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# PROTOTYPE AUTOMATIC STREET LIGHT

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## ABSTRACT

*The automatic street light control is an electric device designed to provide an alternative to the switching system of existing one. The automatic street light control become imperative to overcome the shortcoming of the previous and presently existing methods of switching to control light supply. Automatic street light made use photoelectric device as sensor, it sense light and darkness so that light will automatically switch ON and OF. It is made up of different unit to perform and serves its purpose. This paper aims at designing automatic street light system. Nowadays, human has become too busy, and is unable to find time even to switch the lights whenever not necessary. The present system is like the street lights will be switched on in the evening before the sun sets and they are switched off the next day morning after there is sufficient light on the roads. This is the best solution for electrical power wastage. In this system the two sensors are used which are light dependent resistor LDR sensor to indicate a day /night and the photoelectric sensors to detect the movement on the street. The Microcontroller PIC16F877A is used as brain to control the street light system. Where the programming language used for developing the software to the microcontroller is C- language. Finally, the system has been successfully designed and implemented as prototype system. It is suitable for use at home areas where illumination is important.*

**Keywords**: Street light, LDR, photoelectric sensor, microcontroller, energy saving and circuit design.

## 1. INTRODUCTION

Automatic street light control model is an electronic device designed to provide illumination whenever there is darkness. There is need for this device to serve as illumination after that the radiant light from the sun seizes. This device came into use when civilization and modernization tends to increase and the replacement of the earlier method of illumination like the one will control switches was made. Early method was no all ideal because of the cost and stress involved of human being. The device consists of main power supply unit to be

able to serve its purpose. According to B.L Theraja (1979) circuit, it consists of a resistor connected in sense across the output terminals of the voltage regulator. Obviously, it eliminates the necessity of providing separate DC power supplies to different electronic circuit working on different DC levels, from fig1 that is really required for conversion from AC to DC is a transformer and a rectifier (in fact, even the transformer could be eliminated if no voltage transformation is required). The rectifier, filter, and voltage regulator are mere refinement of a DC power supply though they are essential for most applications except for battery charging and running small DC motor. Jones M. H (2008) The SSC (supply station controller) is installed inside the supply station and controls group of lamps per feeder. In addition to this, the SSC is equipped with a sensor, which generates alarms in the case of the stations door being opened, thus ensuring the security and integrity of the supply station. It automatically switches ON when there is darkness and OFF when there light. This is designed to provide illumination wherever there is darkness, to reduce the strength of human being and to reduce the rate of road accident. The major criticism of street lighting is that it can actually cause accidents if misused, and cause light pollution.[D.A.U Fleet fire (2003)] Discusses on the essential implementation aspect of energy conservation with respect to solar energy. This is simple yet powerful concept by which it uses transistor as switch. Automatic streetlight switches ON when the night falls and turns OFF when the sun rises. By using the system manual works are 100% removed and also energy consumption. The automatic streetlight control operates on 12vDC supply ,it has a photoconductive device whose resistance change proportionally to extent of illumination which switches ON or OFF the L.E.D with the used of transistor as a switches, light dependent resistor, a photo conductive device has been used as the traducer to convert light energy into electrical energy. Power supply to the circuit is applied from the regulated power supply. The A.C input i.e. 220v, DC voltage is required to operate electronic component and these voltage are 9v or 12. But those voltages cannot be obtained directly. L. Hilborn (2007) effective methods for the usage of nonrenewable resources needed to be developed. The automatic street light control is a therefore designed and developed to replace existing ones. It is made up of different unit to perform and serve its purpose. It is suitable for use at home areas where illumination is paramount importance. The internet of things (IoT)is always giving unprecedented answers for the customary issues looked by man. One of the real obstacles in city is we are spending huge expenses on street light. To control the street light based on detection of sunlight by implemented with smart embedded system.

## 2. LITERATURE REVIEW

The earliest lamps were used by Greek and Roman civilizations, where light primarily served the purpose of security, both to protect the wanderer from tripping over something on the path as well as keeping the potential robbers at bay. At that time oil lamps were used predominantly as they provided a long-lasting and moderate flam. The Romans had a word 'laternarius which was a term for a slave responsible for lighting up the oil lamps in front of their villas.

Before incandescent lamps, candle lighting was employed in cities. The earliest lamps required that a lamplighter tour the town at dusk, lighting each of the lamps, but later designs employed ignition devices that would automatically strike the flame when the gas supply was activated. The earliest of such street lamps were built in the Empire, the first modern street lamps, which used kerosene, were introduced in Lviv in what was then the Austrian Empire in 1853.ss

The first electric street lighting employed are lamps, initially the 'Electric candle', 'Jablotchkoff candle' or 'Yablochkov candle' developed by the Russian Pavel Yablochkov in 1875. This was a carbo are lamp employing alternating current, which ensured that both electrodes were consumed at equal rates. Yablochkov candles were first used to light the Grands Magasins du Louvre, Paris where 80 were deployed-improvement which was one of the reasons why Paris earned its 'City of Lights" nickname. Soon after, experimental arrays of arc lamps were used to light Holborn viaduct and the Thames embankment in London- the first electric street lighting in Britain. More than 4,000 were in use by 1881, thought by then an improved differential arc lamp had been developed by friedrich von Hefner- Alteneck of Siemens and Halske.

To avoid having the entire system go dark if a single lamp burned out, each street lamp was equipped with a device that ensured that the circuit would remain intact. Early series street lights were equipped with isolation transformers. That would allow current to pass across the transformer whether the bulb worked or not. Later the film cutout was invented. The film cutout was a small disk of insulating film that separated two contacts connected to the two wires leading to the lamp. If the lamp failed (an open circuit), the current through the string became zero, causing the voltage of the circuit (thousands of volts) to be imposed across the insulating film, penetrating it (see ohm's law). In this way, the failed lamp was bypassed an automatic voltage regulator, preventing the current from increasing lamp was replaced; a new piece of film

was installed, once again separating the contacts in the cutout. This system was recognizable by the large porcelain insulator separating the lamp and reflector from the mounting arm. This was necessary because the two contacts in the lamp's base may have operated at several thousand volts above ground/ earth.
Today, street lighting commonly uses high-intensity discharge lamps, often HPS high pressure sodium lamps. Such lamps provide the greatest amount of photonic illumination for the least consumption of electricity. However, when isotopic/photonic light calculations are used, it can be seen how inappropriate HPS lamps are for night lighting. White light sources have been shown to double driver peripheral vision and increase driver break
Reaction time at least 25%.when S/P light calculations are used; HPS lamp performance needs to be reduced by a minimum value of 75%. This is now a standard design criterion for Australian roads.
A study comparing metal halide and high-pressure sodium lamps showed that at equal photo light levels, a street scene illuminated at night by a metal halide lighting system was reliably seen as brighter as and safer than the same scene illuminated by a high pressure sodium system. New street lighting technologies, such as LED or induction lights, emit a white light that provides high levels of isotopic lumens allowing street lights with lower wattages and lower photo pic lumens to replace existing street lights. However, there have been no formal specifications written around photonics/isotopic adjustments for different types of light sources, causing many municipalities and street departments to hold back on implementation of these new technologies until the standards are updated.

Photovoltaic powered LED luminaries are gaining wider acceptance. Preliminary field tests show that some LED luminaries are energy-efficient and perform well in testing environments. In 2007, the civil twilight collective created a vanned of the conventional LED streetlight, namely the lunar light. This streetlight design thus reduces energy consumption as well as light pollution.
Street lighting systems require ongoing maintenance, which can be classified as either reactive or preventative. Reactive maintenance is a direct response to a lighting failure, such as replacing a discharge lamp after it has failed, or replacing an entire lighting unit after it has been hit by a vehicle. Preventative maintenance is scheduled replacement of lighting components, for example replacing all of the discharge lamps in an area of the city when they have reached 85% of their expected life.

## 3. POWER SUPPLY TO THE SYSTEM

This introduces the operation of AC power supply into DC power supply circuit build using filters, rectifier and then voltage regulator starting with an AC, voltage, a steady DC voltage is obtained by rectifying the AC voltage, then filtering to a DC level, and finally regulating to obtain a desired fixed DC, voltage.

The power supply unit is a component that supplies electrical power to every other component in the system by converting standard 220V, 50/60HZ, DC. Accepted to the microcircuit. A block diagram containing the parts of typical power supply and the voltage at various points in the unit is shown in fig1.

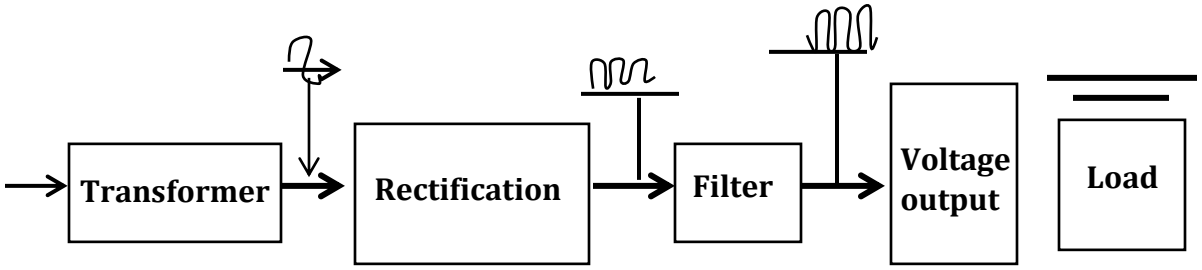



*Fig 1: Rectification Circuit*

Rectification is the conversion of AC the most important rectifying component in modern use is the semi – conductor diode. Severer rectifier circuit is shown in the figure 2, below.

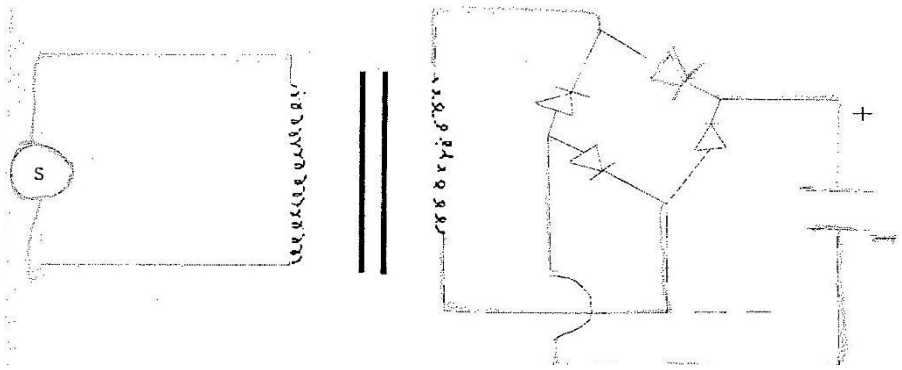



*Fig 2: Full Wave Bridge Rectifier Circuit*

Full wave rectification is universally used in electronics and produces pulse DC at twice the supply frequency. This can be achieved with two diode if a

center – tapped transformer is used, or with four diode connected in a bridge configuration is the most widely used nowadays, requiring a secondary winding without a center tap on the transformer. Four diodes arranged in the bride with four terminals or lead is commonly available and known as bridge rectifier. The rectification employed in this construction is full wave bridge rectification. The diagram in fig. 2. c point A will be positive with respect to ground G point B will be negative with respect to ground G. if the batteries are now reversed, then A will be negative , and Position with respect to G the A. C supply reverses each half-cycle. Therefore, a will be position and B negative, with respect to G on one half-cycle and the position on the other half-cycle.

## 4. NO LOAD VOLTAGE

No load voltage is the output with the load open circuit i.e. when the load is removed a simple power supply with no load resistance reservoir capacitance charge up to the peak voltage as normal. However, with THE ABSENT OF A load resistor, the capacitor retains the charge across its peak voltage without any ripple. The no load voltage is therefore the highest terminal voltage if the main supply is supply is used there is no load terminal voltage.

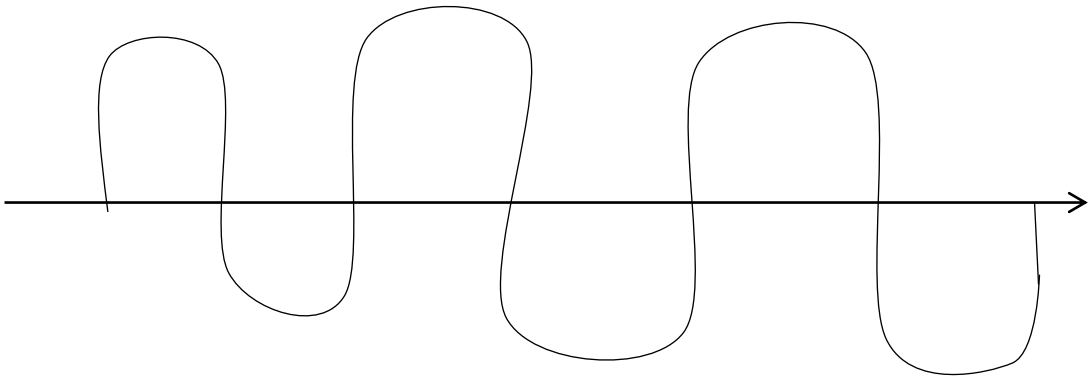


*Fig 3: No Load Voltage*

## 5. METHODOLOGY

### 5.1 COMPONET SELECTION

#### 5.1.1 Transformers

A transformer is a component that can be technically be defined as an inductor, because it is conductor, because it is constructed by placing two coils in close proximity to each other. One of the main applications of transformer is to step up or down an AC voltage. The diagram below shows the typical schematic of a transformer.

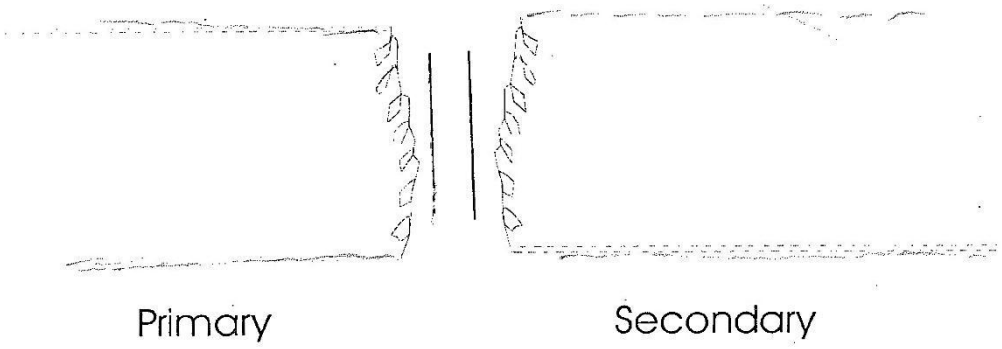
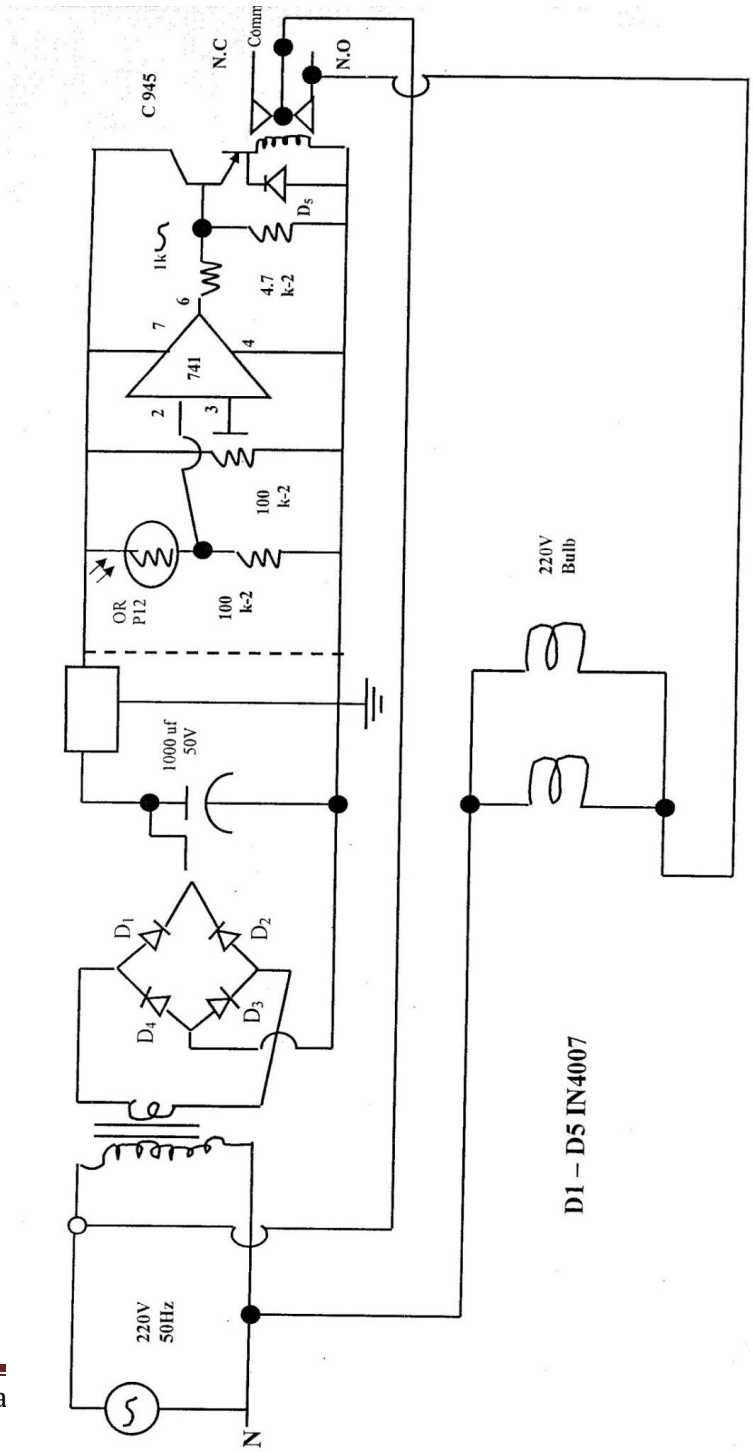



*Fig 4: Transformers*

Transformer are widely available commercially in a large of sizes, power rating and electrical configuration and are designed for operation at a specific frequency usually 50, 60, or 400HZ.




D1 – D5 IN4007

THE COMPLETE CIRCUIT DIAGRAM OF A PROTOTYPE AUTOMATIC DUAL CARRIAGE STREET LIGHT

## 5.2 OPERATION OF THE SYSTEM

The director current voltage that powers the circuit is derived from a two anode step down transformer. Bridge rectification was used for the two – anode transformer. The output from the transformer is then passed to the filter stage, when will smoothen it with capacitor. This smoothing is necessary in order to remove all forms of ripple and is connected to a resistor, which act as a regulator limiting the flow current so that there would not be excessive flow of current. This current thus flow through the photoelectric deice, it carries it to be conductive and provides a low needs light to work. When light strikes the photoelectric device, is carries it to be conductive and provide a low resistive path, this prevent the transistor from charging to a voltage in significant and prevent the circuit system to trigger on, but when there is darkness the resistance is very high and voltage will be enough to trigger their system to flow through it. Then the current will flow into the comparator stage in which it will vary the current to a particular voltage level set up for the system to work and the light indicator will be on, indicating the presence of current flow in the system. After this, the relay will be energized the contact will close and complete the circuit foe current to pass to the bulbs that have been connected to the system.

## 6. TEST AND RESULTS

Various tests are carried out on the design and construction of the automatic street light control system and the results obtained are as follows:

i. The first test was carried out is on the secondary terminal (output) of the 220/12v transformer, which was connecting the secondary terminal to a cathode ray oscilloscope (CRO) as shown in the diagram below it can be noted from the result that the output voltage is still alternating

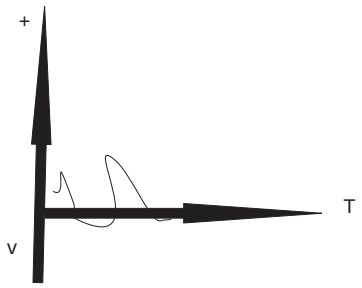



**Fig 6**

ii. The other test that was also carried out is on the diodes, the test on the diode with the help of cathode ray oscilloscope and the result obtained is a unidirectional pulsating output at twice the frequency of the output which

shown that input AC cycle has been rectified was observe. The output voltage is show as:

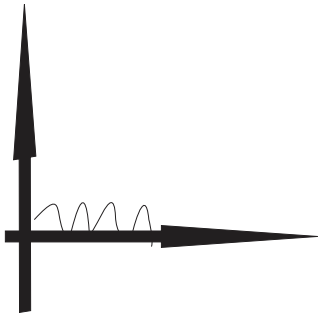


**Fig 7**

iii. The third test was carried out on the smoothing circuit as shown in the diagram below and the result also collected.

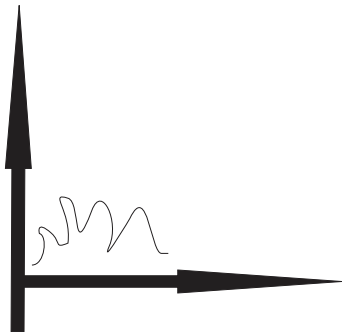


**Fig 8**

iv. The test was carried out after the complete construction of the project as it was connected or plugged in the power source and all bubs bring its illumination.

## 6. CONCLUSION

The automatic street light has exposed the student (s) to the practical knowledge of electrical and electronics and the system or method of joining component together, therefore, the basic principle of all electronic circuit will be well known to every electrical electronics and computer engineering students during time project construction. In the future to use motion sensor to detect surrounding movements to turn a street light ON and OFF.

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