IOT BASED SMART WEIGHING MACHINE INTERLINK WITH POS MACHINE IN RATION SHOP

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ABSTRACT

This paper proposes an innovative IoT-based smart weighing machine interlinked with a Point of Sale (POS) machine for ration shops. The system aims to automate and streamline the ration distribution process, ensuring transparency, accuracy, and efficiency. The smart weighing machine, equipped with sensors and Bluetooth connectivity, accurately measures the quantity of ration items and transmits the data to the POS machine. The POS machine, integrated with the weighing machine, automatically updates the transaction records and generates receipts. The system also enables real-time monitoring and tracking of ration distribution, allowing authorities to detect any discrepancies or malpractices. Additionally, the system provides a user-friendly interface for ration shop owners to manage their inventory and track sales. The proposed system has been tested in a real-world setting, demonstrating improved accuracy, reduced manual errors, and enhanced transparency in ration distribution. Results show significant benefits for ration shop owners, customers, and authorities, including reduced waiting times, improved inventory management, and increased accountability. Overall, the IoT-based smart weighing machine interlinked with POS machine offers a viable solution for modernizing ration distribution systems and ensuring efficient delivery of essential commodities.

Keywords: Public Distribution System, Point of Scale, smart weighing machine, Global System for mobile communication, Global attention & Cyber Physical systems.

1. INTRODUCTION

The Public Distribution System (PDS) is a vital component of the social welfare infrastructure in countries like India, where it ensures the availability of essential commodities such as rice, wheat, sugar, and kerosene to the economically weaker sections of society. Ration shops are the backbone of this system, providing food and household supplies at subsidized prices. However, despite its importance, the traditional ration shop system is plagued by several operational inefficiencies and integrity issues. Problems such as manual errors in weight measurement, lack of accurate record-keeping, fraudulent

practices, delays in service, poor inventory management, and lack of transparency have severely affected the trust and efficiency of the system.

With the rapid advancement in technology, the integration of Internet of Things (IoT) with Point of Sale (POS) systems presents an opportunity to revolutionize the way ration shops operate. This project proposes an IoT-based smart weighing machine integrated with a POS system that aims to automate and streamline the ration distribution process, thereby eliminating manual inaccuracies and increasing accountability. The smart weighing machine is embedded with precision load sensors capable of measuring the exact weight of distributed items. The measured data is then transmitted via Bluetooth or Wi-Fi to a connected POS terminal.

This project proposes the development of an IoT-based smart weighing machine integrated with a Point of Sale (POS) system for ration shops. The goal is to digitize the ration distribution process to ensure accuracy, transparency, efficiency, and accountability. The system uses a smart weighing machine embedded with load sensors capable of measuring commodities with high precision. This device is connected to a POS machine via Bluetooth, Wi-Fi, or other wireless communication methods.

When a ration item is weighed, the data is automatically transmitted to the POS machine, which then processes the transaction, calculates the cost based on government pricing, and generates a digital receipt. This eliminates the possibility of human tampering and ensures that the beneficiary receives the correct quantity. Additionally, the POS system maintains real-time transaction logs, inventory data, and consumer usage records, all of which can be stored and monitored through a cloud-based platform.

This integration not only improves the efficiency of individual ration shops but also enables centralized monitoring by government officials. Authorities can track the movement of goods, identify discrepancies, and take timely corrective actions. The system also reduces customer waiting time and provides a user-friendly interface for shop owners to manage their inventory and daily operations.

Furthermore, the proposed system supports remote diagnostics and maintenance, making it a scalable and future-ready solution for rural and urban implementations alike. By combining IoT with POS, the system introduces automation, enhances trust in public distribution, and helps curb malpractices that plague the current manual systems.

In conclusion, the IoT-based smart weighing machine interlinked with a POS system is a technologically advanced, cost-effective, and scalable solution aimed at reforming ration distribution. It ensures that food subsidies reach the rightful beneficiaries efficiently while reducing wastage, improving service delivery, and reinforcing transparency in government-run distribution networks.

2.LITERATURE SURVEY

2.1.Ali, Shaik Farooq, and Shaik Imran. "A Smart and Systematic Ration Grocery and Liquid Materials Vending Machine using Internet of Things." In *2023 6th International Conference on Recent Trends in Advance Computing (ICRTAC)*, pp. 778-783. IEEE, 2023.

A ration card is essential for every household, since it may be used as evidence of address, for obtaining a gas connection, for verifying family membership, and for many other reasons. Ration card holders may purchase at designated stores for staples including rice, wheat, coconut oil, and more. The current ration system has two flaws: the measurement of the product may be incorrect due to human errors, and if the materials are not bought until the close of a given month, proportion retailers are going to market it to other people at higher prices with no the knowledge of the customers or the government. The purpose of this article is to provide an automated filling machine that can fill all of a customer's ordered items at once. The load-cell feedback used in this equipment ensures precision in weight readings and protects clients from being duped. Ration dispensing machines are the subject of this research. Conventional ration systems for distribution waste a lot of money, so this automated machine was designed to do away with that. Instead of using paper ration cards, this method uses RFID tags as electronic rations. The current Ration store system has several flaws. They are slow to process data. Because of a lack of workers, filling and packaging orders takes an inordinate amount of time. Many ration vendors even under-weigh the goods despite the fact that the consumer has specified a specific weight. The purpose of this article is to provide an automated filling machine that can fill all of a customer's ordered items at once. The load-cell feedback used in this equipment ensures precision in weight readings and protects clients from being duped.

2.2.Suresh, K. P., R. Dhivya Dharshini, AB Keerthi Varshan, A. Arun, and M. Mohamed Umar Ali. "Design and Development of RFID based Unmanned Smart Ration Distribution System." In *2024 International Conference on Inventive Computation Technologies (ICICT)*, pp. 2130-2135. IEEE, 2024.

The Public Distribution System (PDS) in India is an extensive retail network that works to guarantee food security for the country's population. It is one of the biggest retailing systems in the world, operating on a gigantic scale. The main objective is to give people access to subsidized vital food grains. Under the control of state governments, the system distributes ration cards that allow people to buy goods including rice, wheat, kerosene, sugar, and oil. A suggested remedy in view of the existing circumstances is the "Automated Public Distribution System based on RFID, GSM and At mega." This technology automates every step of the procedure, including food grain delivery and billing. Reducing corruption and

difficulty activity, such goods smuggling etc. Improved validation, adaptability, and transparency inside the PDS are all promised by the suggested solution.

3.EXISTING SYSTEM

The existing ration distribution system in most regions is largely manual and outdated. Typically, ration shops rely on mechanical or digital weighing scales operated manually by the shopkeeper. The weight is read and recorded either in a register or entered manually into a standalone Point of Sale (POS) device, often without verification. This approach has led to a range of inefficiencies, inaccuracies, and opportunities for corruption.

One of the most pressing issues in the current system is the lack of integration between the weighing machine and the POS terminal. This disconnect makes it possible for dishonest practices to occur, such as under-weighing commodities, providing lower-quality goods, or manipulating records. Additionally, because the process is not automated, customers often face long waiting times, especially during peak hours or when system errors occur.

The absence of real-time monitoring and automated reporting also limits the government's ability to ensure accountability in the Public Distribution System (PDS). Without real-time insights, there is no effective way to detect misuse or stock shortages until after the fact, by which time losses may have already occurred.

Inventory management is another challenge. Shopkeepers have to manually check stock levels and reorder supplies, which can result in overstocking or stockouts. This affects the availability of essential commodities for beneficiaries.

In summary, the existing system is inefficient, lacks transparency, and fails to leverage modern technology to ensure accurate, fair, and efficient ration distribution. These limitations highlight the urgent need for an automated and integrated system—such as the proposed IoT-based smart weighing machine with POS integration—to address these longstanding issues.

3.1DRAWBACKS OF EXISTING SYSTEM

- **Manual Weighing Errors** – Inaccurate measurement due to human error or deliberate manipulation.
- **Lack of Integration** – No synchronization between weighing machine and POS, allowing data tampering.
- **Data Entry Mistakes** – Manual input increases chances of typing errors and transaction inconsistencies.

- **No Real-Time Monitoring** – Government and authorities cannot track transactions as they happen.
- **Fraud and Corruption** – Opportunities for under-weighing, black marketing, and diversion of ration items.
- **Poor Inventory Management** – Manual stock tracking leads to frequent stockouts or overstocking.
- **High Customer Waiting Time** – Manual processing causes long queues and delays in service.
- **No Centralized Data Storage** – Difficulty in auditing, analysis, or retrieving historical data.
- **Low Transparency** – Beneficiaries cannot verify the accuracy of the ration distributed.
- **Limited Accountability** – Lack of traceable digital records makes it hard to assign responsibility.
- **No Alert Mechanism** – System does not notify shopkeepers or authorities about low stock or anomalies.

4. PROPOSED SYSTEM

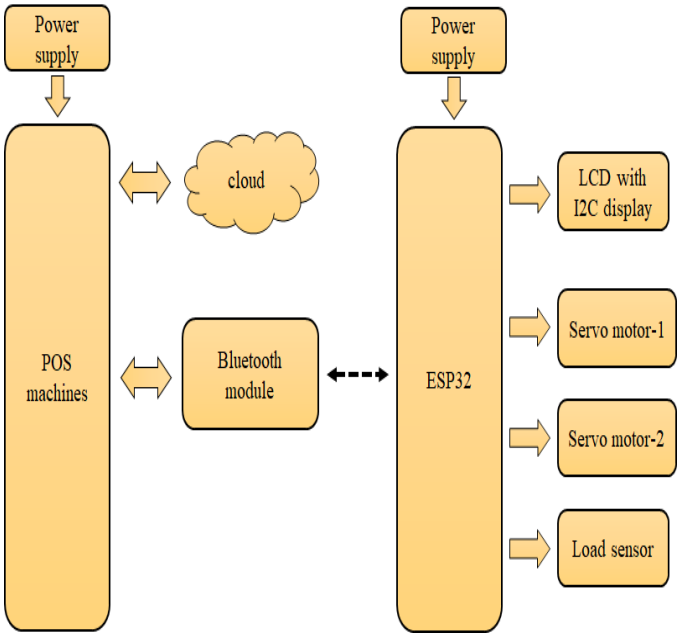
The proposed IoT-based smart weighing machine system integrated with a Point of Sale (POS) system is designed to enhance the efficiency, transparency, and accuracy of ration distribution in ration shops. This system automates the weighing and transaction process, ensuring that the correct quantity of ration items is dispensed, while also eliminating manual errors and reducing waiting times for customers.

The smart weighing machine, equipped with sensors, measures the weight of ration items such as rice, wheat, or sugar. The data from the weighing machine is transmitted wirelessly via a Bluetooth module to the POS system. The POS system automatically updates the transaction details and verifies the customer's eligibility (e.g., through a ration card) in real time. This eliminates the need for manual data entry, improving both accuracy and operational efficiency.

Once the transaction is processed, the POS system generates a receipt, which can be printed or sent digitally to the customer, confirming the details of the transaction. The system also tracks inventory levels and updates them automatically as items are dispensed, providing real-time insights into stock levels and ensuring better inventory management.

Moreover, the system offers remote monitoring capabilities, allowing shop owners or authorities to oversee transactions and inventory, track sales data, and detect discrepancies or potential fraud. The integration with the cloud enables easy access to transaction records, improving transparency and accountability.

4.1 BLOCK DIAGRAM



The proposed system not only streamlines ration distribution but also promotes sustainability by reducing waste, improving resource allocation, and enhancing the overall customer experience. It serves as an effective solution for modernizing ration shops, making them more efficient, transparent, and accountable.

5. HARDWARE DESCRIPTION

5.1 SERVO MOTORS

In the IoT-based smart weighing machine interlinked with a POS system for ration shops, two servo motors play an essential role in automating and controlling the accurate dispensing and distribution of ration commodities. The first servo motor is primarily responsible for controlling the release mechanism of the ration items from a storage container onto the weighing scale. This motor operates a valve or gate that opens to allow a specific quantity of goods (such as rice, wheat, or sugar) to be dispensed. The motor works in synchronization with the load cell (weighing sensor) and the microcontroller to ensure that the exact quantity required is dispensed. As the weight approaches the target amount, the servo motor gradually slows or closes the dispensing valve to avoid overflows, ensuring high accuracy and preventing wastage or fraud.

The second servo motor is typically used to control either a collection flap, a movable tray, or a mechanism that allows the end-user to access the dispensed goods. Once the correct amount of commodity is dispensed and verified by the weighing system, the second servo motor activates to open a

collection door or move a container into position. This ensures that the customer only receives the rationed items after accurate measurement and successful verification through the POS machine. It also helps prevent tampering, double dispensing, or premature access to goods.

Both motors are tightly integrated with the microcontroller and communicate with the POS system and cloud infrastructure in real-time. When a customer authenticates themselves and selects a ration item via the POS interface, the microcontroller commands the first motor to begin the dispensing process. After the precise weight is achieved, the system logs the data, updates the inventory, and then activates the second motor to enable safe collection of the items. This coordinated automation between the servo motors and IoT elements ensures a secure, efficient, and transparent ration distribution process that minimizes manual errors, enhances accountability, and promotes digital governance in public distribution systems.

By automating these processes, the system improves accuracy, efficiency, and transparency in ration distribution, ultimately reducing manual errors, enhancing inventory control, and fostering accountability in the public distribution system.

This feature prevents early collection, spillage, or double dispensing, ensuring the process is both transparent and secure. Both servo motors work in synchronization with the microcontroller, which is connected to the POS system and the cloud, enabling real-time data transmission and monitoring.

5.2 POS MODULE

The **POS (Point of Sale) module** is a critical component in the IoT-based smart weighing machine system, particularly in applications like ration shops, where it integrates seamlessly with other devices to

manage transactions, inventory, and customer interactions. The POS module serves as the interface where all the data related to purchases, weighing, and inventory management are processed and stored.

In this context, the POS module is connected to the **weighing machine** via the Bluetooth module, which allows it to receive real-time data about the quantity of ration items dispensed. When the weighing machine measures the ration, the POS system automatically updates the transaction record, ensuring that the correct amount is dispensed to the customer. This eliminates the need for manual entry of quantities and reduces human error, enhancing the accuracy of the transaction.

The POS system is also responsible for managing **customer details**, such as verifying eligibility (e.g., checking ration card information), **generating receipts**, and tracking inventory levels. Once the data from the weighing machine is received, the POS system can cross-reference the transaction with customer records, update the available stock in the inventory, and create a **receipt** that confirms the purchase. This can either be printed physically or sent digitally to the customer via email or SMS, providing them with proof of the transaction.

Furthermore, the POS module can be integrated with **cloud-based systems**, allowing for real-time monitoring and tracking of transactions. Authorities or shop owners can access this data remotely, ensuring transparency, accountability, and reduced opportunities for fraud. The system can also generate reports for auditing purposes, track sales trends, and provide insights into customer behaviour.

In summary, the POS module in this IoT-based system streamlines operations by automating the transaction process, improving transparency, reducing errors, and ensuring accurate record-keeping, all while making the overall ration distribution process more efficient.

The POS module also plays a role in **inventory management**, where it monitors stock levels in real-time. If inventory runs low, the system can trigger alerts for restocking, preventing shortages or mismanagement.

6. SOFTWARE REQUIREMENTS

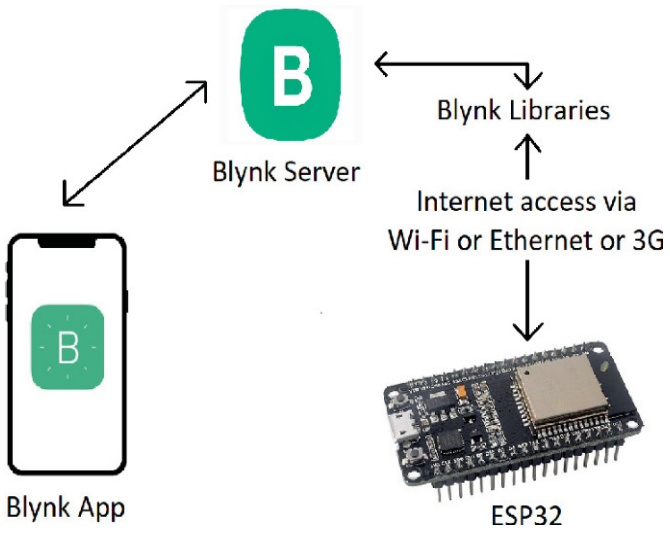
The core feature of Blynk is its mobile app, available for both iOS and Android devices. This app provides an easy-to-use platform for creating custom dashboards that allow users to interact with their hardware through a variety of widgets. Widgets such as buttons, sliders, gauges, graphs, and colour pickers provide the user interface for controlling devices, monitoring sensor data, and receiving real-time alerts. These widgets are intuitive and customizable, allowing users to design applications that suit the specific needs of their IoT projects.

The communication between the hardware and the mobile application is facilitated through Blynk's cloud server, which acts as an intermediary for transmitting data. When a device such as an ESP32 or Arduino is connected to Blynk, it sends sensor readings, status updates, or command signals to the cloud server, which then forwards this data to the app on the user's smartphone.

Blynk supports a variety of communication protocols, making it adaptable to a wide range of IoT projects. It can use Wi-Fi, Ethernet, GSM, and USB for communication between devices and the cloud. This flexibility allows developers to use Blynk in diverse environments, whether they are building a smart home automation system, monitoring industrial equipment, or creating custom wearable devices. Additionally, Blynk supports multiple device integration, enabling users to connect and manage several devices simultaneously through the same app, which is ideal for larger IoT networks.

One of Blynk's significant advantages is its scalability. The platform is suitable for both small-scale prototypes and large-scale systems that can support thousands of devices. Blynk makes it easy to integrate new devices, adjust settings, and monitor performance at any scale.

Blynk also allows users to receive notifications through the app, which can be triggered by specific events or thresholds. These notifications can be in the form of push alerts, keeping users informed about the status of their devices. For example, users can be alerted when a sensor detects unusual readings, when a motor requires attention, or when specific environmental conditions change.



The platform is not only suitable for hobbyists and makers but also scalable enough to be used in commercial applications. From smart home systems to industrial monitoring, Blynk provides a flexible and affordable solution for managing and controlling IoT devices. Its ability to seamlessly connect hardware to mobile applications, paired with its cloud-based communication model, makes it an invaluable tool for anyone involved in IoT development. In conclusion, Blynk is a powerful and intuitive IoT platform that offers a broad range of features for building, managing, and controlling IoT devices. Whether for prototyping or full-scale deployment, Blynk's visual interface, extensive device compatibility, scalability, and cloud-based communication make it a top choice for developers looking to create innovative IoT solutions quickly and efficiently.

7. RESULT AND DISCUSSION

This project represents a prototype for an automated ration distribution system designed to improve efficiency, accuracy, and transparency in public distribution systems. It primarily focuses on automating the measurement and controlled dispensing of rationed commodities like rice, wheat, or sugar. The setup is suitable for use in ration shops, where human errors and malpractices can often disrupt fair distribution.

The system is powered by two ESP32 or Node MCU microcontrollers, which handle different tasks such as sensor data processing, control logic, and wireless communication. These microcontrollers are equipped with Wi-Fi capabilities, allowing them to send real-time data to a central server or dashboard for monitoring and record-keeping. This enables transparency and accountability in the distribution process.

A load cell, placed at the bottom right of the board, is used to measure the weight of the dispensed commodity. It is connected to an HX711amplifier module, which converts the analog signals from the load cell into digital form for the microcontroller to interpret. This ensures that the exact quantity of

rationed goods is measured and dispensed with precision.

To manage the dispensing mechanism, two servo motors are included in the setup. These motors act as automated gates or valves that open and close based on the measured weight, allowing for hands-free and accurate distribution. An LCD display is also integrated to show live information such as the measured weight, system status, or transaction details, making the system user-friendly and informative.

The entire circuit is powered by a regulated power supply module, ensuring consistent voltage to all electronic components. With this setup, the project successfully demonstrates a smart ration distribution model that reduces human interference, prevents pilferage, and promotes fair and efficient service

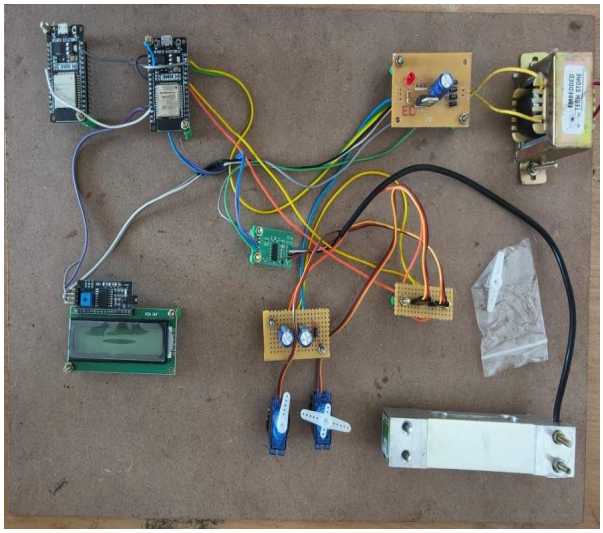


Figure7.1Hardware Kit without Load

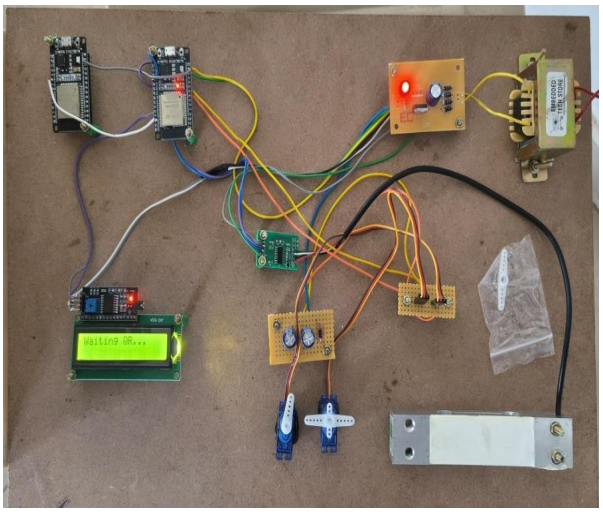


Figure7.2 Hardware Kit with Load

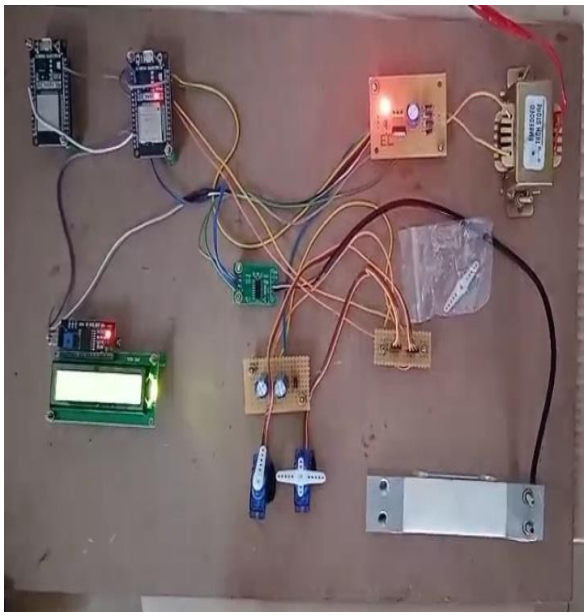


Figure7.3Smart Weighing Machine Output

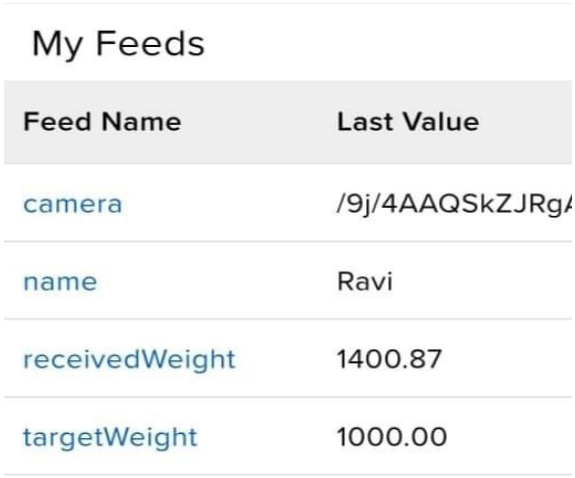


Figure7.4 POS Module Given Output

8. CONCLUSION

The rapid advancement of technology has paved the way for innovative solutions in various sectors, including agriculture, healthcare, water management, and even everyday systems such as ration shops. This paper explores an IoT-based system designed to automate processes, enhance accuracy, and ensure efficiency in managing essential services like ration distribution and farming. By leveraging IoT technologies, the proposed systems offer a significant transformation in how these industries operate, bringing about positive changes in sustainability, transparency, and resource management.

The IoT-based **smart weighing machine interlinked with a POS system** for ration shops, as described in the paper, demonstrates the potential for automating and streamlining distribution processes. The integration of real-time data communication between the weighing machine and POS system offers increased transparency, reduces human error, and enhances the accuracy of transactions. Furthermore, it ensures that ration distribution is properly monitored, minimizing malpractices and ensuring accountability. The ability to track and manage inventory efficiently will not only reduce wastage but also contribute to better inventory control and efficient delivery of services.

Similarly, the **smart IoT solution for sustainable farming** showcased the impact of advanced technologies in agriculture. By integrating IoT sensors, drones, and satellite imaging, this system enables farmers to monitor critical factors such as soil moisture, temperature, and crop health. The system uses advanced analytics and machine learning to provide real-time insights and recommendations, helping farmers optimize irrigation, fertilization, and pest control. This not only improves crop yields but also

reduces water and energy consumption, contributing to sustainable farming practices. The scalability of the system makes it adaptable to different types of farms, whether small-scale or large industrial operations, promoting a more sustainable food production system globally.

Both systems offer practical solutions to some of the most pressing issues in their respective sectors—be it resource wastage, inefficiency, or lack of transparency. The integration of real-time monitoring, data analytics, and automation has the potential to greatly improve operational efficiency, reduce costs, and foster sustainability.

In conclusion, the IoT-based solutions discussed in this paper are not just technologically advanced but are also scalable, flexible, and cost-effective. They hold immense potential to transform industries, improve the quality of services, and make significant strides toward sustainability. The future of these systems lies in further research, continuous innovation, and implementation across various sectors to maximize their benefits for society at large. As these technologies continue to evolve, their ability to improve efficiency, reduce waste, and increase accountability will be critical in addressing global challenges such as food security, resource management, and environmental sustainability.

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