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Bluetooth implementation on automation of Android-based gate doors

D Hadidjaja^{1*}, A Wisaksono¹, A Ahfas¹, S Syahririni¹ and D H Untariningsih²

¹ Electrical Engineering Department, Muhammadiyah University Sidoarjo, Sidoarjo, Indonesia

² Informatics Engineering Department, Stikubank University Semarang, Semarang, Indonesia

*dwiadidjaja1@umsida.ac.id

Abstract. The development of smartphone technology has been increasing in the use of applications with the support of the Android system. The facilities contained on an Android smartphone can be developed as an automatic tool in terms of operation of other equipment and can also be done remotely. By adding Bluetooth equipment to a gate, it can make automation easier for security guards to operate the gate. By using Bluetooth and Android smartphones, it will be more optimal in operating the gate automatically, especially over long distances, and can provide security for users. Automated gate test results for closing time moves with a speed of 3.7 per second. Bluetooth usage without barrier is the optimal distance between the gate automation equipment with the smartphone between 10 meters and 35 meters.

1. Introduction

In the era of technology where buildings and housing still use technology a little as an assistive device in security, such as a gate. The gate is one of the public facilities that are widely used for the entry and exit of people and vehicles. The gate is also used to secure vehicles and facilities in schools, offices and industries. The gate is generally equipped with a conventional security lock, to open and close the gate one must approach the gate security lock, because frequent opening and closing the gate can cause other work interrupted and provide insecurity in terms of monitoring the entry and exit of people and vehicles. This can happen when the vehicle owner is carrying out an activity, and the carrier's negligence factor can cause undesirable things. So it is necessary to automate the gate to secure various vehicles inside the gate and make the work lighter [1]. This gate automation replaces the use of conventional keys with electric locks based on Android. This is expected to be more practical, easy to operate for open and close gate systems and have more security than conventional systems [2-4]. Simulation of Android-based gate automation prototype using Bluetooth sensor. So that by implementing it to its actual form, all that remains is to adjust the equipment needed. With Bluetooth equipment on the gate automation system and also based on Android can provide effective ease of opening and closing the gate [5-9].

2. Method

2.1. Media transfer

Bluetooth has a 2.4 GHz Unlicensed ISM (Industrial, Scientific and Medical) frequency band, using a frequency hopping transceiver capable of providing real-time data and voice communication services between Bluetooth hosts with a range of 10-100 meters [10]. Access speed or Bluetooth bandwidth of 1 Mbps. Bluetooth can use the standard TCP / IP protocol on a Local Area Network (LAN) connection with the concept of PC to PC. The Bluetooth protocol can be connected using standard computer network protocols.

The design of a gate automation system using Bluetooth is explained in Figure 1.

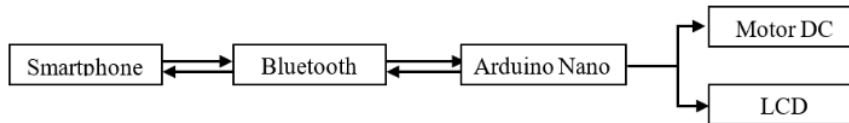


Figure 1. Chart of door gate automation system design.

Bluetooth equipment will receive signals as input from smartphones, Arduino Nano functions to execute incoming signals from Bluetooth. The password stored on the smartphone is read by a Bluetooth device which is forwarded to the microcontroller is detected as a sensor and continued in the process of opening and closing the gate is done by a DC motor Automatically [11]. The LCD is to display an instruction. If the password is correct, the DC motor will move to open the door and close again. Buzzer serves to give a warning sign when the password is wrong.

2.2. Hardware designing

The hardware design provides an overview of the implementation of the simulation form of the prototype automation gate based on android using the Arduino Nano V3 microcontroller. The gate automation hardware design chart is shown in Figure 2.

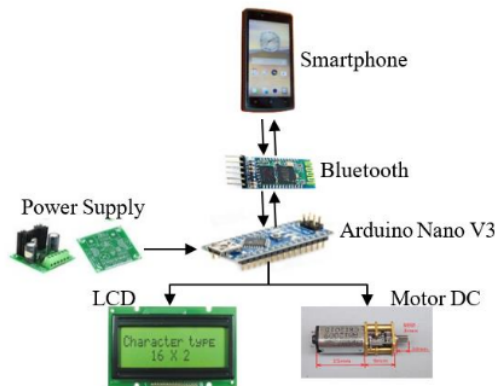


Figure 2. Gate design hardware automation chart.

2.3. Software design

Designing software for Android-based gate automation using the Arduino Nano microcontroller. The software is designed in accordance with the desired working principle. In making the program, it is necessary to define the possibility of reading the Bluetooth sensor module. Programming using CodeVision AVR, and the process for compilers using Cross-compiler C, is able to translate almost all

commands from the ANSI C language with the addition of several features to take special advantages from the AVR architecture and embedded system requirements.

3. Results and discussion

3.1. Results

3.1.1. *Bluetooth sensor testing.* Testing the Bluetooth sensor module when opening and closing the gate automation requires accuracy. Because the microcontroller is used to adjust the sensor input data then processed, to determine the ability of the sensor to work properly or not. Display of test results when open and when closed is shown in Figure 3 and Figure 4.

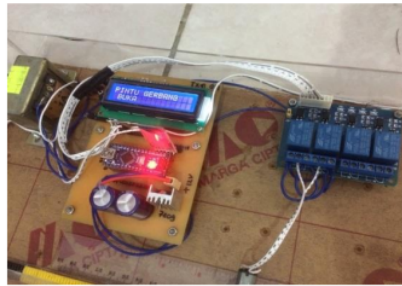


Figure 3. Bluetooth sensor testing when open.



Figure 4. Bluetooth sensor testing when closed.

3.1.2. *System testing while working.* Display system testing at work studying Figure 5. With system testing at work carried out the following:

- Prepare the application on the smartphone to open and close the gate.
- On state system according to the program.
- If the system condition does not occur an error can be connected directly to the application to the Bluetooth Sensor Module.
- If an error occurs the program will stop.

Stages of testing can be explained when opening or closing the gate, the process of opening and closing movements is carried out by a DC Motor controlled by the Arduino Nano Microcontroller in accordance with the Bluetooth Module program. The close book process is directly connected to the smartphone device. The results of opening and closing the gate with a smartphone are shown in Table 1. Testing was also carried out on two conditions, namely testing with conditions blocked by a wall with the results

of the test shown in Table 2. While testing with conditions not blocked by objects with the test results is shown in Table 3.

The use of an Android application on a smartphone can open the gate, whereas when using a smartphone with a Java (Symbian) system experiences an error in the process of opening the gate. For testing the distance of application use of Bluetooth hardware, if the far wall is blocked is less than 27 meters and if it is not blocked it can reach a distance of 33 meters.

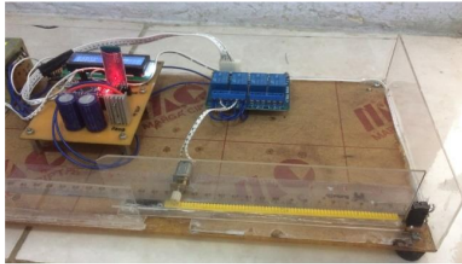


Figure 5. System testing while working.

Table 1. Estimated success of door gates.

No	Brand of Smartphone	Movement
1	Android Oppo Neo 3	Open
2	Android Oppo Neo 9	Open
3	Azus Zenfone Android	Open
4	Samsung Galaxy Android	Open
5	Nokia System Java/Symbian	Error

Table 2. Barrier testing.

No	Testing Distance	Results
1	5 m	Open
2	15m	Open
3	20m	Open
4	25m	Signal Interference
5	30m	Not Open

Table 3. Unobstructed testing.

No	Testing Distance	Results
1	10 m	Open
2	15 m	Open
3	25 m	Open
4	30 m	Open
5	31 m	Open

3.2. Discussion

The test results are shown in Table 1 to Table 3, that by using the Bluetooth module found on an Android smartphone can help in the implementation of the control system, this case when implemented on the gate automation system is very easy to operate. From the results of the design of the prototype simulation if it is implemented in actual conditions, it is necessary to change the DC Motor component to be replaced with an AC Motor. While other components can still be used as in the design of the simulation carried out.

4. Conclusion

Based on the results of testing the tools in the discussion above it can be concluded that the implementation in the form of prototype simulation design can provide convenience in the process of opening and closing the gate. Using gate-based automation for android can provide a sense of security for building voters. The use of Bluetooth applications makes it easy for users to open and close the gate with the farthest distance of 10 meters and a maximum distance of 35 meters, many Bluetooth applications are found on smartphones.

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