Journal of Information Systems and Informatics
Vol. 5, No. 1, March 2023 e-ISSN: 2656-4882 p-ISSN: 2656-5935
DOI: 10.51519/journalisi.v5i1.448 Published By DRPM-UBD

IoT and QRIS Payment System Integration in Entrepreneurship Lockers to Improve Culinary Business in Schools

Andre Kurniawan Pamudji[1], Agus Cahyo Nugroho[2], Bernadinus Harnadi[3], T Brenda Chandrawati[4], Erdhi Widyarto Nugroho[5], FX Hendra Prasetya[6], Albertus Dwiyoga Widiantoro[7], Ridwan Sanjaya[8]

[1,2,3,4,5,6,7,8]Information System Department, Soegijapranata Catholic University, Semarang, Indonesia
Email: andre.kurniawan@unika.ac.id[1], agus.nugroho@unika.ac.id[2], bharnadi@unika.ac.id[3], brenda@unika.ac.id[4], erdhi@unika.ac.id[5], hendra@unika.ac.id[6], yoga@unika.ac.id[7], ridwan@unika.ac.id[8]

Abstract

The Covid-19 pandemic has disrupted various activities, including the operation of school and campus canteens. In response, innovative solutions are needed to ensure the continuation of the culinary business while keeping all stakeholders safe during the pandemic. This study proposes the development of IoT-integrated entrepreneurial lockers that enable cashless payments through QRIS. These lockers can be used to revive the culinary business in school and campus canteens that had to close due to the pandemic. The results of the study show that the use of these lockers can reduce physical contact during transactions, thus minimizing the risk of virus transmission. Overall, this research offers a practical solution for sustaining the canteen business in the face of the pandemic.

Keywords: Locker, IoT, QRIS Payment System, Enterpreneurship

1. INTRODUCTION

Since March 2020, the Covid-19 pandemic in Indonesia has led to the suspension of many activities, as remote work became necessary to reduce the virus's spread. To curb transmission rates, the government implemented policies such as restrictions on community activities (PPKM) in Java-Bali from July 3rd. While the pandemic's spread began to subside in September 2021, canteen business units in schools remain closed due to the high number of Covid-19 cases. This closure is aimed at avoiding crowds and encouraging students to bring their lunch [2]. As a result, there is a need for innovative solutions to assist business actors in continuing their operations during the pandemic's downturn [3].

Since March 2020, the Covid-19 pandemic in Indonesia has led to the suspension of many activities, as remote work became necessary to reduce the virus's spread.

p-ISSN: **2656-5935** http://journal-isi.org/index.php/isi e-ISSN: **2656-4882**

To curb transmission rates, the government implemented policies such as restrictions on community activities (PPKM) in Java-Bali from July 3rd. While the pandemic's spread began to subside in September 2021, canteen business units in schools remain closed due to the high number of Covid-19 cases. This closure is aimed at avoiding crowds and encouraging students to bring their lunch [2]. As a result, there is a need for innovative solutions to assist business actors in continuing their operations during the pandemic's downturn [3].

This research developed a prototype product in the form of an entrepreneurial locker with automated services. Which is part of an effort to revive canteen entrepreneurship in schools and campuses. In this research, the lockers developed are lockers with innovations that are integrated between the Internet of Things (IoT) and a cashless payment system using QRIS. In developing entrepreneurship lockers this time it allows school or campus canteen sellers to leave their food in one of the available locker doors, then buyers can access the food from the existing system and make cashless payments using QRIS then the locker door will open automatically when successful payment. So that the process carried out will minimize physical contact that occurs between stakeholders.

IoT, which stands for Internet of Things, is a technology concept that utilizes the internet to facilitate daily activities, such as controlling the devices around us [4]. Its impact has been widely recognized since its discovery in 2009 and has been beneficial in various fields, including government, industry, education, and health [5]. In the context of entrepreneurial lockers, IoT is utilized to control the door opener, enabling the door to automatically open after a successful purchase. The use of IoT in creating automatic doors has been extensively studied and provides additional benefits compared to traditional door locks, such as enhanced security features and reduced physical contact [6].

QRIS, on the other hand, is a cashless payment system that uses a QR code. This payment method was developed by the payment system industry in collaboration with Bank Indonesia to simplify payment processes [7]. QRIS has become a popular payment method in Indonesia, and users can conveniently make payments using various e-wallets, such as Go-Pay, OVO, Dana, LinkAja, and more [8]. This practical payment method helps reduce physical contact, making it an ideal option for transactions during the pandemic [9]. Combining IoT and QRIS payments can further minimize physical contact between users. This approach can reduce crowds and allow school or campus canteen entrepreneurship to continue despite the ongoing pandemic situation.

2. METHODS

In realizing this entrepreneurial locker prototype product, the development of tools and systems was carried out in several steps.

p-ISSN: **2656-5935** http://journal-isi.org/index.php/isi e-ISSN: **2656-4882**

3.1. System Mockup Development

To begin the process of develop a system, it is important to first develop a system mockup. This mockup serves as an overview of the system's design concept and helps to clarify the system development process. It also provides a realistic depiction of the final product and can be easily presented to all members involved in creating the system [10]. To get a clearer idea of the system mockup, please refer to Figure 1.

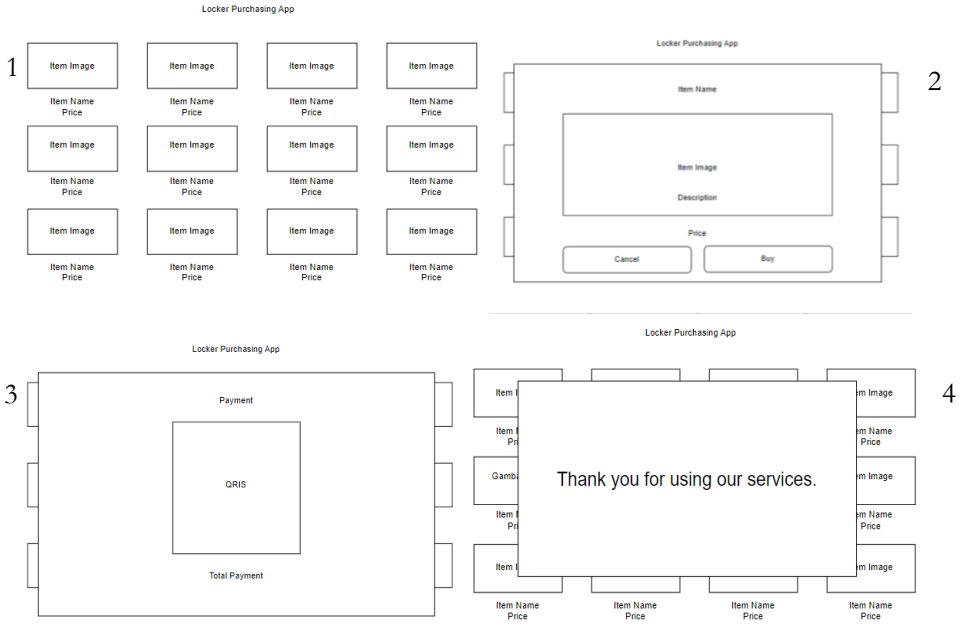

Figure 1. Mockup System

The series of mockups illustrate the user flow of the system. The first mockup depicts the list of food menus available for the user to select before proceeding to purchase. In the second mockup, a confirmation screen is displayed showing the selected item before proceeding with the payment. The third mockup shows the QRIS code that appears after confirmation and waits for the user to complete the payment process. Finally, the fourth mockup displays a success message after the payment has been successfully completed.

3.2. IoT Module Development

To develop the tool, an IoT module was created and an entrepreneurial locker was designed as a prototype. The development process began with the creation of schematic circuits for the module and the preparation of necessary electronic equipment. The IoT module was built using the Wemos module, which has a

similar form factor to the Arduino Uno but offers advantages such as Wi-Fi and Bluetooth connectivity for integration into an IoT network [11]. The electronic components were then assembled and the program code was embedded using the Arduino IDE, a program designed for programming microcontrollers [12].

3.3. QRIS Payment System Development

The developed system employs the PHP programming language and MySQL database to facilitate access across various devices via the website platform [13]. The QRIS system was developed using an API provided by a financial service provider in Indonesia, which acts as an intermediary to connect the bank's QRIS system with the entrepreneurial locker system [14]. The front-end system was designed using the Bootstrap framework, which is an HTML, CSS, and JavaScript framework that enables the creation of responsive websites with ease [15].

3.4. Integration of the IoT Module with the QRIS Payment System

Once the IoT module and payment system were completed, the next step was to integrate them so that the lockers could be controlled through the created sales system. This integration process was done using the Agile method, which allowed for faster development of both the IoT module and the QRIS Payment System. Agile is a popular application development method that involves iterative and incremental development, which can result in a more efficient and faster development process.

3. RESULTS AND DISCUSSION

3.1. IoT Module Development

The IoT module developed in this study comprises several components, namely the Wemos D1 R32, a 16-channel relay, a 12V 0.35A Doorlock Solenoid, a 12V 5A AC/DC Adapter, and a 12V 2A AC/DC Adapter (see Figure 2). The Wemos microcontroller, similar to an Arduino, features WiFi and Bluetooth capabilities that allow it to connect to the IoT network and receive signals from the internet (see Figure 3). The Doorlock Solenoid is a component that facilitates automatic opening and closing of doors. It is a coil made of tightly wound long wires that are much longer than their diameter. In an ideal solenoid, the coil is infinitely long, constructed with wires sandwiched between turns, and produces a uniform magnetic field parallel to the solenoid's axis (see Figure 4). The 16-channel relay functions as an electrically operated switch, comprising an electromagnet (coil) and a mechanical switch contact. It uses electromagnetic principles to drive switch contacts so that a low power electric current can conduct electricity with higher voltage. The 16-channel relays were used to control the 12 locker doors (see Figure

5). Finally, the 12V 2A AC/DC adapter was utilized to provide additional voltage for the 16-channel relay (see Figure 6).

Figure 2. Wemos D1 R3

Figure 3. Solenoid Doorlock 12V 0.35A

Figure 4. Relay 16 Channel

Figure 5. AC/DC Adapter 12V 2A

Figure 6. AC/DC Adapter 12V 5A

To provide additional power to the 12 solenoids, a 12V 5A AC/DC Adapter is utilized. Each solenoid requires a voltage of 0.35A, thus resulting in a total of 4.2A. The 5A adapter is sufficient to power all the solenoids. The components used in the IoT module, such as the Wemos D1 R32, 16 channel relay, and the doorlock solenoid, are arranged in a circuit schematic, which can be seen in Figure 7.

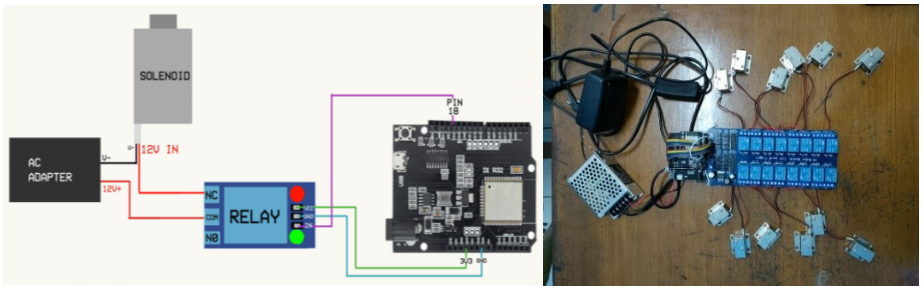

Figure 7. Schematic Circuit and Realization

p-ISSN: **2656-5935** http://journal-isi.org/index.php/isi e-ISSN: **2656-4882**

After assembling the circuit, the next step was to add program code that would enable remote control of the module. This was achieved using the Arduino IDE program, which required adding the Wemos D1 R32 library before the program code was added (refer to Figure 8). The IoT module was then attached to an entrepreneurial locker that was specially designed to give users a modern impression, as depicted in Figure 9.

```
void loop() {
  if ((millis() - lastTime) > timerDelay)
  {
    if (WiFi.status() == WL_CONNECTED)
    {
      HTTPClient http;

      String serverPath = serverName;
      Serial.println(serverPath);

      http.begin(serverPath.c_str());
      int httpResponseCode = http.GET();
      Serial.println(httpResponseCode);

      if (httpResponseCode == 200) {
        String payload = http.getString();
        Serial.println(payload);
        if (payload == "1")
        {
          digitalWrite(18, LOW);
        if (payload == "1")
        {
          digitalWrite(18, LOW);
        }
        if (payload == "0")
        {
          digitalWrite(18, HIGH);
        }
      }
      else {
        Serial.print("Error code: ");
        Serial.println(httpResponseCode);
      }
      http.end();
    }
    else {
      Serial.println("WiFi Disconnected");
    }
    lastTime = millis();
```

Figure 8. Wemos Source Code

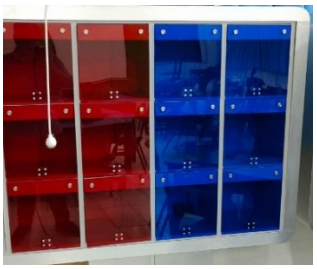

Figure 9. Implementation IoT Module into Locker

3.2 QRIS Payment System Development

The payment system developed in this program utilizes QRIS technology that is integrated into a website-based system. The QRIS system is used in partnership with a private bank in Indonesia that provides QRIS services. The QRIS API employed uses HTTP POST and Secure Socket Layer (SSL) protocol connections, with JSON data type that is encrypted using the Advanced Encryption Standard (AES) to ensure the system's security. Figure 10 shows the process of generating QRIS, while Figure 11 displays an example of a QRIS generated by the system.

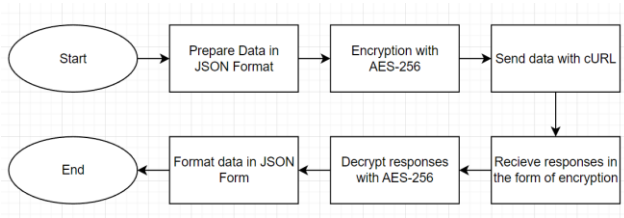

Figure 10. QRIS Flowchart

Figure 11. QRIS

3.3 Integration of the IoT Module and the QRIS Payment System

After completing the development of the IoT module and QRIS payment system, the integration process between the two systems commences. An API is provided from the QRIS payment system to the IoT module, enabling it to detect when a

p-ISSN: **2656-5935** http://journal-isi.org/index.php/isi e-ISSN: **2656-4882**

payment process is successful. Upon successful payment, the IoT module sends a signal to the Relay to open the Solenoid. This is achieved by adding an API to the Arduino IDE code that directs the payment server to check whether the payment was successful or not, as illustrated in Figure 12.

```
sketch_dec28a §
#include <HTTP_Method.h>
#include <Uri.h>
#include <WebServer.h>

#include <ESP_WiFiManager.h>
#include <ESP_WiFiManager.hpp>
#include <DNSServer.h>

#include <WiFi.h>
#include <HTTPClient.h>
//9 nyasar ke 12
const char* ssid = "Unika"; //disesuaikan SSID (dan pass) yang tersedia
const char* password = "";

//Your Domain name with URL path or IP address with path
String serverName = "http://siegaautobox.com/api/api_loker.php";
```

Figure 12. API for Wemos Source Code

3.4 Use of Entrepreneurship Lockers

The system flowchart for using entrepreneurial lockers is presented in Figure 13. The Entrepreneurship Lockers can be accessed remotely through a dedicated website. Users can browse the available food options and select the ones they prefer. After selecting the food items, the user will be presented with a QRIS payment bill that can be paid directly using any E-Wallet. Upon successful payment, the locker door will open automatically.

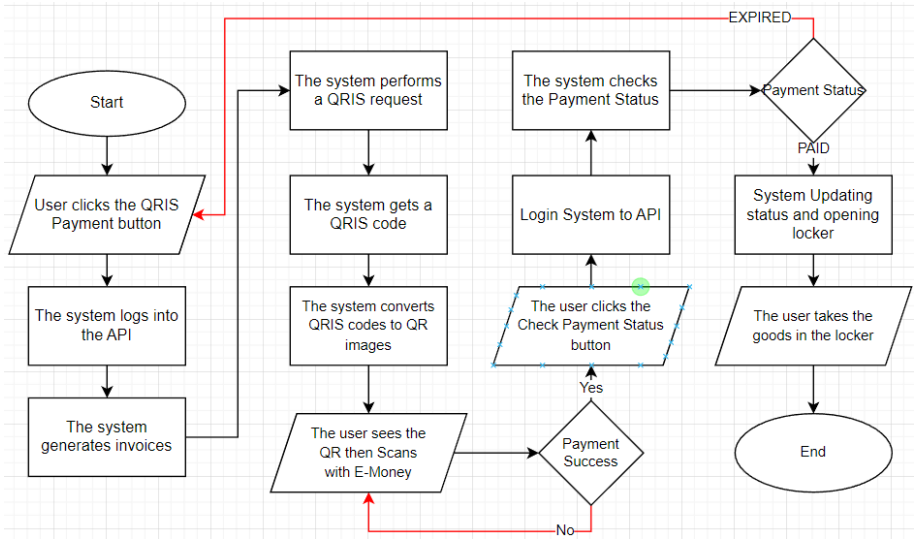

Figure 13. System Flowchart

p-ISSN: **2656-5935** http://journal-isi.org/index.php/isi e-ISSN: **2656-4882**

The user interface above shows the menu display for selecting food items. The food items are added to the system by the admin on duty, shown in Figure 14.

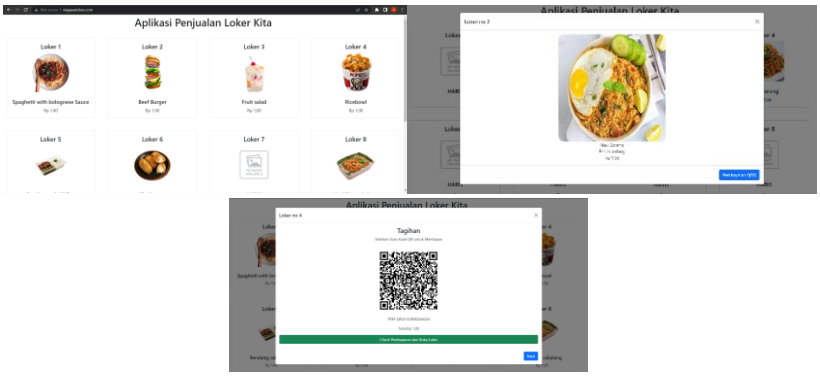

Figure 14. Enterpreneurship Locker Application

3.5 Black Box Testing

The functionality of each electronic component in the Entrepreneurship Locker System was tested using the black box testing method. The tests were carried out with several variables, and the results are as shown in Table 1.

Table 1. Black Box Testing

Activity	Expectation	Result	Conclusion
Opens all doors with a special button in the application system	The door opens automatically	The door opened as expected	Accepted
Open all doors with QRIS Transaction	The door opens after QRIS Payment done.	The door opened as expected	Accepted
Connecting to Wifi	The component automaticly connect to Wifi Connection	Connected as expected	Accepted

3.6 Locker Usage Questionnaire

During the trial, questionnaires were administered to the first 50 customers who utilized the Entrepreneurship Lockers, and the following data was collected from their responses (see Figure 15).

p-ISSN: **2656-5935** http://journal-isi.org/index.php/isi e-ISSN: **2656-4882**

a) 94% of the respondents found the Entrepreneurship Lockers to be helpful in their transactions.
b) 64% of the respondents rated the usage of the lockers as very easy, while 26% found it easy to use.
c) 62% of the respondents stated that the Entrepreneurship Lockers were very useful during the pandemic, while 34% said that they were useful during the pandemic.

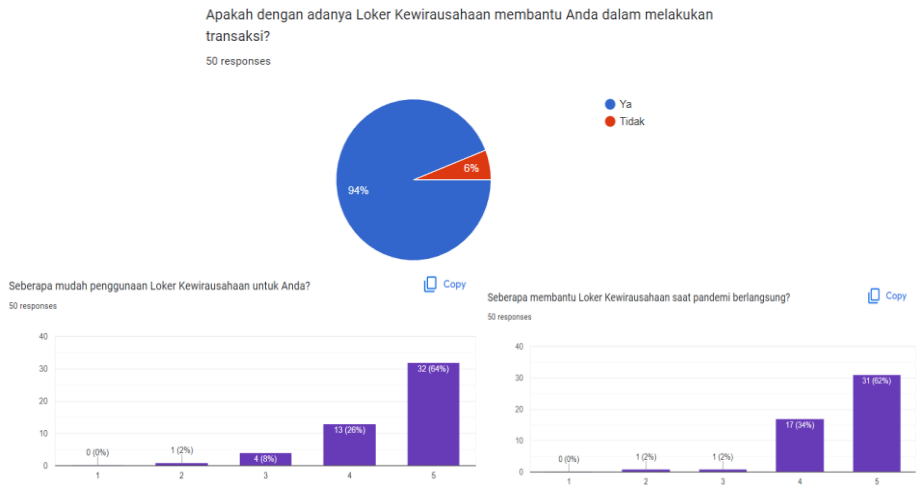

Figure 15. Locker Usage Questionnaire

4. CONCLUSION

The IoT-based entrepreneurship lockers, coupled with the QRIS payment system, offer a solution that reduces physical contact between customers and buyers, as well as between customers themselves. The IoT-based system allows for remote purchasing of food, while the QRIS payment system enables cashless transactions, thereby reducing the need to touch potentially contaminated surfaces. Additionally, the automatic door opening mechanism further minimizes physical contact. The use of IoT-based entrepreneurship lockers and the QRIS payment system has the potential to keep school or campus canteens open during the Covid-19 pandemic with minimal physical contact. The obtained data shows that the use of entrepreneurship lockers can help facilitate transaction activities during a pandemic.

5. ACKNOWLEDGEMENT

This research is a grant from the Indonesian Ministry of Education and Culture program with the name Kedaireka program.

p-ISSN: **2656-5935** http://journal-isi.org/index.php/isi e-ISSN: **2656-4882**

REFERENCES

[1] Kominfo, "Mulai 3 Juli, Pemerintah Berlakukan PPKM Darurat di Jawa-Bali," Jul. 2021. https://www.kominfo.go.id. (accessed Dec. 28, 2022).

[2] Dityasa H. Forddanta, "Hindari Kerumunan, Kantin Sekolah Ditutup Meski Ada Pembelajaran Tatap Muka," Nov. 12, 2021. Accessed: Dec. 28, 2022. [Online]. Available: https://kesehatan.kontan.co.id

[3] Hidayatullah Muttaqin, "Pentingnya Inovasi di Tengah Langkah Berat Perekonomian Indonesia pada Masa Pandemi Covid-19," Feb. 16, 2021. https://iesp.ulm.ac.id (accessed Dec. 28, 2022).

[4] Yoyon Efendi, "Internet of Things (IoT) Sistem Pengendalian Lampu Menggunakan Raspberry Pi Berbasis Mobile," *Jurnal Ilmiah Ilmu Komputer*, vol. 4, no. 2, Sep. 2018, DOI: https://doi.org/10.35329/jiik.v4i2.41

[5] Wilianto Wilianto and Ade Kurniawan, "Sejarah, Cara Kerja Dan Manfaat Internet of Things," *Jurnal Manajemen Teknologi dan Informatika*, vol. 8, no. 2, Jul. 2018, DOI: http://dx.doi.org/10.31940/matrix.v8i2.818

[6] Karthik A Patil, Niteen Vittalkar, Pavan Hiremath, and Manoj A Murthy, "Smart Door Locking System using IoT," *International Research Journal of Engineering and Technology*, vol. 7, no. 5, May 2020

[7] Bank Indonesia, "QR Code Indonesian Standard (QRIS)," 2022. https://www.bi.go.id/QRIS. (Accessed Dec. 27, 2022).

[8] Denny Tenggino and Tuga Mauritsius, "Evaluation of Factors Affecting Intention To Use QRIS Payment Transaction," *ICIC Express Letters*, vol. 16, no. 4, pp. 343–349, Apr. 2022, Accessed: Dec. 28, 2022. DOI: 10.24507/icicel.16.04.343

[9] Oktoviana Banda Saputri, "Preferensi Konsumen Dalam Menggunakan Quick Response Code Indonesia Standard (QRIS) Sebagai Alat Pembayaran Digital," *Jurnal Ekonomi dan Manajemen*, vol. 17, no. 2, 2020, DOI: https://doi.org/10.30872/jkin.v17i2.7355

[10] Husen Mulachela, "Mockup Adalah Gambaran Konsep Desain, Berikut Ulasannya," 2022. https://katadata.co.id (accessed Dec. 28, 2022).

[11] Ivan Gutai, Platon Sovilj, Marina Subotin, Đorđe Novaković, Nemanja Gazivoda, and Bojan Vujičić, "A Prototype of a System for Detecting G Force in an Automobile, Based on Two ESP32's," in *2021 Zooming Innovation in Consumer Technologies Conference (ZINC)*, May 2021. DOI: 10.1109/ZINC52049.2021.9499259

[12] Arduino Documentation, "What is Arduino?," 2015. https://search.iczhiku.com (accessed Dec. 28, 2022).

p-ISSN: **2656-5935** http://journal-isi.org/index.php/isi e-ISSN: **2656-4882**

[13] Yeni Kustiyahningsih and Devie Rosa Anamisa, *Pemrograman Basis Data Berbasis Web Menggunakan PHP & MySQL*. 2011.
[14] Faradilla A., "Apa Itu API? Pengertian, Cara Kerja, dan Manfaat API," 2022. https://www.hostinger.co.id (accessed Dec. 28, 2022).