# AUTOMATIC RAIN SENSING WINDOW

## ABSTRACT

The aim of our project is to closing the window during the rain. Our project is working by the rack and pinion setup. Rain sensor is fixed in outside of the window and circuit is connected to the rack and pinion setup with motor which is connected with the window. During the rain, sensor sense the rain and it send the signal to the circuit then the motor runs and the window starts to close after the rain stops automatically the window gets open. At the time of running we can control the working of window (opening and closing) through switch. The main advantage of this product is no need of man power to run.

# CHAPTER 1

# INTODUCTION

As human beings we cannot control the natural phenomenon such as rain, humidity, high temperature, etc. Some of the measures are taken against this environmental hazard but they are performed manually. Here comes the need of automation. Automation greatly decreases the need for human sensory and mental requirements as well. An automation system consisting of a connection between hardware and software has freed the individuals from their day to day chores. In this paper we try to establish new intelligent system which helps to protect the user daily home application and other useful material against environmental impact like rain.

Nowadays, so many advanced equipments are used to make life easier and comfortable. Those equipments are related with different engineering field (e.g. electrical, mechanical etc.) In order to protect the household in rainy season, this device has been developed. The field of this work is mechatronics, which is a combination of mechanical and electronics has had great advancement in the past few years. Mechatronics is implementing in this development to construct an automatic controlled commercial window.

Now a days, the usage of vehicles especially buses for transporting is increases day by day. During the rainy season the door and as well as the windows are not closes immediately, due to the absence of the human being. Usually passengers will try to close windows when it rains outside. But it cannot be done easily; it may be stuck at the time of closing or opening the windows. And also some of the windows are kept opened because of absence of the passengers on that seat. To avoid this problem we made a setup called as automatic window opening and closing during the rainy season. It helps people to close windows on the buses and buildings automatically.

## 1.1 Problem Identification

Generally opening a window, while raining or after raining is the problem when absence of human source in a building or a window of automobiles. To solve this problem we made a automatic window opening and closing and it also can be controlled by using the switch in a required situation with effectively.

## 1.2 Aim of the Project

The aim of this project was to develop a rain sensing automatic window mechanism for house hold. This project has been done derived for introducing automatic rain sensing windows of luxury cars and has been modified for application in commercial house window. The same principle works for both.

## 1.3 Objective

- To implement a control system this reduces human efforts.
- To achieve high safety by reducing the driver’s work load
- To minimize rates of accident caused by distraction in driving.
- To make the system easy to install.
- To develop a cheaper automated system that can be integrated easily

# CHAPTER 2

# LITERATURE SURVEY

Survey played a very vital role in this project, we analyzed the existing products for protection of vehicles and clothes during rain, there were many demerits which we noticed during the survey, some of them are the existing products are to be operated manually, and if incase there's no one in the home to operate the switch then the clothes easily get wet and the product will be of no use, and secondly if there's a disabled person in the house then he/she will not be able to operate the system and this kind of system needs knowledge regarding the operation. So, we chose to do automatic system which doesn't require any manual operation, which has rain sensors which get activated during anytime of the day or night. Some methods through various papers which we have surveyed are as follows.

## 2.1 An Automatic Sliding Door Using Infrared Sensor

In this research work, an Automatic sliding door System using an infrared sensor was developed. It uses a sensor, a control unit & drive unit to open and close doors at the entrance of a public building. The primary aim of this research work is to learn in details about how the automatic door system works and to understand the concepts involved. The secondary aim is to fabricate a simple circuit model to show how the system works. The main activities involved in this work are the research done on how the automatic door works, sketching a detailed circuit & then fabricating a simple model.

### 2.2 Intelligent Windshield for Automotive Vehicles

Windshield control is a vital operation of driver during driving. The mountings fitted in the windscreen or also called windshields are essential to use for smooth driving. These can be automated by using sensors and microcontroller. A complete windshield controlling system has been developed here to increase human comfort and flexibility. The wiper have been controlled by a water level sensor which regulate the wiper motor through sensing the level of water or rain. A dust sensor has been integrated to spill some water in the windscreen and then wipe it. It senses when a certain level of dust get accumulated in the screen. The sun visor which is mounted inside the car to shade the driver's eye from sun would be easier to control by a servo motor. Here an automatic sun visor has been designed to be controlled through a light sensor which is used to measure the light intensity and send the signal to the main

control unit. This project focuses on improving human comfort in the existing system so that the driver can pay full attention in driving at all weather even in dusty, rainy or summer.

### 2.3 Automatic Rain Water and Crop Saving System Using Embedded Technology

Now a days, during the rainy seasons the cultivated crops gets affected due to the heavy rain fall. The main theme of this project is that to prevent the crops from the heavy rain and save the rain water. The rain sensor and soil moisture sensor is used for the working of automatic roof. This system involves protects the crops by the auto roof which covers the whole field. The rain sensor is activated when there is a rain fall. The soil moisture sensor will sense the water level in the field. If the water level is beyond the normal level it will gives intimation to the controller. So when both the sensor is 'ON', it will gives intimation to the controller, GSM and it will indicate to the DC motor and it will automatically open the roof. In this project, the roof is open automatically when both the sensor is 'ON'. If there is any problem with opening the roof automatically, manually set by remote access.

Hashim et al. tried to develop a new wiper system to wipe rain water from vehicle's windscreen. In older system, wiper was used to control manually and the process of pulling up the wiper was quite difficult. So, objective of their work was to modify the system by providing automatic wiping system. They

developed an automatic control system by using a Peripheral interface controller and water sensor. Their system could manage to achieve the aim as it could remove rain water automatically from outside the car. The rain sensing automatic power window has a rain sensor, a motor operating circuit, a pair of motors and a driver mechanism for sliding type windows. Powered by 12V DC power from a transformer, motors have enough torque to move the windows back and forth as required. When rain falls on the sensor, it sends signals to the circuit. The microcontroller is programmed with Matlab, which acts as a relay for the circuit that sends signal to the motor driver which gives power to the motors. The windows are sliding windows with smooth bearings to reduce drag and friction for proper sliding movement.

## 2.4 Optical Method

Optical sensors utilize light and the principle of total internal refraction within the windshield. The optical sensor consists of a light source, a light detector and an optical assembly. The optical assembly consists of two lenses and a light guides. A beam of light is directed through the optical assembly to the windshields, the light is trapped within the glass due to total internal refraction. The light reflect from the outside surface of the glass back to the inside surface of the windshield glass until it is picked up by the second optical assembly. If rain falls on the windshield within the sensing area, light is directed by the water droplet in the other direction opposite to the optical assembly as shown in figure

2. This causes a corresponding reduction in the light intensity falling on the second optical assembly. The microprocessor is used to distinguish between different amounts of rain and to provide the best wiping method. So the Optical sensors are reliable and effective detectors of rain. By using the suitable rain sensing methods it is possible to develop the automatic wipers. These are by far the most common method, and the one currently employed by Hyundai vehicles.

The complete development of optical wiper system is explained in the paper "Automatic Wiper Controller Using Optical Sensor" published by "H. Kajioka". According to this paper, the basic components used are:

1. Optical Rain Sensor
2. Controller

The working of the controller is based on three major functions

**Types of Functions**

**Semi-automatic Function**

When the wiper switch is set to the intermittent position, then wiper moves once, then moves at intervals automatically controlled.

**Washer Interlock Function**

When the washer switch is turned on, the wiper moves, when it is turned off, the wiper will stop after two wiping cycles.

**Failsafe Function**

It is assured that the wiper operates at 6 second when the rain drop detection function is disabled because the sensing beam is completely blocked by the dust, snow or other matters stuck to the sensor.

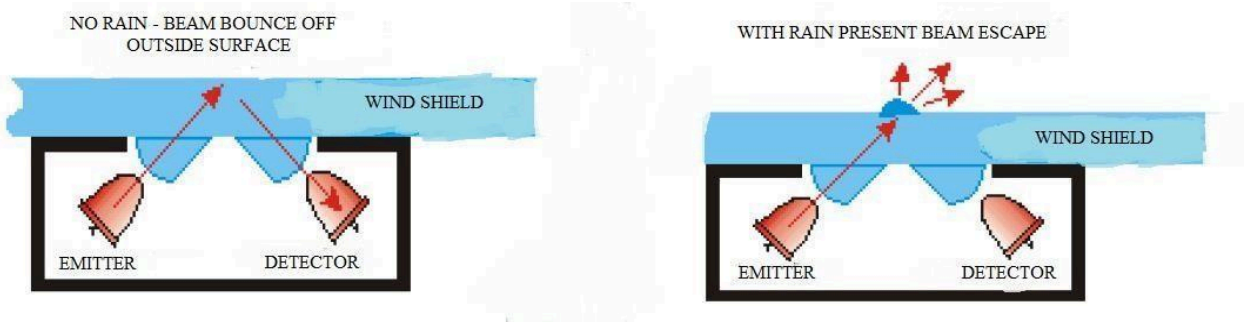



**Figure 2.1: Reflection phenomenon in optical sensor**

From the literature review, it is found that the disadvantage of these products is expensive and else sensitive when the beam is disturbed. This system used the light beam to sense the water hitting. Further, these products were suitable for the country with four seasons and not suitable for the country with hot and climate weathers.

## 2.5 Conductive Method

This method uses a sensor, which consists of two sets of contacts separated by an insulator. When water falls on the sensor, the water conducts the signal and completes the circuit. Then it sends the signals to the next unit to operate the wiper motor. This system has some fundamental problems; the sensors used here are prone to oxidization and become unusable. Also the dirt can foul the sensors. So it is very difficult to design such sensors.

### 2.5 Piezoelectric Method

This method uses a piezo crystal element. While Rain falls on the windscreen generates the sound waves at a certain frequency. These waves are transmitted through and across the windscreen as shown in figure 3. The piezo crystal senses the sound waves, and also compares them with the other noises caused due to wind, dust, etc. this crystal responds only to the sound waves due to rain. Again this system is susceptible to false triggering.

From the literature review, it is found that the disadvantage of these products is that they are expensive and sensitive to interferences. Hence, this project proposed to use capacitive sensor and a microcontroller to be used to execute the function of this system. By using Peripheral Interface Controller (PIC) microcontroller, the controller can be programmed using C language or assembly language.

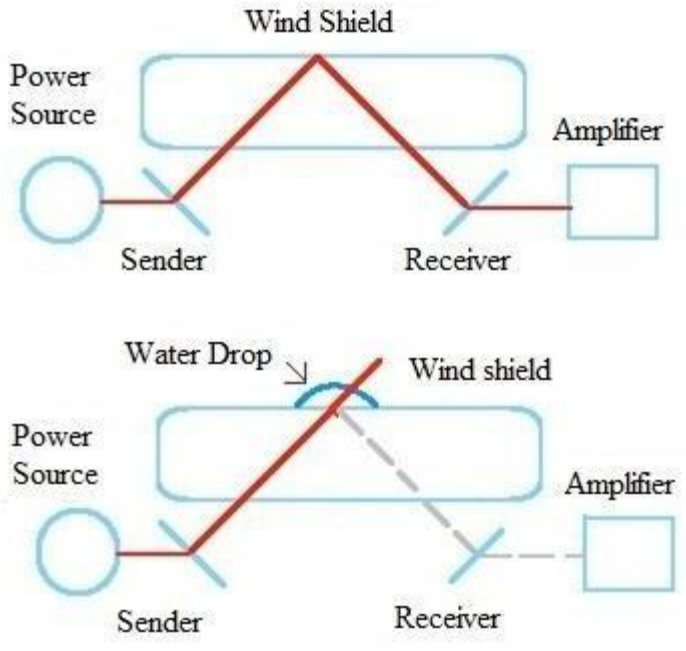



**Figure 2.2: Transmission through Piezoelectric sensor**

## 2.6 Capacitive Method

A Capacitive Sensor works by emitting an electric field which can pass through the glass to interact with objects resting on it. Because water and other objects such as dirt or rocks interfere with the electric field in very different ways, the sensor will be less likely to be fooled if designed correctly.

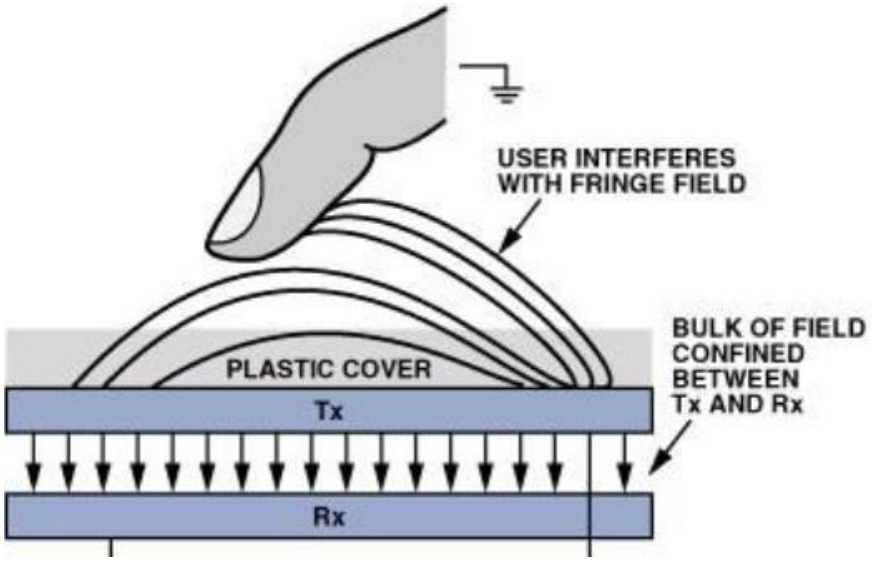



**Figure 2.3: Capacitive detection**

The complete development of optical wiper system is explained in the paper "Capacitive Rain Sensor For Automatic Wiper Control" published by "Design Team 6, Hyundai Kia Motors". The basic components used in this paper are as follows:

### 2.6.1 Capacitance Monitoring Circuitry

Analog Devices AD7745: The AD7745 interfaces with both the capacitive sensor traces and the PIC microcontroller processor. Its primary role is to sample the changing capacitance of the sensor traces and output that data as a digital signal to the microcontroller for processing.

### 2.6.2 Microcontroller:

Microchip PIC18F4520/PIC16F1826: It is responsible for configuring the AD7745 into the correct operating state, polling it for capacitive and other data, and interpreting that data by comparing it to known capacitance values gained through extensive testing of the device. If the incoming capacitive data falls into a certain range over a certain number of samples, the PIC will output a signal instructing the wipers to engage. Furthermore, the PIC can differentiate between varying levels of rain to adjust the speed of the wipers, and prevent false positives by ignoring capacitance values outside the range of rain.

### 2.6.3 Capacitive Sensor Traces Custom Design:

The capacitive sensor trace layout is critical to the performance of the capacitive sensor system. The shape and spacing of the two traces forming the capacitive sensor are directly related to the electric field lines produced when the excitation voltage is applied. As the rain to be detected is present through 6 – 8 mm of glass, the sensor traces should be designed as to maximize the fringing fields away from the plane of the PCB. Glass has a relatively high dielectric constant of around 4.5, allowing easy transmission of electric fields through it. Nonetheless, 6 – 8 mm is a very large distance away from the sensor traces to have to measure, as most capacitive touch screens have an overlay thickness of

only 1 – 2 mm as shown in below figure 2.4. The software COMSOL was used to model a variety of different sensor layout designs, where parameters such as trace patterns, conductor width, conductor spacing.

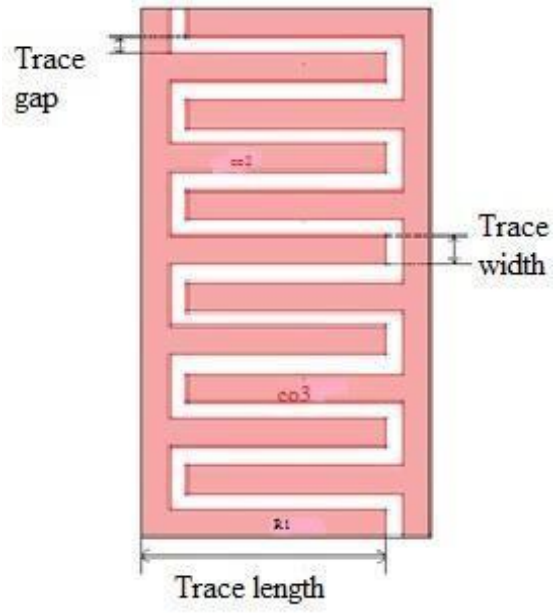



**Figure 2.4: Trace layout of capacitive sensor**

### 2.6.4 Voltage Regulator

Analog Devices ADP3301-5: In a vehicle, the typical battery voltage can range from 11 –13.5 V depending on the strength of the battery and the operating state of the vehicle and the alternator. Both the AD7745 and PIC microcontroller require 5 V DC for operation, so a reliable voltage regulator was required to scale the vehicle power supply voltage to 5V. The Analog Devices ADP3301-5 is a linear voltage regulator which can accept up to 14 V of input voltage, and

outputs a preset 5 V DC. It can source up to 100 mA of current, more than enough for the entire device.

# CHAPTER 3

# METHODOLOGY

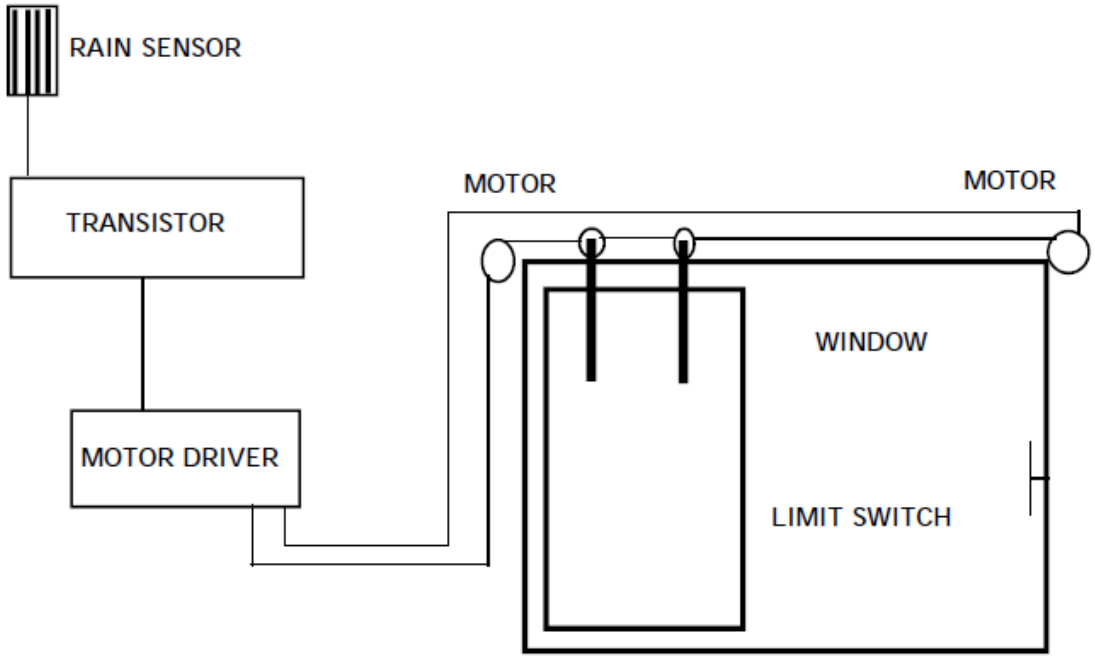



**Figure 3.1 Block Diagram**

## 3.1 Block diagram description

The functional block diagram is shown above and it comprises of various components such as:

1. Rack and Pinion

2. Rain sensor

3. DC motor

4. Power Supply

A 10 rpm DC motor is used for the window pane movement. A limiter is used at the end of the window to break the circuit when the window reaches the extreme point. A sensor detects rain droplets and sends signals to the control circuit. Signals are sent to the motor driver which acts as a relay to electric motors. Motors operate with rope and pulley mechanism. The window is a sliding mechanism window. The windows are clamped to the rope at certain points. When the motors rotate, the rope and pulley mechanism gets into action. This gives closing or opening motion to the window pane. 220V AC power is derived from the household circuit; a transformer converts power to 12V DC appropriate for the circuit.

## 3.2 WORKING PRINCIPLE

During the rain, every window is automatically closed by using the rain sensor. The sensor detects the rain and it send the signals to the circuit board (i.e.

this circuit is designed with two lines are tracked with very short distance. When rain drops falls on this circuit, the track may become short circuit. It gives the corresponding signal to related circuit in order to find the rain fall). Due to this the window gets closed with the help of rack and pinion setup.

# CHAPTER 4

# HARDWARE IMPLEMENTATION

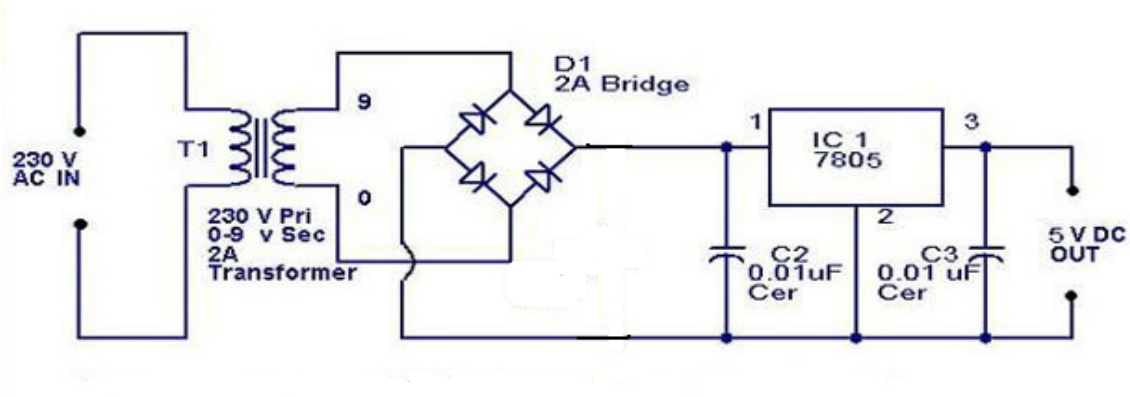
## 4.1 REGULATED POWER SUPPLY

Power supply is a reference to a source of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.

Here in our application we need a 5v DC power supply for all electronics involved in the project. This requires step down transformer, rectifier, voltage

regulator, and filter circuit for generation of 5v DC power. A brief description of all the components is given as follows:

**Circuit Diagram for power supply**



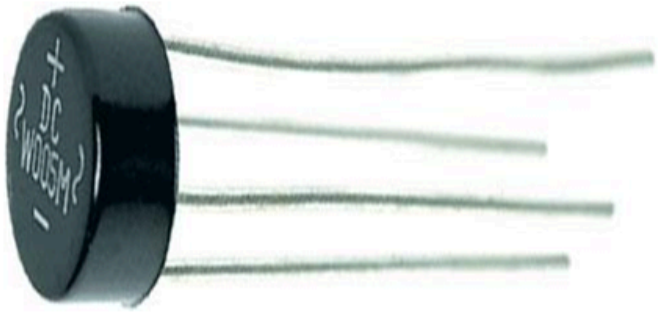

**Transformer**

A transformer is a device that transfers electrical energy from one circuit to another through inductively coupled conductors — the transformer's coils or "windings". Except for air-core transformers, the conductors are commonly wound around a single iron-rich core, or around separate but magnetically-coupled cores. A varying current in the first or "primary" winding creates a varying magnetic field in the core (or cores) of the transformer. This varying magnetic field induces a varying electromotive force (EMF) or "voltage" in the "secondary" winding. This effect is called mutual induction.

If a load is connected to the secondary circuit, electric charge will flow in the secondary winding of the transformer and transfer energy from the primary circuit to the load connected in the secondary circuit.

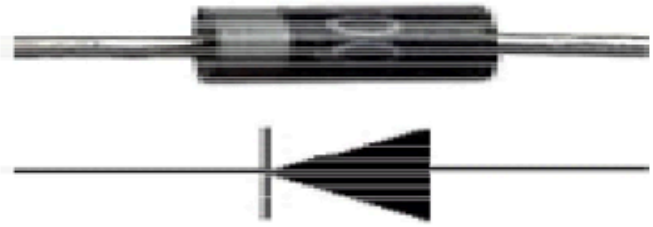
The secondary induced voltage VS, of an ideal transformer, is scaled from the primary VP by a factor equal to the ratio of the number of turns of wire in their respective winding.

**Bridge Rectifier**




A bridge rectifier makes use of four diodes in a bridge arrangement to achieve full-wave rectification. This is a widely used configuration, both with individual diodes wired as shown and with single component bridges where the diode bridge is wired internally.

**Diode**



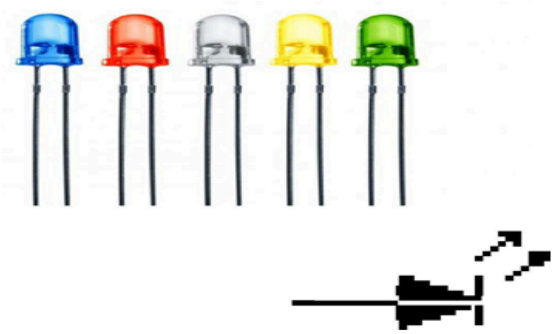
A diode is a semiconductor device which allow s current to flow through it in only one direction. Although a transistor is also a semiconductor device, it does not operate the way a diode does. A diode is specifically made to allow current to flow through it in only one direction. Some ways in which the diode can be used are listed here.

A diode can be used as a rectifier that converts AC (Alternating Current) to DC (Direct Current) for a power supply device.

Diodes can be used to separate the signal from radio frequencies.

Diodes can be used as an on/off switch that controls current.

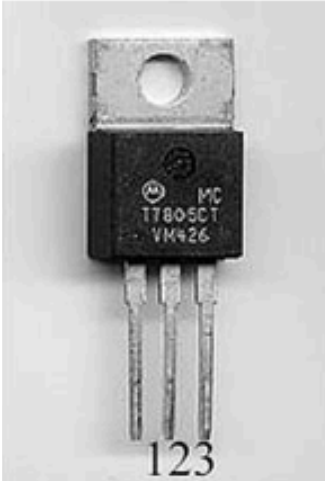
**Light emitting diode**



This type of diode emits light when current flows through it in the forward direction. (Forward biased).

**Regulator (lm7805)**

It is a three pin IC used as a voltage regulator. It converts unregulated DC current into regulated DC current.




Normally we get fixed output by connecting the voltage regulator at the output of the filtered DC (see in above diagram). It can also be used in circuits to get a low DC voltage from a high DC voltage (for example we use 7805 to get 5V from 12V). There are two types of voltage regulators

1. Fixed voltage regulators (78xx, 79xx)
2. Variable voltage regulators (LM317)

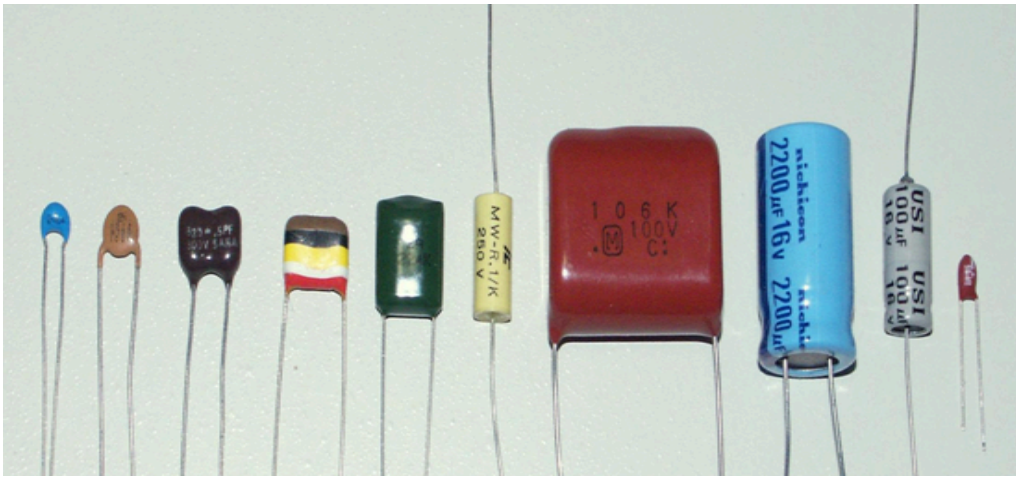
In fixed voltage regulators there is another classification

1. +ve voltage regulators
2. -ve voltage regulators

## POSITIVE VOLTAGE REGULATORS

This includes 78xx voltage regulators. The most commonly used ones are 7805 and 7812. 7805 gives fixed 5V DC voltage if input voltage is in (7.5V, 20V).

## CAPACITORS




In a way, a capacitor is a little like a battery. Although they work in completely different ways, capacitors and batteries both store electrical energy. Like Inside the battery, chemical reactions produce electrons on one terminal and absorb electrons on the other terminal. A capacitor is much simpler than a battery, as it can't produce new electrons -- it only stores them.

## 4.2 DC MOTOR

A direct current (DC) motor is another widely used device that translates electrical pulses into mechanical movement. In the DC motor we have only + and - leads. Connecting them to a DC voltage source moves the motor in one direction. By reversing the polarity, the DC motor will move in the opposite direction. One can easily experiment with the DC motor.

For example, small fans used in many motherboards to cool the CPU are run by DC motors. By connecting their leads to the + and - voltage source, the DC motor moves. While a stepper motor moves in steps of 1 to 15 degrees, the DC motor moves continuously.

The DC motor has two rotation speeds no-load condition and loaded condition. The manufacturer's data sheet gives the no-load rpm. The no-load rpm can be from a few thousand to tens of thousands. The rpm is reduced when moving a load and it decreases as the load is increased.

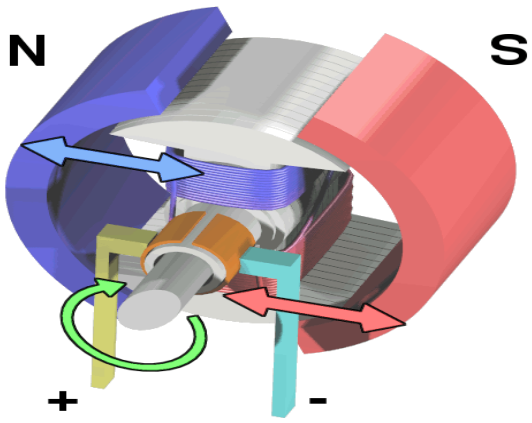



**Figure 4.3 Internal View of DC Motor**

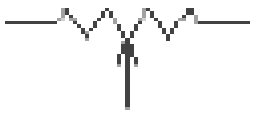
For example, a drill turning a screw has a much lower rpm speed than when it is in the no-load situation. DC motors also have voltage and current ratings. The nominal voltage is the voltage for that motor under normal conditions, and can be from 1 to 150V, depending on the motor.

As we increase the voltage, the rpm goes up. The current rating is the current consumption when the nominal voltage is applied with no load, and can be from 25mA to a few amps.

As the load increases, the rpm is decreased, unless the current or voltage provided to the motor is increased, which in turn increases the torque. With a fixed voltage, as the load increases, the current (power) consumption of a DC

motor is increased. If we overload the motor it will stall, and that can damage the motor due to the heat generated by high current consumption.

## 4.3 POTENTIOMETER



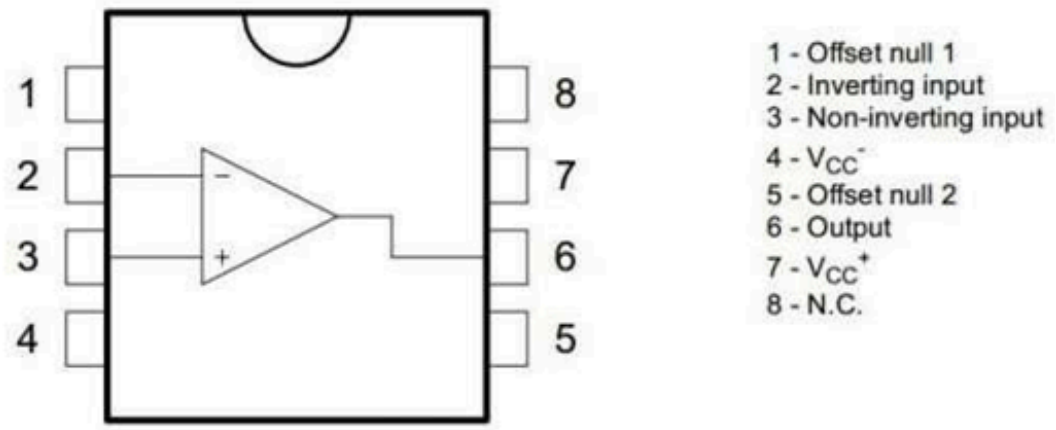
Potentiometer symbol

The arrow represents the moving terminal, called the wiper.

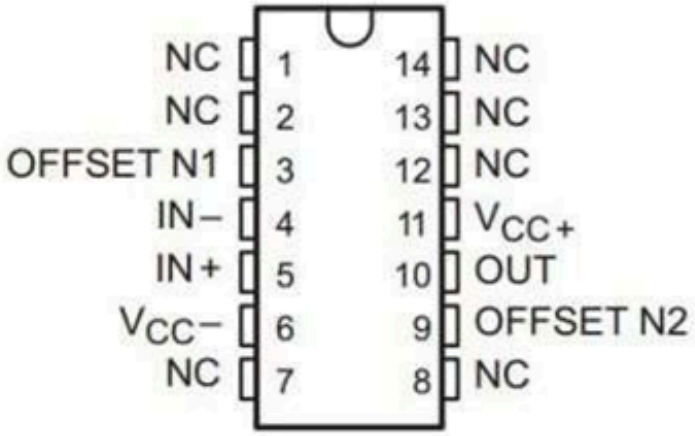
Wikipedia.com stated that the original meaning of the term potentiometer, which is still in use is an apparatus used to measure the potential (or voltage) in a circuit by tapping off a portion of a known voltage from a resistive slide wire and comparing it with the unknown voltage by means of a voltmeter of galvanometer. If all the three terminals are used, it can act as variable voltage divider.

## 4.4 LM 741

According to the datasheet LM741 IC is a general purpose single operational amplifier. The UA741 is a high performance monolithic operational amplifier constructed on a single silicon chip.




741 8 pin package




741 14 pin package

**741 features**

- large input voltage range
- no latch-up
- high gain
- short-circuit protection

- no frequency compensation required
- same pin configuration as UA709

**741 usage**

- summing amplifier
- voltage follower
- integrator
- active filter
- function generator

## 4.5 RELAY

A relay is an electrically operated switch. Many relays use an electromagnet to operate a switching mechanism mechanically, but other operating principles are also used. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal. Relays are switching devices. Switching devices are the heart of industrial electronic systems. When a relay is energized or activated, contacts are made or broken. They are used to control ac or dc power.

They are used to control the sequence of events in the operation of a system such as an electronic heater, counter, welding circuits, and X-ray equipment, measuring systems, alarm systems and telephony. Electromagnetic relays are forms of electromagnets in which the coil current produces a magnetic

effect. It pulls or pushes flat soft iron armatures or strips carrying relay contacts. Several relay contact can be operated to get several possible ON/OFF combinations.

**RELAY CONTACTS AND IDENTIFICATION**

The heart of the relay is the 'junction' of the contact points. The relay contact points may be flat, spherical, pointed and combination of all these. Flat contacts require more pressure for perfect contact closing. Half round contacts are better because the surface contamination will be minimum. The twin contacts give reliable operation.

Relay contacts are made of silver and silver alloys in small power applications. For large relays, contacts are made up of copper. Certain relays use silver – palladium of platinum – ruthenium alloys for contacts. The special types mentioned above give long life, carry moderate currents and keep shape for long time.

To identify relay contacts, some important contact arrangements must be remembered.

SPST - Single Pole Single Throw

SPDT - Single Pole Double Throw

NO - Normally Opened

NC - Normally Closed

Break - Relay action opens or breaks contacts

Make - Relay action makes or closes contacts

Relays are electromagnetic device by which operation of one or more circuits can be controlled by the operation of some other circuit. Relay is a type of switch where switching completely depends upon the electromagnetism. When winding of insulted wire is made on soft iron rod and apply is given across its end then magnetic field develops around the rod and due to this magnetic field, magnetism also becomes magnet. In this way, we can be said that on giving supply to the coil winded over a core, it becomes magnet. This magnet is known as electromagnet.

Relay is a device which can turn ON/OFF any external circuit in some special circumstances. The principal relay is a one pole 2 way switch. The difference is that simple switch is manual switch where as relay is an automatic switch to some extent. It has a coil in it.

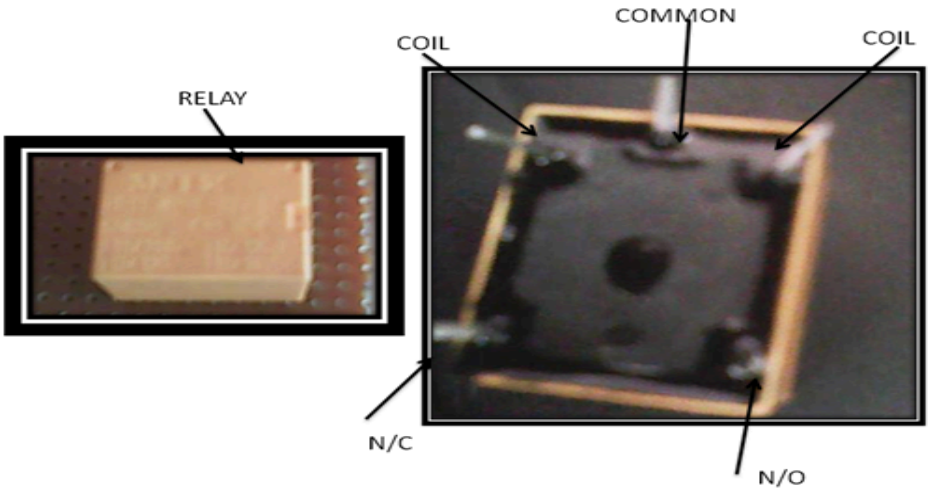
When this coil gets enough supply then it becomes electromagnet and attracts the strip of pole towards itself and changes the position of switch. When supply cuts off then coil demagnetizes and thus switch comes in its normal position. In telephony, the relays are used widely. The relay that we used in this circuit has two states.

1. Normally closed state (NC)

2. Normally opened state (NO)

The control circuit of the relay transistor is shown in figure. When the input to transistor is logic 0, the transistor will be open. So the relay will be holding +12 and which will be in normally closed state.

When the relay is not activated (i.e.) in the reenergized state, NC contacts are closed and NO connections are opened. When the relay is activated (i.e.) in the energized state, NC contacts broken and NO contacts are made. When the relay is de energized the original states of the contacts are returned.




Double contact relays are also present. These relays have a set of common points, a set of NO contacts and set of NC contacts. In single contact relay, only one relay independent load or a series of different loads can be connected.

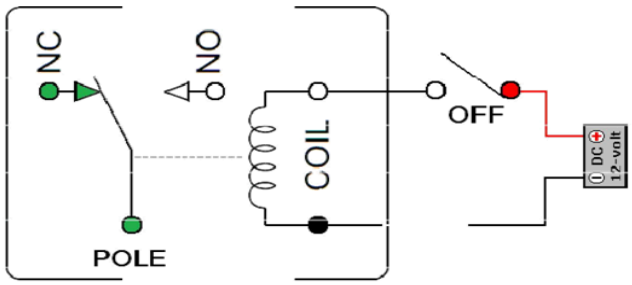
In double contact relay, two independent loads can be connected at two different contacts and these two different and these two loads can be operated as desired.

The Relay consists of 5 terminals namely +12V, Ground, Common, N/O, N/C. Normally the 12V DC power supply is applied to the Relay coil. But the ground terminal is not properly connected to ground i.e., open circuit condition of Relay coil. The output from Driver is applied to the Ground terminal of Relay. When the signal from the Driver is low then the Relay circuit is fully closed and it energizes the Relay. Then the Relay comes to N/O position to N/C position. In this way the Relay connects and disconnects the sources.

Now a day's most of the high end industrial application de vices have relays for their effective working. Relays are simple switches which are operated both electrically and mechanically. Relays consist of an electromagnet and also a set of contacts. The switching mechanism is carried out with the help of the electromagnet. There are also other operating principles for its working. But they

differ according to their applications. Most of the devices have the application of relays.

The main operation of a relay comes in places where only a low-power signal can be used to control a circuit. It is also used in place s where only one signal can be used to control a lot of circuits. The application of relays started during the invention of telephones. They played an important role in switching calls in telephone exchanges.

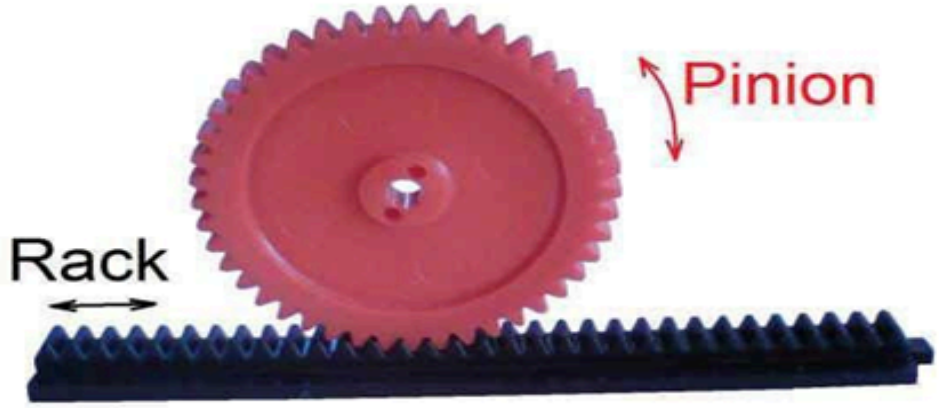



They were also used in long distance telegraphy. They were used to switch the signal coming from one source to another destination. After the invention of computers they were also used to perform Boolean and other logical operations. The high end applications of relays require high power to be driven by electric motors and so on. Such relays are called contactors.

## 4.6 RACK AND PINION MECHANISM

Rack and pinion gears normally change rotary motion into linear motion, but sometimes we use them to change linear motion into rotary motion.

They transform a rotary movement (that of the pinion) into a linear movement (that of the rack) or vice versa.




We use them for sliding doors moved by an electric motor. The rack is attached to the door and the pinion is attached to the motor. The motor moves the pinion which moves the rack and the door moves.

**RACK**

Its primary function is to convert translatory motion into rotary motion. It must have higher strength, rigidity and resistance to shock load and less wear and tear.

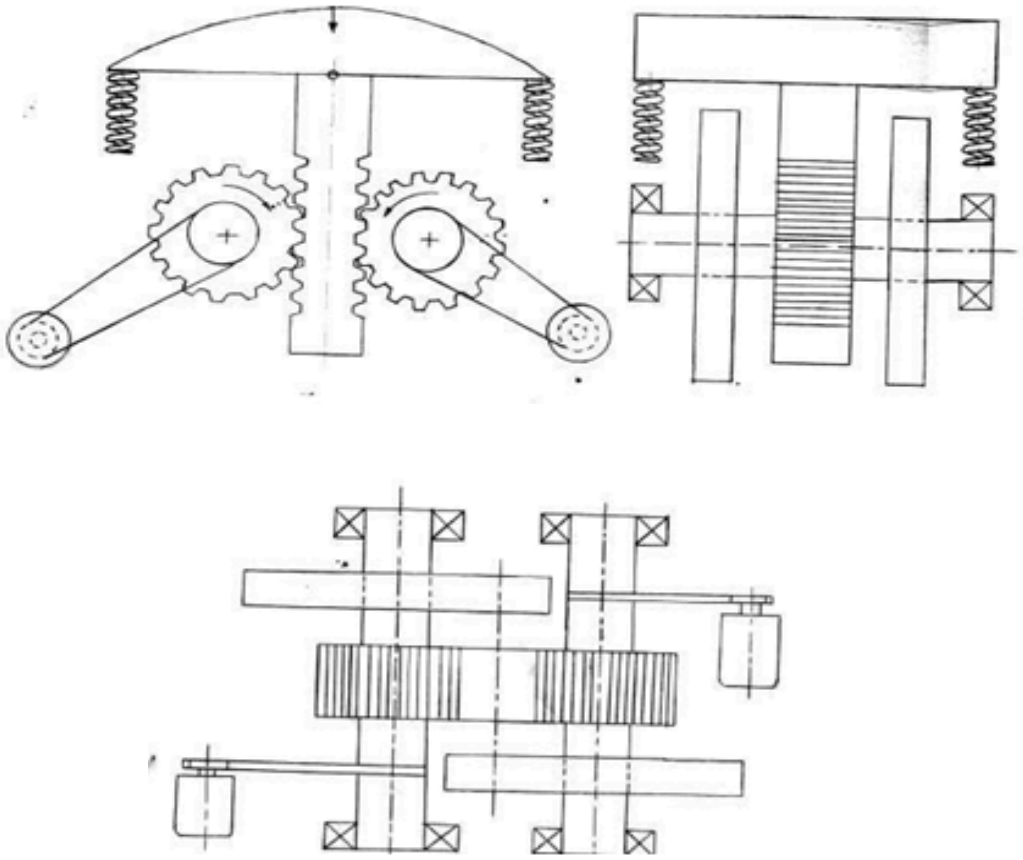


**Fig: Line diagram of power hump**

## 4.7 RAIN SENSOR

Rain is a form of precipitation which forms when separate drops of rain fall to the Earth's surface from clouds. Not all rain reaches the surface, however; some evaporates while falling through dry air. When none of it reaches the ground, it is called virga, a phenomenon often seen in hot, dry desert regions.

The scientific explanation of how rain forms and falls is called the Bergeron process.

Rain plays a role in the hydrologic cycle in which moisture from the oceans evaporates, condenses into clouds, precipitates back to earth, and eventually returns to the ocean via streams and rivers to repeat the cycle again. There is also a small amount of rain vapor that respires from plants and evaporates to join other rain molecules in condensing into clouds.

A rain sensor or rain switch is a switching device by rainfall. There are two main applications by rainfall. The first is a water conservation device connected to an automatic irrigation system that causes the system to shut down in the event of rainfall. The second is a device used to protect the interior of an automobile from rain and to support the automatic mode of windscreen wipers. An additional application in professional satellite communications antennas is to triggers a rain blower on the aperture of the antenna feed, to remove the water droplets from the Mylar and cover that keeps pressurized and dry air inside the wave guides.

In 1958, the cadilac motor car division of general motors experimented with a water sensitive that triggered various electric motors to close the convertible top and raise the open windows of a specially-built Eldorado Biarritz model, in case of rain. The first such device appears to have been used foe that

same purpose in a concept vehicle designated Le Sabre and built around 1950-51.

The most modern rain sensors are based on the principle of total internal reflection: an infrared light is beamed at a 45 degree angle into the windshield From the interior-if the glass is wet, less light makes it back to the sensor, and the wipers turn on. Most vehicles with this feature have an AUTO position on the stalk.

Total internal reflection is the phenomenon which occurs when a propagated wave strikes a medium boundary at an angle larger than a particular critical angle with respect to the normal to the surface. If the refractive index is lower on the other side of the boundary and the incident angle is greater than the critical angle, the wave cannot pass through and is the angle of incidence above the total anfle of internal reflection occurs. This is particularly common as an optical phenomenon, where light waves are involved, but it occurs with many types of waves, such as electromagnetic waves in a general or sound waves.

The amount of rainfall is measured using a rain gauge. It is expressed as the depth of rain that collects on a flat surface, and is routinely measured with an accuracy up to 0.1 mm or 0.01 in. It is sometimes expressed in liters per square meter (1 liter/$m^2$ = 1 mm).

This circuit is designed with two lines are tracked with very short distance. When rain drops falls on this circuit, the track may become short circuit. It gives the corresponding signal to related circuit in order to find the rain fall.

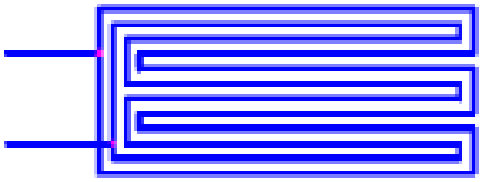


**Fig. 2: Rain sensor**

## CHAPTER 5

## ADVANTAGES

The main advantages of automatic window opening and closing are their low cost and high effectiveness.

- Permitting a wide range of applications and versatility in the buildings (especially like IT Companies).
- It requires no special skill to operate (because of automation) and therefore is most suitable for rural application.

- It can be made from locally available materials.
- Less expensive to install and operate and can be easily made and maintained.

# CHAPTER 6

# APPLICATIONS

- Used in home applications
- Used in industry for furnace automation
- Used to control the more parameters like humidity

# CHAPTER 7

# CONCLUSION

The work is successful and application of such a simple method in a house window seems to be reasonable as unattended open windows can be closed when it rains to protect the indoor from rain. The circuit can further be modified to add

a wind speed sensor so as to close the windows when winds of a certain limit of speed blows, thus it will prevent the indoors from unwanted impurities like dust. The circuit and the window structure and mechanism can further be modified for better efficiency and with the consumption of less energy. Another modification is that a battery can be added as a backup power source under no current conditions can also be included in the future enhancement.

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