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Integrated_Point_of_Sales_and_Snack_Vending_Machin

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Integrated Point of Sales and Snack Vending Machine based on Internet of Things for Self Service Scale Micro Enterprises

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Abstract. Sales management is a key function which helps small and medium size enterprises (SMEs) in monitoring and tracking stock and co-ordinate transaction processing. Point of Sales developed to support sales management for scale micro enterprises. While self-service applications from banking, to travel, to foodservice, to ticketing, to hotels are booming, many have forgotten that the original self-service applications were in the vending industry. Self-service has evolved into an operational mode that no longer should be viewed as merely a device-based channel for selling snacks and beverages. The aim of this research integrates point of sales and vending machine based on internet of Things (IoT) for self-service scale micro enterprise. Applications that record while sending data from multiple sensors. Data that records sensors sent through the IoT module to the server, then the server will save the data in a server database. Periodically new data will be visualized in the system through server application is a service. Real-time sales recapitulation system through a vending machine IoT for 24 hours. After being developed and implemented 24 hours machine will embedded by Internet of Thing (IoT) module. Through this all operational forms of the system are good in the form of stock, recapitulation of sales made by the vending machine and the latest conditions vending machines will be sent to the server so that users can monitor them at any time system. In addition to the profit-taking report, items can be recorded by the system. Owner outlets can remotely controlling vending machines via mobile phones because they are connected to server API (Application Package Interface) to the server application.

1. Introduction

Enterprises (SME) and contributes greatly to the Gross Regional Income is SMES engaged in the food. These SMES are engaged in the processing and distribution of snack foods[1]. SME sector that continues to grow and experiences a lot of renewal includes the culinary and snack sectors. As part of the food and beverage industry which is categorized as small and medium scale businesses now has a great opportunity to expand local businesses and markets after the number of requests for this type of business products from year to year continues to increase[2]. These SMEs have distinctive characteristics, namely small capital, very high risk but also high and free of entrepreneurship for their owners[3]. Generally, SME snack business processes are self-managed by SME owners from production to service to consumers. Because the resources and capital requirements that are limited in sales time are only done between 9-12 hours a day. Time above 9 o'clock at night tends to be used by sellers to close outlets and rest, where time is still possible by customers who do night activities to find snacks or snacks for companions doing night activities. The service to sellers of each SME owner snacks varies every time, this is influenced by the emotional condition of each UKM owner who serves at the same time cooking or doing other household activities so that the response to the buyer



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decreases. The bargaining process of prices for food products tends to affect the profits from the sales of each of these outlets, especially for offers with substandard prices if buyer buy in large quantities and products with shorter durability. In order to improve service to consumers by SMEs snack food, it is necessary to standardize independent services by consumers[4]. Standardization here is intended to give consumers the freedom to choose products based on their own needs and desires through a self-service system[5]. The self-service that is commonly carried out in the service of snack and beverage products is using a vending machine. Vending machine is a machine that can remove goods that the buyer wants[6]. The operation of this machine is quite easy where the buyer inserts a certain number of coins and presses the button according to the desired item.

In order to increase the interaction between vending machines and humans, there is a web representation used to enlarge the social network through the internet of things (IoT) to become what is called "internet vending machine"[7]. Internet of Things (IoT) is an extensive data collection and data sharing for specific purposes. Intelligent sensor technology is needed for develop this paradigm. IoT is an open and comprehensive network of intelligent objects that have the capacity to organize automatically, share information, data and resources, reactions and actions in dealing with situations and environmental changes[8].

There are several challenges that must be resolved to develop IoT applications especially for vending machines. First the high complications of distributed computing, both the lack of general planning and a framework that handles low-level communication to understand high-level implementation, all three different programming languages, and the fourth various types of communication[9]. A framework is needed to answer all these challenges, where the framework meets a set of rules, protocols and standards that facilitate the implementation of IoT applications.

The IoT framework must be able to be used for indoor and outdoor navigation and also provide intelligence where standard communication, interoperability and system resilience are run[10]. The aim of this research proposed framework that integrates point of sales and vending machine based on internet of Things (IoT) for self-service scale micro enterprise. This framework has a server and cloud from all vending machines connected to the API (Application Server Interface) server. The API bridges the communication from the server to the IoT module installed and identified on each vending machine. The communication data from IoT and API modules will be stored in the cloud server, which will be visualized by the application server to be used by the user who is the owner of each vending machine. So that users can monitor the activities of the products sold in the vending machine through android and web applications.

2. Related Work

2.1. Framework Internet of Thing in Vending Machine

The IoT Framework concept provides machine-to-machine (M2M) communication facilities and end-to-end communication that is run without human intervention that connects things (things) to the core IT network. 'Things' in IoT, or 'machines' in M2M, are entities that have their own identity, the state is able to connect to IT infrastructure using the internet. The vending machines links to the Internet through wireless connection while the Expert Decision System runs on the server. The status of the vending machine is obtain by the Data Collection System and transmitted to the Database System on the server through wireless network. The data acquired from the database includes the number of every type of commodities, coins and paper money left, commodities left on each stack and the temperature of the freezer, malfunction warning messages[11].

Yozo Shoji (2016) proposed the concept of community-based wireless IoT infrastructure using ubiquitous vending machines. Assuming to configure a mesh/tree network with data multihopping function based on the wireless standard "Wi-SUN (Wireless Smart Utility Network)," which is to use IEEE802.15.4e/4g for its MAC and PHY layers specifications, this paper shows a network design to be applied to a real deployment plan in Sumida ward, Tokyo, Japan, considering fundamental measured RSSI versus distance performance in a line-of-sight (LoS) environment[12]. Han (2017) proposed the semantic service provisioning architecture for smart objects including its related

algorithms and mechanisms. The proposed architecture presents a secure, scalable, and reliable method to power IoT applications on Web. We have carried out empirical evaluation by means of several prototypes and applications and on different environments[13].

2.2. Point of Sales for Scale Micro Enterprises

Point of sale (POS) systems, sometimes referred to as Point of Purchase systems refer to the location of a transaction also known as a checkout. These systems include cash registers, handheld devices, special terminals, optical scanners and magnetic card readers[14]. Generally, SMEs already use the Point of Sales (POS) in the form of a cash register. The cash register is the most widely used for restaurant payment service as well as the recording of transactions. The limited features of the cash register, makes many problems arise when the daily or monthly transactions recording required[15].

3. Framework POS-IOT Vending Machine Development

In the initial step in this research, the development of automated vending machine hardware will be secured by embedding systems and IoT modules. This development is carried out with the development of mechanical components as it is show in figure 1. In general, components of the vending machine consist of several parts including the front panel, mechanical and keypad. The face panel has several uses besides being used for display but also as a security feature. The development of electrical components and hardware testing as it is shown in figure 3. After all components are assembled and developed, the hardware performance will be tested based on the control system. In the next step, the system analysis and design are carried out by outlining the IoT framework system when it is run, including: system input, user interaction with the system, system output, the possibility of errors occurring, system accuracy improvement techniques.

In supporting the process of running the system, it also requires a standalone server requirement to be controlled directly by the proposer during the development and release process. The most important step in this research, where in this step there is a hardware implementation process, machine communicates to the server and server and user communication. This implementation begins with server development, back-end server development, app server development, communication control system between machines to machines and machines to users and the last process is testing. Testing proses must be carried out to ensure the system works normally according to the procedure and no errors occur. Implementation and testing are carried out iteratively in different laboratory environments and locations to determine the performance of the framework in controlling data communication.

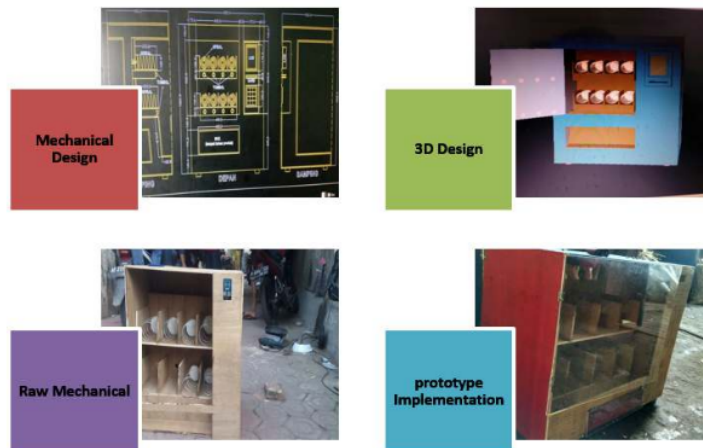


Figure 1. Mechanical step of vending machine



Figure 2. Electrical design of vending machine

3.1. Integrate Point of Sales to IoT Vending Machine Architecture

The challenge faced in the IoT system when there are many vending machines in the system, especially the limitation of the ability to connect vending machines with the internet every day. IoT in vending machines is not only about connectivity, but also about expanding collections and sharing large amounts of data for specific purposes.

The IoT based vending machine system framework will produce vending machine hardware products for the sale of snack food products and software in the form of IoT framework systems that are used as servers and server applications from vending machine products.

Applications that record while sending data from multiple sensors. Data that records sensors sent through the IoT module to the server, then the server will save the data in a server database. Periodically new data will be visualized in the system through server application is a service. Real-time sales recapitulation system through a vending machine IoT for 24 hours. After being developed and implemented 24 hours machine will embedded by Internet of Thing (IoT) module. Through this all operational forms of the system are good in the form of stock, recapitulation of sales made by the vending machine and the latest conditions vending machines will be sent to the server so that users can monitor them at any time system. In addition to the profit-taking report, items can be recorded by the system. Owner outlets can remotely controlling vending machines via mobile phones because they are connected to server API (Application Package Interface) to the server application as it is show in figure 3. One example of the stock recap view from the point of sales vending machine system as it is shown in figure 4. Outline of the function of contributions and features in this study as follows.

1. This vending machine was developed for snacks so as to improve the service of SME snacks as one of the contributors to the national economy.
2. Payment system in cashless vending machines using e-money.
3. The vending machine is connected to an internet network server that provides machine to machine data communication between vending machines.
4. Framework is used to regulate the communication activity of the user to machine or machine to machine.
5. The user can know the activity of the vending machine in real time.
6. Data recapitulation and data visualization can be controlled and monitored through the point of sales system.

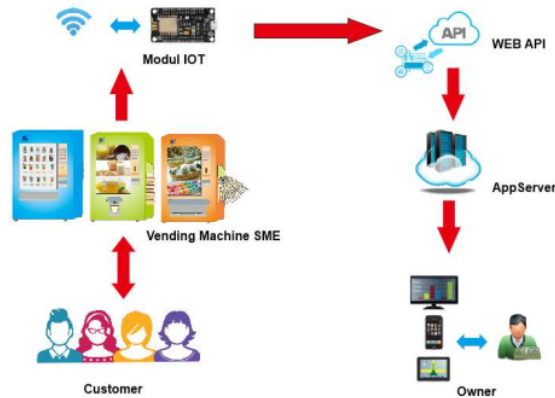


Figure 3. Framework Architecture of POS-IOT Vending Machine

Slot	Nama Items	Stock	#
1	Rokok	5	Reset
2	Tissu	4	Reset
3	Soto ayam	4	Reset
5	Test	2	Reset
5	Oreo	4	Reset
6	Chocolatos	4	Reset
7	Chiki	4	Reset
8	Rechess	4	Reset

Figure 4. Stock Page POS IOT Vending Machine (Please replaced in english)

4. Result

4.1. Real-time Data Recording

The main data in the form of button pressure on the vending machine button, the sensor used to detect the amount of snack food product and the amount of money entered in the vending machine or e-money value that is transacted where all the data recorded by the microcontroller is continued to be sent to the server via the IoT module periodically. In order to avoid data accumulation, communication between the machine and server is supported by an Application Package Interface (API) that controls the distribution of data if communication between the machine and the server occurs.

4.2. Real-time Data Transfer and Visualization

Data captured by the API will be forwarded to the database server through the service function that has been embedded in the server application. The server application that will distribute to the web administrator can be visualized on the front end and back end pages. The system point of sales of this research has a function to recapitulate sales data, stock data, flowing financial data. This system runs in real time for 24 hours. This system is developed with the MySQL Q Databases engine with web-based application development with framework-based PHP programming languages so that it is more responsive.

5. Conclusion

Applications that record while sending data from multiple sensors. Data that records sensors sent through the IoT module to the server, then the server will save the data in a server database. Periodically new data will be visualized in the system through server application is a service. Real-time sales recapitulation system through a vending machine IoT for 24 hours. After being developed and implemented 24 hours machine will embedded by Internet of Thing (IoT) module. Through this all operational forms of the system are good in the form of stock, recapitulation of sales made by the vending machine and the latest conditions vending machines will be sent to the server so that users can monitor them at any time system. In addition to the profit-taking report, items can be recorded by the system. Owner outlets can remotely controlling vending machines via mobile phones because they are connected to server API (Application Package Interface) to the server application. Vending machine products are independently dedicated to regional snacks SMEs. The product will be developed to improve the quality of service in regional snack foods.

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Acknowledgments

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