



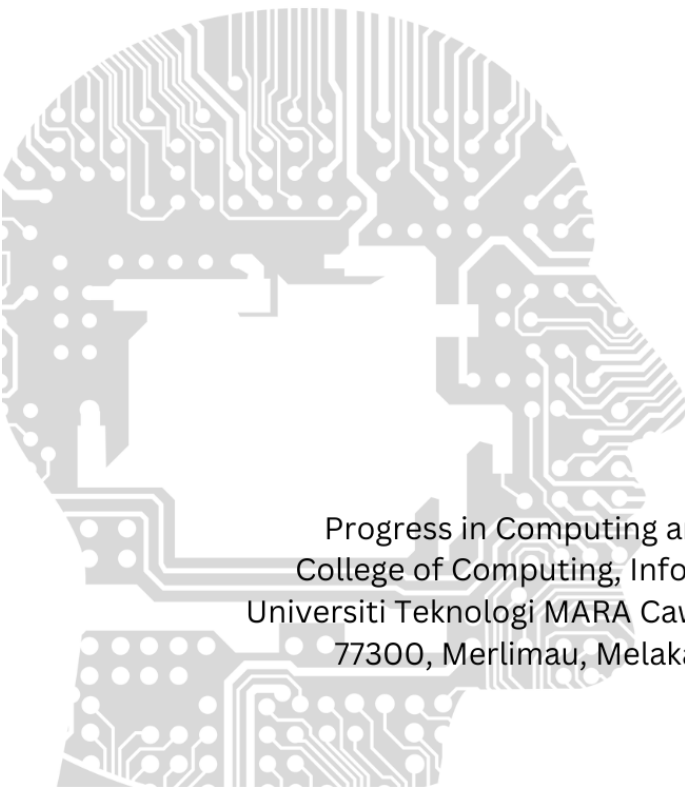
Cawangan Melaka

PCMJ

Progress in Computing and Mathematics Journal

volume 1

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Progress in Computing and Mathematics Journal
College of Computing, Informatics, and Mathematics
Universiti Teknologi MARA Cawangan Melaka, Kampus Jasin
77300, Merlimau, Melaka Bandaraya Bersejarah

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PREFACE

Welcome to the inaugural volume of the **Progress in Computing and Mathematics Journal (PCMJ)**, a publication proudly presented by the College of Computing, Informatics, and Mathematics at UiTM Cawangan Melaka.

This journal represents a significant step in our commitment to fostering a vibrant research culture, initially providing a crucial platform for our undergraduate students to showcase their intellectual curiosity, dedication to scholarly pursuit, and potential to contribute to the broader academic discourse in the fields of computing and mathematics. However, we envision PCMJ evolving into a beacon for researchers both nationally and internationally. We aspire to cultivate a space where groundbreaking research and innovative ideas converge, fostering collaboration and intellectual exchange among established scholars and emerging talents alike.

The manuscripts featured in this first volume, predominantly authored by our undergraduate students, are a testament to the hard work and dedication of these budding researchers, as well as the guidance and support provided by their faculty mentors. They cover a diverse range of topics, reflecting the breadth and depth of research interests within our college, and set the stage for the high-quality scholarship we aim to attract in future volumes.

As editors, we are honored to have played a role in bringing this journal to fruition. We extend our sincere gratitude to all the authors, reviewers, and members of the editorial board for their invaluable contributions. We also acknowledge the unwavering support of the college administration in making this initiative possible.

We hope that PCMJ will inspire future generations of students and researchers to embrace research and innovation, to push the boundaries of knowledge, and to make their mark on the world of computing and mathematics.

Editors

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IDOBI: IOT INTEGRATED SELF-SERVICE WASHING MACHINE RESERVATION SYSTEM WITH CODE BASED BOOKING TOKEN

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Article Info

Abstract

The iDobi project addresses the common challenges of waiting in queues and queue jumping in self-service laundry facilities by introducing an IoT-integrated reservation system with a code-based booking token. Peak-hour demand for laundry machines is efficiently managed through advance bookings, ensuring a seamless and secure process. The implementation of IoT technology provides real-time updates on machine availability, reducing waiting times and enhancing overall user experience. The project follows the waterfall methodology, resulting in successful functionality tests, including connectivity, user interaction, and responsiveness assessments. Despite hardware limitations leading to the removal of some features like the locking mechanism, the system performs well in integration tests with the ESP8266 microcontroller and real-time queue updates. However, future improvements could involve cloud hosting, real-time queue display, additional washing machines, a locking mechanism, and the integration of a payment gateway, paving the way for a comprehensive and efficient self-service laundry solution. The iDobi project represents a significant step towards enhancing the user experience and addressing the challenges faced in self-service laundry facilities.

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INTRODUCTION

The convergence of the Internet of Things (IoT) has given rise to innovative methodologies, shaping the paradigm of interconnected devices. Simultaneously, self-service technology (SST) has rapidly evolved, offering service providers a means to enhance productivity and efficiency by minimizing manpower and costs. Notably, self-service washing machines emerge as a practical solution for individuals, especially busy college students, facing time constraints. With the integration of IoT technology, these self-service devices, including washing machines and smart robots, are poised to become even more advanced. In the hospitality industry, renowned enterprises like McDonald's and Sheraton have embraced self-service machines, marking a shift towards intelligent technologies like robotics, machine learning, artificial intelligence, and IoT. This integration foresees a significant transformation in the hospitality sector, as highlighted by Elkhwesky and Elkhwesky (2023) and Kim et al. (2022).

LITERATURE REVIEW

The literature review explores various technological advancements in self-service machines, queueing systems, reservation systems, and related technologies, providing a comprehensive overview of their applications and impacts on customer experiences.

Self-Service Machines (SSTs)

Self-service technologies (SSTs) have emerged as transformative interfaces allowing customers to perform services independently, eliminating the need for frontline service employees. These technologies encompass a diverse range, including self-checkout systems, kiosks, ATMs, mobile apps, and self-service laundry machines. The adoption of SSTs by service firms is driven by the pursuit of efficiency, cost savings, and alignment with customer preferences.

Reservation Systems

Self-service technologies (SSTs) have emerged as transformative interfaces allowing customers to perform services independently, eliminating the need for frontline service employees. These technologies encompass a diverse range, including self-checkout systems, kiosks, ATMs, mobile apps, and self-service laundry machines. The adoption of SSTs by service firms is driven by the pursuit of efficiency, cost savings, and alignment with customer

preferences.

Self-Service Washing Machines:

The advent of self-service washing machines has revolutionized laundry routines by providing users with control over their washing tasks. These machines boast user-friendly interfaces, diverse wash programs, and automated payment systems. Reviews of similar systems, including companies like Silkron, We-Wash, Electrolux Professional, and Laundry Restart, shed light on the features and advantages of each, contributing to the advancement of knowledge in the field.

Web Application for Queue and Reservation Systems:

The evolution of digital technologies has ushered in web applications specifically designed for queue and reservation systems. Real-time updates in these applications play a pivotal role, offering users accurate information, reducing waiting times, and optimizing resource utilization.

Internet of Things (IoT):

The Internet of Things (IoT) encompasses billions of interconnected physical devices worldwide, collecting and sharing data. Microcontrollers, such as ESP8266, Raspberry Pi, and Arduino MKR Wi-Fi 1010, serve as the brains of IoT devices, facilitating communication and data processing.

Arduino IDE and Visual Studio Code:

The Arduino IDE provides a user-friendly platform for programming microcontrollers like ESP8266, simplifying code development. Visual Studio Code, on the other hand, stands out as a powerful and versatile source-code editor with extensive language support, debugging capabilities, and a vibrant extension ecosystem.

XAMPP Control Panel:

XAMPP, a cross-platform software stack, simplifies the establishment and management of local web server environments. Comprising components like Apache, MySQL, PHP, and Perl, XAMPP offers a user-friendly control panel for easy configuration. This versatile tool finds applications in local development, learning environments, and offline presentations..

METHODOLOGY

The project methodology for the development of the iDobi system is structured around the Systems Development Lifecycle (SDLC) with a focus on the Waterfall model. This approach involves sequential phases, ensuring each stage is completed before progressing to the next. The advantage of the Waterfall model lies in its simplicity, making it well-suited for this project's objectives.

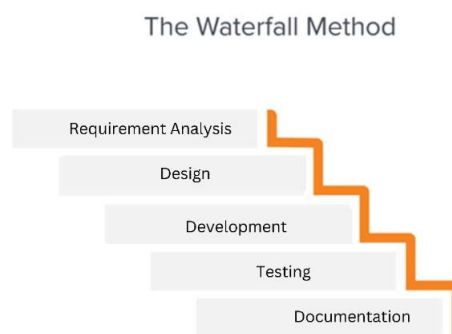


Figure 1 Methodology Framework

The methodology comprises four main phases: Requirements Analysis, Project Design, Project Development, Testing, and Documentation. The Requirements Analysis phase involves gathering necessary information, including hardware and software requirements. Hardware requirements include a PC, ESP8266, mobile phone, and LCD, while software requirements encompass Arduino IDE, Visual Studio Code, and XAMPP.

The Project Design phase encompasses Use Case, Flow Chart, Entity Relationship Diagram (ERD), and System Architecture. The Use Case diagram outlines user and system interactions,

while the Flow Chart illustrates processes like signup, login, and reservation. The ERD provides a visual representation of relationships between entities such as users, reservations, and machines. The System Architecture diagram delineates the system's key components.

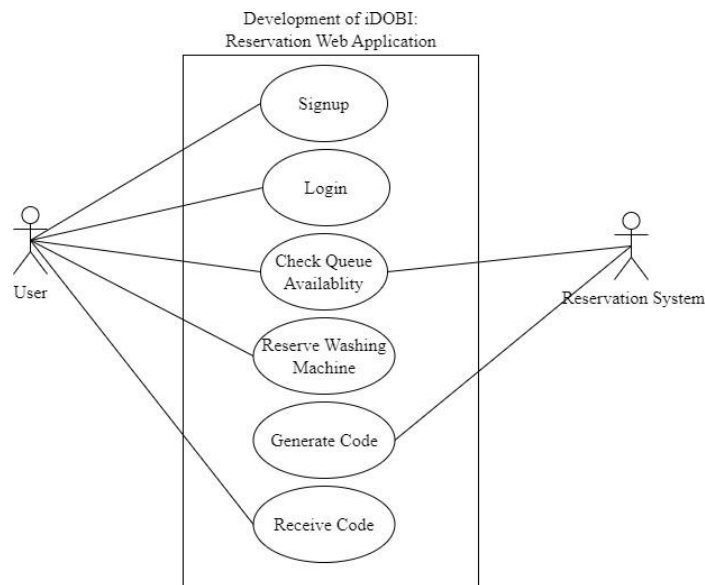


Figure 2

Users can check if washing machines are available at the current time and reserve one for a specific date and time. Once reserved, users receive a confirmation code. Overall, the app simplifies the process from account creation to successful washing machine reservation.

The reservation system can be used to generate the code and check queue availability.

For the flow chart are more focused on the reservation process of the system. Once the user successfully login to the system, the user will redirect to the main page where the users will undergo reserving process where they need to choose the time slot and reserve date that they wanted to reserve. If the date and time slot was reserved, the system will tell that the time Slot is not available. Once the user chooses the available slot, it will redirect the user to confirm booking page where the user needs to double check the detail to make sure the date, time, is correct, Once the user confirmed the reservation, the random code will be generated. On the hardware side, the washing machine will keep idle until the data and time slot match as in the database. If the date and time slot are the same as in the database, The hardware device LCD will output reserve_id and code generated that mark the data is send in respective time.

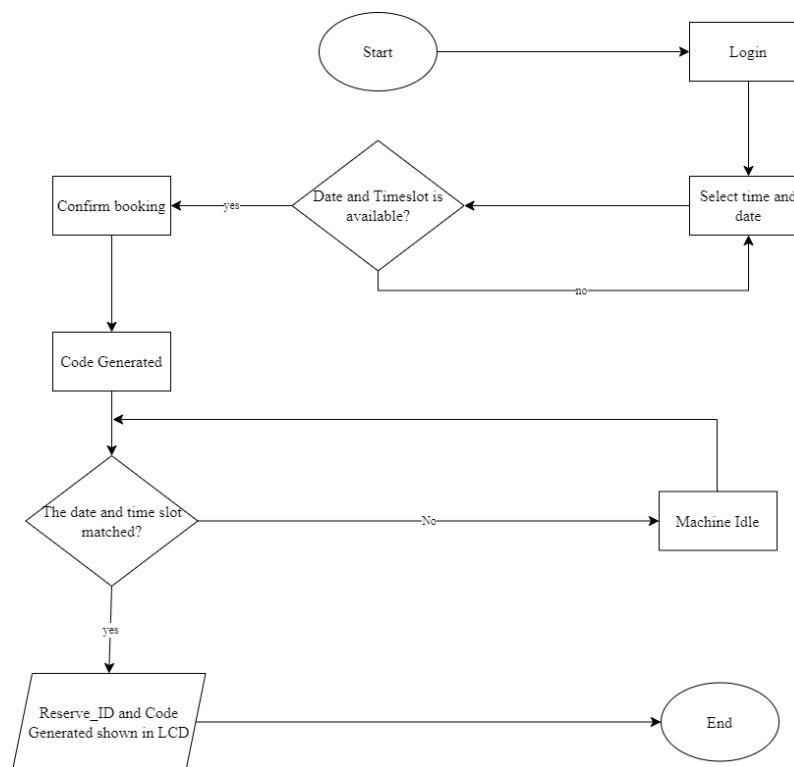


Figure 3 Flowchart of reservation system

Next, ERD includes entities which is users, reservations, and machines. Each entity has its unique identifier, known as the primary key (PK), as user_id, reserve_id, and wmachines_id are primary keys used to identify records within their respective entities uniquely. The relationships between entities are also represented in the ERD. users have a many to one relationship with reservation table which indicates that many users only can do one reservation at a time that is not reserved yet. reservations table has many to one relationship with the washing machine, which means that there would be many reservations that can be booked for a single washing machine.

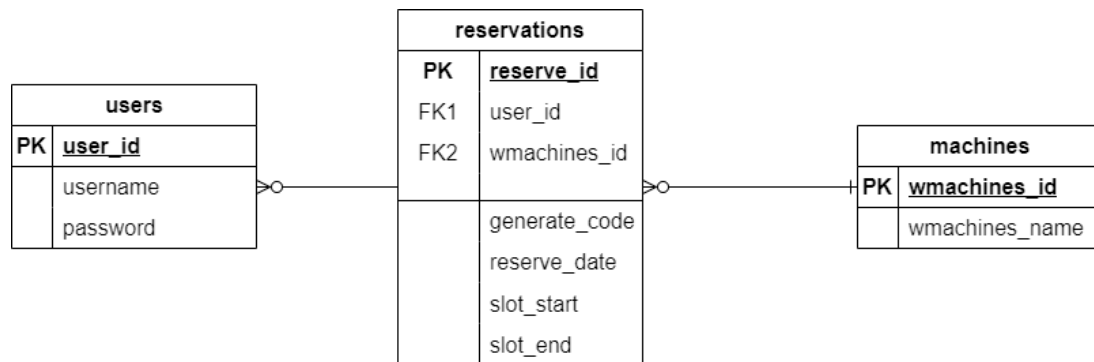


Figure 4 Project's ERD

The system architecture provided an insight of the iDobi Reservation web application system. The illustration delineates key components of the system, encompassing the ESP8266 microcontroller (control unit), mobile phone hotspot as the access points that connect between the ESP8266 and local server, lcd display, end user and database.

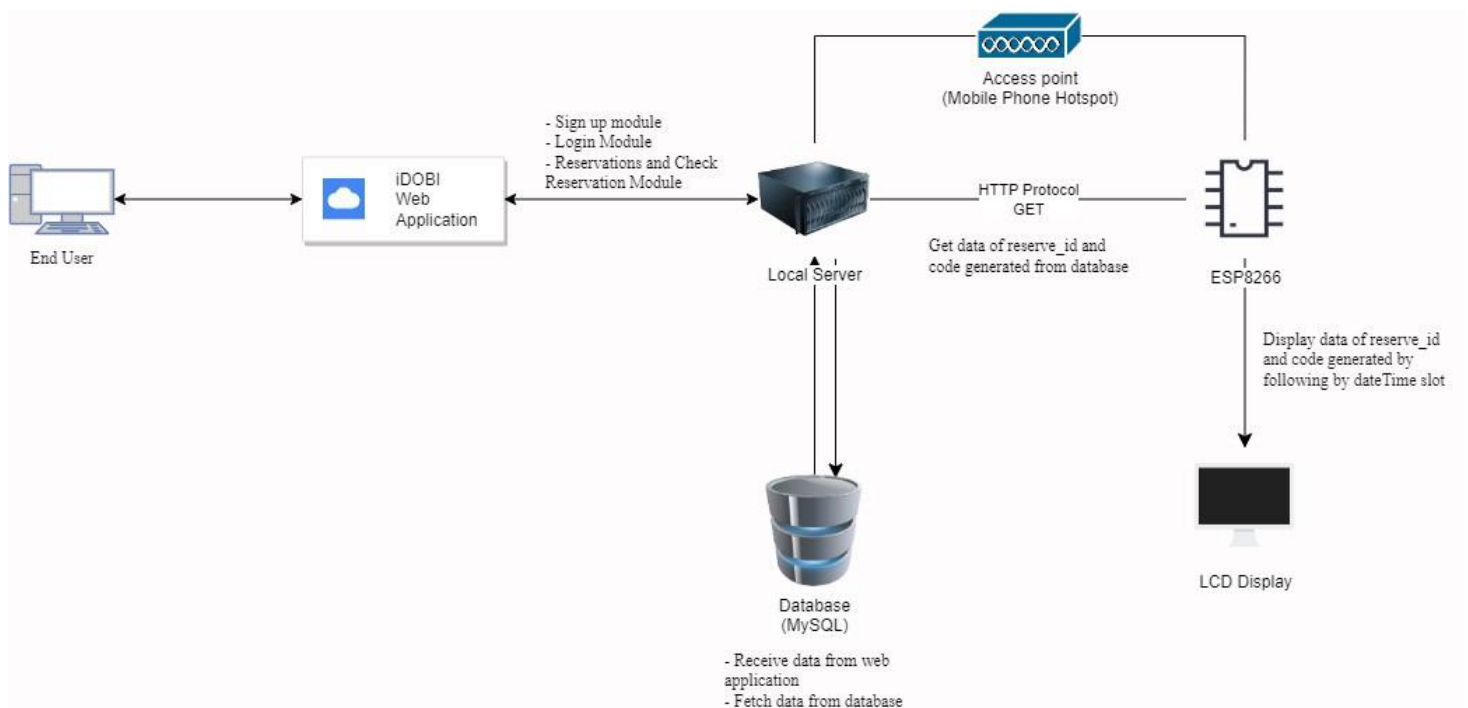


Figure 5 Overview of system architecture.

RESULT AND DISCUSSION

Testing functionality is a necessary process to ensure that each device in the system operates according to the specified requirements. It aims to identify and address any errors present. The table below displays the tested results.

Table 1 Connectivity result testing

Name (IP address)	Description	Result (Pass/Fail)
Database (192.168.0.4)	Be able to communicate with end host (192.168.0.4)	PASS
Webserver (192.168.0.4)	Be able to communicate with end host (192.168.0.4)	PASS
Microcontroller (192.168.0.3)	Be able to communicate with end host (192.168.0.4)	PASS

Table 2 Website System's Response to User Input for result

System Response	Description	Expected Result	Result (Pass/Fail)
User signup	Create a credential	User signup.	PASS
User login	Insert credentials	User can login.	PASS
Washing machine reservation	User reserve for the washing machine.	Washing machine successfully reserve.	PASS
Code generated for specific reservation	System will generate the code for the specific reservation	The code will be generated only if the reservation success	PASS

Table 3 Integration of Microcontroller ESP8266 Testing Result

System Response	Description	Expected Result	Result (Pass/Fail)
Read reservation from database	Microcontroller read the reservation data from the database.	Successful retrieve reservation data from database.	PASS
Send signal to LCD	Microcontroller sends the appropriate signal to the LCD	LCD show the reservation data	PASS

Table 4 Time testing result

System Response	Description	Expected Result	Result (Pass/Fail)
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Check queue reservations.	The system will verify whether the reservation is available in real time	System will display Slot not available if the selected time and date is reserved	PASS
		System will display Slot available if the selected time and date is not reserved	PASS
Send the data read from the database in real time updates	Microcontroller sends the data of reservation from the data table which followed the data of datetime reservation entity	LCD output the reservation data only within the datetime slot	PASS

In the testing results for the system's response to user input in table 2, table 3 and table 4, all actions aligned with the expected outcomes, ensuring the functionality of the system and integration with IoT environment.

CONCLUSION

In conclusion, the self-service washing machine reservation system with code-based booking token play a bigger role in revolutionizing the traditional approach to laundry services. By combing this system with the code-based booking token addresses the persistent queuing issues encountered when reserving for the conventional washing machines. The iDobi system contribute to a more efficient and user-friendly experience for individuals seeking laundry services.

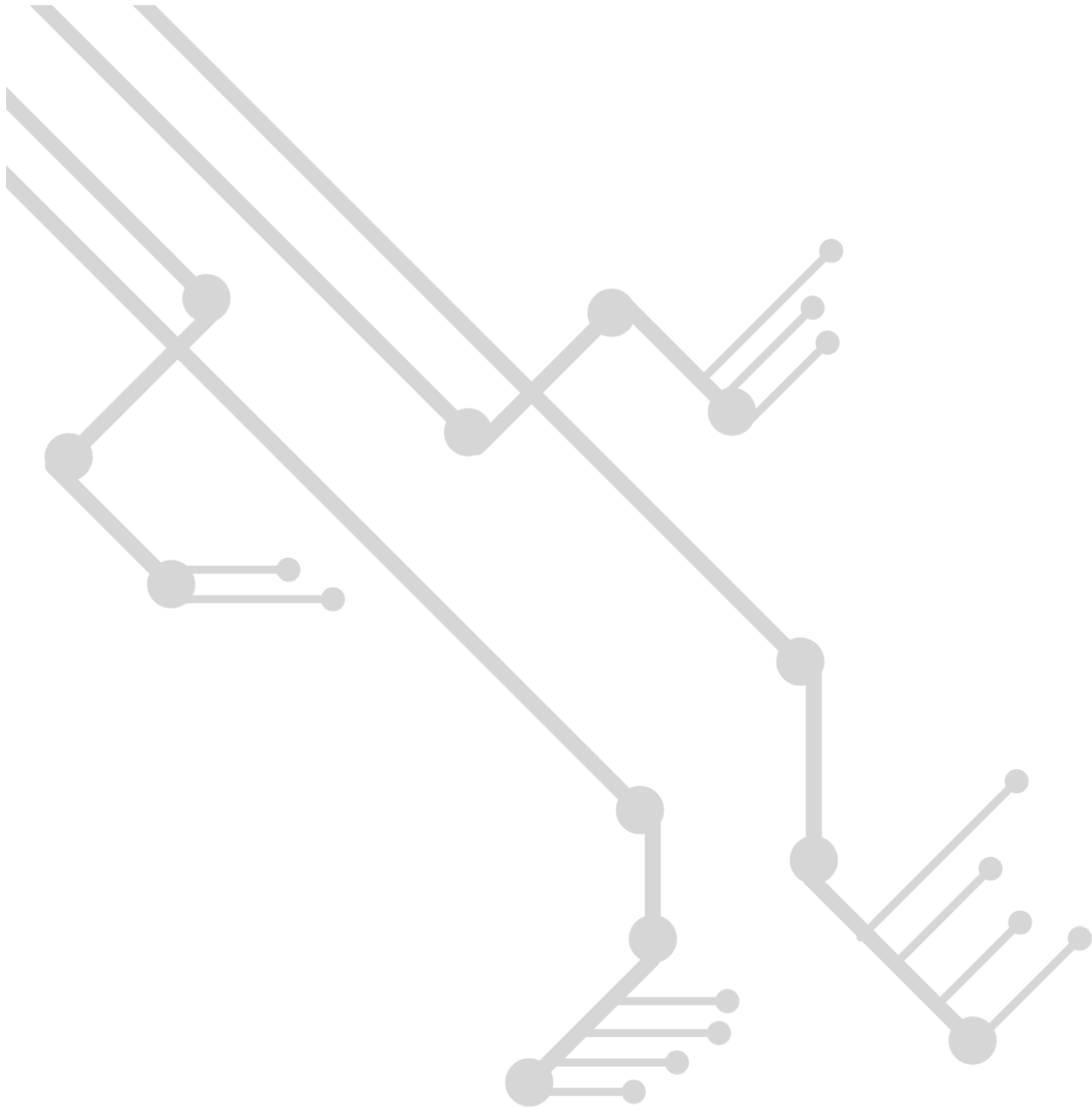
By implementing the code to unlock the washing machine only for the user who booked for the machine will abolish the queue-jumping issues and lessen the physical waiting in queue for laundry machine which will become more convenience for the user.

Overall, of this project, the iDobi system showcases the successful integration of hardware and software components as well as the data communication between both hardware and software concludes that the network element is implemented in this project.

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