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Long Range RFID Based Automatic Doorstops in Housing

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ABSTRACT

The development of science and technology provides great benefits in all aspects of human life. This can be seen from the various digital technologies that have existed in recent decades. So that automation systems in various fields began to be developed in the fields of industry, robotics, medical, and instrumentation. An automatic doorstop system based on Long Range RFID is the application of an automatic system that uses Long Range RFID as an activation medium. This automation system uses a microcontroller with the esp-32 type as the system controller and uses a servo motor as the prime mover of the doorstop. The programming language used is C language with Arduino software. This Long Range RFID doorstop monitoring system uses Blynk software by displaying accumulated activity on the Long Range RFID automatic doorstop system.

Keywords : Doorstop, ESP-32, RFID, Servo Motor, Monitoring.

1.   INTRODUCTION

Currently Internet of Things (IoT)-based technology is one of the new trends in the world which will most likely become a trend in the future. Simply put, IoT connects devices continuously connected to the Internet and can be controlled remotely through a user's device. The Internet of Things (IoT) is a structure where objects and people are given exclusive identities and the ability to relocate data over a network without requiring two-way touch between humans for example source to destination or human-to-computer interaction. (Yohana, 2021).

One of the uses of the Internet of Things (IoT) is an automatic doorstop that is equipped with a monitoring system. At the present time, many developments have been made on doorstop systems in housing. This doorstop system does not require a lot of manpower because vehicle users can press the button provided near the portal so that the doorstop will open automatically (Heri, 2017).

In research conducted in 2019 by Geo and friends, designing an RFID-based automatic doorstop system that will be applied in housing. Researchers use RFID as system input, the maximum reading distance of RFID is around 5 cm, and use the LCD as an indicator and system output. (Geo, 2019).

In this study, researchers conducted research on designing a doorstop security system in a housing estate, designing a doorstop system using Long Range RFID (Radio Frequency Identification) input. The doorstop system designed at the entrance area of the GSM Martubung housing uses RFID. Where RFID cards can be detected with an RFID reader at a certain distance from the object. All visitor information will be stored in the cloud. This system is made with registered RFID so that it can be monitored by security guards. (Yohana, 2021).

The Long Range RFID doorstop system has a wide frequency range so that it can optimize the communication performance of the circuits found in the entrance and exit systems. The Long Range RFID doorstop system can be used for large residential areas so that long-distance communication between devices can run smoothly without causing too much delay. It is hoped that this research on the GSM Martubung housing entry system will help the complex community in terms of confirmation of entry and exit. In addition to maintaining complex security, this doorstop system is expected to speed up monitoring information within the complex.

2. THEORECAL FOUNDATION

An automatic barrier is a barrier that is commonly used at the entrance and exit of vehicles in an area. Generally used in parking areas, office buildings, government buildings, hospitals, hotels, airports, malls, and even in residential complexes. (Heri, 2017).

Figure 2. 1 Automatic Doorstop (https://palangotomatis.com/)

The design of the RFID Long Range automatic doorstop system uses the RFID Long Range as the system output with a maximum reading radius of about 2 meters, this system uses the ESP-32 microcontroller as the system controller, the ESP-32 microcontroller is also used as a monitoring system that will send data to the web server, this system uses a servo motor as a driver or accumulator on the doorstep, the rpm and torque of the servo motor will be controlled by using a motor driver. In the construction design stage, the researcher used the stech-up application as a design medium and used the proteus application to design the control circuit. (Heri, 2017).

Long Range RFID Radio Frequency Identification (RFID) is a general term for non-contact technologies that use radio waves to automatically identify people or objects. There are a number of identification methods, but the most common is storing a serial number that identifies a person or object, on a microchip linked to an antenna. The combination of antenna and microchip is called an RFID transponder or RFID tag, and it works together with an RFID reader. (Yingxian, 2017).

RFID is the process of identifying a person or object using radio transmission frequencies. RFID uses radio frequency to read information from a small device called a tag or transponder (transmitter and responder). The RFID tag will recognize itself when it detects a signal from a compatible device, namely an RFID reader. RFID is an identification technology that is flexible, easy to use, and very suitable for automated operations. RFID combines advantages that are not available in other identification technologies. (Maulana, 2017).

RFID can be provided in devices that can only be read (Read Only) or can be read and written (Read or Write), do not require direct contact or light paths to operate, can function in a wide variety of environmental conditions, and provide a high level of data integrity. tall. In addition, because this technology is difficult to counterfeit, RFID can provide a high level of security. (Yingxian, 2017). RFID Long Range is a remote system using RFID Long Range with a reading distance of 5 -10 meters.

Figure 1. Long Range RFID
(https://www.chafontech.com/)

RFID technology is based on the working principle of electromagnetics, where the main components of the RFID tag are the chip and the tag antenna, where the chip contains information and

is connected to the tag antenna. The information contained or stored in this chip will be sent or read via electromagnetic waves after the antenna tag receives an electromagnetic wave beam from the antenna reader. This RFID reader will simultaneously forward information to the application server. (Yingxian, 2017).
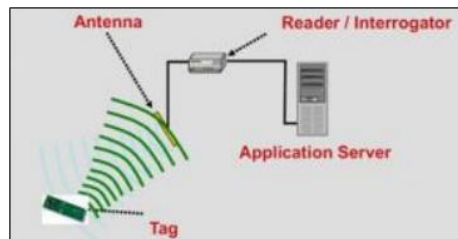

Figure 2 RFID Systems in General (https://panduanteknisi.com/)

3. RESEARCH METHOD
A. Doorstop Design Design
In the automatic doorstop system, researchers carry out 3D designs on doorstop construction planning, researchers design 3D using SketchCup Pro software. The 3D design can be seen in the following figure.
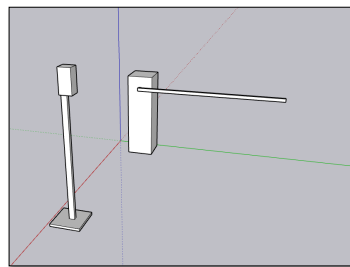

Figure 3. 3D Design of Doorstop Construction

The construction of the automatic doorstop is designed into two parts, namely the crossbar box and the RFID Long Range box. The researchers designed the doorstop length to be around 2.5 meters. The size of the crossbar is 25 cm long, 25 cm wide and 80 cm high. the size of the RFID Long Range box is 120 cm high.

B. System Block Diagram
The automatic doorstop system uses the esp32 microcontroller as the system controller, this system has an input system, namely RFID Long Range and the output in this system is a servo motor as a doorstop drive and also uses Blynk software as a monitoring medium. The block diagram can be seen in the following figure.
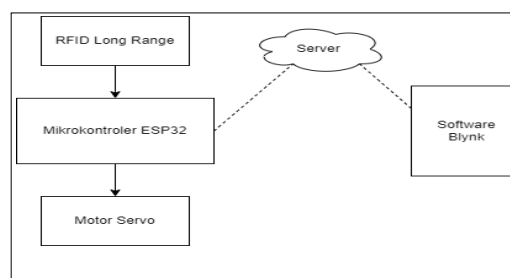

Figure 4 System Block Diagram

Researchers use RFID Long Range with UHF type which has 860-900 MHz, the RFID reader will detect the RSSI value on the RFID card, if the RSSI value is in the program then the microcontroller will execute the system output. RFID Long Range will detect the RFID card, the system input reading will be

sent to the esp32 microcontroller and the esp32 microcontroller will order the servo motor to rotate to open the door latch. The esp32 microcontroller will send the RFID card reading to the server and send it back to be displayed by the blynk application. In this study the researchers compiled the steps in carrying out the system design which can be seen in the following elaboration.

       a)   Designing doorstop construction
       b)   Designing control panel construction
       c)   Control system design

Methods of processing / analysis of results, methods of processing / analysis of results are carried out to find out whether the design of the automatic doorstop system is good and the data obtained can be processed to suit the needs of the doorstop system.

Long Range RFID Testing. In this test, radio waves can detect the presence of an RFID card carried by a driver. Following are some of the results of testing the use of RFID Long Range that has been carried out.

4.   RESULTS AND DISCUSSION

This automatic doorstop system has an input system in the form of RFID Long Range which will send RFID card readings to the esp32 microcontroller, the output of this system is a servo motor that will rotate the doorstop, after the system can work properly esp32 will send monitoring activities to the application blynk. The purpose of this discussion is to identify the workings of the system being built, and whether the system has been made in accordance with predetermined specifications or not.

A.   Results of the Implementation of the Automatic Doorstop System

The results of the implementation of the automatic doorstop system will start from hardware design, hardware design is the design of mechanical parts on the doorstop such as the implementation of the portal box construction design, doorstop implementation, implementation of the Long Range RFID box that will be built.

Figure 4 The results of the entire hardware design

The implementation of the Portal Box Construction was designed based on the design that will be carried out using Sketchup 8 software, the material is plywood with a thickness of 2mm and box ribs using 1 inch x 1-inch wood material, the size of the tool built is 30 cm long, 25 cm wide, 80 cm high.

Figure 5. Portal Box Construction Implementation

In the implementation of the portal box construction which was designed using plywood material, the researcher designed the basic frame of the portal box first using 1-inch x 1-inch wood which has sufficient resistance and so it is more sturdy to hold the doorstop. Doorstop Construction

Implementation. Doorstop construction implementation uses polyfoam material with a portal length of 2.5 meters, doorstop is covered with adhesive plastic to make it more rigid and stronger, doorstop. The implementation of the door sign can be seen in Figure 6 below
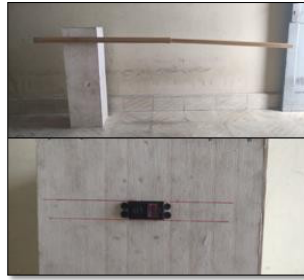

Figure 6. Implementation of Doorstop Construction

The shaft on the doorstop is placed 30 cm after the base of the doorstop and connected to the portal box section about 10 cm from the top of the portal box, the doorstop is also given a weight of about 400 grams to reduce the torque on the servo motor. Construction Implementation of the Long Range RFID Box is designed with a height of 120cm using 1-inch x 1-inch wood material, the part of the RFID box is designed with a size of 15cm x 10 cm using plywood material with a thickness of 2mm as the place for the RFID Long Range. The results of the long-range RFID implementation box can be seen in Figure 7 below.

Figure 7.Implementation of Long Range RFID Box Construction

The Long Range RFID box will be placed about 2 meters before the portal box with the aim of reading the presence of vehicles that will pass through the portal. In implementing the RFID box, it is equipped with a cable pipe that is directed to the bottom of the box so that it can direct the cable in one path and can also anticipate rainwater seepage.

B. System Discussion

In this discussion, the system that has been tested will be discussed to explain whether the system can run according to the system design. Among the results of the discussion, calibration will be carried out so that accurate data will be produced from each system input and output.

Excess

Based on the tests that have been carried out on the system in this final project, some of the advantages that exist in the system can be taken as follows:

    a) This automatic doorstop system is not required to stop to scan the portal.
    b) This doorstop system is equipped with a monitoring system so that every activity can be monitored with the blynk application.
    c) This automatic doorstop system can read RFID cards from motorists.

Lack

Based on the tests that have been carried out on the system in this final project, some of the deficiencies that exist in the system can be taken as follows:

    a) This automatic doorstop system must have wifi access in its operation.

This automatic door latch system will not work during a power outage.

5. CONCLUSION

Based on the results of the design and testing that has been carried out on the automatic doorstop system using RFID Long Range, the researcher can draw several conclusions as follows:

a) Based on research, the Blynk application can carry out an activity monitoring system properly by accumulating the number of incoming vehicles. The esp32 microcontroller can work well in managing system input and output and can work well in sending data to the monitoring system cloud server.

b) RFID Long Range on automatic doorstops can be read with a maximum distance of 2 meters and a maximum vehicle speed of 20 KM/hour. The servo motor in the automatic doorstop system has been able to work well when the doorstop is open with a rotation of 90o and when the doorstop is closed with a rotation of 0o, Blynk will display the amount of vehicle data when it passes the bar.

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