IO T Based Smart Street Light System Using Renewable Energy

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Abstract: IoT based Smart Street lighting systems are one of the key infrastructures of a smart city and are important for safe driving and safety of the pedestrians. Also, owing to the large number of lamps, street lighting accounts to high energy consumption and thus a significant cost to the utilities. Smart street lighting solutions enable control, monitoring and automatic fault detection, transforming these systems into intelligent and energy efficient networks, resulting in huge savings in power bills. This paper presents an overall analysis of the smart grid solutions for street lighting and techniques to automatic charging through solar, wind (dual mode) and utilization of reserved mobile radiation energy.

Index Terms: IoT(Internet of things), Mobile Radiation Energy, Renewable Energy, Smart Street Light, Energy Consumption

1. INTRODUCTION

This work reveals that Perfect operating conditions of the public street lighting are essential to avoid unsafe driving conditions and public areas, which may lead to fatal accidents and crimes[3]. This turns into a huge responsibility on the power system operator and in-turn on the utility. Present day fault reporting systems are completely manual and rely on a passing by pedestrian, driver or maintenance officer, to report back the fault to the operator. Inspection of the health of street light involves regular monitoring by maintenance officer, say once in a month, which is costly and even involves a possibility of a lamp failing shortly after the performed inspection or failing only during specific operating conditions. Lamps fail due to wear or other failures in the operation and control circuits and they fail prematurely due to incorrect power supply caused by faulty mains or ballast. Thus, power quality plays an essential role in determining the operable life of these components. Smart street lighting systems, build on a general concept of smart electricity usage rationalization, are seen to be as one of the crucial elements of the future smart grids. They are a comprehensive system consisting of sensors, control unit, communication unit and management console to ensure energy saving and maximum visual safety of drivers and pedestrians[2]. Availability of sophisticated technology enables varied functionalities from basic monitoring (power consumption, temperature etc.), controlling individual or sets of street lamps (on or off and automatically adjusting desired illumination level depending on road conditions such as increased traffic, special events etc.) to an intelligently optimized energy efficient solution in large installations. Other features include standardized lighting protocols, quick fault detection and locating abnormalities by alarming. Most of these lamp driving solutions are based on a digital approach where microcontroller and advanced semiconductor devices assures all the functions needed to drive the lamp and, at the same time, manages all the suitable data for implementing a smart street lighting network.

2. SMART STREET LIGHT CHARGING-

2.1 Charging from Solar Energy

Solar energy is radiant light and heat from the Sun that is harnessed using a range of ever-evolving technologies such as solar heating, photovoltaics, solar thermal energy, solar architecture, molten salt power plants and artificial photosynthesis[1]. It is an important source of renewable energy and its technologies are broadly characterized as either passive solar or active solar depending on how they capture and distribute solar energy or convert it into solar power. Active solar techniques include the use of photovoltaic systems, concentrated solar power and solar water heating to harness the energy. Passive solar techniques include orienting a building to the Sun, selecting materials with favorable thermal mass or light-dispersing properties, and designing spaces that naturally circulate air[2].

Fig 1: Street Light with Solar Energy

2.2 Smart Street Light Charging from Wind

With traditional technique of Wind Mills, this smart light also utilize the energy of nearby passing vehicles. As shown in the figure, two wind propellers are fitted in the street light, one at the bottom which rotates with the air pressure generated when any fast moving vehicle passes from the road nearby the streetlight and second is located on the top of the street light which rotates from the traditional wind energy.

2.3 Smart Street Light Charging from Reserved Mobile Radiation Energy

Basically the hypothesis of utilising Radio Waves as a source of input to light energy arises from the fancy twinkles on back side of mobile phones which are used in year 2004. These twinkle are nothing but small circuits which absorbs mobile
radiations and rebuild it in the form of sparkles light. If we use very peculiar and efficient capacitor along with strong amplifier in this circuit to provide constant illumination and then we are capable of storing all mobile radiations which are absorbed by earth and other objects (like building/trees/vehicle etc.). Also we will be able to use it as streetlight as constant source provided with the use of battery whose discharge rate is extremely less. The problem in this hypothesis is that the mobile energy radiation is very acute and while storing this energy in battery. But few mechanism for enhancing the charging rate via amplifier will resolve this problem. Somehow amplifier will be used to increase the acuteness of radiation and efficient battery for the storing of this radiation energy (whole day) for the purpose of illumination of street lamp in night. This will be more beneficial than Solar Panels and Wind Energy which do not work in cloudy atmosphere and becomes faulty during rains.

3 HYBRID STREET LIGHT SUN + WIND + RADIATION

Hybrid streetlight powered by sun wind and batteries. The DS300 turbine is a 300W power vertical wind micro generator mounted on the hybrid lamp to compensate for the lack of photovoltaic power in months with less solar hours or overnight. The mix of renewable sources on a LED lamp combined with battery storage ensures considerable lighting autonomy. The illumine on board software completes the solution and makes it a technological innovation because thanks to the use of remote control and integration IoT sensors the intelligent streetlight became the core of Smart City’s development. Just imagine areas of cities that send and exchange information about traffic, air quality, availability of car parks or charging points

![Wind Generator](image)

![Solar Panel](image)

![Street Lamp](image)

![Mobile Radiation Receiver](image)

![Wind Turbine](image)

**Fig.2: Proposed Smart Street Light Syst**

As shown in the figure 2, beside traditional Solar and Wind energy utilization, one more wind turbine is also added at the bottom of the street light which rotates on the threshold kinetic energy generated when any nearby vehicle passes through the street light. Also, one very minute energy source can also be utilized via mobile radiation absorbed by the panel located on the top of street light. Basically the hypothesis of utilising Radio Waves as a source of input to light energy arises from the fancy twinkles on back side of mobile phones which are used in year 2004. These twinkles are nothing but small circuits which absorbs mobile radiations and rebuild it in the form of sparkles light. If we use very peculiar and efficient capacitor along with strong amplifier in this circuit to provide constant illumination and then we are capable of storing all mobile radiations which are absorbed by earth and other objects (like building/trees/vehicle etc.). Also we will be able to use it as streetlight as constant source provided with the use of battery whose discharge rate is extremely less. The problem in this hypothesis is that the mobile energy radiation is very acute and while storing this energy in battery. But few mechanism for enhancing the charging rate via amplifier will resolve this problem. For make use of both amplifier to increase the acuteness of radiation and efficient battery for the storing of this radiation energy (whole day) for the purpose of illumination of street lamp in night. This will be more beneficial than Solar Panels and Wind Energy which do not work in cloudy atmosphere and becomes dead during rains. Mobile phone radiation can be also used to charge Smart Street light. This is because cell phones use Electromagnetic radiation in the Microwave range, which cause of thermal effect of human body and surrounding environment. The mobile phone system is referred to as “cellular telephone system” because the coverage area is divided into “cells” each of which has a base station antenna. Cell phones use Electromagnetic radiation in the Microwave range around 2.5 GHz range. Temperature in the surrounding region increases up to 1 degree or more. When we talk on mobile phones, the transmitter takes the sound and encodes on to a continuous “sine wave”. The sine wave radiates out from the antenna and fluctuates evenly through space. Once the encoded sound has been placed on the sine wave, the transmitter sends the signal to the antenna which then sends the signal out. The encoded signals are made up of electromagnetic radiations. These waves are picked up by the receiver in the base station tower. The base station antenna emits radiations continuously to make a link with the subscribers.

4 CONCLUSION

As in this work, more stress is given on the number of natural energy charging sources. Beside traditional Solar and Wind Energy, kinetic energy of the moving vehicles and radiation energy from mobile towers are also utilized. Solar Panels and Wind Energy which do not work in cloudy atmosphere and becomes faulty during rains but Kinetic energy of moving vehicle and mobile tower radiation energy will remain working even in the worst climatic conditions. Cell phone technology uses electromagnetic radiation in the Giga hertz range. These radiations are close to microwave range and with similar properties. Part of the radio wave emitted from the mobile phone is absorbed by the human head. The radiation emitted by a GSM handset can have a peak power of 2 watts. So the

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