Design and Build a Hotel Service Reservation and Verification System Using Web-Based e-KTP

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***Abstract*— Hotel is a company that provides accommodation services and provides other facilities that meet the requirements of comfort and commercial purposes. The development of the times and technology, also affects the development of the hotel. The use of hotel reservation technology makes it easier for the hotel booking process. Service quality, trustworthiness, facilities and security affect hotel selection decisions. A common application of security technology is the use of duplicable RFID card lock technology. For this reason, it is necessary to add a double security system in the form of an OTP (One Time Password) code and limit access to visitors and visitors from visitors. The test results using NFC PN532 to read e-KTP cards obtained readings in under 1.00 seconds, with 100% accuracy within a distance of 0 - 2.5 cm. In testing with an additional OTP (One Time Password) code, the results obtained are good accuracy readings with an accuracy rate of 100% when the OTP code is appropriate.**

Keywords*— *Cottage, e-KTP, NFC, OTP Code, Security.

I. INTRODUCTION

Hotel is a company that provides services in the form of accommodation and provides meals and other facilities in hotels for the public that meet the requirements for convenience and commercial purposes in these services (Decree of the Minister of Transportation No. 241/11/1970). Its role is very important in the scope of tourism, business, and other travel needs. The development of times and technology has also influenced the development of hotels today, where one of them can easily order and find hotels in an area, only from a smartphone that we have, simply by installing a hotel booking application. We can rest in peace during our journey [1].

The use of hotel reservation technology facilitates the *booking*, but to be able to determine a hotel has many factors. Service quality, trust, facilities and of course security partially and simultaneously influence hotel selection decisions [2]. Service quality can be said to be satisfactory and the level of security affects financial performance and service quality also affects financial performance, this means that the better the level of security and quality of service, the hotel's financial performance will further improve [3].

Currently, the common application of security technology is the limited use of RFID card lock technology provided by star hotels, where visitors only have to scan the card at the room door to open the door. This has a weakness, where the card can be duplicated by people with bad intentions, to be able to open other people's room doors. For this reason, additional security is needed to strengthen the existing system. Where in this study focuses on hotels in the form of *cottages*. And visitors must be restricted from accessing the area where their room is located, but they can still enjoy other existing facilities. Based on those problems, the idea was created to conduct research with the title "Design and Build a Hotel Service Reservation and Verification System Using Web-Based e-KTP". To create a tool that provides multiple levels of security, which can manage the access of each hotel visitor and guest of hotel visitors, to provide a level of security and comfort for hotel customers.

This system carries two integrated security systems using an RFID reader system with an NFC PH532 sensor and additional authentication using an OTP code. Where the system model used today that is common and widely used for reading RFID tags is the RC522 RFID sensor, the use of the PH532 NFC sensor in the system is because it is more concise in the microcontroller summary scheme and more concise in program configuration and of course a more efficient system. Newer than the RC522 RFID sensor. Together with the NFC sensor PH532 becomes a new authentication combination.

This research aimed at strengthening the security system in the existing and commonly used hotel system, namely the use of RFID cards. The implementation of using the e-KTP card as a key is to take advantage of RFID technology in it and make this e-KTP card or electronic identity card usable in more and more countries.

II. METHOD

A. Stages of Research

The stages of research carried out as an initial stage in conducting research, are shown in Fig. 1. Everything related to research must be planned in advance, from searching for references to making reports. The first stage is a literature study

on automated security systems at hotels, NFC Reader, OTP codes, Arduino and Web Servers, which are carried out as lessons learned from the research to be carried out. The second stage is collecting data on tool requirements and research, tool requirements can include 2 components, namely hardware and software used as a design for making the system. The third stage is designing the Web Server interface, in designing the Web Server interface using Visual Studio software as a builder.

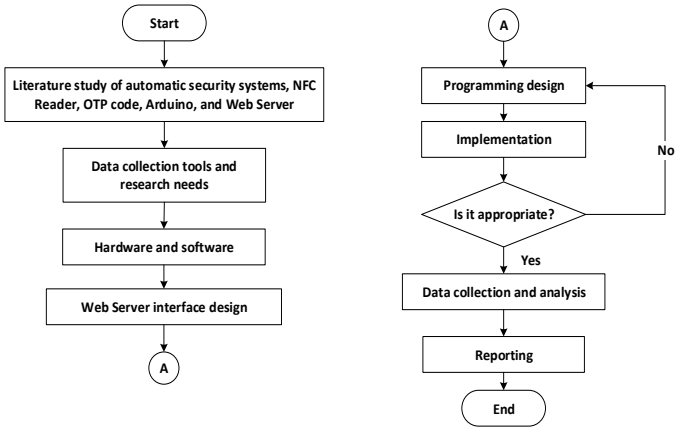

Figure 1. Stages of Research

The fourth stage is the design and design of the program, this stage is the stage for designing a tool/system from the results of data collection that has been done and linking it to the Arduino program. And creating an SQL database as a data storage area connected to Arduino. The fifth stage is implementation, consisting of testing the system created until testing the design results. If it is deemed appropriate then proceed to the next stage, if not then return to the design stage to fix it. The sixth stage is data generation and analysis, this stage is carried out after the implementation stage has been successfully carried out and obtained data from the test. The seventh stage is report preparation, after successfully obtaining data and analysis, the final stage is report preparation.

B. System Planning

The design of this system has 3 important parts in this study. The first is the registration and data collection of visitors e-KTP cards at the reception. The second is part of the entry system at the entrance to the cottage. Third is the entry system that is on the room door from the cottage. Diagram block of the entire system of this research can be seen in Fig.2. Fig 2. explains that there are several parts consisting of, the reception section, the Gate section, the Door section. The reception section functions as a place for registering e-KTP cards which will be used as the main object of this research, where general information is collected from visitors such as names, mobile phone numbers (for sending OTP codes), type of cottage, and room number. The reception section contains several sensors and a microcontroller, including ESP8266 NodeMCU, USB Step Down, NFC PN532. The Gate and Door Parts of the room, several sensors are connected to an Arduino Uno R3 microcontroller as a controller for several sensors that use I2C modules, namely, Keypad and LCD.

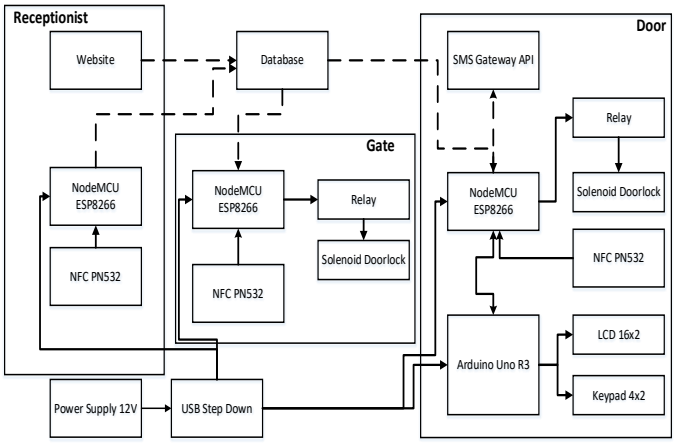

Figure 2. System Planning

The Gate section functions as the entrance gate before going to the room door that has been booked, here visitors and guests from visitors will be asked to tap their e-KTP cards. The Gate section contains several sensors and microcontrollers, including ESP8266 NodeMCU, USB Step Down, NFC PN532, 16x2 LCD, Relay, Solenoid Door Lock.

The Room Door section here taps the e-KTP card and enters the OTP code that has been sent to the mobile of the hotel visitor via the 4x4 Keypad media which can be seen on the 16x2 LCD. The Room Door section contains several sensors and microcontrollers, including ESP8266 NodeMCU, USB Step Down, NFC PN532, LCD 16x2, Relay, Solenoid Door Lock, Keypad 4x4.

III. RESULTS AND DISCUSSION

A. Measurement of the PN532 NFC Reading Distance Test Accuracy

Testing the accuracy of the PN532 NFC reading distance was carried out with the aim of knowing the accuracy of the success of sensor readings on the media used, namely, e-KTP. Tests were carried out by providing reading distance experiments to find out how far the PN532 NFC sensor was able to read chip RFID on e-KTP in real condition. Testing the accuracy of the PN532 NFC reading distance was carried out 10 times with a registered card. Testing of the PN532 NFC sensor was carried out with the help of a ruler to measure the test distance and a stopwatch to see the delay starting from the e-KTP tag process until the results appear on the 16x2 LCD screen. The following is a sample list of e-KTP cards with UID codes used as samples for this test:

1. e-KTP Achmad Farchan Hadi : 04:66:56:42:8C:66:80
2. e-KTP Adam Satria Agung : 05:8A:45:D4:7D:C1:80
3. e-KTP Luthfi Adi Syahputra : 04:79:25:5A:81:61:80

Based on the tests carried out, it was found that the maximum reading distance from the PN532 NFC sensor was

2.5 cm, with the presence of solid media as a barrier from the sensor as thick as 2.5 cm. From the ability of the reading distance, also obtained delay sensor readings from 0.77 seconds to 0.98 seconds' range. However, with a note that when the sensor is initially turned on, it will read with delay longer than the subsequent readings, this can be seen when the sensor's first reading takes 0.80 seconds, but after that the sensor will be able to read with the adjustment of the distance made, if the distance is farther away the sensor will read slower.

TABLE I
PN532 NFC READING DISTANCE TEST ACCURACY

Test	Distance (cm)	e-KTP Card			Delay (s)
		1	2	3	
1.	0,5	Success	Success	Success	0,80
2.	1	Success	Success	Success	0,77
3.	1,5	Success	Success	Success	0,78
4.	2	Success	Success	Success	0,78
5.	2,5	Success	Success	Success	0,95
6.	3	Unread	Unread	Unread	-
7.	3,5	Unread	Unread	Unread	-
8.	4	Unread	Unread	Unread	-
9.	4,5	Unread	Unread	Unread	-
10.	5	Unread	Unread	Unread	-

Testing the reading accuracy of the PH532 NFC sensor on e-KTP cards is carried out to find out or how accurately the PH532 NFC sensor can read or correct the RFID tags on e-KTP cards within a certain distance and it takes time for the PH532 NFC sensor to do so.

B. Measurement of the OTP Code Reading Accuracy

Testing the accuracy of reading the OTP code is carried out to determine the accuracy of the success of reading the OTP code. Testing the accuracy of reading the OTP code was carried out 10 times with testing by entering the OTP code sent to the registered mobile number, the result was that the program was able to read the OTP code that was entered correctly, with a comparison of the time range for reading or delay different. The test for reading the OTP code is carried out with the help of a stopwatch to see the delay starting from the process after inputting the OTP code on the 4x4 Keypad until the results appear on the 16x2 LCD screen. Table II shows the results of the OTP code reading test.

TABLE II
OTP CODE READING ACCURACY

Test	OTP Code	Description	Delay (s)
1.	138019	Appropriate	1,40
2.	839607	Appropriate	1,52
3.	474975	Appropriate	1,38
4.	514331	Appropriate	1,50
5.	393364	Appropriate	1,44
6.	272468	Appropriate	1,45
7.	468857	Appropriate	1,40
8.	283210	Appropriate	1,44
9.	984778	Appropriate	1,48
10.	635903	Appropriate	1,39

Based on the tests carried out, the reading of the OTP code shows a fluctuating time span. However, the overall time shows that reading the OTP code does not take 2 seconds to read, not even 1.6 seconds to read the OTP code. Testing the reading of the OTP code is carried out to find out how accurate the reading of the OTP code is and to find out how long the process took and to find out that the system program has not experienced an error and has run as desired.

C. Testing Quality of Service Delay and Packet Loss

The test that has been carried out aims to obtain the values of the parameters being tested, namely Delay and Packet Loss. The measured packet loss and delay are the result of communication between the microcontroller and the database server.

TABLE III
QUALITY OF SERVICE DELAY

No.	Source	Destination	Delay (s)
1.	202.3.218.138	192.168.43.165	0,0906
2.	202.3.218.138	192.168.43.165	0,0000
3.	202.3.218.138	192.168.43.165	0,0000
4.	202.3.218.138	192.168.43.165	0,0334
5.	202.3.218.138	192.168.43.165	0,0038
6.	202.3.218.138	192.168.43.165	0,0031
7.	202.3.218.138	192.168.43.165	0,0029
8.	202.3.218.138	192.168.43.165	0,0022
9.	202.3.218.138	192.168.43.165	0,0452
10.	202.3.218.138	192.168.43.165	0,0000
Average			0,01812

The delay test aims to determine the time required for data transmission from the microcontroller to the database server. Based on the tests carried out, the results were average delay of 0.01812 seconds or 18.12 ms, with time delay the longest is 0.0906 seconds or 90.6 ms. Based on the results of the tests that have been carried out, it can be concluded that the network quality of the system is in the good category.

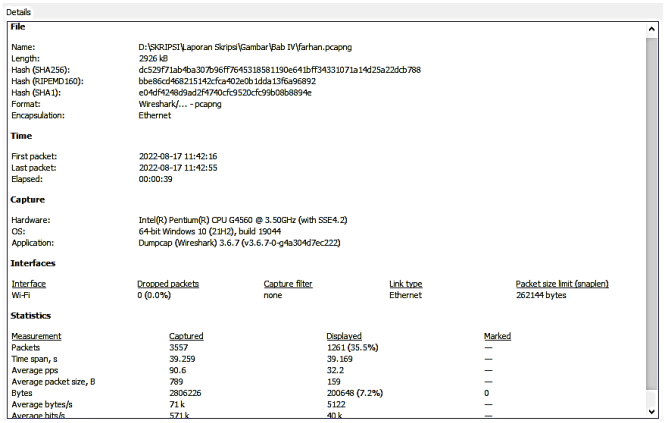

Figure 3. Packet Loss Testing

From the test in Fig. 3 it can be seen that there were 3557 packets sent and 1261 packets received from the results of the packets received. the percentage of packets received was 94.4%. To calculate the packet loss value, use the following formula:

$$\text{Packet Loss} = \frac{(\text{packet sent} - \text{packet received}) x 100\%}{\text{packet received}}$$
$$= \frac{(3557 - 1261)\ x\ 100\%}{3557}$$
$$= 0.65\%$$

The packet loss test aims to determine the percentage of the total number of packets lost when sending data. From the calculation results obtained Packet Loss value of 0.65%. The Packet Loss value is a low value so that the test results fall into the very good quality range according to ITU-T G.114. QoS packet loss testing is carried out to find out how many packets are lost or fail to be sent when the data transmission process is carried out.

D. Testing Overall System Functionality

The overall system functionality test is carried out after testing the NFC PN532 reading and the OTP code has been running properly, the aim is to find out whether the entire system has been running simultaneously or synchronized and to find out the success rate of all systems that have been implemented.

TABLE IV
OVERALL SYSTEM FUNCTIONALITY TEST

e-KTP Card (UID)	OTP Code	Solenoid Door Lock	Description
046656428C6680	138019	Open	Appropriate
058A45D47DC100	839607	Open	Appropriate
0479255A816180	474975	Open	Appropriate
041D5A7A365880	514331	Open	Appropriate
049665922F2A80	393364	Open	Appropriate
058F9A30F4A100	272468	Open	Appropriate
058C64B963A100	468857	Open	Appropriate
046C7AA27D5B80	283210	Open	Appropriate
04314872953180	984778	Open	Appropriate
05807C567DC280	635903	Open	Appropriate

Functionality test is done by testing tag e-KTP card on NFC PN532 and OTP code. This is also done to test how well the communication between the microcontrollers and also how the data transmission communication from the microcontroller to the database server. The test was carried out by taking 10 experimental samples with all samples inputted with the correct data both the UID e-KTP code that has been registered and the OTP code according to what was sent to the cell phone number, this aims to find out whether the program reading is appropriate and there are no errors and so that the process of sending the OTP code runs.

IV. CONCLUSION

Based on the background, test results, analysis, and discussion, which have been made in the previous chapters, the following conclusions can be obtained:

1. The use of a security technology system with the Two Step Authentication by using NFC as a reader of the e-KTP card and the OTP code as validation of the validity of the e-KTP card used. Where will be placed at the door of the room. Only registered visitors can have access to the room, but with the addition that if a visitor orders a cleaning service, the cleaning service will have access to the room. For the gate, you only need to use an e-KTP card to be tagged to the NFC sensor.
2. Use of the website as an interface intended for receptionists, visitors and cleaning services. For the receptionist it is used for registration from visitors, guests from visitors and cleaning services. Whereas for visitors it is used to send messages if there are guests and to order cleaning services. And for cleaning services it is only used as a report if the work has been completed.
3. Testing using an e-KTP card tagged to the PN532 NFC sensor produces 100% accuracy with a reading time of under 1.00 seconds with a recorded distance of 0-2.5 cm. When it is above 2.5 cm the sensor cannot detect the e-KTP card. Testing the OTP code yields 100% accuracy when the code entered is correct, with an average reading time of 1.44 seconds.
4. Quality of Service (QoS) testing based on the TIPHON standard obtained a packet loss value of 0.65%, this value is included in the very good category. For delay, a value of 18.12 ms is obtained, this value is included in the good category.

The suggestions obtained after measuring and testing are as follows:

1. Use of service providers with good network quality, to avoid long delays when sending OTP code SMS due to poor network.
2. The use of a microcontroller that has a faster reading rate on the NFC PN532 also makes it more stable in reading the NFC PN532.
3. Making the interface system even better.

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