KALINGA INSTITUTE OF INDUSTRIAL TECHNOLOGY (KIIT)

Deemed to be University U/S 3 of the UGC Act, 1956

Automatic Night Lamp with Morning Alarm

Minor Project Report

Submitted in partial fulfilment of the requirement for the degree of

BACHELOR IN TECHNOLOGY

IN

ELECTRONICS AND TELECOMMUNICATION ENGINEERING

BY

LIVIA DEY	1504254
NISHANT RANJAN	1504262
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SIDDHANT SINGH	1504285
SOHAM ASIM PAKHIRA	1504286

Under the guidance of

PROF. SATYADEEP DAS

School of Electronics Engineering

KALINGA INSTITUTE OF INDUSTRIAL TECHNOLOGY

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BHUBANESWAR

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CERTIFICATE

This is to be certified that

Ms. Livia Dey	**1504254**
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Students of 3rd Year B.Tech., VI semester of School of Electronics Engineering, Kalinga Institute of Industrial Technology, Bhubaneswar have completed their Minor Project entitled

Automatic Night Lamp with Morning Alarm

They have submitted their Project Report for the partial fulfilment of the curriculum of the Degree of Bachelor of Electronics Engineering from **Kalinga Institute of Industrial Technology, Bhubaneswar.**

Signature of the supervisor
Prof. Satyadeep Das
School of Electronics Engineering
Kalinga Institute of Industrial Technology

The project was evaluated by us on____________________

Examiner1 Examiner3

Examiner2 Examiner4

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We would like to thank **Kalinga Institute of Industrial Technology (deemed to be University)** for giving us the opportunity to work upon this project.

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While working upon this project we got a chance to research upon it and in the process got an opportunity to learn a lot of new things. All the knowledge gained through this project will stay with us forever and help us to become better engineers in the future.

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ABSTRACT

In our day-to-day life, we are used to several automatic electrical and electronics appliances such as automatic cooker, temperature based automatic speed adjustable fan, automatic iron box, automatic washing machines, automatic coolers, and so on. During night time we are used to switch on night lamps or bed lamps and wake up with an alarm set in the morning at a specific time.

But these conventional night lamps need manual control for switching on and off at night time and day time, respectively. [1]

Similarly, setting an alarm is a basic thing required for maintaining our day-to-day activities for proper time scheduling.

Owing to human ambiguity, we sometimes naturally tend to forget these basic things like switching off bed lamps and setting alarms, which may cause power loss and improper time schedule. [3]

Thus, here in this report we discuss about an automatic night lamp with alarm circuit. Primarily, we must understand what is an automatic night lamp.

Automatic night lamp is a simple electronic circuit that is used for switching on the night lamp during night time and switching off the night lamp during daytime, automatically. [1]

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The automatic night lamp circuit turns on a night lamp when bedroom light is switched off. The lamp remains ‘on’ until the light sensor senses daylight in the morning. A super-bright white LED is used as the night lamp. It gives bright and cool light in the room. When the sensor detects the daylight in the morning, a melodious morning alarm sounds. [1]

The circuit utilises light dependent resistor(LDRs) for sensing darkness and light in the room. The circuit is designed around the popular timer IC NE555, which is configured as Monostable. NE555 is activated by a low-pulse applied to its trigger pin 2. Once triggered, output pin 3 of NE555 goes high and remains in that position until timer is triggered again at its pin 2. The musical tone of the alarm is generated by IC UM66. [4]

The circuit is powered from a standard 0-9V transformer. Diodes D1 through D4 rectify the AC voltage and the resulting DC voltage is smoothed by C1. Regulator IC 7806 gives regulated 6V DC to the circuit. A battery backup is provided to power the circuit when mains fails. When mains supply is available, the 9V rechargeable battery charges via diode D5 and resistor R1 with a reasonably constant current. In the event of mains failure, the battery automatically takes up the load without any delay. Diode D5 prevents the battery from discharging backwards following the mains failure and diode D6 provides current path from the battery. [1]

2.

COMPONENTS

SL.NO	COMPONENT NAME	SPECIFICATION	QUANTITY
1.	Transformer	9V,50 Hz,500mA DC	1
2.	Diode	1N4007	6nos
3.	Zener Diode	3.3V,0.5W	1
4.	Resistors	R1, R7-1KΩ, R2-R5-150KΩ, R3-120KΩ, R4-220Ω, R6-580Ω, R8-560Ω	1 Each
5.	Capacitors	C1-1000 µF, C2, C3-0.01 µF	1 Each
6.	IC	IC1-7806(Voltage Regulator), IC2-NE555(Timer) IC3-UM66(3-pin IC)	1 Each
7.	Transistor	T1, T2-BC548	1 Each
8.	Speaker	8 Ω,4.5W	1
9.	Switch		1
10.	LED		1
11.	LDR		2
12.	Bread Board		1
13.	Connecting Wires		As required

Table 1. Components

3.
THEORY

3.1 IC 7806

3.1.1 General Description: -

7806 Voltage regulator is a type of self-contained fixed linear voltage regulator integrated circuit. The IC belongs to 7806 voltage regulator family which is commonly used as the regulated power supply in electronic circuits. The 7806 voltage regulator IC is easy-to-use and available at a very low cost.

7806 is a 3 terminal positive voltage regulator designed with built-in internal current limiting, thermal shutdown and safe-area compensation for maximum flexibility and safety. With adequate heat sinking provided, 7806 can deliver up to 1.5A output current. 7806 can be used as a fixed voltage regulator in a wide range of applications, where local voltage regulation is preferred for elimination of noise and distribution problems associated with single-point regulation. 7806 can also be used to obtain adjustable output voltage and current by adding external compensation. [5]

3.1.2 Pin Diagram: -

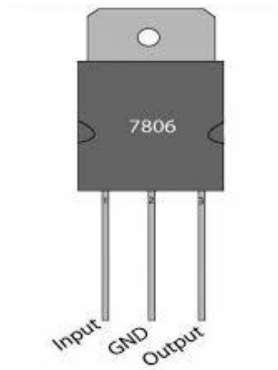


Figure 1. IC7806

3.1.3 Pin Description: -

Pin No.	Function	Name
1	Input Voltage(5V-18V)	Input
2	Ground(0V)	Ground
3	Regulated Output 6V(5.75V-6.25V)	Output

Table 2. Pin Description of IC7806

3.1.4 Advantages: -

- 7806 voltage regulator IC does not require any component to balance or saturate their output voltage.
- The 7806 IC has a built-in protection from the high current. There is a heat-sink with the common ground connected which is helpful in order to prevent our regulator IC from overheating and short-circuits, making it compromising in most applications. [5]

3.2 NE555 Timer

3.2.1 General Description: -

The NE555 is a highly stable device for generating accurate time delays or oscillations. Additional terminals are provided for triggering or resetting if desired. In the time delay mode of operation, the time is precisely controlled by one external resistor and capacitor. For stable operation as an oscillator, the free running frequency and duty cycle are accurately controlled with two external resistors and one capacitor. The circuit may be triggered and reset on falling waveforms and the output circuit can source or sink up to 200mA. [6]

3.2.2 Features: -

Some of the major features NE555 timer are: -

- It operates from a wide range of power ranging from +5 volts to +18 volts supply voltage.
- Sinking or sourcing 200 mA of load current.
- The external components should be selected properly so that the timing intervals can be made into several minutes along with the frequencies exceeding several hundred kilo hertz.
- The output of a 555 timer can drive a transistor-transistor logic (TTL) due to its high current output.
- It has a temperature stability of 50 parts per million (ppm) per degree Celsius change in temperature which is equivalent to 0.005 %/ °C.
- The duty cycle of the timer is adjustable.
- Also, the maximum power dissipation per package is 600 mW and its trigger and reset inputs has logic compatibility. [6]

3.2.3 Pin Diagram: -

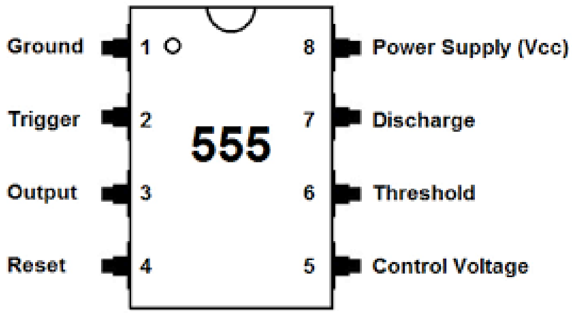


Figure 2. NE555 Timer

3.2.4 Pin Description: -

Pin	Name	Purpose
1	Ground	Ground reference voltage, low level (0 V)
2	Trigger	The OUT pin goes high and a timing interval starts when this input falls below $\frac{1}{2}$ of CTRL voltage (which is typically $\frac{1}{3}Vcc$, CTRL being $\frac{2}{3}Vcc$ by default if CTRL is left open).
3	Output	This output is driven to approximately 1.7 V below +Vcc, or to GND.

4	Reset	A timing interval may be reset by driving this input to GND, but the timing does not begin again until RESET rises above approximately 0.7 volts.
5	Control voltage	Provides “control” access to the internal voltage divider
6	Threshold	The timing (OUT high) interval ends when the voltage at threshold is greater than that at CTRL
7	Discharge	Open collector output which may discharge a capacitor between intervals. In phase with output.
8	Power Supply	Positive supply voltage, which is usually between 3 and 15 V depending on the variation.

Table 3. Pin Description of NE555 Timer

3.2.5 Monostable Operation: -

In this mode of operation, the timer functions as a one-shot. The external capacitor is initially held discharged by a transistor inside the timer. Upon application of a negative trigger pulse of less than $\frac{1}{3}Vcc$ to pin 2, the flip flop is set which both releases the short circuit across the capacitor and drives the output high. The voltage across the capacitor then increases exponentially for a period of t=1.1R,at the end of which time the voltage equals $\frac{2}{3}Vcc$. The comparator then resets the flip-flop which in turn discharges the capacitor and drives the output to its low state.

Since the charge and the threshold level of the comparator both directly proportional to supply voltage, the timing interval is independent of supply. [7]

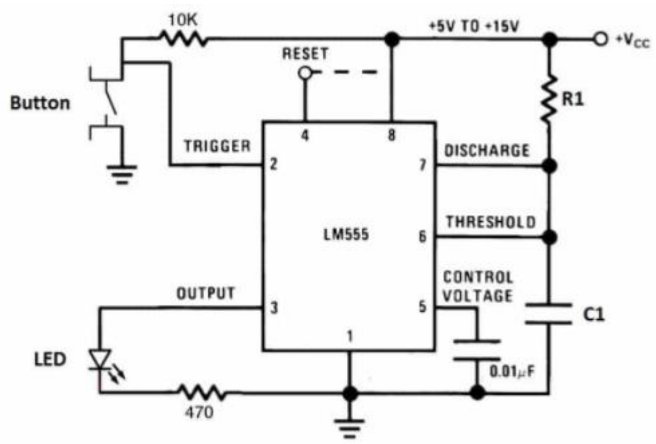


Figure 3. Monostable Mode

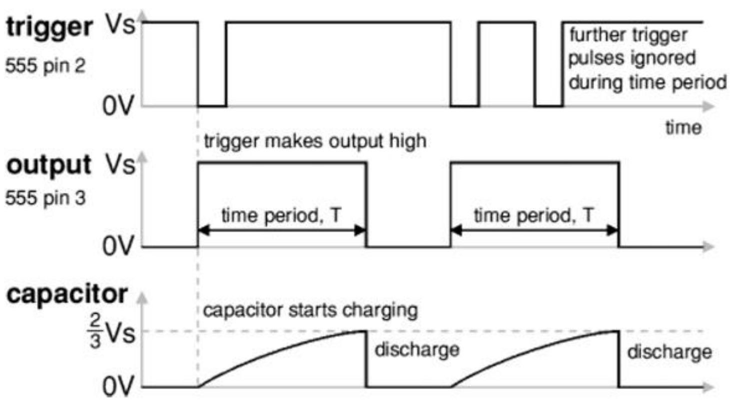


Figure 4. Waveform generated in Monostable Mode of operation.

3.3 Music Generator UM66

3.3.1 General Description: -

UM66 is a melody generating IC commonly used in calling bell, phone, toys, musical bell in doors, home security alarm systems, burglar alarms etc. It is a three pin IC that looks like a transistor. Its first pin is ground, second is Vcc and the third is the melody output. Supply voltage that can be given to the IC is in the range of 1.5V- 4.5V. These are CMOS ICs and have very small power consumption. Melody generator will reset when the power is turned on and then the melody begins from the first note.

The melody generator has an inbuilt beat and tone generator. The time base for beat and tone generator is an inbuilt oscillator. Tone generator and beat generator are programmed divider. Tone generator produces certain frequency. These frequencies are a factor of the oscillator frequency. Beat generator contains 15 available beats. Of these, four beats can be selected. It has a 62 notes ROM to play music. A set of 4 bits controls the scale code while 2 bits control the rhythm code. [8]

3.3.2 Features: -

1) 62 Note ROM Memory
2) Voltage rating: 1.3V to 3.3V
3) Power on reset

3.3.3 Pin Diagram: -

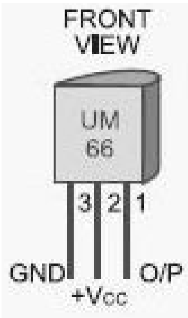


Figure 5. UM66

3.3.4 Pin Description: -

Pin No.	Designation	Description
1	Output	Emitter
2	+Vcc	Base
3	Ground	Collector

Table 4. Pin Description of UM66

3.4 TRANSISTOR BC548

3.4.1 Description: -

BC548 is general purpose silicon, NPN, bipolar junction transistor. It is used for amplification and switching purposes. The current gain may vary between 110 and 800. The maximum DC current gain is 800.

Its equivalent transistors are 2N3904 and 2SC1815. These equivalent transistors however have different lead assignments. The variants of BC548 are 548A, 548B and 548C which vary in range of current gain and other characteristics.

The transistor terminals require a fixed DC voltage to operate in the desired region of its characteristic curves. This is known as the biasing. For amplification applications, the transistor is biased such that it is partly on for all input conditions. The input signal at base is amplified and taken at the emitter. BC548 is used in common emitter configuration for amplifiers. The voltage divider is the commonly used biasing mode. For switching applications, transistor is biased so that it remains fully on if there is a signal at its base. In the absence of base signal, it gets completely off. [4]

3.4.2 Features: -

- Low current (max 100mA)
- Low voltage (max 65V)

3.4.3 Pin diagram: -

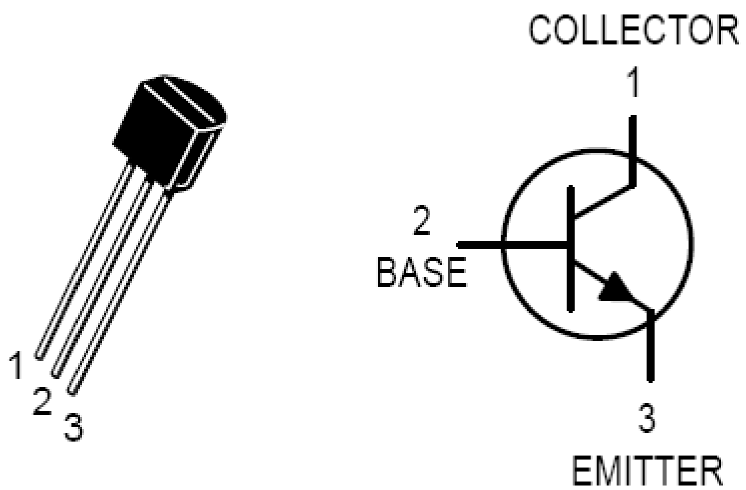


Figure 6. Transistor BC548

3.4.4 Application: -

- General purpose switching and amplification.

3.5 Light Dependent Resistor(LDR)

3.5.1 General Description: -

A Light Dependent Resistor (LDR) or a photo resistor is a device whose resistivity is a function of the incident electromagnetic radiation. Hence, they are light sensitive devices. They are also called as photo conductors, photo conductive cells or simply photocells. They are made up of semiconductor materials having high resistance. There are many different symbols used to indicate a LDR, one of the most commonly used symbol is shown in the figure below. The arrow indicates light falling on it. [8]

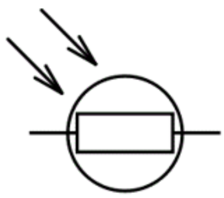


Figure 7. LDR Symbol

3.5.2 Working: -

A **light dependent resistor** works on the principle of photo conductivity. Photo conductivity is an optical phenomenon in which the materials conductivity is increased when light is absorbed by the material. When light falls i.e. when the photons fall on the device, the electrons in the valence band of the semiconductor material are excited to the conduction band. These photons in the incident light should have energy greater than the band gap of the semiconductor material to make the electrons jump from the valence band to the conduction band. Hence when light having enough energy strikes on the device, more and more electrons are excited to the conduction band which results in large number of charge carriers. The result of this process is more and more current starts flowing through the device when the circuit is closed and hence it is said that the resistance of the device has been decreased. This is the most common working principle of LDR. [8]

3.5.3 Characteristics: -

LDRs are light dependent devices whose resistance decreases when light falls on them and that is increased in the dark. When a light dependent resistor is kept in dark, its resistance is very high. This resistance is called as dark resistance. It can be as high as 10^{12} Ω and if the device is allowed to absorb light its resistance will be decreased drastically. If a constant voltage is applied to it and intensity of light is increased the current starts increasing. Figure below shows resistance vs. illumination curve for a particular LDR. [9]

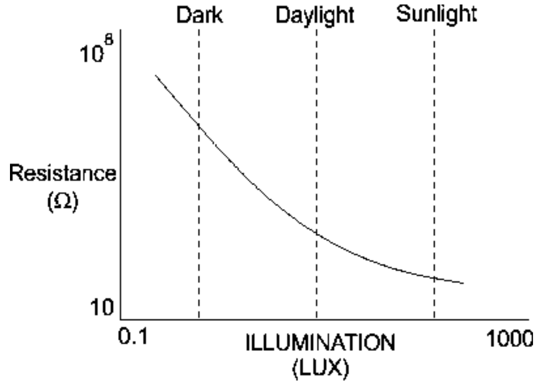


Figure 8. Resistance vs Illumination curve for LDR

Photocells or LDRs are nonlinear devices. There sensitivity varies with the wavelength of light incident on them. Some photocells might not at all response to a certain range of wavelengths. Based on the material used different cells have different spectral response curves.

When light is incident on a photocell it usually takes about 8 to 12 ms for the change in resistance to take place, while it takes one or more seconds for the resistance to rise back again to its initial value after removal of light. This phenomenon is called as resistance recovery rate. This property is used in audio compressors.

Also, LDR**'s** are less sensitive than photo diodes and phototransistor. (A photo diode and a photocell (LDR) are not the same, a photo-diode is a PN junction semiconductor device that converts light to electricity, whereas a photocell is a passive device, there is no PN junction in this nor it "converts" light to electricity). [9]

3.5.4 Types of LDRs: -

Based on the materials used they are classified as:

1. **Intrinsic photo resistors (Un-doped semiconductor):** These are made of pure semiconductor materials such as silicon or germanium. Electrons get excited from valence band to conduction band when photons of enough energy fall on it and number charge carriers is increased.
2. **Extrinsic photo resistors:** These are semiconductor materials doped with impurities which are called as dopants. Theses dopants create new energy bands above the valence band which are filled with electrons. Hence this reduces the band gap and less energy is required in exciting them. Extrinsic photo resistors are generally used for long wavelengths. [8]

3.5.5 Applications: -

LDR**s** have low cost and a simple structure. They are often used as light sensors. They are used when there is a need to detect absences or presences of light like in a camera light meter. These are used in street lamps, alarm clock, burglar alarm circuits, light intensity meters, for counting the packages moving on a conveyor belt, etc. [8]

3.6 DIODES

3.6.1 Introduction: -

A diode is a device which only allows unidirectional flow of current if operated within a rated specified voltage level. A diode only blocks current in the reverse direction while the reverse voltage is within a limited range otherwise reverse barrier breaks and the voltage at which this breakdown occurs is called reverse breakdown voltage. The diode acts as a valve in the electronic and electrical circuit. A P-N junction is the simplest form of the diode which behaves as ideally short circuit when it is in forward biased and behaves as ideally open circuit when it is in the reverse bias condition. Besides simple PN junction diodes, there are different types of diodes although the fundamental principles are more or less same. So a particular arrangement of diodes can convert AC to pulsating DC, and hence, it is sometimes also called as a rectifier.[7]

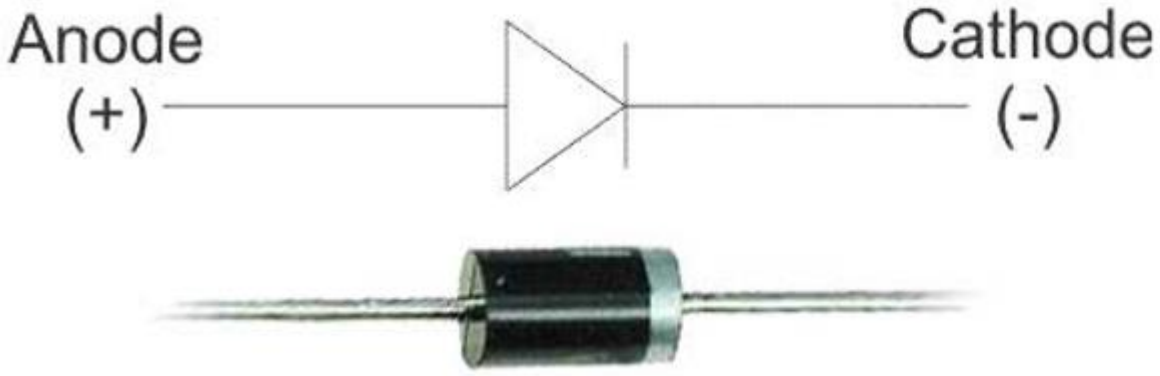


Figure 9. Diode

3.6.2 Characteristics: -

<u>FORWARD BIASING CHARACTERISTICS: -</u>

When, P terminal is more positive as compared to N-terminal i.e. P-terminal connected to positive terminal of battery and N-terminal connected to negative terminal of battery, it is said to be forward biased.

Positive terminal of the battery repels majority carriers, holes, in P-region and negative terminal repels electrons in the N-region and push them towards the junction. This result in increase in concentration of charge carriers near junction, recombination takes place and width of depletion region decreases. As forward bias voltage is raised depletion region continues to reduce in width, and more and more carriers recombine. This results in exponential rise of current. [9]

<u>REVERSE BIASING CHARACTERISTICS: -</u>

In reverse biasing P- terminal is connected to negative terminal of the battery and N-terminal to positive terminal of battery. Thus applied voltage makes N-side more positive than P-side.

Negative terminal of the battery attracts majority carriers, holes, in P-region and positive terminal attracts electrons in the N-region and pull them away from the junction. This result in decrease in concentration of charge carriers near junction and width of depletion region increases. A small amount of current flow due to minority carriers, called as reverse bias current or leakage current. As reverse bias voltage is raised depletion region continues to increase in width and no current flows. It can be concluded that diode acts only when forward biased. Operation of diodes can be summarized in form of I-V **diode characteristics** graph.[9]

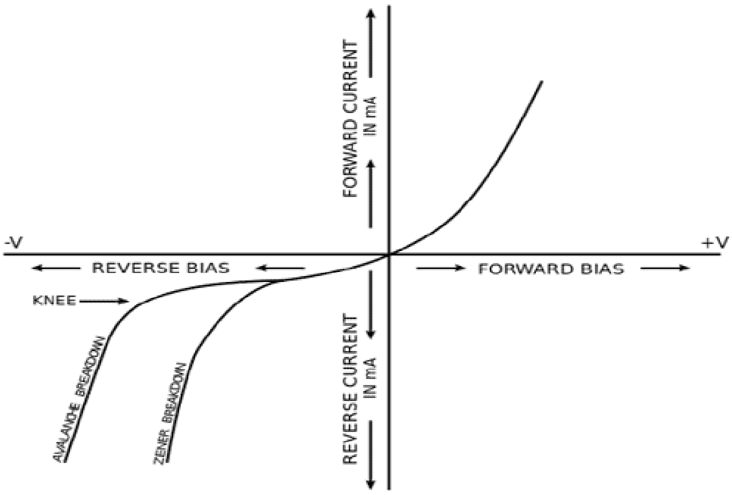


Figure 10. I-V CHARACTERISTICS

As reverse bias voltage is further raised, depletion region width increases and a point comes when junction breaks down. This results in large flow of current. Breakdown is the knee of **diode characteristics** curve. Junction breakdown takes place due to two phenomena:

- **Avalanche Breakdown (for V > 5V)**

Under very high reverse bias voltage kinetic energy of minority carriers become so large that they knock out electrons from covalent bonds, which in turn knock more electrons and this cycle continues until and unless junction breakdowns. [10]

- **Zener Effect (for V < 5V)**

Under reverse bias voltage junction barrier tends to increase with increase in bias voltage. This results in very high static electric field at the junction. This static electric field breaks covalent bond and set minority carriers free which contributes to reverse current. Current increases abruptly and junction breaks down. [10]

3.7 ZENER DIODES

3.7.1 Introduction: -

A normal p-n junction diode allows electric current only in forward biased condition. When forward biased voltage is applied to the p-n junction diode, it allows large amount of electric current and blocks only a small amount of electric current. Hence, a forward biased p-n junction diode offer only a small resistance to the electric current. [11]

When reverse biased voltage is applied to the p-n junction diode, it blocks large amount of electric current and allows only a small amount of electric current. Hence, a reverse biased p-n junction diode offer large resistance to the electric current.

If reverse biased voltage applied to the p-n junction diode is highly increased, a sudden rise in current occurs. At this point, a small increase in voltage will rapidly increases the electric current. This sudden rise in electric current causes a junction breakdown called zener or avalanche breakdown. The voltage at which zener breakdown occurs is called zener voltage and the sudden increase in current is called zener current. [9]

A normal p-n junction diode does not operate in breakdown region because the excess current permanently damages the diode. Normal p-n junction diodes are not designed to operate in reverse breakdown region. Therefore, a normal p-n junction diode does not operate in reverse breakdown region.

A Zener diode is a special type of device designed to operate in the Zener breakdown region. Zener diodes acts like normal p-n junction diodes under forward biased condition. When forward biased voltage is applied to the zener diode it allows large amount of electric current and blocks only a small amount of electric current.

Zener diode is heavily doped than the normal p-n junction diode. Hence, it has very thin depletion region. Therefore, zener diodes allow more electric current than the normal p-n junction diodes. [9]

Zener diode allows electric current in forward direction like a normal diode but also allows electric current in the reverse direction if the applied reverse voltage is greater than the zener voltage. Zener diode is always connected in reverse direction because it is specifically designed to work in reverse direction.

A zener diode is a p-n junction semiconductor device designed to operate in the reverse breakdown region. The breakdown voltage of a zener diode is carefully set by controlling the doping level during manufacture.

The name zener diode was named after the American physicist Clarence Melvin Zener who discovered the zener effect. Zener diodes are the basic building blocks of electronic circuits. They are widely used in all kinds of electronic equipment's. Zener diodes are mainly used to protect electronic circuits from over voltage.

[9]

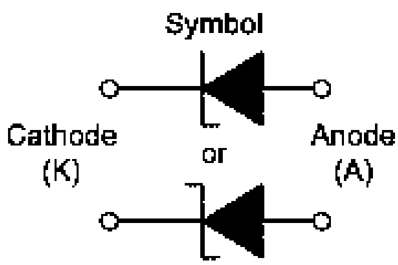


Figure 11. Zener Diode

3.7.2 Characteristics: -

The VI characteristics of a zener diode is shown in the below figure. When forward biased voltage is applied to the zener diode, it works like a normal diode. However, when reverse biased voltage is applied to the zener diode, it works in different manner.

When reverse biased voltage is applied to a zener diode, it allows only a small amount of leakage current until the voltage is less than zener voltage. When reverse biased voltage applied to the zener diode reaches zener voltage, it starts allowing large amount of electric current. At this point, a small increase in reverse voltage will rapidly increases the electric current. Because of this sudden rise in electric current, breakdown occurs called zener breakdown. However, zener diode exhibits a controlled breakdown that does damage the device.

The zener breakdown voltage of the zener diode is depends on the amount of doping applied. If the diode is heavily doped, zener breakdown occurs at low reverse voltages. On the other hand, if the diode is lightly doped, the zener breakdown occurs at high reverse voltages. Zener diodes are available with zener voltages in the range of 1.8V to 400V. [11]

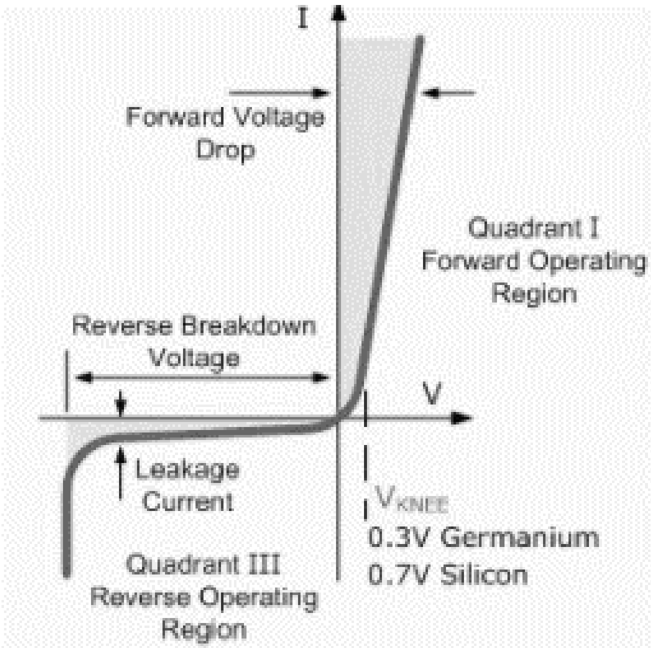


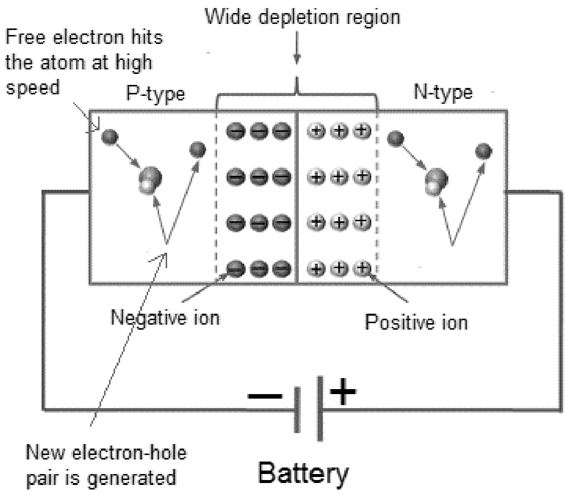
Figure 12. I-V CHARACTERISTICS

There are two types of reverse breakdown regions in a zener diode:

- **Avalanche Breakdown**

The avalanche breakdown occurs in both normal diodes and zener diodes at high reverse voltage. When high reverse voltage is applied to the p-n junction diode, the free electrons(minority carriers) gains large amount of energy and accelerated to greater velocities.

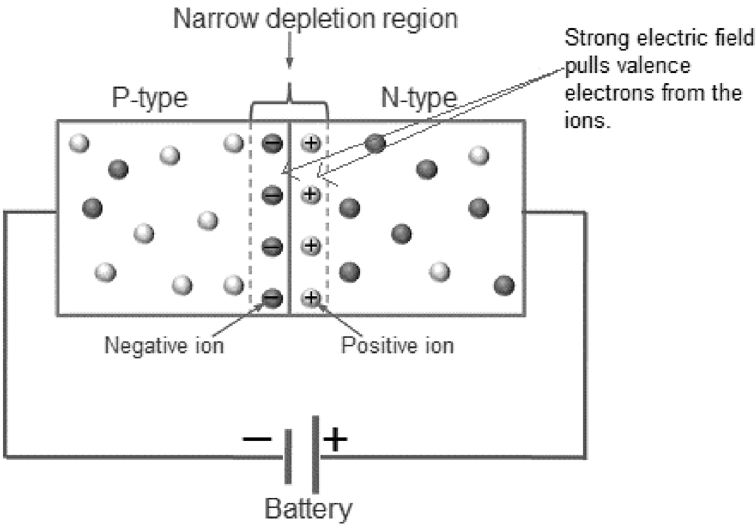
The free electrons moving at high speed will collides with the atoms and knock off more electrons. These electrons are again accelerated and collide with other atoms. Because of this continuous collision with the atoms, a large number of free electrons are generated. As a result, electric current in the diode increases rapidly. This sudden increase in electric current may permanently destroys the normal diode. However, avalanche diodes may not be destroyed



because they are carefully designed to operate in avalanche breakdown region. Avalanche breakdown occurs in zener diodes with zener voltage (V_Z) greater than 6V. [10]

- **Zener Breakdown**

The zener breakdown occurs in heavily doped p-n junction diodes because of their narrow depletion region. When reverse biased voltage applied to the diode is increased, the narrow depletion region generates strong electric field.



When reverse biased voltage applied to the diode reaches close to zener voltage, the electric field in the depletion region is strong enough to pull electrons from their valence band. The valence electrons which gains sufficient energy from the strong electric field of depletion region will break bonding with the parent atom. The valance electrons which break bonding with parent atom will become free electrons. These free electrons carry electric current from one place to another place. At zener breakdown region, a small increase in voltage will rapidly increases the electric current.

- Zener breakdown occurs at low reverse voltage whereas avalanche breakdown occurs at high reverse voltage.
- Zener breakdown occurs in zener diodes because they have very thin depletion region.
- Breakdown region is the normal operating region for a zener diode.
- Zener breakdown occurs in zener diodes with zener voltage (V_Z) less than 6V. [10]

3.7.3 Zener Diode Regulator: -

Zener Diodes can be used to produce a stabilised voltage output with low ripple under varying load current conditions. By passing a small current through the diode from a voltage source, via a suitable current limiting resistor (R_S), the zener diode will conduct sufficient current to maintain a voltage drop of Vout. [9]

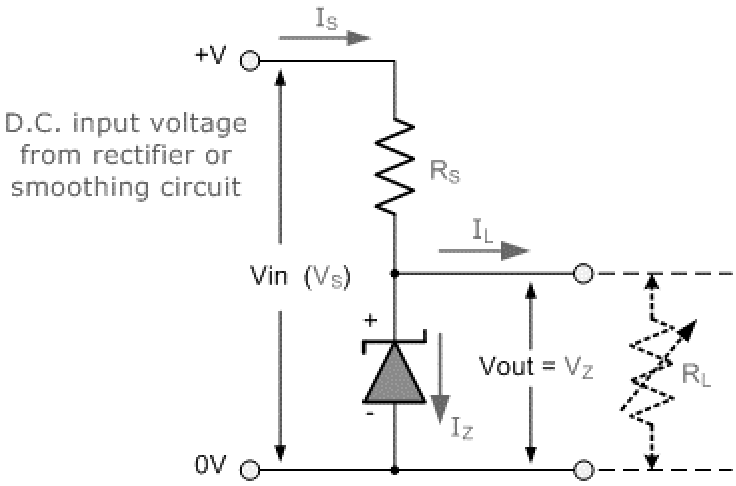


Figure 13. Zener diode as regulator

The resistor, R_S is connected in series with the zener diode to limit the current flow through the diode with the voltage source, V_S being connected across the combination. The stabilised output voltage Vout is taken from across the zener diode. The zener diode is connected with its cathode terminal connected to the positive of the DC supply so it is reverse biased and will be operating in its breakdown condition. Resistor R_S is selected so to limit the maximum current flowing in the circuit.

With no load connected to the circuit, the load current will be zero, ($I_L = 0$), and all the circuit current passes through the zener diode which in turn dissipates its maximum power. Also a small value of the series resistor R_S will result in a greater diode current when the load resistance R_L is connected and large as this will increase the power dissipation requirement of the diode so care must be taken when selecting the appropriate value of series resistance so that the zener's maximum power rating is not exceeded under this no-load or high-impedance condition.

The load is connected in parallel with the zener diode, so the voltage across R_L is always the same as the zener voltage, ($V_R = V_Z$). There is a minimum zener current for which the stabilization of the voltage is effective and the zener current must stay above this value operating under load within its breakdown region at all times. The upper limit of current is of course dependent upon the power rating of the device. The supply voltage V_S must be greater than V_Z. [9]

One small problem with zener diode stabiliser circuits is that the diode can sometimes generate electrical noise on top of the DC supply as it tries to stabilise the voltage. Normally this is not a problem for most applications but the addition of a large value decoupling capacitor across the zener's output may be required to give additional smoothing.

Then to summarise a little. A zener diode is always operated in its reverse biased condition. A voltage regulator circuit can be designed using a zener diode to maintain a constant DC output voltage across the load in spite of variations in the input voltage or changes in the load current. The zener voltage regulator consists of a current limiting resistor R_S connected in series with the input voltage V_S with the zener diode connected in parallel with the load R_L in this reverse biased condition. The stabilized output voltage is always selected to be the same as the breakdown voltage V_Z of the diode. [9]

3.7.4 Advantages of Zener Diode: -

- Power dissipation capacity is very high
- High accuracy
- Small size
- Low cost

3.7.5 Application of Zener Diode: -

- It is normally used as voltage reference
- Used in voltage stabilizers or shunt regulators.
- Used in switching operations
- Used in clipping and clamping circuits.
- Used in various protection circuits

4.
CIRCUIT DIAGRAM AND WORKING

4.1 CIRCUIT DIAGRAM:-

The circuit utilises light-dependant resistors (LDRs) for sensing darkness and light in the room. The resistance of LDR is very high in darkness, which reduces to minimum when LDR is fully illuminated. LDR1 detects darkness, while LDR2 detects light in the morning.[6]

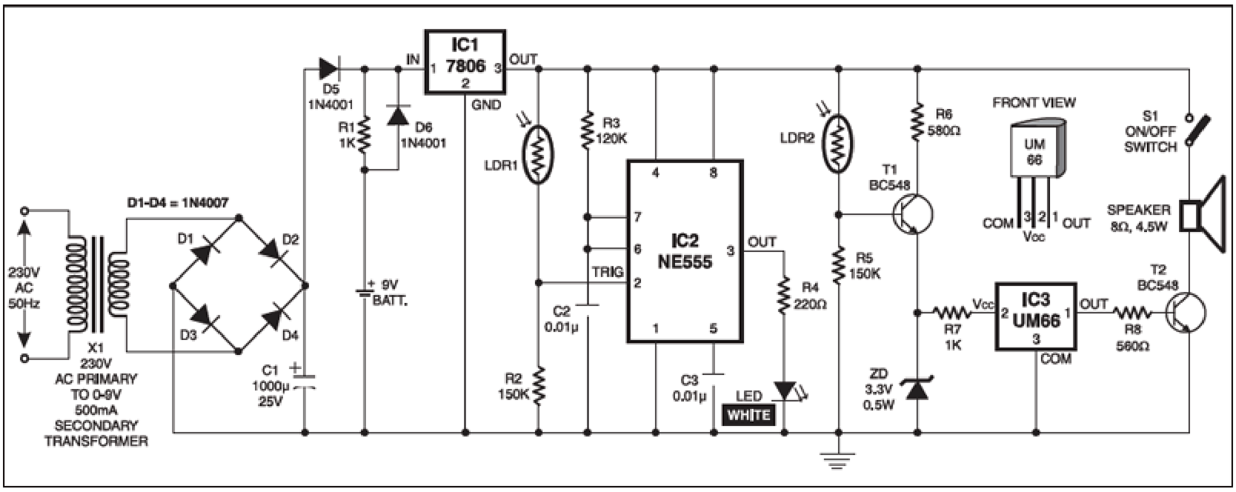


Figure 14. Circuit Diagram

4.2 CIRCUIT OPERATION:-

In total darkness, the specified LDR has a resistance in excess of 280 kilo-ohms. When the resistance of LDR1 increases, a short pulse is applied to trigger pin 2 of IC2 via resistor R2 (150 kilo-ohms). This activates the Monostable and its output goes high, causing the white LED to glow. [6]

Low-value capacitor C2 maintains the Monostable for continuous operation, eliminating the timer effect. By increasing the value of C2, the 'on' time of the white LED can be adjusted to a predetermined time.

LDR2 and associated components generate the morning alarm at dawn. LDR2 detects the ambient light in the room at sunrise and its resistance gradually falls and transistor T1 starts conducting. When T1 conducts, melody-generator IC UM66 (IC3) gets supply voltage from the emitter of T1 and it starts producing the melody. The musical tone generated by IC3 is standard 0-9V transformer. Diodes D1 through D4 rectify the AC voltage and the resulting DC voltage is smoothed by C1. Regulator IC 7806 gives regulated 6V DC to the circuit. A battery backup is provided to power the circuit when mains fails. When mains supply is available, the 9V rechargeable battery charges via diode D5 and resistor R1 with a reasonably constant current. In the event of mains failure, the battery automatically takes up the load without any delay. Diode D5 prevents the battery from discharging backwards following the mains failure and diode D6 provides current path from the battery. [6]

The circuit utilises light-dependant resistors (LDRs) for sensing darkness and light in the room. The resistance of LDR is very high in darkness, which reduces to minimum when LDR is fully illuminated. LDR1 detects darkness, while LDR2 detects light in the morning.

The circuit is designed around the popular timer IC NE555 (IC2), which is configured as a monostable. IC2 is activated by a low pulse applied to its trigger pin 2. Once triggered, output pin 3 of IC2 goes high and remains in that position until IC2 is triggered again at its pin 2.

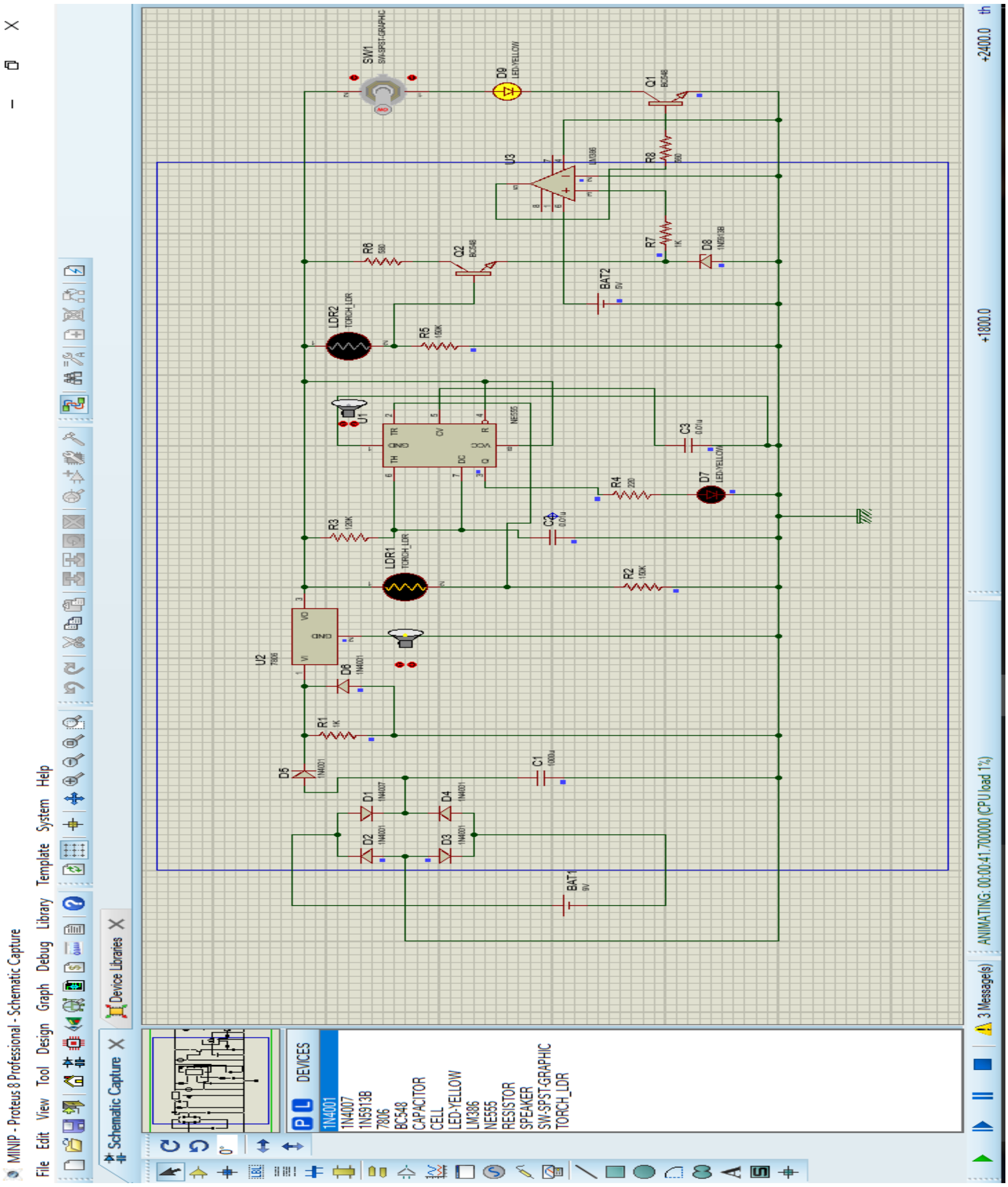
When LDR1 is illuminated with ambient light in the room, its resistance remains low, which keeps trigger pin 2 of IC2 at a positive potential. As a result, output pin 3 of IC2 goes low and the white LED remains off. As the illumination of LDR1's sensitive window reduces, the resistance of the device increases. [6]

In total darkness, the specified LDR has a resistance in excess of 280 kilo-ohms. When the resistance of LDR1 decreases, a short pulse is applied to trigger pin 2 of IC2 via resistor R2 (150 kilo-ohms). This activates the monostable and its output goes high, causing the white LED to glow.

Low-value capacitor C2 maintains the monostable for continuous operation, eliminating the timer effect. By increasing the value of C2, the 'on' time of the white LED can be adjusted to a predetermined time. [6]

LDR2 and associated components generate the morning alarm at dawn. LDR2 detects the ambient light in the room at sunrise and its resistance gradually falls and transistor T1 starts conducting. When T1 conducts, melody-generator IC UM66 (IC3) gets supply voltage from the emitter of T1 and it starts producing the melody. The musical tone generated by IC3 is amplified by single-transistor amplifier T2. Resistor R7 limits the current to IC3 is amplified by single-transistor amplifier T2. Resistor R7 limits the current to IC3 and Zener diode ZD limits the voltage to a safer level of 3.3 volts. [6]

5.
CIRCUIT SIMULATION[GUI]



6.
ADVANTAGES AND APPLICATION

6.1 ADVANTAGES: -

- Highly sensitive
- Works according to the light intensity
- Fit and Forget system
- Low cost and reliable circuit
- Complete elimination of manpower
- Can handle heavy loads up to 7A
- System can be switched into manual mode whenever required

6.2 APPLICATION: -

- Bed Rooms
- Hostels and Hotels
- Balcony / stair case / parking lightings
- Street lights
- Garden Lights

7.
CONCLUSION

An 'Automatic Night Lamp with Morning Alarm' was built and its working was observed with successful results. It was observed that when the first LDR (to be placed inside bedroom) went in a state of complete darkness, the LED corresponding to it lit up which shows the effectiveness of the first part of the circuit. Similarly, the second LDR (to be placed outside), when exposed to light activated the alarm and a melody was heard.

This system can further be improved by providing the facility to set alarms according to the user's desire. This can be done by applying the concepts of IoT wherein one can remotely access and control this system.

7.1 SUMMARY: -

The system designed was built keeping in mind the lifestyle of human beings in the modern world. Providing easy light access at night to go to the washroom or get a glass of water to drink without even thinking about switching on the night lamp would soon become a part of the user's lifestyle and after a certain amount of time the user would completely forget about its existence. Similarly, as our ancestors recommended 'Early to bed, early to rise, makes a person healthy, wealthy and wise', this system aims at waking you up with the rising sun. The user can start their day early without the risk of oversleeping.

Considering all these benefits when the system was designed, some things were kept in mind. These included the cost to construct and the feasibility for everyone, no matter how techno-freak or not, to use this device with minimum effort and maximum efficiency. Components were chosen so as to reduce the power consumption and higher efficiency output.

Although not a perfect version, but certain amount of work can be done on this device to polish it in a manner that it becomes an inherent part of everyone's lives.

7.2 IMPACT ASSESSMENT: -

The device constructed here primarily aims at being deployed in homes. But when certain modifications are made, it can be used in various other fields. Some of them include: -

Street Lights: - How amazing would it be if our street lights could sense the presence or absence of light and switch on/off on its own. That's exactly how this system is being deployed in many countries and also a few cities in India.

Parking Area Lighting: - How often have we seen the lights in the parking lots left switched on from the last night even during the day? This leads to loss in electricity and unnecessary power consumption. This can also be eliminated using this system.

Burglar Alarm: - Think about the condition of the burglar who broke into a dark house but as soon as he turned on his torch, a loud siren/alarm started ringing! Burglary averted! This system can be modified in such a manner that it detects such situations.

7.3 RISK ISSUES: -

The only risk issue that this device can have is the condition of non-working components which would lead to non-function ability of this device. The chances of this condition arising is minimum as this device is very robust, sturdy and long lasting.

7.4 COST ANALYSIS: -

The prices for every component used in the construction of this device is mentioned below specifications of which have been mentioned before. The prices mentioned are according to that of a local vendor of electronic components.

Sr. No.	Name of the component	Cost of each unit (in Rs.)	No. of units used	Total cost (in Rs.)
1	Transformer	55	1	55
2	Diode (including zener diode)	1	8	8
3	Resistor	1	8	8
4	Capacitor (1000µF)	7	1	7
5	Battery	38	1	38
6	IC 7806	15	1	15
7	LDR	10	2	20
8	Capacitor (0.01µF)	1	2	2
9	IC NE555	10	1	10
10	LED	1	1	1
11	BC548	2	2	4
12	UM66	15	1	15
13	Speaker	40	1	40
14	Switch	7	1	7
Grand Total				**230**

Table 5. Cost Analysis

So, the cost to construct this device is Rs.230.

7.5 PROJECT PLANNING AND MANAGEMENT: -

Activity	Starting Week	Number of weeks
Discussing problem statement	3rd week of December,2017	2
Finalising execution steps	1st week of January,2018	1
Design of system circuit	2nd week of January,2018	2
Simulation of system circuit	4th week of January,2018	1
Procurement of components	2nd week of February,2018	1
Circuit designing and testing	3rd week of February,2018	3
Preparation of project report	3rd week of March,2018	2
Preparation of project presentation	1st week of April,2018	1

Table 6. Project planning and management

7.6 GANTT CHART: -

The Gantt chart is shown below: -

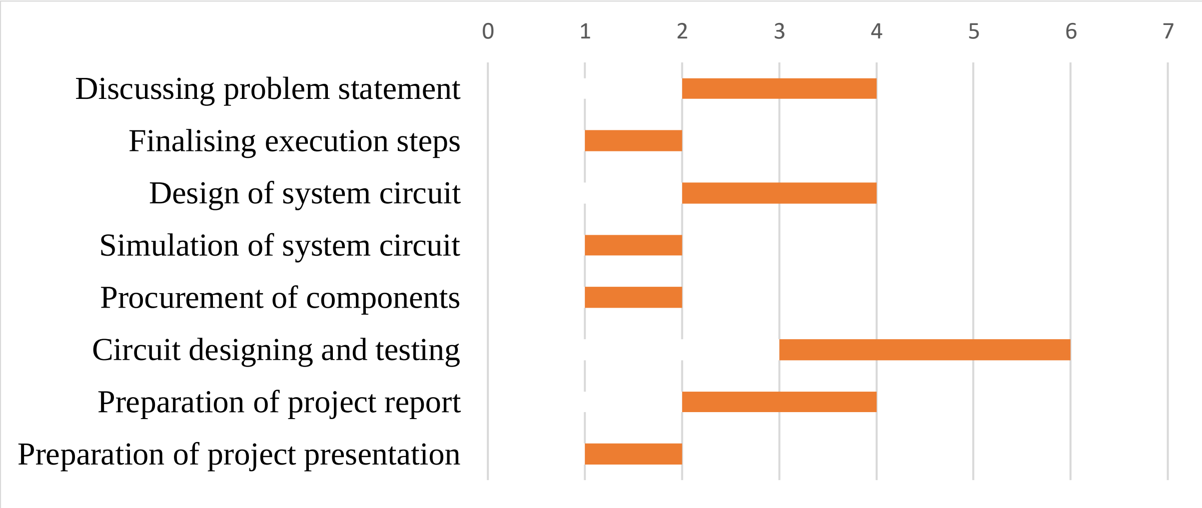


Table 7. Gantt chart

7.
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