MID TERM REPORT ON

BOMB AND FIRE DETECTION ROBOT

SUBMIITED BY

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ABSTRACT

Now-a-days, Automated systems have less manual operations, flexibility, reliability and accurate. Due to this demand every field prefers automated control systems. Especially in the field of electronics automated systems are giving good performance. In the present scenario of war situations, unmanned systems plays very important role to minimize human losses. So this robot is very useful to do operations like detecting bomb, obstacle&fire.

This project aims at designing and executing the bomb ,fire and obstacle detection. The IR sensor is a pair sensors has a receiver and a transmitter sensor. The transmitter sends the, and if the receiver senses any of the transmitted signal it indicates the presence of an obstacle. If the receiver doesn’t sense any signal it indicates the absence of obstacle. If any obstacle is detected the robot will stop. This robot is fitted with motors. A micro controller is used to control all operations. According to the motor operations the robot will operate as specified in program. Whenever any fire is detected, the Buzzer will ON.

However, the microcontroller being used for the project has latched outputs and as such one does not have to keep the buttons on remote control passed for more than a few milliseconds. The working prototype of the land rover including remote is designed using micro controllers at both ends with appropriate code written in "C" language.

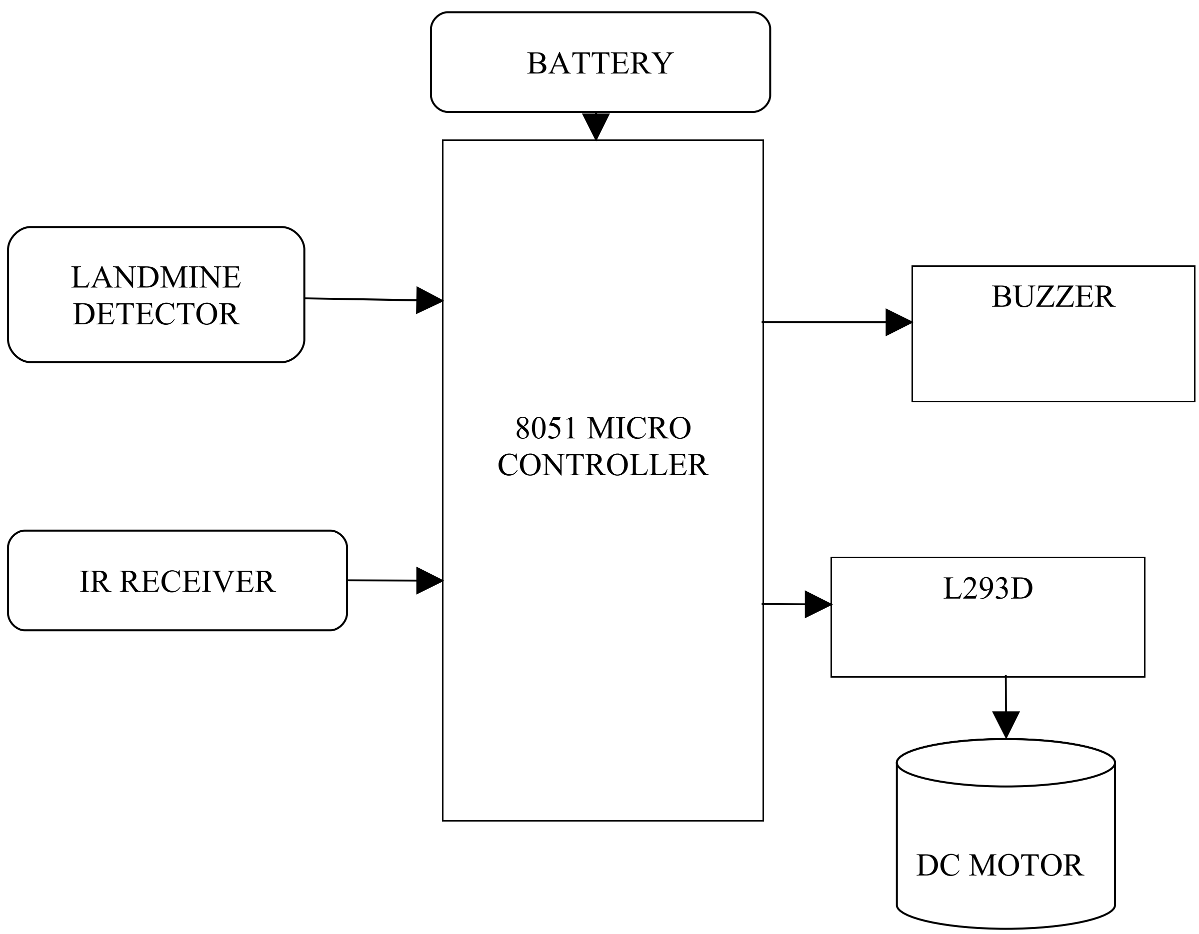
The programming language used for developing the software to the microcontroller is Embedded/Assembly. The KEIL cross compiler is used to edit, compile and debug this program. Micro Flash programmer is used for burning the developed code on Keil in to the microcontroller Chip. Here in our application we are using AT89C51 microcontroller which is Flash Programmable IC. At present the Atmel Corporation represents CMOS technology is used for designing the IC. This IC is one of the versions of 8051.

1. INTRODUCTION

1.1 Objective:

The main aim of this project is to develop a land mine detector robot using 8051 Micro controller.

1.2 Block diagram:



1.3Description:

This application is in the area of embedded systems.

An embedded system is some combination of computer hardware and software, either fixed in capability or programmable, that is specifically designed for a particular function

The Keil C51 C Compiler for the 8051 microcontroller is the most popular 8051 C compiler in the world. It provides more features than any other 8051 C compiler available today. The C51 Compiler allows you to write 8051 microcontroller applications in C that, once compiled, have the efficiency and speed of assembly language. Language extensions in the C51 Compiler give you full access to all resources of the 8051.

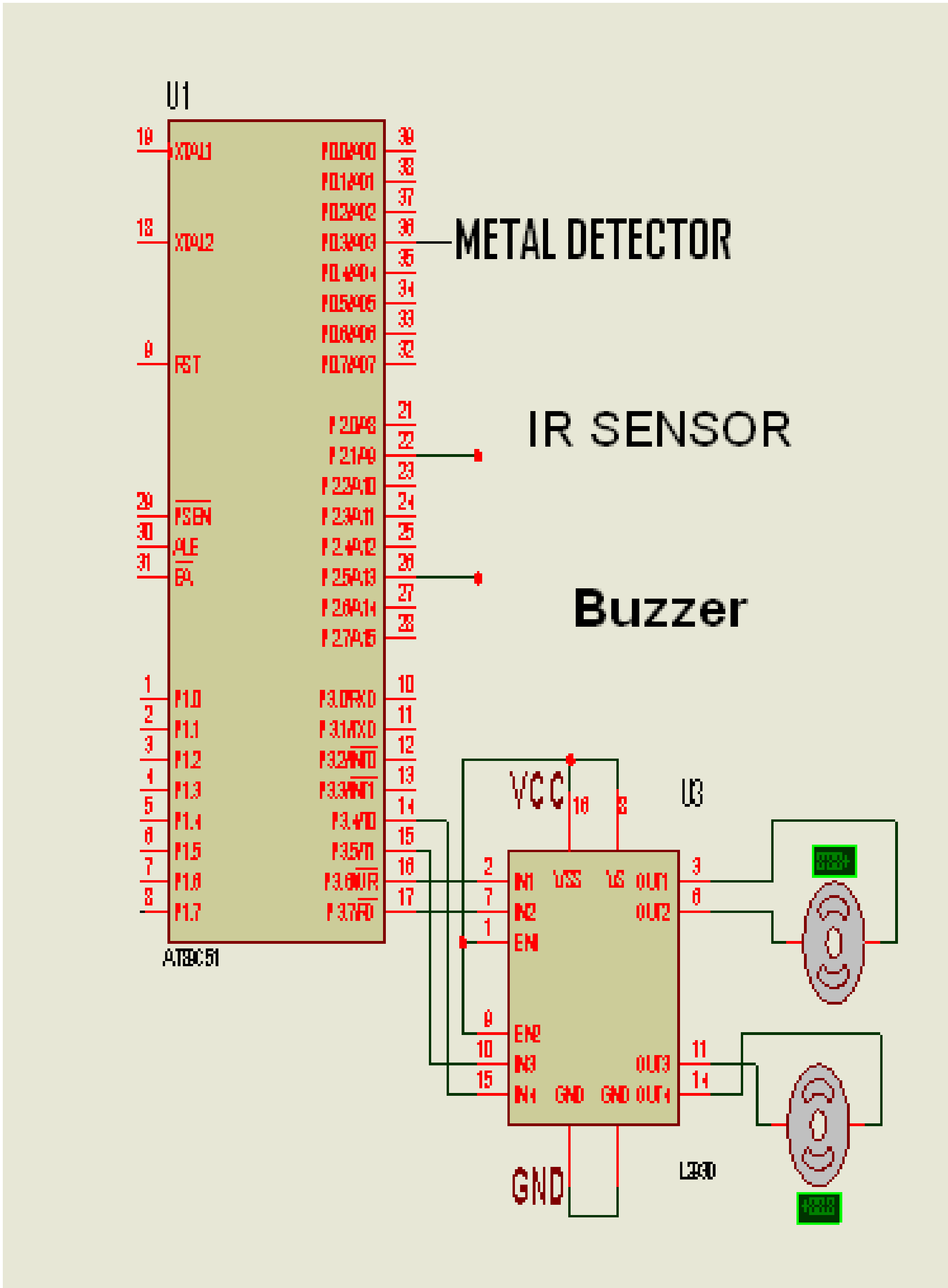
The C51 Compiler translates C source files into relocatable object modules which contain full symbolic information for debugging with the µVision Debugger or an in-circuit emulator. In addition to the object file, the compiler generates a listing file which may optionally include symbol table and cross reference information.

The AT89C51 is a low-power, high-performance CMOS 8-bit microcomputer with 4K bytes of Flash programmable and erasable read only memory (EPROM).

This project aims at designing and executing the bomb and obstacle detection and avoidance robot. A robot obstacle detection system including a robot housing which navigates with respect to a surface and a sensor subsystem having a defined relationship with respect to the housing and aimed at the surface for detecting the surface. The IR sensor is a pair sensors has a receiver and a transmitter sensor. The transmitter sends the, and if the receiver senses any of the transmitted signal it indicates the presence of an obstacle. If the receiver doesn’t sense any signal it indicates the absence of obstacle. If any obstacle is detected the robot will stop.

This robot is fitted with motors. A micro controller is used to control all operations. According to the motor operations the robot will operate as specified in program. Whenever any fire or alcohol is detected, the Buzzer will ON.

1.4 SCHEMATIC DIAGRAM:



2. 8051 MICROCONTROLLER

2.1 Introduction:

The first microprocessor introduced in 1981/1971, was made possible by high levels of integration of digital circuits. Continued integration of peripherals and memory on the same integrated circuit as the microprocessor core led to the creation of micro controllers. A micro controller is an integrated circuit composed of a CPU, various peripheral devices, and typically memory, all in one chip. Using one chip that contains all the necessary functions in place of a microprocessor and multiple peripheral chips has reduced the size and the power consumption of control oriented applications.

A micro controller is different from a microprocessor both in hardware and software. In hardware it includes peripherals such as I/O, memory, and analog and digital interface. Micro controllers are more suited for small applications with specific control functions requiring specialized peripherals and interfaces.

2.2 Pin diagram of AT89C51:

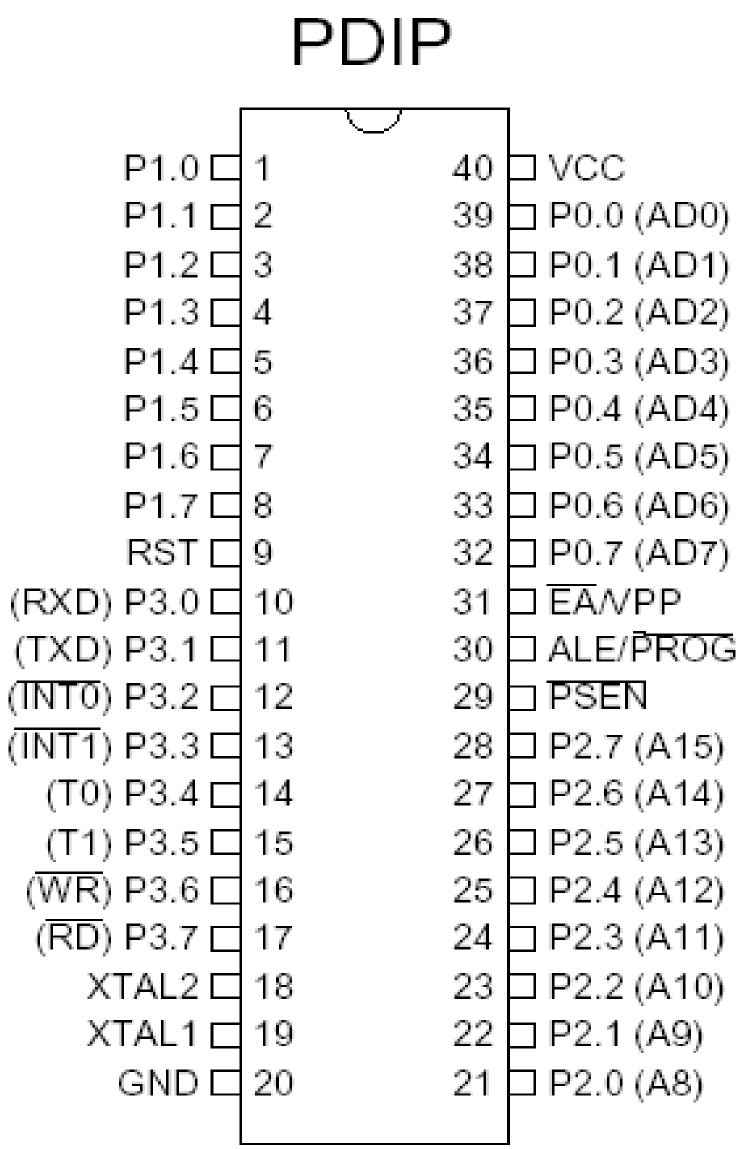


Fig: Pin Configuration of AT89C51

Pin Description:

VCC:

Supply voltage.

GND:

Ground.

Port 0:

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

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 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 3:

Port 3 is an 8-bit bi-directional I/O port with internal pullups.The Port 3 output buffers can sink/source four TTL inputs. When 1s are written to Port 3 pins they are pulled high by the internal pull-ups and can be used as inputs. As inputs, Port 3 pins that are externally being pulled low will source current (IIL) because of the pull-ups.Port 3 also serves the functions of various special features of the AT89C51 as listed below:

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)

Tab Port pins and their alternate functions

RST:

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

ALE/PROG:

Address Latch Enable output pulse for latching the low byte of the address during accesses to external memory. This pin is also the program pulse input (PROG) during Flash programming.

PSEN:

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

EA/VPP:

External Access Enable. EA must be strapped to GND in order to enable the device. however, that if lock bit 1 is programmed, EA will be internally latched on reset.

XTAL1:

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

XTAL2:

Output from the inverting oscillator amplifier.

2.2 Architecture of 8051:

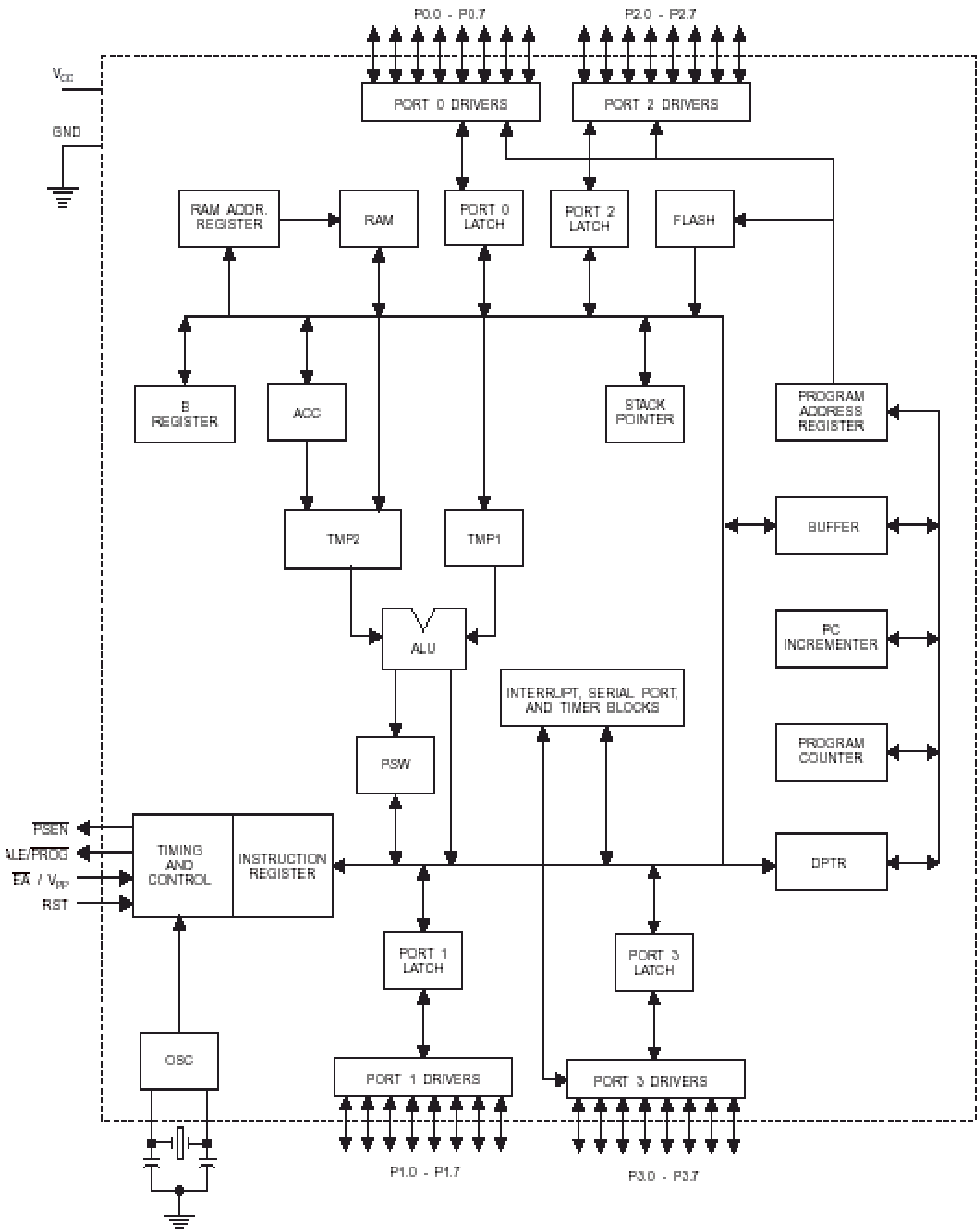


Fig: Block Diagram of AT89C51 Microcontroller

Description of block diagram:

P0 (Port 0, Address 80h, Bit-Addressable):

This is input/output port 0. Each bit of this SFR corresponds to one of the pins on the microcontroller. For example, bit 0 of port 0 is pin P0.0, bit 7 is pin P0.7. Writing a value of 1 to a bit of this SFR will send a high level on the corresponding I/O pin whereas a value of 0 will bring it to a low level.

P1 (Port 1, Address 90h, Bit-Addressable):

This is input/output port 1. Each bit of this SFR corresponds to one of the pins on the microcontroller. For example, bit 0 of port 1 is pin P1.0, bit 7 is pin P1.7. Writing a value of 1 to a bit of this SFR will send a high level on the corresponding I/O pin whereas a value of 0 will bring it to a low level.

P2 (Port 2, Address A0h, Bit-Addressable):

This is input/output port 2. Each bit of this SFR corresponds to one of the pins on the microcontroller. For example, bit 0 of port 2 is pin P2.0, bit 7 is pin P2.7. Writing a value of 1 to a bit of this SFR will send a high level on the corresponding I/O pin whereas a value of 0 will bring it to a low level.

P3 (Port 3, Address B0h, Bit-Addressable):

This is input/output port 3. Each bit of this SFR corresponds to one of the pins on the microcontroller. For example, bit 0 of port 3 is pin P3.0, bit 7 is pin P3.7. Writing a value of 1 to a bit of this SFR will send a high level on the corresponding I/O pin whereas a value of 0 will bring it to a low level.

ALU:

The ALU performs arithmetic and logical functions on 8-bit variable.The ALU can perform addition, subtraction, multiplication and division and the logic unit can perform logical operations. An important and unique feature of the microcontroller architecture is that he ALU can also manipulate 1 bit as well as 8-bit data types. Individual bits may be set, cleared, complemented, moved, tested and used in logic computation.

PSW (Program Status Word, Addresses D0h, Bit-Addressable):

The Program Status Word is used to store a number of important bits that are set and cleared by 8051 instructions. The PSW SFR contains the carry flag, the auxiliary carry flag, the overflow flag, and the parity flag. Additionally, the PSW register contains the register bank select flags which are used to select which of the "R" register banks are currently selected.

ACC (Accumulator, Addresses E0h, Bit-Addressable):

The Accumulator is one of the most used SFRs on the 8051 since it is involved in so many instructions. The Accumulator resides as an SFR at E0h, which means the instruction **MOV A, #20h** is really the same as **MOV E0h, #20h**.

B (B Register, Addresses F0h, Bit-Addressable):

The "B" register is used in two instructions: the multiply and divide operations. The B register is also commonly used by programmers as an auxiliary register to temporarily store values.

SP (Stack Pointer, Address 81h):

This is the stack pointer of the microcontroller. This SFR indicates where the next value to be taken from the stack will be read from in Internal RAM.

The Program Counter (PC)

The Program Counter (PC) is a 2-byte address which tells the 8051 where the next instruction to execute is found in memory.

The Data Pointer (DPTR)

The Data Pointer (DPTR) is the 8051's only user-accessible 16-bit (2-byte) register. The Accumulator, "R" registers, and "B" register are all 1-byte values. DPTR, as the name suggests, is used to point to data. It is used by a number of commands which allow the 8051 to access external memory. When the 8051 accesses external memory it will access external memory at the address indicated by DPTR.

2.4 Basic Registers:

Accumulator:

The Accumulator, as its name suggests, is used as a general register to accumulate the results of a large number of instructions. It can hold an 8-bit (1-byte) value and is the most versatile register the 8051 has due to the shear number of instructions that make use of the accumulator. More than half of the 8051's 255 instructions manipulate or use the accumulator in some way. For example, if we add the number 10 and 20, the resulting 30 will be stored in the accumulator.

The "R" registers:

The "R" registers are a set of eight registers that are named R0, R1, etc. up to and including R7. These registers are used as auxiliary registers in many operations. To continue with the above example, perhaps you are adding 10 and 20. The original number 10 may be stored in the Accumulator whereas the value 20 may be store in, say, register R4. To process the addition you would execute the command:

ADD A,R4 After executing this instruction the Accumulator will contain the value 30.

The "R" registers as very important auxiliary, or "helper", registers. The Accumulator alone would not be very useful if it were not for these "R" registers. The "R" registers are also used to temporarily store values.

MOV A, R3; Move the value of R3 into the accumulator

ADD A, R4; Add the value of R4

MOV R5, A; Store the resulting value temporarily in R5

MOV A, R; Move the value of R1 into the accumulator

ADD A,R2 ;Add the value of R2

SUBB A,R5 ;Subtract the value of R5 (which now contains R3 + R4)

In the above example we used R5 to temporarily hold the sum of R3 and R4. Of course, this isn't the most efficient way to calculate (R1+R2) - (R3 +R4) but it does illustrate the use of the "R" registers as a way to store values temporarily.

The "B" Register:

The "B" register is very similar to the Accumulator in the sense that it may hold an 8-bit (1-byte) value. The "B" register is only used by two 8051 instructions: MUL AB and DIV AB. Thus, if you want to quickly and easily multiply or divide A by another number, you may store the other number in "B" and make use of these two instructions.

Aside from the MUL and DIV an instruction, the “B” register is often used as yet another temporary storage register much like a ninth "R" register.

Data Pointer (DPTR):

The Data Pointer (DPTR) is the 8051’s only user-accessible 16-bit (2-byte) register. The Accumulator, "R" registers, and "B" register are all 1-byte values. DPTR, as the name suggests, is used to point to data. It is used by a number of commands which allow the 8051 to access external memory. When the 8051 accesses external memory it will access external memory at the address indicated by DPTR. While DPTR is most often used to point to data in external memory, many programmers often take advantage of the fact that it’s the only true 16-bit register available. It is often used to store 2-byte values which have nothing to do with memory locations.

Program Counter (PC):

The Program Counter (PC) is a 2-byte address which tells the 8051 where the next instruction to execute is found in memory.When the 8051 is initialized PC always starts at 0000h and is incremented each time an instruction is executed. It is important to note that PC isn’t always incremented by one. Since some instructions require 2 or 3 bytes the PC will be incremented by 2 or 3 in these cases. The Program Counter is special in that there is no way to directly modify its value. That is to say, you can’t do something like PC=2430h. On the other hand, if you execute LJMP 2340h you’ve effectively accomplished the same thing.

2.5 FEATURES OF 8051 MICRO CONTROLLER:

The features of the micro controller are as follows:

- Compatible with MCS-51 ™ Products
- 4K Bytes of In-System Reprogrammable Flash Memory
- Endurance: 1,000 Write/Erase Cycles
- Fully Static Operation: 0 Hz to 24 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
- Programmable Serial Channel
- Low-power Idle and Power-down Modes

2.6 SIX INTERRUPTS IN 8051:

There are really five interrupts available to the user in the 8051 but many manufacturer's data sheets state that there are six interrupts since they include RESET.

RESET:

When the reset pin is activated, the 8051 jumps to address location 0000. This is the power-up reset.

Two interrupts are set aside for the timers: one for timer0 and one for timer1. Memory locations 000BH and 001BH in the interrupt vector table belong to timer0 and timer1, respectively.

Two interrupts are set aside for hardware external hardware interrupts. Pin numbers 12 (P3.2) and 13 (P3.3) in port34 are for the external hardware interrupts INT0 and INT1, respectively. Memory locations 0003H and 0013H in the interrupt vector table are assigned to INT0 and INT1, respectively.

Serial communication has a single interrupt that belongs to both receive and transfer. The interrupt vector table location 0023H belongs to this interrupt.

Table 1: Interrupt Vector Table for the 8051

INTERRUPT	ROM Locatio (Hex)	Pin
Reset	0000	9
interrupt 0 (INT0)	0003	P3.2 (12)
Timer 0	000B	
interrupt 1 (INT1)	0013	P3.3 (13)
Timer 1	001B	
SerialCOMinterrupt	0023	

Enabling and disabling an interrupt:

Upon rest, all interrupts are disabled (masked), meaning that none will be responded to by the micro controller if they are activated. The interrupts must be enabled by software in order for the micro controller to respond to them. There is a register called INTERRUPT ENABLE (IE) that is responsible for enabling and disabling the interrupts.

IE (Interrupt Enable) Register:

EA	**-**	**ET2**	**ES**	**ET1**	**EX1**	**ET0**	**EX0**

1. EA IE.7 Disables all interrupts. If EA=0, no interrupt is acknowledged. If ea=1, each interrupt source is individually enabled or disabled by setting or clearing its enable bit.
2. -- IE.6 Not implemented, reserved for future use.*
3. ET2 IE.5 Enables or disables timer2 overflow or capture interrupt.
4. ES IE.4 Enables or disables the serial port interrupt.
5. ET1 IE.3 Enables or disables timer1 overflow interrupt.
6. EX1 IE.2 Enables or disables external interrupt1.
7. ET0 IE.1 Enables or disables timer0 overflow interrupt.
6. EX0 IE.0 Enables or disables external interrupt0.

NOTE: * User software should not write 1s to reserved bits. These bits may be used in future Flash micro controllers to invoke new features.

Steps in enabling an interrupt:

To enable an interrupt, we take the following steps:

Bit D7 of the TE register must be set to high to allow the rest of register to take effect. If EA=1, interrupts are enabled and will be responded to if their corresponding bits in IE are high. If EA=0, no interrupt will be responded to, even if the associated bit in the IE register is high.

3. HARDWARE DESCRIPTION

3.1 DC Motor:

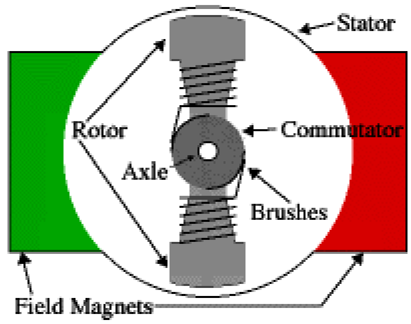
DC motors are configured in many types and sizes, including brush less, servo, and gear motor types. A motor consists of a rotor and a permanent magnetic field stator. The magnetic field is maintained using either permanent magnets or electromagnetic windings. DC motors are most commonly used in variable speed and torque.

Motion and controls cover a wide range of components that in some way are used to generate and/or control motion. Areas within this category include bearings and bushings, clutches and brakes, controls and drives, drive components, encoders and resolves, Integrated motion control, limit switches, linear actuators, linear and rotary motion components, linear position sensing, motors (both AC and DC motors), orientation position sensing, pneumatics and pneumatic components, positioning stages, slides and guides, power transmission (mechanical), seals, slip rings,solenoids,springs.

Motors are the devices that provide the actual speed and torque in a drive system. This family includes AC motor types (single and multiphase motors, universal, servo motors, induction, synchronous, and gear motor) and DC motors (brush less, servo motor, and gear motor) as well as linear, stepper and air motors, and motor contactors and starters.

In any electric motor, operation is based on simple electromagnetism. A current-carrying conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field. As you are well aware of from playing with magnets as a kid, opposite (North and South) polarities attract, while like polarities (North and North, South and South) repel. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current-carrying conductor and an external magnetic field to generate rotational motion.

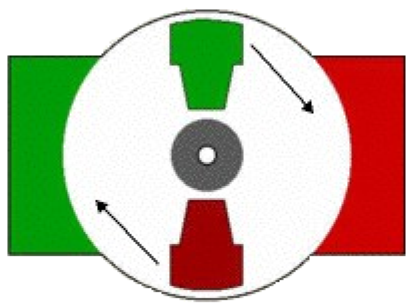
Let's start by looking at a simple 2-pole DC electric motor (here red represents a magnet or winding with a "North" polarization, while green represents a magnet or winding with a "South" polarization).



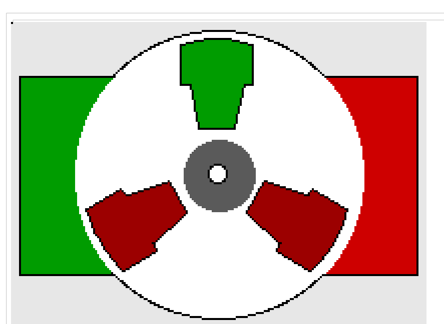
Every DC motor has six basic parts -- axle, rotor (a.k.a., armature), stator, commutator, field magnet(s), and brushes. In most common DC motors (and all that Beamers will see), the external magnetic field is produced by high-strength permanent magnets[1]. The stator is the stationary part of the motor -- this includes the motor casing, as well as two or more permanent magnet pole pieces. The rotor (together with the axle and attached commutator) rotates with respect to the stator. The rotor consists of windings (generally on a core), the windings being electrically connected to the commutator. The above diagram shows a common motor layout -- with the rotor inside the stator (field) magnets.

The geometry of the brushes, commutator contacts, and rotor windings are such that when power is applied, the polarities of the energized winding and the stator magnet(s) are misaligned, and the rotor will rotate until it is almost aligned with the stator's field magnets. As the rotor reaches alignment, the brushes move to the next commutator contacts, and energize the next winding. Given our example two-pole motor, the rotation reverses the direction of current through the rotor winding, leading to a "flip" of the rotor's magnetic field, and driving it to continue rotating.

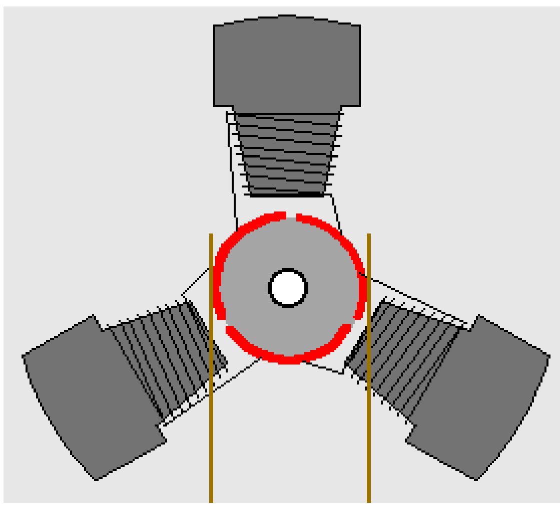
In real life, though, DC motors will always have more than two poles (three is a very common number). In particular, this avoids "dead spots" in the commutator. You can imagine how with our example two-pole motor, if the rotor is exactly at the middle of its rotation (perfectly aligned with the field magnets), it will get "stuck" there. Meanwhile, with a two-pole motor, there is a moment where the commutator shorts out the power supply (i.e., both brushes touch both commutator contacts simultaneously). This would be bad for the power supply, waste energy, and damage motor components as well. Yet another disadvantage of such a simple motor is that it would exhibit a high amount of torque" ripple" (the amount of torque it could produce is cyclic with the position of the rotor).



So since most small DC motors are of a three-pole design, let's tinker with the workings of one via an interactive animation (JavaScript required):



You'll notice a few things from this -- namely, one pole is fully energized at a time (but two others are "partially" energized). As each brush transitions from one commutator contact to the next, one coil's field will rapidly collapse, as the next coil's field will rapidly charge up (this occurs within a few microsecond). We'll see more about the effects of this later, but in the meantime you can see that this is a direct result of the coil windings' series wiring:



There's probably no better way to see how an average dc motor is put together, than by just opening one up. Unfortunately this is tedious work, as well as requiring the destruction of a perfectly good motor.

This is a basic 3-pole dcmotor, with 2 brushes and three commutator contacts.

3.2 L293D IC (DC MOTOR DRIVER):

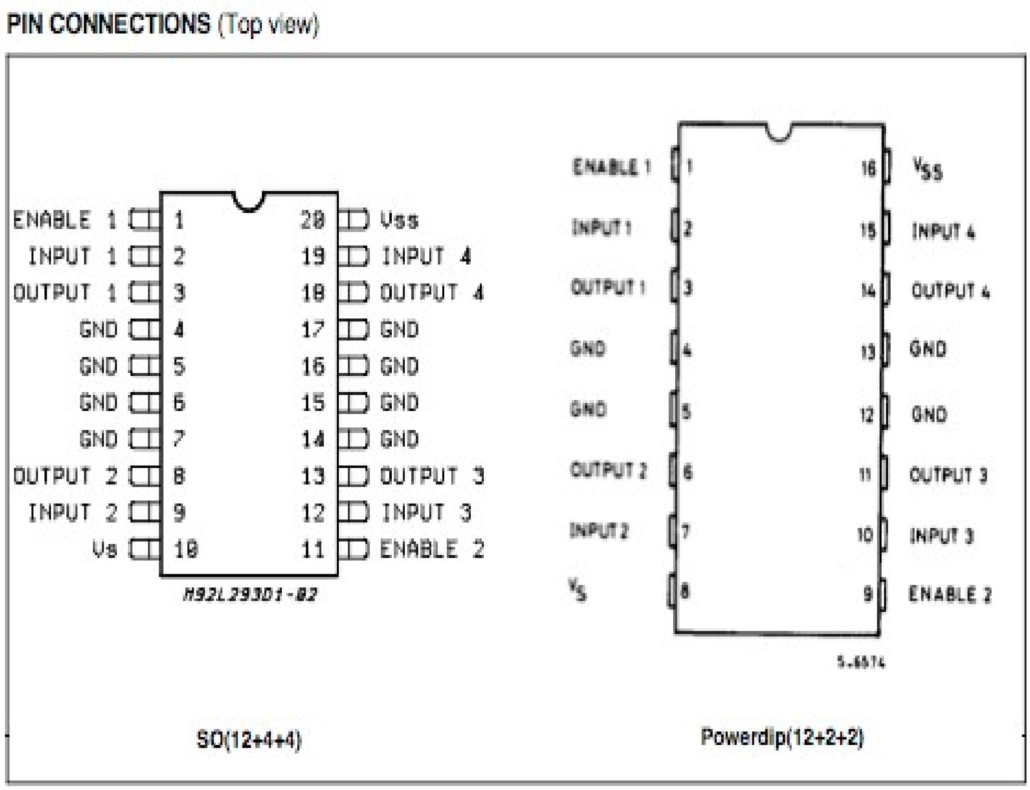
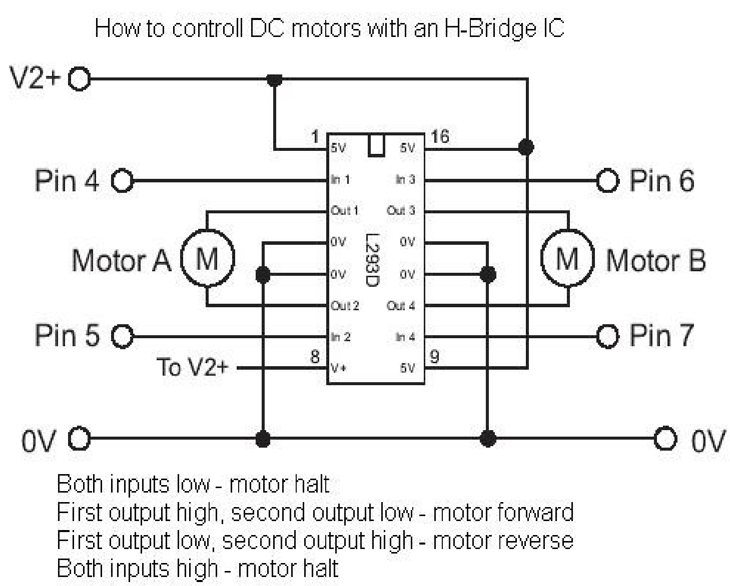


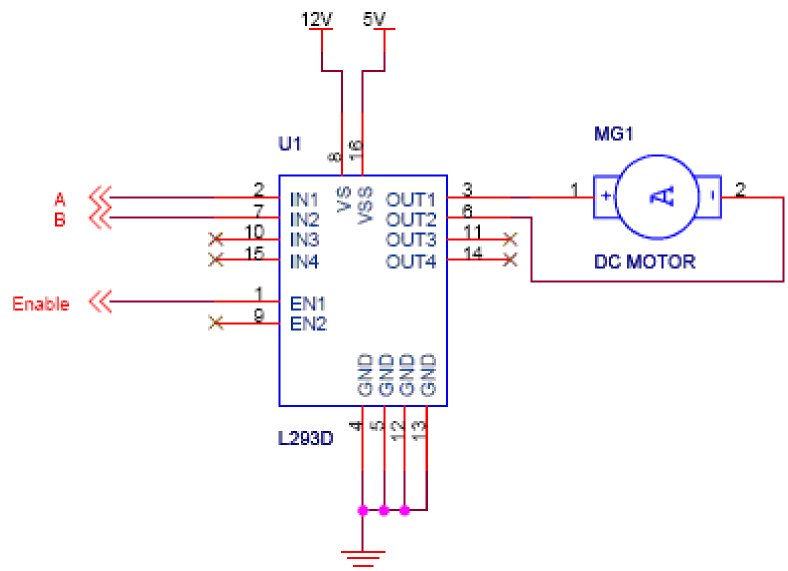
FIGURE: L293 & L293D Driver ICs

The L293 and L293D are quadruple high-current half-H drivers. The L293 is designed to provide bidirectional drive currents of up to 1 A at voltages from 4.5 V to 36 V. The L293D is designed to provide bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V. Both devices are designed to drive inductive loads such as relays, solenoids, dc and bipolar stepping motors, as well as other high-current/high-voltage loads in positive-supply applications. All inputs are TTL compatible. Each output is a complete totem-pole drive circuit, with a Darlington transistor sink and a pseudo-Darlington source. Drivers are enabled in pairs, with drivers 1 and 2 enabled by 1,2EN and drivers 3 and 4 enabled by 3,4EN.

When an enable input is high, the associated drivers are enabled and their outputs are active and in phase with their inputs. When the enable input is low, those drivers are disabled and their outputs are off and in the high-impedance state. With the proper data inputs, each pair of drivers forms a full-H (or bridge) reversible drive suitable for solenoid or motor applications.

On the L293, external high-speed output clamp diodes should be used for inductive transient suppression. A VCC1 terminal, separate from VCC2, is provided for the logic inputs to minimize device power dissipation. The L293and L293D are characterized for operation from 0°C to 70°C.





Truth Table

A	B	Description
0	0	Motor stops or Breaks
0	1	Motor Runs Anti-Cloclwise
1	0	Motor Runs Clockwise
1	1	Motor Stops or Breaks

For above truth table, the Enable has to be Set (1). Motor Power is mentioned 12V, but you can connect power according to your motors.

3.3 Metal Detector:

A metal detector is a device which responds to metal that may not be readily apparent.

The simplest form of a metal detector consists of an oscillator producing an alternating current that passes through a coil producing an alternating magnetic field. If a piece of electrically conductive metal is close to the coil, eddy currents will be induced in the metal, and this produces an alternating magnetic field of its own. If another coil is used to measure the magnetic field (acting as a magnetometer), the change in the magnetic field due to the metallic object can be detected.

The first industrial metal detectors were developed in the 1960s and were used extensively for mining and other industrial applications. Uses include de-mining (the detection of land mines), the detection of weapons such as knives and guns, especially in airport security, geophysical prospecting, archaeology and treasure hunting. Metal detectors are also used to detect foreign bodies in food, and in the construction industry to detect steel reinforcing bars in concrete and pipes and wires buried in walls and floors.

The modern development of the metal detector began in the 1930s. Gerhard Fisher had developed a system of radio direction-finding, which was to be used for accurate navigation. The system worked extremely well, but Fisher noticed that there were anomalies in areas where the terrain contained ore-bearing rocks.

He reasoned that if a radio beam could be distorted by metal, then it should be possible to design a machine which would detect metal using a search coil resonating at a radio frequency. In 1937 he applied for, and was granted, the first patent for a metal detector. However, it was one Lieutenant Jozef Stanislaw Kosacki, a Polish officer attached to a unit stationed in St Andrews, Fife, Scotland during the early years of World War II, that refined the design into a practical Polish mine detector.The design invented by Kosacki was used extensively during the clearance of the German mine fields during the Second Battle of El Alamein when 500 units were shipped to Field Marshal Montgomery to clear the minefields of the retreating Germans, and later used during the Allied invasion of Sicily, the Allied invasion of Italy and the Invasion of Normandy. As it was a wartime research operation to create and refine the design of the detector, the knowledge that Stanislaw created the first practical metal detector was kept secret for over 50 years.

Larger portable metal detectors are used by archaeologists and treasure hunters to locate metallic items, such as jewelry, coins, bullets, and other various artifacts buried shallowly underground.

3.4 RESISTORS:

A Resistor is a heat-dissipating element and in the electronic circuits it is mostly used for either controlling the current in the circuit or developing a voltage drop across it, which could be utilized for many applications. There are various types of resistors, which can be classified according to a number of factors depending upon:

- Material used for fabrication
- Wattage and physical size
- Intended application
- Ambient temperature rating
- Cost

Basically the resistor can be split in to the following four parts from the construction view point.

(1) Base

(2) Resistance element

(3) Terminals

(4) Protective means.

The following characteristics are inherent in all resistors and may be controlled by design considerations and choice of material i.e. Temperature co–efficient of resistance, Voltage co–efficient of resistance, high frequency characteristics, power rating, tolerance & voltage rating of resistors. Resistors may be classified as

(1) Fixed
(2) Semi variable
(3) Variable resistor.

3.5 CAPACITORS:

The fundamental relation for the capacitance between two flat plates separated by a dielectric material is given by:-

C=0.08854KA/D

Where: -

C= capacitance in pf.

K= dielectric constant

A=Area per plate in square cm.

D=Distance between two plates in cm

Design of capacitor depends on the proper dielectric material with particular type of application. The dielectric material used for capacitors may be grouped in various classes like Mica, Glass, air, ceramic, paper, Aluminum, electrolyte etc. The value of capacitance never remains constant. It changes with temperature, frequency and aging. The capacitance value marked on the capacitor strictly applies only at specified temperature and at low frequencies.

3.6 LED (Light Emitting Diodes):

As its name implies it is a diode, which emits light when forward biased. Charge carrier recombination takes place when electrons from the N-side cross the junction and recombine with the holes on the P side. Electrons are in the higher conduction band on the N side whereas holes are in the lower valence band on the P side. During recombination, some of the energy is given up in the form of heat and light. In the case of semiconductor materials like Gallium arsenide (GaAs), Gallium phoshide (Gap) and Gallium arsenide phoshide (GaAsP) a greater percentage of energy is released during recombination and is given out in the form of light. LED emits no light when junction is reverse biased.

3.7 BUZZER:

A buzzer or beeper is a signaling device, usually electronic, typically used in cars or anything electronic, household appliances such as microwave ovens, or game shows.

It most commonly consists of a number of switches or sensors connected to a control unit that determines if and which button was pushed or a preset time has lapsed, and usually illuminates a light on the appropriate button or control panel, and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound.

Initially this device was based on an electromechanical system which was identical to an electric bell without the metal gong (which makes the ringing noise). Often these units were anchored to a wall or ceiling and used the ceiling or wall as a sounding board. Another implementation with some AC-connected devices was to implement a circuit to make the AC current into a noise loud enough to drive a loudspeaker and hook this circuit up to an 8-ohm speaker. Nowadays, it is more popular to use a ceramic-based piezoelectric sounder which makes a high-pitched tone. Usually these were hooked up to "driver" circuits which varied the pitch of the sound or pulsed the sound on and off.

In game shows it is also known as a "lockout system" because when one person signals ("buzzes in"), all others are locked out from signalling. Several game shows have large buzzer buttons which are identified as "plungers".

3.8 BATTERY:

An electrical **battery** is a combination of one or more electrochemical cells, used to convert stored chemical energy into electrical energy. Since the invention of the first Voltaic pile in 1800 by Alessandro Volta, the battery has become a common power source for many household and industrial applications. According to a 2005 estimate, the worldwide battery industry generates US$48 billion in sales each year, with 6% annual growth.

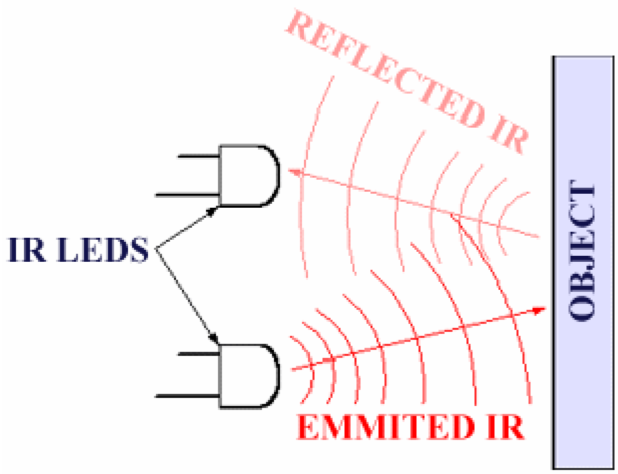
Batteries may be used once and discarded, or recharged for years as in standby power applications. Miniature cells are used to power devices such as hearing aids and wristwatches; larger batteries provide standby power for telephone exchanges or computer data centers.

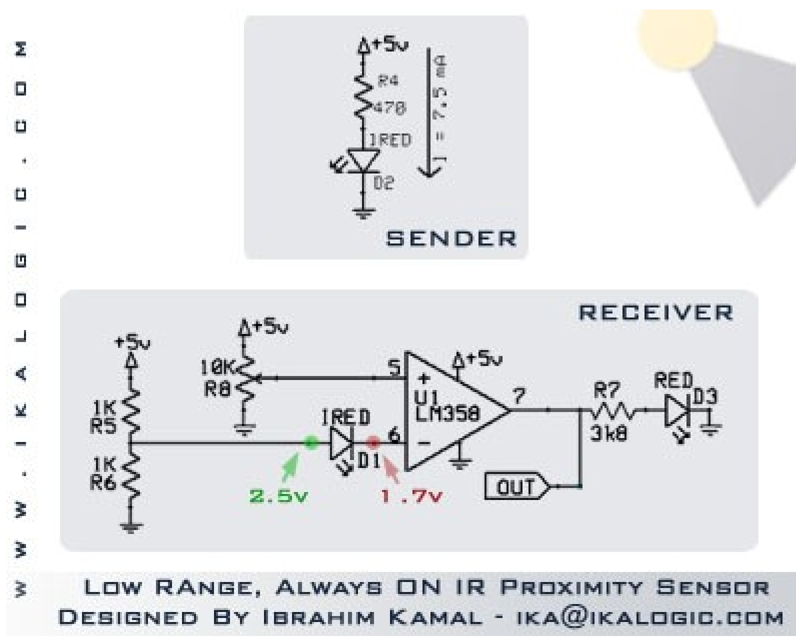
3.9 IR SENSORS:

Object Detection using IR:

It is the same principle in ALL Infra-Red proximity sensors. The basic idea is to send infra red light through IR-LEDs, which is then reflected by any object in front of the sensor.

Then all you have to do is to pick-up the reflected IR light. For detecting the reflected IR light, we are going to use a very original technique: we are going to use another IR-LED**,** to detect the IR light that was emitted from another led of the exact same type. This is an electrical property of Light Emitting Diodes (LEDs) which is the fact that a led Produce a voltage difference across its leads when it is subjected to light. As if it was a photo-cell, but with much lower output current. In other words, the voltage generated by the leds can't be - in any way - used to generate electrical power from light, It can barely be detected. that's why as you will notice in the schematic, we are going to use a Op-Amp (operational Amplifier) to accurately detect very small voltage changes.





The sender is composed of an IR LED (D2) in series with a 470 Ohm resistor, yielding a forward current of 7.5mA. The receiver part is more complicated, the 2 resistors R5 and R6 form a voltage divider which provides 2.5V at the anode of the IR LED (here, this led will be used as a sensor). When IR light falls on the LED (D1), the voltage drop increases, the cathode's voltage of D1 may go as low as 1.4V or more, depending on the light intensity. This voltage drop can be detected using an Op-Amp (operational Amplifier LM358).

You will have to adjust the variable resistor (POT.) R8 so the the voltage at the positive input of the Op-Amp (pin No. 5) would be somewhere near 1.6 Volt. if you understand the functioning of Op-Amps, you will notice that the output will go High when the volt at the cathode of D1 drops under 1.6. So the output will be High when IR light is detected, which is the purpose of the receiver.

If the +ve input's voltage is higher than the -ve input's voltage, the output goes High (5v, given the supply voltage in the schematic), otherwise, if the +ve input's voltage is lower than the -ve input's voltage, then the output of the Op-Amp goes to Low (0V). It doesn't matter how big is the difference between the +ve and -ve inputs, even a 0.0001 volts difference will be detected, and the the output will swing to 0v or 5v according to which input has a higher voltage.

4. SOFTWARE DESCRIPTION

4.1 SOURCE CODE:

```
#include<reg51.h>
sbit lmotorp=P2^0;
sbit lmotorn=P2^1;
sbit fire=P3^7;
sbit rmotorp=P2^3;
sbit rmotorn=P2^4;
sbit buzz=P1^0;
main()
{
unsigned int i;
P2=0x00;
P1=0x00;
fire=1;
buzz=1;
while(1)
{
 rmotorp=1;lmotorp=1;lmotorn=rmotorn=0;
   if(fire==1)
 {
  buzz=0; for(i=0;i<20000;i++);buzz=1;
 rmotorp=lmotorp=lmotorn=rmotorn=0;
//for(i=0;i<=60000;i++);
 }while(fire==1);
 }
}
```

5. CONCLUSION

The project “METAL DETECTOR ROBOT” has been successfully designed and tested. It has been developed by integrating features of all the hardware components used. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit.

Secondly, using highly advanced IC’s and with the help of growing technology the project has been successfully implemented.

Finally we conclude that EMBEDDED SYSTEM is an emerging field and there is a huge scope for research and development.

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