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A SELF POWERED INTERNET OF THINGS BASED WATER MANAGEMENT SYSTEM

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Abstract

Water is very important for human being and other living things. In human body, more than 70% are fluid such as blood and all these fluid are basically formed by water. Bone marrow needs water to generate blood then blood carries the oxygen from lung to whole body. Besides that, water can maintain human's body temperature and provide natural material with mineral. Water is not only essential for human body, it is also playing an important role in our daily life activities, examples like washing clothes and food, bathing for personal hygiene and acting as solvent for all cleaning reagent. Consequently, water industries refer to a problem solver in this situation. We design a system which can help us to save water consumption at every node. The following report focuses on the design and implementation of water management system, calculating the respective quantities of water required for the school and for the hospital to run effectively and evaluating the alternative green solutions available to ensure efficient use of water. Installing water meters at every valve and pipes (if possible) for example, is a good way to monitor the establishment's water consumption, by doing so we can determine the monthly water consumption and cost of our workplace, if we are aware of this we'll know what department consumes too much water and necessary action will be taken immediately. Water saving devices like flow regulators, water flow sensors, and low flush toilets are just some of the things we can put in our comfort rooms and kitchens to make sure that wasting water is at a minimal, and if observed thoroughly.

Keywords: DC Motor, Wi-Fi, Water level sensor, RPS, Water flow sensor,Tap.

1. INTRODUCTION

Now -a -days, water wastage is a major problem around the world. Proper water management system will decrease the water wastage. The design and implementation of water management system, calculating the respective quantities of water required for the school and for the hospital to run effectively and evaluating alternative green solutions available to ensure efficient use of water.

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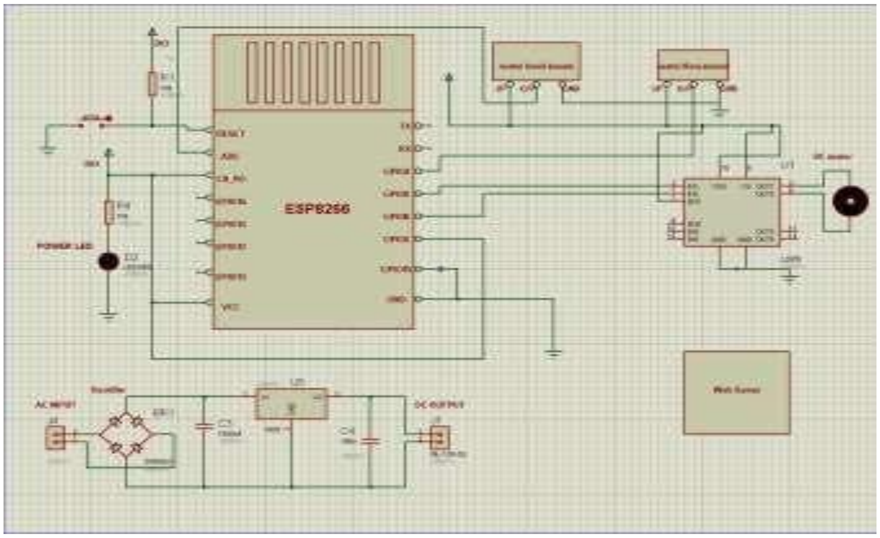
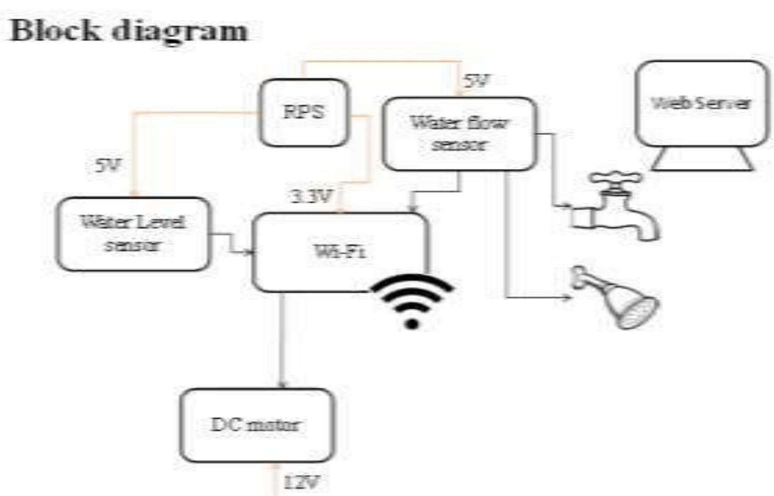


Installing water flow sensor at every valve and pipes to monitor the establishment's water consumption. The amount of water consumed is called, based on that the monthly water consumption and cost is calculated. The consumed amount of water and cost can be viewed using android mobile. The filter process is also obtained to get fresh pure water



CIRCUIT DIAGRAM OF PROPOSED SYSTEM

Hardware Requirements:

- Flow meter
- Wi-Fi module

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- Water level sensor
- DC motor
- RPS

The detailed description is as follows:

FLOW METER

A flow meter is a device that measures mass flow rate of a fluid traveling through a tube. The mass flow rate is the mass of the fluid traveling past a fixed point per unit time. In other words Flow measurement is the quantification of bulk fluid movement. Flow can be measured in a variety of ways. Positive-displacement flow meters accumulate a fixed volume of fluid and then count the number of times the volume is filled to measure flow. The mass flow meter does not measure the volume per unit time (e.g., cubic meters per second) passing through the device; it measures the mass per unit time (e.g., kilograms per second) flowing through the device. Volumetric flow rate is the mass flow rate divided by the fluid density. If the density is constant, then the relationship is simple. If the fluid has varying density, then the relationship is not simple.

This sensor sit in line with your water line, and uses a pinwheel sensor to measure how much liquid has moved through it. The pinwheel has a little magnet attached, and there's a hall effect magnetic sensor on the other side of the plastic tube that can measure how many spins the pinwheel has made through the plastic wall. This method allows the sensor to stay safe and dry.

Flow meter

Water flow sensor consists of a plastic valve body, a water rotor, and a hall-effect sensor. When water flows through the rotor, rotor rolls. Its speed changes with different

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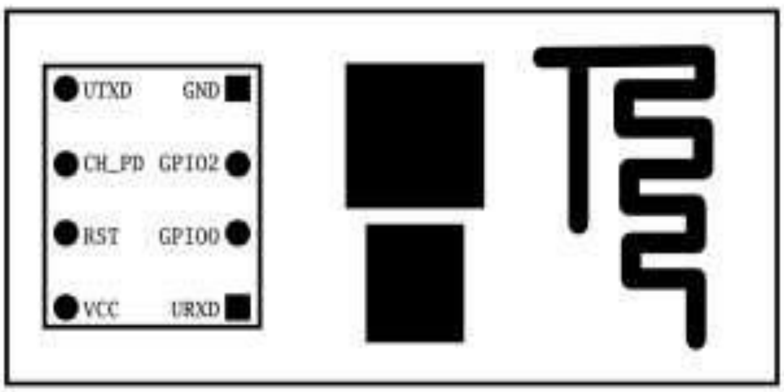
rate of flow. The hall-effect sensor outputs the corresponding pulse Signal. The sensor comes with three wires: red (5-24VDC power), black (ground) and yellow (Hall effect pulse output). By counting the pulses from the output of the sensor, you can easily track fluid movement: each pulse is approximately 2.25 milliliters. Note this isn't a precision sensor, and the pulse rate does vary a bit depending on the flow rate, fluid pressure and sensor orientation. It will need careful calibration if better than 10% precision is required. However, its great for basic measurement tasks.

WI-FI MODULE ESP8266 WIFI Module

ESP8266 is an impressive, low cost WIFI modulesuitable for adding WIFI functionality to an existing microcontroller project via a UART serial connection. The module can even be reprogrammed to act as a standalone WIFI connected device–just add power! The feature list is impressive and includes: 802.11 b/g/n protocol Wi-Fi Direct (P2P), soft-AP Integrated TCP/IP protocol stack. This guide is designed to help you get started with your new WIFI module so let’s start! The hardware connections required to connect to the ESP8266 module are fairly straight-forward but there are a couple of important items to note related to power: The ESP8266 requires 3.3V power–do not power it with 5 volts. The ESP8266 needs to communicate via serial at 3.3V and does not have 5V tolerant inputs.

PIN DIAGRAM :



ESP8266 WiFi Pinout
Top View (Not to scale)

ESP8266 PIN DESCRIPTION

ESP8266 has 8 pins, 4 in the row of 2. The first pin on the top left is GND. The two pins right from the GND are GPIO 2 and 0. The pin on the top right side is the RX pin and the pin on the lower left is TX. These are the pins for communication. The middle pins on the bottom are CH_PD (chip power-down) and RST (reset). The main thing to remember is, that this device works with 3.3V; Even the RX and TX pins. Controller or many USB to serial converters work with 5V.

INTERNET ACCESS

Wi-Fi technology may be used to provide Internet access to devices that are within the range of a wireless network that is connected to the Internet. The coverage of one or more interconnected access points (*hotspots*) can extend from an area as small as a few rooms to as large as many square kilometres. Coverage in the larger area may require a group of access points with overlapping coverage. For example, public outdoor Wi-Fi technology has been used successfully in wireless mesh networks in London, UK. An international example is FON.Wi-Fi provides service in private homes, businesses, as well as in public spaces at Wi- Fi hotspots set up either free-of-charge or commercially, often using a captive portal webpage for access. Organizations and businesses, such as airports, hotels, and restaurants, often provide free-use hotspots to attract customers. Enthusiasts or authorities who wish to provide services or even to promote business in selected areas sometimes provide free Wi-Fi access.

WIRELESS ACCESS POINT:

A wireless access point (WAP) connects a group of wireless devices to an adjacent wired LAN. An access point resembles a network hub, relaying data between connected wireless devices in addition to a (usually) single connected wired device, most often an Ethernet hub or switch, allowing wireless devices to communicate with other wired devices.Wireless adapters allow devices to connect to a wireless network. These adapters connect to devices using various external or internal interconnects such as PCI, Mini PCI, USB, Express Card, Card bus and PC Card. As of 2010, most new laptop computers come equipped with built in internal adapters.

DATA SECURITY RISKS

The most common wireless encryption-standard, Wired Equivalent Privacy (WEP), has been shown to be easily breakable even when correctly configured. Wi-Fi Protect Access (WPA and WPA2) encryption, which became available in devices in 2003, aimed to solve this problem. Wi-Fi access points typically default to an encryption-free (*open*) mode. Novice users benefit from a zero-configuration device that works out-of-the-box, but this default does not enable any wireless security, providing open wireless access to a LAN. To turn security on requires the user to configure the device, usually via a software graphical user interface (GUI). On unencrypted Wi-Fi networks connecting devices can monitor and record data (including personal information). Such networks can only be secured by using other means of protection, such as a VPN or secure Hypertext Transfer Protocol over Transport Layer Security (HTTPS).

Wi-Fi Protected Access encryption (WPA2) is considered secure, provided a strong passphrase is used. A proposed modification to WPA2 is WPA-OTP or WPA3, which stores an on-chip optically generated onetime pad on all connected

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devices which is periodically updated via strong encryption then hashed with the data to be sent or received. This would be unbreakable using any (even quantum) computer system as the hashed data is essentially random and no pattern can be detected if it is implemented properly. Main disadvantage is that it would need multi-GB storage chips so would be expensive for the consumers.

Securing methods

A common measure to deter unauthorized users involves hiding the access point's name by disabling the SSID broadcast. While effective against the casual user, it is ineffective as a security method because the SSID is broadcast in the clear in response to a client SSID query. Another method is to only allow computers with known MAC addresses to join the network, but determined eavesdroppers may be able to join the network by spoofing an authorized address. Wired Equivalent Privacy (WEP) encryption was designed to protect against casual snooping but it is no longer considered secure. Tools such as AirSnort or Aircrack-ng can quickly recover WEP encryption keys.[61] Because of WEP's weakness the Wi-Fi Alliance approved Wi-Fi Protected Access (WPA) which uses TKIP. WPA was specifically designed to work with older equipment usually through a firmware upgrade. Though more secure than WEP, WPA has known vulnerabilities.

The more secure WPA2 using Advanced Encryption Standard was introduced in 2004 and is supported by most new Wi-Fi devices. WPA2 is fully compatible with WPA. A flaw in a feature added to Wi-Fi in 2007, called Wi-Fi Protected Setup, allows WPA and WPA2 security to be bypassed and effectively broken in many situations. The only remedy as of late 2011 is to turn off Wi-Fi Protected Setup, which is not always possible. Virtual Private Networks are often used to secure Wi-Fi. Piggybacking refers to access to a wireless Internet connection by bringing one's own computer within the range of another's wireless connection, and using that service without the subscriber's explicit permission or knowledge. During the early popular adoption of 802.11, providing open access points for anyone within range to use was encouraged to cultivate wireless community networks, particularly since people on average use only a fraction of their downstream bandwidth at any given time. Recreational logging and mapping of other people's access points has become known as war driving. Indeed, many access points are intentionally installed without security turned on so that they can be used as a free service. Providing access to one's Internet connection in this fashion may breach the Terms of Service or contract with the ISP. These activities do not result in sanctions in most jurisdictions; however, legislation and case law differ considerably across the world. A proposal to leave graffiti describing available services was called war chalking. A Florida court case determined that owner laziness was not to be a valid excuse. Piggybacking often occurs unintentionally – a technically unfamiliar user might not change the default "unsecured" settings to their access point and operating systems can be configured to connect automatically to any available wireless network.

A user who happens to start up a laptop in the vicinity of an access point may find the computer has joined the network without any visible indication. Moreover, a user intending to join one network may instead end up on another one if the latter has a stronger signal. In combination with automatic discovery of other network resources this could possibly lead wireless users to send sensitive data to the wrong middle-man when seeking a destination .For example, a user

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could inadvertently use an unsecure network to log into a website, thereby making the login credentials available to anyone listening, if the website uses an unsecure protocol such as HTTP. An unauthorized user can obtain security information (factory preset passphrase and/or Wi-Fi Protected Setup PIN) from a label on a wireless access point can use this information (or connect by the Wi-Fi Protected Setup pushbutton method) to commit unauthorized and/or unlawful activities.

FEATURES

- 802.11 b/g/n protocol
- Wi-Fi Direct (P2P), soft-AP
- Integrated TCP/IP protocol stack
- Integrated TR switch, balun, LNA, power amplifier and matching network
- Integrated PLL, regulators, and power management units
- +19.5dBm output power in 802.11b mode
- Integrated temperature sensor
- Supports antenna diversity
- Power down leakage current of < 10uA
- Integrated low power 32-bit CPU could be used as application processor
- SDIO 2.0, SPI, UART
- STBC, 1×1 MIMO, 2×1 MIMO
- A-MPDU & A-MSDU aggregation & s guard interval 0.4
- Wake up and transmit packets in < 2ms
- Standby power consumption of < 1.0mW (DTIM3)

WATER LEVEL SENSOR

Principle of Operation:

A liquid level control system by using a float sensor works on the principle of buoyancy, which states, "A float immersed in a liquid is buoyed towards upward direction by an applied equal force to the weight of the displaced liquid". As a result, the body drives partially and gets submerged upon the liquid surface and covers the same distance the liquid level moves.

Construction:

A level measurement float system consists of a float, a sensor stem, a magnet, a reed switch and a weight suspended on the outside of the open tank. A scale is fixed on the outside of the tank, and the contents of the tank's level are indicated by the position of the weight along the scale.

Working:

Level detection of liquids is often done with a float- type liquid level switch. The float transfers on a mechanical

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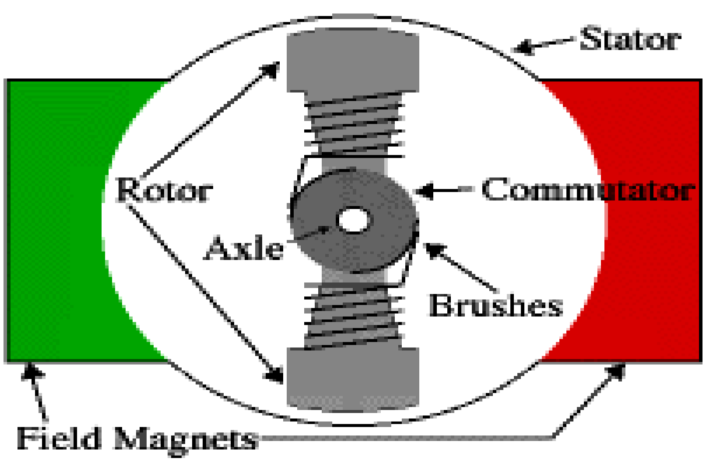
arm or sliding pole and activates a switch when the level moves towards upward direction. Sometimes the float itself contains a small magnet that varies the state of a switch when the liquid level gets moving up and moves into the original position. This type of level sensor comes with many advantages like it is very simple, highly accurate, and best suitable for various products. The Disadvantages of this sensor are that it requires various mechanical equipment, especially the pressure vessels.

Primary Areas of Float Sensor Application:

In view of the requirements pertaining to the increase in usage of sealed tanks, the current industrial systems make use of this type of float method for precise reading and accuracy, which is a good example of electronics and mechanical engineering, making it the most accurate level- measuring system for various applications in very large storage tanks.

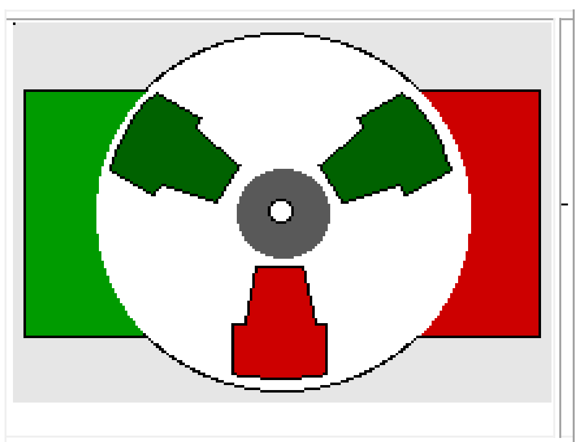
DC MOTOR

In any electric motor, operation is based on simple electromagnetism. A current-carrying conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field. As you are well aware of from playing with magnets as a kid, opposite (North and South) polarities attract, while like polarities (North and North, South and South) repel. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current-carrying conductor and an external magnetic field to generate rotational motion. Let's start by looking at a simple 2-pole DC electric motor (here red represents a magnet or winding with a "North" polarization, while green represents a magnet or winding with a "South" polarization).



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

polarities of the energized winding and the stator magnet(s) are misaligned, and the rotor will rotate until it is almost aligned with the stator's field magnets. As the rotor reaches alignment, the brushes move to the next commutator contacts, and energize the next winding. Given our example two-pole motor, the rotation reverses the direction of current through the rotor winding, leading to a "flip" of the rotor's magnetic field, driving it to continue rotating. In real life, though, DC motors will always have more than two poles (three is a very common number). In particular, this avoids "dead spots" in the commutator. You can imagine how with our example two-pole motor, if the rotor is exactly at the middle of its rotation (perfectly aligned with the field magnets), it will get "stuck" there. Meanwhile, with a two-pole motor, there is a moment where the commutator shorts out the power supply (i.e., both brushes touch both commutator contacts simultaneously). This would be bad for the power supply, waste energy, and damage motor components as well. Yet another disadvantage of such a simple motor is that it would exhibit a high amount of torque "ripple" (the amount So since most small DC motors are of a three-pole design, let's tinker with the workings of one via an interactive animation (JavaScript required):



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

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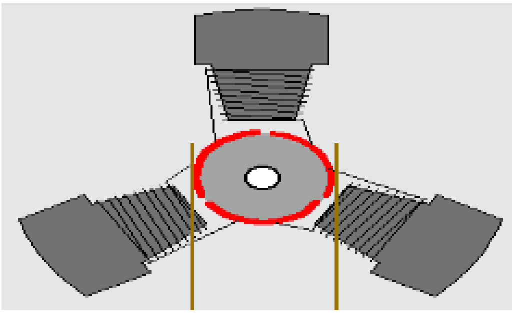

There's probably no better way to see how an average DC motor is put together, than by just opening one up. Unfortunately this is tedious work, as well as requiring the destruction of a perfectly good motor. Luckily for you, I've gone ahead and done this in your stead. The guts of a disassembled Mabuchi FF-030-PN motor (the same model that Solarbotics sells) are available for you to see here (on 10 lines / cm graph paper). This is a basic 3-pole DC motor, with 2 brushes and three commutator contacts. The use of an iron core armature (as in the Mabuchi, above) is quite common, and has a number of advantages[2]. First off, the iron core provides a strong, rigid support for the windings -- a particularly important consideration for high-torque motors. The core also conducts heat away from the rotor windings, size, extending brush and commutator life.

The coreless design also allows manufacturers to build smaller motors; meanwhile, due to the lack of iron in their rotors, coreless motors are somewhat prone to overheating. As a result, this design is generally used just in small, low- power

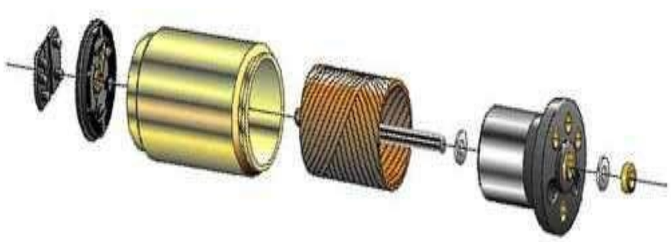

Diagram courtesy of MicroMo

motors. BEAMers will most often see coreless DC motors in the form of pager motors.

points) for the passive and active electronic devices incorporated in the system.

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1. **Poor regulation**. The output voltage is far from constant as the load varies. The internal resistance of an ordinary power supply is relatively large (more than 30 ohms).

2. **Variations in the ac supply mains**. The permissible variation in the ac supply mains voltage as per Electricity Rules is 6% of its rated value. But in some countries, the variations in ac mains voltage is much more than this (sometimes it may vary from 180 V to 260 V). The dc output voltage being proportional to the input ac voltage, therefore, varies largely.

3. **Variations in temperature**. The dc output voltage varies with temperature, particularly if semiconductor devices are employed.Regulated power supply is an electronic circuit that is designed to provide a constant dc voltage of predetermined value across load terminals irrespective of ac mains fluctuations or load variations.

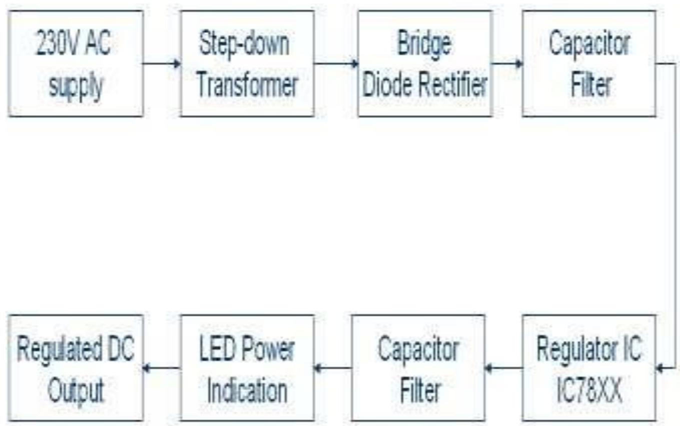

Figure: Block Diagram of RPS

The output from an ordinary power supply is fed to the voltage regulating device that provides the final output.

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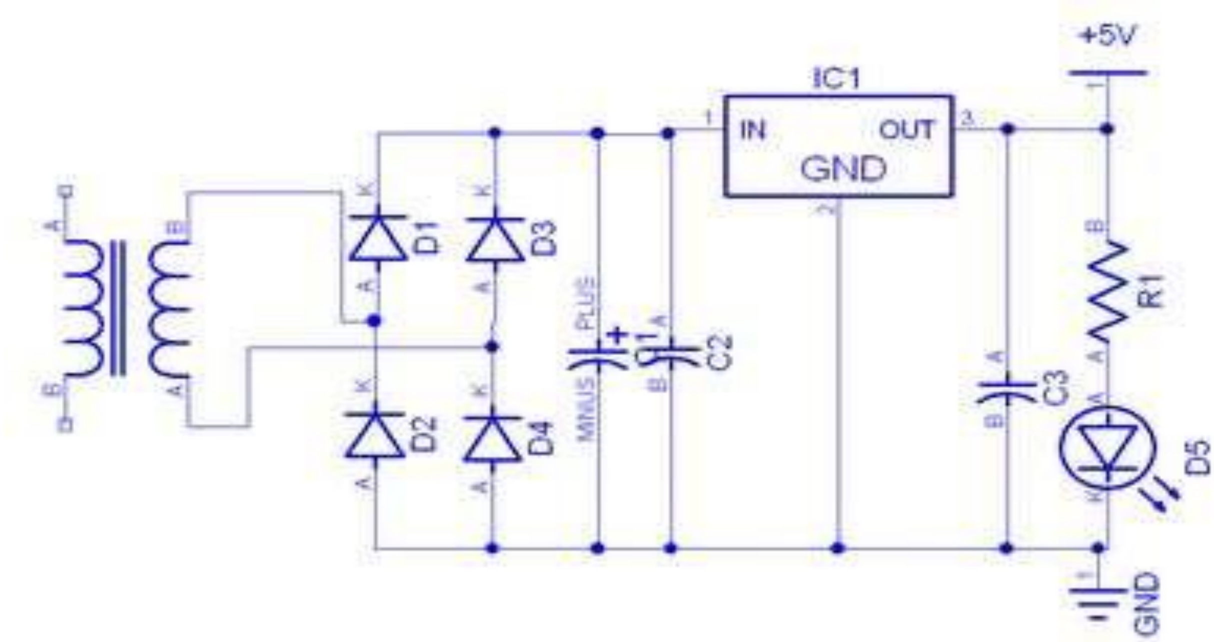

Figure: Regulated power supply circuit

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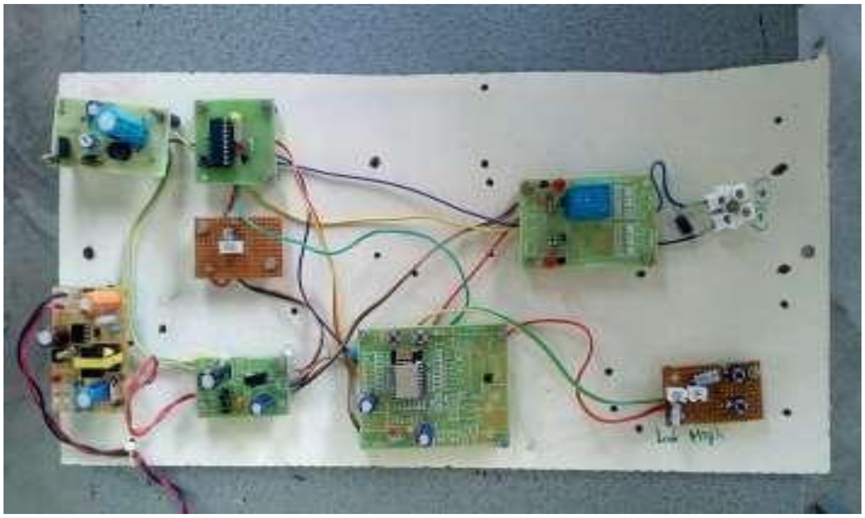

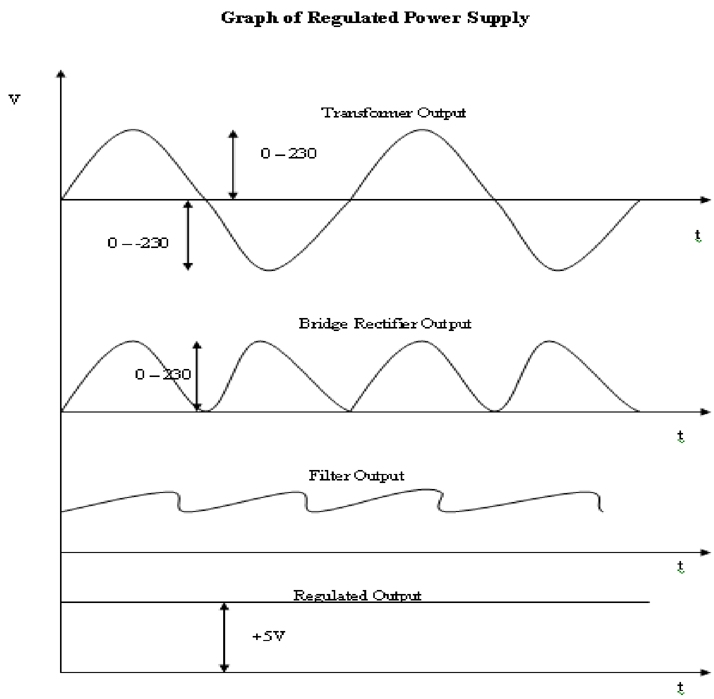

Often more than one dc voltage is required for the operation of electronic circuits.

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HARDWARE MODEL

SUPPLY CHARACTERISTICS

There are various factors that determine the quality of the power supply like the load voltage, load current, voltage regulation, source regulation, output impedance, ripple rejection, and so on. Some of the characteristics are briefly explained below:

1. **Load Regulation** – The load regulation or load effect is the change in regulated output voltage when the load current changes from minimum to maximum value.

Load regulation = Vno-load – Vfull-load

Vno-load – Load Voltage at no load Vfull-load – Load voltage at full load.

From the above equation we can understand that when Vno-load occurs the load resistance is infinite, that is, the out terminals are open circuited. Vfull-load occurs when the load resistance is of the minimum value where voltage regulation is lost.

% Load Regulation = [(Vno-load - Vfull-load)/Vfull- load] * 100

Minimum Load Resistance – The load resistance at which a power supply delivers its full-load rated current at rated voltage is referred to as minimum load resistance.

Minimum Load Resistance = Vfull-load/Ifull-load

The value of Ifull-load, full load current should never increase than that mentioned in the data sheet of the power supply.

2. **Source/Line Regulation** – In the block diagram, the input line voltage has a nominal value of 230 Volts but in practice, here are considerable variations in ac supply mains voltage. Since this ac supply mains voltage is the input to the ordinary power supply, the filtered output of the bridge rectifier is almost directly proportional to the ac mains voltage.

The source regulation is defined as the change in regulated output voltage for a specified rage of lie voltage.

3. **Output Impedance** – A regulated power supply is a very stiff dc voltage source. This means that the output resistance is very small. Even though the external load resistance is varied, almost no change is seen in the load voltage. An ideal voltage source has an output impedance of zero.

4. **Ripple Rejection** – Voltage regulators stabilize the output voltage against variations in input voltage. Ripple is equivalent to a periodic variation in the input voltage. Thus, a voltage regulator attenuates the ripple that comes in with the unregulated input voltage.

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