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Genetic Algorithms Method On Street Lighting Energy Saving

Jefri Lianda, Hikmatul Amri

Polytechnic of Bengkalis
Jalan Bathin Alam, Sungai Alam, Bengkalis, Riau
e-mail: jefri@polbeng.ac.id, hikmatul_amri@polbeng.ac.id

Abstract

Based on the strategic issues of the development of rock and hill districts Siak Kecil as Industrial Zone, Port and Agribusiness demand developments, improvements and fixtures public roads. Road equipment that is needed is a street lighting (PJU). PJU condition mounted in the district of Bukit Batu and Siak Kecil using AC lamps with high wattage power thus increasing the burden of payment of electricity accounts PJU. This study makes setting brightness lamp LED 50 watts using Genetic Algorithm (GA). Adjust the brightness level control (Illumenation) based on time. Hours 1830WIB - 2200 WIB illumenasi used 100% and hours 2200 WIB - 0600 WIB illumenation s varied., Then to electrical energy efficiency but does not reduce the comfort of road users, forming an industrial area that is energy efficient.

Keywords : *Genetic algorithms, Street lighting, Energy saving*

1 INTRODUCTION

The rapid development of of Bengkalis regency, especially created district of Bukit Batu and Siak Kecil as Industry, Harbor, Agribusiness demand growth, improvement of public roads and equipment. Equipment that is needed is a way of street lighting (PJU). The lights used are still many who use lights that are not in accordance with the requirements of the road grade (high wattage lamps with energy but low lux), and also the increasing number of illegal street lighting installed by the communities themselves.

PLN as a provider of electric energy, calculating electrical energy consumption is used for PJU is power consumption recorded in kWh meter for PJU has installed kWh meters and PJU not installed kWh meters based power group that has been set. cost of electrical energy for PJU obtained local government from the local government street lighting tax levied on every month from each subscriber PLN based on the percentage of electricity customer accounts. Load payment of electricity bills PJU Bengkalis progressively increases with lights of PJU installed on street. This condition is very burdensome Bengkalis Government to cover the shortage of electricity costs for PJU.

Some researchers including Agung Nugroho [1] implement PJU savings by turning off most point of the light automatically at certain hours where people have started to sleep,

the roads quiet but the support of the safety factor still needed. Hermawan and Karnoto [2] said that the arrangement of PJU with various classes of roads, lights of different models of structuring the electricity costs each month for PJU installed KWH meter with less than the cost of electricity PJU without KWH meters. The cost of payment of electricity each month will be smaller when selecting the right lighting (energy saving lamps) are the type SONT.

Muamar, Jefri, Syaiful [3] said that the review of the literature shows that the LED lamp can reach values between 50-100 lumens / watt, while the CFL has the efficacy of 60-72 lumens / watt. LED lamp price is relatively expensive, 2-10 times the price of CFL bulbs. Laboratory measurements to measure the characteristics of some examples of LED lights that are commercially available, such as Lumen, Lux, PF, Power and THD. LED lamp efficacy values obtained from the measurements of lumen output power divided by the measured voltage measurements. LED lights use economic study carried out simply using the Present Worth Value (PWV).

The benefits of this research is to support Bengkalis government programs in an effort to form subdistrict of Bukit Batu and Siak Kecil as Industrial Zone, Port and Agribusiness especially in light of Public Roads. Efficiency bill public street lighting, and the success of the energy conservation program with the energy efficiency of electric street lighting which use energy-saving lamps. This study begins with the formulation of the main problem is how to create an industrial park in the field of energy efficient street lighting, how to make the system control lamp brightness level (dimming) to be efficient in the use of electrical energy.

2 RESEARCH METHODS

This research consists of several activities, among which:

2.1 Lux to watts calculation with area in square meters

The luminous flux v in lumens (lm) is equal to the illuminance Ev in lux (lx) times the surfacearea A in square meters(m2) [4]:

$$\Phi_v = E_{v(lx)} x A(m^2) \tag{1}$$

The power P in watts (W) is equal to the luminous flux Φ_v in lumens (lm), divided by theluminous efficacy in lumens per watt (lm/W):

$$P_{(w)} = \Phi_{v(lm)} / \eta(lm/W) \tag{2}$$

So the power P in watts (W) is equal to the illuminance Ev in lux (lx) times the surface area A insquare meters (m2), divided by the luminous efficacy in lumens per watt (lm/W):

$$P_{(w)} = E_{v(lx)} x A(m^2) / \eta(lm/W) \tag{3}$$

So watts=lux * (square meters)/(lumens per watt) or W=lx*m2/(lm/W)

2.2 LED Parameter

In this paper, we use LED parameter as follows:
Power (P) = 50
Volt(V) = 220

Eff_LED = 0.90
Eff_LM = 31.75

2.3 Program Code

Program in the form of a set of instructions (in software) on hardware, which was written by an arrangement or procedure (syntax) specified, for doing a job than humans (get results / outputs, can be in the form of information, action, etc.) [5]. Program also include a data structure.

The data structure [6] is a model of logic / math specifically organize data. A model should be able to reflect the real-world data connectivity and simple shape / effective (can process the data as needed).As follow in the program code for this research:

```
disp('Optimisasi Konsumsi Daya LAmpu PJU LED metoda GA')
maxLUMEN=sum(Ra);
fprintf('Kemampuan Efisiensi LUMEN = %1.0f',maxLUMEN);
disp('Masukkan permintaan Tingkat Kecerahan');
ILUM = input(['ILUM = ']); % Qload = ILUM
if ILUM == maxLUMEN;
    n=Nvar;
    for ii=1:Nvar
        LUMENx=ILUM/n;
        I=V/R;
        Px= 50;              % Px=(fx/fs)^3*P
        Vx=Px/I;             % fx = Vx
        BestLUMEN(ii)=LUMENx;
        BestV(ii)=Vx;        %Bestf = BestV
        BestP(ii)=Px;
    end
    fprintf('\n')
for ii = 1:Nvar
    fprintf('Tingkat kecerahan %1.0f',ii)
    fprintf(' = %5.3f',BestLUMEN(ii))
    fprintf('    tEGANGAN Led %1.0f',ii)
    fprintf(' =  %5.3f',BestV(ii))
end
for ii = 1:Nvar
    fprintf('Daya LAMPU LED %1.0f',ii)
    fprintf(' = %5.3f',BestP(ii))
end
    fprintf('Total Tingkat Kecerahan = %5.2f',ILUM)
    fprintf('Total Daya  = %5.2f',sum(BestP))
    break
end
if ILUM > maxLUMEN
     fprintf('KECERAHAN melebihi batas kemampuan')
     break
end
```

3 RESULTS AND DISCUSSION

The measurement results show that the maximum illumination 90, it will generate an electric voltage of 220 volts and 100 watts power as can be seen in table 1 below.

LED lights Voltage 50 watt are dimmed by entering the value ilumenasi varied so by using a genetic algorithm will produce a voltage is entered and the power generated will also vary.

Table 1: Simulation results for PJU LED Lamp 2 x 50 watt

No	Number of iteration	Source Voltage (Volt)	Iteration Time	Power PJU light (Watt)
1	550	220	0	100
2	650	220	0	100
3	750	220	0	100

In this study, the maximum number of iterations is also made variations of the number of iterations 550, 650 and 750. The results of simulations with varying levels of ilumenasi can be seen in Table 2, Table 3, Table 4, Table 5, Table 6 danTabel 7.

Table 2: Simulation results with GA PJU LED lights with Lumen 89

No	Number of iteration	Source Voltage (Volt)	Iteration Time	Power PJU light (Watt)
1	550	197,86	15,23	89,94
2	650	183,05	16,145	83,21
3	750	193,37	17,309	87,9

Table 3: Simulation results with GA PJU LED lights with Lumen 85

No	Number of iteration	Source Voltage (Volt)	Iteration Time	Power PJU light (Watt)
1	550	1,949,764	14,511	68,942
2	650	179,386	15,328	81,54
3	750	194,29	18,172	88,31

Table 4: Simulation results with GA PJU LED lights with Lumen 80

No	Number of iteration	Source Voltage (Volt)	Iteration Time	Power PJU light (Watt)
1	550	1,581,248	13,888	71,874
2	650	180,333	15,124	81,968
3	750	18,37	18,37	77,52

Table 5: Simulation results with GA PJU LED lights with Lumen 70h

No	Number of iteration	Source Voltage (Volt)	Iteration Time	Power PJU light (Watt)
1	550	160,913	14,575	73,142
2	650	135,944	15,445	61,792
3	750	140,98	17,76	64,08

Table 6: Simulation results with GA PJU LED lights with Lumen 60

No	Number of iteration	Source Voltage (Volt)	Iteration Time	Power PJU light (Watt)
1	550	1,364,984	13,606	62,046
2	650	125,821	15,156	57,19
3	750	127,61	16,461	58,00

Table 7: Simulation results with GA PJU LED lights with Lumen 55

No	Number of iteration	Source Voltage (Volt)	Iteration Time	Power PJU light (Watt)
1	550	1,134,102	13,623	51,55
2	650	115,4	14,957	52,454
3	750	112,07	16,255	50,94

ED lights Voltage 50 watt are dimmed by entering the value ilumenasi varied so by using a genetic algorithm will produce a voltage is entered and the power generated will also vary. In this study, the maximum number of iterations is also made variations of the number of iterations 550, 650 and 750. The results of simulations with varying levels of ilumenasi can be seen in Table 2, Table 3, Table 4, Table 5, Table 6 danTabel 7From the above table are the most ideal lumen level with the power and voltage output of 2x50 watt LED Lights PJU that uses the highest iteration 750 iterations.

4 CONCLUSSIONS

From the research that has been done, it can be concluded as follows:

1. Genetic algorithms are used to generate the lamp lumen PJU resulting in efficient power and voltage in order to support the establishment of industrial zones in the district of Bukit Batu and Siak Kecil

2. The simulation results produce good lumen with efficient power obtained by multiplying the number of iterations on genetic algorithms, but also increases long time iteration.

3. PJU LED lamp very well applied, other than low cost also support government programs in an effort to conserve and use renewable energy.

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