives the code bytes during Flash programming, and outputs the code bytes during program verification. External pull-ups are required during program verification.

- **Port 1**

Port 1 is an 8-bit bi-directional I/O port with internal pull-ups. The Port 1 output buffers can sink/source four TTL inputs. When 1s are written to Port 1 pins they are pulled high by the internal pull-ups and can be used as inputs. As inputs, Port 1 pins that are externally being pulled low will source current (IIL) because of the internal pull-ups. Port 1 also receives the low-order address bytes during Flash programming and verification.

- **Port 2**

Port 2 is an 8-bit bi-directional I/O port with internal pull-ups. The Port 2 output buffers can sink/source four TTL inputs. When 1s are written to Port 2 pins they are pulled high by the internal pull-ups and can be used as inputs. As inputs, Port 2 pins that are externally being pulled low will source current (IIL) because of the internal pull-ups. Port 2 emits the high-order address byte during fetches from external program memory and during accesses to external data memory that uses 16-bit addresses (MOVX @ DPTR). In this application, it uses strong internal pull-ups when emitting 1s. During accesses to external data memory that uses 8-bit addresses (MOVX @ RI), Port 2 emits the contents of the P2 Special Function Register.

Port 2 also receives the high-order address bits and some control signals during Flash programming and verification.

- **Port 3**

Port 3 is an 8-bit bi-directional I/O port with internal pull-ups. The Port 3 output buffers can sink/source four TTL inputs. When 1s are written to Port 3 pins they are pulled high by the internal pull-ups and can be used as inputs. As inputs,

Port 3 pins that are externally being pulled low will source current (IIL) because of the pull-ups. Port 3 also serves the functions of various special features of the AT89S51 as listed below.

Table 3.2: Alternate functions of port 3

Port Pin	Alternate Functions
P3.0	RXD (serial input port)
P3.1	TXD (serial output port)
P3.2	$\overline{INT0}$ (external interrupt 0)
P3.3	$\overline{INT1}$ (external interrupt 1)
P3.4	T0 (timer 0 external input)
P3.5	T1 (timer 1 external input)
P3.6	$\overline{WR}$ (external data memory write strobe)
P3.7	$\overline{RD}$ (external data memory read strobe)

Port 3 also receives some control signals for Flash programming and verification.

- **RST**

Reset input. A high on this pin for two machine cycles while the oscillator is running resets the device.

- **ALE/PROG**

Address Latch Enable output pulse for latching the low byte of the address during accesses to external memory. This pin is also the program pulse input (PROG) during Flash programming. In normal operation ALE is emitted at a constant rate of 1/6 the oscillator frequency, and may be used for external timing or clocking purposes. Note, however, that one ALE pulse is skipped during each access to external Data Memory. If desired, ALE operation can be disabled by setting bit 0 of SFR location 8EH. With the bit set, ALE is active only during a MOVX or MOVC instruction. Otherwise, the pin is weakly pulled high. Setting the ALE-disable bit has no effect if the microcontroller is in external execution mode.

- **PSEN**

Program Store Enable is the read strobe to external program memory. When the AT89C51 is executing code from external program memory, PSEN is activated twice each machine cycle, except that two PSEN activations are skipped during each access to external data memory.

- **EA/VPP**

External Access Enable. EA must be strapped to GND in order to enable the device to fetch code from external program memory locations starting at 0000H up to FFFFH.

Note, however, that if lock bit 1 is programmed, EA will be internally latched on reset. EA should be strapped to VCC for internal program executions. This pin also receives the 12-volt programming enable voltage (VPP) during Flash programming, for parts that require 12-volt VPP.

- **XTAL1**

Input to the inverting oscillator amplifier and input to the internal clock operating circuit.

3.7 SYSTEM SPECIFICATION

The system has the following specifications which must be observed in order to keep the system in its operating standard. These are as follows;

Maximum voltage supply (Vs max)	12volts

Minimum voltage supply (Vs min)	8volts
System current	2.1amps
Frequency	50Hz
Operating temperature	room temperature
System mode	prototype
Operating environment	indoor

CHAPTER FOUR

4.0 CONSTRUCTION APPROACH, CONSTRUCTION STEPS AND EVALUATION

4.1 CONSTRUCTION APPROACH

The approach of a system follows a definite pattern. The pattern followed to construct a system is not restricted to a definite mode but rather, it is dependent on the designer's choice of approach. The approach enables the designer to organize the different stages of the system and the components to be used in order to achieve the desired aim.

In general, there are two types of design approach which are normally employed by every designer. They cannot be used together in one design but can be chosen alternatively. These approaches includes

-Top-down design approach and

-Down-top design approach

>Top-down design

This is a type of design approach employed by a designer when the system is designed from the input to the output. Once the target is named, the designer that chooses this mode designs the input of the system first. It is designed input that determines the condition or state of the system output.

>Down-top design

In this design approach, the system is designed from the output to the input. The design obtains the output state after naming the systems target and from the current state of the output; the input part of the system is designed. In this particular system design, we designed the system following a down-up design approach. The output condition of our system is what determines the state of the input.

As regards to this system construction, the down-top design approach was employed. The output of the system was first considered before designing the input of the system. The major device that determined the power dissipation of the system was the motor that moves the gate. The device was taken into consideration before designing other parts of the system.

4.2 CONSTRUCTION

The construction of this project was carried out following the understated procedures;

4.2.1 COMPONENT TESTING

- The components to be mounted were tested with the use of digital multi meter to ensure that their value is in concord with the values stated in the circuit diagram.
- The components were also tested to ensure that they were in there operational standard.

4.2.2 COMPONENT PLACING

- The individual components of the system were mounted on the Vero board with close observations made to the circuit diagram.
- The components with polarities were observed and placed accordingly.

4.2.3 SOLDERING

After mounting the components on the Vero board, they were soldered using soldering iron and lead. The soldering was made to be firm to avoid loose parts that might introduce noise in the circuit.

4.2.4 SYSTEM TESTING

- A continuity test was carried out between individual components to ensure that they link together as required.
- A short circuit test was also carried out to check if there was the existence of wrong connections. The short circuit test was conducted between VCC and GROUND to make sure that they were not linked together. The test was also conducted between component connections to ensure that individual components are connected as they are supposed to.

4.2.5 CONSTRUCTION MATERIALS

The materials used in the construction of this project include the following;

- Soldering iron (60 watts).
- Lead.
- Vero board.
- Linking wire.
- Digital multi meter.

4.3 TESTING EQUIPMENT

- Digital multi meter.

4.4 TESTING METHOD

4.4.1 RESISTORS:

These components were tested by adjusting the meter to its resistance part. The probes of the meter were placed end to end of the resistor. The reading shown by the meter was cross checked with the color codes of the resistor. If the reading exceeds the tolerance value of the resistor then the resistor is bad.

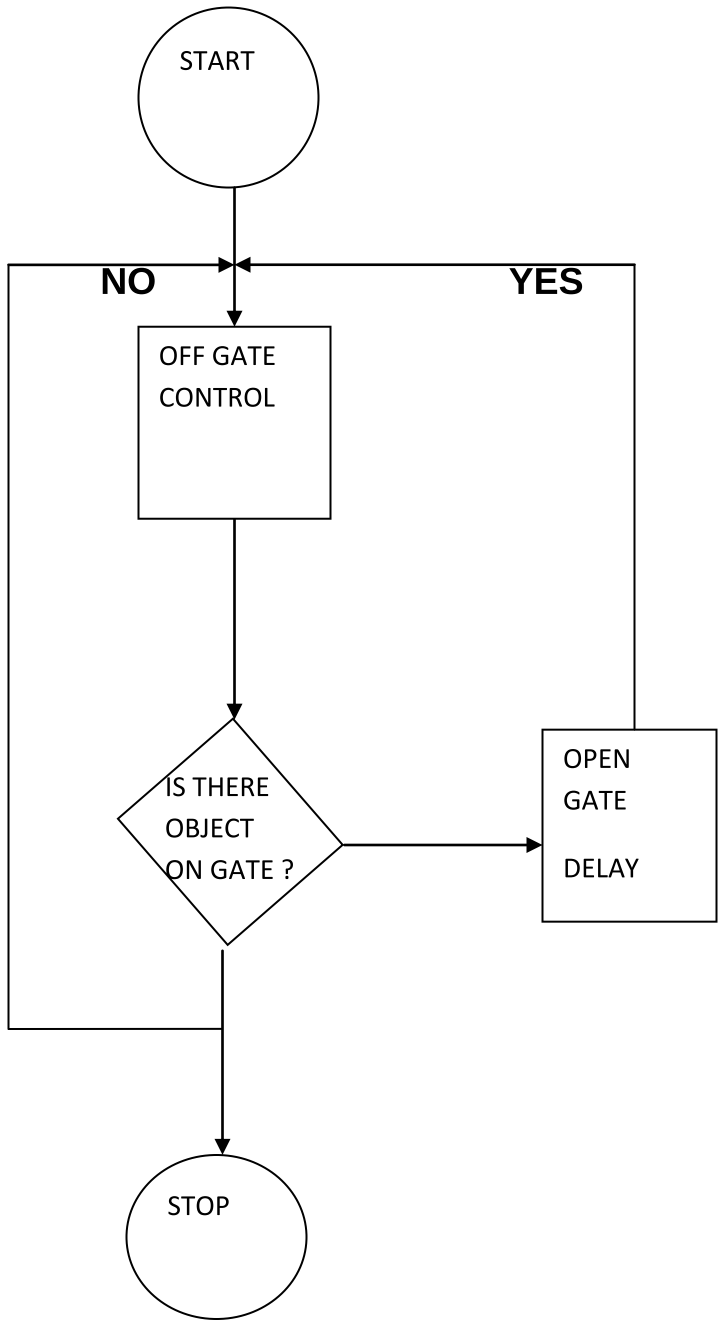
4.4.2 CAPACITORS:

The meter was set to continuity before testing. The capacitor is expected to charge and discharge when the probe is connected to both positive and negative terminal. Otherwise the capacitor is labeled to be bad

4.4.3 TRANSISTORS:

The meter is set to continuity. One probe of the meter is set to one terminal of the transistor while the other probe is alternated between the remaining two terminals of the transistor. A value is expected at base-emitter junction or base collector junction. The base-emitter reading has a higher resistance value compared to base-collector reading. If a reading is obtained at collector-emitter, then the transistor is bad. While the reading is being carried out, if black probe is at the base of the transistor, the transistor is a p-n-p transistor. Otherwise the transistor is an n-p-n transistor.

4.5 SYSTEM FLOW CHART



4.6 CIRCUIT DIAGRAM:

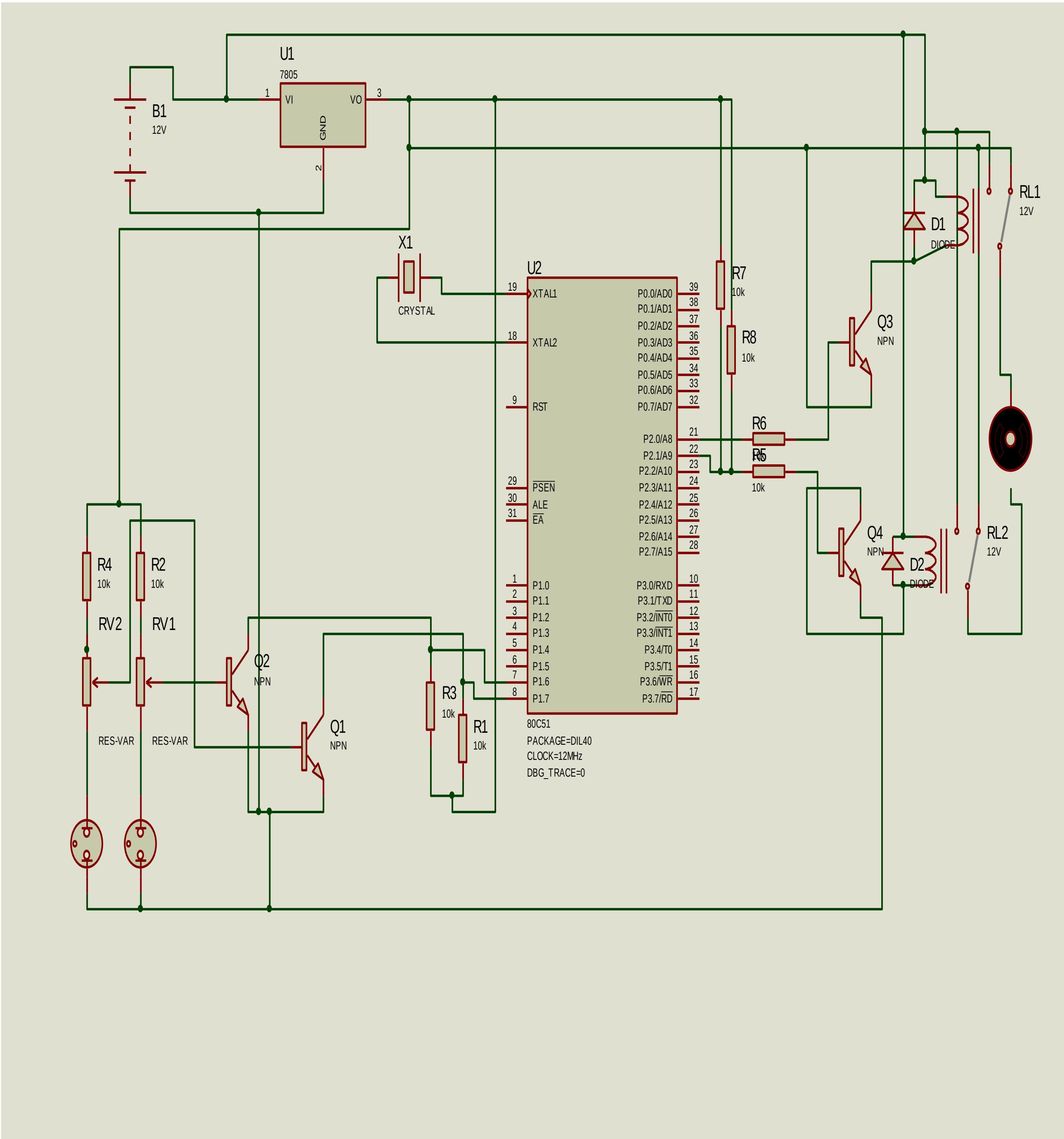


Fig: 4.1: CIRCUIT DIAGRAM OF MICROCONTROLLER BASED GATE

4.6.1 CIRCUIT DIAGRAM EXPLANATION

IC 1 is a voltage regulator device that allows only 5volts to be passed on to the microcontroller section. This is so because, anything more than 5volts that enters the IC will simply damage it.

LDR is a light dependent resistor which is being used for the detection of objects on the gate. The output of this device is used in biasing a transistor Q1. The transistor then sends the appropriate logic signal to the microcontroller.

IC 2 is a microcontroller decides the state of the output with respect to the input state. Q2 and Q3 are transistors that are used in driving the relays RL1 and RL2 respectively. D1 and D2 are diodes which return current in RL1 and RL2 respectively. XTAL is a crystal that determines the speed of program execution.

4.7 EVALUATION

In carrying out this project, certain expenses were made. This involves the cost involved in purchasing the electronic components and other expenses. Below is a table that shows the list of components used in the project design, the quantity and the price of those components.

S/N	COMPONENT NAME	VALUE	QUANTITY	UNIT PRICE	BULK PRICE
1	RESISTORS	1OKilo ohm	6	10	60
2		100 ohms	6	10	60
3	INTEGRATED CIRCUITS	AT89S51	1	400	400
4	REGULATORS	7805	1	50	50
5	LIGHT EMITTING DIODES		6	10	60
6	LIGHT DEPENDENT RESISTORS		4	120	480

7	INFRA RED TRANSMITTER LED		2	120	240
8	INFRA RED RECIEVER LED		2	120	240
9	TRANSISTORS	C945	6	20	120
10	VERO BOARD		1	100	100
11	LEAD		4	30	120
12	LINKING WIRES		6	30	180
13	CASING	ALUMACO		900	900
14		DC MOTOR	1	1500	1500

15	WELDING			600	600
17	NUTS AND BOLTS		12	20	240
18	BATTERY CLIPS		2	60	120
19	12V BATTERY		1	2700	2700
20	PEXPEX			1800	1800
21	**CAPACITOR**	**2200 UF**	**1**	**120**	**120**
22	3 PIN PLUG			180	180
	TOTAL				**N 10270**

CHAPTER FIVE

5.0 TEST RESULT, RECOMMENDATION AND CONCLUSION

5.1 SYSTEM TESTING

Prior to the final assembling of the automatic door opener each unit was subjected to various characteristics test. Use was made of a digital multi-meter to determine and compare the voltage level at some strategic points. For instance;

-In the power supply unit, the dc motor requires 5V while the electronic circuitry was powered by 5V. It was expedient that the voltage output be tested before coupling.

-Voltages on the microcontroller input and output pins were also tested. Pins 40 and 31 should be at Vcc Potential, Pin 20 at ground potential.

-The motor was also observed to rotate in a clockwise and anticlockwise direction when there was an interruption in the respective sensor pair.

5.2 SUMMARY

This project work attempts to proffer a lasting solution to the long lingered difficulties and inconveniences with door opening in an unprecedented manner. Unprecedented in the sense that it employs the microcontroller as the brain of the system, thereby eliminating the use of unnecessarily large number components.

The use of assembly language to program the microcontroller guarantees excellent performance and accuracy beyond average. Information surfed from the internet and relevant books form the sources of data used to achieve the desired goal.

Components selected were assembled on a Vero-board in accordance with schematic diagram. The assembly was tested with relevant instrument before the final packaging and casing. Tested results reveal that:

The voltage measured at some strategic points were approximately tending to the value obtained from calculations.

This can be justified with fact that,

i. No conducting material is perfect.

ii. Same components of some values do not measure perfectly the same when tested with multimeter.

iii. Joints made with soldering lead introduce capacitive effects especially if not properly soldered.

Instead of a 5V dc motor of used in this model, if a motor of higher torque were acquired, it could be mounted in any real standard door for automatic operation.

5.3 RECOMMENDATION

From the experiences gathered during the construction of this project, I hereby recommend the following;

1. The practical works carried out by students especially projects should be carried out under the supervision of qualified personnel.
2. Adequate research equipments such as internet should be made available so that student can research on the design which they want to carry out.
3. The laboratory should be well equipped so that students can easily access components from there when carrying out their construction.

5.4 CONCLUSION

Automatic gate control is a self dependent system that works like a report. It doesn’t need to be operated manually. It is found to be very useful in life when developed appropriately. The system serves a major purpose when used in public offices where the doors of the office are in used always. The doors are not expected to be manually operated and that’s where the system comes to play. The system was successfully constructed using components found in our local markets and it was tested and ensured that it works perfectly well.

REFERENCES

Floyd L.T. (2002). *Electronic Devices, Sixth Edition, Pearson Education Singapore pte.* Limited India.

Krutz, R.L.(1980).*Microcontroller and Logic Design*, *John Wiley and Sons*, Inc: New York, NY

Mazidi, A.M. and Mazidi J.(2000).*The 8051 microcontroller and Embedded System.*

McGlen, L. (1978).*8080A, 8085 Assembly Language Programming*. McGraw-Hill, inc: New York, NY

Neal S.W.(1998).*Digital System; Principles and Application. Eigth Edition Prentice-Hall International*: Princeton, NJ.

Robert L.B. and Lo1uis N.(2004).*Electronic Devices and Circuit Theory. Eight Edition, Prentice-Hall of India Private Limited,* New-Delhi

Shoewu O. and Baruwa O.T. (2004).”*Design and construction of microprocessor Based Automatic Gate*”. Unpublished B.sc project, Lagos State University: Epe, Nigeria

Theraja B.L and A.K Theraja, (2005).*A Textbook of Electrical Technology S.Chand Company Limited. Ram Nagar*, New Delhi-110005.

Tokheim, R.L. (1988).*Digital Electronics; Principles and Application. Fifth Edition. McGraw-Hall,* Inc: New York, NY.

APPENDIX

ACRONYMS AND THEIR MEANINGS

ALE	Access Latch Enable
AMP	Ampere
BSY	Busy
CMOS	Complementary Metal-Oxide Semi-conductor
CTRL	Control
CPU	Central Processing Unit
DOS	Disc operating
EA	External access enable
GND	Ground
Ip	Primary current
Is	Secondary current
LED	Light Emitting Diode
LCD	Liquid Crystal Diode

P	Power
Pp	Primary power
Ps	Secondary power
PSEN	Program Store Enable
PEROM	Programmable and Erasable Read Only Memory
PSU	Power supply unit
RAM	Random Access Memory
RST	Reset
RDY	Ready
TTL	Transistor-Transistor Logic
Vp	Primary voltage
Vs	Secondary voltage
Vin	Input voltage
Vout	Output voltage