SMART TECHNOLOGY BASED ON LDR AND SMARTPHONE FOR LIGHT INTENSITY MEASUREMENT

Muhammad Iqbal[1]*, Ahmad Julfan Lubis[2], Herdianto[3]
Universitas Pembangunan Panca Budi

Keywords:
LDR Sensor, Light Intensity, Smartphone, Smart Technology, Light Measurement

***Correspondence Address:**
wakbalpb@yahoo.co.id

Abstract: Measuring sunlight intensity is an important aspect in various fields, such as renewable energy, agriculture, and scientific research. However, existing light measurement devices are often expensive and not portable. This research aims to develop smart technology based on Light Dependent Resistor (LDR) sensors integrated with smartphones as an efficient and economical solution for measuring light intensity. This system is designed using LDR sensors to detect changes in light intensity, which are then processed through a microcontroller and transmitted to a smartphone using a Bluetooth connection. The smartphone application serves to visualize data in real-time, store measurement results, and allow users to analyze light intensity patterns. The test results show that this system is capable of measuring light intensity with adequate accuracy compared to standard devices. Additionally, this solution offers high portability and ease of access, making it suitable for use in various field situations. With this innovation, it is hoped that light measurement can become more inclusive and practical in the digital era.

INTRODUCTION

Light is one of the essential elements in daily life, which not only serves as a source of illumination but also acts as an indicator in various fields such as agriculture, energy management, and scientific research. Measuring light intensity has become a highly relevant need to understand lighting patterns, optimize resources, and develop renewable energy-based technologies such as solar panels. However, commonly used light intensity measuring devices are often expensive, difficult to access, and impractical for field use. With the advancement of technology, there is a growing need for measurement tools that are more affordable, portable, and easy to use. The Light Dependent Resistor (LDR) sensor is one of the potential solutions due to its ability to efficiently and economically detect light intensity. This sensor can convert changes in light intensity into resistance data that can be further processed using modern technology.

The integration of LDR sensors with smartphones opens up new opportunities to create practical and intelligent light measurement systems. Smartphones, with their advanced computing and connectivity capabilities, can process data from LDR sensors and display the results in real-time visualizations. With this approach, measuring light intensity no longer requires complex devices, but rather a combination of simple sensors and smartphone applications. This research aims to develop LDR-based smart technology integrated with smartphones for light intensity measurement. In addition to offering an economical and portable solution, this system is also expected to make significant contributions in various fields, particularly in resource optimization and environmental analysis.

RESEARCH METHODS

Research is a systematic and structured process conducted to obtain knowledge or solutions to a problem. In the context of this research, the research stages consist of the stages that are passed through in the completion of the research. Whatever the stages of the research, they can be seen in the following figure 1.

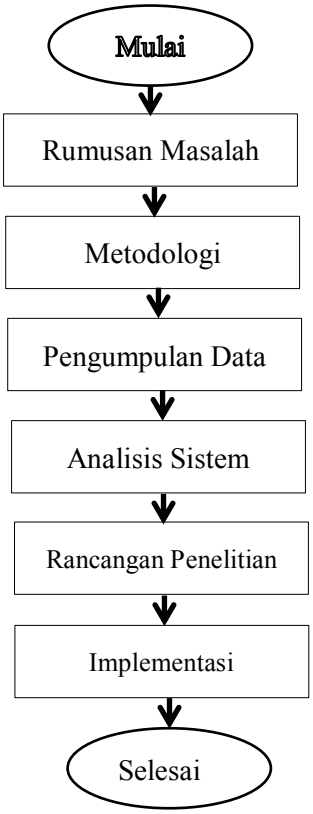

Figure 1. Research Stages

In this research, the main objective is to develop an intelligent technology system capable of accurately, portably, and economically measuring sunlight intensity. This system utilizes Light Dependent Resistor (LDR) sensors integrated with smartphones to provide light intensity data in digital and real-time formats. This approach is expected to become an innovative solution for light measurement needs in various fields such as energy, agriculture, and the environment.

To achieve these goals, the research is conducted through a series of systematically designed stages. These stages include problem identification, data collection, system analysis, and device implementation. Each stage is designed to ensure that the developed system is not only functional but also efficient and meets user needs.

1. Problem Formulation, this stage identifies the main challenges, including the need for a cost-effective, portable, and user-friendly light intensity measurement tool.
2. Methodolog, the research employs experimental and system development methods. The steps include:
   - Sensor Experimentation: Testing the LDR sensor to understand its response to varying light intensities.
   - System Design: Creating a prototype that integrates the LDR sensor with a microcontroller and smartphone.
   - System Testing: Conducting calibration and validation by comparing results with standard measuring tools.
3. Data Collection, Data Collection, This research begins with the collection of all related data. Conducting the collection of materials from readings about the microcontroller used, namely Arduino Uno, LDR sensor, and the creation of an Android application.
4. Data Analysis, data analysis begins with measuring the required output voltage and analyzing the created interface.
5. System Design, at this stage, begins with designing hardware, which includes block diagram design and circuit design for each block, as well as designing software, which includes a system flowchart to create a solar light intensity measuring device using an Android-based LDR sensor.
6. System Implementation, at this stage, implements the design of a solar light intensity measurement tool using an Android-based LDR sensor.

Research Design

This research aims to develop an intelligent technology system that can measure sunlight intensity using a Light Dependent Resistor (LDR) sensor integrated with a smartphone device. This system is designed to provide an efficient, portable, and economical solution for measuring light intensity, with wide applications in agriculture, renewable energy, and environmental research. To systematically illustrate the flow and structure of the research, the researchers used a block diagram as a visual aid.

Figure 2. Blok Diagram

Block Diagram Explanation:

1. The LDR sensor is a light sensor used as input.
2. The Arduino Uno receives the data read by the LDR sensor, then calibrates and sends the data to Bluetooth.
3. The HC-05 Bluetooth module acts as a transmitter, sending the sensor reading data from the Arduino Uno to an Android smartphone.
4. The Android smartphone is used as an interface, functioning as the receiver of the LDR sensor reading data sent by the Arduino Uno via the HC-05 Bluetooth module.

a. Flowchart Hardware

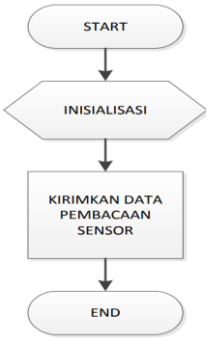

Figure 3. Flowchart Hardware

The hardware flow chart in this design begins with the initialization process, where all the components used are declared according to their respective functions. In this design, the LDR sensor is used as an input to read the value of light intensity,

Bluetooth is set up for serial communication, where the entire system is controlled by the Arduino Uno microcontroller. The next process is data transmission, where each reading from the LDR sensor will be sent via Bluetooth transmission media, which will later be interpreted by an application embedded on an Android smartphone.

b. Flowchart Software

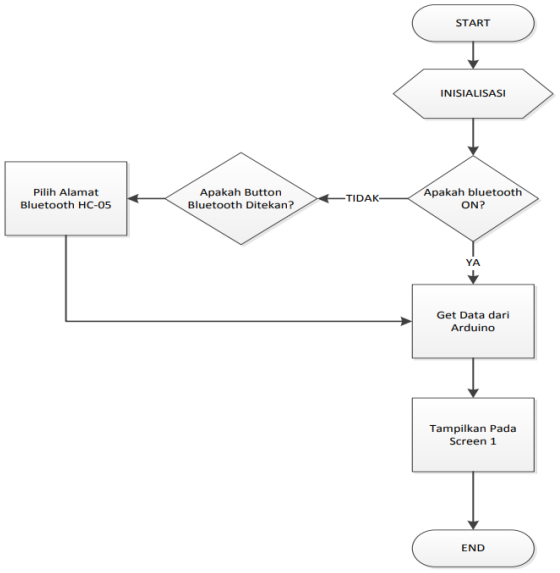

Figure 4. Flowchart Software

This Android software flow chart starts with the initialization process where all the elements used must be declared. After that, check if Bluetooth is connected. If Bluetooth is already connected to the Android smartphone, display the LDR sensor reading results on Screen 1. If Bluetooth is not connected, press the Bluetooth icon and select the HC-05 Bluetooth address.

RESULTS AND DISCUSSION

In this section, the researchers will discuss the results obtained from the study on "Smart Technology Based on LDR and Smartphone for Light Intensity Measurement." This research aims to develop an accurate, efficient, and user-friendly solar light intensity measurement system. This system utilizes a Light Dependent Resistor (LDR) sensor integrated with a smartphone application, which can provide real-time light intensity information.

a. Source Voltage Measurement, this Power Supply measurement uses a digital multimeter. This Power Supply measurement is to determine the voltage that will

be used in this circuit. This measurement is done by placing the positive multimeter connected to the positive Power Supply and the negative multimeter connected to the negative Power Supply. This Power Supply measurement results in a voltage of 7.76 Vdc.

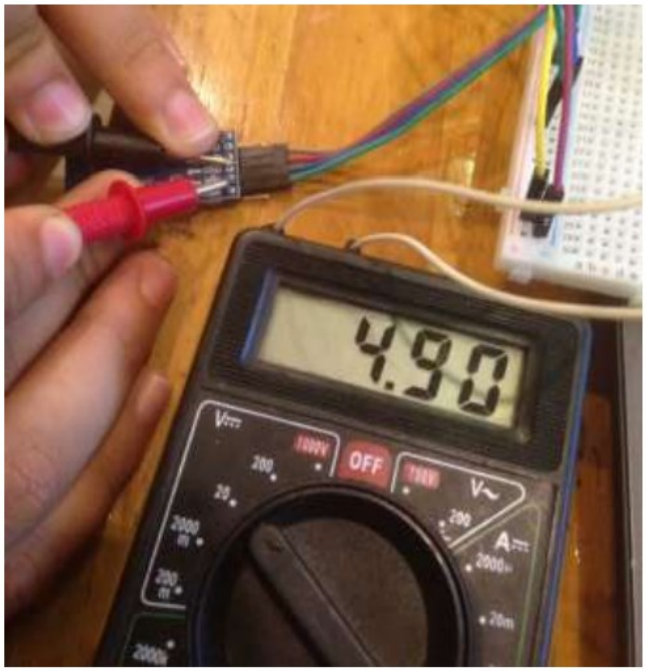

Figure 5. Power Supply Measurement

b. Measurement of Bluetooth HC-05 Voltage, the measurement of Bluetooth HC-05 voltage is intended to determine the voltage operating during the data transmission process transmitted by Bluetooth HC-05. According to the data sheet, Bluetooth operates optimally at a voltage of 5 volts, and in this design, Bluetooth receives a voltage supply of 4.90 volts. Figure 4.2 shows the results of the Bluetooth voltage measurement in this design.

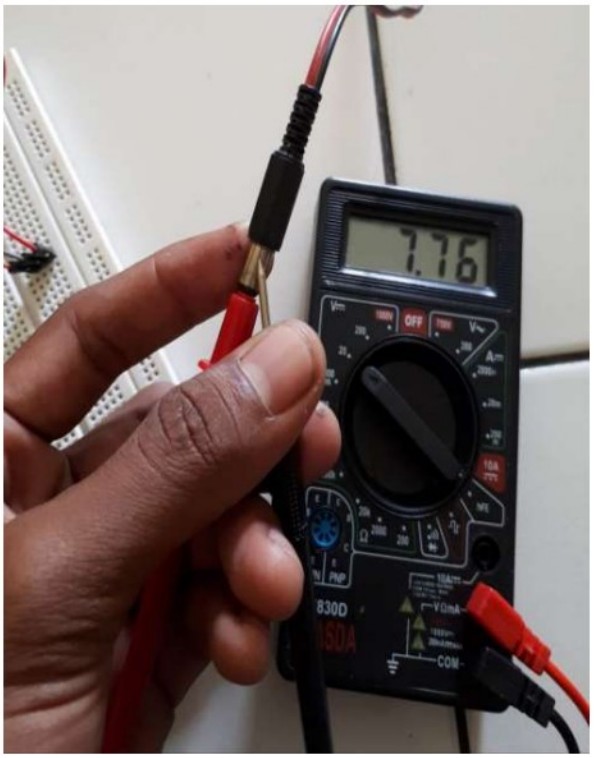

Figure 6. HC-05 Bluetooth Voltage Measurement

c. The appearance of the application icon that has been created. This icon shows the application we will use, which is located in the Android smartphone menu.

Figure 7. LuxMeter Application Icon View

d. The main display if the connection between the device and the Android smartphone is successful

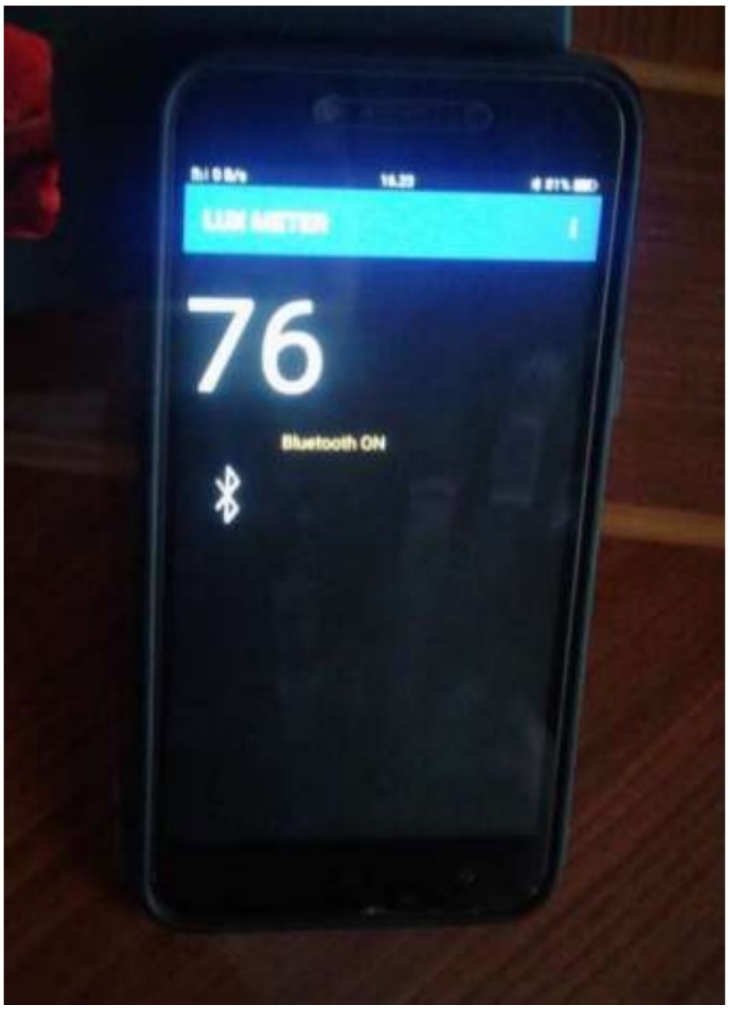

Figure 8. Sensor Reading Display

The image above is the main display if the connection between the device and the Android smartphone is successful. The number 76 is the lumen value read by the LDR sensor.

CONCLUSION

After conducting the design and testing, the author can draw the following conclusions:

a. The sunlight intensity measurement tool using an LDR sensor based on Android has been designed and built and works well in this circuit.
b. The sunlight intensity measurement tool using an LDR sensor with an Android smartphone is well connected using the HC-05 Bluetooth module.

REFERENCE

Ardianto, W. (2018). Penggunaan Sensor LDR dalam Sistem Otomatisasi untuk Pencahayaan Efisien. Jurnal Sistem Informasi dan Teknologi, 12(4), 221-228.

Elkhodr, M., Shahrestani, S., & Cheung, H. (2012). A review of mobile location *privacy in the Internet of Things*. 2012 Tenth International Conference on ICT and Knowledge Engineering.

Gata, Windu dan Gata, Grace. (2013). Sukses Membangun Aplikasi Penjualan dengan Java. Jakarta: Elex Media Komputindo.

Hendini, Ade. (2016). Pemodelan UML Sistem Informasi Monitoring Penjualan dan Stok Barang (Studi Kasus: Distro Zhezha Pontinak.) Jurnal Khatulistiwa Informatika Vol.4 No.2.

Iswandi, Eka. (2015). Sistem Penunjang Keputusan Untuk Menentukan Penerimaan Dana Santunan Sosial Anak Nagari dan Penyalurannya Bagi Mahasiswa dan Pelajar Kurang Mampu di Kanagarian Barung – Barung Kanagarian Timur. Jurnal TEKNOIF Vol.3 No.2.

Iswanto. (2011). Belajar microcontroller AT89s51 dengan bahasa C. Yogyakarta: Andy.

Junaidi, Apri. (2015). Internet of Thing, Sejarah, Teknologi, dan Penerapannya: Review. Jurnal Ilmiah Teknologi Informasi Terapan Vol.1 No.3.

Kumar, Manoj., Mahato, Sunita., Kumar, Ravi., Dev, Kapil. (2017). Home Automation Using Arduino Uno.). International Journal of Application or Innovation Engineering & Management (IJAIEM) Vol.6 No.2.

Kurniawan, F. (2018). Aplikasi Smartphone untuk Monitoring Sistem Pencahayaan Otomatis Berbasis LDR. Jurnal Teknik Komputer, 6(2), 45-50.

Luthfi, M., & Rahman, A. (2020). Sensor LDR untuk Pengukuran Intensitas Cahaya pada Sistem Otomatisasi Rumah Cerdas. Jurnal Teknologi dan Inovasi, 15(3), 89-95.

Nugroho, A., & Widodo, B. (2018). Pengembangan Sistem Monitoring Energi Berbasis Smartphone Menggunakan Sensor LDR. Prosiding Seminar Nasional Teknologi, 6(1), 233-240.

Prihatmoko, Dias. (2016). Penerapan Internet of Thing Dalam Pembelajaran di UNISNU Jepara. Jurnal Simetris Vol.7 No.2.

Rinaldi, T., & Prasetyo, Y. (2020). Pengukuran Intensitas Cahaya dengan Sensor LDR:

Studi Kasus dan Implementasi pada Sistem Energi Terbarukan. Jurnal Energi dan Lingkungan, 18(5), 234-243.

Siregar, H., & Yuliana, D. (2019). Penerapan Sensor LDR pada Sistem Pendeteksi Cahaya untuk Pertanian Pintar. Jurnal Rekayasa Sistem dan Informatika, 13(2), 110-117.

Suryani, R. (2021). Pemanfaatan Smartphone dalam Sistem Monitoring Intensitas Cahaya: Tinjauan dan Aplikasi. Jurnal Teknologi Informasi dan Komunikasi, 8(2), 78-85.

Sharma, R., & Patil, P. (2019). Light Dependent Resistor (LDR) in Light Measurement Systems. International Journal of Research in Electronics and Computer Science, 7(3), 112-118.