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Smart Rationing System

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Abstract: *The Smart Ration Distribution System is an embedded, hardware-based solution designed to eliminate corruption, manual errors, and inefficiencies in the Public Distribution System (PDS). It replaces the traditional paper-based process with a technology-driven setup that uses RFID smart cards, microcontrollers, and LCD displays to automate the identification of beneficiaries and distribution of food grains. Each user is provided with a unique RFID card containing personal details and monthly entitlements. At the ration shop, the card is scanned to access real-time data, allowing users to view available stock and remaining ration balance on the LCD screen. Through simple push-button inputs, users can select the quantity of items they wish to collect. The system then automatically updates the central record, ensuring accurate, tamper-proof data and eliminating fake entries or unauthorized claims. Operating in offline mode, it is both cost-effective and suitable for rural areas. This system promotes transparency, security, and efficiency, ensuring that government subsidies reach only the rightful beneficiaries. Future integrations may include biometric authentication and blockchain technology for improved scalability and security.*

Keywords: Smart Ration System, RFID Smart card, Microcontroller, LCD Display

I. INTRODUCTION

The Indian Ration Card is a crucial document that ensures food security by providing subsidized food items like rice, wheat, and sugar through the Public Distribution System (PDS), particularly to BPL, APL, and Antyodaya families. It also acts as a valid identity proof for availing various government schemes and services. Despite digital advancements, the traditional ration system still faces challenges such as fake card issuance, long queues, stock mismanagement, and corruption by ration shopkeepers, often depriving the needy of their entitlements. To overcome these issues, the Smart Ration Distribution System proposes a technology-based upgrade using RFID smart cards, microcontrollers, LCD displays, and push buttons. Each beneficiary receives an RFID card containing their personal details and ration entitlements. When scanned at the shop, the system verifies their data, displays available stock, and processes the transaction digitally. This automates inventory tracking and updates records in real-time. Additionally, each transaction is logged online, allowing both users and authorities to access data transparently. This reduces manual errors, prevents fraud, and ensures timely and fair distribution of government-subsidized goods, making the system more secure, efficient, and accountable.

II. METHODOLOGY

The RFID-Based Smart Ration Distribution System employs a comprehensive approach that merges both hardware and software to upgrade the Public Distribution System (PDS). Central to the setup is an ARM microcontroller that oversees all system functions. The process begins with authenticating users: each beneficiary holds a smart ration card embedded with a passive RFID tag containing their unique identification and entitlement details. When the card is scanned, the RFID reader transmits this data to the ARM controller, which verifies the credentials against a preloaded database. If the details match, the beneficiary gains access to the system interface, where they can select items such as rice, wheat, or sugar via push buttons. The controller records the transaction, updates the beneficiary's entitlement, and adjusts the inventory in real time to reflect accurate stock levels. Should the card be deemed invalid, the system denies access and

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informs the user through an LCD display. Once a transaction is completed, all relevant data—including user ID, chosen goods, and updated inventory—is uploaded to an online portal. This digital record-keeping facilitates centralized monitoring by officials and allows beneficiaries to review their transaction history, thereby reducing the risks of manual record manipulation and fraud. The system's design features an intuitive interface with straightforward controls and an LCD that provides real-time updates and alerts, ensuring ease of use even for individuals with limited technical skills. A reliable power source keeps all components operational without interruption. Additionally, the incorporation of RFID technology not only speeds up transactions but also bolsters security by preventing the misuse of counterfeit cards or manual inventory tampering. Overall, this integrated methodology ensures that the ration distribution process is efficient, transparent, secure, and scalable, markedly enhancing service delivery within the PDS framework.

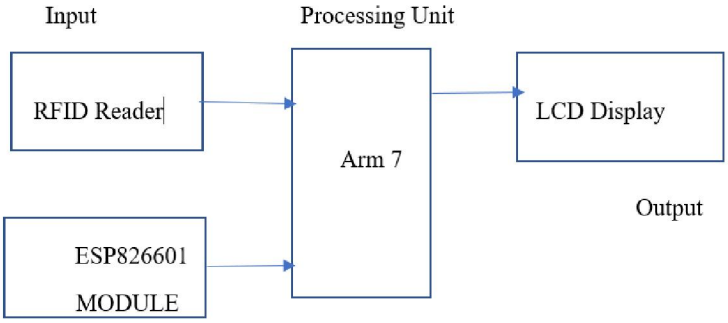

Figure No .1 Block Diagram Smart Rationing System

III. FLOWCHART

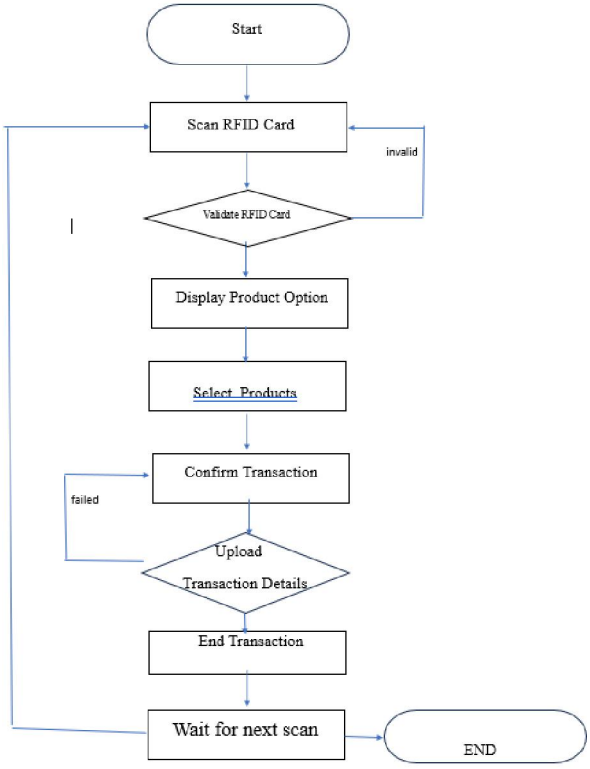

Figure.2. Flowchart

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IV. LITERATURE SURVEY

The integration of IoT in Public Distribution Systems (PDS) and Smart Ration Cards brings major improvements in transparency, safety, and efficiency. Mast. Amarsinh Desai (2022) These systems use biometric fingerprint verification through Minutiae extraction algorithms to ensure only rightful beneficiaries access the rations, reducing the risk of fake cards and manual distribution errors [7].

An Android app supports users in selecting items and tracking quantities. Appireddygari Chirudeepesh Reddy, Gonuguntla Prasad, Kunchapu Harish, Shreesha Kalkoor M (2023) One of the biggest strengths is its ability to curb corruption. Since all transactions are digitally logged in a centralized database, authorities can easily audit and verify records, promoting accountability and minimizing ration fraud [8]. Mr. Gurumallesh M, Mr. Gokul Kumar, Mr. Hoysala Vishnu G, Mr. Bharath C, Dr. Bhaskar (2020). The system also avoids direct contact with goods, ensuring better hygiene during distribution [9]. D. Malathi, Vijayakumar Ponnusam (2022) IoT-based solutions save time by removing the need for long queues. Ration is directly linked to smart cards, and QR code-based asset tracking ensures secure transportation of goods, reducing theft and black-market activity [1].

Mrs. Sathya, Karthikeyan, Monish Kumar (2023) Despite no Indian state having a fully automated system, surveys show that traditional methods suffer from issues like poor stock availability, inaccurate instruments, and outdated rate charts—problems that this system can address [12]. Shivakumar Swamy N, Manjunath. R, Shruthi S (2022) By reducing dependency on manpower, the automated setup lowers operational costs and boosts accuracy. Its scalable nature makes it suitable for both villages and cities. Voice-assisted kiosks in local languages like Tamil help even illiterate users access services easily [6].

Shivaanivarsha N, Vigita S, Santhini V (2021) These systems can also support disaster response with real-time monitoring and efficient stock management during emergencies [4]. Mrs. Snehal S. Golait, Ms. Lutika Kolhe, Ms. Snehal Rahangdale (2020) By updating customer accounts after each withdrawal, the system prevents unauthorized entries and ensures that beneficiaries don't lose their entitled materials if missed [11].

Sathya.M.P. P, Jayachithra.S, Muthu Kumara Pandian (2020).Finally, the use of GSM-based updates to a central database ensures real-time stock tracking, reducing manual workload and enhancing government oversight [15]. Overall, these smart systems can transform ration distribution by making it more transparent, secure, and reliable [9]

V. RESULTS

The RFID-Based Smart Ration Distribution System has shown great potential in upgrading the traditional Public Distribution System (PDS) into a more secure, streamlined, and technologically advanced model. Utilizing RFID technology enables fast and precise identification of beneficiaries, which helps reduce errors and ensures that subsidies are received only by eligible individuals. With automated transaction tracking and real-time data updates, the distribution process becomes more transparent and easier to audit. Incorporating a web-based portal enables centralized supervision, allowing officials to instantly view distribution statuses and quickly identify and address any discrepancies. The system has also drastically cut down on human involvement, which has historically contributed to inefficiencies and corruption. By eliminating manual tasks, it reduces the risk of fraud, such as the misuse of fake ration cards or mismanagement of supplies. Its simple controls and intuitive user interface make the system easy to operate, even for users with limited technological skills, improving accessibility for all beneficiaries. Beyond immediate improvements in efficiency and fraud prevention, the system is highly scalable and flexible, making it well-suited for deployment in both densely populated urban areas and remote rural regions. Since it works well with existing infrastructure, the solution is also budget-friendly and doesn’t require major new investments. Overall, this system has not only streamlined the ration distribution process but has also enhanced the experience for both users and administrators. By ensuring timely, fair, and accurate distribution of subsidized food and essentials, it plays a vital role in improving food security and ensuring that government welfare programs reach the people who need them most. This contributes meaningfully to the broader vision of inclusive growth and national welfare

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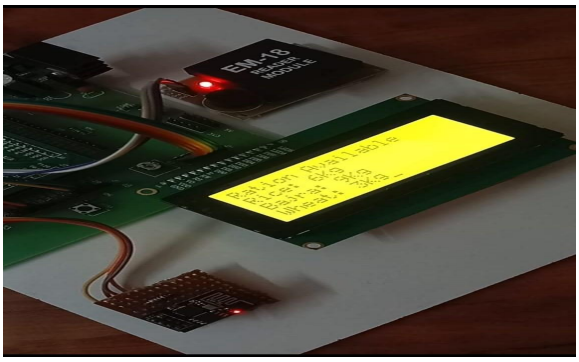

Fig. 3. Showing how much ration Available

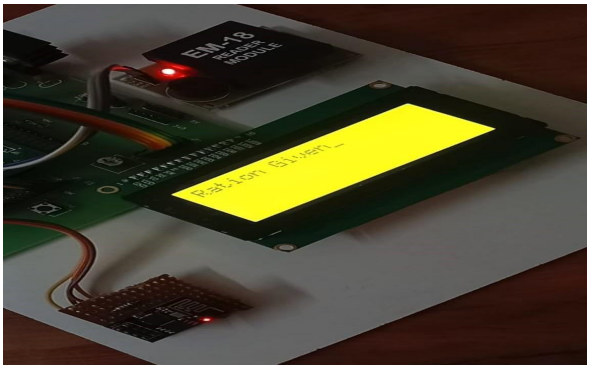

Fig.4. Showing ration given

VI. CONCLUSION

The RFID-Based Smart Ration Distribution System significantly improves the transparency, accuracy, and security of the Public Distribution System (PDS). By replacing manual processes with automation, the system minimizes human errors and fraudulent practices that have long affected the traditional setup. Real-time data synchronization ensures that each transaction is recorded accurately, allowing for better monitoring and immediate detection of irregularities. Automatic inventory and transaction updates reduce stock discrepancies and eliminate the need for manual record-keeping. The system includes a web portal where transaction details are uploaded, enabling authorities to supervise distribution and resolve issues quickly. This transparency builds trust and accountability in the rationing process. Additionally, the system ensures a user-friendly experience for beneficiaries, allowing only verified individuals to access subsidized goods with ease. This aligns with the government's goal of establishing a digital, corruption-free welfare distribution mechanism. Overall, the proposed solution modernizes the PDS infrastructure, making it more adaptable for use in both rural and urban settings. By reducing inefficiencies and ensuring fair access to resources, it represents a scalable and sustainable step toward an inclusive and transparent public welfare system.

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