SWITCH AUTOMATION USING A/D CONVERTER

AND

RELAY

A DESIGN LAB REPORT

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BONAFIDE CERTIFICATE

Certified that this project report **Switch Automation Using A/D converter and Relay** is a bonafide work of **Utkarsh Ambasta** who carried out the project work under my supervision.

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CHAPTER 1 INTRODUCTION

When we normally use microcontroller like Arduino, NodeMCU to automate our switches, normally 10-12 pin of are required to automate four appliance connected to the corresponding switch board.
With the help of our design we could achieve this task with maximum of 4 pin to automate the same four appliances.
In this project we are utilizing only 2-bit to automate the corresponding 4 appliances with the help of decoder but if we use more bit we can even automate larger number of appliances and if the microcontroller taken into use like NodeMCU(ESP 8266), we can control our appliances with any device connected to internet or directly connected to the NodeMCU or directly connected to local network created by the MCU.

CHAPTER 2 A/D CONVERTER

2.1 What is A/D Converter?

In electronics, an analog-to-digital converter(A/D Converter) is a system that convert an analog signal, such as a sound picked up by a microphone or light entering a digital camera, into a digital signal.

An A/D Converter may also provide an isolated measurement such as an electronics device that converts an input analog voltage or current to a digital number representing the magnitude of the voltage or current. Typically the digital output is a two's complement binary number that is proportional to the input, but there are other possibilities.

2.2 How does the A/D Converter converts a signal?

Many ways have been developed to convert an analog signal, each with its strengths and weaknesses. The choice of the ADC for a given application is usually defined by the requirements you have: if you need speed, use a fast ADC; if you need precision, use an accurate ADC; if you are constrained in space, use a compact ADC.

All ADCs work under the same principle: they need to convert a signal to a certain number of bits N. The sequence of bits represents the number and each bit has the double of the weight of the next, starting from the Most Significant Bit (MSB) up to the Least Significant Bit (LSB). In a nutshell, we want to find the sequence of bits bN−1, bN−2, ..., b0 that represents the analog value Vin as

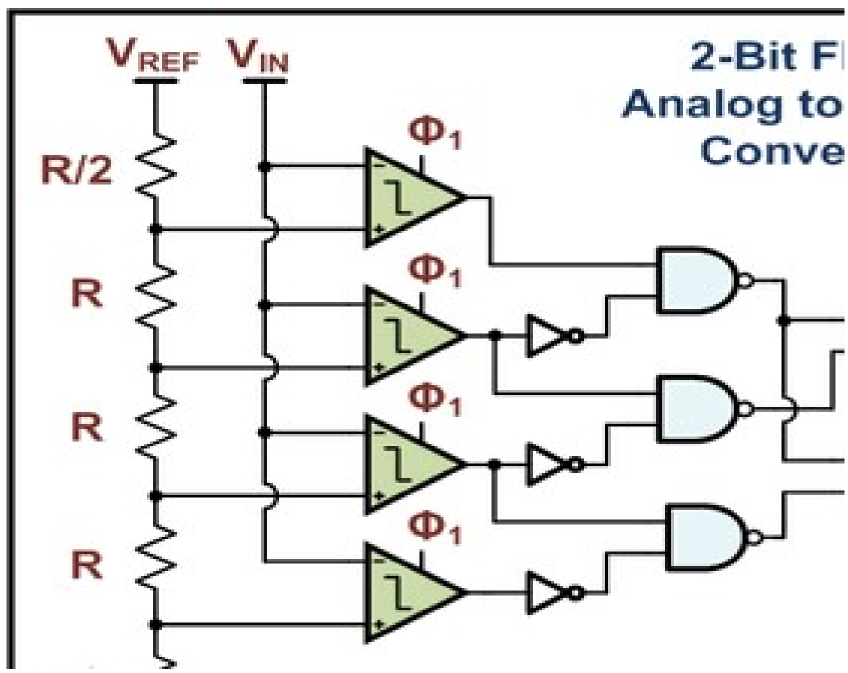
Vin=∑n=0N−1bn2nVref2N.

The MSB has weight Vref/2, the next Vref/4, etc., and the LSB has weight Vref/2N. Therefore, more bits leads to more precision in the digital representation. Here we simplify the range to be between 0 and Vref, although the range may be between any two values.

2.3 Types of A/D converter

There are different types of Analog-to-Digital Converter for different purposes.
The most basic types of A/D Converter are:

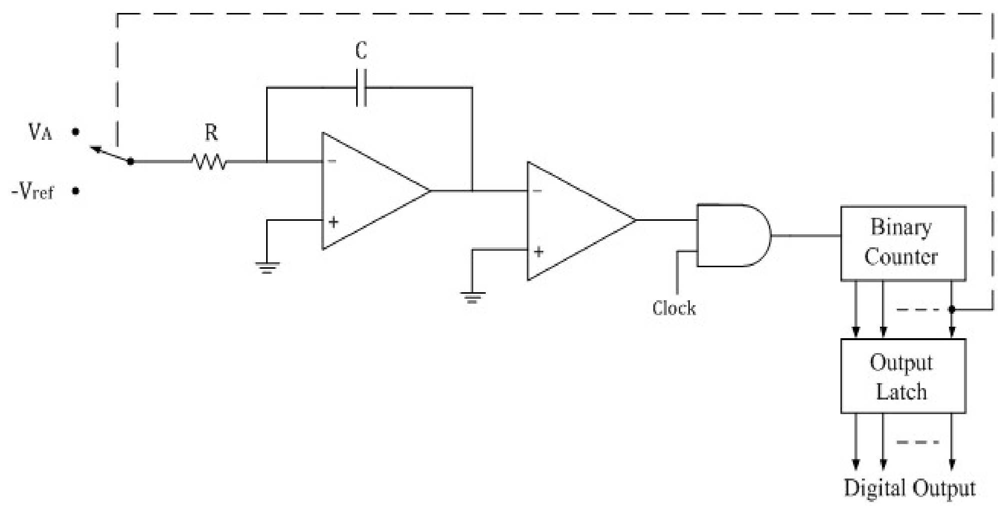
1. Parallel-Comparator A/D Converter
   Parallel-Comparator A/D Converter also known as Flash ADC is a type of analog-to-digital converter that uses a linear voltage ladder with a comparator at each rung of the ladder to compare the input voltage to successive reference voltages.



2. Successive-Approximation A/D Converter
   A **successive approximation ADC** is a type of analog-to-digital converter that converts a continuous analog waveform into a discrete digital representation via a binary search through all possible quantization levels before finally converging upon a digital output for each conversion.

3. Dual-Slope A/D Converter

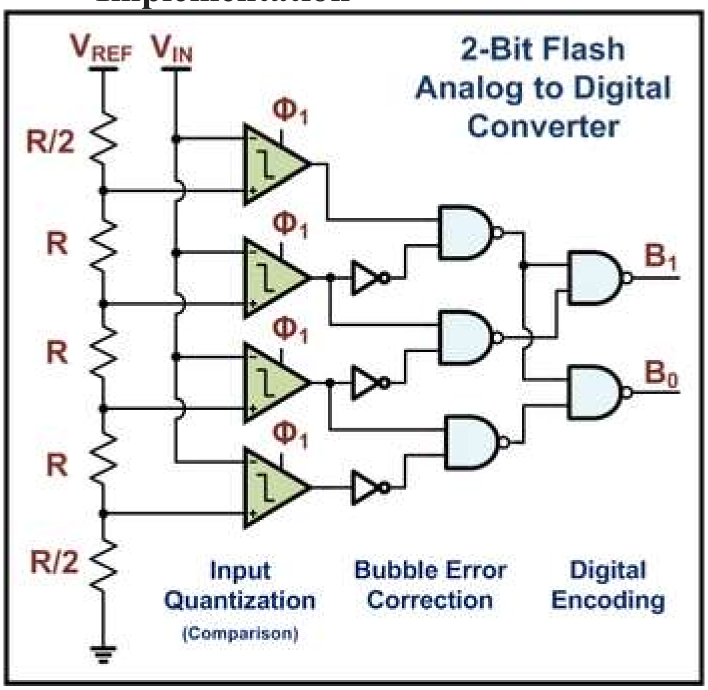
   In dual slope type ADC, the integrator generates two different ramps, one with the known analog input voltage Va and another with a known reference voltage –Vref. Hence it is called dual slope Analog to Digital Converter.



2.4 Flash Type A/D Converter

A **flash ADC** (also known as a **direct-conversionADC**) is a type of analog-to-digitalconverter that uses a linearvoltage ladder with a comparator at each"rung" of the ladder to compare the inputvoltage to successive reference voltages. Often these reference ladders areconstructed of many resistors; however,modern implementations show thatcapacitive voltage division is alsopossible. The output of thesecomparators is generally fed into a digitalencoder, which converts the inputs into abinary value (the collected outputs fromthe comparators can be thought of as aunary value).

Implementation



A 2-bit Flash A/D Converter

Flash ADCs have been implemented inmany technologies, varying from siliconbasedbipolar (BJT) and complementarymetal–oxide FETs (CMOS) technologiesto rarely used III-V technologies. Oftenthis type of ADC is used as a firstmedium-sized analog circuit verification.The earliest implementations consistedof a reference ladder of well matchedresistors connected to a reference voltage. Each tap at the resistor ladder isused for one comparator, possibly preceded by an amplification stage, andthus generates a logical 0 or 1 depending on whether the measured voltage isabove or below the reference voltage of the resistor tap. The reason to add anamplifier is twofold: it amplifies thevoltage difference and thereforesuppresses the comparator offset, and the kick-back noise of the comparatortowards the reference ladder is also

strongly suppressed. Typically designsfrom 4-bit up to 6-bit and sometimes 7-bit are produced.
Designs with power-saving capacitivereference ladders have beendemonstrated. In addition to clocking thecomparator(s), these systems alsosample the reference value on the inputstage. As the sampling is done at a veryhigh rate, the leakage of the capacitors isnegligible.
Recently, offset calibration has beenintroduced into flash ADC designs.Instead of high-precision analog circuits(which increase component size to suppress variation) comparators withrelatively large offset errors aremeasured and adjusted. A test signal isapplied, and the offset of eachcomparator is calibrated to below theLSB value of the ADC.
Another improvement to many flashADCs is the inclusion of digital errorcorrection. When the ADC is used inharsh environments or constructed from very small integrated circuit processes,there is a heightened risk that a single comparator will randomly change stateresulting in a wrong code.

Application

The very high sample rate of this type ofADC enables high-frequency applications (typically in a few GHz range) like radardetection, wideband radio receivers,electronic test equipment, and opticalcommunication links. More often theflash ADC is embedded in a large ICcontaining many digital decodingfunctions. Also a small flash ADC circuit may bepresent inside a delta-sigma modulation loop.
Flash ADCs are also used in NAND flashmemory, where up to 3 bits are stored percell as 8 voltages level on floating gates.

2.5 Specification of A/D Converters

The following specifications are usually specified by the manufacturer of A/D converters:

1. Range of input voltage
2. Input impedance
3. Accuracy
4. Conversion time
5. Format of digital output

In electronics, a flip-flop or latch is a circuit that has two stable states and can be used to store state information. A flip-flop is a bistablemultivibrator. The circuit can be made to change state by signals applied to one or more control inputs and will have one or two outputs. It is the basic storage element in sequential logic. Flip-flops and latches are fundamental building blocks of digital electronics system used in computers, communication, and many other types of system.

Flip-flops are used as data storage elements. A flip-flop is a device which stores a single bit of data; one of its two states represents a “one” and the other represents a “zero”. Such data storage can be used for storage of state, and such a circuit described as sequential logic in electronics. When used in a finite-state machine, the output and the next state depend not only on its current input, but also on its current state (and hence, previous inputs). It can also be used for counting of pulses, and for synchronizing variably-timed input signals to some reference timing signal.

Flip-flops can be either simple (transparent or opaque) or clocked(synchronous or edge-triggered). Although the term flip-flop has historically referred generically to both simple and clocked circuits, in modern usage it is common to reserve the term flip-flop exclusively for discussing clocked circuit; the simple ones are commonly called latches.

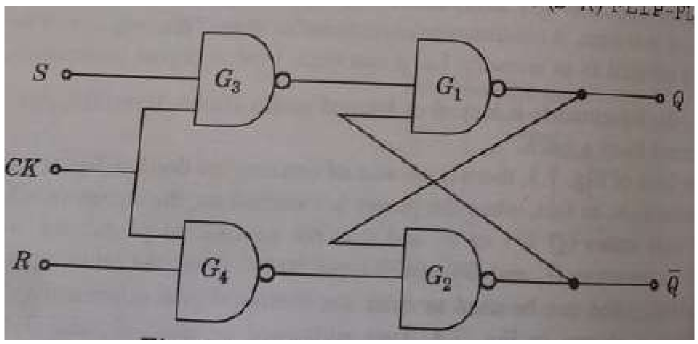
Using this terminology, a latch is level-sensitive, whereas a flip-flop is edge-sensitive. That is, when a latch is enabled it becomes transparent, while a flip flop’s output only changes on a single type (positive gou=ing or negative going) of clock edge.

3.1 **Types of Flip-Flops**

There are 4 different types of flip-flops, named SR flip-flop, JK flip-flops, D flip-flops, T flip-flops.

i)SR Flip-Flops

It is often required to set or reset the memory cell in synchronous train of pulse known as clock (abbreviated as CK). Such a circuit is shown in figure, and is referred to as a clocked set-reset (S-R) FLIP-FLOP.



When the clock is LOW (CK=0), the flip-flops acts as a memory storage and the output does not depend upon the given input it remains same as that of the earlier value.

If the clock is HIGH (CK=1), the flip-flip operates and the output shows changes. The table represents the outputs for different input when the clock is HIGH.

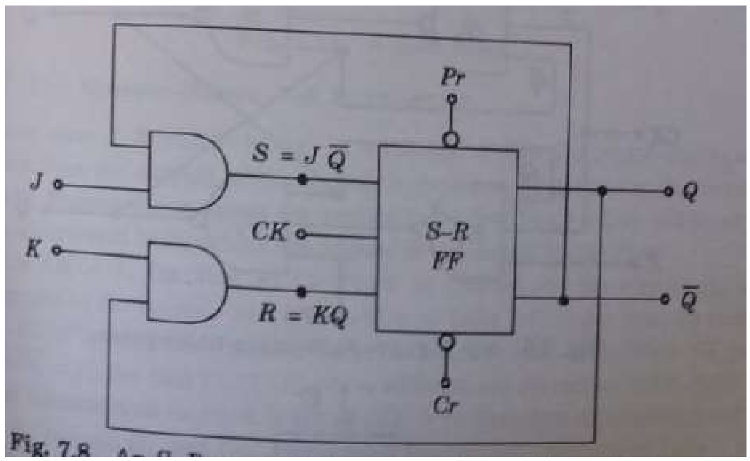
Sn	Rn	Qn+1
0	0	Qn
0	1	1
1	0	0
1	1	?

ii) JK Flip-Flop

The uncertainty in the state of an S-R flip-flop when Sn=Rn=1(fourth row of the truth table) can be eliminated by converting it into a J-K Flip-Flop. The data input are J and K which are ANDed with Qo and Q, respectively, to obtain S and R inputs, i.e.

S=J.Qo

R=K.Q



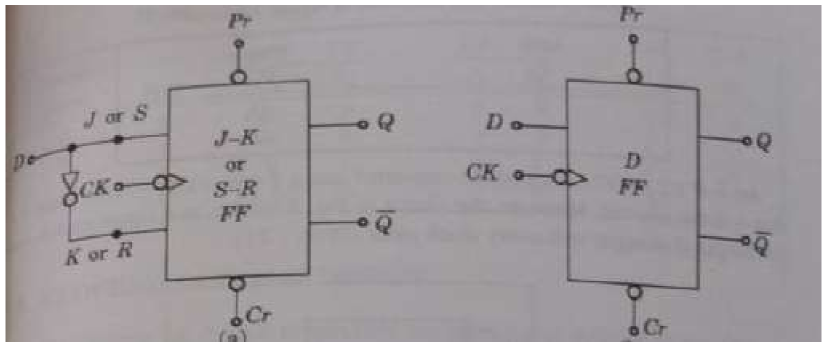
When the clock is LOW (CK=0), the flip-flops acts as a memory storage and the output does not depend upon the given input it remains same as that of the earlier value.

If the clock is HIGH (CK=1), the flip-flip operates and the output shows changes. The table represents the outputs for different input when the clock is HIGH.

Sn	Rn	Qn+1
0	0	Qn
0	1	1
1	0	0
1	1	Qno

iii) D Flip-Flop

If we use only the middle two rows of the truth table of the of S-R or J-K FLIP-FLOP, we obtain a D-type FLIP-FLOP as shown in Figure. It has only one input referred to as D-input.



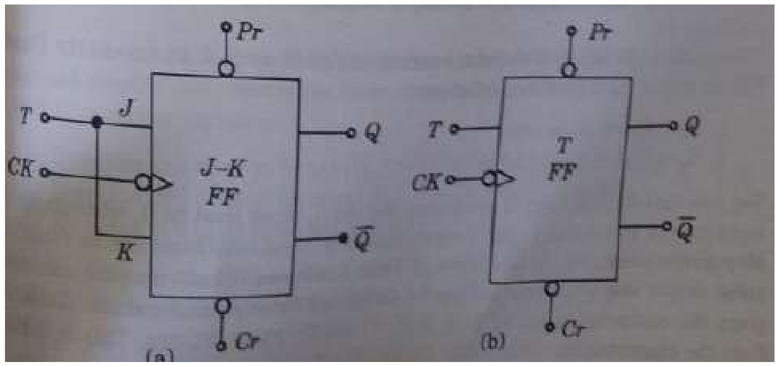
The truth table is given in figure.

Input D_n	Output Q_{n+1}
0	0
1	1

This is equivalent to saying that the input data appears at the output at the end of the clock pulse. Thus, the transfer of data from the input to the output is delayed and hence the name delay (D) FLIP-FLOP. The D-type FLIP-FLOP is either used as a delay device or as a latch to store 1-bit of binary information.

iv)<u>T-TYPE FLIP-FLOP</u>

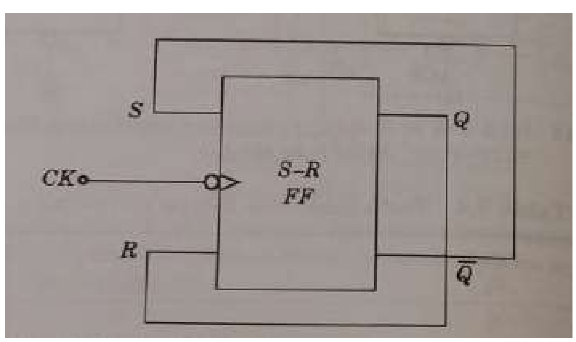
In a J-K FLIP-FLOP, if J=K, the resulting FLIP-FLOP is referred to as a T-type FLIP FLOP and is shown in figure. It has only one input, referred to as T-input.



The Truth Table is given in figure

Input T_n	Output Q_{n+1}
0	Q_n
1	$\bar{Q}_n$

A S-R FLIP-FLOP cannot be converted into a T-type FLIP-FLOP since S and R=1 is not allowed. However, the circuit in figure can act as a toggle switch, i.e the output changes with every clock pulse.



A shift register basically consists of several single bit "D-Type Data Latches", one for each data bit, either a logic "0" or a "1", connected together in a serial type daisy-chain arrangement so that the output from one data latch becomes the input of the next latch and so on.

Data bits may be fed in or out of a shift register serially, that is one after the other from either the left or the right direction, or all together at the same time in a parallel configuration.

The number of individual data latches required to make up a single **Shift Register** device is usually determined by the number of bits to be stored with the most common being 8-bits (one byte) wide constructed from eight individual data latches.

Shift Registers are used for data storage or for the movement of data and are therefore commonly used inside calculators or computers to store data such as two binary numbers before they are added together, or to convert the data from either a serial to parallel or parallel to serial format. The individual data latches that make up a single shift register are all driven by a common clock (Clk) signal making them synchronous
devices.

Shift register IC's are generally provided with a *clear* or *reset* connection so that they can be "SET" or "RESET" as required. Generally, shift registers operate in one of four different modes with the basic movement of data through a shift register being:

Serial-in to Parallel-out (SIPO) - the register is loaded with serial data, one bit at a time, with the stored data being available at the output in parallel form.

Serial-in to Serial-out (SISO) - the data is shifted serially "IN" and "OUT" of the register, one bit at a time in either a left or right direction under clock control.

Parallel-in to Serial-out (PISO) - the parallel data is loaded into the register simultaneously and is shifted out of the register serially one bit at a time under clock control.

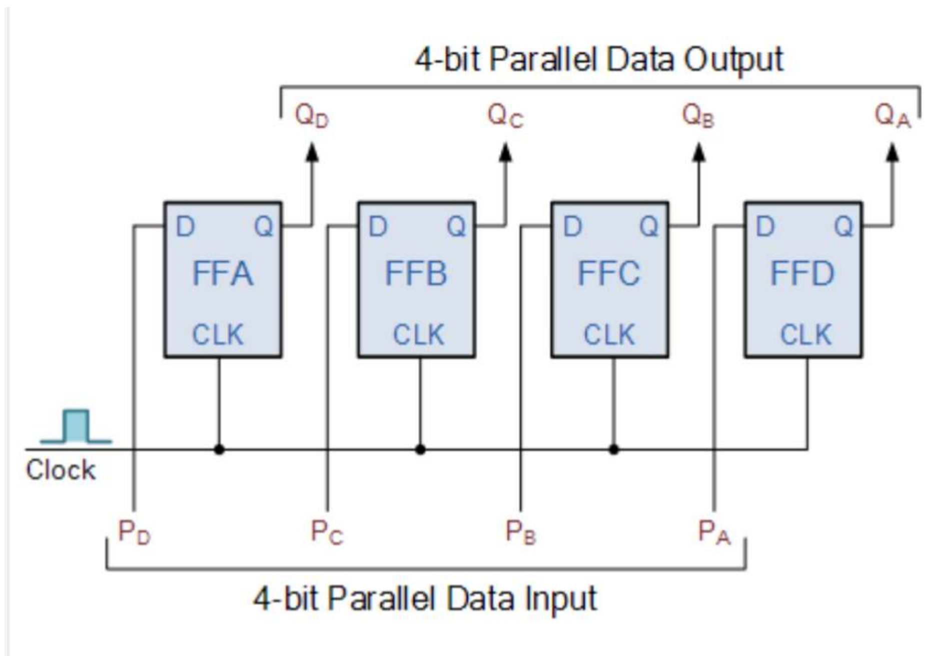
Parallel-in to Parallel-out (PIPO) - the parallel data is loaded simultaneously into the register, and transferred together to their respective outputs by the same clock pulse.

4.1 Parallel-in to Parallel-out Shift Register

The PIPO shift register is the simplest of the four configurations as it has only three connections, the parallel input (PI) which determines what enters the flip-flop, the parallel output (PO) and the sequencing clock signal (Clk).

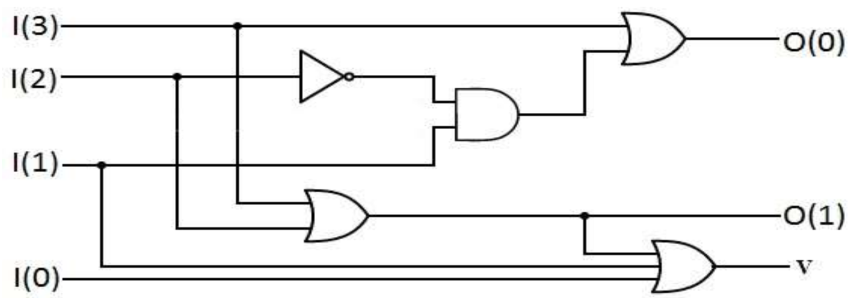
Similar to the Serial-in to Serial-out shift register, this type of register also acts as a temporary storage device or as a time delay device, with the amount of time delay being varied by the frequency of the clock pulses.

Also, in this type of register there are no interconnections between the individual flip-flops since no serial shifting of the data is required.



CHAPTER 5 PRIORITY ENCODER

A priority encoder is a circuit or algorithm that compresses multiple binary inputs into a smaller number of outputs. The output of a priority encoder is the binary representation of the original number starting from zero of the most significant input bit. They are often used to control interrupt requests by acting on the highest priority encoder.



A 4:2 Priority Encoder

If two or more inputs are given at the same time, the input having the highest priority will take precedence. An example of a single bit 4 to 2 encoder is shown, where highest priority inputs are to the left and “x” indicates an irrelevant value i.e. any input value there yields the same output since it is superseded by higher-priority input. The output V indicates if the input is valid.

4 to 2 Priority Encoder

I_3	I_2	I_1	I_0	O_1	O_0	V
0	0	0	0	x	x	0
0	0	0	1	0	0	1
0	0	1	x	0	1	1
0	1	x	x	1	0	1
1	x	x	x	1	1	1

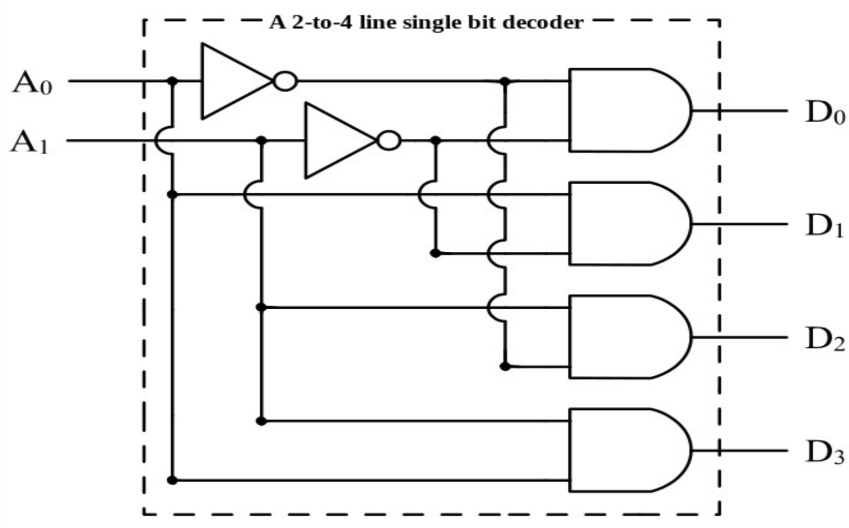
Priority encoder can be easily connected in arrays to make larger encoder, such as one 16-to-4 encoder made from six 4-to-2 priority encoder four 4-to-2 encoder having the signal source connected to their inputs, and the two remaining encoders take the output of the first four as input. The priority encoder is animprovement on a simple encoder circuit, in terms of handling all possible input configurations.

CHAPTER 6 BINARY DECODER

In digital electronics, a **binary decoder** is acombinational logic circuit that convertsbinary information from the n coded inputsto a maximum of 2n unique outputs. Theyare used in a wide variety of applications, including data demultiplexing, sevensegment displays, and memory addressdecoding.
There are several types of binary decoders,but in all cases a decoder is an electroniccircuit with multiple input and multipleoutput signals, which converts everyunique combination of input states to aspecific combination of output states. Inaddition to integer data inputs, somedecoders also have one or more "enable" inputs. When the enable input is negated(disabled), all decoder outputs are forced to their inactive states.Depending on its function, a binarydecoder will convert binary informationfrom n input signals to as many as 2nunique output signals. Some decodershave less than 2n output lines; in suchcases, at least one output pattern will berepeated for different input values.A binary decoder is usually implementedas either a stand-alone integrated circuit(IC) or as part of a more complex IC. In thelatter case the decoder may besynthesized by means of a hardwaredescription language such as VHDL orVerilog. Widely used decoders are oftenavailable in the form of standardized ICs.

6.1 Types of decoders

i)1-of-n decoder



Truth Table

A_1	A_0	D_3	D_2	D_1	D_0
0	0	0	0	0	1
0	1	0	0	1	0
1	0	0	1	0	0
1	1	1	0	0	0

Minterm Equations

$$D_0 = \overline{A_1} \cdot \overline{A_0}$$
$$D_1 = \overline{A_1} \cdot A_0$$
$$D_2 = A_1 \cdot \overline{A_0}$$
$$D_3 = A_1 \cdot A_0$$

A 1-of-n binary decoder has n output bits.This type of decoder asserts exactly one of its n output bits, or none of them, forevery integer input value. The "address" (bit number) of the activated output isspecified by the integer input value. Forexample, output bit number 0 is selectedwhen the integer value 0 is applied to the inputs.

Examples of this type of decoder include:

- A 2-to-4 line decoderactivates one of four output bits for each input value from 0 to 3 — the range of integer valuesthat can be expressed in two bits.

- A *3-to-8 line decoder* activates one ofeight output bits for each input value from 0 to 7 — the range of integer valuesthat can be expressed in three bits. Similarly, a *4-to-16 line decoder* activatesone of 16 outputs for each 4-bit input inthe integer range [0,15].

- A *BCD to decimal decoder* has ten outputbits. It accepts an input value consistingof a binary-coded decimal integer valueand activates one specific, uniqueoutput for every input value in the range[0,9]. All outputs are held inactive whena non-decimal value is applied to theinputs.

- A demultiplexer is a 1-of-n binarydecoder that is used to route a data bit to one of its n outputs while all otheroutputs remain inactive.

ii)Code translator

Code translators differ from 1-of-ndecoders in that multiple output bits may be active at the same time. An example ofthis is a *seven-segment decoder*, which converts an integer into the combinationof segment control signals needed to display the integer's value on a sevensegmentdisplay digit.One variant of seven-segment decoder isthe *BCD to seven-segment decoder*, whichtranslates a binary-coded decimal valueinto the corresponding segment controlsignals for input integer values 0 to 9. Thisdecoder function is available in standardICs such as the CMOS 4511.

A **relay** is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and retransmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

A type of relay that can handle the high power required to directly control an electric motor or other loads is called a contactor. Solid-state relays control power circuits with no moving parts, instead using a semiconductor device to perform switching. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called "protective relays".

Magnetic latching relays require one pulse of coil power to move their contacts in one direction, and another, redirected pulse to move them back. Repeated pulses from the same inputhave no effect. Magnetic latching relays are useful in applications whereinterrupted power should not be able to transition the contacts.

Magnetic latching relays can have eithersingle or dual coils. On a single coil device, the relay will operate in onedirection when power is applied with one polarity, and will reset when the polarityis reversed. On a dual coil device, when polarized voltage is applied to the resetcoil the contacts will transition. AC controlled magnetic latch relays havesingle coils that employ steering diodes to differentiate between operate andreset commands.

7.1 APPLICATION OF RELAY SWITCH

Relays are used wherever it is necessary to control a high power or high voltage circuit with a low power circuit, especially when galvanic isolation is desirable. The first application of relays was in long telegraph lines, where the weak signal received at an intermediate station could control a contact, regenerating the signalfor further transmission. High-voltage or high-current devices can be controlled with small, low voltage wiring and pilots switches. Operators can be isolated from the high voltage circuit. Low power devices such as microprocessors can drive relays to control electrical loads beyond their direct drive capability. In an automobile, a starter relay allows the high current of the cranking motor to be controlled with small wiring and contacts in the ignition key.

Electromechanical switching systems including Strowger and Crossbar telephone exchanges made extensive use of relays in ancillary control circuits. The Relay Automatic Telephone Company also manufactured telephone exchanges based solely on relay switching techniques designed by GotthilfAnsgariusBetulander. The first public relay based telephone exchange in the UK was installed in Fleetwood on 15 July 1922 and remained in service until 1959.

The use of relays for the logical control of complex switching systems like telephone exchanges was studied by Claude Shannon, who formalized the application of Boolean algebra to relay circuit design in A Symbolic Analysis of Relay and Switching Circuits. Relays can perform the basic operations of Boolean combinatorial logic. For example, the boolean AND function is realised by connecting normally open relay contacts in series, the OR function by connecting normally open contacts in parallel. Inversion of a logical input can be done with a normally closed contact. Relays were used for control of automated systems for machine tools and production lines. The Ladder programming language is often used for designing relay logic networks.

Early electro-mechanical computers such as the ARRA, Harvard Mark II, Zuse Z2, and Zuse Z3 used relays for logic and working registers. However, electronic devices proved faster and easier to use. Because relays are much more resistant than semiconductors to nuclear radiation, they are widely used in safetycritical logic, such as the control panels of radioactive waste-handling machinery. Electromechanical protective relays are used to detect overload and other faults on electrical lines by opening and closing circuit breakers.

7.2 RELAY APPLICATION CONSIDERATIONS

Selection of an appropriate relay for a particular application requires evaluation of many different factors:

- Number and type of contacts –normally open, normally closed, (double-throw)

- Contact sequence – "Make before Break" or "Break before Make". For example, the old style telephone exchanges required Make-before-break so that the connection didn't get dropped while dialing the number.

- Contact current rating – small relays switch a few amperes, large contactors are rated for up to 3000 amperes, alternating or direct current Contact voltage rating – typical control relays rated 300 VAC or 600 VAC, automotive types to 50 VDC, special high-voltage relays to about 15,000 V

- Operating lifetime, useful life – the number of times the relay can be expected to operate reliably. There is both a mechanical life and a contact life. The contact life is affected by the type of load switched. Breaking load current causes undesired arcing between the contacts, eventually leading to contacts that weld shut or contacts that fail due erosion by the arc.

- Coil voltage – machine-tool relays usually 24 VDC, 120 or 250 VAC, relays for switchgear may have 125 V or 250 VDC coils,

- Coil current - Minimum current required for reliable operation and minimum holding current, as well as effects of power dissipation on coil temperature, at various duty cycles. "Sensitive" relays operate on a few milliamperes

- Package/enclosure – open, touch-safe, double-voltage for isolation between circuits, explosion proof, outdoor, oil and splash resistant, washable for printed circuit board assembly

- Operating environment - minimum and maximum operating temperature and other environmental considerations such as effects of humidity and salt

- Assembly – Some relays feature a sticker that keeps the enclosure sealed to allow PCB post soldering cleaning, which is removed once assembly is complete.

- Mounting – sockets, plug board, rail mount, panel mount, through-panel mount, enclosure for mounting onwalls or equipment

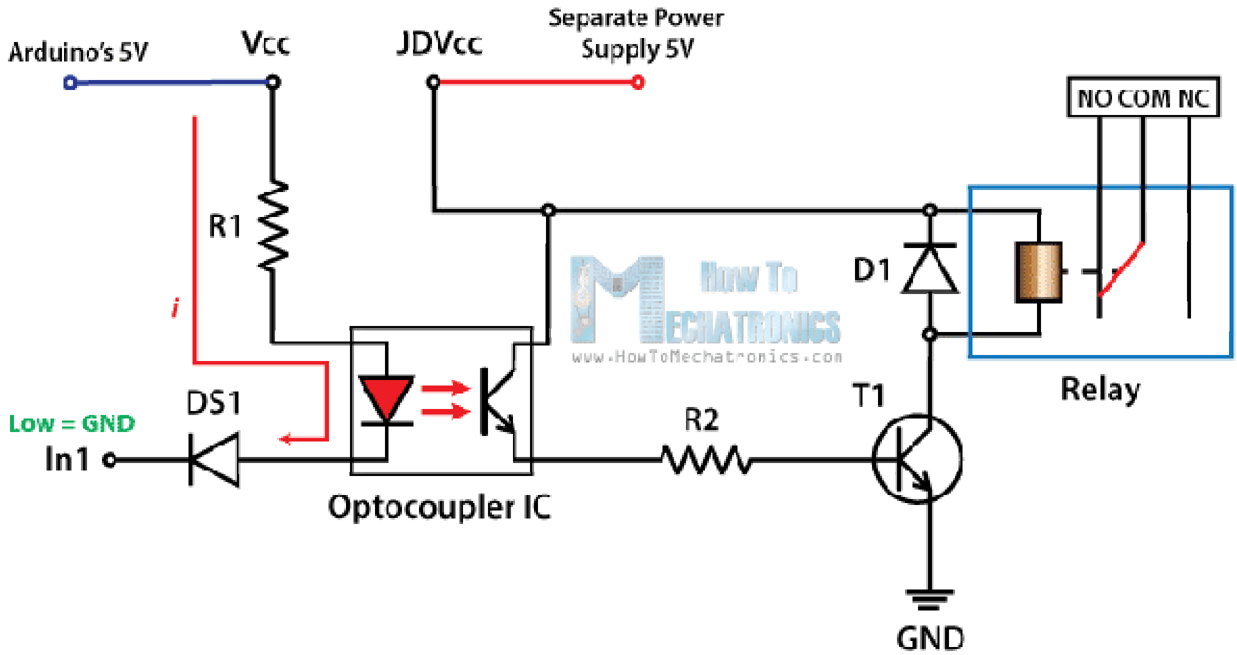
- Switching time – where high speed isrequired
- "Dry" contacts – when switching verylow level signals, special contact materials may be needed such as goldplatedcontactsContact protection – suppress arcingin very inductive circuits
- Coil protection – suppress the surgevoltage produced when switching the coil current
- Isolation between coil contacts
- Aerospace or radiation-resistanttesting, special quality assurance
- Expected mechanical loads due toacceleration – some relays used in aerospace applications are designedto function in shock loads of 50 *g* or more
- Size - smaller relays often resistmechanical vibration and shock better than larger relays, because of the lowerinertia of the moving parts and the higher natural frequencies of smallerparts. Larger relays often handlehigher voltage and current than smaller relays.
- Accessories such as timers, auxiliarycontacts, pilot lamps, and test buttons
- Regulatory approvals
- Stray magnetic linkage between coilsof adjacent relays on a printed circuit board.

There are many considerations involvedin the correct selection of a control relay for a particular application. Theseconsiderations include factors such asspeed of operation, sensitivity, andhysteresis. Although typical controlrelays operate in the 5 ms to 20 msrange, relays with switching speeds asfast as 100 us are available. Reed relayswhich are actuated by low currents andswitch fast are suitable for controllingsmall currents.

As with any switch, the contact current(unrelated to the coil current) must not exceed a given value to avoid damage. Inhigh-inductance circuits such as motors,

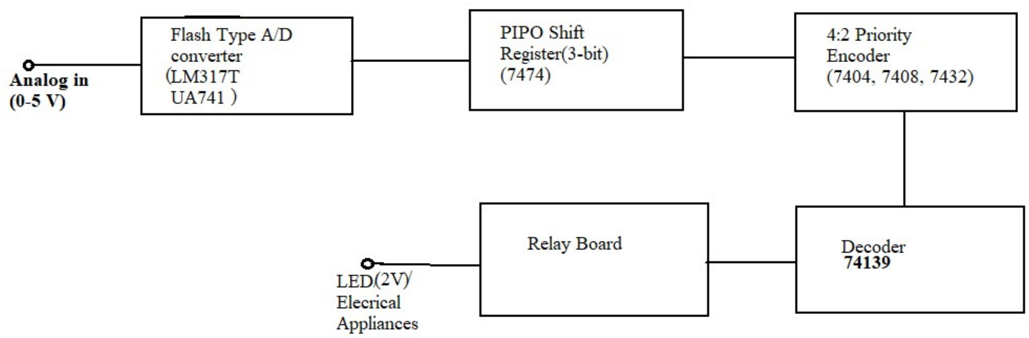
other issues must be addressed. Whenan inductance is connected to a powersource, an input surge current orelectromotor starting current larger thanthe steady-state current exists. When thecircuit is broken, the current cannotchange instantaneously, which creates apotentially damaging arc across the separating contacts.
Consequently, for relays used to controlinductive loads, we must specify the maximum current that may flow throughthe relay contacts when it actuates, the *make rating*; the continuous rating; andthe *break rating*. The make rating may be several times larger than the continuousrating, which is itself larger than the break rating.

Arcing
Switching while "wet" (under load)causes undesired arcing between thecontacts, eventually leading to contactsthat weld shut or contacts that fail due toa buildup of surface damage caused bythe destructive arc energy.Inside the 1ESS switch matrix switch andcertain other high-reliability designs, thereed switches are always switched "dry"(without load) to avoid that problem,leading to much longer contact life.
Without adequate contact protection, theoccurrence of electric current arcingcauses significant degradation of thecontacts, which suffer significant and visible damage. Every time the relaycontacts open or close under load, an electrical arc can occur between thecontacts of the relay, either a *break* arc (when opening), or a *make* / *bounce* arc(when closing). In many situations, the *break* arc is more energetic and thusmore destructive, in particular with resistive-type loads. However, inductiveloads can cause more destructive *make* arcs. For example, with standard electricmotors, the start-up (inrush) current tends to be much greater than therunning current. This translates into significant *make* arcs.
During an arc event, the heat energycontained in the electrical arc is very high (tens of thousands of degreesFahrenheit), causing the metal on thecontact surfaces to melt, pool, andmigrate with the current. The extremelyhigh temperature of the arc cracks thesurrounding gas molecules, creatingozone, carbon monoxide, and othercompounds. Over time, the arc energyslowly destroys the contact metal, causing some material to escape into theair as fine particulate matter. This action causes the material in the contacts todegrade, resulting in device failure. This contact degradation drastically limits theoverall life of a relay to a range of about 10,000 to 100,000 operations, a level farbelow the mechanical life of the same device, which can be in excess of 20million operations.



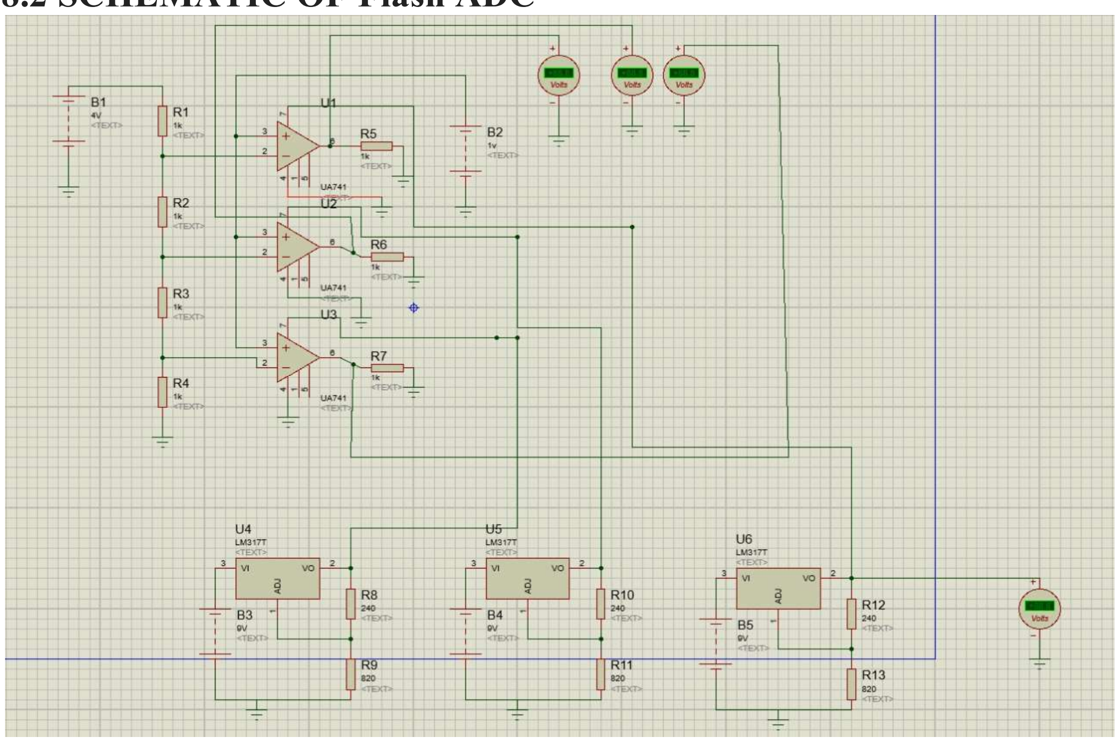
Arduino's 5V
Vcc
JDVcc
Separate Power Supply 5V
NO COM NC
R1
D1
i
Relay
Low = GND
DS1
In1
R2
T1
Optocoupler IC
GND
How To Mechatronics
www.HowToMechatronics.com

8.1 BLOCK DIAGRAM

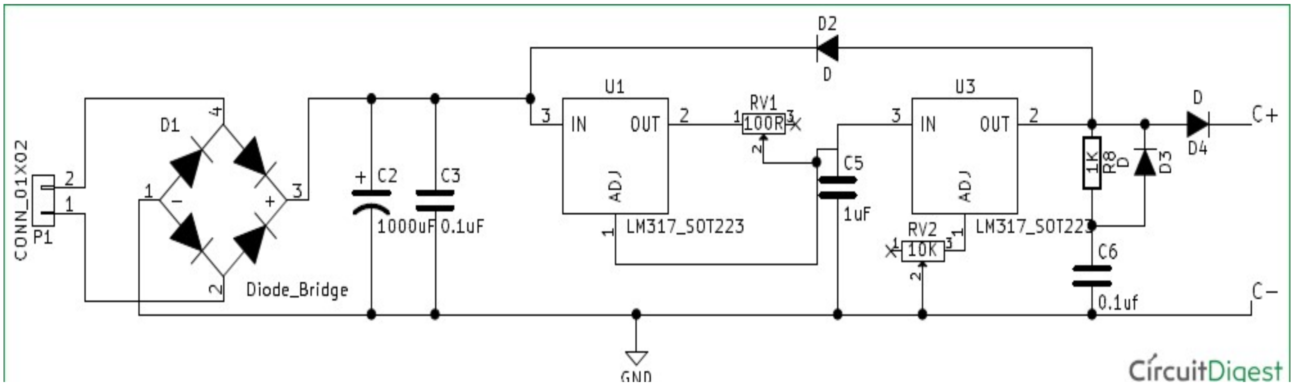


Block Diagram of project "Home automation using A/D converter"

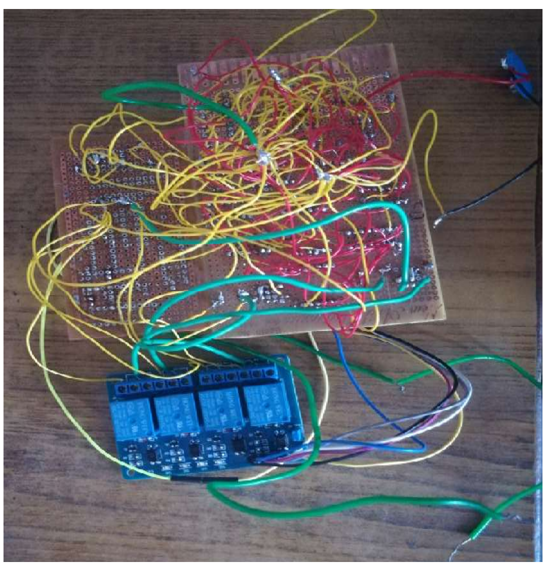
8.2 SCHEMATIC OF Flash ADC

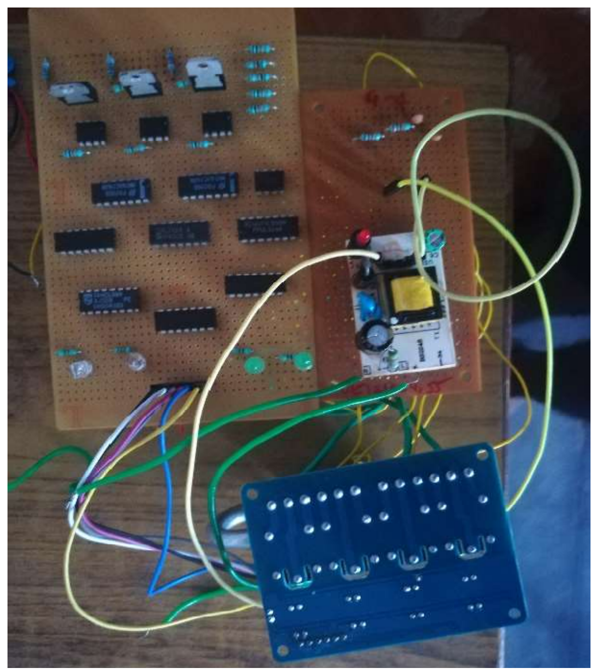


8.3 SCHEMATIC OF RECTIFIER



8.4 CIRCUIT ON PCB BOARD





CHAPTER 9 WORKING

This project is divides into 5 different stages which are integrated together to perform the required task.

1.First stage comprises of the Flash ADC, this is built up of a resistive network which supply the necessary analog voltages to the three op-amps and are connected to the inverting terminal of the op-amps. The noninverting terminals of the three op-amps are connected together and then to a supply which provides the voltage to be converted. In this ADC the op-amps are used in open loop mode. The +VCC of all the three op-amps are given about 6v from the LM317T power supplyand the -VCC terminalsare grounded. The 9v battery power ups the three power supply ic's.

2.Second stage consists of parallel input parallel output register constructed using three D flipflops available in the form of ic 7474. This register stores the bits generated from the ADC after conversion.

3.Third stage consist of a priority encoder that takes the bits received from the register and convert them into the proper binary format. For example if the voltage supply gives voltage between 0-1v the bits generated by the ADC will be 000 which will be stored in register and passed to the encoder which converts it into 00 which is the binary equivalent of 0v.Similary if the supply gives voltage greater than 3v then the ADC will give an output of 111 which will be converted by the encoder into 11 which is a binary equivalent of 3.

4.Fourth stage consist of a decoder which takes the binary equivalent and gives a high voltage on the the corresponding output pins of the decoder.

5.Fifth stage consist of a relay board which receives the output of the decoder and completes the external circuit corresponding to the pin which receives a high signal from the decoder.

In this circuit all the leds, ic's and the resistive network connected to the input of the ADC are powered by a rectifier circuit which provides the necessary volatges and current to the ic's without burning them.

10.1 WHAT IS SWITCH AUTOMATION

Home automation system is one of the automation systems, which is used for controlling automatically (sometimes remotely) with the help of various control systems. The home automation for controlling the indoor & outdoor lights, heat, ventilation, air conditioning in the house, to lock gates, to control electrical & electronic appliances and so on using various control systems with app.

10.2 APPLICATONS OF HOME AUTOMATION

- The inefficiency of operation of conventional wall switches can be overwhelmed using various systems (without using conventional switching methods).
- The loss of power can be reduced and manpower required for home automation is very conventional methods.
- The IR, RF, android application, Arduino, Bluetooth, DTMF, etc., based home automation system which are efficient, provides ease of operation.
- Provides safety from electrical power short circuits while using conventional wall switches to operate.
- Home automation system with automated door locking and security cameras facilitates more security.
- By using a home automation system, we can save a lot of time to operate home appliances from anywhere (wasting time to move from office to home for just unlocking door for family members to enter the home).