Budapest International Research and Critics Institute-Journal (BIRCI-Journal)
Humanities and Social Sciences
ISSN 2615-3076 Online)
ISSN 2615-1715 (Print)
www.bircu-journal.com/index.php/birci
Budapest Institute

Design of Control and Monitoring System for Remote Television Transmitter Stations Based on Internet of Things (Case Study on ITV Malang)

Wincoko
Electrical Engineering Study Program, Malang Engineering College, Indonesia
wincoko@stt.ac.id

Abstract

The Problem with television stations between the Master Control Room (MCR) studio and TV Transmitters is that the location difference is quite far, so there are problems in controlling the transmitter station. Required special personnel assigned to the transmitting station. The obstacle that is often faced by MCR is the difficulty in monitoring between the transmitter and the controller studio. Therefore, it is necessary to control and control the Internet of Things (IoT) based centralized. The method used in making this system is waterfall. The system in this case study also has several features or functions that facilitate the management and control of television transmitters, namely in the form of monitoring the temperature of the transmitter engine, adjusting the on and off lights, turning on the air conditioner, turning the TV transmitter on and off. The results showed that all of these systems were connected to the internet through the website as a control and monitor medium, so that the Master Control Room (MCR) section could determine the condition of the TV transmitter.

Keywords
index terms— iot; website; TV transmitter

I. Introduction

A form of media as a means of mass communication, which is communicated through mass media to a large number of people. A good TV station can be judged by the quality of broadcasting services provided that meet the standard TV signal quality. Internet of Things (IoT) is when we connect something (things) that are not operated by humans to the internet (F. A. de C. G. Fabio, 2015; Juaidi, 2015; A.W. Burange, 2015). The need for television transmitter stations that have a wide range of transmit power requires the placement of towers that match the topology of the area that will receive television broadcasts. Indonesia Television Malang (ITV Malang) places television transmitters far from the master control room (MCR). Television transmitters with master control In order for the room to be controlled remotely, additional tools are needed that can control transmitters and other devices such as air conditioners, lights, exciters, amplifiers, and Transmitter Engine Temperatures so that they can be monitored in real time on the condition of television transmitting stations. Web-based system control using IoT technology allows controlling devices via remote, but also how to share data, virtualize all real things into the form of the internet, etc. The internet becomes a liaison between machines automatically (A. Marvin, 2012); A. Bayu, 2018). In addition, there is also a user who acts as regulators and supervisors

of the work of all at it directly. The benefit of using IoT technology is that the work done by humans becomes faster, younger and more efficient. According to Pramusinto (2020) the power of technology including digitalization and automation continues to grow and change the pattern of production, distribution, and consumption. As with other areas of life, technology is used to make changes, so also with the legal system as technology in making changes (Hartanto, 2020). Meanwhile, the use of information technology is the benefit expected by users of information systems in carrying out their duties where the measurement is based on the intensity of utilization, the frequency of use and the number of applications or software used (Marlizar, 2021). Based on these problems, the design, implementation, monitoring, and control of the IoT-based remote television transmitter station control and monitoring system were arranged (M. I. KURNIAWAN, 2018; B.A.A. Adetokunbo, 2013; F. Sharevski, 2019).

II. Research Methods

This case study is devoted to discussing the Design of Control and Monitoring System for Remote Television Transmitter Stations based on IoT, as well as conducting the documentation process. The following is a flow chart applied by the author in this method (S. Notra, 2014).

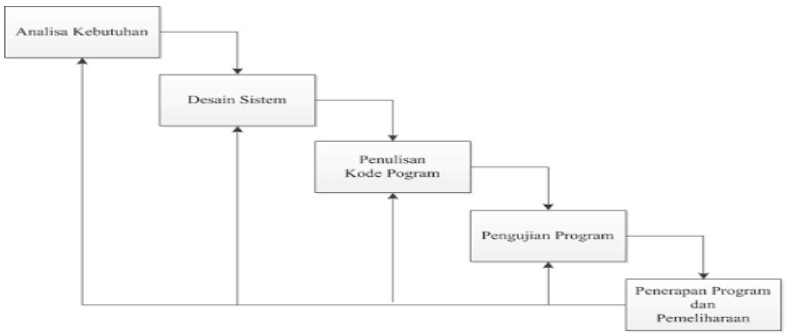


Figure 1. *Flowchart of Study Implementation*

Based on Figure 1, in general the flowchart of the implementation of the study has the following steps: Analysis, System Design, Program Code Writing, Program Testing and Program Implementation and Maintenance.

2.1 Research Location

The location of this case study was carried out at the Studio Master Control Room (MCR) ITV Jl. Soekarno Hatta No. 94 Malang 65142

2.2 Data Collection Techniques

The data collection carried out in the making of this system was carried out by:

1. Interviews were conducted with the resource persons in particular the Engineering section and the master control room when and what interview questions use social media or directly.
2. Analysis of Applications
   Similar to applications related to the control of electronic devices, which have become more and more commercialized. Therefore, the application that the author will make will be compared with applications that have been circulating or applications from

other researchers' research results and adapt their advantages and disadvantages. The following are similar applications that the author analyzes:

1. Philips Hue

Philips Hue is an android mobile application released by Philips, one of the world's leading lighting companies (B.A. Setyawan, 2020). The application is used as a remote control for lights which was just a few months ago released by the lighting company. The type of lamp or the name of the lamp is Hue. This Hue lamp can be adjusted for color, brightness intensity, turning on or off the lights, all of which are controlled by the Android mobile application called Philips Hue.

- Easy to Control
  Can be connected to the mobile phone message application and become an indicator when a message arrives on the smartphone.
- Disadvantages
  Wifi connection sometimes disconnects itself.

2. Amazon Alexa

A new product from amazon, the digital assistant android mobile app to realize a smart home. The app resides or is embedded in an amazon device called echo, which is a speaker connected to a wi-fi device and equipped with a microphone that can be spoken to [11]. Alexa is an artificial intelligence that can be used to find basic information, this artificial intelligence capability is also still being developed so that it is more able to accept commands. Here are the advantages and disadvantages of the Amazon Alexa application from the analysis:

a. Pros:

- It is an intelligent system.
- Don't have to speak right in front of the echo.
- Can provide various kinds of information and play music and turn lights on and off.
- Always updated

b. Disadvantages:

- Does not have a built-in battery so it must be connected continuously to an electric current.
- Not yet available for the Indonesian region.

2.3 Analysis Techniques

The analysis technique used in making this system is based on two things, namely user needs analysis and application needs analysis. The description of the analysis is as follows:

1. User Needs Analysis
   Based on data collection, it is obtained that users who play a role in the application are only end users or the last user. This last user is the owner of the app (MCR section)
2. Application Requirements
   Analysis Application requirements analysis refers to user requirements. Application user needs are divided into two, namely functional and non-functional requirements. The following is the definition:
   a) Functional requirements that must exist in the application and affect application performance are as follows:
      1. The application provides functions for login.
      2. Application provides a function to reset passwords.
      3. The application has the feature of changing the data in the database

4. The application has the feature of changing the system theme / appearance.

b) Non-Functional

Requirements Non-functional requirements are requirements that are not related to the design and development of applications, but affect the running of the system. The non-functional requirements of this control and control system are as follows:

1. The application is installed on the Raspberry server.
2. The application is accessed using a browser application.
3. Applications can be accessed when in one network.

Data was collected by means of observation and literature study

III. Discussion

This case study research was conducted using the Waterfall (B.A.A. Adetokunho. 2013). The waterfall consists of five stages, namely as follows:

3.1 Analysis and Definition of Requirements

This first stage will be the basis for developing a system. Needs analysis and definition of these requirements will produce user requirements or what is often referred to as user requirements. This stage is carried out to collect data related to the system to be built. Data was collected by means of observation and literature study.

3.2 System Design

The system design is made based on the results of the needs analysis carried out in the first stage. The system design stage will produce use case diagrams, activity diagrams, sequence diagrams, class diagrams, collaboration diagrams, and interface designs that will be used as a reference in writing program code at a later stage.

3.3 Implementation and Unit Testing

This stage is the stage of writing program code by translating the system design that has been made into commands that are understood by computers using programming languages. The programming languages that will be used are the PHP and Python programming languages. The database used is MySQL, while the display will use HTML, CSS, Java Script, and Jquery. Along with writing program code, from this stage will produce the desired system.

3.4 System Integration and Testing

The integration and system testing phase is the testing phase for the system as a whole. This test is carried out to find out the errors that exist in the system that are not in accordance with the system design that has been made. There are two types of testing that will be carried out in this study, namely hardware testing and software testing. The hardware will be tested by testing all the sensor responses that are connected in response to requests from the Web by the user manually, and the response of the temperature sensor that is connected to the program that has been designed will automatically turn on when the temperature sensor receives changes in engine temperature (Z. Guo, 2017) Software testing. This is done by testing the data taken by the sensor which is stored on the server and displayed to the Web.

3.5 Operation and Maintenance

The operation stage is the stage of implementing the software in the agency environment. While the maintenance phase is done by creating a user manual. The user manual can be used as a guide for users in running the system so that the system can be run

steadily and the system is well maintained, as well as to prevent problems that may arise when the system is running.

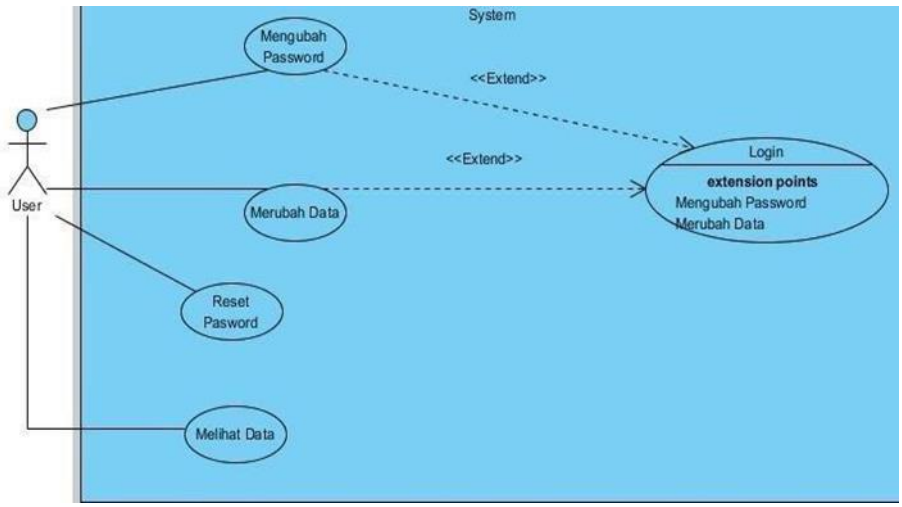


Figure 2. *Use Case Application Diagram*

Figure 2 shows that in the application there is one actor who interacts with the application, namely only the user. Use cases are tailored to the needs of the application functionality and user needs that have been obtained previously. An explanation of the use case for application and user functionality requirements can be seen in the table below.

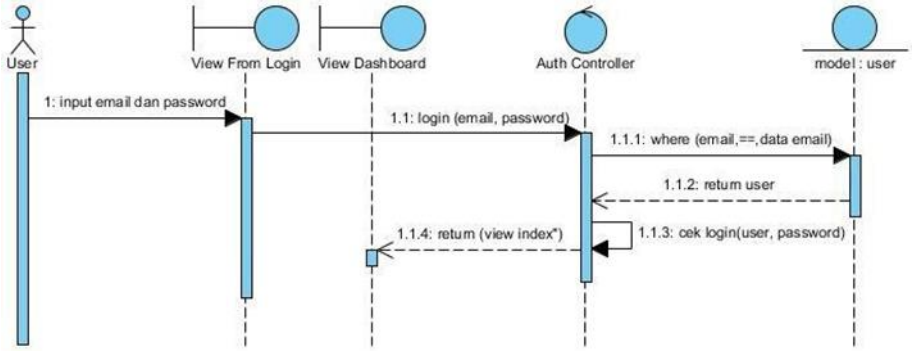


Figure 3. *Sequence Login Diagram*

Based on Figure 3, this Login Sequence Diagram explains the user process to enter the application control page. The user on the application page presses the login button then a pop-up login form will appear and fill in with the user id and password then press the enter button. The user id and password data is sent to the auth controller and executes the login function. In the login function, the user id and password data are compared with the user data in the user model.is the same as the user id and password entered, the user will be referred to the application dashboard page in the form of application

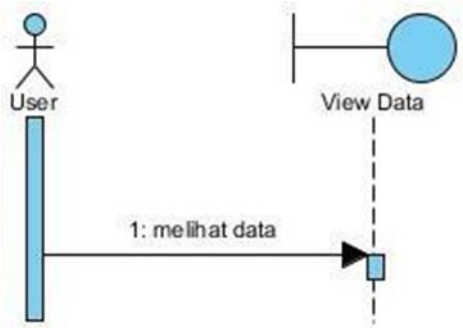


Figure 4. *Control the Database*

When you visit the address of the application, the user can immediately see the data in the application.

3.6 Sequence Diagram Changing Data

Sequence diagrams changing data from the case changing data can be seen in the following figure:

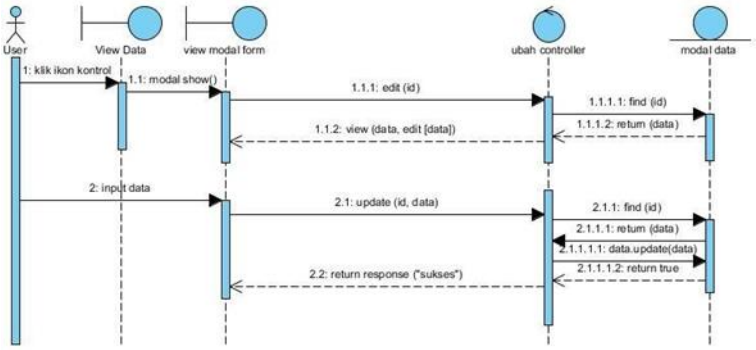


Figure 5. *Sequence Diagram Changing Data*

Figure 5 describes Sequence diagrams changing data describing the process when a user changes data. Users who have access rights who are on the data view page press the control icon on the data they want to change (Meiliana, 2017).

3.7 Application User Interface Design

At the user interface design stage, the user interface is designed for system users by adjusting use cases and the required business processes. The interface design is documented in the form of a website display.

3.8 Login Page Design

The design of the application data view page can be seen in this:

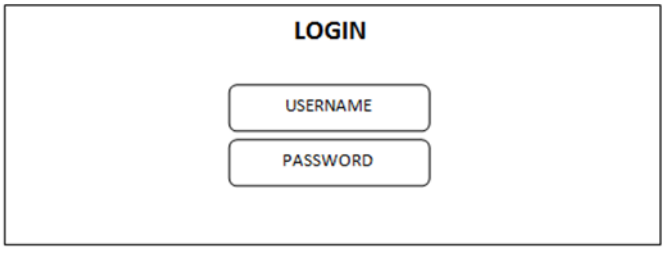
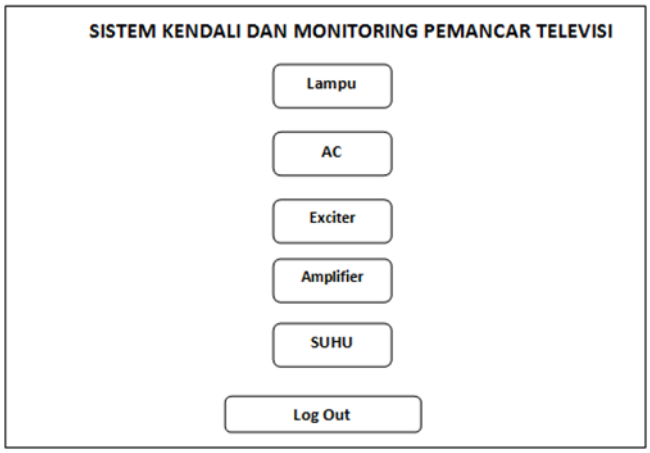


Figure 6. *The Login Pop-up*

Figure 6 explains that this page is for viewing the initial data that will bring up the login pop-up when the user presses the login button/menu. Where in the login pop-up contains a login form in the form of input email and password

3.9 Design Page



3.10 Data

View And change data is a data view page after the user has logged in. After the login process is successful, the user will open access rights to change data which is marked by changing the color of the switch, the switch sign can be pressed and issue a form to change the data value.

3.11 Implementation

At this stage of implementation will be presented a system that is made based on the design that has been made previously. First Circuit along with the electronic circuit will be explained first. Then code on the server and ends with the python on Raspberry (S.C.L, 2015).

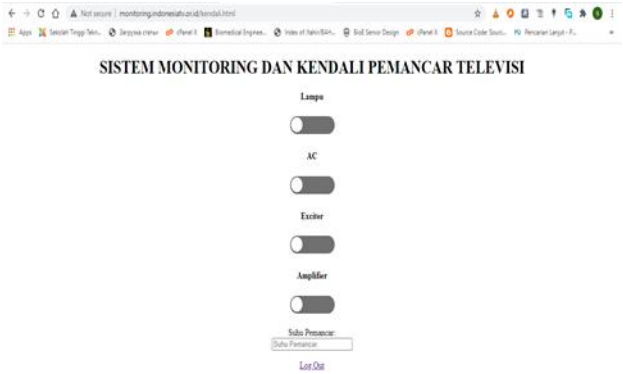


Figure 8. *Web Page Display See Data*

Figure 8 shows that the code above runs directly when opening the website. The if else command in the code is made to display the parts of the button that have been created. The button will adjust when the $crud->'value' variable matches what we want or what we have set in the database.

Figure 9. *Snippet of Login*

Figure 9 shows the code above contains a *login* form of a modal that has been called in the *login button*. The login function will run with *POST method* which is sent to the *web route* and will be processed in the *login controller.*

3.12 Testing

Testing Data

1. Testing Software Test Results

For *software*, it is divided into several tests, namely, testing on the tool using a raspberry pi 3, and on the web which will later be a place to control the tool itself (M. Dawond, 2014).

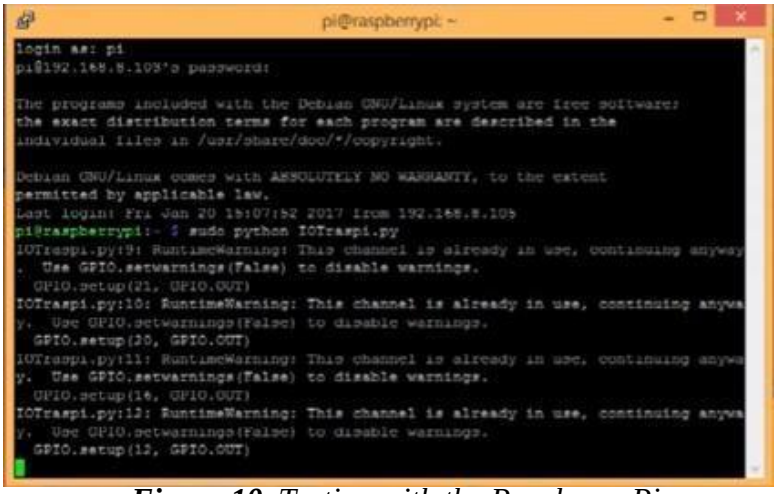


Figure 10. *Testing with the Raspberry Pi*

Figure 10 shows that the Raspi can be connected properly and is ready to be used for later opening via the website (B.D. Davis, 2020).

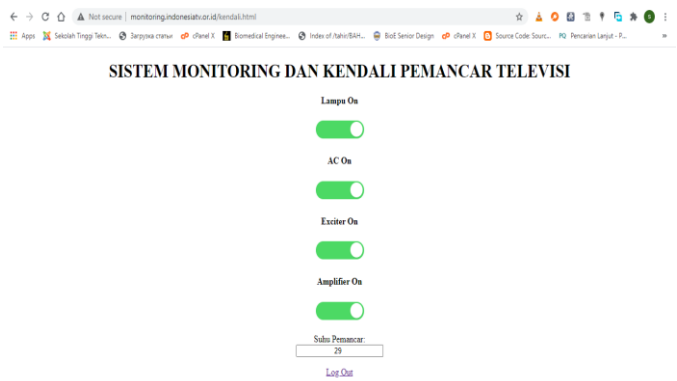


Figure 11. *Page View from the Web*

Figure 11 after trying to control the *website* by clicking *ON* or *OFF* on each *device* home electronic Figure 12 above is the display on *gadget* when trying to control *ON* or *OFF* home electronics on the *website*, which shows that the program for software successfully created and the RasPi and the Web are well connected (D. Kho. 2018).

2. Hardware Test Results

At this stage, we prepare the required electronic components such as the Raspberry Pi 3, in this case the AC, Exciter, and Amplifier we test on lights and fans as models.module *relay* is Lampu1, Lampu2 (Exciter), fan (AC) and Lamp 3 (Amplifier). Then compose a circuit using electronics. First of all, connect the Raspi whose program has been uploaded to a power source with a charger. Then connect the Raspi GPIO power pin to *ground* and VCC to the relay, then connect the GPIO 26, 19.13.6 (SPI1 MISO) or input to the Raspi. Then connect the GROUND on *the relay* to a power source, and the other to the *output* on the *device* as shown in Figure 12.

Figure 12. *Circuit Using Electronics*

Figure 12 shows that the circuit is installed correctly, and the Raspberry pi is well connected with *wireless*.

Then proceed with opening the *website* with the address http://monitoring.indonesiatv.or.id/, after the page appears, click *on* or *off* on each *device* to ensure the program and electronic circuit are running. In the picture, the control design test was successfully executed.

Figure 13. *The Lights are Successfully Turned on through the Website*

Figure 13 shows that the lights are successfully turned on through the website. Based on the picture above, it can be concluded that the device can be connected with both hardware and software and can be run according to the design in this case study. Test Table 1.

Table 1. Test 1

Testing	Lamp 1	Lamp 2 (Exciter)	Lamp 3 (Amplifier)	Fan (AC)	Results
1	1	0	0	0	OK
2	0	1	0	0	OK
3	0	0	1	0	OK
4	0	0	0	1	OK

From the table 1 Test 1 The first test can be seen that when lamp 1 is on, the rest of the other devices do not light up, as well as when the second test is on when the second light is on, the rest of the other devices also don't light up, continue with testing the third light, when the rest of the devices are turned on it doesn't turn on and stays off, until the last test, namely the fan, when it turns on, the other devices don't turn on and remain in the *off*.

Table 2. Test 2

Testing	Lamp 1	Lamp 2 (Exciter)	Lamp 3 (Amplifier)	Fan (AC)	Results
1	1	1	0	0	OK
2	0	1	1	0	OK
3	0	0	1	1	OK
4	0	0	0	1	OK

Likewise what happens in table 2 test 2, when two devices are turned on together, the device that is not turned on will not turn on or remain in the off state. For example, when lamps 1 and 2 are turned on, the third lamp, fan and will turn off. When lamps 2 and 3 are turned on, lamp 1, the fan will be in the off state, and when lamps 3 and fan are on, lamps 1, 2 and will remain off. Likewise, when the fan is turned on, lights 1, 2 and 3 will turn off.

Table 3. Test 3

Testing	Lamp 1	Lamp 2 (Exciter)	Lamp 3 (Amplifier)	Fan (AC)
1	1	1	1	0
2	0	1	1	1
3	0	0	1	1
4	1	0	0	1

In table 3 shows when three devices are turned on at once, the rest of the devices don't turn on too. When lights 1, 2 and 3 are turned on together then the rest of the equipment such as the fan does not turn on. Likewise, when only the fan and are turned on, the lights and 1, 2 and 3 will not turn on too.

Table 4. Test 4

Testing	Lamp 1	Lamp 2 (Exciter)	Lamp 3 (Amplifier)	Fan (AC)	Results
1	1	1	1	1	OK
2	0	1	1	1	OK
3	1	0	1	1	OK
4	1	1	0	1	OK

In the table 4 Test 4 tests by turning on to 4 *devices* or devices at once. And the result is that when lights 1, 2, 3 and the fan are turned on, they will not turn on or stay in the off position, and when lamp 2, lamp 3, fan, and camera are turned on, lamp 1 will also not turn on, or stay in position dead. And finally when lamp 1, lamp 2, fan and lamp 3 will not turn on or remain in the off position.

Based on the test table, it can be concluded that the results made are in accordance with the design and system desired by this case study, both in terms of hardware and in terms of software.

IV. Conclusion

Based on the research that has been done, some conclusions are obtained as follows.

1. A control and monitoring with features to monitor temperature, control relays connected to lamps, amplifiers, AC, Exciter and control them with interface and can be operated remotely has been successfully designed and built. Has succeeded in designing a control and monitoring system using a Raspberry Pi 3 and 4 channel relay 10A and it can function properly.
2. Successfully built software for interface and connected to Raspberry Pi 3.

References

A. Bayu Riyadi, “Rancang Bangun Sistem Keamanan Rumah Berbasis Piranti Raspberry Pi 3 Menggunakan Internet of Things,” J. Tek. Elektro, Fak. Teknol. Inf. dan Elektro Univ. Teknol. Yogyakarta, 2018, [Online]. Available: http://eprints.uty.ac.id/3349/.

A. Kadir, Dasar Raspberry Pi. Yogyakarta: CV Andi Offset.

A. W. Burange and H. D. Misalkar, “Review of Internet of Things in development of smart cities with data management & privacy,” 2015 Int. Conf. Adv. Comput. Eng. Appl., pp. 189–195, 2015.

A. Marvin and E. P. Widiyanto, “Marvin and E. P. Widiyanto, ‘Sistem Keamanan Rumah Berbasis. Internet of Things (IoT) dengan Raspberry Pi,’ Sist. Keamanan Rumah. Berbas. Internet Things dengan Raspberry Pi, no. x, pp. 1–12, 2012. [6].,” pp. 1–12.

B. A. A. Adetokunbo A.A. Adenowo, “Software Engineering Methodologies: A Review of the Waterfall Model and ObjectOriented Approach,” Int. J. Sci. Eng. Res., vol. 4, no. 7, pp. 427–434, 2013.

B. A. Setyawan, T. Agustianto, and S. F. Achmad Widodo, “Desain Portable Android Thermometer Fever (Prometer): Termometer Non-Kontak Praktis Berbasis Android,” J. Din. Vokasional Tek. Mesin, vol. 5, no. 2, pp. 129–135, Sep. 2020, doi: 10.21831/dinamika.v5i2.34787.

B. D. Davis, J. C. Mason, and M. Anwar, “Vulnerability Studies and Security Postures of IoT Devices: A Smart Home Case Study,” IEEE Internet Things J., vol. 7, no. 10, pp. 10102–10110, Oct. 2020, doi: 10.1109/JIOT.2020.2983983.

D. Kho, “Pengertian dan Fungsi Relay,” Pengertian dan Fungsi Rela, 2018.

F. A. de C. G. Fabio Cardoso de Souza, “Automatic Generation of Sequence Diagrams and Updating Domain Model from Use Cases,” 2015, pp. 85–92.

F. Sharevski, P. Treebridge, and J. Westbrook, “Experiential User-Centered Security in a Classroom: Secure Design for IoT,” IEEE Commun. Mag., vol. 57, no. 11, pp. 48–53, Nov. 2019, doi: 10.1109/MCOM.001.1900223.

Hartanti, D. (2020). Sociology Review of Social Phenomenon, Social Rules and Social Technology. Budapest International Research and Critics Institute-Journal (BIRCI-Journal) Vol 3, (2): 1175-1184.

I. Lopatovska and H. Williams, “Personification of the Amazon Alexa,” in Proceedings of the 2018 Conference on Human Information Interaction&Retrieval - CHIIR ’18, 2018, pp. 265–268, doi: 10.1145/3176349.3176868.

Junaidi, “Internet of things, sejarah, teknologi dan penerapannya,” J. Ilm. Teknol. Inf. Terap., vol. 1, no. 3, pp. 62–66, 2015.

M. Dawood, R., Said, F.Q., & Sayed, “Kelayakan raspberry pi sebagai web server: perbandingan kinerja nginx, apache dan lighttpd pada platform raspberry pi.,” J. Rekayasa Elektr., vol. 11, no. 1, p. 25, 2014.

M. I. Kurniawan, U. Sunarya, and R. Tulloh, “Internet of Things : Sistem Keamanan Rumah berbasis Raspberry Pi dan Telegram Messenger,” ELKOMIKA J. Tek. Energi Elektr. Tek. Telekomun. Tek. Elektron. vol. 6, no. 1, p. 1, Apr. 2018, doi: 10.26760/elkomika.v6i1.1.

Marlizar, et.al. (2021). Effect of Service Quality and Use of E-Service Technology on Customer Loyalty: A Case Study of Maxim in Aceh. Budapest International Research and Critics Institute-Journal (BIRCI-Journal) Vol 4, (4): 8002-8016.

Meiliana, I. Septian, R. S. Alianto, Daniel, and F. L. Gaol, “Automated Test Case Generation from UML Activity Diagram and Sequence Diagram using Depth First Search Algorithm,” Procedia Comput. Sci., vol. 116, pp. 629–637, 2017, doi: https://doi.org/10.1016/j.procs.2017.10.029.

Pramusinto, N.D., Daerobi, A., and Hartanto, D. (2020). Labor Absorption of the Manufacturing Industry Sector in Indonesia. Budapest International Research and Critics Institute-Journal (BIRCI-Journal) Vol 3 (1): 549-561.

S. C. L. Cheah Wai Zhao, Jayanand Jegatheesan, “Exploring IOT Application Using Raspberry Pi,” Int. J. Comput. Networks Appl., vol. 2, 2015.

S. Notra, M. Siddiqi, H. Habibi Gharakheili, V. Sivaraman, and R. Boreli, “An experimental study of security and privacy risks with emerging household appliances,” in 2014 IEEE Conference on Communications and Network Security, Oct. 2014, pp. 79–84, doi: 10.1109/CNS.2014.6997469.

Z. Guo and J. Chu, “Design and Implementation of Infrared Temperature Measurement System,” 2017, doi: 10.2991/icmmct-17.2017.115.