

LIGHT CONTROL SYSTEM DESIGN USING INTERNET OF THINGS-BASED VOICE COMMAND (CASE STUDY: HANA WERDHA PANTI)

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Abstract

Lights are a need that is always needed by humans for lighting the main room and also for other needs, but lights in the current era are still not practical and there are also many shortcomings for those who cannot reach the light switch, especially those with strong disabilities. or elderly people sitting in wheelchairs. The Hana Werdha Home is a nursing home whose contents are mostly elderly parents who want to enjoy their twilight years in peace and most of them are parents who sit in wheelchairs. Because their reach to the light switch was not within reach of those in wheelchairs.

Keywords: Lights, Light Control Systems, Voice Commands and the Internet of Things

1. INTRODUCTION

Control of electronic devices by entering commands into the system in this era has developed very rapidly, such as the application of voice commands. Voice command is one of the concepts of controlling electronic devices using voice commands. With this concept, all electronic equipment can be controlled with voice commands from the user (Dani et al., 2019).

Having a voice command will really help people with disabilities who sit in wheelchairs or even the elderly who can't stand up to reach the switch. Therefore, if this application is implemented, the role of the microcontroller, Android smartphone, and Bluetooth facilities is very important to provide comfort and convenience, especially for people with physical disabilities or the elderly. (Anggara et al., 2019).

Among the problems faced by persons with disabilities is the lack of facilities that are friendly to persons with disabilities, for example, the design of a house light switch which is placed at a height of 1500 mm where this situation is difficult for persons with disabilities when they use wheelchairs, because it is high to raise their hands when sitting on a chair wheel is 1300 mm.

Other problems faced by persons with disabilities, such as the difficulty of controlling (turning on or off) a light switch that is located far from their bed, because their movement is limited and this obstacle makes it difficult for them to control the switch.

The Hana Werdha Home is a nursing home where elderly parents are there. At the Hana Werdha Home there are many elderly parents who sit in wheelchairs and they have difficulty controlling the lights because of their distance from the wheelchair. And most of them are always on a smartphone routine.

2. MATERIALS AND METHODS

2.1 Related Research

(Anggara et al., 2019)in his research entitled "A New Method of Turning on Lights with Voice Commands Based on Arduino Uno Using a Smartphone". Seeing the existence of people with special needs such as people with disabilities or physical disabilities and also people who are old, this makes(Anggara et al., 2019)create a method for turning on the lights with voice commands based on Arduino Uno using the speech recognition method on an Android smartphone and also Bluetooth. The research was successfully carried out and can provide convenience and comfort, especially for people with physical disabilities and also the elderly.

2.2 Theoretical Basis

2.2.1 Design

Design is an activity that has the goal of designing a new system that can solve the problems faced by the company which is obtained from selecting the best alternative system. Build is the activity of creating a new system or replacing or repairing an existing system either in whole or in part(Susanti & Minarmi, 2019). According to(Susanti & Minarmi, 2019), Design and build is the process of building a system to create a new system or replace or improve an existing system either in whole or only in part. Design is a series of procedures for translating the analysis results of a system into a programming language to describe in detail how the system components are implemented. Thus the notion of design or design is an activity to create and also implement a programming language into a system or a system into a programming language.

2.2.2 System

The system comes from the Latin (systema) and Greek (sustema) is a unit consisting of components or elements that are linked together to facilitate the flow of information, material or energy to achieve a goal. This term is often used to describe a set of interacting entities, around which a mathematical model can often be constructed. The system is also a unity of interconnected parts that are in an area and have driving items, general examples such as the state. The state is a collection of several other unified elements such as provinces that are interconnected so as to form a state where the people who act as the driving force are the people in the country.(Maros & Juniar, 2018).

2.2.3 Lights

A lamp is a device that produces light. The word "lamp" can also mean light bulb. Sir Joseph William Swan was the person who first invented the light. The lamp is an object that functions as a light, the lamp has a shape like a bottle with a cavity containing a small wire that will light up when connected to an electric current. LED (Light-Emitting Diode) lamps are a type of lamp that can save energy. This lamp is of small construction so that it can be applied in various applications. This lamp is colorful so that it makes the appearance more beautiful and attractive. LED lamps are one of the most energy-efficient types of lamps among other types of lamps, although they are more expensive than ordinary lamps(Kiswanton & Arzadiwa, 2021).



Figure 2.Light

2.2.4 Voice Commands

Voice Command Recognition System or what is often called Speech Recognition technology (sentence or word recognition) in computer science and electronic engineering is a system that converts voice sentences into digital codes that function as commands to do something about the system, for example driving a vehicle, turning off or

turning on the Lights, or other tasks(Dani et al., 2021). Speech Recognition is a form of AI (Artificial Intelligence). Speech Recognition is a technique that allows devices to recognize and understand the sounds we produce. Words that appear in our voices will be processed and converted into a format that can be read by the machine or application. After the words and phrases have been processed into a format that can be read by the machine or application, speech recognition will analyze what commands are entered and what work or response must be issued by the machine or application.(Rohman & Rizqi, 2021).

2.2.5 Internet Of Things

Internet of Things(IoT) is a network that connects various objects that have identification identities and IP addresses, so they can communicate with each other and exchange information about themselves and the environment they sense. Objects in IoT can use or produce services and work together to achieve a common goal. With this ability, IoT has shifted the definition of the internet as computing anywhere, anytime, to anything, anyone and any service. One implementing characteristic that refers to the identification of an object. Attacks on IoT security can include attacks on RFID labels, communication networks and on data privacy. To prevent and overcome it, security mechanisms and protocols are needed(Adani & Salsabil, 2019).

3. METHOD

3.1 Current System Analysis

Current system analysis is an overview of the current system with the aim of knowing more clearly how the system works, besides being used to find out which system is running it is also used to define and evaluate problems that occur and so that the system can be used as a new system to be computerized , the design of the running system analysis is carried out based on the sequence of events that exist in the current system. Based on the analysis carried out, the working mechanism of the current system can be described as follows.

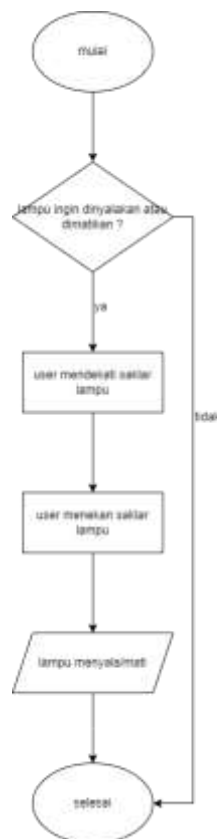


Figure 3.Flow chart Current System Analysis

3.2 Analysis of the Proposed System

Proposed system analysis is a form of system description that will be designed and made with the aim of knowing more clearly how the needs and flow of the system are, this proposed system is a solution to the current system problems.

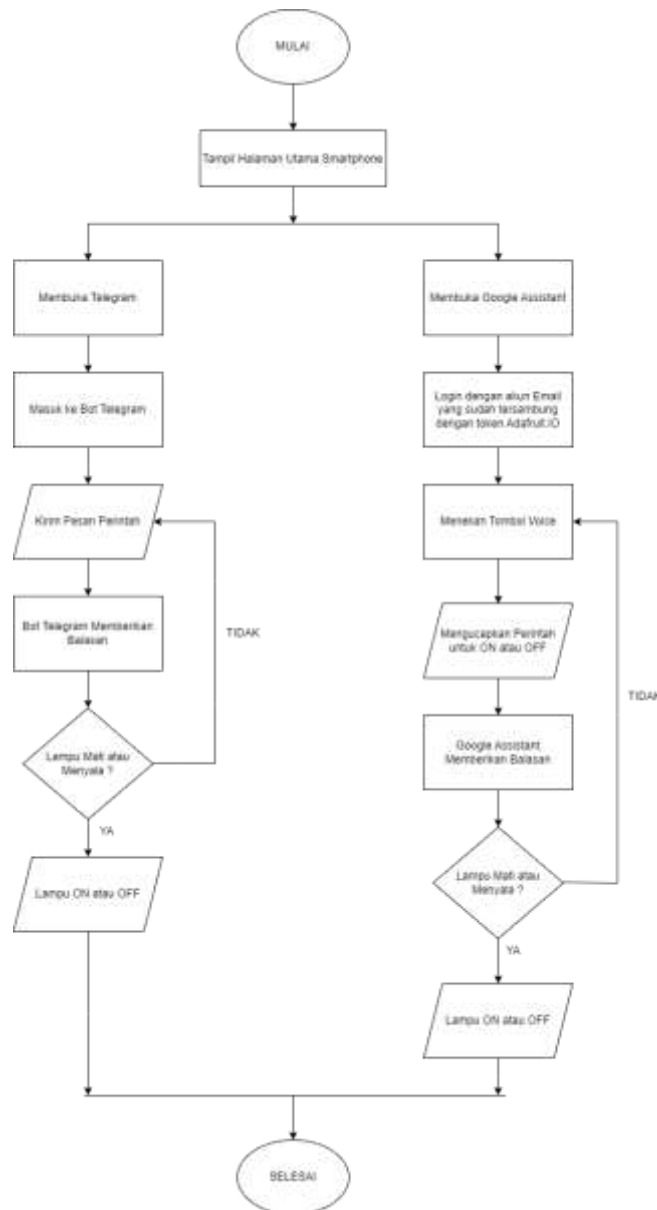


Figure 3. Flow chart Proposed System Analysis

3.3 Unified Modeling Language (UML) Design

UML design is a design that aims to develop a system using a visual language of program flow in the form of diagrams and supporting texts. This design identifies the system components designed in detail. The following is the design of a light control system using voice commands based on the internet of things.

3.3.1 Use Case Diagrams

Use case diagrams is a picture of the interaction between actors and the system whose purpose is to find out what can be done and can be accessed by users of the system.

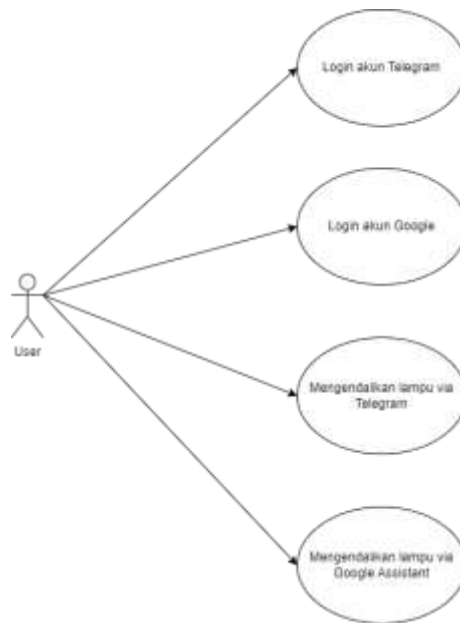


Figure 3. Use Case Diagrams Proposed System

3.3.2 Activity Diagrams

Activity diagrams is an overview of the activities of the system or activities that can be carried out by the system against the software and relates between brainware, software, and hardware.

1). Telegram Login Activity Diagram

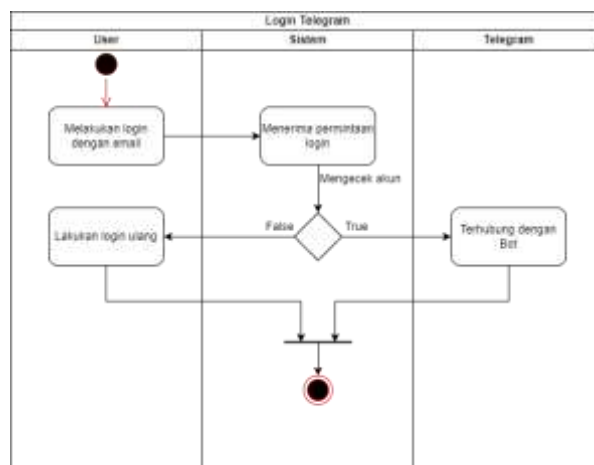


Figure 3. Activity Diagrams Telegram login

3.4 Sequence Diagrams

Sequence Diagrams is a diagram that aims to describe the interaction between objects in successive times. The following is a sequence diagram of the light control system using voice commands based on the internet of things.

1). Telegram Login Sequence Diagram

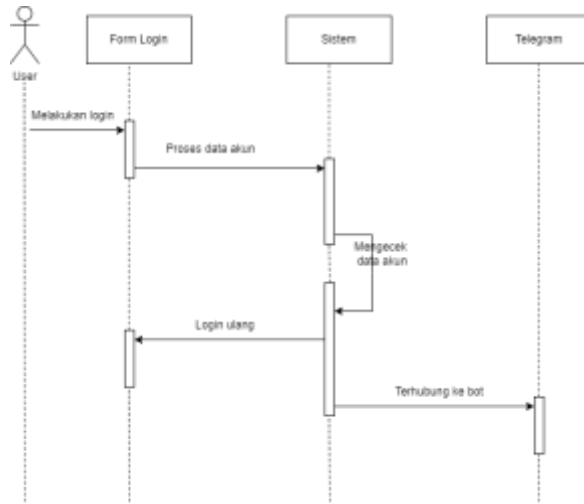


Figure 3. Login Sequences Telegram

3.5 Tool Design

This section describes the design of the tool which includes the NodeMCU ESP8266 circuit schematic with relays and also lights and other components to make light control devices using voice commands based on the internet of things.

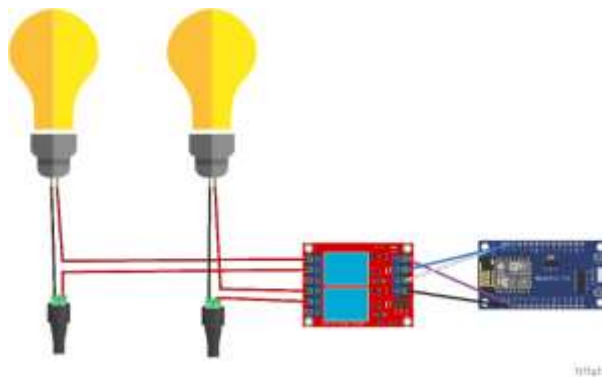


Figure 3. Tool Design

In the figure there are components used to design a light control device and one of the most important components for turning on and off the lights is the 2 channel relay. The relay is connected to the lamp and also to the NodeMcu ESP8266, where the NodeMcu ESP8266 is the input board that has been programmed and the relay is the program output.

4. Implementation and Testing

4.1 System Specifications

System specifications are the device requirements used to support the running of a system. In designing a lamp application, hardware and software specifications are required, along with the specifications.

4.1.1 Hardware Specifications (Hardware)

Hardware is a physical device used in information processing. The hardware used to support programming in this lamp application is as follows:

Table 4.Hardware Specifications (Hardware)

No	Hardware	Specifications used
1	<i>Processor</i>	<i>Intel(R) Celeron(R) N4000 CPU @ 1.10GHz</i>
2	<i>RAM</i>	<i>4GB DDR3</i>
3	<i>Hard drive</i>	<i>1TB</i>
4	<i>VGA</i>	<i>Intel(R) HD Graphics</i>

4.1.2 Software Specifications (Software)

Software is a set of predefined commands which require hardware to operate. The software used to design the application is as follows:

Table 4.Software Specifications (Software)

No	Software	Support System
1	Operating system	<i>Windows 11 Home 64-bit</i>
2	Programming Languages/Tools	<i>C++ language / C language / Arduino IDE</i>
3	Database	<i>Adafruit. IO</i>
4	IDE applications	<i>Arduino IDE</i>
5	Text Editor	<i>Arduino IDE</i>
6	Frame Design	<i>Fritzing</i>
7	Interface Design	<i>Whimsical</i>

4.1.3 IoT Implementation Support Device Specifications

IoT implementation support devices are devices used in the implementation of the Internet of Things. The devices used to support the manufacture of Internet of Things-based tools are as follows:

Table 4.IoT Implementation Support Device Specifications

No	IoT Implementation Support Devices	Specifications used
1	<i>microcontroller</i>	<i>NodeMCUESP8266</i>
2	Jumper Cable	<i>Female to Female</i>
3	Light	<i>5 watts</i>
4	<i>Relays</i>	<i>Relay Module 2 channel 5V Optocoupler</i>
5	<i>Power Supply</i>	<i>5V 5A</i>

4.2 Interface Implementation

Interface Implementation is the implementation of an interface design that has been made with the aim of providing an overview of the appearance of the application that has been designed. The following is the implementation of the application that has been made:

- 1). Google Assistant interface



Figure 4. Google Assistant interface

2). Telegram Bot interface

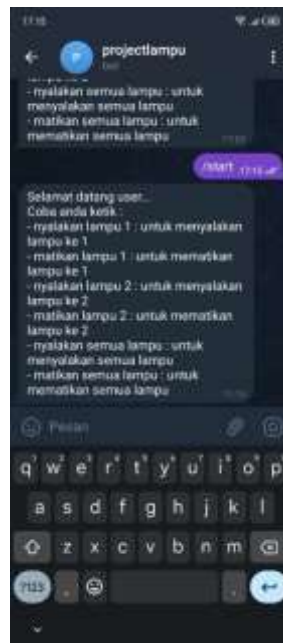


Figure 4. Telegram Bot interface

4.3 System Testing

The purpose of system testing is to check whether a system that has been made is in accordance with certain standards. System testing is the most important thing to find errors or deficiencies in the system being tested. The system testing technique used is black box testing.

5. Cover

5.1 Conclusion

After carrying out the design and manufacture stages, the following conclusions can be drawn:

- 1). By making this tool, it is hoped that it can help people with physical disabilities to easily control lights.
- 2). By implementing voice command applications and typing internet-based command messages on this tool, users can control this tool flexibly and easily and can be controlled remotely.

By implementing two control methods in this tool, users can adjust their needs and no longer have to bother reaching for the light switch on the wall.

5.2 Suggestions

In the manufacture and design of this tool there are still shortcomings and weaknesses. Therefore there are several things that can be used as suggestions for further perfection of the tool in the future, as follows:

- 1). In the voice command section, there are still deficiencies to turn on the lights at once and turn off the lights at once.
- 2). In order for this tool system to run properly and effectively, it is suggested that the applications and tools that have been made can be developed later and can be expanded in a wide audience and can be of benefit to many people.

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