Jurnal Salome: Multidisipliner Keilmuan
Vol. 2 No. 1 Januari 2024, hal. 192-200
e-ISSN: 2986-4968

SMART LAMP BEBRBASIC ARDUINO UNO USING AN ANDROID SMARTPHONE

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Abstract

In the rapidly developing digital era, the Internet of Things (IoT) and the popularity of smartphone control applications have opened the door to innovation in the development of automation and device control systems. This research project aims to design and develop a smart lamp that can be operated using an Arduino-based smartphone device. The combination of advances in IoT and rapidly growing demand for remote control solutions makes this project relevant and interesting. These smart lights will allow users to control their home lighting via a smartphone app, creating great flexibility and potential energy savings. In addition, this project will enable the development of skills in the fields of programming, electronics, and design, as well as contributing to the open-source community by sharing the design and source code of this project. This project will outline the development of smart lighting that focuses on energy efficiency and stronger integration with smartphone technology, which has potential impact in daily life and applications in various industrial sectors.

Keywords: *Arduino, relays, & Smart lights.*

Abstrak

In the rapidly developing digital era, the Internet of Things (IoT) and the popularity of smartphone control applications have opened the door to innovation in the development of automation and device control systems. This research project aims to design and develop a smart lamp that can be operated using an Arduino-based smartphone device. The combination of advances in IoT and rapidly growing demand for remote control solutions makes this project relevant and interesting. These smart lights will allow users to control their home lighting via a smartphone app, creating great flexibility and potential energy savings. In addition, this project will enable the development of skills in the fields of programming, electronics, and design, as well as contribute to the open-source community by sharing the design and source code of this project. This project will outline the development of smart lighting that focuses on energy

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INTRODUCTION

Technology is currently developing rapidly and experiencing significant progress, and this cannot be separated from the development of science and technology (science and technology). In the current era of life, human dependence on technology is very high, encouraging a creative mindset in developing technology. In industry, technological support is very important to improve production quality(Widyantoro et al., 2021). Technological innovation not only aims to discover new things, but also creates more efficient tools. Sometimes, people's busy lives make them forget small tasks, such as turning off the lights, which can lead to energy waste.

Controlling lights is important in managing energy sources, especially electronic devices that use electricity, such as lamps as a lighting source. The use of Android smartphones as a communication tool has progressed rapidly, and now controlling home lights can be done via smartphone using a microcontroller component, such as Arduino Uno.(Anggara et al., 2019). Arduino Uno, which is both hardware and software, is often used in prototyping microcontroller-based electronic circuits(Asmaleni et al., 2020). Today's industry needs to continue to improve product performance and quality by utilizing advanced technology and improving operator skills.(Firmansyah et al., 2023).

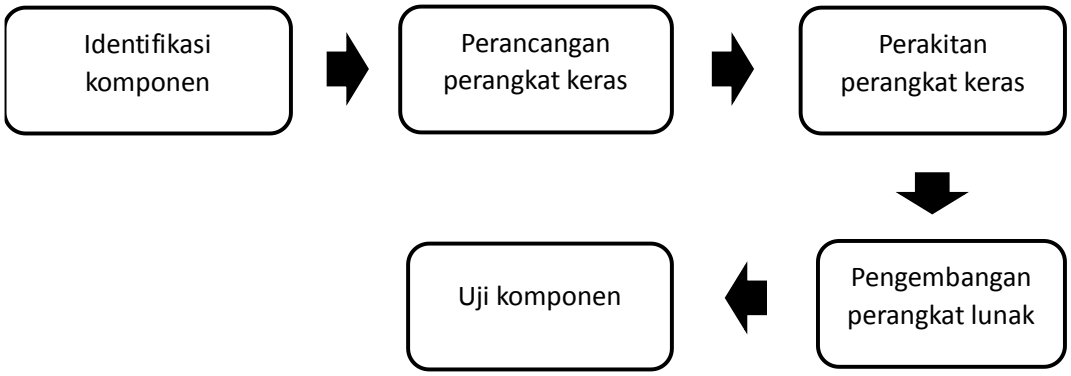
To overcome the challenges of manually controlling lights, an Arduino Uno-based automatic lighting system was created that can be operated via an Android smartphone. This system utilizes the HC-05 Bluetooth Module as a link between the Arduino Uno and an Android smartphone(Anggara et al., 2019). The Arduino Uno has a variety of functions, including developing interactive objects and receiving input from various switches or sensors(Alan Prasetya & Aulia, 2020).

Previous research(Asep Nurhuda et al., 2019)Controlling lights by voice via the internet using the speech recognition feature on a smartphone remotely is the focus of future research(Fatimah et al., 2021)involves the use of PIR sensors to detect the presence of objects, as well as the development of a system for controlling night lights via Google voice commands with Bluetooth at a certain distance without being blocked by walls. Other research(Kurniawan et al., 2013) talks about automatic lighting systems that use light sensors to adjust lights based on the intensity of surrounding light. They measure the light intensity and then convert the value to an ADC value to decide whether to turn the light on or off. The list of questions for Voice of Customer (VoC) is created in flexible and easy-to-understand language and asked during the brainstorming session(Paduloh, 2023).

In recent research(Muh. Yusrifar Haris & Aryo Abdi Putra, 2017), developed a lighting control system with Arduino Uno R3, using the Inventor Application, Delphi for voice commands, and the C programming language as a database system. Research and development methods are used to produce innovative products, test effectiveness, and find new solutions to make it easier to use automatic lights via voice commands via smartphone. This research aims to increase efficiency and effectiveness, eliminating the need for manual settings in turning lights on or off, and [number] is the principal investigator on this project.

RESEARCH METHODS

The development methodology for Arduino-based smart lamps, which can be accessed via smartphone, includes software development, hardware design and performance testing. Providing an in-depth understanding of the development of these smart lights and how to integrate smartphone and Arduino control into everyday life is the goal. To facilitate the implementation and achievement of research objectives, certain steps are taken in the research process:



Picture1Research Stages

This research develops smart lights that can be used by smartphones using software and hardware development techniques. The research methodology consists of several steps:

1. Component Identification: The initial stage involves selecting key components, such as Arduino microcontroller, wireless communication module, lighting sensors, and other necessary components.
2. Hardware Design: Schematic design and PCB layout of hardware that includes all smart lamp components.
3. Hardware Assembly: Mounting components to PCB and testing to ensure good functionality.
4. Software Development: Creation of source code required to control smart lights and integrate it with smartphone devices.
5. System Component Test: Testing of the entire system to ensure performance and conformity to project objectives.

In this methodology chapter, determine a series of important steps in the development of smart lamps that can be operated using a smartphone. This process begins with identifying the key components required, taking into account the appropriate hardware components and software required to control the system efficiently. The next step is hardware development, where effective hardware design and assembly is the key to success. We have also developed software that allows control of system operations and integration with smartphone devices. By focusing on testing system components, the smart lights we create meet expected performance standards. All these steps

contribute to our efforts to create practical solutions that combine modern technology with everyday needs. With this methodology, we hope to provide valuable guidance for future technology developers and researchers looking to create similar solutions for a variety of situations. In addition, this research opens the door to further understanding of the use of technology in creating homes that are smart and energy efficient. Technological support is very important in industry to improve the quality of the products produced(Widyantoro & Paduloh, 2022).

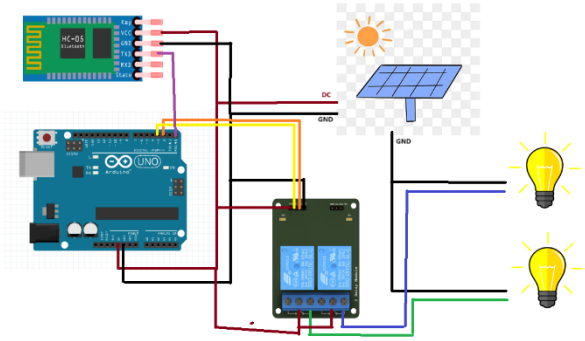
Tables and Figures

Table 2.1Hardware components

Component	Function
Arduino UNO	Give orders to each component
Bluetooth HC-05	Receiver of commands from the Arduino Bluetooth Controler application
RELAYS	Connecting electric current to the circuit
Jamper Cable	Conduct electricity
Solar Panels	As a source of electricity used
Battery	As energy storage from solar panels
Smartphones	As command control
Breadboards	connect electronic components without the need for soldering

Table 2.2Software components

Component	Function
Arduino Bluetooth Controller	Gives commands to Bluetooth HC-05
Bluetooth Voice	Gives voice commands



Picture2Network

DISCUSSION RESULT

Problem Analysis

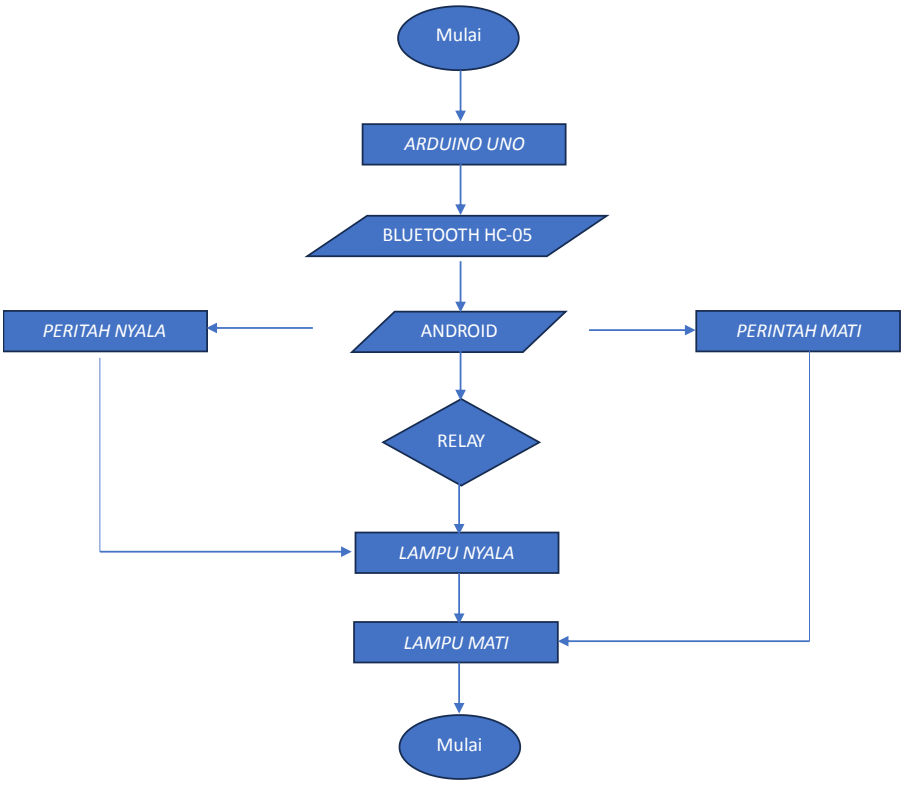
Currently, most of the lamps used generally still rely on manual switches located on the walls of the house. Even though some lamps are equipped with sensors, their use has not been fully adopted by the public. Light control systems that are still manual often become an obstacle, because they can make people less motivated to move and take action to turn on or turn off the lights. Therefore, as an innovation to overcome this problem, a device was developed that can regulate lighting automatically. This aims to make it easier for humans to manage lighting, where lights can be turned on and off automatically without requiring manual intervention.

Processing

At this stage we visualize the component schematic circuit in Figure 2 showing the circuit diagram of the Arduino UNO microcontroller board connected to the HC-05 Bluetooth and the 4-channel relay module. The Arduino UNO board is a blue electronic board that has a USB port, a power jack, and several pins for connecting external components. This board uses an 8-bit ATmega328P microcontroller that can be programmed via the Arduino IDE. The Bluetooth HC-05 is a blue rectangular module that is used to give commands from the Smartphone to the Arduino UNO. The TXD pin on the Bluetooth HC-05 is connected to the RXD pin on the Arduino UNO board with a purple cable. The relay module is a black rectangular module with three pins that can turn electricity on or off to other components, such as LED lights, based on digital signals from the Arduino UNO board. This module is connected to digital pins 2 and 3 on the Arduino UNO board with yellow and orange cables. This image also shows several other components such as solar panels connected to the Arduino UNO board and lights as the main material in making this project with red and black cables. Lights are used to show the results of successful project creation, for example, when the Smartphone gives the light to turn on, the light will come on. Breadboard is a plastic board with holes that can be used to connect electronic components without the need for soldering.

Modeling Design

This device is manufactured by planning a mechanical design that supports the tool's performance in real-world conditions.



Picture3work sequence flowchart

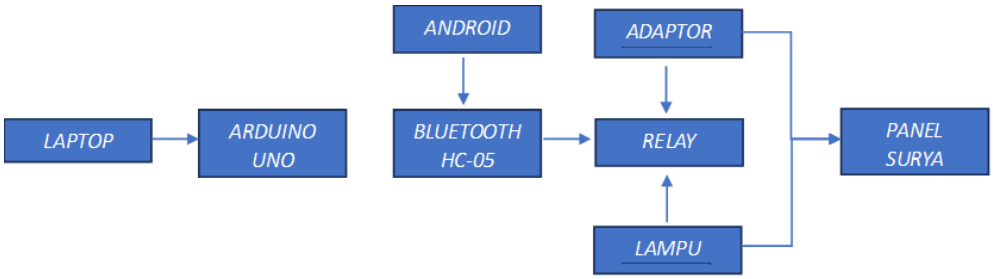
*Flow chart*This describes the working circuit of an automatic lighting system, which begins with the use of an Arduino UNO to enter a program that gives commands via the Arduino IDE. The program is then sent via the HC-05's Bluetooth to provide a signal, allowing the Android to connect to the HC-05's Bluetooth. Through the Bluetooth Voice application on Android, users can control the lights automatically by connecting the Bluetooth HC-05 with Bluetooth Android. Once the HC-05 Bluetooth is connected to Android, the 5V relay functions as an on/off switch to control the automatic lights. If Google receives a voice command "turn on the light", the relay automatically turns on the light.

Arduino IDE program

```
#include <SoftwareSerial.h>

SoftwareSerial module_bluetooth(2, 3); // pin RX | TX
int lampu = 7;
char data = 0;
boolean shouldBlink = false; // Variabel untuk mengontrol apakah LED harus berkedip atau tidak

void setup()
{
  Serial.begin(9600);
  module_bluetooth.begin(9600);
  pinMode(lampu, OUTPUT); // Inisialisasi PIN 7 Menjadi Output
  digitalWrite(lampu, HIGH);
  pinMode(2, OUTPUT); // Inisialisasi PIN 2 Menjadi Output
  pinMode(3, OUTPUT);
  pinMode(4, OUTPUT);
  pinMode(5, OUTPUT);
  digitalWrite(2, HIGH); // Pada kondisi awal dibuat high supaya relay mati (karena modul relay aktif low)
  digitalWrite(3, HIGH);
  digitalWrite(4, HIGH);
  digitalWrite(5, HIGH);
}

void loop()
{
  if (Serial.available() > 0)
  {
    data = Serial.read(); // Baca data yang dikirim

    if (data == '1')
    {
      digitalWrite(2, LOW); // Nyalakan relay 1
    }
    else if (data == '2')
    {
      digitalWrite(2, HIGH); // Matikan relay 1
    }
    else if (data == '3')
    {
      digitalWrite(3, LOW); // Nyalakan relay 2
    }
    else if (data == '4')
    {
      digitalWrite(3, HIGH); // Matikan relay 2
    }
    else if (data == '5')
    {
      digitalWrite(4, LOW); // Nyalakan relay 3
    }
    else if (data == '6')
    {
      digitalWrite(4, HIGH); // Matikan relay 3
    }
    else if (data == '7')
    {
      digitalWrite(5, LOW); // Nyalakan relay 4
    }
    else if (data == '8')
    {
      digitalWrite(5, HIGH); // Matikan relay 4
    }
    else if (data == '9')
    {
      shouldBlink = true; // Mengaktifkan kedipan LED
    }
    else if (data == '0')
    {
      shouldBlink = false; // Mematikan kedipan LED
      // Mematikan semua lampu
      digitalWrite(2, HIGH);
      digitalWrite(3, HIGH);
      digitalWrite(4, HIGH);
      digitalWrite(5, HIGH);
    }
  }

  // Bagian kontrol LED
  if (module_bluetooth.available() > 0)
  {
    data = module_bluetooth.read(); // Baca data yang dikirim melalui Bluetooth

    if (data == '1')
    {
      digitalWrite(lampu, HIGH); // Nyalakan LED
    }
    else if (data == '0')
    {
      digitalWrite(lampu, LOW); // Matikan LED
    }
  }
}
```

The lamp program above consists of two main parts, namely the program to control the HC-05 Bluetooth module and the program to control the relay. These two programs function to give commands to the automatic lighting system so that it can be controlled via an Android smartphone. The use of libraries in this program helps make program code creation easier, reduces the need to write program code from scratch, and effectively shortens the programming process according to the desired commands.

Work system



Picture4working system diagram

From Figure 3 above, each function of each circuit block can be described. The functions of these blocks are:

are as follows :

1. Arduino Uno is a microcontroller that can be used to create programs that can control various electronic components.
2. The HC-05 Bluetooth module for wireless serial communication can transmit Bluetooth signals to the serial port. Using Bluetooth v2.0+EDR 3 mbps modules using radio waves with a frequency of 2.4 Hz.
3. Relays function as activators and signal breakers in electronic devices.
4. Android functions as a control to regulate the turning on and off of the lights.

DESIGN RESULTS

The design starts with the Bluetooth HC-05, which connects to Android via wireless signal and allows the smartphone to read and display input. This automatic light system uses Bluetooth HC-05 as a signal sender to control the lamp operation itself. To control the lights, the Arduino Uno was connected to an Android smartphone and the HC-05 was sent wireless, allowing control of the lights via a 5V relay switch.

After the Android smartphone inputs a voice command, such as "turn on the lights" via Google, the Arduino Uno will receive a code in the form of the number 1. As a result, the relay switch will automatically turn on the lights. Conversely, if the code is 0, the relay switch will automatically turn off. This process can be monitored through the tool display in the image below.

CONCLUSION

You are developing an Arduino-based smart lamp that can be operated using a smartphone. The background to this project is that humans' dependence on manual light switches can result in wasted energy and a lack of motivation to move. In overcoming this problem, you propose a solution by developing a tool that is able to control the lights automatically. The research methodology involves selecting key components, designing hardware, assembling hardware, developing software, and testing system components. This project uses an Arduino Uno microcontroller, an HC-05 Bluetooth module, a relay module, and a lighting sensor to create a smart lamp that can be controlled via voice commands from an Android smartphone. The development process includes designing the schematic and PCB layout of the hardware, programming the source code to control the smart lights, and testing the entire system. The system's working circuit involves Arduino Uno, Bluetooth HC-05, and relays to produce responses to voice commands from users via the Bluetooth Voice application on Android. The design results show that the automatic lighting system has succeeded in overcoming the manual switch problem, and users can control the lights by voice via a smartphone device. In conclusion, this project aims to provide a practical and efficient solution for managing everyday home lighting by

utilizing Arduino and smartphone technology. Thus, it is hoped that these smart lights can provide comfort and energy efficiency in everyday life.

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