GSM Based Gun Control System with Video Monitoring

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Certificate

We accept the work contained in this report as a confirmation to the required standard for the partial fulfillment of the degree of BS(ETM).

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Head of Department   Supervisor

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Internal Examiner   External Examiner

Dedication

We dedicated this project to all the teachers who taught us throughout the degree and helped us gain shear knowledge and played their vital role in building our character and academia. Dedication cannot be completed without mentioning our parents & friends who provided us with all the necessary back end support to accomplish our degree and make us what we are today.

Acknowledgements

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I am really thankful to my parents for guiding me throughout my life and their support and to all my group members for their help and support and their backup whenever I needed them. I am also thankful to all my coworkers for helping me throughout my project who have helped me with their abilities and in achieving my goal.

Abstract

Security is one of the biggest concerns now days. With increasing security threats an elevation in the safety measures needs to be considered. Our nation has suffered too much at the hands of dangerous people. In this project we aim to develop an UGAV (Unmanned Ground Armed Vehicle). The UGAV will be mounted with a gun and a camera. The gun will be able to move in four directions and rotate in 360 degrees based on the commands of the user using DTMF (Dual Tone Multi Frequency). The system is based on mobile communication through which signals are sent in order to perform a certain function. The system will work in two modes i.e. (a) GSM mode (b) RF mode. The GSM (Global System for Mobile Communications) mode uses GSM network to transmit the DTMF tones and the RF (Radio Frequency) mode uses RF signal to transmit the DTMF tones.

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Chapter # 1

Introduction

1.1 Project Background/Overview

Our country is located at a very strategic location in the world. Especially after the twin tower attack in September 9/11 Pakistan has played a key role as an ally with USA. This alliance did not come without a price. The security condition of Pakistan has deteriorated quickly. One of the major security threats are the suicide blasts. It is observed that the suicide bomber mostly detonate themselves during the security check. The idea came in our mind that would it be possible to save a human life by replacing a human with a UGAV which will work on GSM or RF technology. There are numerous advantages of using UGAV. Avoiding daily terrorists' activities, thieves and burglars. It's a front line combat. It can be used for security purposes. Through technology we are able to save lives.

1.2 Problem Description

Security is one of the basic concerns in this ever evolving society. With increasing security threats safety precautions are taken under high notice. Now a days armored vehicles are required which can have the potential of securing human lives.

1.3 Project Objectives

As we have to stand with the security threats which Pakistan is facing , we have to design and implement a GSM base system by which we a UGAV.

The project is divided into parts

- Hardware parts
- Mechanical parts
- Circuit design
- GSM or RF Connectivity

Chapter # 2

Literature Review

Literature Review

Our project's main focus is on the current security threats in pakistan as well as to serve the for the betterment of the mankind.

After 9/11 incident the situation in Pakistan is becoming worse day by day we would find a casuality or a suicide activity every day.There is scarceness of in sequence on suicide in Pakistan. An Islamic country in which variety of social, legal, and religious factors make reporting and diagnosing suicide difficult. Oddly enough the incidents of suicides are frequently reported in newspapers. In the deficiency of other means these reports serves a useful and basic information source for suicidal deaths [7]. In last two year examination of all such reports in major newspaper in Pakistan shows 306 suicidies reports from 35 cities. The number of men are 208 which out numbered the women by 2:1.

Despite the fact that there are more single than married men and but the trends is overturned in women. Bulk of subjects were below 30 years and "domestic problems" was the most common problem declared.

Also in the current incident of Aitzaz Hussan a school boy from hangu District in KPK who gained martyrdom while preventing a suicider to inter in his school in which 2000 or more students were saved in Ibrahimzai village on Jan 6, 2014. After this incident this boy was awarded with high civil award of Sitara-e-shujaat by the government of Pakistan.

After all these incident we were determine to find a solution for all the casualities and to prevent our nation from this type of incidents. So we design a GSM based system to controll

a gun which have a camera and can monitor all the activity which are going around and to overcum all the security issues.

It can can deployed in various place some are as follows

- Intense area (High security alert areas)
- Masjid
- Borders
- Schools
- Jails

It can be used for security purposes. Through technology we are able to save lives.

Chapter # 3

Requirement Specifications

3.1 Structure

We have to design a structure over which we have to fixed a gun on a top of the structure and pin hole camera for the video streaming and audio tansmission as well.

3.1.1 Base

For the movement of the gun we have to design the base first. We have used a lamination board over which acrylic sheet is used to structure a moving part over which our base is structured   with 6*6 width and   2.5 inch in height. Gear motor is installed at the centre of the base. Gear barring and circular barring are supported with a excel and moving part is also connected to this excel as well.

3.1.2   Columns

There are two column supporting with 6mm acrylic sheet . Moving part is attached with the top of the column with the gare and shaft and drive motor is connected with gear to drive the gun up and down slowly. The bottom gear motor is used to move the Gun from right to left and vice versa.

3.2 Hardware

3.2.1 DTMF

Dual Tone Multi Frequency is the basis for your telephone system. It is the generic term for Touch Tone. Mobile phone generates DTMF tone as you press the buttons [12].

DTMF Keypad

Hz	1209	1336	1477
697	1	ABC 2	DEF 3
770	GHI 4	JKL 5	MNO 6
852	PRS 7	TUV 8	WXY 9
941	*	OPER 0	#

Dual Tone Multi Frequency used for navigation
of the vehicle. (**Fig 3.1**)

3.2.2 Microcontroller

We have use 89c52 controller because it is easily available , easy to use and easy to implement. PIN 18 and 19 is connected with external crystal oscillator data in the controller will be run when it is connected with external crystal oscillator with frequency 11.0592MHz. (It also generate system Pulse)

And show the data of DTMF 4-bit in LED form. It also have a strobe light which is turn on when the frequency is matched. Speaker is also connected to recognized the phone tone signal. C535 transister are connected in NPN configuration and resister are also attached to direct the signal to turn on the LED.

3.3 Requirement Specifications

The requirement specification for our system include

- Microcontroller

- Resistors

- Capacitors

- Ics

    - LM 386

    - MT 8870

    - Rx2b & Tx2b

- Battery

- Microcontroller

- Transistors

- Relays

- Diode

- LED

- Voltage Regulators

- Crystal Ocillators

- Pin Hole Camera

3.3.1 Microcontroller

Microcontroller is a device that can act as a mini computer. It consists of a processor, memory and input/output peripherals. There designed aimed at embedded applications, whereas They are used in computers or other general purpose applications. The hardware used for controlling remote devices is now decreased due to

microcontroller. Microcontrollers are used in machinery, such as automobiles, telephones, appliances, and other computer systems. The most famous type of microcontroller is PIC Microcontroller. In our project we have used 89c52 Microcontroller.

Microcontroller 89C52 Used to relay commands to Gun,
after processing inputs from GSM **Fig 3.2**

3.3.2 Resistors

It is an electronic device which have a resistance to the flow of current through a particular circuit. Resistor act to reduce the current flow and same time acts to lower the voltage level as well. It may have fixed resistant or variable résistance. They can be connected in series or in parallel configurations. In series it will have constant current flowing but differ voltage and when it is connected in parallel it will have a constant voltage but different current levels.

Resistor used controll the current
flow in circuits **FIG 3.3**

3.3.3 Capacitors

It's an electronic device which is used to store electric charge. It is also used in timer circuits. A capacitor may be used with a resistor to produce a timer. A simple capacitor can be made by placing two conductors together, but don't join them. The conductor plates should be separated and a dielectric material should be in between them. Now in our circuit we are using different capacitors. 1000uF, 470uF, 10uF.
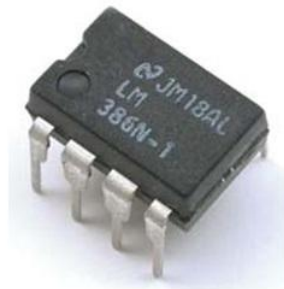

Capacitor used for temporary
current storage. **Fig 3.4**

3.3.4   ICs

LM 386

The LM386 is an intgrated circuit consisting of a low voltage audio power amplifier. It is suitable for battery-powered devices such as radios, guitar amplifiers, and hobbyist projects. The IC consists of an 8 pin dual in-line package (DIP-8) and can output 0.5 watts power using a 9-volt power supply [4].

LM386 used for amplification
of DTMF. **Fig 3.5**

MT 8870

Now a days most of the telephone equipment uses a DTMF receiver IC. MT8870 is one of the common DTMF receiver IC, developed by Motorolla that is widely used in electronic communications circuits. The IC consists of 18 pin. It is used in telephone and number of applications. By using this IC if proper outputs are not obtained then engineers need to test this IC separately [2]. A quick testing of this IC could save a lot of time in research labs and manufacturing industries of communication insturments. Here is a small and handy tester circuit for the DTMF IC.
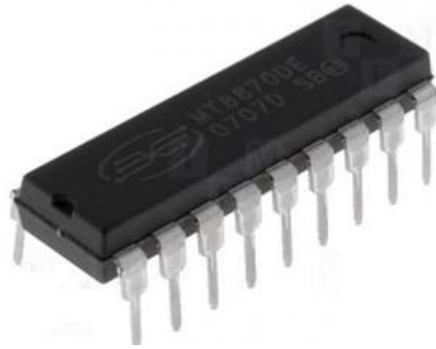
MT8870 used for the purpose of digitization
and encoding of DTMF. **Fig 3.6**

3.3.5 Transistor

A three legged electrical device whose basic function is to act as a switch. Another use of this device is amplification. The two main types of transistor are NPN and PNP. Different transistors work on different voltage levels. The three legs told earlier are known as Collector, Base and Emitter. Collector is the positive lead of the Transistor. Base is responsible for activating the transistor. And Emitter is the negative lead of the transistor.
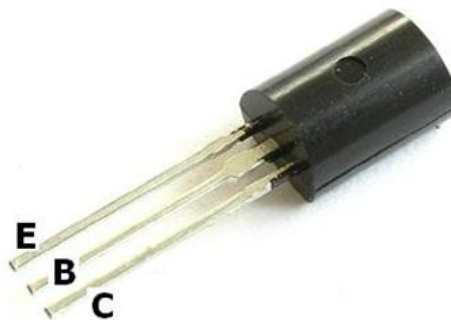
NPN transistor used for amplification of
signal from Microcontroller. **Fig 3.7**

3.3.6 Voltage Regulator

It consists of three legs. Basic purpose is to give a constant regulated voltage in output by varying input voltage. Voltage Regulators are available in a variety of outputs.

The most common part numbers start with the numbers 78 or 79 and finish with two digits indicating the output voltage. 78 number represents the positive voltage and 79 represents th negative one. The 78XX series are designed for positive input. And the 79XX series of voltage regulators are designed for negative input [3].

Voltage Regulator used for
regulating current. **Fig 3.8**

3.3.7 Relays

Relay is basically act as a switch that is activated by electricity and it uses the magnetism to either on or off the switch. Relay purpose is to switch high power items that can draw too much current to safely come in contact with the switch itself or to enable you to run high currents through one wire and connect and disconnect them with low current through another wire. Relay is a switch that keeps you away from dangerous amounts of power or lets you use smaller wires to run things [1].

Apart from switching a circuit with heavy load, on & off, a relay is required to

1. Conserve Energy

2. Prolong the life of device

3. Improve the efficiency of a device [8].

Relays used for switching and driving the hardware. **Fig 3.9**

3.3.8 Diode

Diodes allow electricity to flow in one course only and block the flow in the opposite course. They may be considered as one way values and they are typically used in a range of circuits frequently as a form of protection. It contains two electrodes which act in a similar manner as semiconductors. It has low (ideally zero) resistance to current flow in one direction, high ideally infinite resistance in the oher [10].

Diode used to keep the flow of
current in one direction. **Fig 3.10**

3.3.9 Crystal Oscillator

A crystal oscillator is an electronic circuit. A microcontroller/processor needs a stable clock to run. Provided the circuit and external capacitors are set up correctly, and located close to the xtal pins on the micro, the crystal oscillator will oscillate at the specified rate. If the clock is not stable you could encounter timing problems inside your micro. Violating setup and hold times will cause eratic behaviour.

Crystal Osciallator used to provide
frequency to the microcontroller.**Fig 3.11**

3.3.10 Pin Hole Camera

This type of camera is usually built without a lens having a very small opening at one end which acts as aperture. This camera is inside a light proof box.

For the purpose of capturing a picture the light pasess through that small opening known as pinhole and falls on the opposite side of box and forms an inverted image. Advantages of using pinhole camera Pinhole camera has a very small aperture which enables it to have focus to infinity and reducing the chances of any out of focus picture or video, which ensures a clear detection or recognition of any object.

Pinhole can be made by hand by having a simple box and a film or any kind of photographic paper placed on the opposite side of the pinhole opening. The opening is not more then a small opening as made by the needle.

Pinhole camera is used because of
Small aperture and infinite focal length. **Fig 3.12**

3.3.11 Tx-2B & Rx-2B IC

Tx2b and Rx2b IC is used for five channel radio remote control circuit. It is a remote encoder/decoder pair and is used for remote control applications. It contains 5 channels having a very wide operating voltage which varies from 1.5 volt to 5v , and having a very low amount of low stand current which is around 10uA while 2mA of low operating current. The basic purpose of this TX-2B/RX-2B was originally to control toy cars but its versatility enables it to be used for many other remote switching purposes
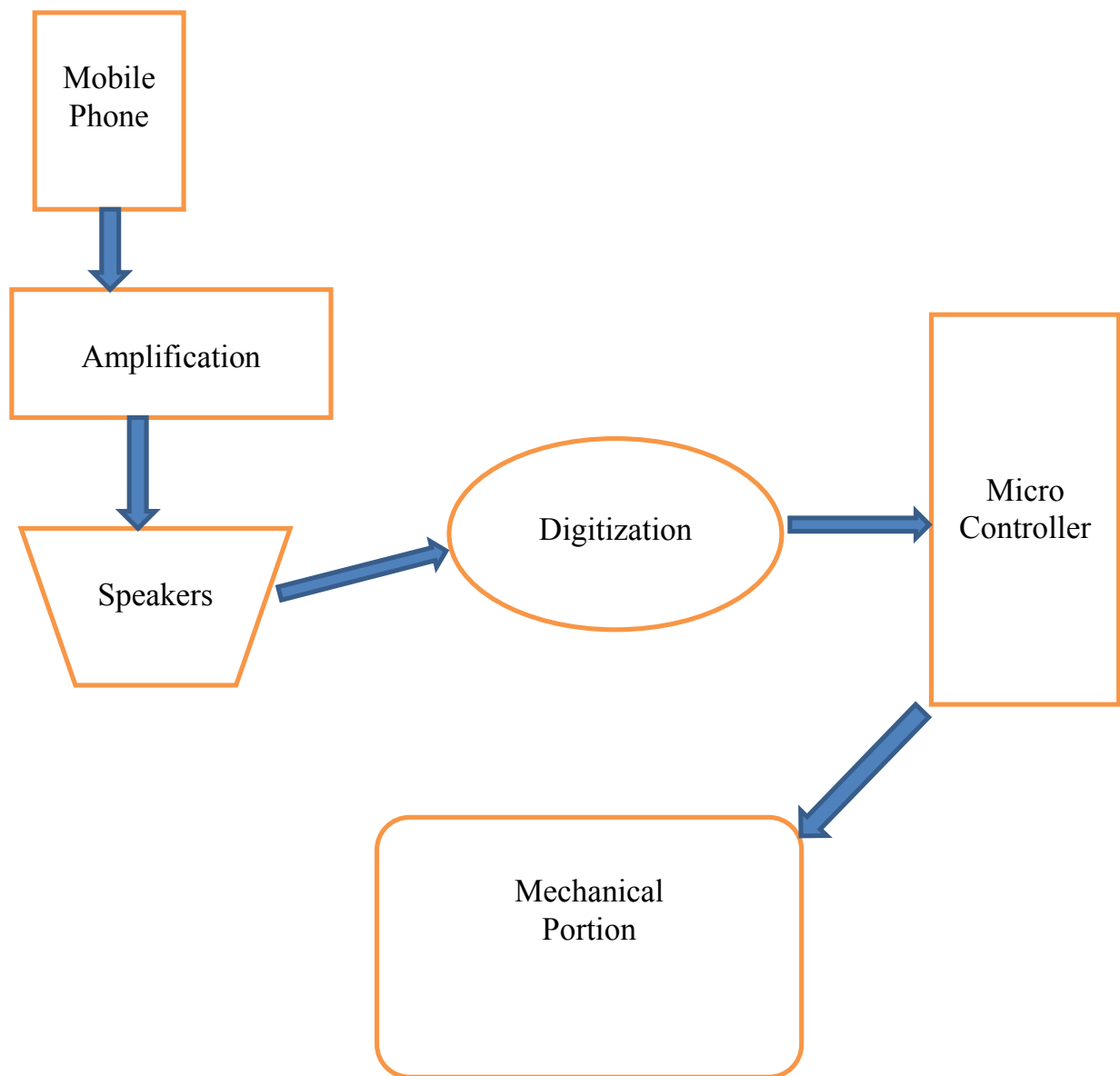

Tx2b and Rx2b IC is used for five channel
radio remote control circuit **Fig 3.13**

Chapter # 4

System Design

4.1 System Architecture

This chapter include the system architecture its component its module, interfaces, and data

for the system which specified requirements regarding system

```
┌──────────┐
│  Mobile  │
│  Phone   │
└──────────┘
     │
     ▼
┌──────────────┐
│ Amplification│
└──────────────┘
     │
     ▼
  Speakers  ──────►  Digitization  ──────►  Micro
                                            Controller
                                                │
                                                ▼
                                        Mechanical
                                        Portion
```

Fig 4.1 System Arcitecture

This Project is composed of three parts

- Hardware Part

- Mechanical Part

- Software Part

4.2 Design Constraints

This system has a constraint of Frequency matching. The frequency which is burned in the microcontroller should match the DTMF frequency of the mobile phone, otherwise this system won't work. Second constraint of the system is that the battery should be charged properly or else the mechanical part will stop working.

4.3 Hardware Design

The purpose of the IC, MT 8870 is to perform decoding. Decoding is done by using counting techniques to detect and decode all the sixteen DTMF tune pairs in to a four bit code. The advantage of this IC is that it has a small circuit and is easily available. But we can also use other decoders such as SSL 202, LC 7385, KT 3170.

Output of the speaker is connected to MT 8870. The output of this IC is a four bit digital output, now this output is send to Microcontroller.

89C52, this microcontroller is programmed to take a decision of its input to output for movement of gun.

- Port 18 and 19 of the microcontroller is connected with external crystal oscillator. The program will be executed when the oscillator is attached. The frequency is 11.0592MHz.

- As soon as the frequency matches with that in the controller a strobe light starts blinking.

- Speaker is also connected to recognize the phone tone signal.
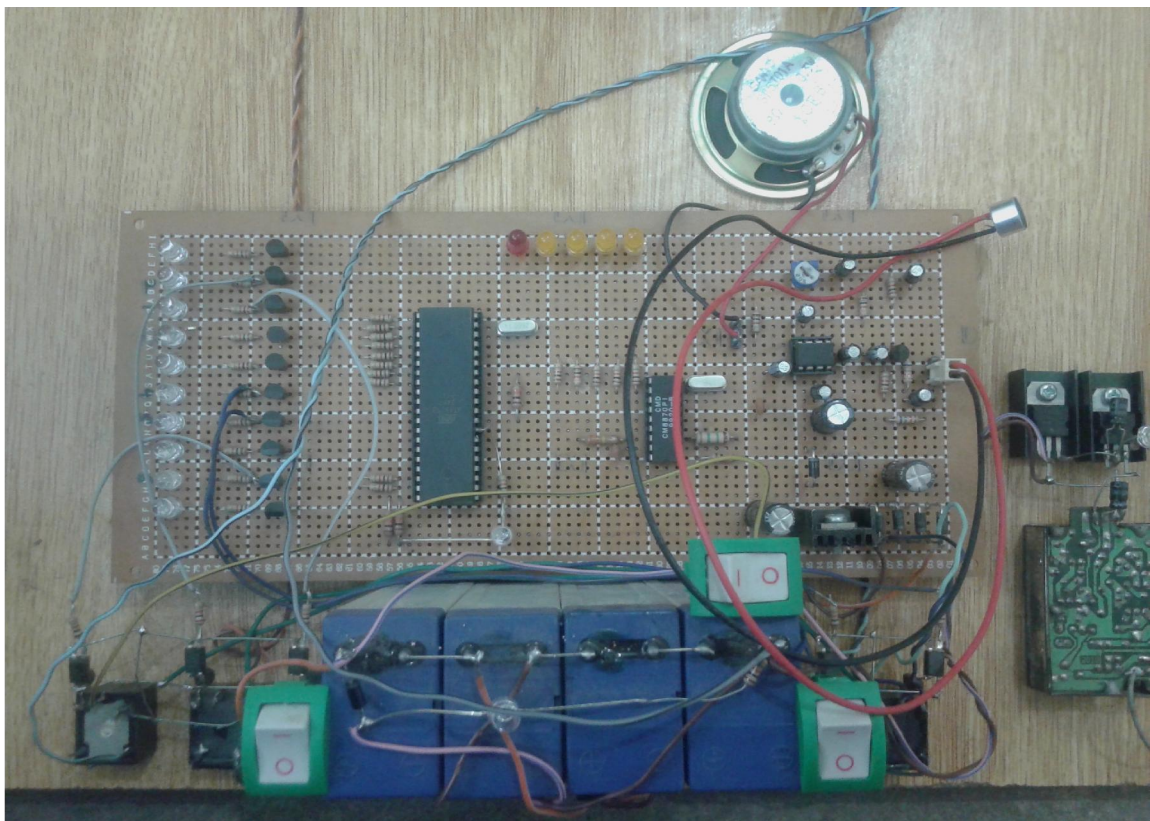
Fig 4.2 Hardware

LM 386 is known as the tone amplifier. It amplifies the tone of the mobile phone 200 times more. Transistors relays are attached with the microcontroller. The output of the microcontroller which is in the binary form is connected with the base of the transistor. Here the signal is amplified. The purpose of this transistor is to isolate. The crystal frequency is 3.871MHz; this crystal frequency sets the tone frequency according to the one which is in it. Just beside the LM 386 are the filters.

The signal coming from microcontroller is coming to the transistor and then that signal is amplified. Those pins will turn high on which the voltage is coming and then it goes to the OPT coupler. Now there is a transistor at the OPT coupler. It isolates it when the relay is on 0.77. During switching all the high voltages that are created are not allowed to enter the microcontroller. We can also use a diode on a relay. But it works sometime not all the time. And hence the surge which is the high voltage, it enters the microcontroller. In order to avoid that we use OPT coupler. Battery is attached with the relays, which helps the motor run.

On the twelfth pin of the microcontroller there is this strobe led, to match the frequency. It shows whether the microcontroller is working properly or not. And the led next to it indicates that whether the data is coming in or not. If suddenly the microcontroller stops working, then the transistor led won't work. The led which is placed just beside the microcontroller, when it blinks it means that the software is working properly at the microcontrollers end.

The five relays are as follows:

1	2	3	4	5
Clockwise	anticlockwise	up	down	trigger

Fig 4.3 Mechanical Part

After the Clock and Anticlock relays, there is a diode bridge, IN 4007 diode is attached and with it a 5V regulator is placed. Next to the regulator are the filter capacitors. After LM 386 there is a variable mean potentiometer. The reason of this potentiometer is that we can regulate the tone, how much we want to give so that the circuit would work.

Relays are single pole, double through 6 volts. And the capacitors are of 1000uF also of 6 volts. And the rest are 470uF and 10uF. There is a video transmitter beside it are two regulators.For camera, 12 volts are provided. And for video transmitting 5volts are provided. One antenna for video transmitter second for RF. There are 2 switches used. The right one is for the motor supply. And the left one is for the hardware. Upper one is for the video transmitter and the camera. The gear motor is working on 12 volts.

In our project we used Pinhole Camera as it is really easy to build and cheaply available and replaceable incase of any damage. Secondly the greatest advantage that pinhole camera offers is the infinite focal length of the camera this eradicates the extra control of having a focus control on the camera gun. Camera acts as an eye of the complete project and it the focus can't be compromised. This solution offers the greatest advantages.

There may be a chance that GSM coverage may run out in some area of operation, to coop with this scenario UGAV can be controlled from a close vicinity with the help of a RRC (Radio Remote Control). Utilizing the radio frequency the Remote control can be used to handle the equipment. In our project we used TX-2B /RX-2B ICs to form a 5 channel radio remote control.

Our Rf Remote control has 5 channels having a very wide operating voltage which varies from 1.5 volt to 5v , and having a very low amount of low stand current which is around 10uA while 2mA of low operating current. The basic purpose of this TX-2B/RX-2B was originally to control toy cars but its versatility enables it to be used for many other remote switching purposes.

Chapter # 5

System Implementation

5.1 System Implementation

Firstly when this idea came to our mind many questions also arise regarding, How this idea would be implemented physically? how the gun would work? and how it will rotate in 360 degree and also move up and down? Afterwards we also have query about the interface what we should use which will also be suitable for the GSM connectivity, what inputs we should give, what will decode the input and how this UGAV will and have video monitoring as well.

Then we started our research for resolving our queries .First of all we design a circuit simulations on proteus . then for according to our requirements we have choose a microcontroller , resistors , LED , capacitor and other various important components which are in circuit design.

After that we have issues on the mechanical structure implementations . Then we designed a balance structure which can hold a to gun and a camera . With that we also have to measure some other measures as well like the movement of this UGAV
In four direction and what sort of camera should be used for the video monitoring purpose as well.

Slowly and steadily these questions were being solved and our UGAV was building and then we had another problem with the movement, what motors should we use to reduce torque and has a firm movement of this UGAV then we used two Gear motor one at the bottom and in the center of the structure which will direct the movement in circular manner and other Gear motor was on the top with shafts which will help to move the gun up and down.

Implementation is the process of moving an idea from concept to reality. The System implementation is a realization of a technical specification or algorithm as a program, software component, or other computer system through programming and deployment [9].
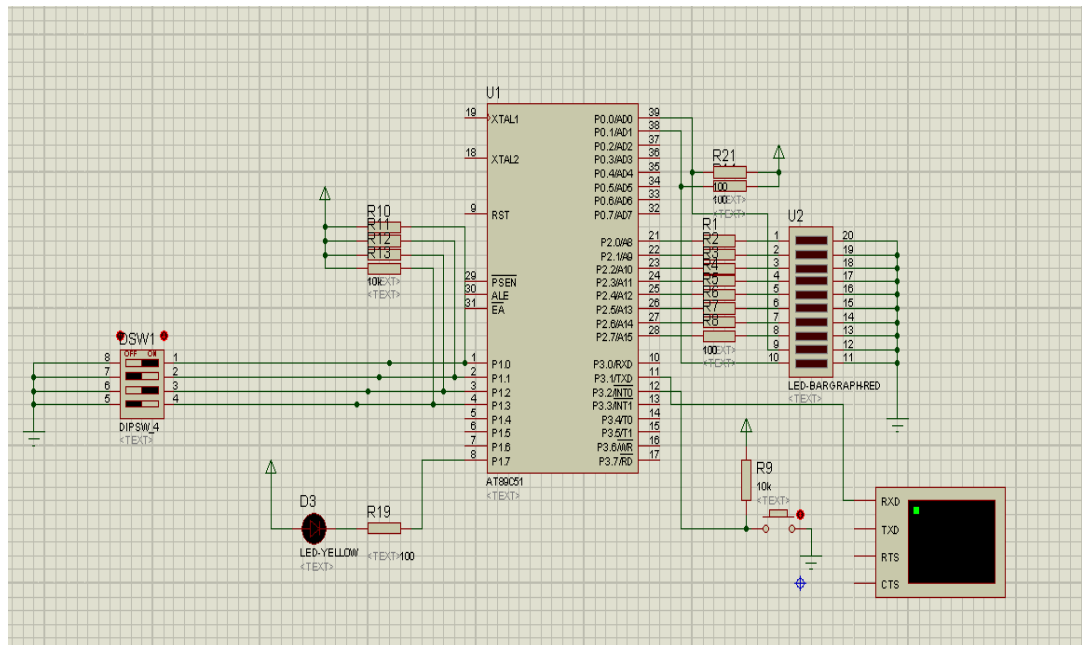

Fig (5.1)

5.2 Tools and Technology

In hardware we have used vara board, on which the circuit is implemented. Then the gear motors are installed. Levelling instrument is used to accurately hold the shaft. Circular barring, gear barring.

In software, proteus, keil uvision, and voltmeter was used. GSM kit is used to connect with mobile. RF is used to remotely control the hardware.

5.3 Languages Used

C++ and hexadecimal are used

Chapter # 6

System Testing and Evaluation

6.1 System Evaluation

This project was tested in a complete isolated environment and under ideal conditions. The sytstem was working perfectly. Then the project was taken in open air, and we observed that the noise pollution had a 0.5% effect on the speaker. Hence we had to change the speakers and installed good ones.

This system was designed user friendly. We just have to press the desired keys and we can rotate the gun in any direction we want. The installment of this project is a little space consuming but the ease caused is countered.

6.2 Performance testing

The performance of this system was tested by changing the mobile, we came to know that only specific mobiles can be used in order to run the system perfectly. Because the frequency which is programmed in the microcontroller must match with that of the mobile phone.

Test 1: Rotate 90 Degree.

No. Of Times	1	2	3	4	5
Values					
Avg Value					

Test 2: Degree Movements per second.

Degree	0-45	0-90	0-270	0-360
Time				

6.3 Compatibility testing

Project is compatible as long as it is handled with care. As the project is very sensitve. A slight mistake in the programme can cause victory of the enemy, hence the programmed should be tested frequently.

6.4 Load Testing

Avoid hitting multiple keys. Press the keys gently and smoothly, so that the board might not get fried.

Chapter # 7

Conclusion

Conclusion

This project can be used in millitary, wars, defence and any where terrorist threat is implied. And in order to control an unmanned ground army vehicle. This project requires space but the work which is taken from it is countered to it. We can suggest that if an automatic gun is installed the system should be much proficient that it can withstand multiple trigger shots.

In the near future we will be able to replace such mechanics in to robots. We can design a system in which a human like machine will be able to move, carrying a gun and fighting on the behalf of real human beings. As you know this is an ever evolving world. In which people are in the struggle to invent more and more things. Just for the ease and comfort of the society. And on the other hand there are also some forces which are working day and night to find solutions, to end their enemy with out the loss of humans.

For Example, unmanned air vehicle also known as the Drone. They are also driven remotely. People will prefer a robot to die in a battle field rather than a human being.

From time to time more fast moving machines are invented because in a battle field we need to move quickly and hit the location on time. A person is not capable of executing a plan without mistakes. But a robot, a re-progammed robot is capable of moving fast and executing a plan on time, more precisly and reliably.

Need is the mother of Invention. Nothing is carried out unless and until we dont need it. This project is also a fullfilment of a need.

References

References

[1]   http://seaperch.mit.edu/hew_relays.php

[2]   http://electronics-diy.com/schematics/170/CI-2-DTMF.pdf

[3]   http://eidusa.com/Electronics_Voltage_Regulator.htm

[4]   http://wiki.bildr.org/index.php/LM386

[5]   http://danpritchard.com/wiki/Crystal_oscillator

[6]   http://www.ebibus.sk/content/products/automatizacia/danaher_motion/catalogs/servodrive/s_cd_e.pdf

[7]   http://www.hhpub.com/journals/crisis/2000/abstv21i1.html

[8]   http://www.gtco-digitizers.com/14-automotive-relays-what-are-they-and-why-do-you-need-them.html

[9]   http://www.freebase.com/view/en/implementation

[10]   http://en.wikipedia.org/wiki/Semiconductor_diode

[11]   http://www.andronikos.co.uk/Anno_Preprocess.php?id=3319

[12]   http://www.semafone.com/Glossary

[13]   http://www.genave.com/dtmf.htm

[14]   http://www.caritasuni.edu.ng/pro/engineering/ee.doc

[15]   http://www.sikhiwiki.com/index.php/Makindu_Sikh_Temple

[16]   http://www.egr.uh.edu/research/files/Final_0-4282_Part2.pdf

Abbreviatons

UGAVU = Unmanned Ground Armed Vehicle

DTMF = Dual Tone Multi Frequency

GSM = Global System for Mobile Communications.

RF = Radio Frequency

KPK = Khyber Pakhtunkhwa

NPN = Negative Positive Negative (transistor)
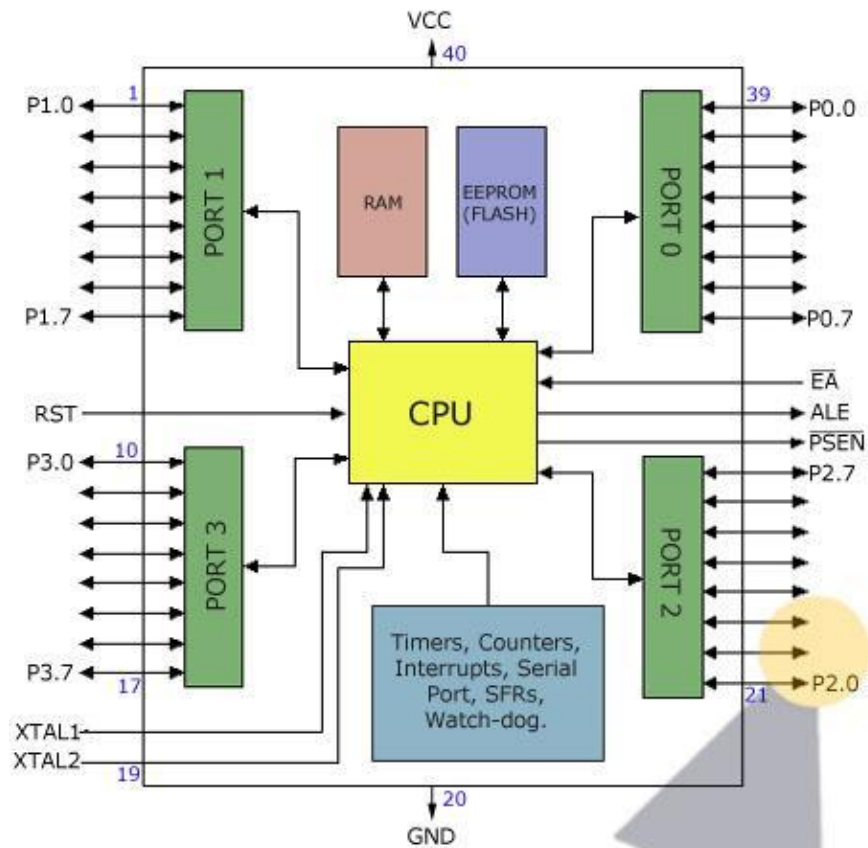
PNP = Positive Negative Positive

LED = Light Emitting Diode

IC = Integrated Circuit

RRC = Radio Remote Control

Appendices

89c52 Internal Diagram

89c52 Pinout Description

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 Pin	Alternate Functions
P1.0	T2 (external count input to Timer/Counter 2), clock-out
P1.1	T2EX (Timer/Counter 2 capture/reload trigger and direction control)

Pin Number	Description
1 - 8	P1.0 - P1.7 - Port 1
9	RST - Reset
10 - 17	P3.0 - P3.7 - Port 3
18	XTAL2 - Crystal
19	XTAL1 - Crystal
20	GND - Ground
21 - 28	P2.0 - P2.7 - Port 2
29	PSEN - Program Store Enable
30	ALE - Address Latch Enable
31	EA - External Access Enable
32 - 39	P0.7 - P0.1 - Port 0
40	Vcc - Positive Power Supply

Block Diagram
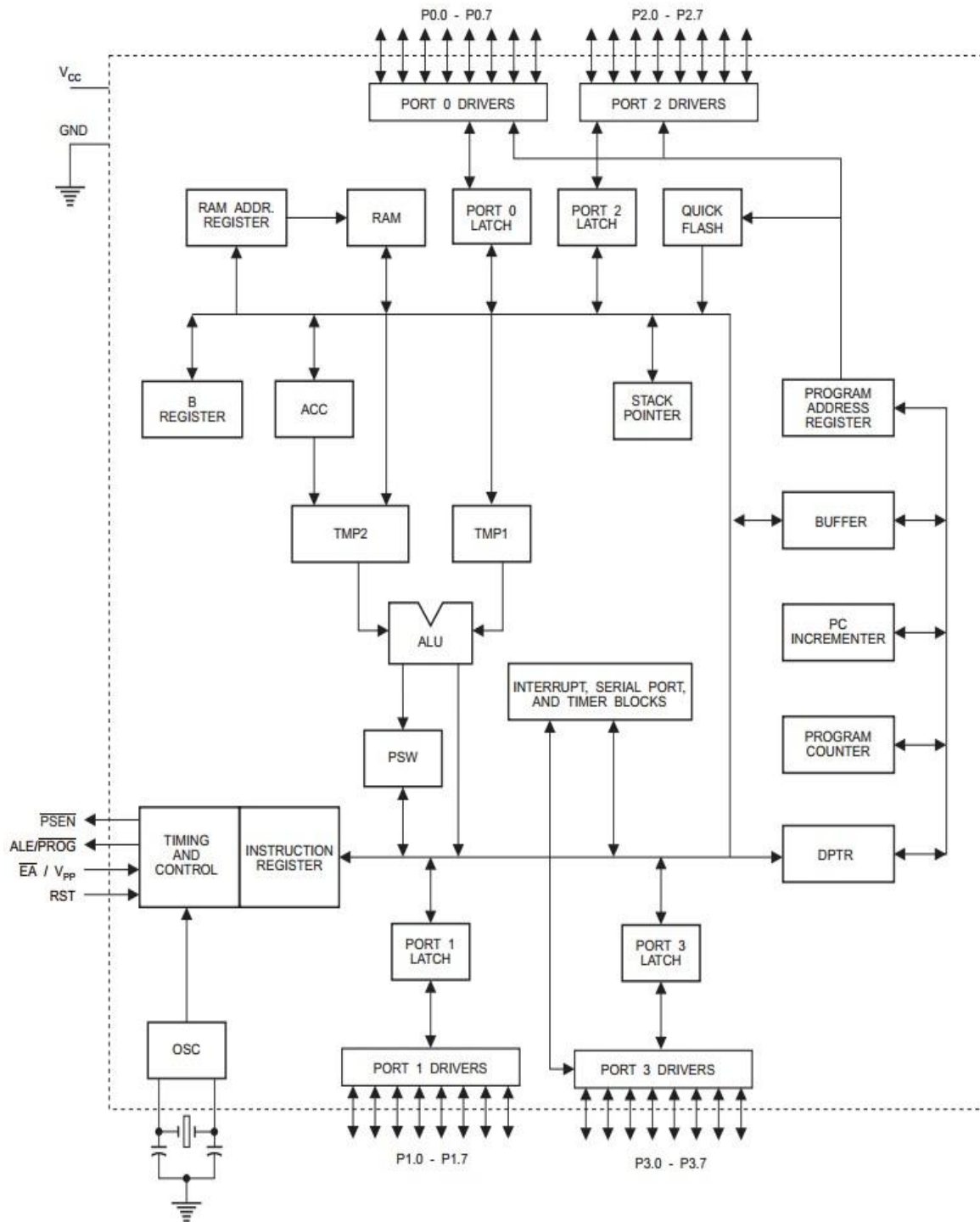
LM386 Block Diagram

DS006976-1
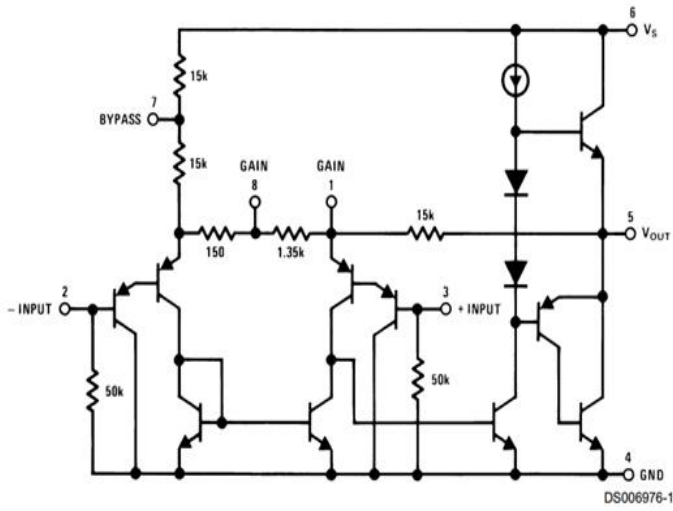
**Small Outline,
Molded Mini Small Outline,
and Dual-In-Line Packages**

GAIN — 1		8 — GAIN
−INPUT — 2		7 — BYPASS
+INPUT — 3		6 — V_S
GND — 4		5 — V_{OUT}

DS006976-2
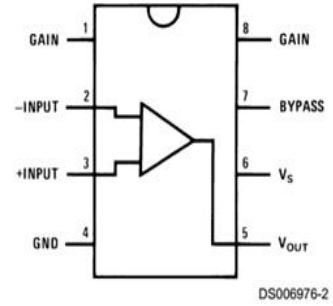
**Top View
Order Number LM386M-1,
LM386MM-1, LM386N-1,
LM386N-3 or LM386N-4
See NS Package Number**