

CONCEPT DEVELOPMENT OF AUTOMATIC SLIDING DOOR AND LIGHT USING NODEMCU SENSOR

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To cite this article:

Pandini, J., bin Zulkipli, M. A., & Fenoria Putri. (2024). Concept Development of Automatic Sliding Door and Light Using NodeMCU Sensor. *International Journal of Mechanics, Energy Engineering and Applied Science (IJMEAS)*, 2(1), 20–25. <https://doi.org/10.53893/ijmeas.v2i1.236>.

Received: 01 14, 2024; Accepted: 01 29, 2024; Published: 01 31, 2024

Abstract: The rapid advancement of technology has led to the emergence of smart systems that aim to enhance convenience, energy efficiency, and safety. In this study, we present the development of an automatic door and light system utilizing a NodeMCU sensor. The system is designed to automatically control open and close the door, as well as lighting in indoor environments. To implement the system, this experiment utilized the NodeMCU sensors onboard Wi-Fi capabilities, enabling remote control and monitoring via a dedicated mobile application. The application provides users with the ability to customize various system parameters, according to their specific requirements. This development offers a practical and connected solution to automate door and light, increasing safety, comfort and energy efficiency in premise, house or any buildings. It can enable users to control both the door and light remotely, providing convenience and flexibility. This automatic sliding door and light can unlock the system by sending commands through the Blynk application on the user's smartphone, then NodeMCU sensor as a microcontroller will confirm the command and send data to other components to move sliding door and turn on the light, the use of this system is very effective because it makes it easier for users to open and close the door and turn on and turn off the light without extra efforts.

Keywords: Automatic, NodeMCU, Blynk

1. Introduction

In the current era of modernization, equipment is designed in such a way as to facilitate human work and many of them are designed for practical work without continuous manual instructions or control by humans. For example, to open and close the door that if done manually will take a lot of time and energy. As well as lights, to avoid small things like forgetting to turn off the light switch. This is a waste of electricity when there is no more activity when the light stays on. To save and make work more practical, a door and light are designed to turn on by sent a command from application from smartphone when someone enters the room.

The use of manual door and light which are still widely

used in public places is not efficient in terms of time and energy wasted on manual processes. [1] Especially in public facilities, workplaces or industries such as archive room which require a fast and practical process so the workers can enter or carry things easily without having to open the door and turn on the lights first when entering the room. Furthermore, this project can minimize and prevent crime from freely entering the room. By using an IoT application as a security system, we can get notifications, control systems, prevent unauthorized persons and can monitor the doors and rooms in real time. Therefore, this project can't be handsfree and only can be accessed by visitors who have the

Blynk application.

However, with the ease of technology that has been implemented, it will also be very easy for theft to occur in rooms that are unpredictable and can cause losses, so a good security system is needed. The use of CCTV cameras in rooms that are not equipped with additional security devices is considered less effective in tackling theft. [2]

1.1 Review of Current Situation

In this day, very often human life cannot be separated from the development of technology that is increasing day by day. One of them is by creating automatic equipment so humans can do all their activities more efficiently. Automatic doors are an important thing in a building or place that requires high mobility. For example, in office buildings that require a fast and easy process to access from one to another room. But in reality, people still use manual doors.

As well as lights in the room, of course, savings are important in reducing expenses or waste in every facility. In this case, we also can reduce the habit of not turning off the light switch when it is not needed either deliberate or not. This project is given a security system or lock to reduce negligence if someone forgets to lock and reduce worry to prevent other people or unauthorized people from entering, in the other word everyone cannot access to enter the room. [3]

1.2. Review of Relate Literature

1.2.1 Design of Automatic Sliding Door Using Arduino and Passive Infrared Sensor (PIR)

This tool is designed using the Arduino Uno controller, passive infrared (PIR) sensors, and DC motors. Other supporting components are relay drivers and limit switches. This tool can open and close the door automatically when someone is about to enter and exit. This design is made in the form of a miniature door whose input is read by the PIR sensor but does not reduce the function in its actual size. [4]

1.2.2 Design and Build an Sliding Door Prototype Using Passive Infrared Sensor Based on Arduino (Case Study of Region General Hospital)

There's research about automatic door prototype by Siska Aprillah from Islam Kuantan Singingi University designed to facilitate access for hospital staff 6 who have difficulty opening the door when bringing patients in and out of the hospital. This research contains the design of an automatic door prototype using an Arduino-based passive infrared sensor (a case study of a regional general hospital). The features in the system include Arduino as a controller and Passive Infrared as an instruction interface, servo motor as output. Arduino Uno board circuit with passive infrared sensors that are connected using several jumper cables as connectors. This passive infrared sensor has three pins including the red cable is VCC 5V which is a positive cable, the yellow cable is OUT, and the black cable is GND or Ground which is a negative cable.

The system works starting by turning on the microcontroller

system, namely by providing power via an adapter that is connected to the Arduino board, if the microcontroller system is active then the PIR will detect, then Arduino receives data from the PIR then the Servo Motor opens and if the microcontroller system is not active then the PIR cannot detect or stop. [5]

1.2.3 Development of Automatic Light Control System Using Fuzzy-based Time Delay Scheme

Research made by Bima Ilham Naufal, Asep Suhendi, and Endang Rosdiana from Telkom University to overcome users who are negligent of how important it is to manage their usage time, so they made a control system for automatic lights based on Passive Infrared (PIR). The PIR sensor cannot detect the user who tends to be silent, therefore the time delay application will be very suitable for applied in a room with little activity. To further support the use of lamp time, a time delay scheme is added to the control system where the time delay will cover the shortcomings of the PIR Sensor-based control system which is too fast to escape from the detection system if people tend not to move even though they are still within the sensor work area. [6]

1.2.4 Automatic Door Design Monitoring System IoT-based Using ESP32-CAM

The purpose of this study is to design a door security system using internet-based facial recognition of thinks using the Blynk App as monitoring so that homeowners know who has been caught on camera. This system is built with ESP32-Cam, DfPlayer Mini, and Servo Motor. Based on the results of the analysis and testing that has been carried out, it is concluded that the door security system using the internet-based ESP32-Cam in this study can work optimally. This tool can be opened using face recognition, Touch Sensor and the Blynk App, so that it can minimize the crime of theft of valuables. Test Results for Face Detection and Face Recognition Systems Go Well. Although it has a delay during face registration and face detection. [7]

1.2.5 Automatic Light on Control System Using Motion Sensor in Arduino-based Learning Room

There is research that using a motion (PIR) sensor combined with audio sensor in an Arduino-based learning room by Iqbal from Muhammadiyah Makassar University in Indonesia. From his research of Arduino sensor, the system will function when the PIR sensor gets human motion input, and then ISD 1820 will 7 also work. ISD 1820 is a small Voice Recorder and Playback module that can do multi-segment recording. Then it will be accumulated in Arduino according to the program that was uploaded to be used as a 5-volt output to turn on/off the light and produce a sound "HAPPY STUDY".

The duration of voice information that can be recorded by an ISD chip (Information Strong Device) is shown in the last 2 digits of the ISD chip series. In this 1820 ISD chip there are parts that support the process of recording and recalling recorded voice information. Inside the ISD 1820 IC chip, there is a complete circuit block for recording sound, calling the recorded voice, both the entire recorded sentence and

displaying the entire sentence in word form. The PIR sensor will work when there is a movement made by humans, which is where the height of the sensor greatly affects the range of the PIR sensor. [8]

1.2.6 Smart House Lighting Automation and Remote-Control System Based NodeMCU ESP8266

This research aims to utilize IoT on home remote control and automates systems that can be operated with a smart phone application via an internet connection (Wi-Fi). This system used the NodeMCU ESP8266 module as a microcontroller, the light emitting diode (LDR) sensor as an automation controller for lighting the environment according to environmental conditions, and the Blynk smartphone application as a remote controller. The process of controlling the lights can be done specifically on certain lights and can be controlled by the changes of environmental light in the morning and evening. The results showed that when the LDR sensor was poorly lit, the lamp would be ON and otherwise the lamp would be OFF when the LDR receives more light intensity. In addition, the Blynk application is able to control the lights when connected with internet and tested, in this research, up to 2.7 km. It can be concluded that as long as the system is connected to the Wi-Fi in a stable and continuous manner, then this control system can perform the task of turning on and off the lights independently when the owner is not at home. [9]

1.3 Review of Related Product

1.3.1 Design of Automatic Sliding Door Using Arduino and Passive Infrared Sensor (PIR)

In this project they use passive infrared and servo motors, where this circuit has input as a medium human detector by recording the heat temperature of the human body then sensor passive infrared sends digital signal data to the Arduino microcontroller. Then Arduino Uno microcontroller proceeds to the servo motor to open and then close the door. [3]

1.3.2 Development of Automatic Light Control System Using Fuzzy-based Time Delay Scheme

Arduino Uno will be used to control the "ON-OFF" lights automatically with the PIR (Passive Infrared) sensor. If someone enters the room and detects movement, the sensor will detect the passive infrared waves emitted by that person and then the Arduino will program the relay to active so the light will turn on. If people go out (no one is in the room) then the lights will turn off automatically after a few seconds (delay). [4]

2. Methods

2.1. System Workflow

The flow of the research used in designing automatic sliding doors and lights using NodeMCU sensors is divided through several stages which are presented in the following



Figure 1. Flowchart of Automatic Sliding Door and Light Using NodeMCU Sensor.

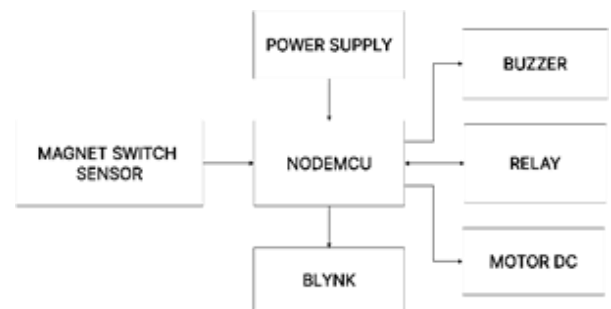


Figure 2. Block Diagram of Automatic Sliding Door and Light Using NodeMCU

2.2. Design

At this stage the system is implemented as a security system in a house, by installing magnetic switch sensors at two different points, at the sliding door and at the door frame



Figure 3. Design the implementation via Solidworks

In the installation process it aims to detect movement when the door is shifted manually or forcibly without going through the Blynk application. When the sensor detects movement outside the command, information will be sent to NodeMCU, then information will be received in the form of incoming notifications on the smartphone.

2.3. Planning System

The design of the development that becomes the main control system in controlling the on and off of the sliding door and light consists of the results of research hardware and software design.

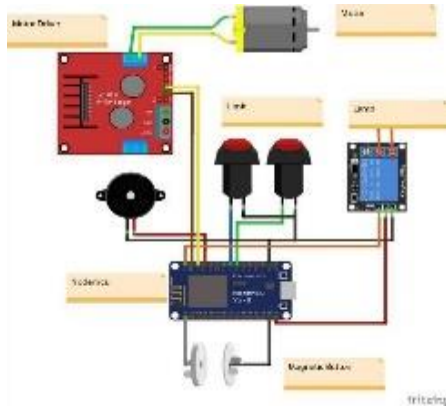


Figure 4. Circuit



Figure 5. Implementation from the circuit

In designing the system in this study used the following specifications:

2.3.1 NodeMCU

The NodeMCU used is ESP8266, the communication line can be through access to the Wi-Fi network and also access to the USB to chip serial. [10]

2.3.2 Magnetic Sensor Switches

The magnetic sensor used is the MC-38 Magnetic Contact Switch Sensor which can be used as a door or window security system. It produces the signal when moved away from each other which can be fed to the microcontroller (e.g Arduino) to perform the desired action as per requirement. [11]

2.3.3 Relay

The relay used is a 2 channel relay module. Relay 2 channel is a convenient board which can be used to control high voltage, high current load such as motor, solenoid valves, lamps and AC load. [12]

3.3.4 Blynk

The project on blynk that will be made is called smart home which functions as a remote control and means of accessing information. [13]

3. Result and Discussion

3.1. Testing

As will be discussed in this chapter, data collection is carried out under several test conditions, starting from sensor detection testing, application access testing, until testing the security function in door access locking.

3.1.1 NodeMCU Test

In this system test, awareness of checking components whether NodeMCU is connected to Wi-Fi is very important so the tool can work as it should. [14] Since checking the NodeMCU is the important part, the user must ensure in advance whether the NodeMCU sensor is connected to Wi-Fi or not connected.

Before checking the NodeMCU, user must first ensure whether the Wi-Fi name and password used same with the criteria according to what was made in the programming.

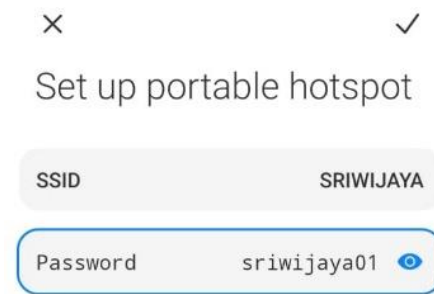


Figure 6. Wi-Fi and password name according to the Arduino code

After checking the Wi-Fi device, then checking the NodeMCU sensor components by seeing whether the led on the NodeMCU sensor is on constantly, if the led blinks, then it can be stated that NodeMCU is not connected to Wi-Fi.

3.1.2 Blynk Application Test

Other than NodeMCU, checking on the Blynk server is also the most important part. In this case the Blynk server connects the Blynk application on the smartphone with NodeMCU which is connected to the internet network (Wi-Fi) so as when there is a command from Blynk such as signal to control the relay, the sliding door and lights will turn on or off according to the command. Before do the testing on the device that will be used, the first thing that must be done is access the Blynk application that is already installed on the smartphone. This application aims to be a remote control that will be used to send commands to NodeMCU.

In this test, the Blynk server is designed so that the lights can turn off or on without having to open and close the door first. To do this, the user only needs to press the command off or on the light on the Blynk Application.



Figure 7. Implementation from the circuit

If the user has finished accessing the room, the next step is to give the command again to close the door through the Blynk application. After the command has been sent, the light will turn off together with the door closing by itself, then the door will be locked automatically.

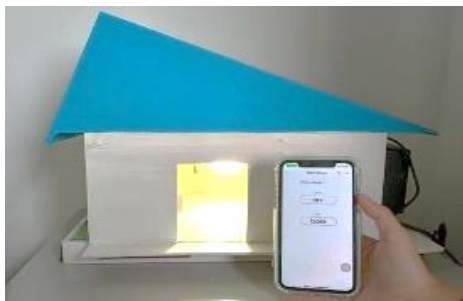


Figure 7. Blynk running the commands

3.1.3 Security System Test

Blynk locking system can be set in several ways, such as entering a password or using certain buttons or sensors to unlock. [15] If the lock system is forced to open, it means the person tries forced to open the door without using the Blynk, so if the device has been forced open, the sensor will send a signal to the user's smartphone and will provide a notification in the form of a warning or notification that the room has been forcibly accessed. To identify it by separating the magnetic switch sensor with a large distance then the sensor will give an alarm signal and the buzzer will automatically issue a sound in the form of a warning alarm.

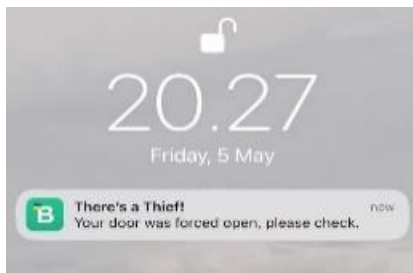


Figure 8. Notification from Blynk

3.2 Result

The tests carried out on checking this project are by giving commands through various smartphone devices and giving commands repeatedly. From the tests carried out by the user

10 times through 5 different smartphone devices, each smartphone giving 2 times commands, the following results are obtained: 10 tests were tried and the total success in the tool trial was 9 times and the total tool failure was 1 time, from the explanation above the results of this experiment the percentage error for the equation can be calculated as follows:

Success percentage:

$$\frac{10 - 1}{10} \times 100\% = 90\%$$

From the results of calculating the percentage of errors resulting from the overall tool testing table, an error result of 90% is obtained. And the system runs according to the purpose of making automatic sliding door and light to make it easier for users.

4. Conclusion

In conclusion from the tests that already implement, the project has successfully accomplished all components and application tests have been successfully work and satisfies all functions and conditions necessary to operate successfully.

From the tests that already run after going through many processes on this project, several conclusions can be drawn such as the automatic door allows remote control and eliminates the need for manual operation. Users can open and close the door from a distance using the Blynk app on their smartphones or other connected devices.

Testing performs on security system to determine the sensor reaction by detecting movements made by the user such as separating two poles of the magnetic switch sensor placed on the door and frame so that the magnetic switch sensor sends a signal to NodeMCU as a sign that the security system has been forcibly opened.

The development of automatic sliding door and light system using NodeMCU and Blynk provides convenience by allowing remote control of the doors and lights through the Blynk app on smartphone. The system enhances security by incorporating features such as magnet switch sensors for monitoring and notifying suspicious activity.

Using Blynk allows for remote control and customization of settings, providing flexibility and personalized experiences. Furthermore, the automatic light system can be programmed to turn on and off based on the commands. This helps to save energy by ensuring that lights are only active when needed. Overall, this development offers a practical and efficient solution for automating sliding doors and light.

Acknowledgements

The authors would like to thanks to Politeknik Negeri Sriwijaya and Management and Science University for giving and teaching me about engineering knowledge that is useful for me today and later.

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