Caribi Mobile Application Based on Radio Frequency Identification (RFID) for Internet of Things (IoT)

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ABSTRACT

Nowadays, the e-commerce industry in Indonesia is growing substantially and expanding annually. This is one of the revolutions that has affected various aspects of life, including animal husbandry. In Indonesia, buying and selling livestock has become routine; however, it is still conducted conventionally. Therefore, a system is required to facilitate online purchasing and selling transactions; thus, farmers can expand their enterprises. This study aimed to develop a mobile application for the online purchase and sale of livestock. The Caribi Mobile Application is built with a system that can provide consumers with accurate information by recording the tracks of each animal that will be sold. Each animal's age, weight, and recent pictures are included. Tag RFID based Internet of Things (IoT) system is used in searching for mobile applications. The RFID Tag System is used to carry out two functions at once, namely assistance and security. This application is designed to integrate livestock data from the internet and save it in a database. This study's findings demonstrate that the system can read the data related to each farm animal. Additionally, the system has created data on the weights of each animal, which anyone with access to the Caribi Mobile Application can view.

1.   Introduction

The development of e-commerce in Indonesia has expanded yearly, and the increasing usage of the internet has significantly affected numerous aspects of daily life. Technological advancements have a substantial impact on the social behavior of society. People prefer the internet system for its convenience in accomplishing their life's responsibilities. E-commerce technology was developed to facilitate business transactions over the internet and on websites. Smartphones can be a place for performing buying and selling transactions since e-commerce applications are readily accessible. The stock apps report demonstrates that smartphone users worldwide will reach 5.3 billion in July 2021.

Currently, the livestock sector provides a significant contribution to society. Animal husbandry is breeding and cultivating livestock activities to obtain profitable results. Sheep livestock is one of the many opportunities for growth in the livestock industry. Sheep livestock has substantial development potential, is simple to develop, and has a reasonably straightforward maintenance system. Therefore, livestock development must be conducted regularly to enhance breeder welfare

With the advancement of technology, there are increasingly more strategies to acquire information, the Internet of Things (IoT) being one of them. The Internet of Things (IoT) aims to expand the benefits of continuously connected internet connectivity. It enables the connection of machines, equipment, and other physical items to networked sensors and actuators to obtain data and manage their performance. IoT can collect data using several protocols, including HTTP, MQTT, and CoAP. The MQTT protocol offers various advantages, including its ability to save resources and be lightweight.

Utilizing a digital platform to extend the market is one of the steps of executing the industrial revolution in the agriculture sector through technology Purchasing and selling transactions conducted through e-commerce are technological advances that may be accessed easily anywhere using a smartphone. The mobile application's database must correspond to the existing data. Using IoT, it is possible to construct a system that connects breeders with purchasers; purchasers can obtain livestock information and developments without visiting the farm and only viewing it from the Caribi Application.

The Caribi Mobile Application is a marketplace platform that enables purchasing and selling transactions. The Caribi Mobile Application is developed to facilitate the purchasing and selling of livestock and may be accessed and utilized by anyone. The development of the Caribi Mobile Application is one of the attempts to develop e-commerce for breeders and grant them easy-to-utilize mobile devices; thus, they may transact anytime and anywhere. This research uses technology that can store databases integrated with the Caribi mobile application, namely Radio Frequency Identification (RFID) based on IoT.

2. Methods

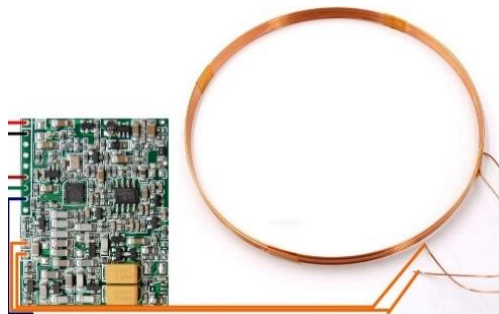**Radio Frequency Identification (RFID)**

Figure 1. Radio Frequency Identification (RFID)

Fig.1 show The RFID tag attached to livestock is depicted. Radio frequency identification (RFID) is a wireless identification system that retrieves data from an object using electromagnetic waves of a specific frequency. RFID technology consists of two principal components: RFID readers and RFID tags. An RFID tag is an instrument attached to an object and contains identification data (ID). On the other hand, the RFID Reader reads the identification data (ID) contained in the RFID Tag. RFID tags provide the same functionality as barcode labels. However, RFID has advantages over barcode labels, including being attached and concealed, not requiring direct visibility, and being used in harsh conditions, such as outside the home, among chemicals and humidity [5].

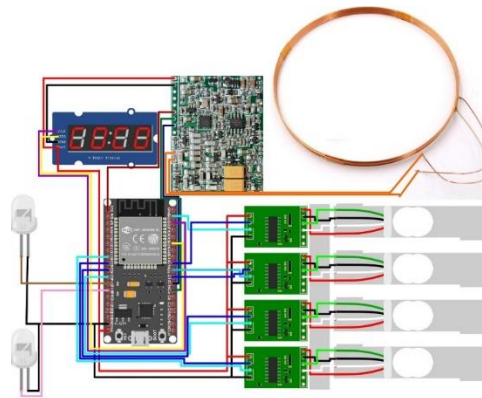**RFID based IoT System Architecture**

Figure 2. System Architecture

Fig. 2 show demonstrates the system architecture to be described in this research. This hardware includes input, processing, and output components. RFID is the system employed in this study [6]. Radio Frequency and Identification (RFID) is a technology that uses radio waves to identify specific objects automatically. In this study, an RFID tag was used to identify the inputs attached to the ears of animals that would be weighed. In addition, IoT utilized a programming argument that provides interaction between machines connected automatically, without human intervention, regardless of distance. The internet is the connection between the two machine interactions, while human function merely as regulators and direct supervisors of the device's operation. Ardiouno is used as a single Open source microcontroller. The primary component of the digital scale system is the Load Cell sensor.

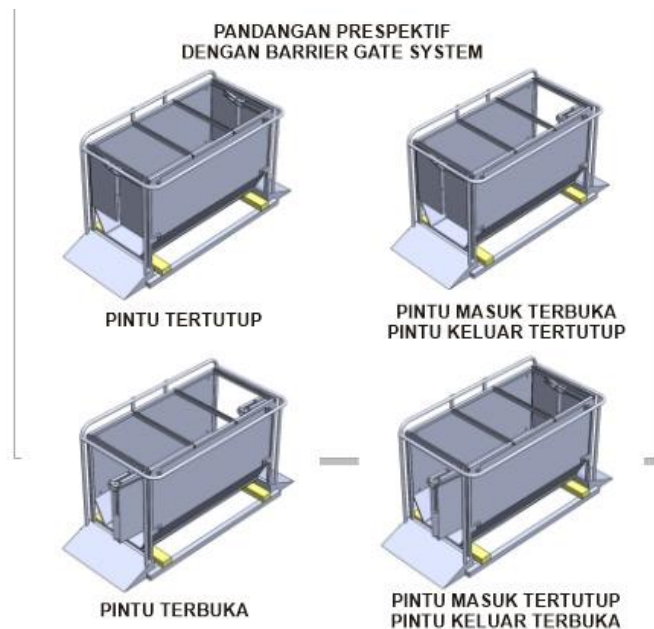**Design of Livestock Scales Equipment System**

Figure 3. Weighing Scale

The design of the livestock weighing equipment is demonstrated in Figure 3. Sheep livestock scales consist of an entry, an exit, and a weight sensor. The door features red and green lights to signify the sheep's entrance, and red and green lights on the portal indicate that the sheep have been weighed.

The weight sensor consists of four load cells attached to the base of the scale. This weighing device is designed; thus, precise data is generated.
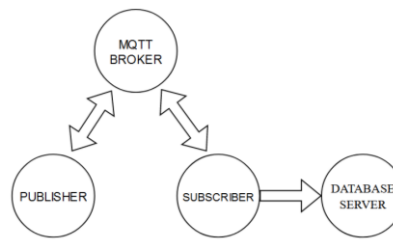
How It Operates

Figure 4. Data flow system

Figure 4 reveals the transmission of livestock weight information from the weighing procedure to the database server. The publisher is an ESP32, and the customer is a PC with a desktop application designed to receive data from the publisher. The data is subsequently sent to the database server for processing into product information. MQTT is the Messaging Protocol used by the microcontroller to send and receive data.

MQTT is processed using the publish-subscribe model of messaging. Publishers deliver messages, subscribers receive messages that interest them, and intermediaries relay messages from sender to recipient. Publishers and subscribers are MQTT clients which communicate exclusively with MQTT intermediaries. An MQTT client can be any device or application (from a microcontroller such as Arduino to a cloud-hosted application) that operates the MQTT library and connects to MQTT intermediaries through a network. The MQTT intermediaries are responsible for receiving messages from publishers and sending them to subscribers (and maintaining a list of topics that subscribers are interested in).
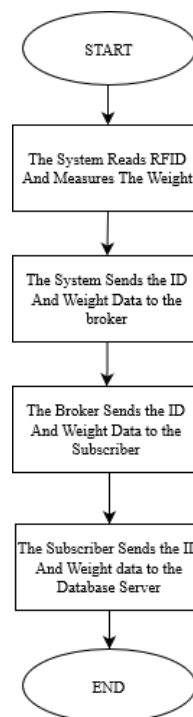

Figure 5. Flowchart system

Figure 5 demonstrates that the RFID reader will read the livestock's ID data when the animal enters the scale. Subsequently, the system measures the cattle's weight. The ID and weight data are transmitted through ESP32 to MQTT Broker. Data is delivered from MQTT intermediaries to the desktop application, which acts as the customer. The application sends data to the database server as material to be processed into information.

3.   Result and discussion

User Interface of the Caribi Mobile Application

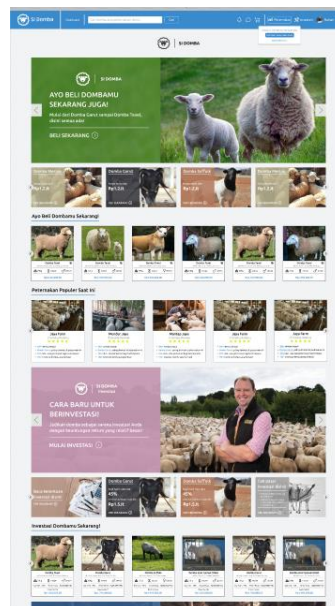**Figure 6.** The home page of the CARIBI mobile application

Figure 7. The home page of the CARIBI mobile application

Figures 6 and 7 depict the initial appearance of the Caribi application. Users of the Caribi application are breeders, purchasers and investors. In addition, Purchasers and investors can view the wide

variety of sheep that have been entered. Since the Caribi application is connected to the Internet of Things system, the application's data is correct and regularly updated

Weighting Instrument

Figure 8. IoT-based weighing equipment

Figure 9. IoT-based weighing equipment

Figures 8 and 9 illustrate weighing equipment for sheep livestock equipped with an Internet of Things system. This IoT system will store sheep weight data connected to the Caribi mobile application. In addition, this IoT system consists of an Arduino microcontroller and a Load Cell Sensor. Arduino Uno controls and processes data from the input device before transmitting it to the output, which is the Caribi application. Load cell sensors are used to convert loads into electrical changes.

Weight Measure Test

Loads in the form of goods are employed to test the IoT system using conventional scales, and the results are compared with the IoT system's measurement data. The table below demonstrates that the average measurement error is 4.59%.

Table 1. Weighing test

No	Goat ID	System Measuring Result (Kg)	Measurement Results of Measuring Instruments (Kg)	Error Rate (%)
1	124fahvf	31	29	6,45%
2	QadZ145	12	12	0,00%
3	124fahvf	31	30	3,23%
4	QadZ145	12	11	8,33%
5	134ASALDCW	21	20	4,76%
6	134ASALDCW	21	20	4,76%
Error Rate Average				**4,59%**

Data Transfer Test

Table 2. Database system test

No	Goat ID	System Measuring Result (Kg)	Database Status (Receive/Not)
1	124fahvf	31	Receive
2	QadZ145	12	Receive
3	124fahvf	31	Receive
4	QadZ145	12	Receive
5	134ASALDCW	21	Receive
6	134ASALDCW	21	Receive

During testing, experiments were carried out six times to transfer data from the Arduino microcontroller to the database server. The experimental findings reveal that the database correctly receives all data transmitted by the system and displays it in the Caribi application.

4.   Conclusion

IoT-based RFID in the Caribi mobile application enables e-commerce for the purchase and sale of sheep, making it easier for all parties to receive accurate data. The instrument for measuring the weight of sheep can regularly update sheep data to remain current. The results of the tests indicate that the livestock weighing equipment has a low error rate of 2%. The Caribi Mobile application is anticipated to enhance the purchase and sale in the livestock sector.

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