

Photocell Sensor Implementation as an Automatic Lighting System for Public Street Lighting

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ABSTRACT

Nowadays, the demand for electrical energy has experienced exponential growth due to the need for energy sustainability and economic growth in society. However, this increase of electrical energy consumption leads to the high cost of electricity bills. To address the issue, this PKM (Community Service Program) aimed at reducing electricity costs through the re-structurization of the PJU (Public Street Lighting) systems. The method used in this activity included planning and implementing the installation of PJU lighting and automatic systems involving local youth to provide them with hands-on knowledge and practical experiences in installing automatic systems directly on 11 units of PJU lights utilizing eight (8) photocells as the main components. The result of this community service activity showed the feasibility and effectiveness of the electrical installation and automatic system for PJU lights using 8 pcs of LDR on 11 electric poles along the roads in the area.

Keywords: *electrical energy, electricity bills, public street lighting, automatic systems, photocell*

1. INTRODUCTION

The Institute for Research and Community Service of Pamulang University plays a very important role in encouraging and directing Research and Community Service activities as a manifestation of the Tri Dharma of Higher Education (**Salamun & D. Arisandi, 2020**). Research and Community Service is one of the duties of tertiary institutions to provide services to the community covering various fields of life by utilizing, developing and applying science and technology as an effort to contribute to the progress of society (**Keerberg, 2014**). Community service activities are activities that include efforts to improve the quality of human resources, including in terms of broadening insight, knowledge and increasing skills carried out by the academic community (**Rozak et al., 2022**)

Electrical energy can encourage economic growth and public knowledge. In modern life like today, people and business actors have a very high dependence on electrical energy (**Rosaira & Wati, 2014**). However, electrical energy also has a potential hazard to safety if mishandled and used. We still often hear in the mass media that there are fire accidents caused by leakage currents or short circuit currents or accidents due to being hit/touched by electric currents which cause injuries and even fatalities. Therefore it is necessary to check the electrical installation equipment periodically to find out whether the electrical installation equipment is still suitable for use or not. If it is not suitable for use, electrical installation rejuvenation must be carried out to avoid unwanted things. The Indonesian government has determined that in carrying out electrical installation activities it must comply with PUIL 2011 standards (**Bambang Prasetya, 2016; Steven Sim, 2014**).

The rapid development of technology at this time encourages people to be more creative in making a tool that is simple and environmentally friendly, helps with daily work and is useful for many people. Many electronic circuits are used to help human work, such as: automatic lights that do not require a switch. Current technological advances shift the role of the switch as a process input, so that only a sensor is needed to trigger the process to control the output. With lots of creative ideas, can make an easy circuit that can support ideal traffic in the future and don't need to think about how to turn on or turn off the lights because the lights will turn on automatically when it's dark and turn off when it's light. This technology utilizes a number of electronic circuits as a very important part, these devices make it easier for humans to control and are efficient in many ways. The problems that will be discussed in this report are the concept of electronics and the implementation of photocontrol (Photocell) sensors as an automatic system for designing public street lights (PJU). Photocell or also called photocontrol and LDR (light dependent resistance) is an electronic component that works based on the intensity of the light it receives. Photocell is a substitute for a manual switch to a switch that works automatically, disconnecting the power source to the lamp when the light intensity is bright so the light will turn off and vice versa, the photocell will be connected and flow the power source to the lamp when the light intensity is less (dark) so that the light will turn on. The formulation of the problem in community service (PkM) is the basic thing that is offered to help solve the problems at hand (**Rozak et al., 2021**).

In this way, it is hoped that it can assist the community in controlling public street lighting, be more efficient in the use of electric power and be safer than having to remove and install an electric plug or ON-OFF miniature circuit breaker MCB with minimal installation conditions which are only protected by used fiber that is split as protection from rainwater, it is necessary to make an automatic public street lighting system by utilizing the Photocell to reduce the increasing cost of electricity bills.

2. METHOD

2.1 Implementation Method

The method is an important technique so that the plan above can be realized (**Rozak et al., 2021**). The steps for the "Automatic Street Light Using Photocell sensor" activities include:

- a. The intended introduction is to provide a clear description of this "Automatic Street Light Using Photocell sensor" so that people understand its functions and uses that can help them, such as eliminating the need to turn on public lights in the evening and pulling them out in the morning will certainly help people and understand about what we mean by the theme we bring.
- b. The willingness of partners to cooperate in the program that will be held is none other than so that this plan can be realized. Especially the Palasari village administration who are

willing to cooperate with this activity. For the continuation of the application of "Automatic Street Light Using Photocell sensor" as a medium to help the government of Palasari village a little in making good infrastructure for its citizens.

- c. Concept and Manufacturing Method: (1) photocell functions for Public Street Lighting (PJU) which works automatically by using a light intensity sensor called Photocell (photocontrol). Photocell is a replacement for a manual Switch to a Switch that works automatically and (2) the steps for making an "Automatic Street Light Using Photocell sensor" system are as follows: (a) create a public street lighting installation path (if not yet available); (b) tidy up the installation that was made; (c) install the Photocell sensor; and (d) do a test by temporarily closing the Photocell sensor to find out if the system is working.
- d. Technical Implementation: (1) Providing an understanding of "Automatic Street Light Using Photocell Sensor" to the local community, especially operators who turn on and off these public street lights every day; (2) Education on proper and correct installation of public lighting installations or general purpose installations; (3) Installation of PJU lines (public street lighting) and installation of sensors (Photocell sensors) and (4) Testing system.

2.2 Theoretical Method

SNI 7391:2008 concerning specifications for street lighting in urban areas that have the scope of provisions for lighting roads, level and non-level intersections, bridges and tunnels in urban areas that have classification functions of arterial, collector and local roads. The specifications referred to in this standard include the required function, type, dimensions, installation, placement/arrangement of street lighting (**Badan Standarisasi Nasional, 2008**).

Roads are land transportation infrastructure that includes all parts of the road, including auxiliary buildings and equipment intended for traffic that is on the ground surface, below ground level and/or water, except for railroads, lorry roads and cable roads (**DPR-RI, 2004**). Energy Saving PJU lamps are street lamps that have a higher efficacy value compared to baseline PJU lamps (**ESDM, 2020**). Installation and utilization of energy saving PJU lamps in areas where PJU lamps are not yet available (**Lukman Azis & Sultan Hasanuddin, 2020**).

LDR or light dependent resistor is one type of resistor whose resistance value is affected by the light received by it. The resistance value of the LDR depends on the size of the light received by the LDR itself. An example of its use is in garden lights and street lights which can turn on at night and go off automatically during the day. Or we can also use it in our own room (**Supatmi, 2011**).

2.3 Preparation of Tools and Materials

Community Service Process by carrying out "Implementation of Photocell Sensor as an Automatic Lighting System for Public Streets in Palasari Village, Kec. Legok Kab. Tangerang" begins with planning to calculate the required materials and tools to be used. The results of planning the tools and materials used can be seen in Table 1.

Table 1. Tools and Materials

No.	Description	Specifications	Quantity
1	LED Lamp	30W Hannochs	11 Pcs
2	Photocell Light Sensor	EWIG Waterproof 3A	8 Pcs
3	Hood WD + Street Light Fittings	Size 30 cm	9 Pcs
4	MCB + Box MCB Single	Broco 1P 10A	3 Set
5	Stainless Steel Bending Wire	08 mm (10 m)	2 Set
6	Nitto Cable Isolation	0.15 mm x 3/4" x 20 mm	1 Roll
7	Tap MTR PLN Power Cable Connector	(35-70 mm)	6 Set

No.	Description	Specifications	Quantity
8	PLN TIC SR Twisted Cable	NFA2X 2x10 mm ² /100 m	2 Lot
9	Cable	NYM 2x1.5 mm / 50 m	3 Roll
10	Mild Steel Bolt	(1/4)	1 Dust
11	Stainless Mild Steel	1 inch	3 Stem
12	Electrical Tool Kits	Tekiro Max. 1000 Volt	1 Set
13	Multitester	KrisBow Max. 1000 Volt	1 Unit

3. RESULTS AND DISCUSSION

3.1 Assembly of the Frame and Components

The first stage of activity in Community Service with the title Implementation of Photocell Sensor as an Automatic Lighting System for Public Streets in Palasari Village, Kec. Legok Kab. Tangerang is the process of assembling the components of the Public Street Lighting Automated System as shown in Figure 1.

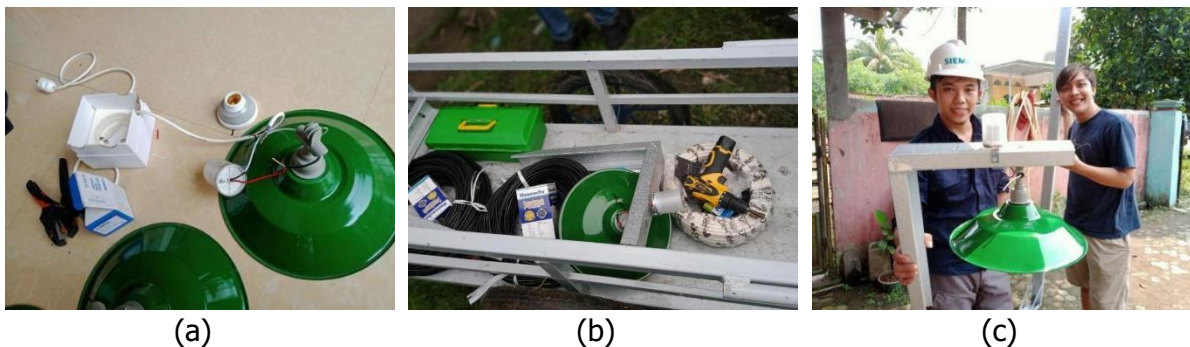


Figure 1. Assembly (a) Material Preparation, (b) Frame Preparation, (c) Assembly Results

3.2 Installation

The second stage of activity in Community Service with the title Implementation of Photocell Sensor as an Automatic System for Lighting Public Streets in Palasari Village, Kec. Legok Kab. Tangerang is the process of installing the safety MCB of the Automatic Public Street Lighting System as shown in Figure 2.



Figure 2. The Process of Installing Security System

The third stage of activity in Community Service with the title Implementation of Photocell Sensors as an Automatic Lighting System for Public Streets in Palasari Village, Kec. Legok Kab. Tangerang is the process of installing the LDR Sensor Automatic Public Street Lighting System on each pole as shown in Figure 3.



Figure 3. LDR Sensor Installation

The fourth stage of activity in Community Service with the title Implementation of Photocell Sensor as an Automatic Lighting System for Public Streets in Palasari Village, Kec. Legok Kab. Tangerang is the process of installing Automatic Street Lighting System Lights on each pole and the results of the installation are shown in Figure 4.



Figure 4. Process and Results of Installing

3.3 Testing

The fifth stage of activity in Community Service with the title Implementation of Photocell Sensor as an Automatic Lighting System for Public Streets in Palasari Village, Kec. Legok Kab.

Tangerang is the process of testing an Automatic Public Street Lighting System as shown in Figure 5.



Figure 5. PJU Automatic System Testing

3.4 Evaluation and Closure of the Implementation

The following is before the closing of the Community Service activity entitled Implementation of Photocell Sensor as an Automatic Lighting System for Public Streets in Palasari Village, Kec. Legok Kab. Tangerang by evaluating people's understanding of the implementation of photocell sensors as an automatic public street lighting system. The next stage in this Community Service is the process of handing over the Public Street Lighting Automated System.

The next stage of activity in Community Service is the closing of the activity which was attended by all activity participants, both Unpam Electrical Engineering Lecturers and Students and the RT community. 01 RW. 04 Desa Palasari Kec. Legok Kab. Tangerang as shown in Figure 6.



Figure 6. Closure of PkM Activities for Implementation of PJU Automatic Systems

3.5 Results Analysis and Discussion

From some of the pictures above we have taken before and after the activity, where we have made and replaced the existing street lights as well as repaired the cable connections previously made by the local residents which were not in accordance with safety standards. The steps we have taken to follow up on the approval process that was previously carried out include the following:

- a. Dividing tasks and finalizing plans After praying together, we divided the members into several teams with their respective tasks. There are those who prepare tools and necessities, assemble sensors that will be used later, take measurements, repair installations and document them.
- b. Prepare the tools and materials to be used Next we will install the Photocell sensor on the frame that will be used as a support for the lamp that we have previously made and do a test drive on the sensor, by covering the Photocell sensor with a cloth to see if the light can turn on properly Good.

We started to install a series of lights that had been made to be placed on the PJU (public street lighting) path from the easiest place to reach. Occasionally we also repair several circuits that have previously been made by local residents. We do this activity in 2 days and always end with a trial system before it gets dark and after dark to see the reaction of the sensors and the response of the lights we have made. On the last day, we provided education to residents about the maintenance of the "Automatic Street Light Using Photocell sensor" system.

4. CONCLUSIONS

This work intalled 8 pcs of photocell sensors in an automatic system for street lighting (PJU) in RT.01 RW. 04 Palasari Village, Kec. Legok Kab. Tangerang Province Banten. This installation supports the community by controlling 11 units of PJUs efficiently, thus, automatic electric management can be done effortlessly, reducing the risk of electric shock and short circuit ase well. Of course, so that there is sufficient lighting on the roads around the village and also so that security is maintained, especially for motorists and the community when night falls, moreover, it can help reduce the cost of electricity bills.

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