# A Novel FLC Controlled Energy Efficient Street Lighting Using NI LabVIEW

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*Abstract* — **Energy saving has become very important issue now a days due to energy crisis. The rate of electricity is also increasing day by day. In this scenario, it has become essential to conserve the electrical energy Street lights are one of the major sources of energy wastage. The investigator has developed a new technology which can save near about 66.66% of electrical energy.  This will not only save the electrical energy but also increase the life of electrical devices.**
*Keywords* — **NI Lab VIEW, Solar Cell, Energy management software, Energy saving.**

## I.  INTRODUCTION

 Street lighting is a particularly critical concern for public authorities in developing countries because of its strategic importance for economic and social stability. Inefficient lighting wastes significant financial resources each year, and poor lighting creates unsafe conditions. Energy efficient technologies and design can cut street lighting costs dramatically (often by 25-60%); these savings can eliminate or reduce the need for new generating plants and provide the capital for alternative energy solutions for populations in remote areas. [1][2]. This software helps in development of efficient energy system.

## II GLOBAL NEED TO CONSERVE ENERGY

- Day by day the numbers of Electrical appliances are increasing and in the same way the demand for energy is also increasing. But the sources are not increasing in the same ratio. This leads energy crisis in the country.
- Coal is the main source of electrical energy generation. But it is in limited amount. In the coming 50-60 years, it will be fully consumed. Then it will be major problem for the country to generate the electricity.
- If energy will not be preserved and manage properly a huge problem of energy crisis will take place and collapse condition may reach.

## III BENIFITS OF USING ENEGRY EFFICIENT LIGHTING SYSTEM

- Higher efficiency
- Low billing rate
- Less UV Emission
- High intensity of light
- Increased life span of street lights
- Huge saving in electricity bill

## IV BENEFITS OF ENERGY MANAGEMENT SOFTWARE

Using software for energy management has tremendous benefit over traditional one. Main need for using this software based street lights are [3], [4], [5]

- Environmentally friendly – 100% powered by the sun, solar panels reduce fossil fuel consumption, eliminating pollution
- Fully automatic system – Automatically turns off the street light in morning  and turns on at evening
- Better light source – LED lamps has high intensity of lights with less electricity consumption. It also does not decrease the power quality.
- Sufficient  backup power is provided for rainy , cloudy or any other this type of situation
- Distributed light and power - no single point of failure for enhanced  security
- Easy to install with quick connect plugs - less than 1 hour
- Less  maintenance cost

- Due to proper switching and intensity control, electricity bill reduces as well as the life of light increases
- Less line losses

## V ENERGY EFFICIENT STREET LIGHTING SOFTWARE

The energy efficient street lighting software applications are shown in Fig.1 to 4.

The concept behind this street lighting is to divide the street lights into four parts. In general practice it is found that almost all street lights are ON during the whole night. The investigator in the present work has used Lab VIEW software to switch OFF alternate street lights after 10 pm. As the traffic gets reduced to quite an extent in the night hours, therefore the requirement to keep all the street lights ON is not so essential for whole night. The front panel is shown in Fig 1 to 4. [6], [7], [8], [9]

All the lights are put off during day time. From 6 pm to 10 pm mains power is used and after 10 pm till morning solar power is used.



**Fig. 1 Front Panel of Street Light**

**In the front panel, following controls are there:**

- **Time –** The time is one of the input parameter of fuzzy logic. It will decide at which time the street lights has to get ON or OFF
- **Light intensity -** Light intensity is controlling the intensity of street lights. As the darkness

increases, in the same ratio the light intensity will increase. At night, the lights will glow with full intensity.

- **Season -** According to the season, the on/off timing of street light will be controlled. For example, in summer season the sun set time is not the same as in winter season. So the ON/OFF time of street lights will change according to season.
- **Day -** Day is used to schedule the street lights. On alternate day, half the street lights will get on/off.

The input variables of the fuzzy logic are as follows:

(i) Time
(ii) Day

The output variables of the fuzzy logic are in the form of voltage which is given to the following devices:

(i) Street Light 1
(ii) Street Light 2

## VI WORKING PRINCIPLE

Fig.2. shows the evening time when all the lights get ON simultaneously. All the lights get ON during 6pm to 10 pm. At this time the Mains supply will on. As this is the peak hrs, therefore there is a requirement to keep all the street lights ON from 6pm to 10 pm.



**Fig. 2 All Lights are ON During 6 pm to 10 pm**

**Fig. 3 Half of the Lights are ON During 10 pm to 12am**

This continues up to 12am. After 12am, the half street lights which were turned OFF, gets turned ON and the ones which were ON get turned OFF, as shown in Fig.4. This scheduling of turning ON half the number of street lights at a time saves 33.33 % of electrical energy and 33.33% energy is saved by not using mains supply. So total 66.66% of electrical energy is saved by using this software.



**Fig. 4 Next Half Lights are ON During 12 am to 6 am**

This special software developed in LabVIEW, which can automatically control the street lights and can save energy approximately 66.66%

To understand the working of the system lets divide the entire day into four parts. Let's assume we switch on the street lights at 6pm. So, the four parts of the day are:

1) 6pm to 10pm

2) 10pm to 12am

3) 12am to 6am

4) 6am to 6pm

**1) 6pm to 10pm:**

During this time all the lights are ON. At this time the street light is taking the supply from mains. Fig 5, Shows the lighting system from 6-10, from the fuzzy surface graph it is clear that all street lights are ON during this period.
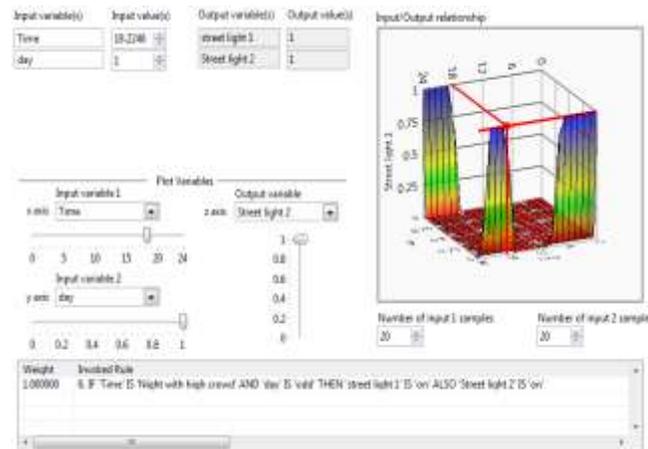


**Fig. 5 Fuzzy Surface Graph for 6-10 pm**

**2) 10pm to 12am:**

From 10pm to 12am the source of energy for the street lights will be the solar energy stored during the day. Only half of the street lights will be working at this time because at late night traffic on road is very low. The fuzzy surface graph shown in fig.6 clearly validates it.
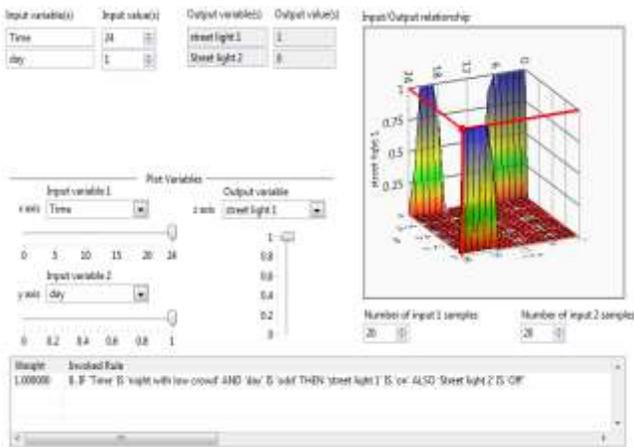
**Fig. 6 Fuzzy Surface Graph between 10-12 Nights**

### 3) 12am to 6am:

During 12am to 6am also the source of energy for the street lights will be the solar energy stored during the day. The other half of the street lights will be working at this time. The fuzzy surface graph shown in fig. 6 and fig. 7 clearly shows that alternate pair of street lights are getting ON during 10pm -12 am (night) and 12-6 am.
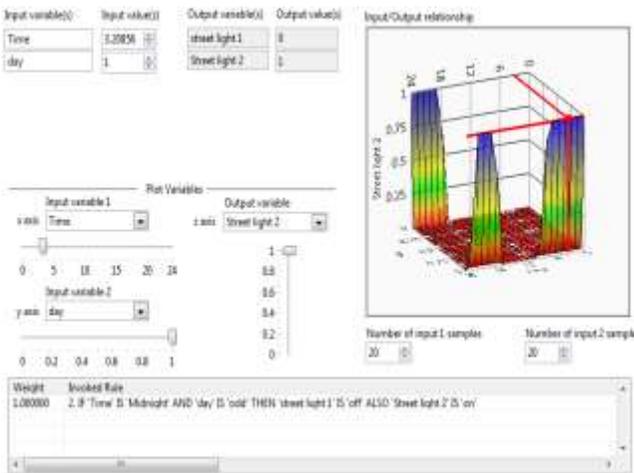


**Fig. 7 Fuzzy Surface Graph between 12-6 AM**

### 4) 6am to 6pm:

From 6am to 6pm all the lights will remain switched off. Switching off of the street lights will be automatic. At this time period the solar power is being utilized for water pumping/ Agriculture use. In the fuzzy surface graph shown in fig 8, it is clear that from 6am to 6pm all the street lights are off.
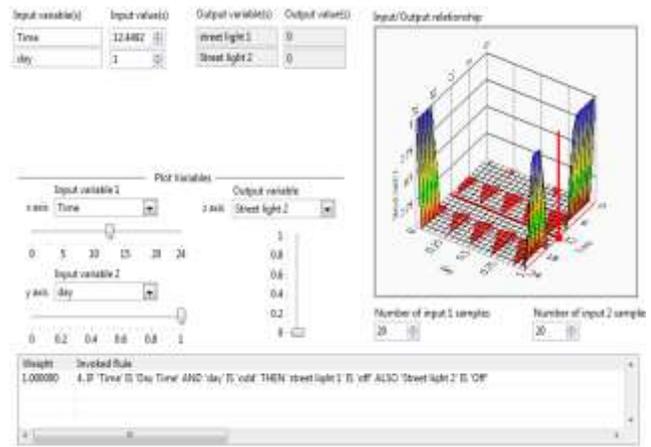


**Fig. 8 Fuzzy Surface Graph of Street Light from 6 am-6pm**

Let's say for a continuous working of 10 normal street Lights from 6pm to 6am, 30 units of energy is consumed per day,

Therefore,

  (i) 6pm to 10pm: 33.33 units

  (ii) 10pm to 12am: 16.66 units

  (iii) 12am to 6am: 50 units

Now let's take a view on our proposed street light

(i) From 6pm to 10pm ac mains supply is used therefore 33.33 units (neglecting the light intensity control)

(ii) 10pm to 12am: zero units (because only solar energy is consumed)

(iii) 12am to 6am: zero units (because again only solar energy is used)

So, therefore hybrid street lighting saves up to **66.66%** of energy daily (neglecting the energy saved by automatic light intensity control).

### VII CONCLUSION

Street lights are one of the major sources of energy consumption. By using this new technology 66.66% of energy is saved. This will lead to huge saving of electrical energy of the country.

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