

Development of Light On/Off Controller Simple Using LDR Sensor-Based Relay and Arduino Uno on Physics Learning Electromagnetic Material

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ABSTRACT

The purpose of this research is to develop a simple light On/Off controller using relay based LDR sensors and Arduino Uno Which is composed of simple components assembled into an automatic device. The design and tools that have been made there are several physical concepts that we may not know, namely the electromagnetic concept in the relay where in the relay there is a coil that detects and turn On / Off the lights automatically by the microcontroller system (Arduino Uno) and decorative lights there is also a parallel circuit in it. The Experiment carried out is to provide a light source such as a flashlight at a certain distance then brought close to LDR Sensor then made an image of how the condition of the lamp with a certain distance and the results of the experiment.

Keywords: LDR Sensor, Arduino Uno, Controller, Physics, Electromagnetic concept.

1 Introduction

Technology is growing and the amount of electricity needed in Indonesia tends to increase rapidly. The increase in the need for electric power can be caused by the addition of new loads, it can also be caused by the wasteful use of electric power. Waste of electrical energy must be prevented, because PLN's electric power supply is increasingly limited. By saving energy will reduce the cost of electricity financing (T'sauqi et al., 2016).

Many Indonesians still turn on their house lights when they are not needed. Sometimes we forget to turn off after using it. This is very unfortunate amidst the large number of people in remote areas of the country who still do not experience how to live using electricity (Fariska & Yenni, 2020).

Technological developments and current lifestyles show that we are increasingly being chased by the current of globalization which makes practicality important in being able to control one of the electrical devices, namely lights. Current technological developments mean the need for electrical or electronic equipment at home, such as turning on the lights in a house, which many people are negligent about. If there is a controller, it makes everything more practical if it can be controlled and controlled properly through the controller of electrical equipment (Girsang & Ritonga, 2019).

Based on the Instruction of the President of the Republic of Indonesia Number 10 of 2005 concerning energy saving, it is expected that every community uses electricity sparingly. For this reason, it is necessary to design an automatic control system for electrical energy saving electronic device (Prasetya & Aulia, 2020:).

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When using electrical tools we need an electric current that is generated from the energy source of PT. PLN (Persero) is the largest electricity company generated using fossil fuels. With ever-increasing consumption, it is estimated that in the next 10-15 years Indonesia will experience an electricity crisis (Mahardiananta, et al., 2021).

We cannot stay away from technological developments that can be said to be useful in everyday life. Besides being able to make things easier, it can also help people get the job done. With the development of increasingly sophisticated and sophisticated technology and an increasingly modern way of life, it displays how useful something that is practical is. Therefore, today's humans must be able to think critically and creatively in finding new ideas so they can innovate in the field of technology, such as making tools that help control lights with the help of technology that can make it easier to use. (Fariska & Yenni, 2020).

The busier a person is, sometimes to do many small things is forgotten and the time increases, making even simple things difficult to do. Like lights inside or outside the house, small or simple things to turn on or turn off the lights are sometimes a problem for some people which will have an impact on excessive use of resources, causing bills to increase and make the lamp power decrease faster. (Isra, et al., 2021).

With an automatic home light controller, we can save electricity and energy consumption so that we can reduce the cost of paying for electricity. By using the Arduino Uno microcontroller, it can be controlled automatically with the help of the relay module which functions to control on/off automatically and does not need to be pressed manually and can also utilize the LDR sensor so that when the room is bright the lights will turn off automatically while when it is dark it will turn on automatically (Maharmi, 2018).

Therefore we must take advantage of currently developing technology to help improve the quality and welfare of human life. One such technology is the Microcontroller (Arduino). Arduino Uno is a microcontroller drive that can process digitally with the commands given and this microcontroller is the same as a microprocessor. The advantage is that it makes it easier to control the house with an intelligent system and Arduino Uno as the brain controlling the system (Yoga Widiana, et al., 2019).

Arduino Uno with the help of a relay as a device for disconnecting and connecting networks connected to electricity, this relay utilizes the principle of a small current that conducts electricity with high voltage (Fariz Abdul & Sumariyah 2020). Based on the description, there are a number of main ideas from researcher who become role models and researchers are interested in overcoming the above problems. The design of this tool will make it easier for humans to control home light that can be controlled through simple props.

2 Research Methods

2.1 Time and Place

The research was conducted at the Media Development Laboratory of the Physics Education Study Program, PMIPA Department, Teaching and Education Faculty, University of Riau, in February - May 2023.

2.2 Simple Lamp On/Off Design

Broadly speaking, the design of a simple light control device consists of: Arduino Uno, Relay, LDR sensor, Project Board, lamp, tab-A usb cable, manual switch and cellphone charger adapter. The system block diagram for making a simple light control device using an Arduino Uno-based relay is shown in the following figure 1.

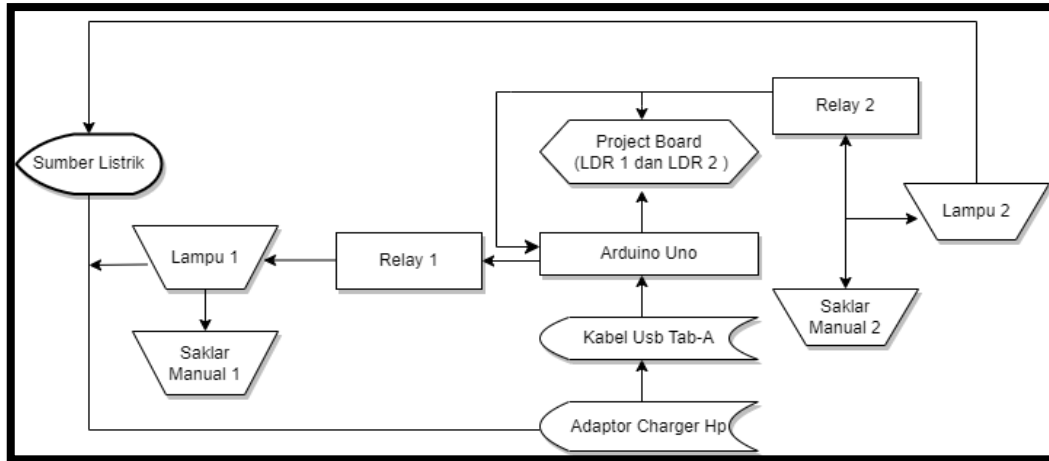


Figure 1 : System Block Diagram

2.3 Result of the Development of a Simple Light On / Off Control Tool Using LDR Sensor-Based Relays and Arduino Uno in Electromagnetic Physics Learning Materials.

A simple light On/Off Control Tool using a relay based on an LDR sensor and Arduino Uno is a device whose circuit is composed of simple components that are assembled into an automatic device. The following is an overview of a simple On/Off light controller circuit using a relay based on an LDR and Arduino Uno sensor that has been assembled and a picture of the device that will be included in a miniature house

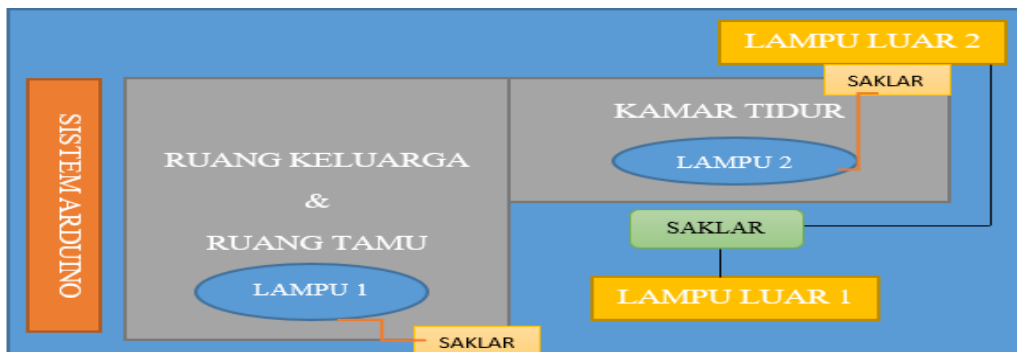


Figure 2 : Simple Miniature House Design



Figure 3 : A Simple On / Off controller circuit using a relay based on LDR sensor and Arduino Uno



Figure 4 : Miniature of Simple Light On / Off Controller using LDR and Arduino sensor-based Relays Uno is Complete and has been created

2.4 Result Data

Based on the description above, the author has conducted an experiment on a simple light On/Off controller using an LDR sensor-based relay and Arduino Uno by providing a light source such as a flashlight at a certain distance and then bringing it closer to the LDR sensor and then calculating the light intensity using a lux meter and making a description of how the condition of the lights with a certain distance and the experimental results are in the table below:

Flashlight Intensity: 1710 Lux

Cellphone Light Intensity: 1230 Lux

Light Detected Distance : starting from 10 cm

Table 1 : Measuring the Distance of Light when Approaching the LDR Sensor using a Lux Meter with a different distance from the Flashlight

No.	Distance(cm)	Light intensity		Information
		Lamp 1	Lamp 2	
1.	10cm	36 Lux	92 Lux	When the light source is 10 cm from the LDR sensor, the lights in the miniature house will turn off because the sensor detects light coming in
2.	15cm	328 Lux	225 Lux	The LDR sensor detects light but it is faint, therefore the light will blink rapidly.
3.	20cm	890 Lux	675 Lux	At a distance of 20 cm it detects light but not too bright which makes the light not flicker quickly

4.	25cm	1200 Lux	925 Lux	Because the distance is far enough to make lamp 1 not flicker but lamp 2 still detects light which makes the lamp flicker because it is perpendicular to the light source
5.	30cm	1232 Lux	1200 Lux	If we position the light straight horizontally, the LDR sensor will not detect any light because it is far away. The lights shone brightly without flickering

Table 2 : Measuring the Distance of Light when Approaching the LDR Sensor Using a Lux Meter at a different distance from the HP light

No.	Distance(cm)	Light intensity		Information
		Lamp 1	Lamp 2	
1.	10cm	1 lux	48 lux	Lamp 1 only detects a little light because it is in front and the cellphone light only focuses on one point and does not spread, therefore lamp 2 gets great intensity when the lights are off
2.	15cm	20 lux	576 lux	Light 1 when there is light with a distance of 15 cm, the light will blink quickly because it detects light. Part of it makes the light blink fast, while light 2 blinks normally.
3.	20cm	29 lux	1524 lux	Lamp 2 is blinking but not fast because the light source has moved away, while lamp 1 is on
4.	25cm	32 lux	1515 lux	Lamp 1 and lamp 2 light up brightly because the distance is far away and the sensor detects when it is dark it will be bright
5.	30cm	22 lux	1072 lux	Lights 1 and 2 light up brightly because they have a long distance to detect the dark light and the light is on.

This simple lamp On/Off controller uses an LDR Sensor and an Arduino Uno which is composed of simple components and assembled into a lamp On/Off controller. The components of the On/Off light controller are Arduino Uno, HP Charger Adapter, relay module, LDR sensor, resistor $10k\Omega$, project board, manual switch and jumper cables. The main controller of this tool is Arduino Uno, LDR sensor, and relay where this Arduino acts as a microcontroller through coding that is entered into Arduino and connected to the relay and LDR sensor.as a light detector in a room when a voltage of 5 V is applied to the relay, then the relay will activate and detect light through the LDR sensor.

At the time of the experiment using the tool that has been made, it can be seen that the tool is functioning properly. This is evidenced by the data generated in table 1 Steps of experimental work using a

simple light on/off controller using an LDR sensor and Arduino Uno by connecting the device to PLN voltage via a socket, then providing a light source such as a flashlight brought closer to a certain distance by calculating the intensity of the light. Data collection is done by varying the distance between the light and the LDR sensor to see if it moves well when it is dark the light will turn on and when it is bright the light will turn off.

Table 4.1 is a table to see if the light controller functions when the atmosphere is dark or bright with varying light distances and you can see how much light intensity is received with varying distances. Based on the data obtained, the farther the distance from the light source, the sensor cannot detect the existing light and says that it is dark and the lights will be bright. When the light source gets closer to the LDR sensor, the light will turn off because light is detected.

The difference in the light source that enters the miniature house is the difference in the results of the experiments carried out, when using a flashlight the incoming light spreads out and causes only a slight difference in results, while when using a cell phone flashlight, a very large difference is obtained. When there is light from the cellphone lamp, lamp 1 tends to rarely get light, which causes the intensity results to tend to be small and large in lamp 2, because the light source from the cellphone flashlight does not spread but only in one point and the light is not as bright as the light from the flashlight.

The advantage of this tool is that with this tool we can see a small picture that if there is an On/Off light controller it will make it easier and make us not wasteful of electricity usage. At night the tool will detect and turn on automatically as well as during the day if there is light coming in then the light will immediately turn off, but there are some drawbacks to using this tool, namely during the day there is not always light coming into the house and room it would be dark but we didn't use the lights at that time, therefore an innovation was made with the controller manually, namely using a manual switch. This means that the use of this light controller has two uses, automatically and manually, which work well together.

3 Conclusion

Based on the results of this study it can be concluded that: The design and tools that have been made there are several physics concepts that we may not know to be aware of, namely the existence of an electromagnetic concept in a relay where inside the relay there is a coil (coil) that detects and turns on/off lights automatically by microcontroller system (Arduino uno) and in decorative lights there is also a parallel circuit in it. The design of a simple light On/Off Control Tool using a relay based on an LDR sensor and Arduino Uno is made according to the design. Broadly speaking, the design of a simple light On/Off Control Tool: Relay, LDR Sensor, and Arduino Uno, adaptop charger module, tab-A usb cable. Making a simple lamp On/Off controller consists of 2 stages, namely: making a simple lamp On/Off controller circuit, and making miniature houses out of ice cream sticks to house simple light control circuits. A simple light On/Off controller using a relay based on an LDR sensor and Arduino Uno which is made to be used as a simple automatic lamp by detecting whether the room is dark or bright.

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