SEMICONDUCTOR DEVICES AND CIRCUITS

EEE2002

DARKNESS DETECTOR USING LDR

PROJECT REVIEW - 3

SLOT – L15 + L 16

Team Members :-

ARYAN SHEKHAR 20BEI0085

HARSH KUMAR 20BEI0088

Guided By :-

Dr. ARUNKUMAR G

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ABSTRACT

Darkness Detector or Dark Detector is a circuit that detects darkness or absence of light. In this project, we have implemented a simple Darkness Detector Circuit using the simplest of all light sensors: the LDR (Light Dependent Resistor). Darkness Detector circuits like this can be used in applications where we can automatically turn on lights when it becomes dark.

In addition to the LDR, we have also used the good old 555 Timer IC in Astable Mode to generate the required square wave. There are some passive components like capacitor and resistors. We have used a Piezo Buzzer as an alarm to indicate darkness.

The aim of this simple project is to detect darkness with the help of LDR and activate the buzzer.

CONTINUED…

LDRs are of many types. Inexpensive cadmium sulfide (CdS) cells can be found in many consumer items such as camera light meters, clock radios, alarm devices (as the detector for a light beam), nightlights, outdoor clocks, solar street lamps, and solar road studs, etc.

LDRs can be placed in streetlights to control when the light is on. Ambient light falling on the photoresistor causes the streetlight to turn off. Thus energy is saved by ensuring the light is only on during hours of darkness.

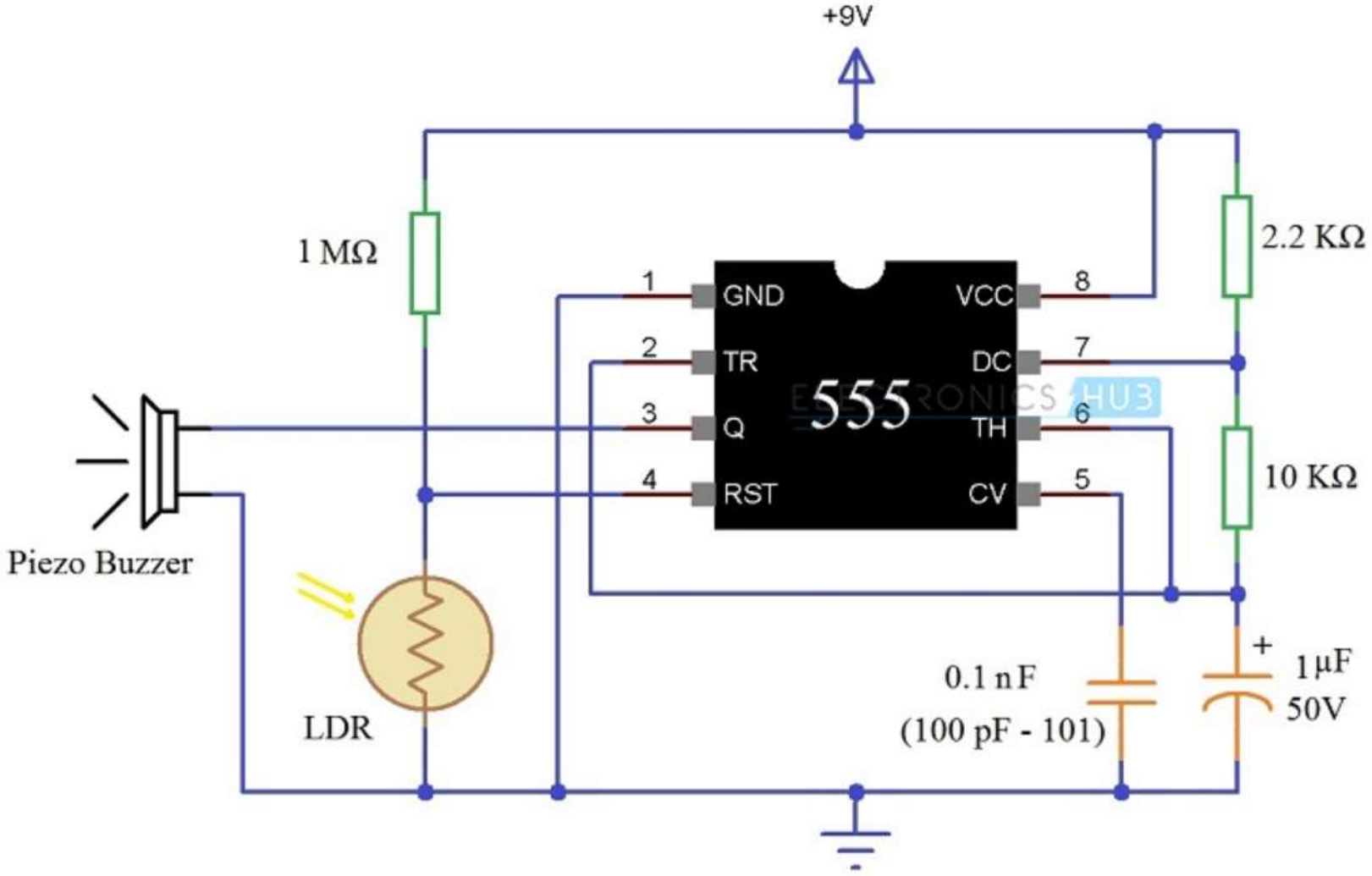
LDRs are also used in laser-based security systems to detect the change in the light intensity when a person/object passes through the laser beam.

They are also used in some dynamic compressors together with a small incandescent or neon lamp, or light-emitting diode to control gain reduction. A common usage of this application can be found in many guitar amplifiers that incorporate an onboard tremolo effect, as the oscillating light patterns control the level of signal running through the amp circuit.

AIM OF THE PROJECT

The aim of this project is to detect darkness with the help of LDR. It also has to activate the buzzer. But the main aim of this project is to save the power. Our primary concern here is to do everything automatically without any need of manual labor. The power saving will be done automatically. The saved power can be used somewhere else. This project will be extremely beneficial for countries that are developing like India. In rural and urban areas this project can be used extensively to cut the useless high amount budget for electricity. This project has other benefits too. It can be used for security purposes in banks, houses and other public and private buildings. This dark detector circuit uses as a main component an LDR. An LDR changes its resistance value depending on the amount of light it receives. The more light means less resistance, the less light means more resistance.

CIRCUIT DIAGRAM

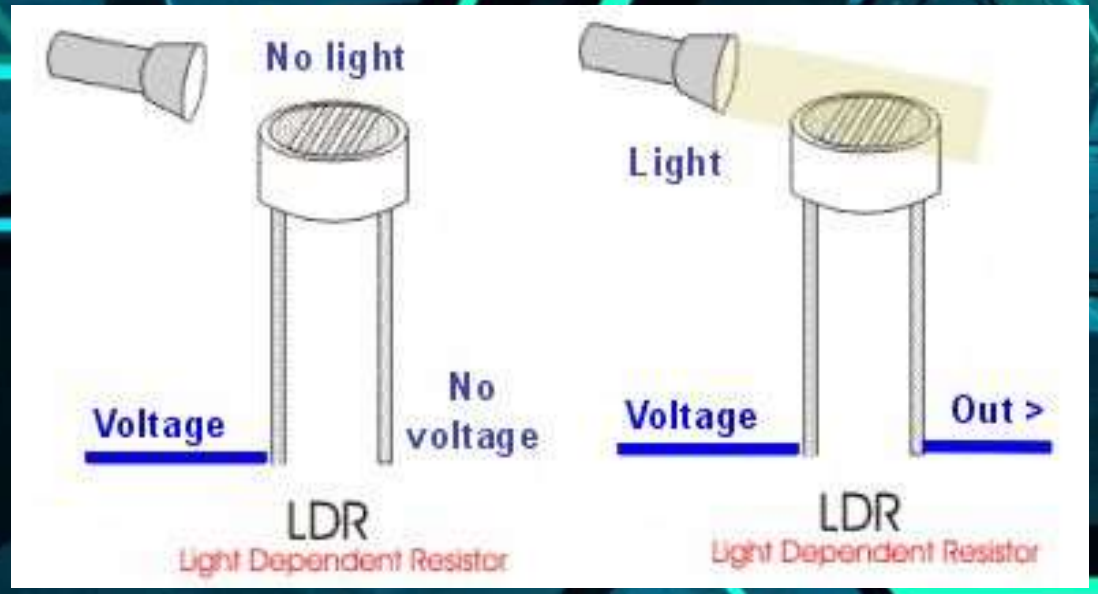


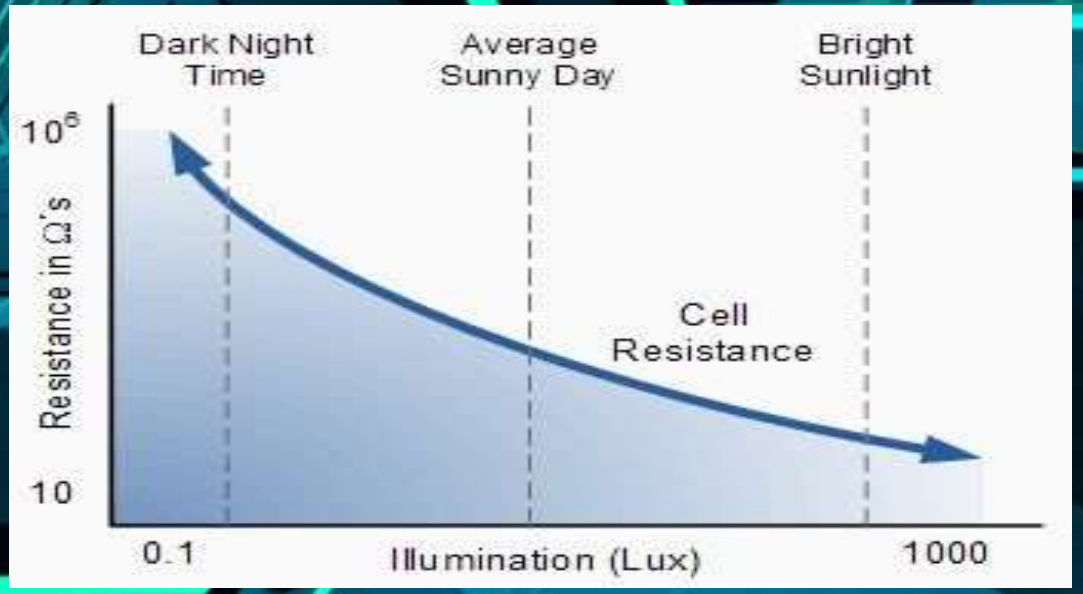
EXPLANATION OF THE CIRCUIT

The sensing component in this circuit is LDR (short form for Light Dependent Resistor or Photo-Resistor). The resistance of LDR depends on the intensity or brightness of light incident on it and the relation is of inverse proportionality. Which means that when the intensity of light increases, the LDR's resistance reduces and vice versa. Now if we reduce the brightness of ambient light, the LDR's resistance increases, resulting in lesser current flowing through the circuit (remember: more the resistance, less the current) and so you will observe that the LED's brightness reduces. Exactly the opposite happens when you increase the brightness of ambient light. The 555 Timer is configured in astable mode but the RESET pin is controlled by the LDR and resistor network. When there is ample light around the LDR, its resistance becomes very low. In this condition, the voltage divider formed by the 1MΩ resistor and the LDR will produce almost 0V at its output. As this is given to the RESET pin of the 555 timer IC, the 555 Timer IC is reset due to which we won’t be seeing any output at the output pin.

Continued...

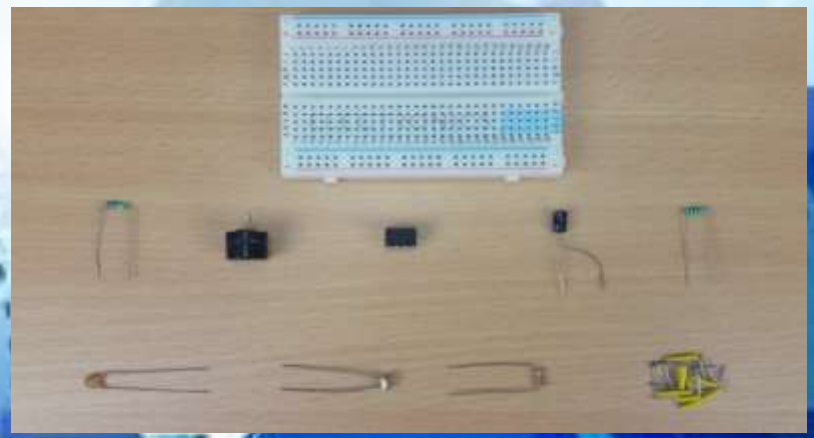
When we block the LDR with an obstacle such as hand (reducing the falling light on it). Then the resistance of the LDR will increase due to this and this will pull up the RESET pin and the astable mode will be activated. A small buzzer is connected to the output pin of 555 Timer IC, the buzzer will be activated. Hence, when there is enough light on the LDR, the buzzer will be off and when the light is gone i.e its darkness then buzzer will get activated.

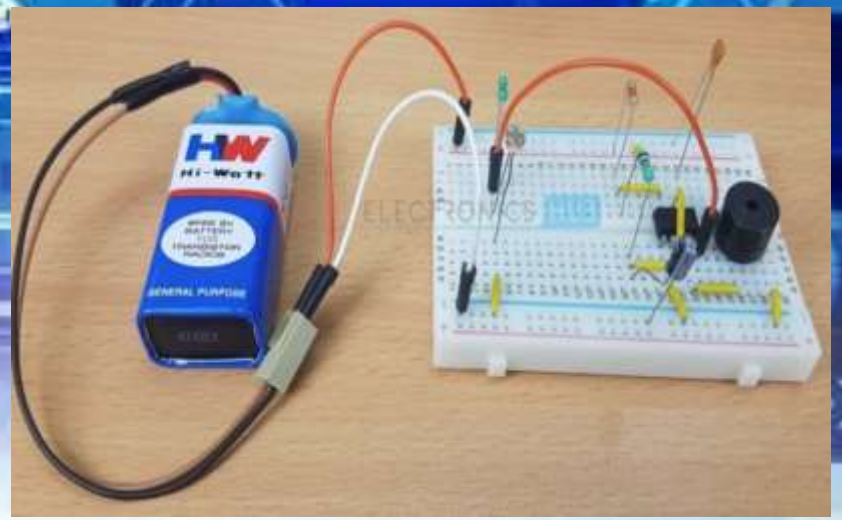




COMPONENTS REQUIRED

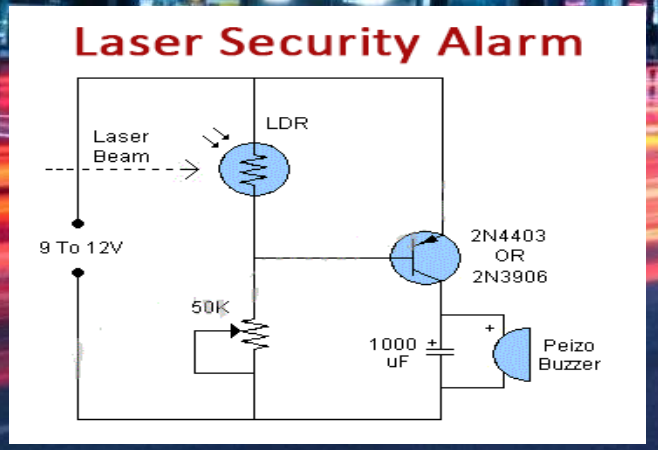
555 Timer IC
Bread Board
Light Dependent Resistors
Resistors
Wires
Piezo Buzzer
Capacitors
Jumper Wires
Point Source
Switch





APPLICATIONS OF THE PROJECT

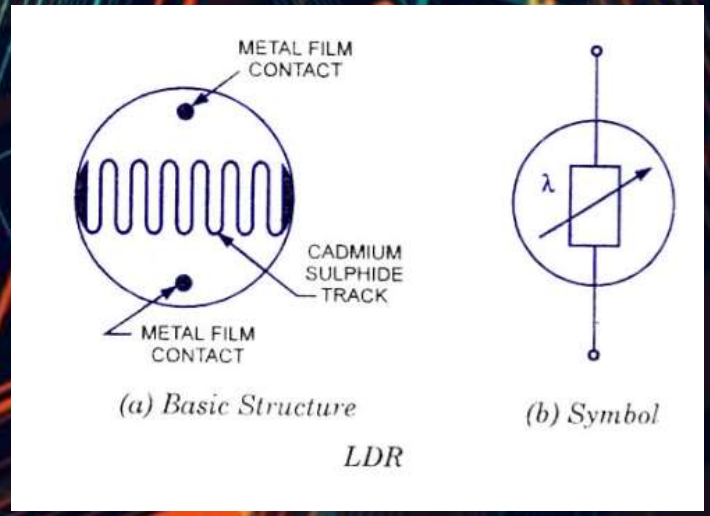
This project has several uses and that is why it makes the need of the hour to utilize this project as much as we can. Some of the applications are that this project can be used in the headlights of the vehicles and in this way it can save the battery of the car for a long time. Then, we can use this project in street lights and it can be be very useful there. It will get on automatically when the surrounding will get dark and hence it will be able to save a lot of power and everything will go smoothly as it is automatic. This can also have a huge contribution in security systems of buildings.



Working Principle of LDR

LDR works on the **principle** of **photo conductivity**. It is nothing but, when the light falls on its surface, then the material conductivity reduces and also the electrons in the valence band of the device are excited to the conduction band. It is a component that has a (variable) resistance that changes with the light intensity that falls upon it. This allows them to be used in light sensing circuits.

The snake like track is the Cadmium Sulphide (CdS) film which also passes through the sides. On the top and bottom are metal films which are connected to the terminal leads. It is designed in such a way as to provide maximum possible contact area with the two metal films. The structure is



LDRs are non-linear devices. As explained in the previous page, the main component for the construction of LDR is cadmium sulphide (CdS), which is used as the photoconductor and contains no or very few electrons when not illuminated. In the absence of light it is designed to have a high resistance inthe range of megaohms. As soon as light falls on the sensor, the electrons are liberated and the conductivity of the material increases. When the light intensity exceeds a certain frequency, the photons absorbed by the semiconductor give band electrons the energy required to jump into the conduction band. This causes the free electrons or holes to conduct electricity and thus dropping the resistance dramatically (< 1 Kiloohm). LDR's are cheap and are readily available in many sizes and shapes. Practical LDRs are available in a variety of sizes and package styles, the most popular size having a face diameter of roughly 10 mm. They need very small power and voltage for its operation.

TYPES OF LDR

Based on the type of material

1) Intrinsic photoresistors

This is made of pure semiconductors materials like silicon and germanium. Electrons get excited to the conduction band from the valence band. Because these types of photoresistors only release a small amount of charge carriers, they are not sensitive enough for most applications and they are only useable within narrow wavelength ranges.

2) Extrinsic Photoresistors

These are the semiconductors that are doped with impurities called dopants. These are the more common choice and are made from extrinsic-type semiconductor materials, i.e. semiconductor materials which have been doped with other atoms with a higher number of valence electrons—commonly phosphorus . These semiconductor materials are known as n-type semiconductors, and the presence of higher valence atoms in the lattice leads to more free electrons in the lattice. This is because the extra valence electrons can’t physically form bonds in the (commonly) 4-coordinated silicon (or similar) lattice, so these extra electrons become delocalized within the lattice, leading to a greater concentration of free charge carriers in the lattice.

CONCLUSION

This project's main aim is energy conservation. We want to ensure that this project could contribute to the world of electronics and as well as do good to the society. This is entirely based on the properties of LDR. Along with this, depending on the intensity of light, the circuit is designed to set an alarm. It is conserving energy through light sensing and can be well integrated with other circuits to save energy. The working of the circuit is very clear and the other advantage is that everything is automatic. This is also very much environmentally friendly and can be used in long run. It most importantly is very much cost effective.

COST EFFECTIVE

1) electronicshub.org

2) electronics-notes.com

3)wikipedia.org

4) google.com

5) Google Books

ACKNOWLEDGMENT

At last we would like to give a huge thanks to our faculty Dr. Arunkumar G sir for guiding us throughout the project. His way of leading and motivation has always been a big help for us. We have learnt a lot from him during the semester and he has always been there for us whenever we needed his guidance. He did a lot for us and it is because of his selfless duty that we were able to do this. He always answered our doubts and queries even after the classes. We thank him for all of his words of wisdom and leadership.