

# Automated Ration Dispensing System for Public Distribution System (PDS)

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## Abstract

An automated ration dispensing system is proposed to disperse the ration through Public Distribution System (PDS) without human intervention. The system ensures that leakage is minimized and the benefit reaches the needy people, in accordance with the Government policy. It helps in identifying the beneficiaries accurately on the basis of their biometrics, weeding out bogus ration cards. It eliminates inaccuracy in the measurement of grains during dispensing and helps in preventing the food grains from reaching the open market illegally. The data regarding the inventory received, distributed and the stocks remaining in the shop are updated, in real time, in a central server. Further, the data generated in the system can be utilized for policy formulation and implementation to continuously evolve in order to meet changing requirements. The proposed system is a case of technology adoption for robust policy implementation.

**Keywords:** Public Distribution System (PDS), ration dispensing, load cell, biometrics.

## 1. Introduction

Public Distribution System (PDS) is a nourishment security structure set up by the Government of India, in association with the state governments, for the benefit of poor and the undernourished. It offers sponsored nourishment and non-sustenance things to India's poor. The food grains distributed through ration shops include wheat, rice, sugar and kerosene. Nourishment grains to poor people are supplied at subsidized prices lower than in open market, by directly procuring the grains from farmers, guaranteeing them with a minimum support price (MSP) determined by the Government based on input costs [1]. A significant rise in the beneficiary households of PDS is observed from 27% in 2004-05 to 52% by 2011-12 [2]. The National Food Security Act (NFSA) mandates that the Governments should introduce schemes for cash transfers to bank accounts of beneficiaries directly to eliminate leakages [3]. A study is carried out on the performance of Targeted PDS in Karnataka and the food security scheme called Annabhagya, highlighting its merit and demerits with suggestions for improvement [4]. A unique identification based centralized model for the Indian Public

Distribution System is proposed to address various issues like pilferage [5]. The design and implementation of automation in ration shops based on embedded PLC is presented [6]. A web based PDS system using QR-code and smartcards is proposed for user authentication and to ensure better inventory management using GSM [7].

The Public Distribution System of India suffers from several shortcomings:

1. Quality of sustenance grains distributed through PDS is inferior.
2. Diversion of good quality grains to open market for illegal monetary gains and replacing it with poor quality grains.
3. Bogus ration cards to procure food grains to sell in the open market.
4. Irregularities in the recognition of beneficiary families and distribution of commodities.
5. Failure to achieve price control and stabilization of basic commodities.

## 1.1 Objectives

The proposed work focuses on developing an efficient and fully automated framework consisting of the ration shop and a central database with simple and easy to use human interfaces to address various shortcomings in the PDS. The salient features of the proposed system are listed as follows:

1. A fully automated system to bring in transparency and efficiency in the entire supply chain of the system.
2. A fingerprint based biometric identification module for user authentication.
3. A stepper motor based automated dispensing unit with load cell feedback for accurate measurement of grains [6].
4. A real-time database with alerts to FPS and consumers using GSM module to ensure better inventory management [7].

5. Creation of real-time database at both the FPS level and state level.

The paper is organized as follows: Section 2 describes the automated ration dispensing system with operational details. While Section 3 presents the results obtained on the prototype of the system, Section 4 outlines the conclusions.

## 2. Automated Ration Dispensing System

The block diagram of the automated ration dispensing system for PDS is shown in Figure 1. The core of the system consists of ARM7 LPC2148 microcontroller to monitor and control the operation of the entire system. The fingerprint sensor authenticates the beneficiary on arrival at the fair price shop (FPS). The grains and the quantity entitled are entered using the push buttons. While the load cell weighs the grains accurately, the stepper motor and DC motor system dispense the grains. The GSM is used to send messages and LCD displays messages.

The ARM7 microcontroller is responsible for data collection from Human-Machine Interface (HMI) devices such as finger print sensor, keypad and the LCD and generates appropriate output for the motors (Stepper and DC motor) to operate in a pre specified procedure. A mobile number and a unique mark are enlisted alongside each ration card holder in a database and a message is sent to their mobile notifying the availability of their ration. The beneficiary confirms his unique identification mark, enters the amount of food grains required and weighing is done utilizing load cell accurately. The data regarding the inventory received, distributed and the stocks remaining in the shop are updated, in real time, in a central server.

### 2.1 Flowchart

The flowchart of automated ration dispensing system is shown in Figure 2 and gives a detailed description of the working of the system. The system is powered up using the power supply. The GSM modem searches for the network and a message is sent to registered consumers notifying the availability of their ration. The controller matches the fingerprint with the database and if it matches, the system allows the consumer to select the

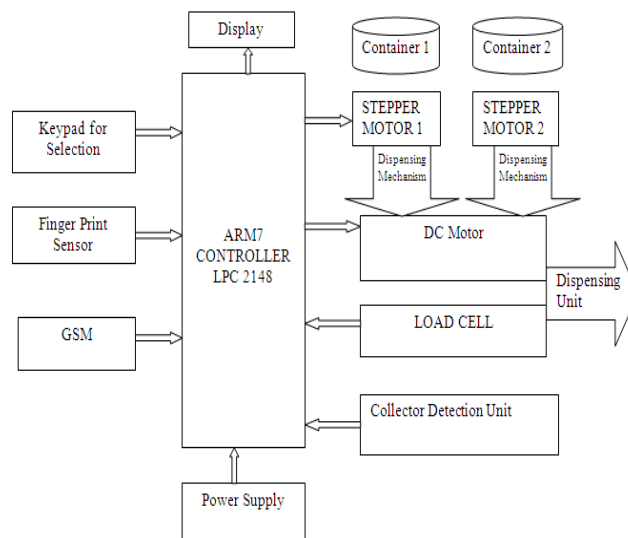


Fig.1 Block Diagram of Automated Ration Dispensing System.

grains and the quantity required by pressing the push buttons. This gives a signal to the stepper motor to open the doors of respective storage drum & a container placed above the load cell collects the grains and weighing is done by the load cell. Once the selected grain quantity and weighed quantity are matched, the microcontroller gets a signal from load cell to stop the stepper motor & close the doors of the drum. A signal is sent to DC motor to tilt the container to dispense the grains. A relay is switched on to dispense liquids like kerosene and is switched off after dispensing. The data regarding the inventory received, distributed and the stocks remaining in the shop are updated, in real time, in the central database.

## 3. Results & Discussion

The system trial results for all possible outcomes are given in Table 1.

The prototype of the automated ration dispensing system is developed and extensive testing is carried out. The prototype is designed to dispense wheat and rice in three different weight categories: 80 g, 100 g, 120 g. Kerosene is designed to be dispensed in terms of 200 ml. Testing shows that on an average, a consumer takes about four minutes to collect the ration. Hence, the prototype dispenses grains to 15 users on an average in 1 hour. If the normal working hours of a FPS is 8 hours, the proposed fully automated system dispenses ration to  $15 \times 8 = 120$  consumers in a day. This demonstrates the efficiency of the system. Further, the proposed system is superior to the work [7] on two counts: it adopts fully

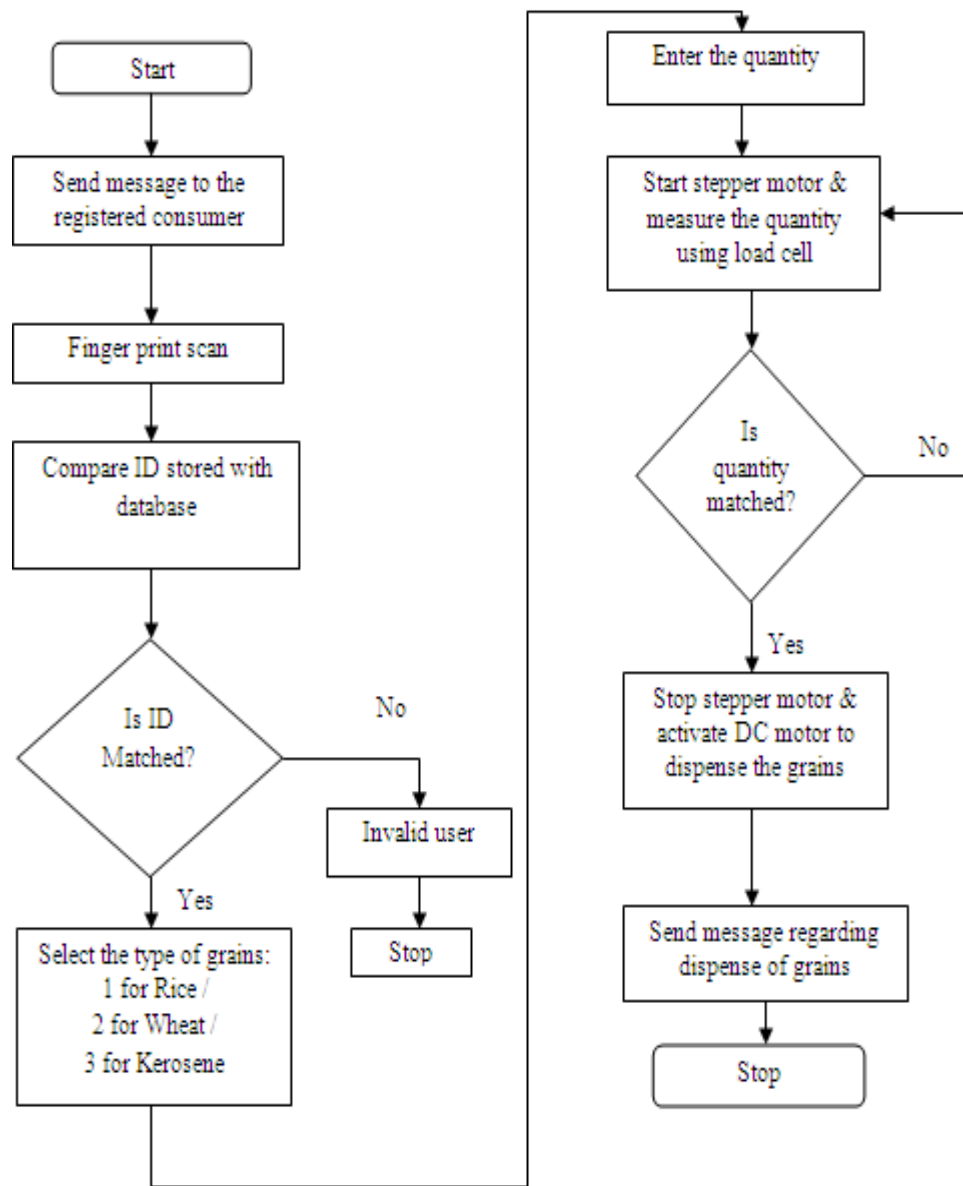


Fig. 2: Flowchart of Automated Ration Dispensing System.

Table 1: Results of Automated Ration Dispensing System.

Sl. No.	User	Grain type	Weight (g/ml)	Inference
1.	Consumer 1	Wheat	80	Stepper motor closes valve at 80 g & DC motor dispenses wheat.
2.	Consumer 1	Rice	120	Stepper motor closes valve at 120 g & DC motor dispenses rice.
3.	Consumer 2	Wheat	100	Stepper motor closes valve at 100 g & DC motor dispenses wheat.
4.	Consumer 2	Kerosene	200	Relay switches on and cut off after dispensing 200ml
5.	Consumer X	----	----	Consumer not found

secure biometrics for user authentication as against QR-code based smart card which provides no security and fully automated weighing and grain dispensing system without human intervention for accuracy, as against manual weighing.

#### 4. Conclusions

The proposed system facilitates easy, transparent, reliable and efficient administration of Public Distribution System with technology adoption. The update of central database on grain stocks at all levels including the FPS in real time ensures that pilferage is prevented at all levels. With dynamic tracking of the amount of food grains in every FPS, grains can be transferred from one shop to the other based on demand dynamics. Further, the data generated in the system can be utilized for policy formulation and implementation to continuously evolve, in order to meet the changing requirements. Hence, the proposed system is a classic case of technology adoption for robust policy implementation.

The prototype of the proposed system is dedicated to help the Government in implementing its policy of providing food security and nourishment to needy people in India.

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