Design and Development of a Vending Machine for Plastic Bottle Waste

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ABSTRACT
This research aims to design and develop an innovative and responsive Android-based vending machine system that meets the needs of the modern market. Traditional vending machines often have limitations in user interaction and payment method flexibility. Therefore, the integration with an Android-based system is expected to enhance the user experience through a more intuitive interface and support for various digital payment methods, such as e-wallets and QR codes. The methodology used in this research includes software development using an Agile Development approach, user-friendly Android-based interface design, and integration with vending machine hardware. The application is designed to allow users to operate the vending machine easily, monitor product availability in real-time, and receive notifications regarding transactions and promotions. In conclusion, the development of the Android-based vending machine can significantly improve user experience and operational efficiency. This research suggests further development with additional features such as user data analysis to support marketing strategies and enhancements.

General Terms
Android, ReactJs, Qrcode

Keywords
Vending Machine, Android, Mobile Application, Qrcode.

1. INTRODUCTION
Plastic bottles have become one of the largest contributors to environmental problems in the world today. This is due to excessive use of plastic bottles and the difficulty of these materials breaking down naturally. According to data from the Central Statistics Agency (BPS), plastic waste in Indonesia reaches 64 million tons per year. The lack of public awareness regarding plastic waste management also contributes to the high usage of plastic bottles. If this issue continues to be neglected, the condition of the environment will become increasingly threatened. Based on this research, the development of a Reverse Vending Machine (RVM) was initiated as a flagship product in higher education research. This RVM is based on the Internet of Things (IoT), incorporating a user ID feature that can be read directly by users, as well as centralized monitoring of plastic waste. This will enhance the smart system for controlling plastic waste by the management team. The aim of this research is to address the issue of plastic bottle waste at the Manado State Polytechnic, an educational institution where faculty, staff, and students are directly involved in contributing to plastic bottle waste during meetings and community groups that use plastic bottles for drinking.

2. SYSTEM DEVELOPMENT METHOD
The system development method used is the waterfall method. The waterfall method is the work of a system carried out sequentially or linearly.

2.1 SYSTEM PLANNING
2.1.1 System Flow Chart
Use case diagrams describe the behavior of the system behavior to be created. Use case diagrams describe an interaction between one or more actors and the system to be created. In simple terms, use case diagrams are used to understand what functions are in a system and who can use these functions.

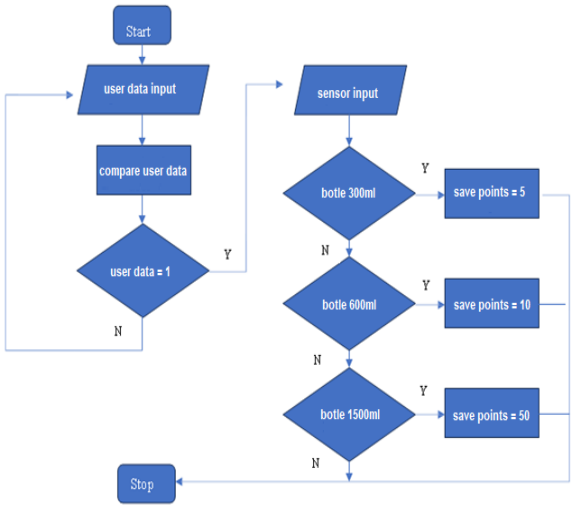

Fig 1:RVM System FlowChart

2.1.2 Use Case Diagram

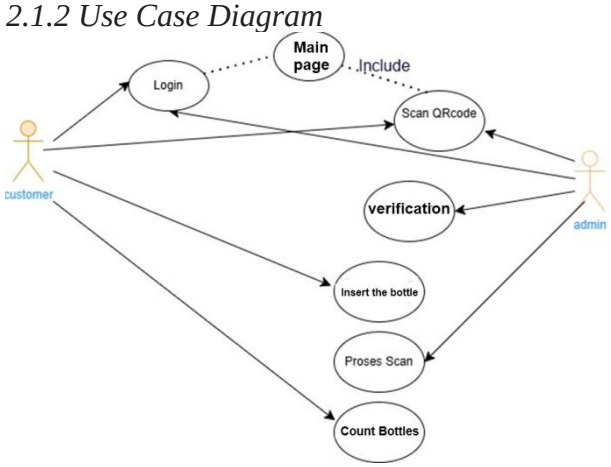

Fig 2:Use Case Diagram

In Fig 5, there are two actors: the user and the admin. The user accesses the QR code via Android, while the admin verifies the point data for each bottle. The point data will then be input through the Android phone as the user's points. The user inserts the plastic bottle, and the system detects it and displays the QR code that has been verified by the admin.

2.2 System development

The system testing method in this research is Black-box testing. The purpose of this test is to test all the elements of the software that are made whether they are in accordance with what is expected or otherwise. This test will ensure that the input and response received are the same so that there is a match between the application and admin, users, and visitors.

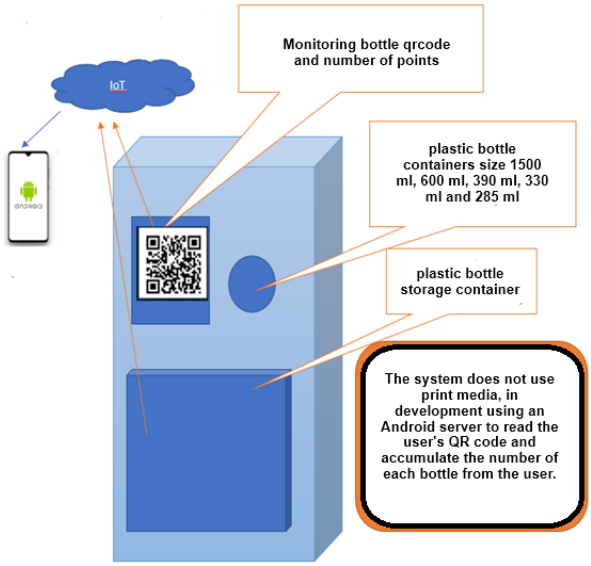

Fig 3:Use Case Diagram

Development of a system using Android and a server for user data storage. The Android system displays user data and points for plastic bottles when users utilize the vending machine to collect plastic bottles.

3. RESULT AND DISCUSSION

The hardware design of the system begins with the creation of a mechanical box to hold the bottles, the placement of sensors and electronic components, the crushing of bottles, and the collection of the bottles.

Fig 4: Testing the input display of the bottle object

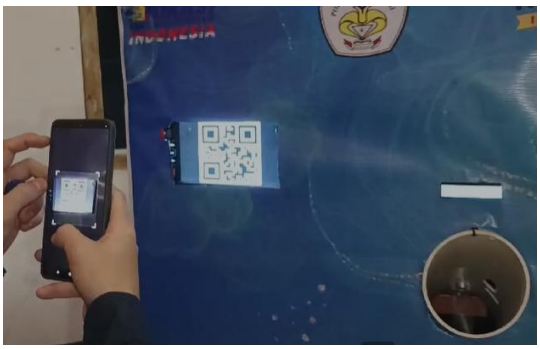

Fig 5:scand qrcode

Fig 6:Display User points via android phone

Table 1: Plastic Bottle Testing Data Table

No	distance of bottle to sensor(ml)	LCD Display	Qr code Display	Point Display to andoid
1	1.500	Distance 2cm	Qrcode 10 points	10
2	600	Distance 4cm	Qrcode 5 points	5
3	390	Distance 4cm	Qrcode 5 points	5
4	330	Distance 4cm	Qrcode 5 points	5
5	285	Distance 6cm	Qrcode 3 points	3

The results of the test in Table 1 show that 5 plastic bottles were tested, each producing readable data on the system that successfully displayed the QR code. The Android application, as shown in Fig 6, displays the data resulting from the QR code scan of the bottles presented by the system

4. ACKNOWLEDGMENTS

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5. REFERENCES

[1] Firmansyah, G.C., Ardhi, S.H., Sumarmi, W. 2021. Peran Sirkular Sampah Produk Untuk Meningkatkan Produktivitas Usaha Masyarakat Desa Bagorejo. Jurnal Pemberdayaan Masyarakat. Vol. 9 No. 2: 1-14.

[2] Ghaffar, Moh S., Nur A. dan Catur W. 2021. Pengelolahan Bank Sampah dalam Meningkatkan Perekonomian Masyarakat di Desa Banangkah Kecamatan Burneh

Kabupaten Bangkalan. Buletin Pemberdayaan Masyarakat dan Desa; Vol 1 No 1: 13-19.

[3] Halid, Kiki Y., dan Muhammad S. 2022. Strategi Pengelolaan Bank Sampah di NTB (Studi Kasus Bank Sampah Bintang Sejahtera). Journal of Innovation Research And Knowledge; Vol..1 No.8: 763-770.

[4] Hamid dan Hilwatullisan. 2022. Peran Bank Sampah Dalam Meningkatkan Pendapatan Nasabah (Studi Bank Sampah Sakura Palembang). Jurnal Lentera Pendidikan Pusat Penelitian Lppm Um Metro; Vol. 7. No. 1: 21-27.

[5] Irwanto, Endi P., Didik A., dan Irwani. 2019. Pemberdayaan Masyarakat Dalam Manajemen Bank Sampah di Desa Citaman Kecamatan Ciomas Kota Serang, Banten. Jurnal Ilmu Ekonomi dan Studi Pembangunan; Vol. 19 No. 2: 158-168.

[6] vakdalam dan Far Far. 2021. Persepsi Masyarakat pada Pengelolaan Sampah (Studi Kasus: Bank Sampah Bumi Maluku Lestari Kota Ambon). Jurnal Agribisnis Perikanan; Vol. 14 No. 1: 161-171.

[7] Julita dan Zulkarnanini S. 2018. Pengelolaan Sampah Berbasis Masyarakat Melalui Program Bank Sampah di Pekanbaru. Jurnal Ilmu Lingkungan; Vol.12. No. 1: 59-62.

[8] Kasmir dan Andi Y. 2022. Pemberdayaan Ekonomi Masyarakat Melalui Bank Sampah AlFaidzi Di Kota Kendari. Dalam https://ejournal.iainkendari.ac.id, diakses pada 16 Agustus 2022.

[9] Manalu dan Purba. 2020. Analisis Kebijakan Pengelolaan Sampah Melalui Program Bank Sampah Kota Batam. Jurnal Akrab Juara; Volume 5, Nomor 3: 12-24.

[10] Manggala dan Sugiantiningsih. 2020. Menabung di Bank Sampah sebagai Pendapatan Tambahan: Studi Kasus pada Masyarakat kota Denpasar, Bali. Jurnal Sains Sosio Humaniora; Volume 4, Nomor 2: 974-986.

[11] Muanifah dan Cahyani. 2021. Pengelolaan Bank Sampah Dalam Menumbuhkan Peluang Usaha Nasabah Bank Sampah. Scientific Journal of Reflection; Vol. 4, No. 1: 150159.

[12] Mulyadin, Mohamad I., dan Kuncoro A. 2018. Konflik Pengelolaan Sampah di DKI Jakarta dan Upaya Mengatasinya. Jurnal Analisis Kebijakan Kehutanan; Vol. 15, No.2 : 179191.

[13] Nasrul, D.G., Febri Y., Hasim A. 2020. Inovasi The Gade Clean & Gold Pada Bank Sampah Mutiara di Kota Pekanbaru. Jurnal Penelitian Administrasi Publik; Vol.8. No.1: 7288

[14] Nenobais. 2021. Strategi Pengelolaan Sampah Rumah Tangga: Solusi Alternatif bagi Pemerintah Kota Kupang. Jurnal Inovasi Kebijakan. Volume VI, Nomor 1, hal. 1-15.

[15] Pasanda dan Tari. 2020. Daur Ulang Sampah di Desa Paisbuloli Sulawesi Tenggara. Jurnal Pengabdian Kepada Masyarakat; Vol. 5, No. 1: 147-153

[16] Marali, M. D., Pradana, F., & Priyambadha, B. (2018). Pengembangan Sistem Aplikasi Transaksi Bank Sampah Online Berbasis Web (Studi Kasus : Bank Sampah Malang). Jurnal Pengembangan Teknologi Informasi Dan Ilmu Komputer, 2(11), 2548–2964. http://j-ptiik.ub.ac.id