A Project Report On

ELECTROMAGNETIC SPACE SHUTTLE LAUNCHER

Submitted in fulfillment of the requirement For BE (EE)

SUBMITTED BY:

AZIM SHAIKH 17DEE71

MUSAB CHAGAN 17DEE42

AFSAL SHAIKH 17DEE62

ROHIT SINGH 17DEE72

GUIDED BY : Prof RIZWAN FARADE

A.I. KALSEKAR TECHNICAL CAMPUS, NEW PANVEL

MUMBAI UNIVERSITY

2020 -2021

Certificate

ANJUMAN-I-ISLAM'S

KALSEKAR TECHNICAL CAMPUS

NEW PANVEL.

This is to certify that students have satisfactorily completed project work titled "***Electromagnetic Space Shuttle Launcher***". Along with their batch mates in partial fulfillment for the final year project in Electrical Engineering. Under Mumbai university during academic year 2020-2021.

SR NO	NAME	ROLL NO
1	Azim sheikh	17DEE71
2	Musab Chagan	17DEE42
3	Afsal sheikh	17DEE62
4	Rohit singh	17DEE72

Project Guide Head Of Dept. Principal

External Examiner

Date:

Place: Mumbai

Acknowledgement

It is indeed a matter of great pleasure and proud privilege to be able to present this project on "***Electromagnetic Space Shuttle Launcher"***

The completion of the project work is a millstone in student life and its execution is inevitable in the hands of guide. We are highly indebted the project guide P***rof . RIZWAN FARADE*** for his invaluable guidance and appreciation for giving form and substance to this report. It is due to his enduring efforts; patience and enthusiasm, which has given a sense of direction and purposefulness to this project and ultimately made it a success.

We would like to tender our sincere thanks the staff members for their co-operation.

We would also like to express our deep regards and gratitude to the HOD: **RIZWAN FARADE**

PREFACE

We take an opportunity to present this project report on **"Electromagnetic Space Shuttle Launcher "** and put before readers some useful information regarding our project.

We have made sincere attempts and taken every care to present this matter in precise and compact form, the language being as simple as possible.

We are sure that the information contained in this volume would certainly prove useful for better insight in the scope and dimension of this project in its true perspective.

The task of completion of the project though being difficulty was made quite simple, interesting and successful due to deep involvement and complete dedication of our group members.

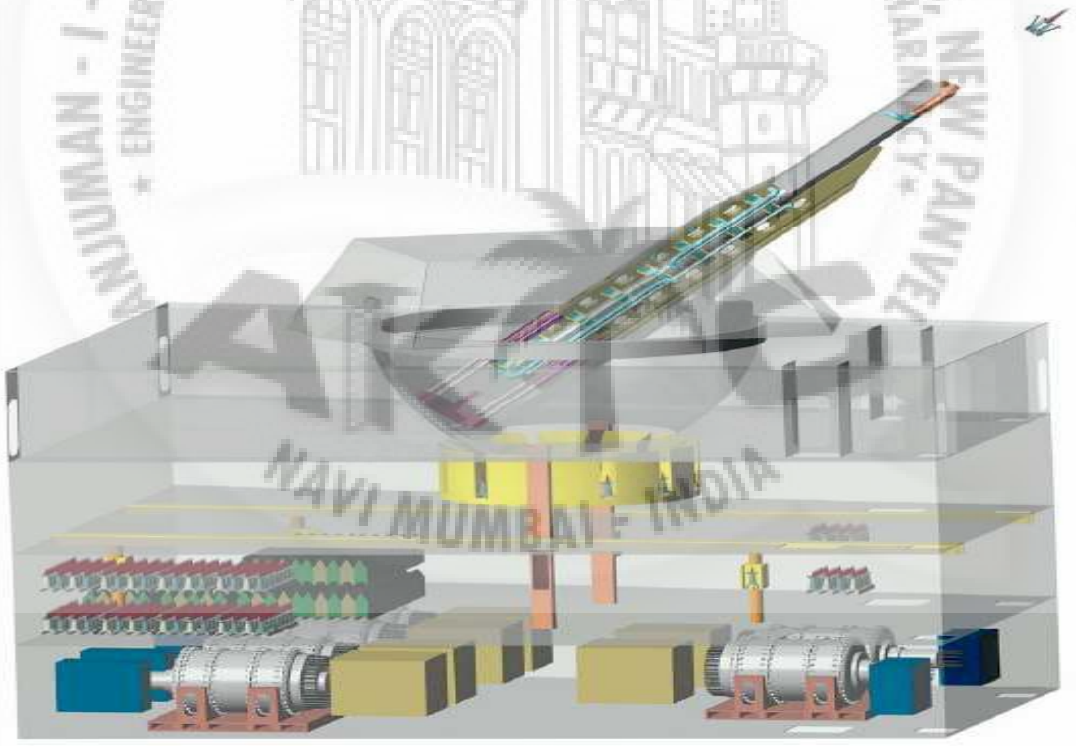
INDEX

INTRODUCTION

In this project we are developing the Electromagnetic antinuclear launcher for missile launching and space shuttle launching, this works on principle of magnetizing and demagnetizing of coil. There is a wide length tube and the objectto be fired is placed in tube. Over the tube, coils are wounded. when the supply is given, first coil get energized it try to attract a object and suddenly object get attracted towards it. After attraction the first coil De-energized and suddenly second coil is energized, Then the object get attracted towards that coil.

This procedure of energizing and de-energizing is continued tin the object get not reached to last coil, In between this running process the object will get a large force and energy, that the object is fired from the tube with the sound speed and to the decided direction. The speed of the object can be control by varying supply voltage by voltage regulator. It is a projectile launcher conceived in 1983 at the Universify of washingtonthatuses chemical enerBY to accelerate projectiles to hypermic speeds (Hertzberget al. 1988). Although it resembles a

conventional bng-barreled mnr+on, the principle of operation of the ram accelerator is notably different, being related to that of a supersonic air breathing ramjet engine. This device consists of a stationary tube, analogous to the cylindrical outer cowting of a ramjet engine lied with combustible gaseous mixtures (typical*y methane or hydrogen, oxygen,and diluents such as nitrogen, helium, of excess hydrogen) at fill Pressures ranging from 5 to 200 atm. FranBible diaphragms dose off each end of the tube.

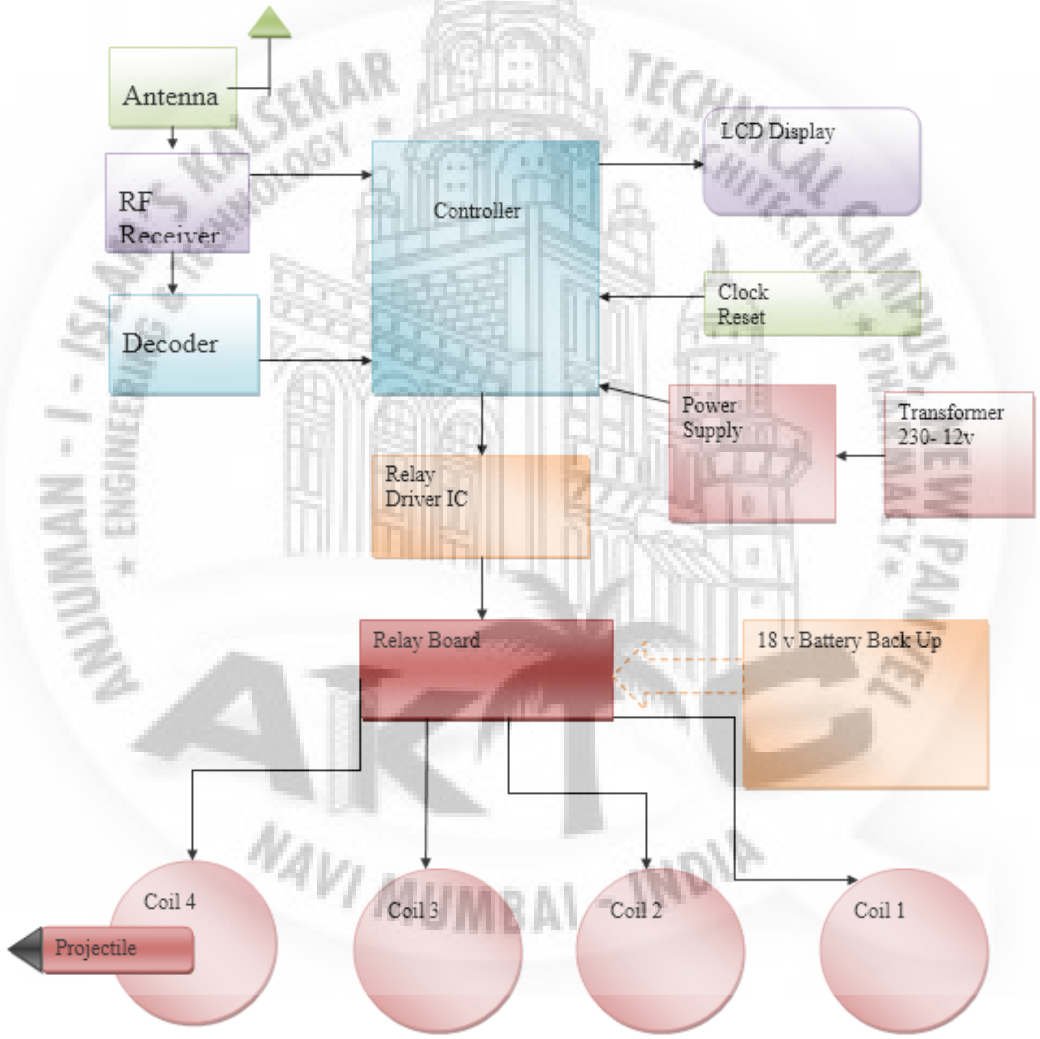


To contain the propeltant. The projectile is similar in shape to the center body of a ramjet and has a diameter smaller than the bore of the accelerator tube.

ls it possible to launch space shuttle economically and everyday or rather every hour into the space? One solution is the electromagnetic rail gun, or rail gun for short. Using a magnetic field powered by electricity, a rail gun can accelerate a projectile up to 52, 493 feet (16, 000 meters) per second. And while current Navy guns have a maximum range of 12 miles, rail guns can hit a target 250 miles away in six minutes.

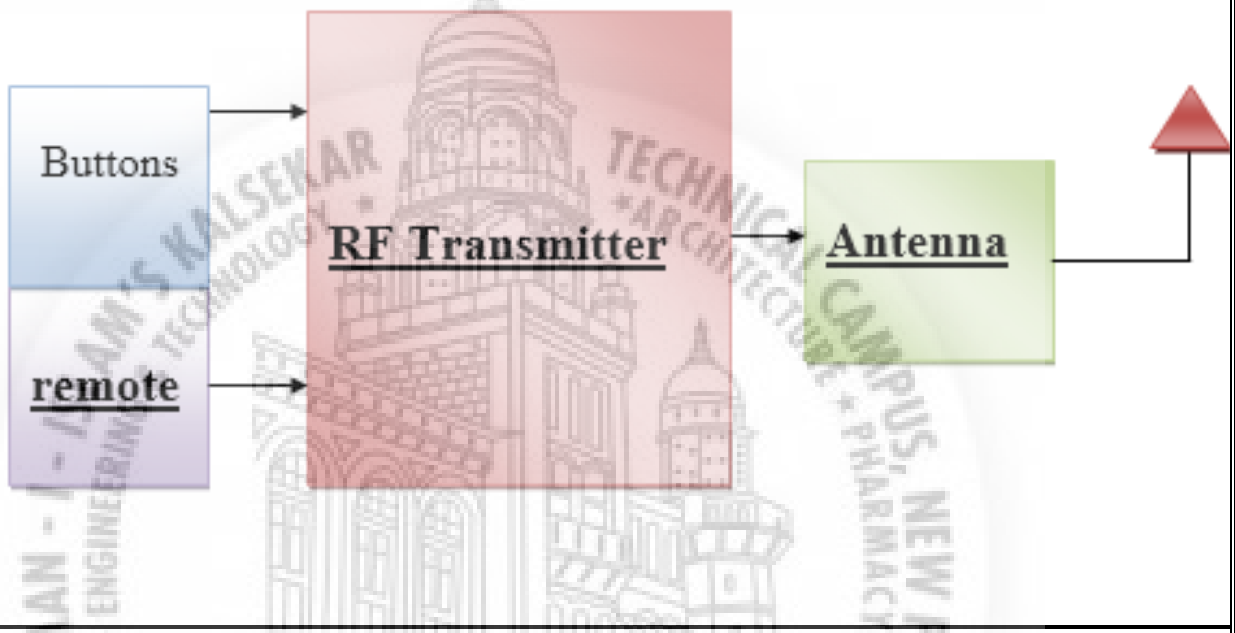
The (induction) coilgun is a type of electromagneticmass launcher that uses the Lorentz force to accelerate aprojectile. A coilgun consists of a stack of outer coilsforming the "barrer (stator) that generates a magneticfield which pushes a second, coaxial, single coil axiallyalong a guide-way. The moving coil is referred to as the armature. A typical induction coilgun has a shortedarmature in which current is induced by the changingmagnetic flux from the outer coils. The induced armaturecurrent interacts with the magnetic field from the outercoils and

produces a J × B force propelling the armaturealong the guide-way. Each coil is driven by its own capacitor bank. Energy isstored up in capacitors and then discharged through thecoil at the appropriate time.

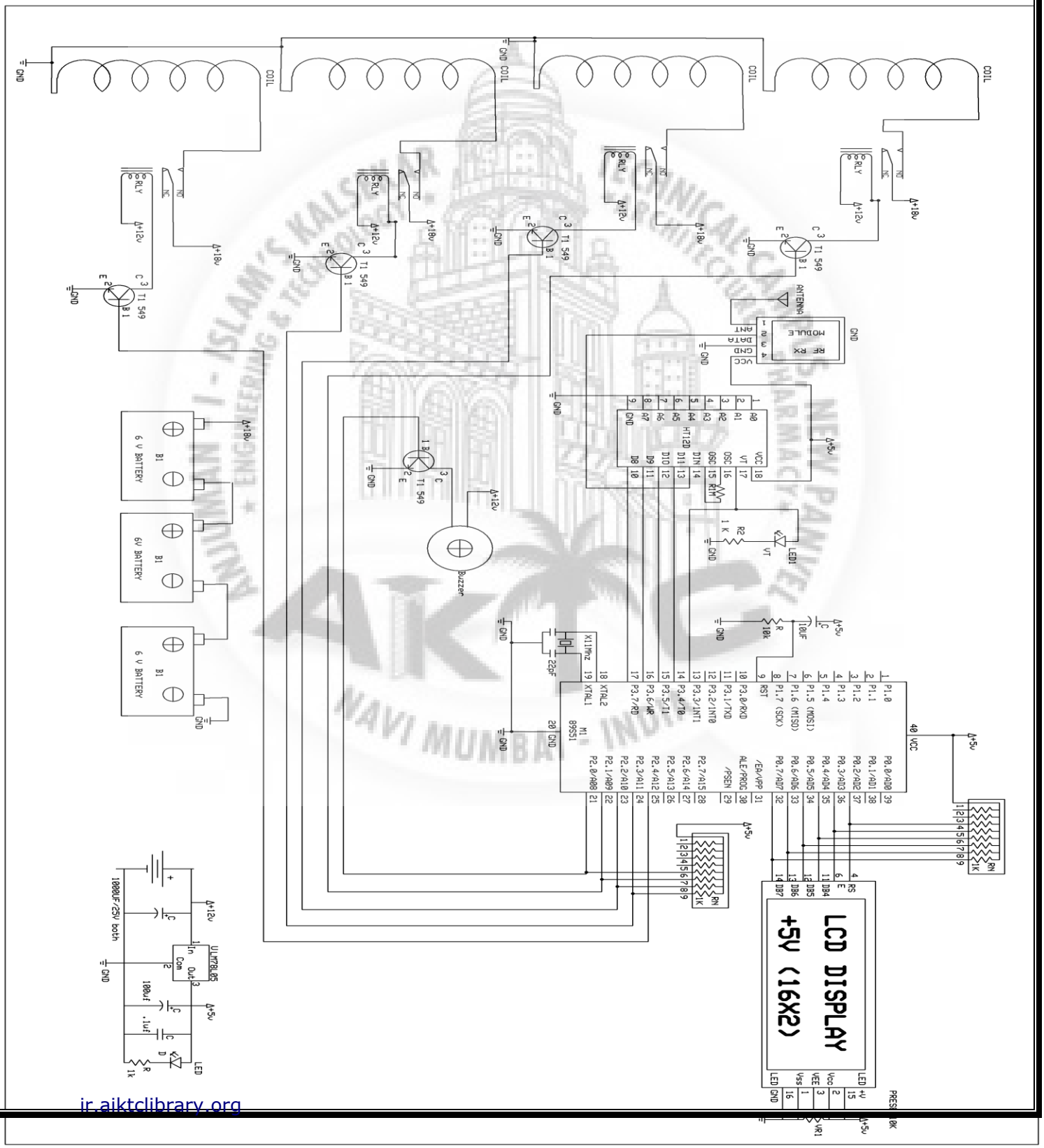


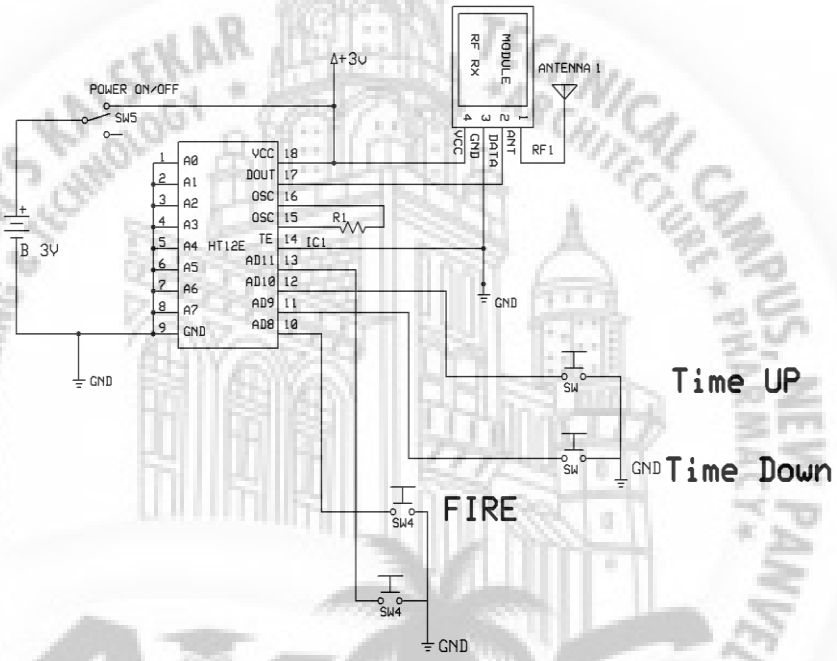
BLOCK DIAGRAM

Transmitter Section



CIRCUIT DIAGRAM




+3V
POWER ON/OFF
SW5
B 3V
GND
A0
A1
A2
A3
A4
A5
A6
A7
GND
HT12E
VCC
DOUT
OSC
OSC
TE
AD11
AD10
AD9
AD8
R1
IC1
RF RX
MODULE
ANTENNA 1
VCC
GND
DATA
ANT
RF1
GND
SW
Time UP
SW
GND
Time Down
SW4
FIRE
SW4
GND

WORKING

In this project we are developing the antinuclear launcher for missile launcher and space shuttle launcher, this works on same principle of nagnetizing and demagnetizing of coil. There is a wide length tube and the object to be placed in tube. Over the tube, coils are wounded. when the first coil get energized it try to attract a object and suddenly object get attracted towards it.

After attraction the first coil de-energized and suddenly second coil is energized, then the object get attracted towards that coil, this procedure of energizing and de-energizing is continued till the object get not reached to last coil, In between this running procces the object will get a large force and energy, that the object is fired from the tube with high speed and to the decided direction. The speed of the object can be control by varying supply voltage by voltage regulator. A typical coilgun, as the name implies, consists of a coil of wire, an electromagnet, with a ferromagnetic projectile placed at one of its ends.

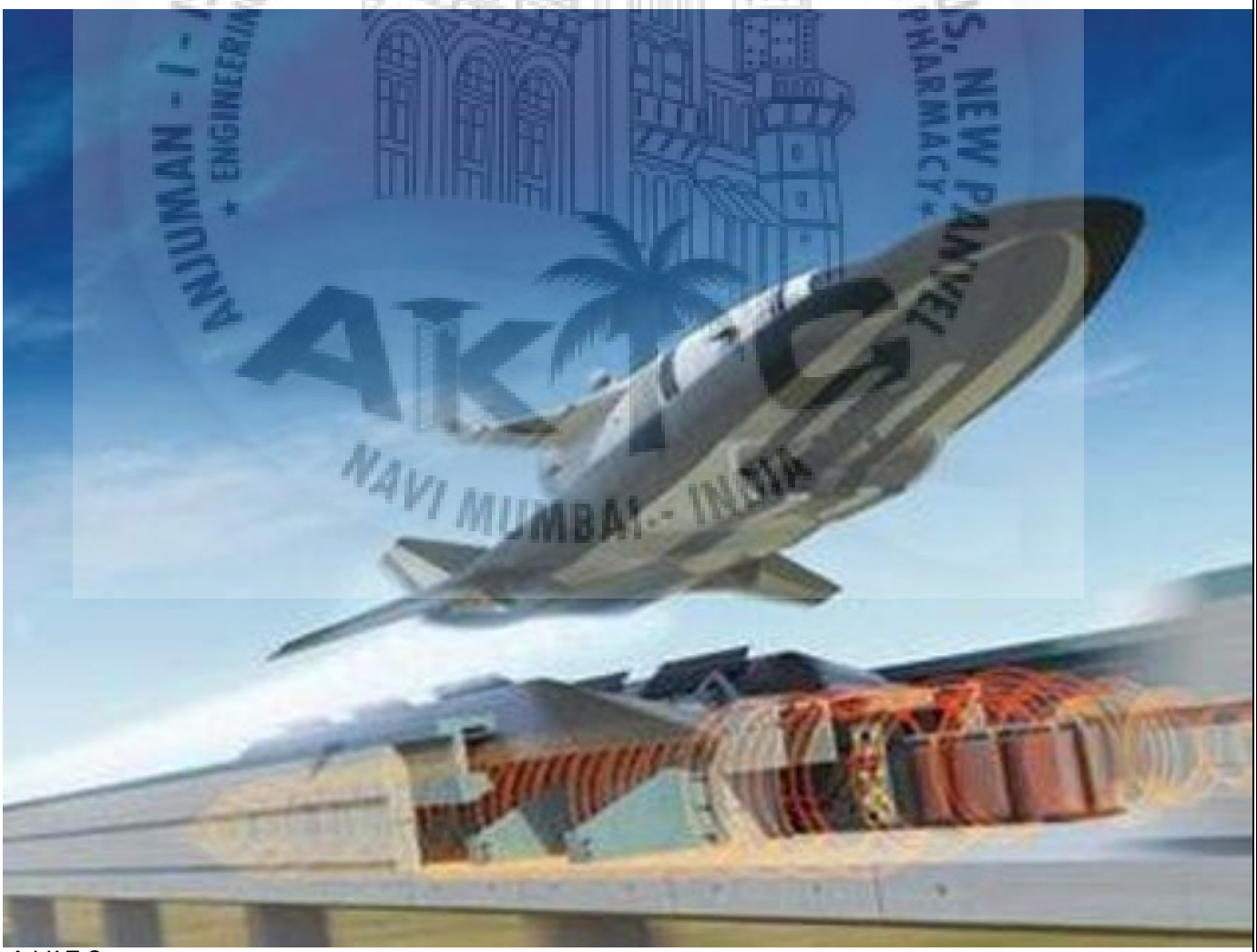
Effectively a coilgun is a solenoid, a current-carrying coil which will draw a ferromagnetic object through its center. A large current is pulsed through the coil of wire and a strong magnetic field forms, pulling the projectile to the center of the coil.

When the projectile nears this point the electromagnet is switched off and the next electromagnet can be switched on, progressively accelerating the projectile down successive stages. In common coilgun designs the"barrel"of the gun is made up of a track that the projectile rides on, with the driver Into the magnetic coils around the track.

Power is supplied to the electromagnet from some sort of fast discharge storage device, typically a battery or high-capacity high voltage capacitors designed for fast energy discharge. A diode is used to protect polarity sensitive components (suchas semiconductors or electrolytic capacitors) from damage due to inverse polarity of the voltage after turning off the coil.

There are two main types or setups of a coilgun : single-stage and multistage. A single-stage coilgun uses one electromagnet to propel a projectile. A multistage coilgun uses several electromagnets in succession to progressively increase the speed of the projectile.

Typical single stage coilgun :



Many hobbyists use low-cost rudimentary designs to experiment with coilguns, for example using photoflash capacitors from a disposable camera, or a capacitor from a standard cathode-ray tube television as the energy source, and a low inductance coil to propel the projectile forward. [2][3] Some designs have non-ferromagnetic projectiles, of such as aluminum or copper, with the armature of the projectile acting as an electromagnet with internal current induced by pulses of the acceleration coils.

A superconducting coilgun called a quench gun could be created by successively quenching a line of adjacent coaxial superconducting coils formins a Bun barrel, generatinB a wave of magnetic field gradient traveling at any desired speed. A traveling superconducting coil might be made to ride this wave like a surfboard. The device would be a mass driver or linear synchronous motor with the propulsion energy stored directly in the drive coils.

Another method would have non-superconducting acceleration coils and propulsion energy storecl outside of them but a projectile with superconducting magnets. Though the cost of power switching and other factors can limit projectile energy, a notable benefit of some coilgun designs over simpler railgunsis avoiding an intrinsic velocity limit from hypervelocity physical contact and erosion. By having the projectile pulled towards or levitated within the center of the coils as it is accelerated, no physical friction with the walls of the bore occurs. If the bore is a total vacuum (such as a tube with a plasma window) there is no friction at all which helps prolonged reusability.

Switching

One main obstacle in coilgun design is switching the power through the coils. There are several common solutions-the simplest (and probably least effective) is the spark gap, which releases the stored energy through the coil when the voltage reaches a certain threshold. A better option is to use solid-state switches these include IGBTs or power MOSFETs (which can be switched off mid-pulse) and scRs (which release all stored energy before turning off).

A quick-and-dirty method for switching, especially for those using a flash camera for the main components, is to use the flash tube itself as a switch. By wiring it in series with the coil, it can silently and non-destructively (assuming that the energy in the capacitor is kept below the tube's safe operating limits) allow a large amount of current to pass through to the coil. Like any flash tube, ionizing the gas in the tube with a high voltage triggers it.

However, a large amount of the energy will be dissipated as heat and light, and, due to the tube being a spark gap, the tube will stop conducting once the voltage across it drops sufficiently, leaving some charge remaining on the capacitor.

A Multistage coilgun

The electrical resistance of the coils and the equivalent series resistance (ESR) of the current source are among other limits to the efficiency of a coilgun. [editlThe magnetic circuit Ideally, 10o% of the magnetic flux generated by the coil would be delivered to a nd act on the projectile, but this is often far from the case due to the common air-core solenoid construction of most coilguns, which are usually relatively simple and inefficient designs made by hobbyists.

With a simple air-cored solenoid, the majority of the magnetic flux is not coupled into the projectile because of the magnetic circuit's high reluctance. The uncoupled flux generates a magnetic field that stores energy in the surrounding air. The energy that is stored in this field does not simply disappear from the magnetic circuit once the capacitor finishes discharging, instead returning to the coilgun's electric circuit. Because the coilgun's electric circuit is inherently analogous to an LC oscillator, the unused energy returns in the reverse direction ('ringing'), which can seriously damage polarized capacitors such aselectrolytic capacitors.

Reverse charging can be prevented by a diode connected in reverse-parallel across the capacitor terminals ; as a result, this diode and the coil dissipate all of the unused energy as heat. While this is a simple and frequently utilized solution, it requires additional expensive high-power semiconductors and a well-designed coil with enough thermal mass and heat dissipation capability in order to prevent component failure. Some designs attempt to re cover the energy stored in the magnetic field by using a pair of diodes. These diodes, instead of being forced to dissipate the remaining energy, recharge the capacitors with the right polarity for the next discharge cycle.

This will also avoid the need to fully recharge the capacitors, thus significantly reducing charge times. However, the practicality of tinis solution is limited by the resulting high recharge current through the equivalent series resistance (ESR) of the capacitors ; the ESR will dissipate some of the recharge current, generating heat within the capacitors and potentially shortening their lifetime.

To reduce component size, weight, durability requirements, and most importantly, cost, the magnetic circuit to deliver more energy to the projectile for a given energy input. This has been addressed to some extent by the use of back iron and end iron, which are pieces of magnetic material that enclose the coil and create paths of lower reluctance in order to improve the amount of magnetic flux coupled into the projectile.

Results can vary widely,depending on the materials used ; hobbyist designs may use, for example, materials ranging anywhere from magnetic steel (more effective, lower reluctance) to video tape (little improvement in reluctance). Moreover, the additional pieces of magnetic material in the magnetic circuit can potentially exacerbate the possibility of flux saturation and other magnetic losses.

SOFTWARE DEVELOPMENT

The following tasks are to be executed :-

Requirement Analysis Phase 1

Requirement Analysis Phase 2

Design of System

Coding Phase 1

Coding Phase 2

Testing Phase 1

Requirement analysis 1 : This will include the research of existing software and a discussion with the Project guide.

Requirement Analysis Phase 2 : Based on the above results, the project team will discuss and finalize the requirements that are to be provided. We shall consult a number of experts during this phase. The SPMP shall also be prepared during this phase.

Design Phase : The design phase will involve the design of the static view, dynamic view, and the functional view of the software. A number of diagrams including the Use case, class diagram, activity diagram, and data flow diagrams will be used to model the software. Also, the GUls will be designed during this phase

Coding Phase 1 : The prerequisite to this phase is the study of Microsoft Visual basic6. After this study, an initial code of the entire project will be written. Also, the database will be created during this phase. Finally, we shall conduct unit tests.

Coding Phase 2 : This phase will include a review of the code created in Phase 1. After the review, the necessary code and database will be modified to include the results of review.

Testing Phase : We shall be following a testing program that will involve unit testing, integration testing, and validation testing. More information will be known after further discussion.

MICROCONTROLLER

AT89S51

An embedded microcontroller is a chip which has a computer processor with all its support functions (clock & reset), memory (both program and data), and I/O (including bus interface) built into the device. These built in functions minimize the need for external circuits and devices to be designed in the final application.

- **Embedded Microcontroller**

When all the hardware required to run the application is provided on the chip, it is refer to as an Embedded Microcontroller. All that is typically required to operate the device is power, reset, and a clock. Digital I/O pins are provided to allow interfacing with external devices.

- **External Memory Microcontroller**

Sometimes, the program memory is insufficient for an application or, during debug; a separate ROM (or even RAM) would make the work easier. Some microcontrollers including the 8051 allow the connection of external memory.

An external memory microcontroller seems to primarily differ from a microprocessor in the areas of built-in-peripheral features. These features could include memory device selection (avoiding the need for external address decoders or DRAM address multiplexers), timers, interrupt controllers, DMA, and I/O devices like serial ports.

The AT89C51 is a low-power, high-performance CMOS 8-bit microcomputer with 4K bytes of Flash programmable and erasable read only memory (PEROM). The device is manufactured using Phillips's high-density nonvolatile memory technology and is compatible with the industry-standard MCS-51 instruction set and pin out. 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 Phillips AT89C51 is a powerful microcomputer which provides a highly-flexible and cost-effective solution to many embedded control applications.

The AT89C51 is designed with static logic for operation down to zero frequency and supports two Software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port and interrupt system to continue functioning. The Power-down Mode saves the RAM contents but freezes the oscillator disabling all other chip functions until the next Hardware reset.

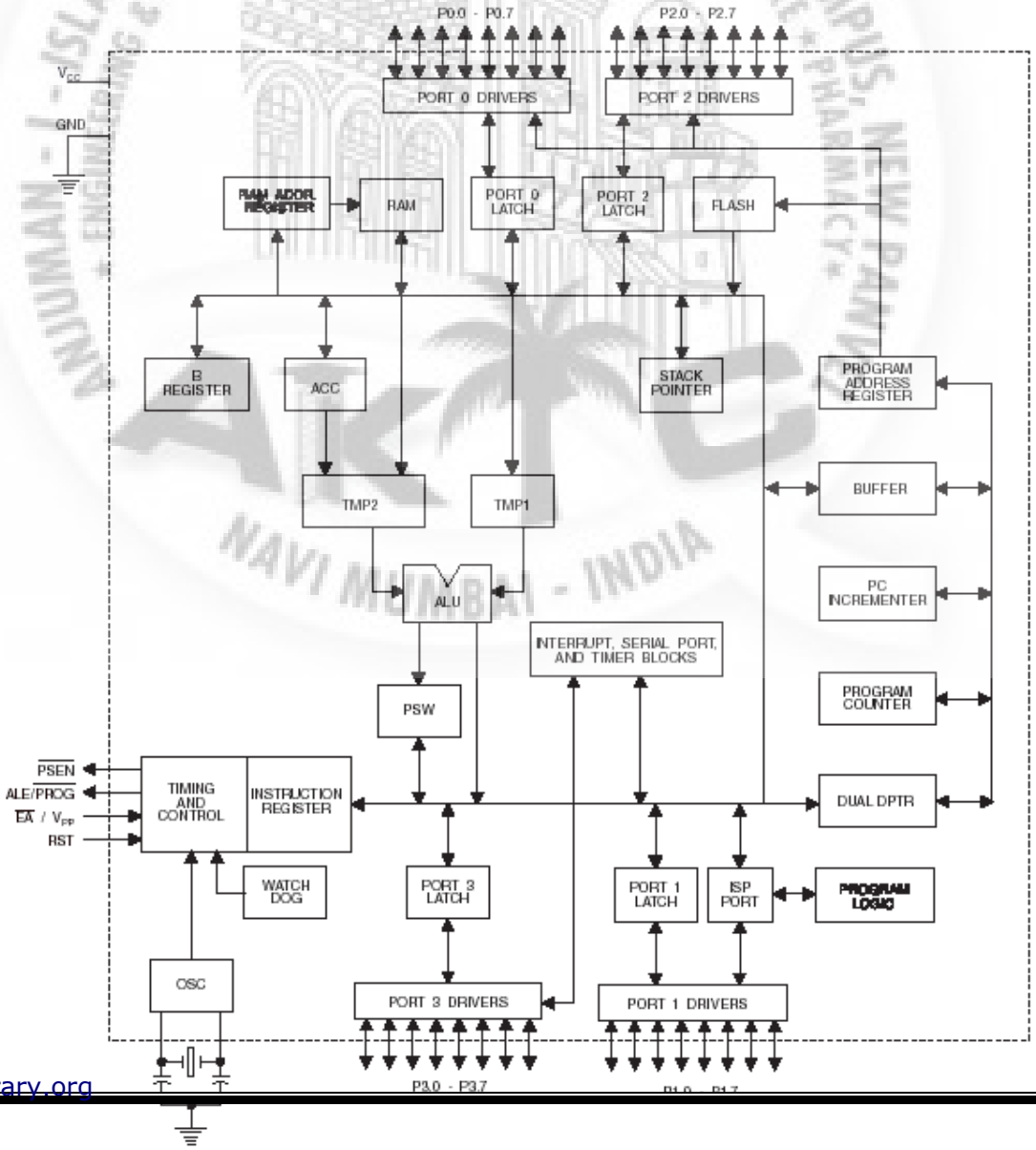
Features

- Compatible with MCS®-51 Products
- 4K Bytes of In-System Programmable (ISP) Flash Memory – Endurance: 10,000 Write/Erase Cycles
- 4.0V to 5.5V Operating Range
- Fully Static Operation: 0 Hz to 33 MHz
- Three-level Program Memory Lock
- 128 x 8-bit Internal RAM
- 32 Programmable I/O Lines
- Two 16-bit Timer/Counters
- Six Interrupt Sources
- Full Duplex UART Serial Channel
- Low-power Idle and Power-down Modes

- Interrupt Recovery from Power-down Mode
- Watchdog Timer
- Dual Data Pointer
- Power-off Flag
- Fast Programming Time
- Flexible ISP Programming (Byte and Page Mode)
- Green (Pb/Halide-free) Packaging Option

BLOCK DIAGRAM

3. Block Diagram



A.

Pin Description

4.1 VCC

Supply voltage.

4.2 GND

Ground.

4.3 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 can 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.

4.4 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 Pin	Alternate Functions
P1.5	MOSI (used for In-System Programming)
P1.6	MISO (used for In-System Programming)
P1.7	SCK (used for In-System Programming)

4.5 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 use 16-bit addresses (MOVX @ DPTR). In this application, Port 2 uses strong internal pull-ups when emitting 1s. During accesses to external data memory that use 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.

4.6 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 inter-

Port Pin Alternate Functions

P1.5 MOSI (used for In-System Programming)

P1.6 MISO (used for In-System Programming)

P1.7 SCK (used for In-System Programming)

nal 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 receives some control signals for Flash programming and verification.

Port 3 also serves the functions of various special features of the AT89S51, as shown in the following

table.

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)

4.7 RST

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

the device. This pin drives High for 98 oscillator periods after the Watchdog times out. The DISRTO bit in SFR AUXR (address 8EH) can

be used to disable this feature. In the default state of bit DISRTO, the RESET HIGH out feature is enabled.

4.8 ALE/PROG

Address Latch Enable (ALE) is an 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.

4.9 PSEN

Program Store Enable (PSEN) is the read strobe to external program memory. When the AT89S51 is executing code from external program memory, PSEN is activated twiceeach machine cycle, except that two PSEN activations are skipped during each access to external data memory.

4.10 EA/VPP

External Access Enable. EA must be strapped to GND in order to enable the device to fetchcode 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.

4.11 XTAL1

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

4.12 XTAL2

Output from the inverting oscillator amplifier

11. Oscillator Characteristics

XTAL1 and XTAL2 are the input and output, respectively, of an inverting amplifier that can beconfigured for use as an on-chip oscillator, as shown in Figure 11-1. Either a quartz crystal orceramic resonator may be used. To drive the device from an external clock source, XTAL2should be left unconnected while XTAL1 is driven.

The circuit is divided into two parts

1. Transmitter

2. Receiver

For transmitter section, the different commands signals are transmitted via RF transmitter module of 433 MHz. it has 4 pins of antenna, Vcc, Gnd, & serial data input.

Antenna ,+5v &Gnd are connected to respective places and serial data input is generated from encoder IC HT12E. This encoder IC's function is to convert parallel data into serial data address lines of encoder are grounded because they are not used.

Data lines are fed with command signals since four lines are available 16 different commands can be generated. The output modulating frequency is decided by resistor connected at OSC pin of the encoder. Currently because of 1.2Mohms resistor, It is 30 KHz. The output of encoder is fed to RF transmitter module is currently Roughly 100 sq. Ft.

On receiver side the data is received by RF receiver module of 433 MHz . This demodulated signal is fed to decoder for further decoding. If address send from encoder IC GND matches with decoder address then valid tone (VT) signal on decoder goes high , which indicates receives signal. The decoded by decoder is fed to uC for further control of relay. uCrequiers mainly three things for operation.

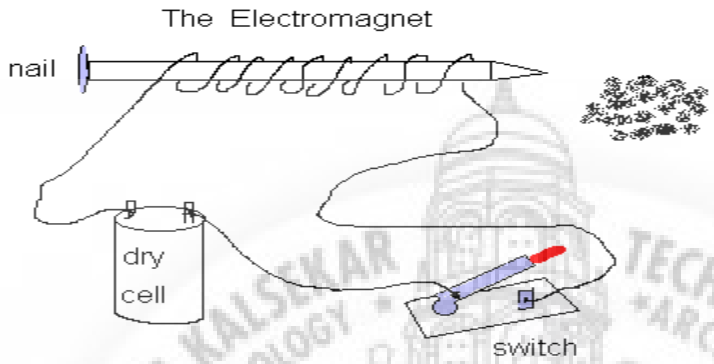
Which are power supply clock & reset. Power supply provided to uC is +5v & GND on pin40 &pin20 respectively. On osc pin18 &19,a crystal oscillator is connected which generates clock for program execution for reset on pin9 & 10k resistor &10k capacitor is connect which reset controller on power up.

Controller receives data from decoder & after decoding of commands it gives proper command to relay driver IC ULN2803, which amplifies signal coming from controller & controls as per controller instruction.

Relay used of 12v, 400ohms SPDT type. For making motor on/off single relay is required for changing direction of motor two relays are required .direction of motor can be changed by changing the direction of supply of motor.

RELAYS

The basis for relays, is the simple electromagnet

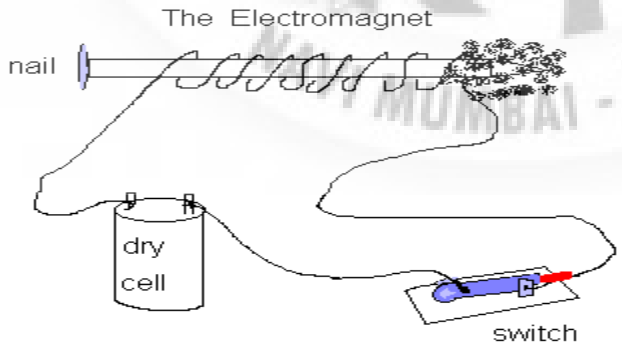


A nail, some wire, and a battery is all that is needed to make one,

to demonstrate and amaze your small children..add a switch, and presto! You're the talk of the town.

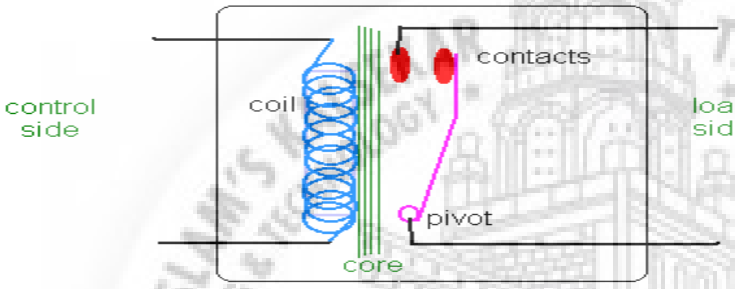
With no power applied to the coil, the nail is NOT magnetized

Connect this to a power source, and it will now grab and hold small pieces of metal.



So, herein lies the concept. If we take an electromagnet, it will interact with metals in its vicinity. now lets take this one step further...

If we were to place a piece of metal, near the electromagnet, and connect some contacts, so that when the electromagnet is energized, the contacts close, we have a working relay.

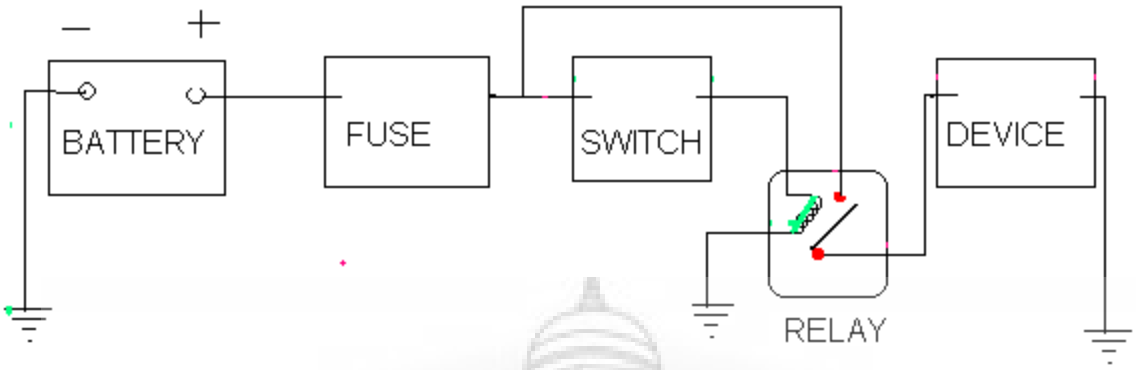


INSIDE A SPST RELAY

pic r-1a

The simplest relay, is the Single Pole, Single Throw (spst) relay. It is nothing more than an electrically controlled on-off switch.

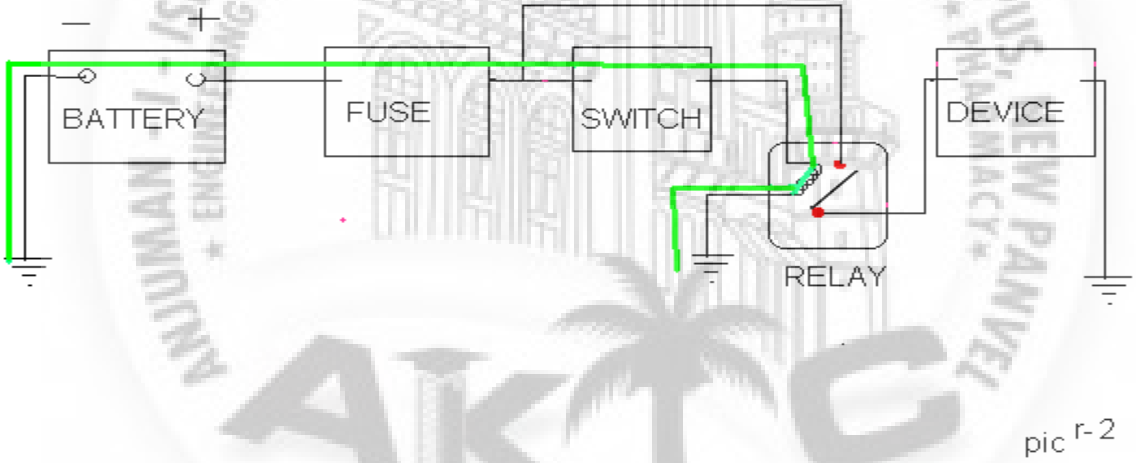
It's biggest property, is the ability to use a very small current, to control a much larger current. this is desireable because we can now use smaller diameter wires, to control the current flow through a much larger wire, and also to limit the wear and tear on the control switch.



a SIMPLE RELAY CIRCUIT

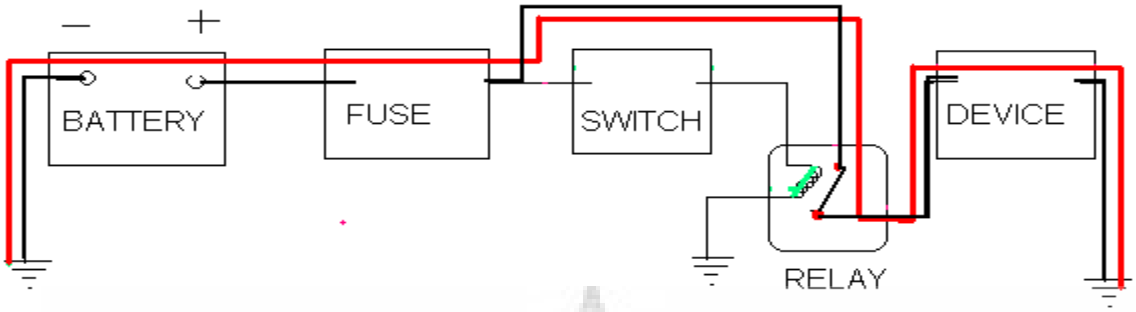
pic r-1

Above is a simple relay control. Now, here is what is happening.....



pic r-2

The control circuit (GREEN) powers the coil inside the relay, using a small amount of current. It flows from the battery, thru the fuse (for protection) to a switch, (say, a light switch) then to the coil in the relay, energizing it.



pic r-3

The coil, now energized becomes an electromagnet, and attracts the metal strip with the contacts, which closes, providing a secondary heavy current path (**RED**) to the device (say, the fog lights)

Turning off the switch, opens the circuit to the coil, removes current flow, and the electromagnet is no longer a magnet, the secondary path is opened, and the lights extinguish

Relay Driver

ULN2803

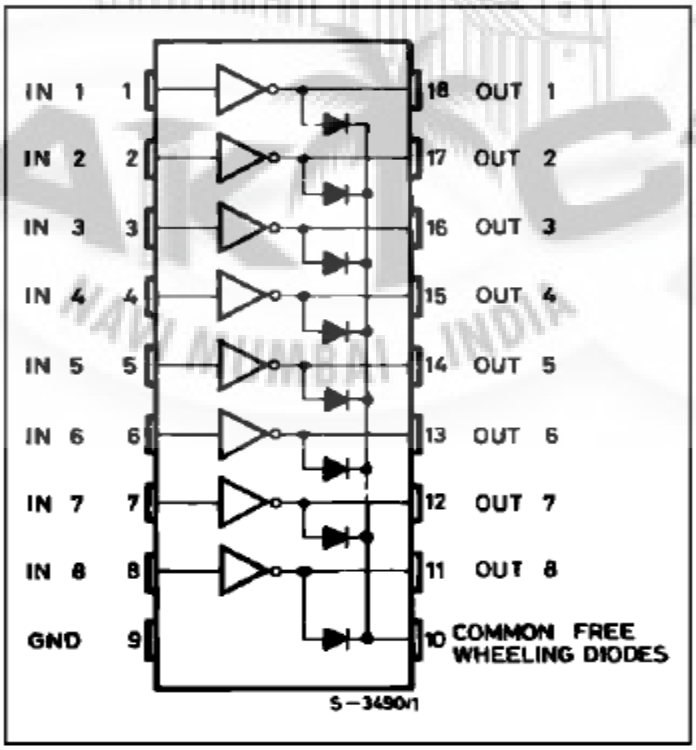
The eight NPN Darlington connected transistors in this family of arrays are ideally suited for interfacing between low logic level digital circuitry (such as TTL, CMOS or PMOS/NMOS) and the higher current/voltage requirements of lamps, relays, printer hammers or other similar loads for a broad range of computer, industrial, and consumer applications. All devices feature open–collector outputs and free wheeling clamp diodes for transient suppression.

The ULN2803 is designed to be compatible with standard TTL families while the ULN2804 is optimized for 6 to 15 volt high level CMOS or PMOS.

Features

1. Eight darling tons with common emitters;
2. Output current to 500 Ma;
3. Output voltage to 50 V;
4. Integral suppression diodes;
5. Versions for all popular logic families;
6. Output can be paralleled;
7. Inputs pinned opposite outputs to simplify board layout.

PIN CONNECTION (top view)



Description

The ULN2801A-ULN2805A each contains eight Darlington transistors with common emitters and integral suppression diodes for inductive loads. Each Darlington features a peak load current rating of 600mA (500mA continuous) and can withstand at least 50V in the off state. Outputs maybe paralleled for higher current capability.

Five versions are available to simplify interfacing to standard logic families: the ULN2801A is designed for general purpose applications with a current limit resistor; the ULN2802A has a 10.5k input resistor and zener for 14-25V PMOS; the ULN2803A has a 2.7k input resistor for 5V TTL and CMOS; the ULN2804A has a 10.5k input resistor for 6-15V CMOS and the ULN2805A is designed to sink a minimum of 350mA for standard and Schottky TTL where higher output current is required.

All types are supplied in an 18-lead plastic DIP with a copper lead from and feature the convenient input opposite-output pinout to simplify board layout.

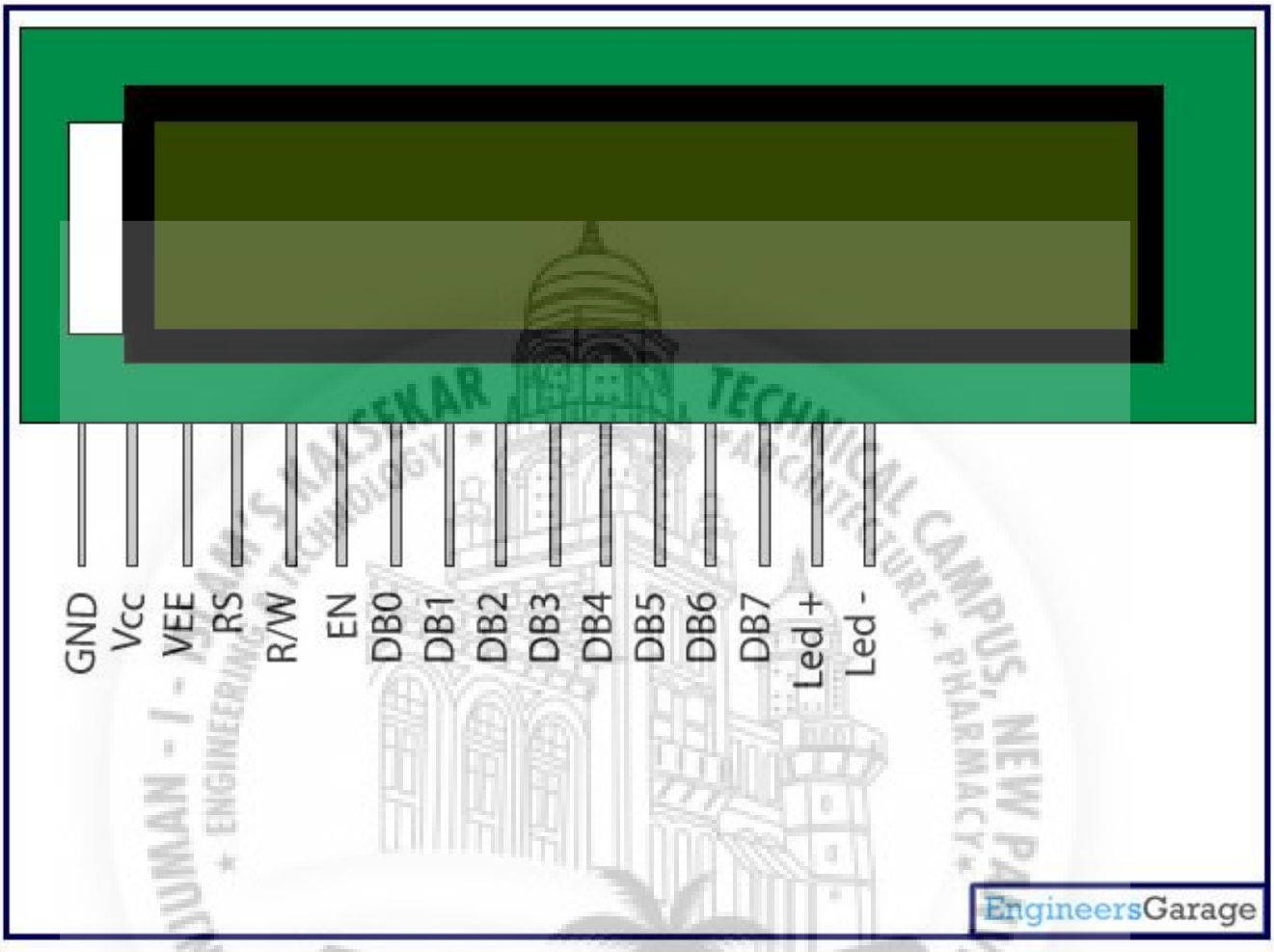
LCD

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily

programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. Click to learn more about internal structure of a LCD.


GND
Vcc
VEE
RS
R/W
EN
DB0
DB1
DB2
DB3
DB4
DB5
DB6
DB7
Led +
Led -
EngineersGarage

Pin Description:

Pin No	Function	Name
1	Ground (0V)	Ground
2	Supply voltage; 5V (4.7V – 5.3V)	Vcc
3	Contrast adjustment; through a variable resistor	V_{EE}
4	Selects command register when low; and data register when high	Register Select
5	Low to write to the register; High to read from the register	Read/write
6	Sends data to data pins when a high to low pulse is given	Enable
7	8-bit data pins	DB0
8		DB1
9		DB2
10		DB3
11		DB4
12		DB5
13		DB6
14		DB7
15	Backlight V_{CC} (5V)	Led+
16	Backlight Ground (0V)	Led-

FABRICATION OF PCB

P.C.B. MAKING

+ P.C.B. is printed circuit board which is of insulating base with layer of thin copper-foil.
+ The circuit diagram is then drawn on the P. C. B. with permanent marker and then it is dipped in the solution of ferric chloride so that unwanted copper is removed from the P.C.B., thus leaving components interconnection on the board.
+ The specification of the base material is not important to know in most of the application, but it is important to know something about copper foil which is drawn through a thin slip.
+ The resistance of copper foil will have an affect on the circuit operation.
+ Base material is made of lamination layer of suitable insulating material such as treated paper, fabric; or glass fibers and binding them with resin. Most commonly used base materials are formed paper bonded with epoxy resin.

+ It is possible to obtain a range of thickness between 0.5 mm to 3 mm.
+ Thickness is the important factor in determining mechanical strength particularly when the commonly used base material is "**Formea"** from paper assembly.
+ Physical properties should be self supportingthese are surface resistivity, heat dissipation, dielectric, constant, dielectric strength.
+ Another important factor is the ability to wishstand high temperature.

DESIGNING THE LAYOUT :

+ While designing a layout, it must be noted that size of the board should be as small as possible.
+ Before starting, all components should be placed properly so that an accurate measurement of space can be made.
+ The component should not be mounted very close to each other or far away from one another and neither one should ignore the fact that some

component reed ventilation, which considerely the dimension of the relay and transformer in view of arrangement, the bolting arrangement is also considered.

+ The layout is first drawn on paper then traced on copper plate which is finalized with the pen or permanent marker which is efficient and clean with etching.
+ The resistivity also depends on the purity of copper, which is highest for low purity of copper. The high resistance path are always undesired for soldered connections.
+ The most difficult part of making an original printed circuit is the conversion from, theretical circuit diagram into wiring layout. without introducing cross over and undesirable effect.
+ Although it is difficult operation, it provides greatent amount of satisfaction because it is carried out with more care and skill.
+ The board used for project has copper foil thickness in the range of 25 40 75 microns.
+ The soldering quality requires 99.99% efficiency.

+ It is necessary to design copper path extra large. There are two main reasons for this,

  i) The copper may be required to carry an extra large overall current:-

  ii) It acts like a kind of screen or ground plane to minimize the effect of interaction.

+ The first function is to connect the components together in their right sequence with minimum need for interlinking i.e. the jumpers with wire connections.

+ It must be noted, that when layout is done, on the next day it should be dipped in the solution and board is move continuously right and left after etching perfectly the board is cleaned with water and is drilled.

+ After that holes are drilled with 1 mm or 0.8 mm drill. Now the marker on the P. C. B. is removed.

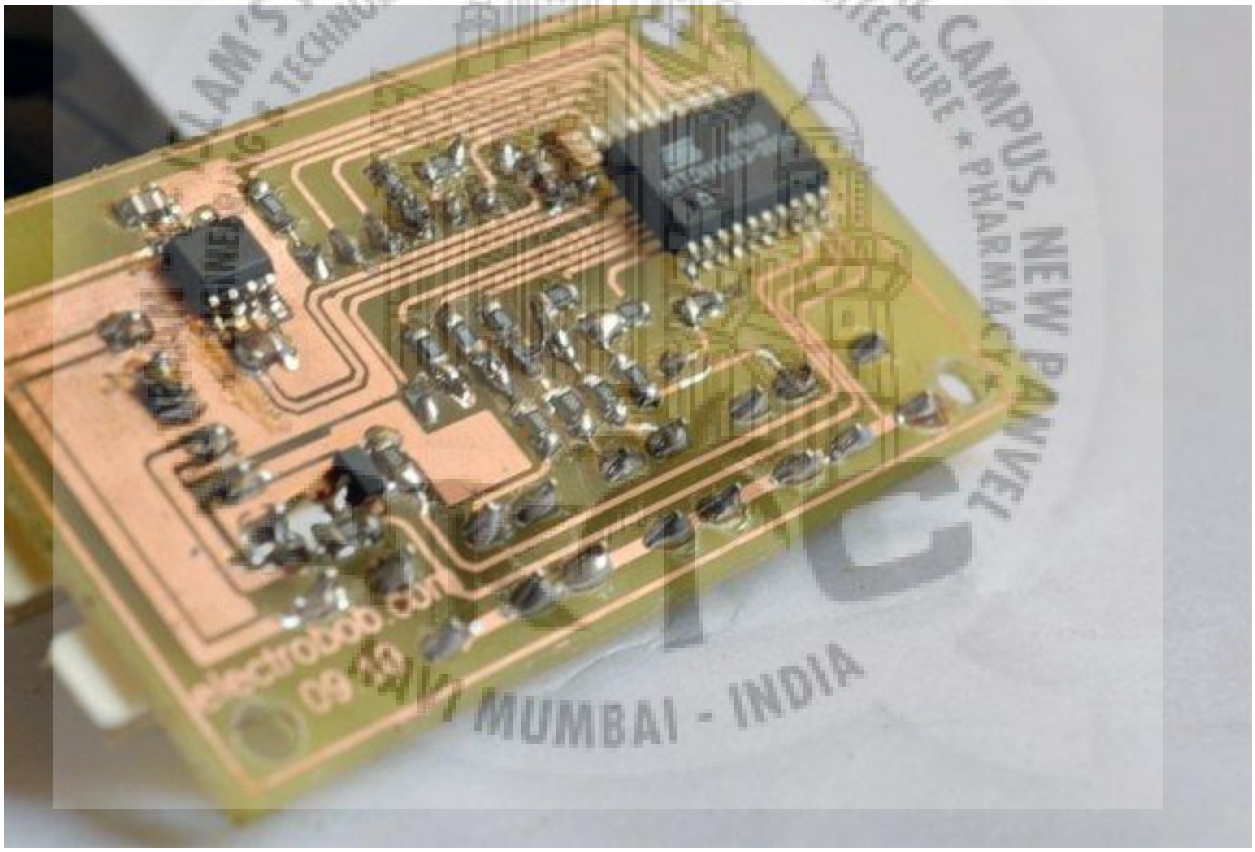
+ The Printed Circuit Board is now ready for mounting thecomponents on it.

SOLDERING :

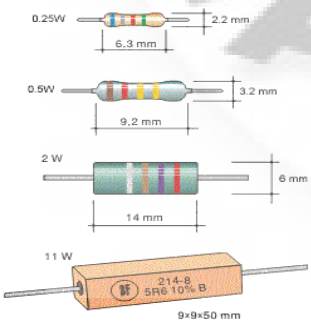
+ For soldering of any joints first the terminal to be soldered are cleaned to remove oxide film or dirt on it. If required flux is applied on the points to be soldered.
+ Now the joint to be soldered is heated with the help of soldering iron. Heat applied should be such that when solder wire is touched to joint, it must melt quickly.
+ The joint and the soldering iron is held such that molten solder should flow smoothly over the joint.
+ When joint is completely covered with molten solder, the soldering iron is removed.
+ The joint is allowed to cool, without any movement.
+ The bright shining solder indicates good soldering.
+ In case of dry solder joint, a air gap remains in between the solder matenal and the joint. It means

that soldering is improper. This is removed and again soldering is done.

+ Thus is this way all the components are soldered on P. C. B.



COMPONENTS LIST

product Image	Item Name-	Price
	**Resistor network 1k - 10K 9Pin** This is a 10K resistor array in 9Pin package. useful for pull up.	Price - Rs.5.00
	**Plastic Preset 1k to 1m**	Price - Rs.20.00
	**1R to 1M Resistor 1/4 W (10Pcs)** -	Price - Rs.10.00
	1R to 1M Resistor 0.5 to 11 W (10Pcs)	Price - Rs.50.00

1N4007

Price - Rs.2.00

1N4007 is a
1.0A general purpose rectifier diode.

3.3V to 12 v Zener Diode

Price - Rs.3.00

This is a 3.3V Zener Diode 1/2 watt rating.

7805 - 5V voltage regulator

Price - Rs.15.00

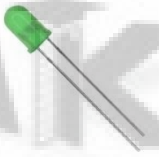
This is an positive 5V - 500mA to 1.5A regulator

LED RED - 3mm
Price - Rs.2.00

LED GREEN - 3mm
Price - Rs.2.00

LED YELLOW - 3mm
Price - Rs.2.00

LED Red 5mm
Price - Rs.2.00



LED Green 5mm
Price - Rs.2.00

LED Yellow - 5mm
Price - Rs.2.00

16x2 LCD with green Backlight
Price - Rs.240.00

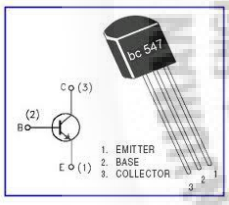
Crystal 4 to 20 MHz

Price - Rs.20.00

This is an 4 MHz quartz crystal in HC49U casing.

40 Pin IC Base

Price - Rs.20.00



BC547 Transistor .

Price - Rs.8.00

IC -HT12E & D
Price - Rs.90.00

IC- ULN2803
Price - Rs.30.00

MICROCONTROLLER

89S51

Price - Rs.85.00

RF TX-RX MODULE

433Mhz or315Mhz

Price - Rs.750.00

2 pin push to on switch

Price - Rs.8.00

3v to 24v buzzer

Price - Rs.12.00

12v SPDT Relay

Price - Rs.18.00

12v SPDT 25 amp Relay

Price - Rs.45.00

10-PIN CONNECTOR W/ HEADER

Price - Rs.18.00

Solder Wire 24 Gauge

Price - Rs.40.00

Solder iron 25w

Price - Rs.140.00

Copper wire

Gauges 1 to 36

Price - Rs.1200.00

Per kg/-

Copper clad PCB

Price - Rs.30.00

BATTERY 6V x3Price – RS 840

PROGRAM

```
Dim T As Byte
Dim C As Byte

P3 = 255

T = 21

Cursor Off
P2 = 0
```

```
Cls
Lcd " M.H.S.S.P "
Lowerline
Lcd "   "
Wait 2

Cls
Lcd "Guided By.Prof:"
Lowerline
Lcd "Mrs.M.K.Vani"
Wait 2

Do
P2 = 0
Cls
Lcd "Shuttle Launcher"
Lowerline
Lcd "Time:" ; T ; "(ms)"
```

If P3.3 = 1 And P3.4 = 0 And P3.5 = 1 And P3.6 = 1 And P3.7 = 1 Then

T = T + 1

Waitms 250

End If

If P3.3 = 1 And P3.4 = 1 And P3.5 = 0 And P3.6 = 1 And P3.7 = 1 Then

T = T - 1

Waitms 250

End If

If P3.3 = 1 And P3.4 = 1 And P3.5 = 1 And P3.6 = 0 And P3.7 = 0 Then

P2.7 = 1

Cls

Lcd " Countdown"

Lowerline

```
Lcd "Remaining Time"
Wait 2

C = 3
While C > 0

Cls
Lcd "  Countdown"
Lowerline
Lcd "Time:" ; C ; "Sec."

P2.7 = 0
Waitms 250
Waitms 250
P2.7 = 1
Waitms 250
Waitms 250
```

```
C = C - 1

Wend

If P3.3 = 1 And P3.4 = 1 And P3.5 = 1 And P3.6 = 0
And P3.7 = 0 Then
Cls
Lcd "    Fire"
Lowerline
Lcd "Shuttle Launched"
Call Fire
Wait 3
End If
End If

Waitms 100
Loop
```

Sub Fire

P2.0 = 1

Waitms T

P2.0 = 0

P2.1 = 1

Waitms T

P2.1 = 0

P2.2 = 1

Waitms T

P2.2 = 0

P2.3 = 1

Waitms T

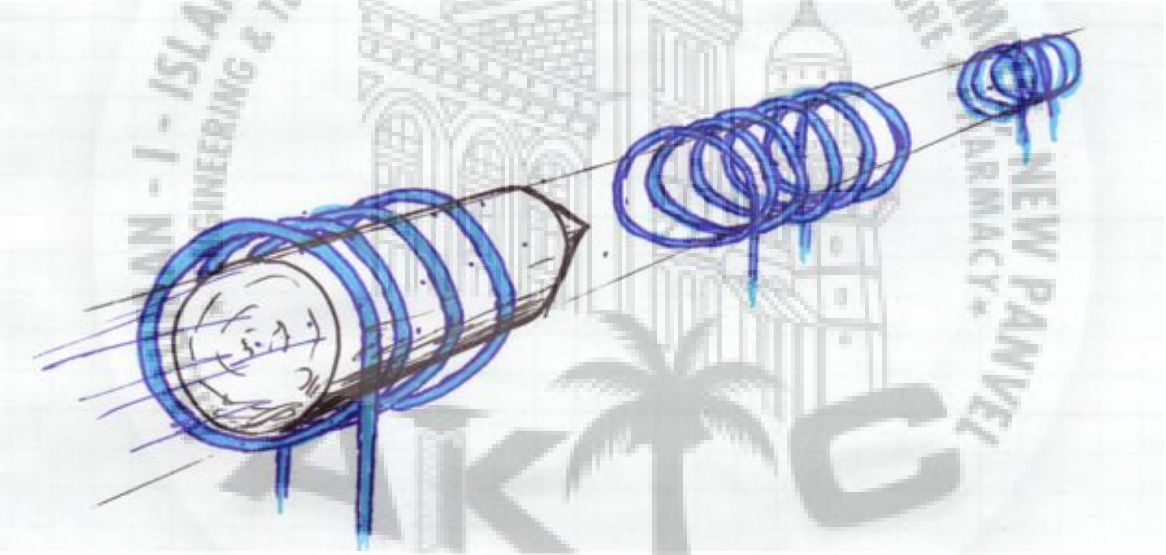
P2.3 = 0

P2 = 0

End Sub

APPLICATION (*OF TECHNOLOGY*)

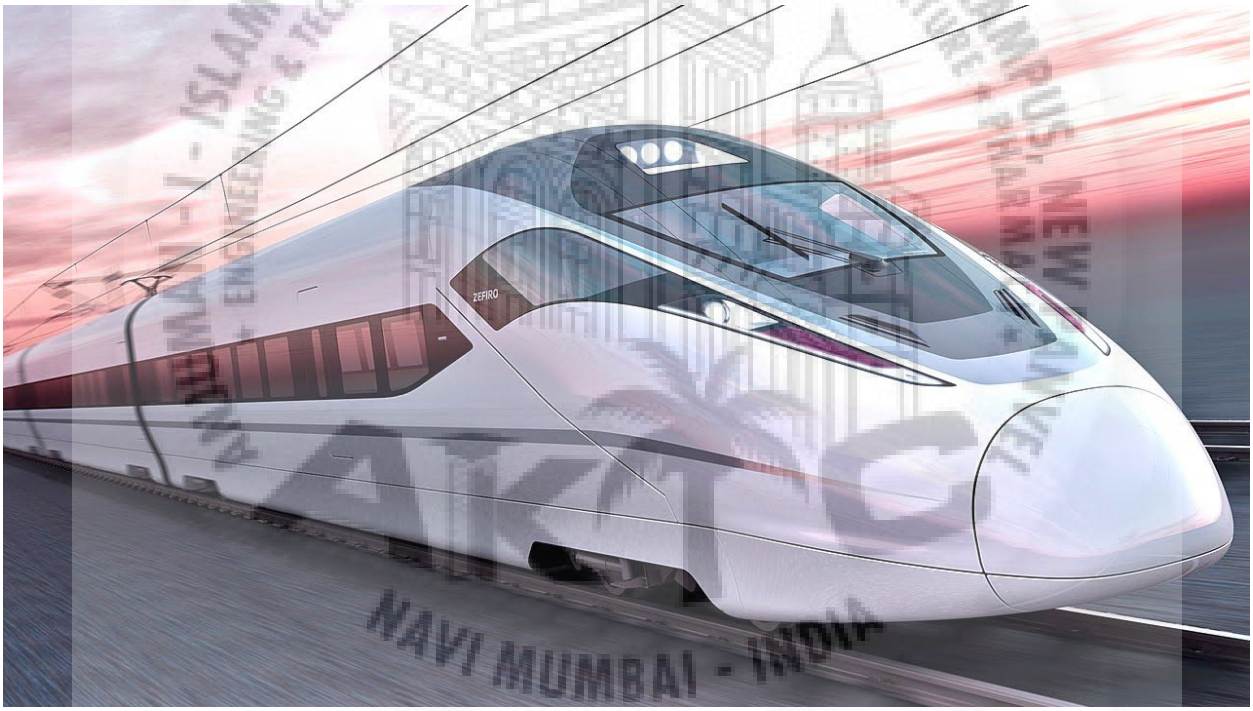
1.**Coil Gun**



A coilgun is a type of projectile accelerator that consists of one or more coils used as electromaws in the confiBuration of a synchronous linear which accelerate a magnetic projectile to high velocity. The nameGauss gun is sometimes used for sucH devices in reference to carl Friedrich Gau who formulated mathematical descriptions of the magnetic effect used by magnetic accelerators.

Coilguns consist of one or more coils arranged along a barrel. The coils are switched on and off in sequence, causing the projectile to be accelerated quickly along the barrel via magnetic forces. Coilguns are distinct frommm which pass a large current through the projectile or sabot via slidinscontacts. Coilguns and railguns also operate on different principles. The first operational coilgun was developed and patented by Norwegjanphysicistmstian Birkeland. In 1934 an American inventor developed a machine gun similar in concept to the coilgun. Except for a photo in a few publications, very little is known about it.

2.**Magnetic Train**



Maglev (derived from magneticleviation), is a system of transportation that uses magnetic levitation to suspend, guide and propel vehicles from magnets rather than using mechanical methods, sucH as wheels, axles and bearings. Maglev transport is a means of flying a vehicle or object

along a guideway by using magnets to create both lift and thrust, only a few inches above the guideway surface.

High-speed maglev vehicles are lifted off their guideway and thus are claimed to move more smoothly and quietly and require less maintenance than wheeled mass systems-regardless of speed. It is claimed that non-reliance on friction also means that acceleration and deceleration can far surpass that of existing forms of transport. The power needed for levitation is not a particularly large percentage of the overall energy consumption most of the power used is needed to overcome air resistance), as with any other high-speed form of transport.

4.**Space Shuttle Launcher**

The space shuttle was a partially reusable launch system and orbital space craft operated by the U.S. (NASA) for human missions. The first of four orbital test llights occurred in 1981 leading to operational flights beginning in 1982. It was used on a total of 135 missions from 1981 to 2011 all launched from Major missions included launching numerous satelites, interplanetary probes, Hubble Telescope (conducting space science experiments, and constructing and servicing the space station. Major components included the , payloads, and supporting infrastructure. Five space-worthy orbiters were built ; two were destroyed in accidents.

During launch, the external tank provided fuel for the orbiter's main engines. The sRBs and ET were jettisoned before the orbiter reached orbit. At the conclusion of the orbiter's space mission, it fired its thrusters to drop out of orbit and the lower atmosphere. The orbiter decelerated in the atmosphere before flying like a glider but with reaction control thrusters before landing on a long runway.

Testing & Troubleshooting

Before you apply power, read the instructions carefully to check you haven't missed anything, and whether there are any specific instructions for switching on and testing.

Check again that you have all polarity sensitive components the right way around, and that all components are in the correct places.

Check off - board components are connected correctly. Check the underside of the board carefully for short circuits between tracks - a common reason for circuits failing to work.

When you are sure everything is correct, apply power and see if the circuit behaves as expected, again following the kit manufacturers instructions.

If it works, WELL DONE! You have your first working circuit - be proud of it! Skip the rest of this page and click the right arrow at the bottom.

If it doesn't quite work as expected, or doesn't work at all, don't despair. The chances are the fault is quite simple. However, disconnect the power before reading on.

Check the basic's first - is the battery flat? Are you sure the 'On' switch really is on? (Don't laugh, it's easily done) If the project has other switches and controls check these are set correctly.

Next - check again all the components are in the correct place - refer to the diagram in the instructions. Look again at the underside of the board - are there any short circuits? These can be caused by almost invisible 'whiskers' of solder, so check for these with a magnifying glass in good light. Brushing the bottom of the board vigorously with a stiff brush can sometimes remove these.

Pull the components gently to see if they are all fixed into the board properly. Check the soldered joints - poor soldering is the most common cause of circuits failing to work.

The joints should by shiny, and those on the circuit board should be volcano shaped with the component wire end sticking out of the top. If any look suspect then redo them. Remove the solder with a solder sucker or braid and try again.

Check for solder splashes shorting across adjacent tracks on the circuit board, especially where connections are very close such as on integrated circuits ('chips'). Solder splashes are most likely on stripboard.

You can check for shorts using a multimeter set it to it's continuity range, or low resistance range. Be aware if you do this though, that there will be a resistance between some tracks due to the components.

Any resistance below 1 ohm between tracks is likely to be a solder splash. Run the soldering iron between tracks on stripboard to remove any solder bridges.

If the circuit still fails to work you will need to refer to the circuit diagram and take voltage readings from the circuit to find out what's wrong. You will need a multimeter to do this (see tools). Remember that if you find one fault such as a reversed component and correct it, it might have caused damage to other components.

More Tools & Test Equipment

To design your own circuits, or build more complex kits, you will probably need more in the way of tools and test equipment. If you did not buy a multimeter before then this is essential now, a basic power supply is also very useful.

More expensive items such as an oscilloscope can be useful, but think carefully about whether you really need them - after all, you can build a lot of projects for the price of an oscilloscope. PC-based virtual instruments could perhaps be more suitable. Other tools can be useful too.

Here is a list of other useful items, although this by no means covers all the tools and equipment available. Maplin codes are included, however similar items are available from most suppliers.

Tools:

Helping Hands - Useful for holding PCB's, connectors etc. while you solder them. Also normally have a magnifying glass to help see small components. Can save hours of aggravation! Maplin code YK53H A small vice can also be useful and provides a more rigid mounting than a Helping Hands.

Pearl Catcher - Useful for the retrieving those screws that inevitably fall into the most inaccessible corner of a project! Maplin code BK43W

Heat Shunt - an inexpensive item for soldering heat sensitive devices. Clipped onto the component lead between the joint and the component it will soak up the heat to save you melting your components. As you get faster at soldering you probably won't need it so much. Maplin code FR10L

RCD Circuit Breaker - If you start building mains projects (only do this when you are more experienced and are aware of the safety requirements) then one of these is ESSENTIAL. It could also prevent a shock if you accidentally melt through the soldering iron flex.

These are sold very cheaply in most electrical shops. Well worth the price, although check if your building wiring is already protected by an RCD in the consumer unit first.

Breadboard - If you want to test a circuit without soldering it together permanently then these are useful. Just push the wires into holes joined by metal strips to build the circuit. If the circuit doesn't work, you can easily make changes. Different sizes are available, e.g. Maplin code AG10L

Other items - Other sizes of screwdriver, 0.5Kg reel of solder, tool roll or box etc.

Test Equipment:

Multimeter - almost essential for all but the absolute beginner. See the tools section for more information.

Power Supply - Also very useful for powering circuits that you are testing. One with a variable voltage up to at least 12V is best. The current rating doesn't need to be that high, 1A maximum is fine for most jobs.

If you can afford it then one with an adjustable current limit is useful - set right it can prevent damage to an incorrect circuit, rather than frying it instantly!

Oscilloscope - Quite expensive and not really worth it for all but the advanced constructor. Nonetheless a very useful piece of test equipment, especially on audio circuits.

There are some cheaper PC based alternatives, and some hand - held 'scopes now, although I haven't tried them.

Signal Generator - Useful when testing audio circuits, again not really necessary for beginners.

Produces variable frequency waves of several different waveforms (sine, square, triangle)

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