Electrical and Computer Engineering Department

Industrial Automation Engineering Program

Bachelor Thesis

Graduation Project

Movable Camera for Special Purposes

Project Team

Raed Abukhalil

Project Supervisor

Dr. Nizar Amr

Hebron – Palestine

June, 2012

جامعة بوليتكنك فلسطين

الخليل - فلسطين

كلية الهندسة والتكنولوجيا

دائرة الهندسة الكهربائية والحاسوب:

اسم المشروع:

Movable Camera for Special Purposes

اسم الطالب:

رائد ابو خليل

بناء على نظام كلية الهندسة والتكنولوجيا و اشراف ومتابعة المشرف المباشر وموافقة أعضاء اللجنة الممتحنة تم تقديم هذا المشروع الى دائرة الهندسة الكهربائية والحاسوب وذلك للوفاء بمتطلبات درجة البكالوريوس في الهندسة تخصص هندسة أتمتة صناعية.

توقيع المشرف

.....

توقيع اللجنة الممتحنة

....

توقيع رئيس الدائرة

.....

Abstract

The project will be interested in redesigning a car (toy car) that will be controlled by a special remote control rather than the original one. The car is going to be controlled by a remote which will give the order for the car to move forward and backward in a straight line and to stop at any time. The car will be driven by a dc motor and we will design the motor circuit using digital IC's plus there will be a camera on the car designed specially to send he picture for places under a real car or any other transport ways such as(buses, trucks,……) to a screen wireless to help the workers on the checkpoints to check whether there might be something hidden under the cars also it may help the workers to check the kind of a car before fixing it and that's the main purpose of my project.

ملخص

سيكون المشروع مهتم في اعادة تصميم سيارة (لعبة) التي سيتم التحكم بها عن طريق رموت خاص غير الاصلي.

السيارة سيتم التحكم بها عن طريق رموت الذي سيعطي لها الاوامر بالتحرك الى الامام والخلف في خط مستقيم والتوقف في اي لحظة. السيارة سيتم تطويرها باستخدام نوع من انواع الموتورات وهو الدي سي موتور وسيتم تصميم دوائر الموتور عن طريق قطع الكترونية بالاضافة سيكون هنالك كاميرا على السيارة لالتقاط صور في اماكن تحت وسائل النقل على المعابر وارسال الصورة الى شاشة لاسلكي للتأكد من عدم تهريب الممنوعات بالاضافة الى ان المشروع سيساعد عمال الصيانة لمعرفة نوع وسيلة النقل قبل صيانتها وهذه هي الاهداف الاساسية للمشروع.

Dedication

My project is dedicated to

Our parents … Sisters … Cousins…

My supervisor, Doctor Nizar Amr…..

Anyone who has taught me any letter, word or information……

My college my second home …….

I give my project as a gift for a lot of people……

Raed Abukhalil……..

Acknowledgement

So, while finishing my hardware project; I would like to thank everybody who helped me to complete my project.

Special thanks for my supervisor Doctor Nizar Amr, who gave me a lot of his time and experience to teach me how to design my project, and to convert my ideas into a real work.

Table of contents

List of Tables

List of Figures

Glossary

1

Chapter One

Introduction

1.1 Overview

As we are in the 21st century, we see that the technology is being developed very fast and we see also that our life is connected to the computer and the digital life so we want every task to be done by the robots.

My project is an outlook to the future and we hope it will be a simple participation in the field of Industrial Automation.

Using the remote control in our life is very simple and very used; people are counting very much on that so that's why I am using my own remote control to move my project (toy car) to do its function.

1.2 General Idea

The design of my project begins by building a dc motor circuit which

will be controlled by a remote control which will give the order to the remote receiver to move the car forward and backward in a straight line so it can get under a real car and takes pictures from the wireless camera posed on (the toy car) and sends it to a screen as will be shown in the next chapters.

So, here I must mention that beside building the circuits my main purpose is the shooting mode which will be a new way for checking under cars rather than the original methods as will be described in the next few pages.

1.3Project Objectives

My project accomplishes the following tasks:

- Build a system that controls the movement of a car by a wireless remote control as input
- Designing a dc motor & LDR circuit using several IC's
- Designing a 555 circuit using the 555 IC
- Connecting the circuits and redesign the toy car with the motor with adding the remote receiver and the remote control plus the camera
- The main object is to let the toy car be controlled by a remote and to go under places the human being can't reach which is under the big transportation ways such as cars or trucks and to take pictures and sends it to a screen

1.4 Literature Review

Actually I made a lot of reviews on the internet and I haven't found such a device or an idea like this before so that's why I am going to continue working on it and we hope it is going to a new idea for a future use.

1.5 Team Work

The supervisor of my project is Doctor Nizar Amr. The team consists of me alone Raed Abukhalil.

1.6 Time Planning

In this section the time schedule must be determined in specific way and includes the related tasks of study and system analysis.

The time planning consists of two time estimation schedules; the first one demonstrates what is done in the first semester and the second one demonstrates the expected scheduling time of the second semester.

1.6.1 The time table for the next few months will be as bellow:

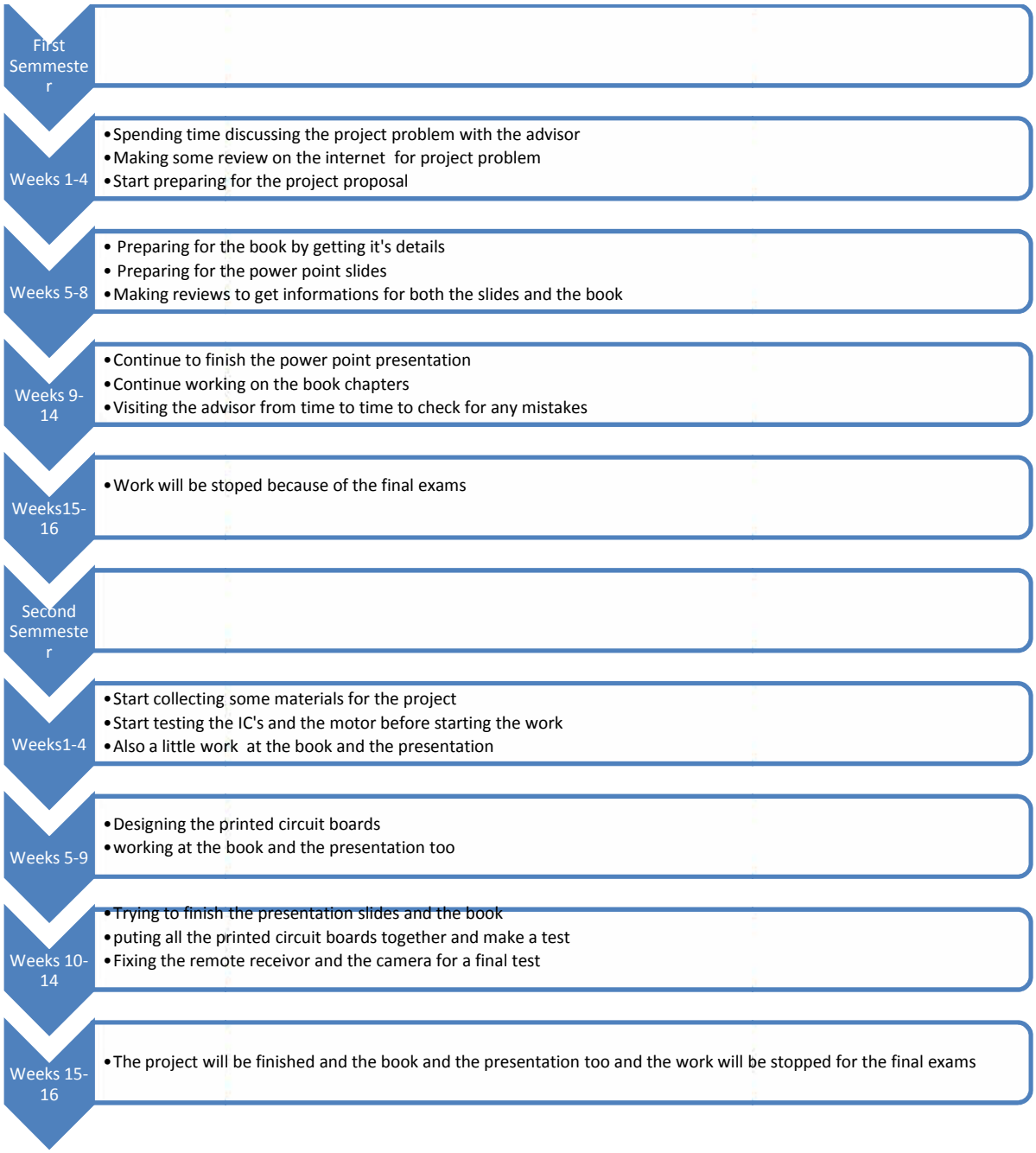


Table 1.1: The time table for the two semesters

1.7Project Schedule

The project was divided into the following stages:

- Research the motor technologies and circuits.
- Acquire parts needed to build the circuits.
- Acquire parts needed to build the 555 circuit
- Getting some information for the camera and the screen
- Getting some information for the toy car
- Testing each circuit alone in labs
- Test the final product

1.8Estimated Development Cost

The following table shows the main components that are needed for my project and the price of each one in NIS.

Item	Cost	Price(of the project)	Notes
Remote receiver	200 NIS		
IC’s	300 NIS		
Camera&screen	2000 NIS		
Vehicle	600 NIS		
Table	300 NIS		
Printing	400 NIS		
Total	3800 NIS	4800 NIS	

Table 1.2 Estimated Development Cost

1.9 Project Benefits

My project has several benefits some of it:

- The project will be used at the check point rather than the old ways
- The project will introduce a kind of remote controls and receivers plus the camera and screen and how to use a camera in new and special way

1.10 Project Risk Management

1.10.1 General Risk

Actually the main worry was the wireless camera and the way it's going to be placed on the project. The size also the cost of it is very high.

1.10.2 Team Risk

- The risk was that I am working alone so working without any help from others would mean that you need to work very hard.

1.10.3 Requirement Risks

- Several requirement may be replaced by others due to high cost

1.10.4 Project Risk

- Some requirements need changes may arise lately.
- The budget may not be sufficient.
- Schedule may not be accurate.

1.11Technology and Brief Description

The technology that I am planning to do is that I am going to buy a vehicle (a toy car) and I am going to take its circuit and put my printed circuit boards on the car plus the camera also and the remote receiver and everything else related to it. So, my project consists of a vehicle controlled by a remote control that gives the order to move the car forward and backward and to stop at anytime. The remote is capable of control the car at a range of 30 meters, so this vehicle is capable of getting under a car or any big transportation way such as trucks, buses ….and sends the picture to a screen through the camera which is posed on the vehicle. So, first the vehicle moves forward and the person is capable of getting it stop and moves forward again then after, it gets backward. The wireless camera has a range of 35 meter so it is suitable for the case here too.

2

Chapter Two

Theoretical Background

2.1 Introduction

This chapter discusses the main theoretical subjects which are needed to explain the main ideas of this system. And will illustrate the hardware related to the project components. And will argue the project integrity and demonstrate the theoretical background of the project components.

2.2 Theoretical Background of the Project

There are some theories and truths that the project depends on while performing it, some of them are:

- **The remote Control**

A **remote control** is a component of an electronics device, most commonly a television set, used for operating the television device wirelessly from a short line-of-sight distance. The *remote control* is usually contracted to *remote*. These devices are usually small wireless handheld objects with an array of buttons for adjusting various settings such as television channel, track number, and volume.

- **Dc motor**

A DC motor is an electric motor that runs on direct current (DC) electricity. DC motors were used to run machinery, often eliminating the need for a local steam engine or internal combustion engine. DC motors can operate directly from rechargeable batteries, providing the motive power for the first electric vehicles. Today DC motors are still found in applications as small as toys and disk drives, or in large sizes to operate steel rolling mills and paper machines. Modern DC motors are nearly always operated in conjunction with power electronic devices.

- **555 IC**

In astable mode, the 555 timer puts out a continuous stream of rectangular pulses having a specified frequency. Resistor R_1 is connected between V_{CC} and the discharge pin (pin 7) and another resistor (R_2) is connected between the discharge pin (pin 7), and the trigger (pin 2) and threshold (pin 6) pins that share a common node. Hence the capacitor is charged through R_1 and R_2, and discharged only through R_2, since pin 7 has low impedance to ground during output low intervals of the cycle, therefore discharging the capacitor.

2.3 Project Integrity

My project actually can be useful in many sides, for instance, it can help the security check on the borders to check whether there might be anything hidden under the cars or any other transportation way by getting the project under the trucks and take picures and sends it to a screen.

My project may help the mechanics to see the kind of the car before fixing it to check whether they are able to fix it or not.

2.4 Project Components

2.4.1 Remote control& Receiver

So, the remote in the figure below is the remote that I wanted to use actually for several reasons, first I wanted a small remote and a remote is easy to use. So as it is shown in the figure 2.1 the remote has two buttons each one activates the receiver as will be described later at the receiver circuit. So, here I must mention that the bigger button is responsible for moving the car forward and to stop any time as will be described later and the smaller one which is at the right is responsible for makes it move backward.

Figure 2.4.1 the remote control

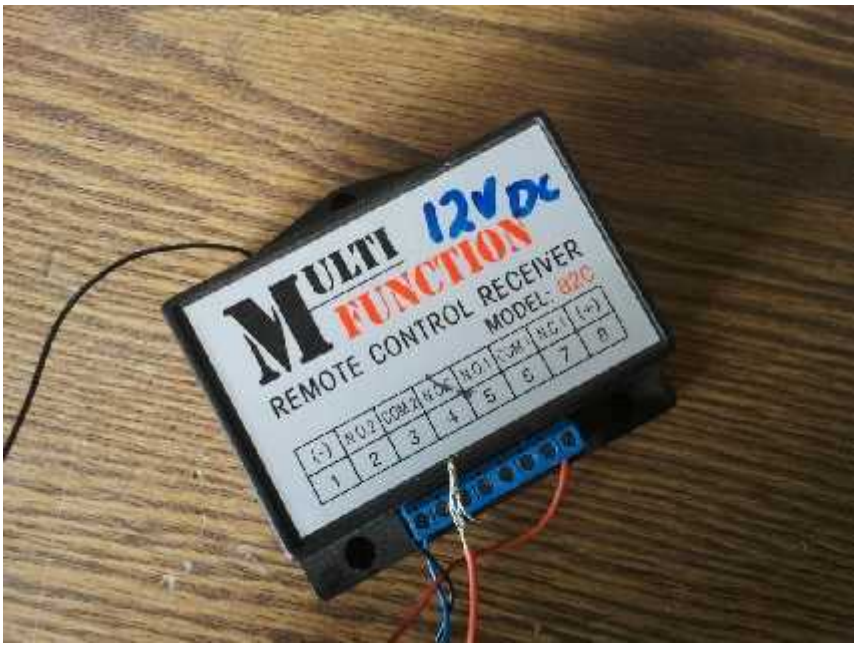


Figure 2.4.2 Remote Receiver

So, here by focusing at figure 2.4.2 we can see that the receiver here which is related to the remote has two relays like it is shown at the eight numbers we can see the (N.O.,COM,N.C.) for the two relays. We must mention that the receiver needs 12 volt to work and finally as it is obvious that the remote buttons activate the two relays from the two buttons the left one activates the second relay and the right one activates the first relay . So here while testing the receiver we noticed that relay #2 latches at the first time we press the button that means the normally close moves to the normally open and stays but at the second push it goes back to its original state, but relay #1 doesn't latch so at each time we push the first button the relay acts as a push button and here we had a problem but we will see later how we could face the problem at the circuit design.

2.4.2 555 IC and its components

In astable mode, the 555 timer puts out a continuous stream of rectangular pulses having a specified frequency. Resistor R_1 is connected between V_{CC} and the discharge pin (pin 7) and another resistor (R_2) is connected between the discharge pin (pin 7), and the trigger (pin 2) and threshold (pin 6) pins that share a common node. Hence the capacitor is charged through R_1 and R_2, and discharged only through R_2, since pin 7 has low impedance to ground during output low intervals of the cycle, therefore discharging the capacitor.

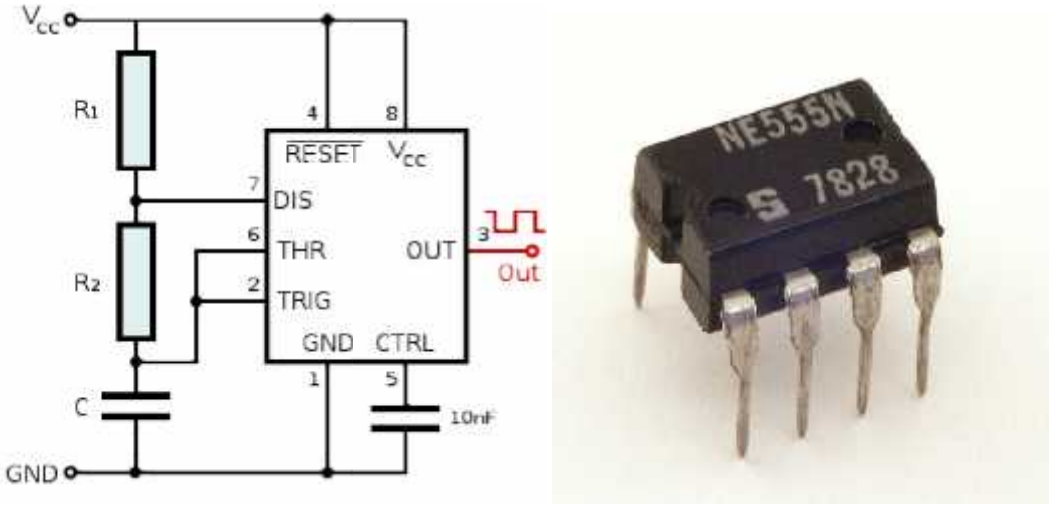


Figure 2.4.3 555 IC and its components

2.4.3 Ldr and dc motor circuit

Beginning at this chapter I am just going to talk generally about the circuit board. Here first the circuit board that will be described later has two circuits which are the ldr and the motor circuit. Beginning with the motor circuit as will be shown in the design chapter it has the main IC which is the l293b which controls the direction of the dc motor plus the 555 IC which generates the square pulses and the relay and finally the transistors that acts as a switch.

This circuit is going to be connected to the receiver and will be controlled by the special remote of the receiver.

Now, the ldr circuit which is a simple circuit but it is very necessary for lighting under the transportation way during the shooting. It consists of the 741 IC plus other related transistors and relays and resistors.

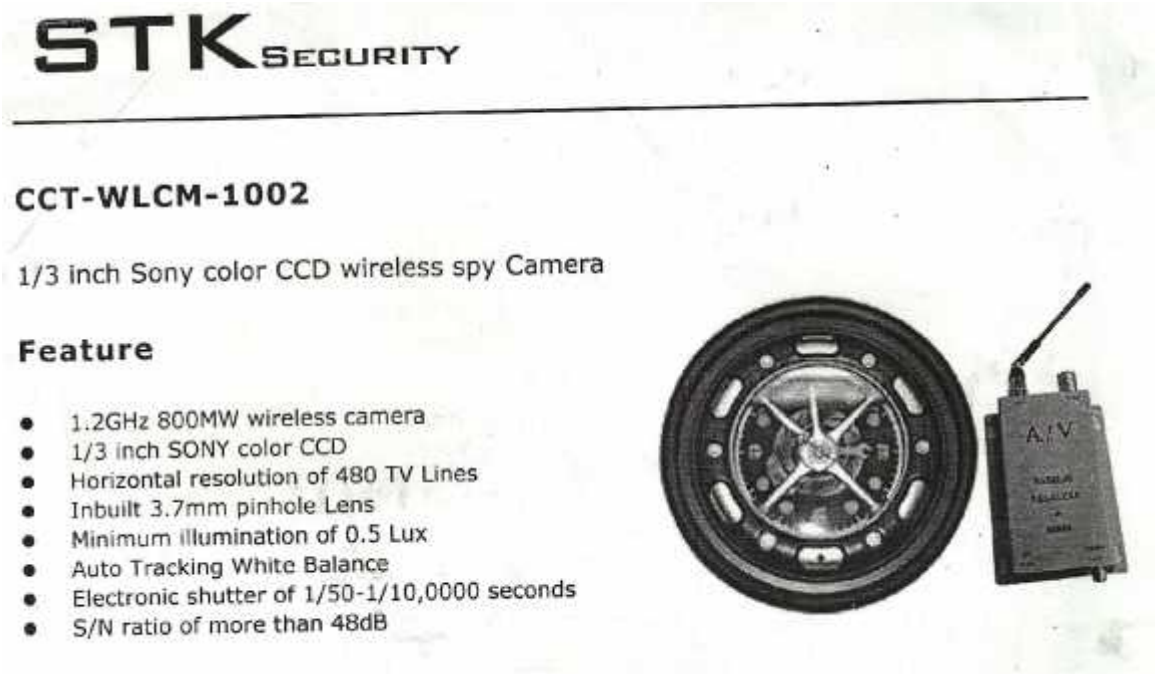
2.4.4 Car

There are several types of toy cars that can be used in many applications. This system needs only one type of toy cars that have a small size so it can get under real transportation ways and that’s the most important thing in choosing the car for the project.

So, here after measuring the height of the real cars from the ground we saw that the range is between 20cm-50cm, so what matters most is the minimum which is the 20cm so the toy car must not exceed 10 cm heigh.

2.4.5 Camera

While choosing the camera here I wanted to have a wireless one and on the other hand it is difficult because of the high cost and the big size of it so here I had to use a special kind of cameras which is taken from a spy machine.



The camera actually was hidden inside this circular shape and it will be shown in the next chapters.

2.4.6 The screen

Appearance and function

1.Remote Window 3.V1/V2 Switch

2.Power on/off

Function parameter

Screen size: 7 inches
Display format: 16:9
Power supply: DC 12V
Power consumption: About 7.5W
Video: Dual video input
System: NTSC/PAL
Pixels: 480(W)×RGB×240=345600 dots
Blue screen appears when no signal.

So, here while I was thinking of the type of the screen I wanted to use, I wanted a small one which can be hold with a single hand but on the other hand I wanted a screen that shows a full and clear image and that was the best choice for me.

3

Chapter Three

Design Concepts

3.1 Introduction

In this project there is a need to select a suitable car with small size to let it able to get under places the human being can't reach such as under a truck …….I have to setup the required camera and other components that have the best specifications as mentioned in chapter 2, I wanted to develop a remote controlled wireless system that is flexible and able to do a specific function which is as I mentioned before is to take pictures in a places the human will ever be able to reach in his own hands and eyes. So I started to think of the type of motor and the cameras and the wireless way.

On a personal level, I wanted a system that relied on my own originality.

I therefore used some approaches as a starting point but I tried not to copy approaches that are already known to work. In short, I wanted to come up with a system has the ability to do its task.

3.2 Project Objectives

My project has so many ideas and objectives that can be summarized as following:

- Build a toy car based on a dc motor circuit and remote control.
- The ability of the system to move forward and backward in a straight line and take pictures for places the human being can’t reach.
- Get to know the newest technology about taking pictures by digital cameras and sending the videos to a screen by using the AV technology.
- Get to know special type of IC’s such as the l293b

3.3 Design Options

From the strategies that were used in my project the strategy of replacing chips and circuits with others in special cases. And here are some of these alternate strategies that were used:

- I used the dc motor l293b IC instead of the PIC because of:

    1. Using the PIC needs too much time to learn, and the time of the project is limited.
    2. I think that the PIC programming goes more for the computer side rather than the electrical side.

- Using the AV technology instead of the wired way:

    Really here no specific reason just to follow the technology and also to make sure the wireless way is used so it would be more practical.

3.4 Design Realization Approach

Design realization approach can be of three types. Actual implementation, modeling and simulation. A toy car will be used as a model for my project. The choice was made due to the size. So using the model approach will be the more suitable and efficient choice for the project.

So, here we can say that the project's first priority is to take pictures under places the human can't reach then getting to know the dc motor circuits plus the wireless technology by using the camera and the screen, so here the mechanical side isn't very important as much as the other priority. Also in my design I didn't focus much on moving the car right and left first because the purpose of using the project can be good enough in forward and backward, which is the scanning mode.

3.5 General Block Diagram

The system as whole consist of many subsystems, but the general block diagram of this project shown as following:

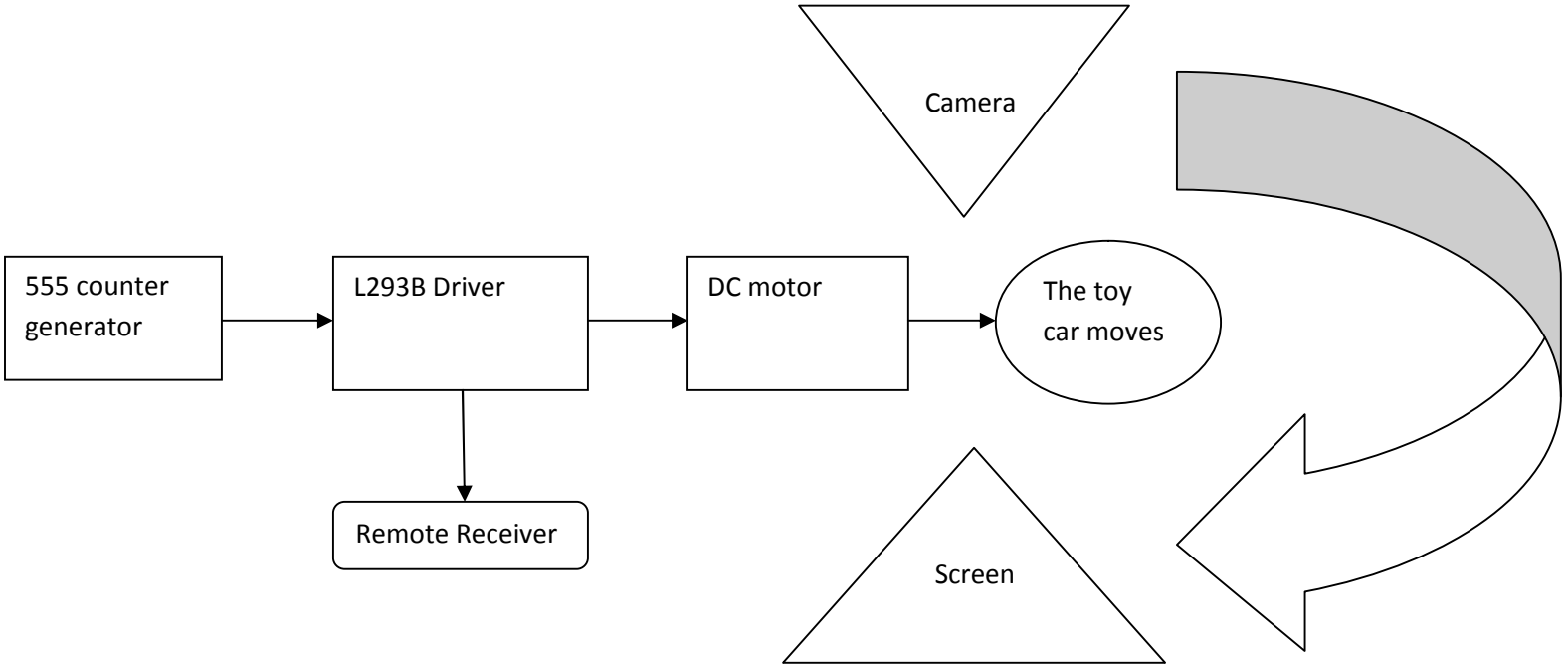


Figure 3.1 The General Block Diagram of the system

3.5.1 Behavior for the system

The behavior of the system will go through several steps; these steps are first the remote control which has two bottoms the left one moves forward and stops then while moving forward the right one must be pressed to move backward and pushing the left one again stops the circuit and another push at the left one will drive the toy car forward again.

3.6 How must the system be used and why?

3.6.1 The shooting mode!

Now, before talking about the way we must use the system we must give the reasons for it. As we all know that the transportation ways are kinds and each kind has a special size. What matters most at our problem is the length of the car and the height from the floor as shown is the figure below:

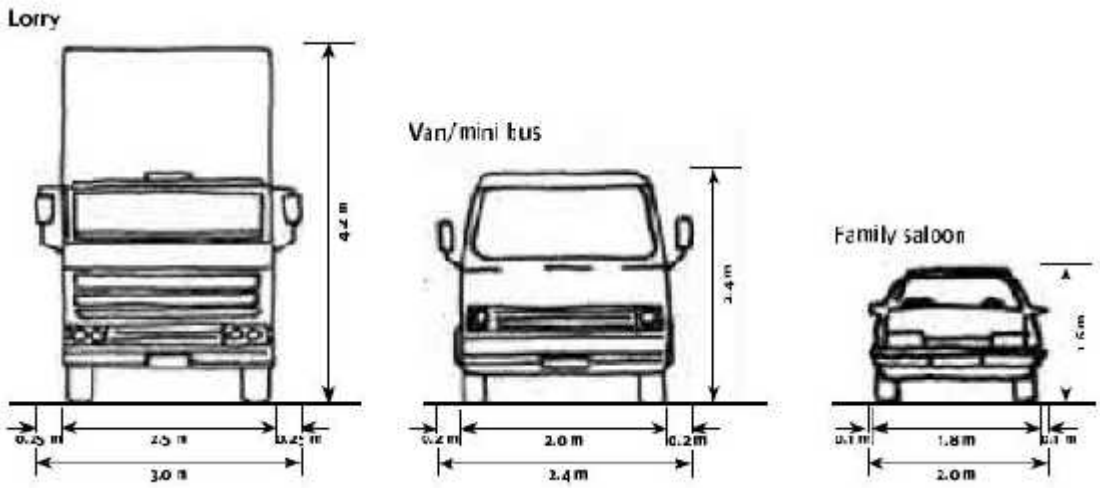


Figure 3.2 Transportation way sizes

So, here if we think about the shooting mode we see that the scanning mode is the best way to scan and cover the whole area, but the question is where should I pose the toy car and what is the angle of the camera must be. To answer all these questions let us take a look at the figure below which is figure 3.3: We can see that the length range of the cars is between 200-250 cm and the height is between 20-50 cm that makes the angle of the camera about 90 degree ….but there is something missing which is the pose of the toy car at the beginning …..

The toy car must be posed either at the right side of the transportation way as near as possible to the right back wheel, this case if we are at the back of the car or as near as possible to the right wheel if we are in front of the car so it can has an angle of 90 degree an can scan the area under the real transportation ways and in this case the length and the height of the real cars doesn't affect as the figure shows below …..So, here we have the horizontal shooting method.

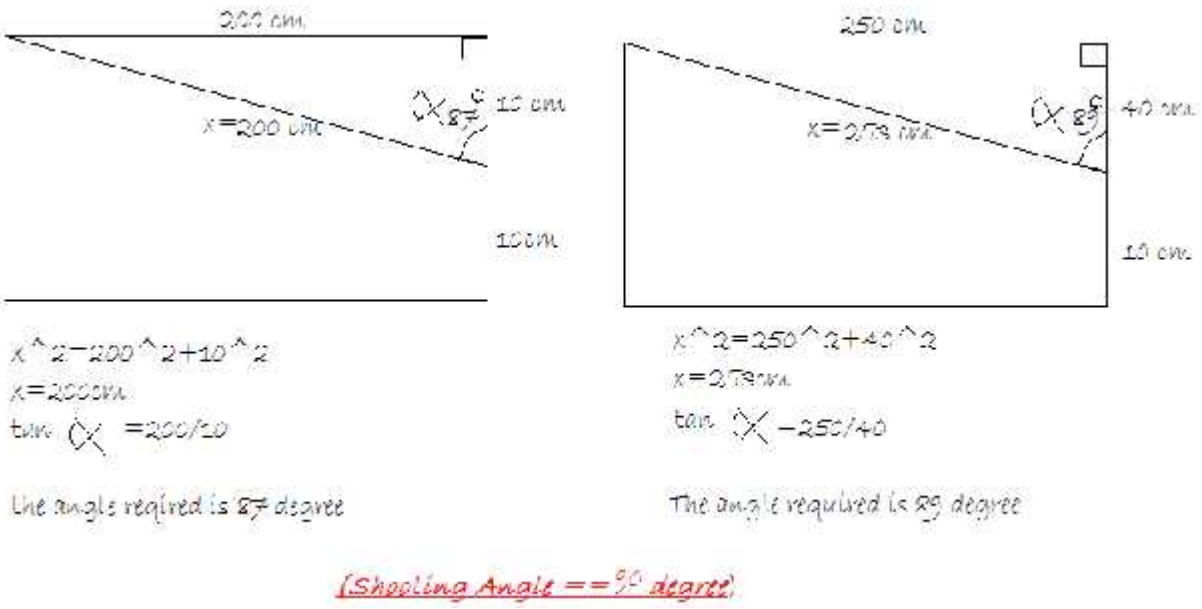
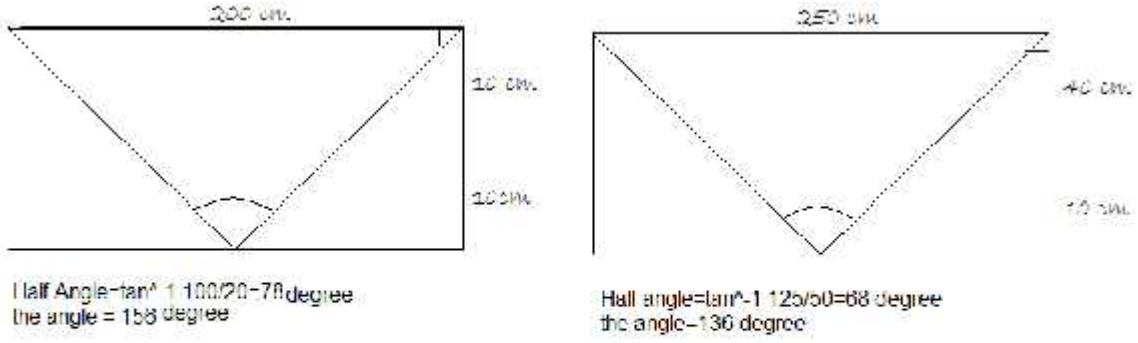


Figure 3.3 the angle required for the camera

So, after posing the toy car at the right place the toy car can be moved forward and backward and it can stop any time…….and that's how the scanning mode be done.

Why choosing the horizontal mode of shooting?

If we look closely at the figure below we see that the position of the toy car is very important in the scanning and determining the angle of the camera:



The angle required if the scaning is from the middle of the car.

So we can see that if we want to scan from the middle of the car we need at least a camera with an angle of 156 degree which is almost impossible to find at my case especially I need a small size and a wireless one plus at the vertical shooting the angle of the camera is decreased few degrees from the angle it must give.

What if something unexpected shown on the screen?

Actually, if the person has suspected in anything really he doesn't have much choices unfortunately. The toy car here can move forward and backward by the angle of the camera and the position of the camera has the best location to cover the area.

Unfortunately, although the camera is wireless and expensive but it doesn't have a zoom so the only choice the person has is to move it again in both directions and stop it at any time and keep focusing at the screen for better view.

Some conditions must be satisfied in the real car and the toy car!

First, I must mention that the toy car is not covered with anything, so here the transportation way must not be wet it must be clear and dry, so it won't affect the camera or the circuit board.

Second, the toy car and the screen power supply must be always full charged to guaranty a full power for both and for the camera of course.

Third, the transportation way must be posed in a flat land and clean one so the toy car can move without any problems.

Project interaction with surrounding environment

The user interacts with system through the remote then the receiver receives the signals from the remote after that the signals drive the driver which drives the motor and the car move according to the signals from the remote.

Here I must mention some stuff, the environment around the toy car play a role here which is first the place must be clean under the toy car and it needs a flat ground so it can moves.

3.7 Final Detailed Design

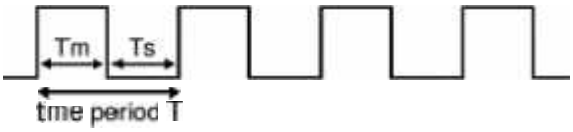
And finally, before moving to the next chapter which is the implementation we must see the full detailed design of the project.

Beginning, getting into the design of the toy car we wanted to have a wireless system, so here at the beginning I faced so many problems with choosing the equipment such as the camera, the size the price the power supply everything was expensive and actually wasn't available even if we have the ability to buy.

So, here the next few pages of this chapter will introduce the design before getting to the implementation.

3.7.1 555 circuit

An astable circuit produces a 'square wave', this is a digital waveform with sharp transitions between low (0V) and high (+Vs). Note that the durations of the low and high states may be different. The circuit is called an astable because it is not stable in any state: the output is continually changing between 'low' and 'high'.



555 astable output, a square wave
(Tm and Ts may be different)

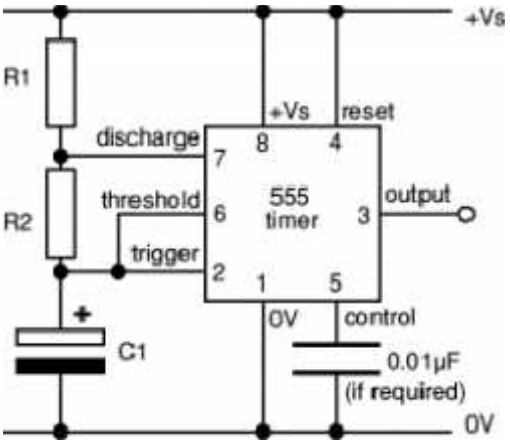


Figure 3.8.1 555 astable circuit

The time period (T) of the square wave is the time for one complete cycle, but it is usually better to consider frequency (f) which is the number of cycles per second.

$$T = 0.7 \times (R1 + 2R2) \times C1 \quad \text{and} \quad f = \frac{1.4}{(R1 + 2R2) \times C1}$$

T = time period in seconds (s)
f = frequency in hertz (Hz)
R1 = resistance in ohms (Ω)
R2 = resistance in ohms (Ω)
C1 = capacitance in farads (F)

The time period can be split into two parts: **T = Tm + Ts**
Mark time (output high): **Tm = 0.7 × (R1 + R2) × C1**
Space time (output low): **Ts = 0.7 × R2 × C1**

Many circuits require Tm and Ts to be almost equal; this is achieved if R2 is much larger than R1.

For a standard astable circuit Tm cannot be less than Ts, but this is not too restricting because the output can both sink and source current. For example an LED can be made to flash briefly with long gaps by connecting it (with its resistor) between +Vs and the output. This way the LED is on during Ts, so brief flashes are achieved with R1 larger than R2, making Ts short and Tm long. If Tm must be less than Ts a diode can be added to the circuit as explained under duty cycle

below.

Choosing R1, R2 and C1

R1 and R2 should be in the range 1kΩ to 1MΩ. It is best to choose C1 first because capacitors are available in just a few values.

555 astable frequencies			
C1	**R2 = 10kΩ R1 = 1kΩ**	**R2 = 100kΩ R1 = 10kΩ**	**R2 = 1MΩ R1 = 100kΩ**
0.001µF	68kHz	6.8kHz	680Hz
0.01µF	6.8kHz	680Hz	68Hz
0.1µF	680Hz	68Hz	6.8Hz
1µF	68Hz	6.8Hz	0.68Hz
10µF	6.8Hz	0.68Hz (41 per min.)	0.068Hz (4 per min.)

- **Choose C1** to suit the frequency range you require (use the table as a guide).
- **Choose R2** to give the frequency (f) you require. Assume that R1 is much smaller than R2 (so that Tm and Ts are almost equal), then you can use:

$$\mathbf{R2 = \frac{0.7}{f \times C1}}$$

- **Choose R1** to be about a tenth of R2 (1kΩ min.) unless you want the mark time Tm to be significantly longer than the space time Ts.
- If you wish to use a **variable resistor** it is best to make it R2.
- If R1 is variable it must have a fixed resistor of at least 1kΩ in series (this is not required for R2 if it is variable).

3.7.2 Dc Motor&LDR Circuit

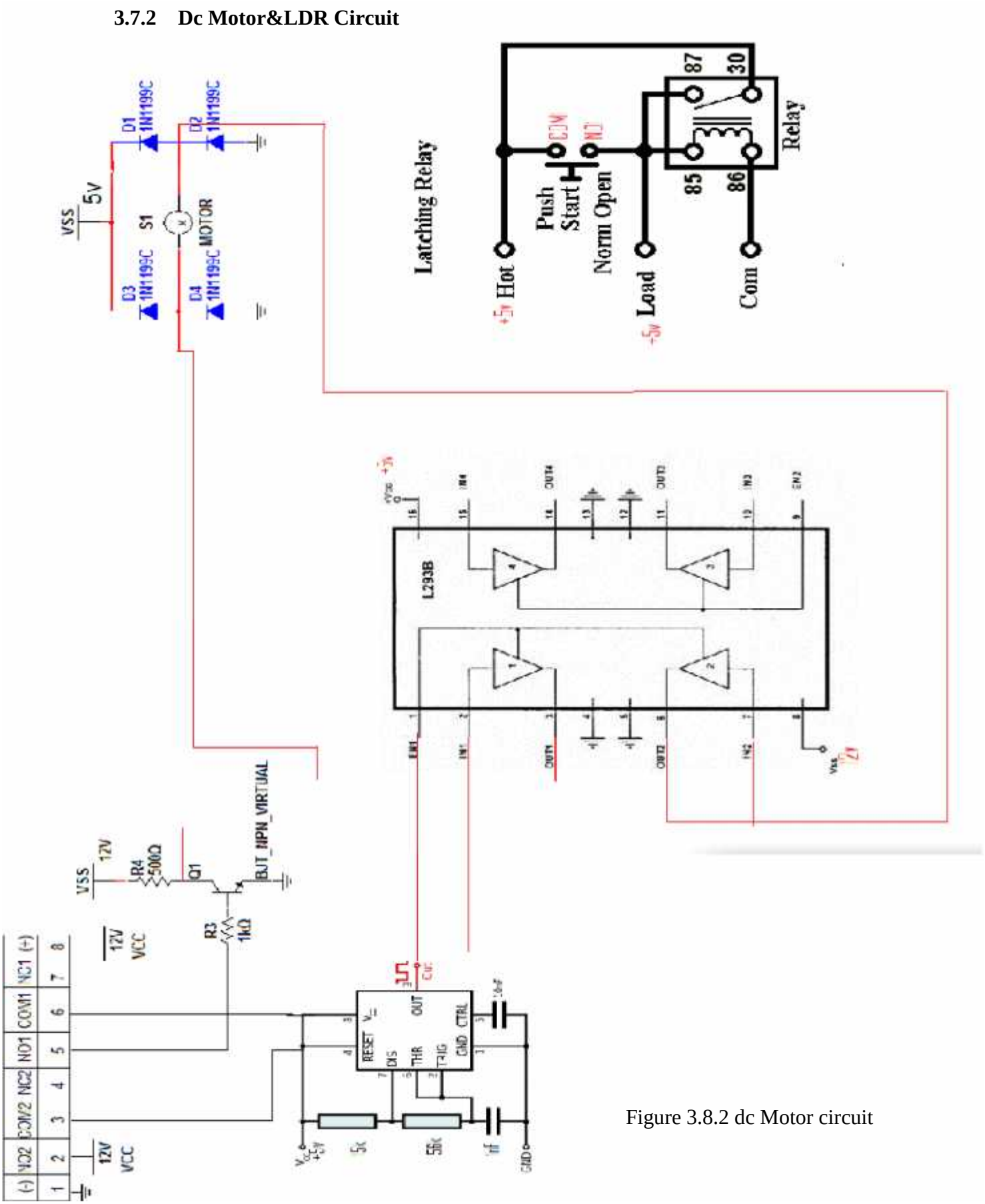


Figure 3.8.2 dc Motor circuit

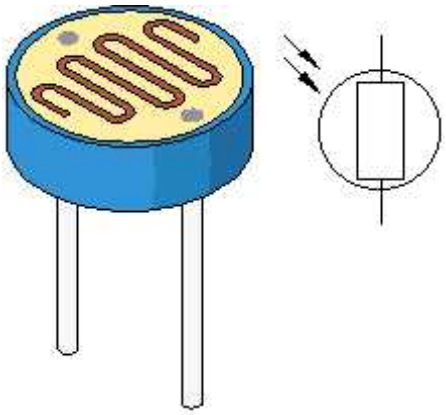
So, here while designing a motor circuit I was thinking of a circuit that is simple and at the same time it does the job. If we get back a little bit we remember that the toy car movement is just forward and backward that means we need just one motor and we want a circuit that controls the direction of the motor.

As the figure3.8.2 shows we have here the remote receiver which consists of the two relays then getting down we have the 555 IC then we have the transistor that acts here as a switch plus the l293b relay and finally we have here the motor and a latching external relay. Actually the idea of designing this circuit came from the receiver, if we look closely at the receiver we see that relay number two is connected to the VCC of the 555 IC and as we remember that the second relay at the receiver is controlled by the push button is latching relay that means at each pressing at the button the relay moves from the NC2 to the NO2 and connects the pin 8 at the 555 IC at the 12V and latches, but after another push at the push button the relay unlatches and that's how the motor moves forward and stops. Now, for getting the motor reverse its direction I really faced a problem and it was as we remember that the receiver's relay No1 is unlatching relay so here I had to think of a way and it was the external latching relay. If we look at the latching relay we see that the push start normally open button is connected to COM1 and NO1 at the receiver that means the unlatching relay at the receiver acts here as a push button and the external relay latches and keeps the circuit closed. The latching relay works as follow when the push button is pressed the coil of the relay which is at pin 85 and 86 is connected to the 5v and latches the normally open which is at pin 87 and 30 then the load is taking the 5v from the hot which is connected to the 5v as shown in the circuit so the coil of the relay in this case is continuously under the 5v and the normally open at pin 87 and 30 keeps closing and that's how we faced the problem of the unlatching relay at the receiver at the first relay.

Now, the function of the transistor and the l293b IC and how does it reverse the direction of the motor. If we look at the transistor we see that the collector and the base are connected to the IC at pin 7 and pin 2. At the beginning when the second relay at the receiver is on by the push button from the remote the motor turns on at this time the motor terminals gets the power from pin 3 and pin 6 which is pin 3 the low and pin 6 the high (the five volt) while the motor is on if the first relay is on it connects COM1 with NO1 and then the external relay is on that means the base of the transistor has the 5v which closes the transistor and connects the collector to the ground that means pin 7 and out2 are low and pin two is high which has the 5v now. Out 1 at the l293b has the 5v now and that's how the motor direction is reversed.

LDR Circuit

A light/dark sensing circuit is extremely useful and versatile in a wide range of renewable energy projects from automatic lighting to security. Here I explain how an LDR can be used in simple circuits to control devices according to the ambient levels of lighting.



The main problem is that the automatic turn-on is not *sharp* rather than switching the lamp on fully as soon as ambient levels of light fall to a fixed point, the lamp turns on slowly getting brighter and brighter as light levels fall. This is not a serious problem when controlling a lamp - in fact it may even be desirable - however when controlling other devices (such as a night vision camera) it is not optimal.

One way around this is to use a relay, however a typical 12 Volt relay draws 300-500mW of power - a significant waste of energy when a 1 Watt LED spotlight for example is to be controlled.

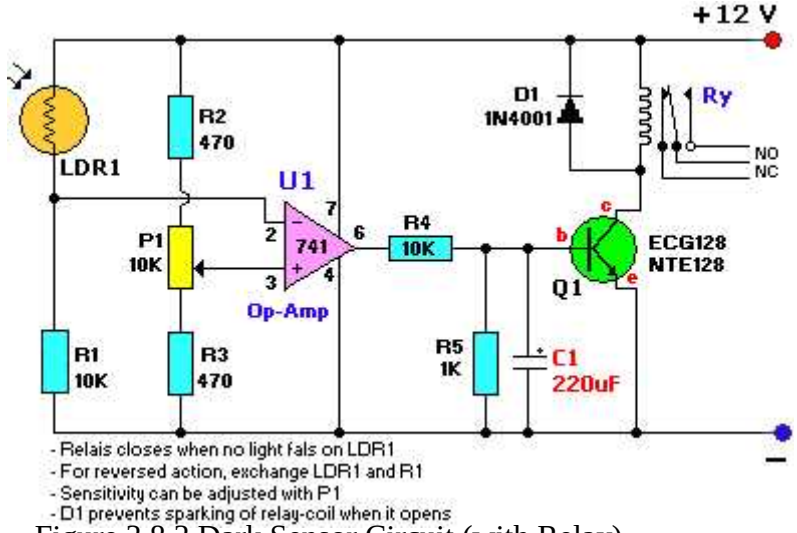


Figure 3.8.3 Dark Sensor Circuit (with Relay)

3.7.3 The toy Car

The toy car plays a very big role at my design; actually I had so many choices but the best choice was the one in figure below. I wanted a toy that is not more than 10 cm height as I described before at the previous chapters so it can get under the big transportation ways but on the other hand I wanted a toy that has a space so we can put the receiver and the circuit board and all the other collection on it.

Figure 8.4 the toy car form

So as shown in figure the form is just 19cm*25cm and 10cm height.

A small toy car but has the specification on the approach design.

3.7.4 The Remote Control& the Remote Receiver

Actually here I am not intending to repeat the pictures or the words but it's just I am getting my final detailed done before moving to the implementation chapter.

So; as I said before just without getting deep into the details but the previous chapter describes everything which is a receiver with two relay are controlled by a remote with two push buttons each button is responsible for activate each relay.

Figure 3.8.5 the remote control and its receiver

The receiver is capable of getting the signal from the remote at 30 meter and that's a good distance and an enough distance for my project.

3.8.5 The Camera

Well, if we look at the beginning I named my project (movable camera for special purposes) I honestly don't know why, maybe because I had some feelings that I am going to have a special camera maybe, any way the figure below show my wireless camera it is really a special one because of it size, its weight and it's angle too.

I honestly wanted to have a wireless transmission and reception, small size, light weight, low power consumption, high sensitivity, easy to install& operate and easy to conceal.

My camera has a name of (STK Security) it's a 1/3 inch Sony color CCD wireless spy camera. Some of its features are:

- 1.2 GHz 800MW wireless camera
- 1/3 inch SONY color CCD
- Horizontal resolution of 480 TV lines
- Inbuilt 3.7mm pinhole lens
- Minimum illumination of 0.5 lux
- Auto tracking white balance
- Electronic shutter of 1/50-1/100000 seconds
- S/N ratio of more than 48 dB

Plus some other information related to my camera at the table below:

Image sensor	1/3 inch Sony super HAD CCD
Power supply	DC +8V
Output frequency	900MHz-1200MHz
Output power	50mw-200mw
Minimum illumination	0LUX
Weight	Approx.1.5Kg
Power	12V DC 50/60Hz
Operating Temperature	Outdoor:-10 degree Celsius to 50degree
Video output	1V p-p,75 ohm
Tracking white balance	Auto
Gamma Ratio	0.45
Angle	90 Degree
Image pickup device	1/3, ¼

I really wanted from the last table to show every important details although I may not be interested in everything but at some important ones like the angle and the power.

Now, the figure below shows the camera: although it looks big but it’s just 3cm *3cm a small one but with a good resolution and perfect screen .

Figure 3.8.6 the camera

But there is something missing at the picture which is the transmitter which is connected to the camera directly and needs 9V DC and 800MW and shown in the figure below which sends its signals to the receiver of the screen which has an AV1 receiver and will be discussed at the next few pages.

Figure 3.8.7 the transmitter of the camera

3.8.6 The Screen

The type of the screen that I am going to use is the TFT LCD MONITOR which was my best choice; I wanted a minimum size with a good screen and something that can be hold by a person's hand and that was my choice.

Some of its function parameters are:

- Screen size: 7 inches
- Display format:16:9
- Power Supply:DC12V
- Power consumption: About 7.5w
- Video: Dual video output
- System:NTSC/PAL
- Pixels:480(W)*RGB*240=345600 dots

BLUE screen appears when no signal

The figure below shows the screen:

Figure 3.8.8 The LCD screen

Now as I said before that I have a wireless camera so it has a transmitter, so here I must attach a receiver with the screen so it can show the picture and that ‘s what the figure below shows:

Figure 3.8.9 the A/V receiver

So, here the receiver has a reception antenna plus the frequency controller which controls the frequency of the oscillator in the receiver to be synchronized with the frequency of the transmitter, also we have the dc power supply terminal and the video out.

Finally, we have here the small remote which is used to power the screen on/off and shifting between AV1/AV2 video plus a button to show the menu and two buttons for analog increase and decrease as shown in figure below:

Figure 3.8.10 The remote of the screen

This block diagram actually shows how the wireless connection between the screen and the camera:

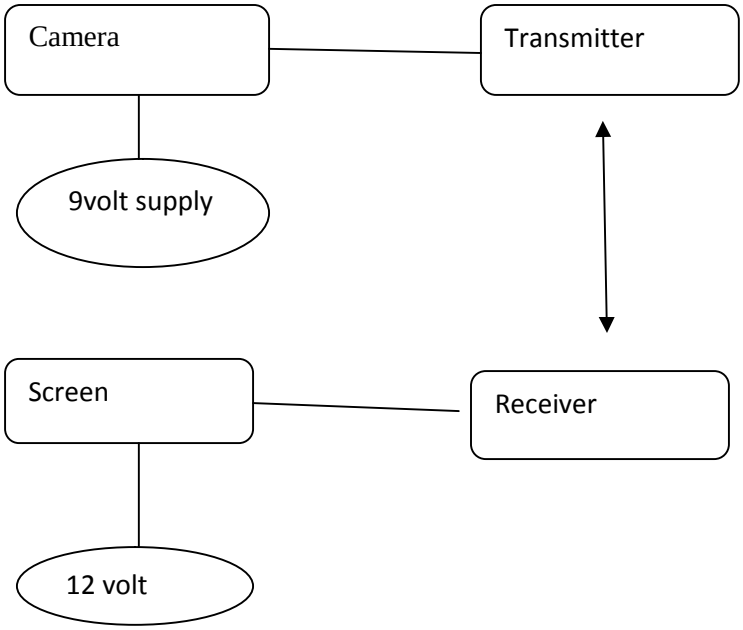


Figure 3.8.11 block diagram for wireless connection between screen& camera

So, before finishing I just want to describe the way the screen is going to be designed.

I am planning to get a wooden box and I want to put the screen at the front then the 12v battery inside it and the receiver is going to be connected on the box as will be shown at the implementation chapter.

So the stuff in the box is going to be connected as the block diagram shows:

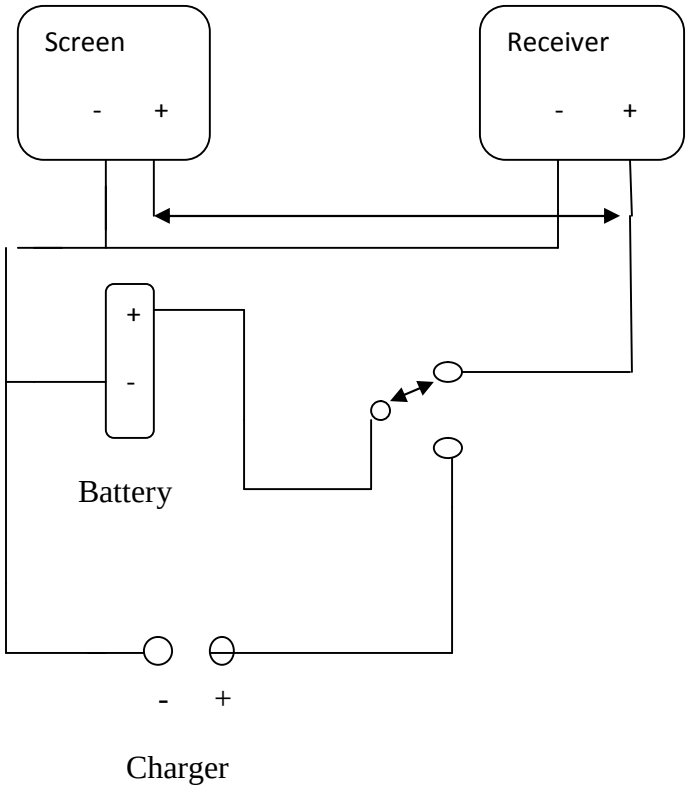


Figure 3.8.12 the connections of the screen and the receiver and the battery on the box

So if the switch is up as it is in the figure the screen is on but if the switch is down it charges the battery when the charger is on of course.

3.8.7 The Power Circuit

The power circuit here consists of 8 batteries connected in series to make a 10v so that the camera connected the toy car and the circuit has the power supply.

4

Chapter four

System Implementation and testing

4.1 Introduction

4.2 555 circuit testing

4.3 DC motor&LDR circuit testing

4.4 Testing the remote &its receiver

4.5 Testing the camera & screen

4.6 testing the power circuit

4.7 Building the whole system

4.1 Introduction

So, here the implementation begins and the problems begin.

I really want to say here that I faced so many problems with the power of the motor and at the same time I wanted a speed that is not fast so the shooting can be done in a good way. Also, the size of the battery was really big and it was heavy for the toy to carry it on the other hand I wanted a battery that can stand for the circuit, the camera and the receiver.

Building the system wasn’t easy and facing all the problems was not easy too but I did my best and the next few pages show everything.

4.2 555 circuit testing

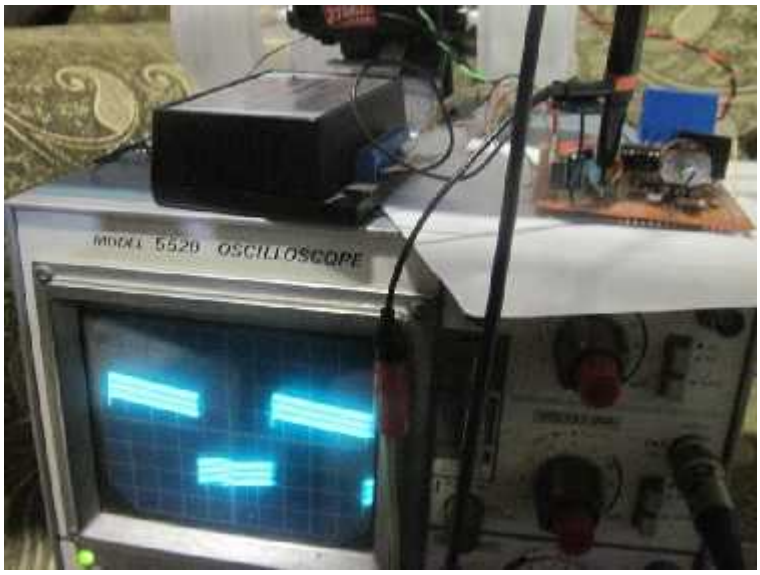


Figure 4.1 555 square wave

So, after finishing the circuit board we made the test using the oscilloscope and we saw the square wave at the output at pin 3 and that's how we made sure that the circuit is working and then we moved to the next step.

As we noticed when the frequency of the square pulses is high the speed of the motor is high too and vice versa.

4.3 Dc motor & LDR circuit testing

So, here the figure below shows the complete circuit board which has the 555 circuit and the dc motor and the ldr circuit.

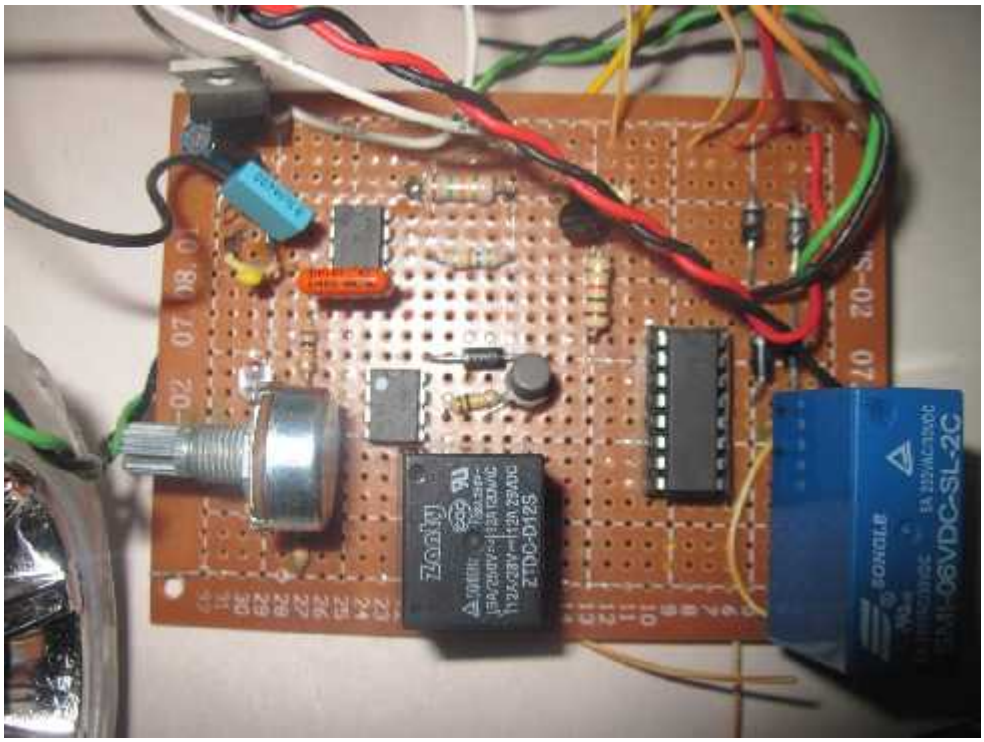


Figure 4.2 the complete circuit board

As we can see from the figure I had to use a small circuit board so it can fit on the toy car and that wanted a hard work to do.

The motor worked well it goes first forward and stops and it moves forward and then backward and it stops too. But like I said I wanted a low speed and at the same time I wanted a high torque for start up the motor.

Now, for the ldr circuit as the figure below shows when we covered the resistor we saw that the light is on so it is really working and it is ready to light under the transportation ways when the shooting begins.

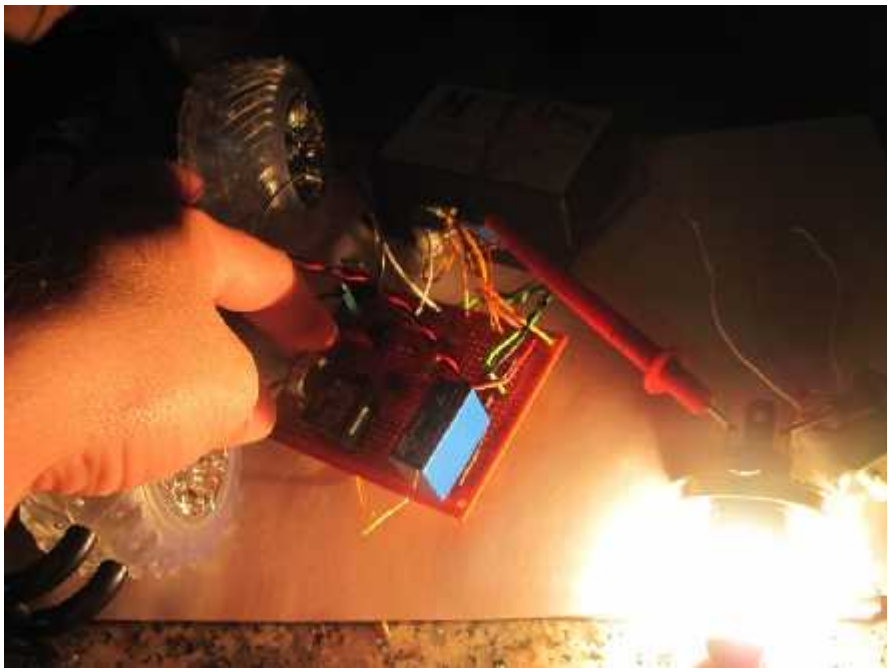


Figure 4.3 The ldr testing

4.4Testing the remote and its receiver

As we all know that the normally open means the circuit is opened and it gives O.L at the digital multimeter on the other hand the normally close means that we have a short circuit and it gives 0 ohm at the digital multimeter.

Figure 4.4 testing the receiver

While testing I also noticed that when clicking at the remote buttons we noticed the change at the digital mutlimeter which is the open become close and so we made sure that the receiver and the remote is working.

4.5 Testing the camera and the screen

As I said before the design of the screen is going to be a wooden box as the figure shows, the screen is in the front on the top of the box is the receiver and at the back is the switch and the charger terminals.

Figure 4.5 the screen from the front side

The idea from this box is that the person who carries the remote in a hand is capable of carrying the box in the other hand which consists of the battery 12v which is big and not to forget the receiver so this box makes it possible.

The figure below shows the screen from the back side

Figure 4.6 the screen from the back side

We can see that the two wires getting inside are connected to the battery which is hidden inside and here the switch and the two terminals as I described before.

Now we saw the box but we haven't seen it on and that's what the next figure is going to prove a picture that has been taken of course from the wireless camera described before.

Figure 4.7 the screen has a picture

Now everything is almost done, the thing we must always check is the batteries to have the power supply on at the voltage required and we will be fine.

So, the next step here is to build the whole system and to get each part at its place and that's what the next few pages is going to prove.

4.6 Building the whole system

This is beautiful, the project is almost done, what I have to do now is to collect every part of the project and get everything ready. What finally I had to do is to fix the camera on the car so it can has a 90 degree angle and that the most important thing and that's what the figure below shows almost a full complete system the toy car and the screen box:

Figure 4.8 building the whole system

5

Chapter five

Conclusion and future work

5.1 Introduction

5.2 Conclusion

5.3 Future work

5.1 Introduction

Finally we are at the conclusion chapter, the work is done, the problem had a solution, I really had the idea of the project when I saw the difficulty that the workers at the check point face when checking under the transportation ways for security. I enjoyed working and designing every single part of my project and I will be so happy when I will see the project helping the people who want it. I really faced some problems while designing but at the end I am happy for what I have done. I wanted a simple idea but on the other hand and idea that is useful and is able to make the job.

5.2 Conclusion

After finishing my project I had so many experience, I learned so many stuff especially at the electrical side and how to continue working although facing troubles.

I wanted from the beginning to design a wireless system no matter the cost, the difficulty of getting the components and that’s what we finally get.

On the electrical side I conclude so many stuff while designing the circuit board and learned so many stuff, on the personal side I really learned to be patient especially when facing a problem in the design and try to face each problem in a good way.

5.3 Future Work

So, after all I really had an idea, I wanted a system that can sends pictures under transportation ways and I did it. I used several IC's, a wireless camera. I am satisfied with what I have done. But of course I would be happier if I see people develop the idea in another way such as:

- Using image processing method
- Maybe controlling the toy car by another drivers
- Using LCD flat screens
- Some may suggest making a track for the toy car

All these ideas maybe developed and added later by other people. I would be glad to see improvement for my idea and thanks everybody.