Digital Queue Prototype at West Denpasar Auxiliary Health Center

Kadek Agus Mahabojana Dwi Prayoga[1], Made Dika Nugraha[2], Nyoman Gunantara [3*]
[1,2] Warmadewa University
[3] Udayana University
[1,2] Jl. Terompong No.24, Denpasar and 80239, Indonesia
[3] Jl. Raya Kampus Unud, Jimbaran and 80361, Indonesia
[*]Email: gunantara@unud.ac.id

Abstract – In the growing era of digitalization, the use of technology is a solution to improve the efficiency of health services. Health centers often face the problem of long and irregular queues. A promising solution is the use of an Arduino Uno-based digital queue. This system allows patients to register electronically through a counter or mobile app. After registration, the patient is given a queue number which is displayed on the LCD screen. The advantage of this system is that it reduces patient waiting time, improves service efficiency, and helps medical staff manage queues better. This research aims to create an Arduino Uno-based digital queuing system at the Dauh Puri Sub-Community Health Center in West Denpasar. This tool consists of Arduino Uno, thermal printer, LCD display, speaker, and wireless push button at the counter. Testing shows that all devices are well integrated, providing timely responses. In conclusion, the Arduino Uno-based digital queue can improve efficiency and patient satisfaction at the health center.

Keywords: Arduino Uno, Digital queue, Health Center.

I. INTRODUCTION

In the era of growing digitalization, the use of technology is one of the solutions to optimize services in various sectors, including the health sector. Long and disorganized patient queues are often a challenge in health centers [1]. Therefore, innovative solutions are needed that can improve efficiency and patient experience. One promising solution is the use of an Arduino Uno-based digital queue.

Traditionally, when someone comes to a health center, they have to face a long and often time-consuming queue. Conventional queuing systems are often inefficient and can cause confusion among patients as well as medical staff. To solve this problem, Arduino Uno is a microcontroller that is flexible and easy to operate, and can be used to control various electronic devices. In a community health center, the implementation of an Arduino Uno-based digital queue has helped manage patient queues efficiently [2].

This digital queuing system allows patients to register electronically through a counter or mobile application, and after registration, patients will be given a queue number displayed on an LCD (liquid crystal display) screen [3]. The queue number will be updated automatically each time a new patient registers or when the next patient is called for service.

The implementation of an Arduino Uno-based digital queue has a number of significant advantages. First, the system can reduce patient waiting time and improve service efficiency at the health center [1]. Patients can monitor their queue number in real-time and estimate their waiting time. This helps reduce confusion and improve patient satisfaction.

In addition, the Arduino Uno-based digital queue also assists medical staff in managing queues better and prioritizing patients based on urgent needs [3]. This system provides clear and structured information about the order of patient services, making it easier for medical staff to manage schedules and optimize resource allocation.

Based on the above, the author wants to create a queuing system that makes the transaction process at the West Denpasar Dauh Puri auxiliary health center PUSTU (Puskesmas Pembantu) more organized and efficient in service. The digital queue prototype system is made and combined with a thermal printer, LCD display, speaker, and wireless module for push button control in the counter area of the auxiliary health center (PUSTU) Dauh Puri West Denpasar.

II. BASIC TEORY

2.1. Arduino Uno

The Arduino Uno is a popular and versatile microcontroller board. It is the basic version of the Arduino family and is widely used in electronics and programming projects [4]. The Arduino Uno has an ATmega328P microcontroller that can be programmed using the Arduino programming language.

This board has 14 digital input/output (IO) pins, 6 of which can be used as PWM (Pulse Width Modulation) outputs, 6 analog input pins, a 16 MHz crystal oscillator, a USB connection, and a power socket [5].

2.2. Thermal Printers

Thermal printers have become one of the popular printing technologies in various applications such as cashier, tickets, labels, and documents with relatively low print requirements [6]. This article provides a brief literature review on the development and advantages of thermal printers in terms of efficiency, speed, print quality, and reliability. In addition, it also discusses some research related to technology updates and development of thermal printers to meet future printing needs.

2.3. LCD Display

LCD (Liquid Crystal Display) is one of the most common display technologies used in various electronic devices, such as televisions, computer monitors, smartphones, and more. LCDs use liquid crystal materials that can be controlled by electric fields to produce visible images [7].

III. METHODS

In this study, the authors conducted research at the West Denpasar Auxiliary Health Center. A digital queue device is placed near the entrance to the Auxiliary Health Center, an LCD (Liquid Crystal Display) display and a wireless push button are placed at the queue counter. In this study the equipment is divided into 4 main components, namely digital queuing machines, thermal printers, wireless push buttons and LCD displays. The data from this study were obtained by measuring the response of each of the main components and the success rate of these components responding to one another. The first test is testing the queue machine push button with a thermal printer, the second is testing the wireless push button with an LCD display and the last test is testing the integration of each component.

3.1. Research Flow Chart

The research diagram is organized based on the process of the course of research and the research flow chart can be seen in Figure 1.

In Figure 1 starting from research preparation, literature review, research instruments, data collection to the preparation of reports including preparation of tool design. After the data used was ready, the author entered the tool design and tool installation sessions. Then testing the tool is carried out, if the tool does not work properly then it must be checked again from the literature and supporting components. If the tool is running well, then the quality control of the tool is carried out and afterwards an analysis of the tool is carried out

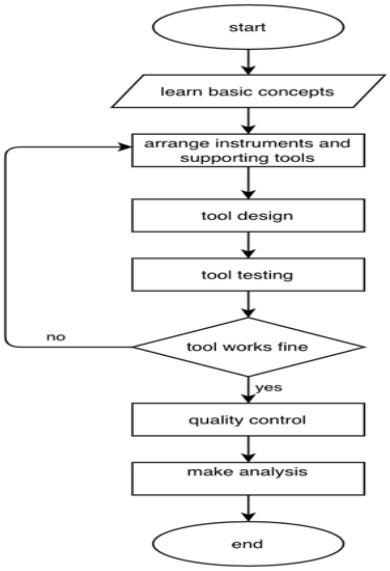

Figure 1. Research Flow Chart

3.2. Flowchart of Tool Design

In Figure 2 the design shows the design flow of the research tool. Arduino Uno as a micro controller that manages the retrieval of sequence numbers that connect data from the visitor push button to the health center counter push button which will be displayed on the LCD display and also informed through the speaker and proof of queue will be displayed from the Thermal Printer printout.

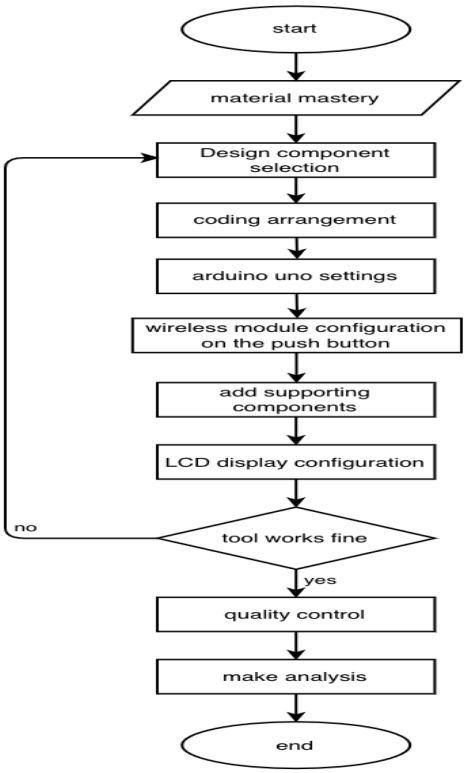

Figure 2. Flowchart of Tool Design

Based on Figure 2, the process begins with preparing and mastering the material/components, once ready, design and code the Arduino in the software. After that make settings on the wireless module on the queue tool. Then set the LCD

display to match the queue printed by the queue machine. If the tool is connected to all the components and is running well, quality control will be carried out and an analysis will be made, if not the tool will be checked again from the start of the component selection.

3.3. Tool Implementation

In implementing a digital queuing tool using several main design components including

1. Arduino Uno as the control center in the digital queuing system. The ATmega328P micro controller attached to the Arduino Uno is programmed to run the queue program and control other devices.
2. Thermal printer which is used to issue or print queue numbers in the form of thermal paper which has 3 different counter numbers from each service at the health center using 3 push buttons.
3. LCD Display displays data from a thermal printer that is interconnected with 3 push buttons located on the prototype of a digital queuing machine.
4. Speakers are connected to the LCD Display to amplify the sound produced according to the data coming out of the thermal printer
5. Push Button wireless which is placed at the health center counter to call the queue number

3.4. How the Tool Works

At this stage, it is explained how the wireless-based digital queuing tool works as follows:

1. To turn on the tool make sure it is connected to 220 V electric power
2. If it is connected to the power the indicator light on the printer will light up and the LCD display will also light up

Figure 3. Tool Implementation Digital Queue Prototype

3. Press one of the push buttons found on the digital queuing tool according to the service that the health center patient will go to
4. After the push button is pressed, the thermal printer will issue a paper containing the queue number according to the service.
5. Queue number data will be stored on Arduino
6. Patients can wait until the wireless Push Button at the counter is pressed by the counter officer according to the service.
7. The LCD will display the service code and queue number stored previously when taking the queue number and can be seen by the patient. The speaker will sound according to the service code and queue number.

IV. RESULT AND DISCUSSION

4.1. Push button testing of queuing machines with thermal printers

This test will measure the time required from the thermal printer in responding to commands from the push button found on the queuing machine. The results of this test are shown in Table 1.

Table 1. Testing Results Push button queuing machine with thermal printer

No	Button	Function	Print Time	Status
1	Elderly Push Button	Printing queue numbers for elderly patients	4 sec	Successful
2	General Push Button	Print queue numbers for General patients	4 sec	Successful
3	Toddler Push Button	Print queue numbers for under-five patients	4 sec	Successful

Table 1 shows that the elderly patient push button successfully responds to the thermal printer and takes 4 seconds. The general patient push button takes 4 seconds and the toddler push button also takes 4 seconds. Of the three push buttons each succeeded in responding to the thermal printer.

4.2. Testing wireless push button with LCD display

This test will see the suitability of the wireless push button in responding to the LCD (Liquid Crystal Display) and speaker. The results of this test are shown in Table 2.

Table 2. Testing results of wireless push button with LCD display

No	Button	Function	LCD Display	Speaker
1	Elderly Push Button	Display the last queue number for Elderly patients	Active	Active
2	General Push Button	Display the last queue number for General patients	Active	Active
3	Toddler Push Button	Displays the last queue number for Toddler patients	Active	Active

Table 3. Inter-device integration test results

No	Button	Function	Button	Print Time	Status	Function	LCD & Speaker	Status
1	Elderly Push Button	Printing queue numbers for elderly patients	Push Button loket Lansia	4 sec	Successful	Display the last queue number for Elderly patients	Active	Integrated
2	General Push Button	Print queue numbers for General patients	Push Button loket Umum	4 sec	Successful	Display the last queue number for General patients	Active	Integrated
3	Toddler Push Button	Print queue numbers for under-five patients	Push Button loket Balita	4 sec	Successful	Displays the last queue number for Toddler patients	Active	Integrated

From Table 2, it can be seen that the elderly wireless push button located at the health center counter, if pressed, will activate the LCD display and speaker according to the last queue listed on the card received by the elderly patient. On the general wireless push button, if pressed, it will activate the LCD display and speaker according to the last queue listed on the card received by the general patient. On the toddler wireless push button, if pressed, it will activate the LCD display and speaker according to the last queue listed on the card received by the toddler patient. Table 2 shows that the wireless push buttons found at the general elderly and toddler counters all three successfully respond to the LCD display and also to the speaker.

4.3. Integration testing between devices

In this test it is proven that each device can be connected between each other so as to produce the same queue sequence number on the thermal printer, LCD display and speaker. The results of this test are shown in Table 3.

From Table 3, it can be seen that the elderly push button is integrated with all devices, which takes 4 seconds to print the queue number and the elderly wireless push button successfully activates the LCD display and speaker according to the elderly patient's queue number. The general push button is integrated with all devices, which takes 4 seconds to print the queue number and the general wireless push button successfully activates the LCD display and speaker according to the general patient queue number. Then the toddler push button is integrated with all devices, which takes 4 seconds to print the queue number and the toddler wireless push button successfully activates the LCD display and speaker according to the toddler patient queue number. In this integration test it is proven that each device can be connected between each other so as to produce the same queue sequence number on the thermal printer, LCD display and speaker, as shown in Table 3.

V. CONCLUSION

Based on the results of research and discussion of the performance of the Arduino Uno-based digital queue at the auxiliary health center PUSTU (Puskesmas Pembantu) Dauh Puri West Denapasar, it is known that the 3 push buttons on the queue machine successfully respond to the thermal printer which takes 4 seconds. While the 3 wireless push buttons on the counter function properly to call the queue and are displayed on the LCD (Liquid Crystal Display) display along with the sound on the speaker 1 second before the queue number appears on the display and the number will not be able to increase without an additional queue number coming out of the printer, thus minimizing errors in the call and from the above tests it can be concluded that all components are well integrated.

Suggestions for further research are to be able to carry out usability testing on digital queue prototypes at the West Denpasar auxiliary health center. Involve users (patients and staff) in the testing process to identify usability issues, errors, and usage challenges that may arise. This data can help in improving the design and development of more effective and easy-to-use digital queues.

REFERENCES

[1] Jones, A. B., Brown, C. D., & Johnson, E. F. Improving Patient Flow Through a Digital Queue Management System. Journal of Healthcare Information Management, 32(4), 28-34. 2018

[2] Nurcahyo, A., Hartono, R., & Sutedjo, A. mplementasi Sistem Antrean Digital Menggunakan Arduino Uno Di Puskesmas X. Jurnal Teknologi Informasi dan Ilmu Komputer (JTIIK), 6(3), 271-280. 2019

[3] Smith, J. K., Anderson, L. M., & Davis, R. M. Enhancing Patient Experience and Efficiency Through Digital Queue Management. Healthcare Management Forum, 33(2), 57-62. 2020

[4] Banzi, M. Getting Started with Arduino. O'Reilly Media. 2011

[5] Monk, S. Programming Arduino: Getting Started with Sketches. McGraw-Hill Education. 2012.

[6] Bhatt, K., & Patel, K. A Review Paper on Thermal Printing Technology. International Journal of Scientific Research in Computer Science, Engineering and Information Technology, 5(1), 47-50. 2019

[7] Jang, J. H., Choi, H., Shin, J., Hwang, Y., & Park, C. Liquid crystal display: physics and applications. John Wiley & Sons. 2016.

[8] Erlinda, C. P. S. & Chyntia C. A. Desain Fisik Aplikasi Nomor Antrean Pendaftaran Pasien Rawat Jalan Berbasis Android di Puskesmas Nganjuk. Jurnal Rekam Medis dan Informasi Kesehatan Indonesia (Jurmiki). 1(1), 39-46. 2021

[9] Raihan, A., Wahyu, A., dan Achmad, H. Implementasi Mikrokontroler Arduino Uno dan Mini- Computer Raspberry Pi 3 dalam Pengendalian Sistem Gerbang Tol Cerdas. Transient: Jurnal Ilmiah Teknik Elektro. 8(1). 101-109. 2019.