IoT Based Smart Ration Distribution System

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ABSTRACT

The current ration distribution system in India faces challenges such as fake ration cards leading to unauthorized sales by dealers, lack of awareness about government-subsidized rates, and discrepancies in the allocated ration quota. This results in malpractice, corruption, and a lack of effective tracking mechanisms. Hence to overcome the drawbacks of current ration distribution system, we would like to introduce a new concept that involves the use of Internet of Things (IoT) technology through two Android apps—one for user booking and the other for dealers, using Firebase as the database. Users link their ration card and phone number to create an account, allowing them to book a specific date and time slot, add items to their cart, and choose cash or online payment. Upon successful booking, a QR code is generated and sent to the user's mobile. Dealers use their app to scan the QR code, validate it, and activate the Automatic Dispensing Machine via a Wireless module for the customer to collect their ration. The dealer's app also facilitates updating next month's ration supplies and viewing previous month's allotment details.

Keywords—Internet of Things IoT, Quick Response code (QR), Automatic dispensing machine, Onetime Password (OTP), Firebase Database, Android Application

INTRODUCTION

The proposed Smart Ration Distribution System is a comprehensive solution that aims to transform India's Public Distribution System (PDS) through the use of Internet of Things (IoT) technology. Ration cards, which are required to secure subsidized food and essential commodities, often face challenges such as counterfeiting and corruption in the distribution process. To address these issues, the project introduces a technologically advanced approach.

The plan revolves around developing two mobile applications—one for users and one for vendors—and using the Firebase database built with Android Studio, this technical framework for users helps them to participate in the ration distribution process. When individuals access the user application, it allows them to enter specific dates times, and locations, collect their essentials in a virtual cart, and choose convenient payment options, whether through online shopping or in-store payments.Upon successful registration, a QR code is generated and sent to the user's mobile device, acting as a unique identifier for the collection. Sellers, using a dedicated app, can then search for a QR code to connect to an Automatic Dispensing Machine. This integration improves the efficiency of the distribution system, providing users with a safe and efficient way to store their rations.

Beyond the immediate gains in efficiency, the project has wider implications. It wants to contribute to the vision of smart cities and is in line with the objectives of the Digital India initiative.Adopting internet-based technology, the proposed system seeks to make the traditional manual error-prone ration distribution process more efficient and effective with its objectives of efficient distribution management, intelligent technology solutions delivery, reducing human interaction, reducing the time and effort invested by consumers and distributors. In conclusion, the proposed ration distribution system represents a comprehensive and adaptive process. This not only addresses existing challenges within the PDS but also aligns with the broader vision of creating a technologically advanced and efficient public distribution system.

LITERATURE SURVEY

The proposed IoT-based Smart Ration System uses Arduino UNO and a biometric unit for user authentication, allowing only enrolled individuals to access assigned goods. Users are identified through fingerprint records. A GSM link notifies customers and distributors of goods' arrival times. An LCD module indicates user eligibility and account balance. After collecting goods, the system debits the amount. Connectivity with a Wi-Fi module helps in real-time information exchange between the cloud and the distributor, displayed on the LCD screen [1]

The proposed Automatic Smart Ration Distribution System addresses civil supply hoarding in India through a unique approach. A webpage created with JavaScript and HTML for security and authentication purposes. Hardware

components interfaced with Arduino use a passcode system with a keypad. This passcode is generated through the webpage and is linked to the user's digital ration card, which is scanned during their visit to the ration shop. The information is then stored in a PHP database. The verification process uses two app modules, reducing the use of Arduino UNO and keypad. The system is flexible for users as they can send proxies for the collection of goods, maintaining security through their Android devices [2].

The literature survey explains existing solutions to challenges in India's Public Distribution System (PDS). Previous approaches include RFID-based systems ensuring basic information storage, E-ration techniques using biometrics for enhanced security, and QR code-based systems for automatic transaction updates. The proposed IoT-based Smart Ration Card System uses fingerprint verification, Android application product selection, and an automatic ration distribution mechanism. These advancements aim to overcome existing issues and create a more secure and efficient system for distributing subsidized commodities to people with low incomes.[3]

The proposed smart ration card system uses RFID and IoT technology to address the challenges of the current Indian Public Distribution System (PDS). The system replaces traditional ration cards with RFID tags, which are verified through a microcontroller connected to an Amazon Web Services (AWS) database. Additional security is provided through One Time Passwords (OTPs) sent to users' mobiles. This digitized approach aims to reduce malpractices and corruption, and improve tracking of ration distribution.[4]

This paper presents a Smart Ration Distribution System for the Public Distribution System (PDS) in India. Using RFID technology, Aadhaar cards, and an ARM microcontroller, the system automates ration distribution with precise quantity monitoring. This includes fingerprint scanning, SMS notifications and real-time updates in the cloud database to ensure transparency and prevent rationing fraud. The proposed system aims to reduce corruption in PDS, enhance food security, and propose future developments such as online payments.[5]

PROPOSED SYSTEM

A. MODELING AND FUNCTION OF THE PROPOSED SYSTEM

The main objective of this paper is to make the ration distribution system smarter and secure along with eliminating the issues involved in the traditional ration system. The hardware and software requirements for the proposed system is shown in Table 1.

Table 1. Hardware And Software Requirements

| Category	Component	Functions
Hardware	HM-10Wireless module	Bluetooth communication, data transmission.
	Arduino Uno (Microcontroller)	To control the Hardware
	Precision Flow Control Valve	To regulate the flow rate
	Bluetooth HC-05	To establish hardware and software connection
	LCD	To display the output
Software	Android Studio (4.2.0)	To create an android app
	Arduino IDE	To write and upload Node MCU code
	Proteus Software	To design the circuit
	Firebase Database	To store the data of customer and the user

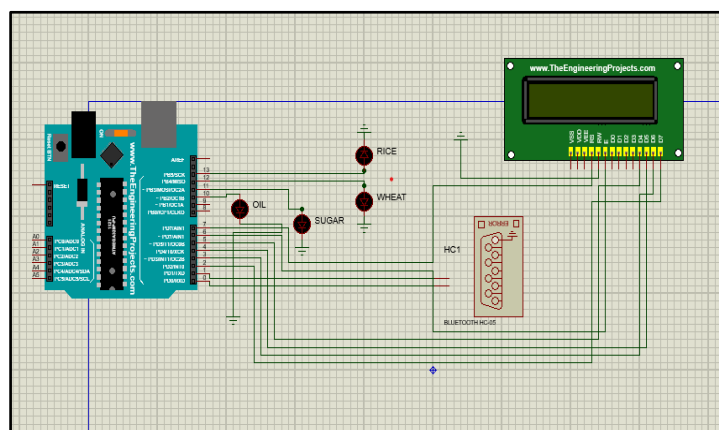*B.* *Implementation Of Proposed System*
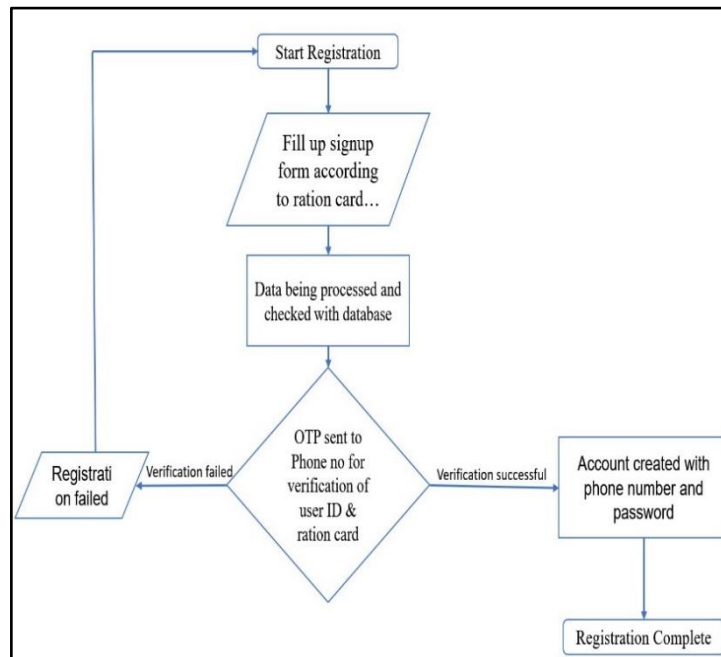
Fig. 1. Registration Process:
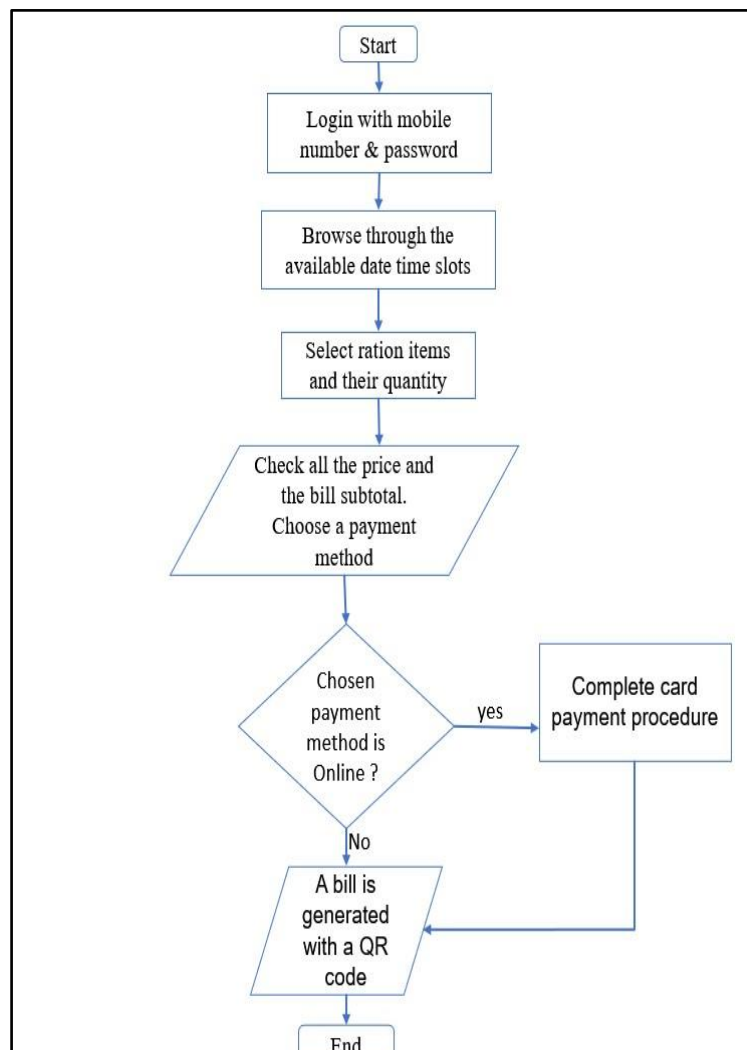
Fig. 2. Booking Time Slots
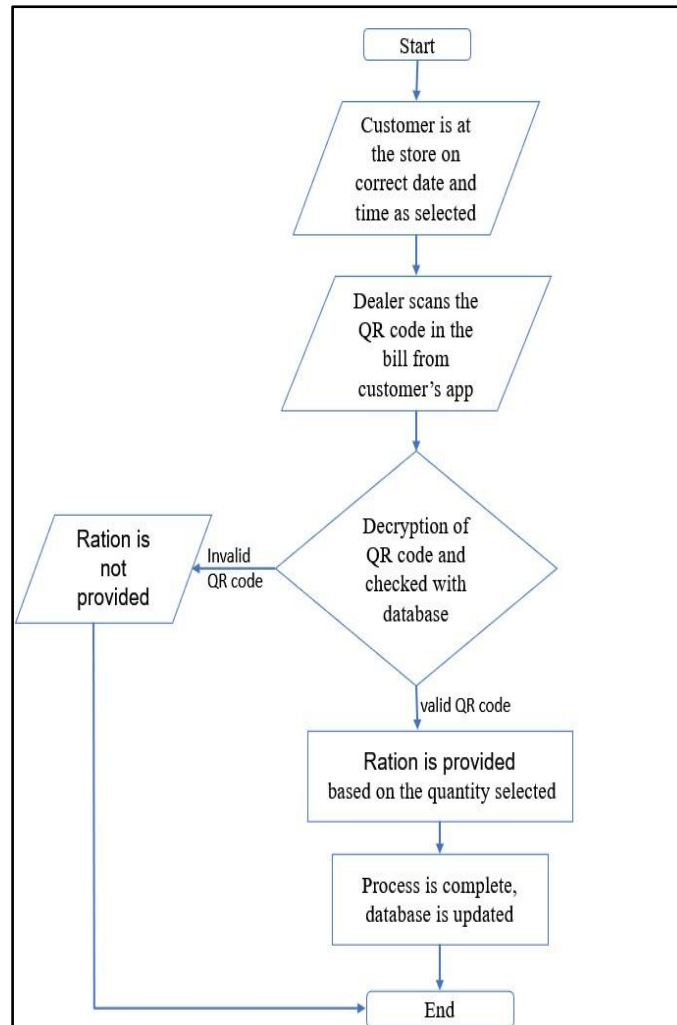
Fig. 3. Ration Collection Procedure

Fig. 4. Circuit Diagram of Distribution System

An online secured platform is developed for storing records for every user. The first step for a user is to sign up, i.e., providing all the credentials, relevant to their ration card. For the first time, the user is prompted with a message signup. To make sure that the user is genuine, the phone number linked to the account will be verified by OTP, and then the signup process will be completed. After signing up, or if the user already has an account, he or she can log in and access their profile. The option of linking multiple ration cards to a single account is also available for adding family member's ration cards, this makes the overall user experience better and prevents adding of redundant accounts. After signing, the user can buy items available in the ration store virtually through the app. The user can browse through and select a list of all available items in a particular week. Option for cash on delivery is also available.

Users can use this app to access all the features as all the details are stored in the cloud. For security purposes, after each transaction and successful booking of a time slot for ration collection, a unique QR code will be generated. This QR code will be verified on the dealer side, thereafter selected ration items will be provided to the customer. Moreover, the user app also has a provision for setting an alert for the booking which will be displayed on the day of ration collection in the form of a notification in the user's mobile phone. This will prevent the user from forgetting about the ration collection on that particular day as it will act as a reminder.

The dealer app will have a dealer login page where the dealer has to log in using ID and password. The dealer dashboard will comprise the dealer details along with 3 different functions. The scan function is used to scan the QR code of the customer and give access to the Automatic dispensing machine. There is a page for updating the ration for the upcoming months which allows the user to upload the cost and quantity allotted for ration distribution by the government for its citizens. The third function is to view the ration details allotted by the dealer in the previous months to keep a track record of the complete process.

We have made the entire two apps using Android Studio 4.2.0 which is a software tool for developing Android applications. It is written in Java, Kotlin, and C++ and it is supported on Windows MacOS, and Linux. Android Studio helped us to get a very professional look for our apps and all Our coding part is done in Java. Instead of an automatic dispensing machine, Proteus software is used to demonstrate the distribution of groceries through blinking LEDs according to the number of items the customer requires. Now, about Proteus, it introduced a model called Proteus Virtual System Modelling (VSM) which blends mixed-mode SPICE simulation with world-leading fast microcontroller simulation. It enables rapid prototyping of both hardware and firmware designs, in software. It also introduces IoT Builder a unique product designed to make it quick and easy to control remote electronics from a mobile device. Presently, we have used a Bluetooth module to illustrate the concept of wireless connectivity. The circuit diagram is provided below.

<div align="center">

RESULT

</div>

C. Customer Android App:
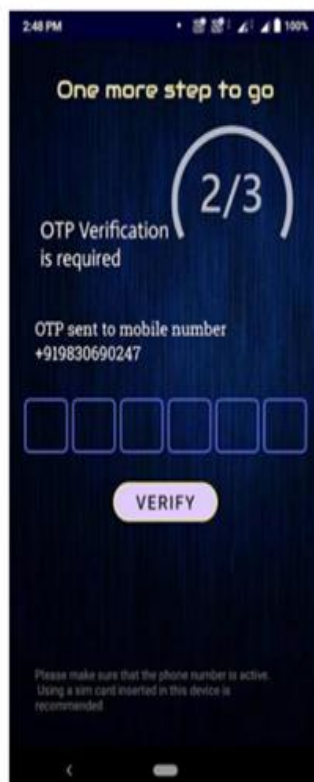

<div align="center">

Fig.5. Sign up number   **Fig.6. OTP verification**   **Fig.7. New account details**
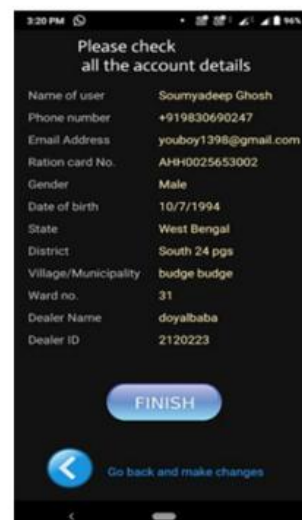
</div>

Fig.8. Details of user

Fig.9. Dealer details

Fig.10. Confirm details

Fig.11. OTP authentication

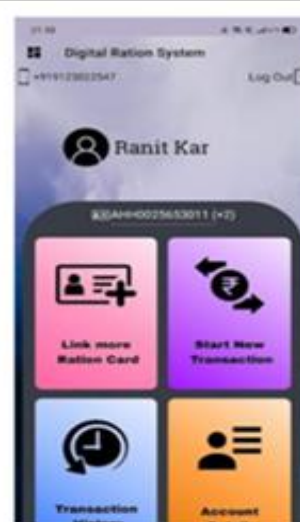**Fig.12. Login Page**

Fig.13. User Dashboard

Fig.14. Link ration card

Fig.15. Forgot password

Fig.16. OTP authentication
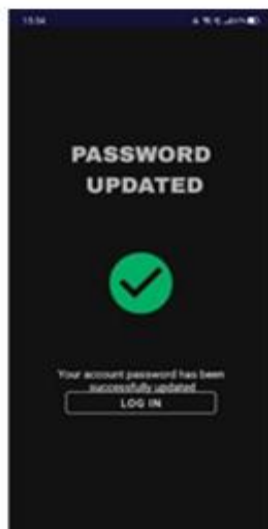
Fig.17. Set new password

Fig.18. Password updated

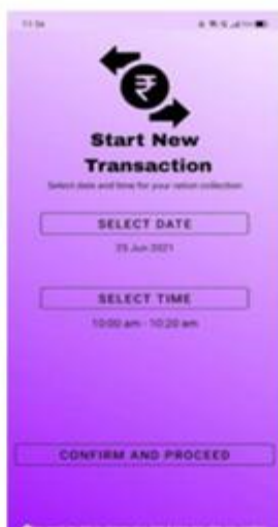Fig.19. Account details

Fig.20. Transaction history
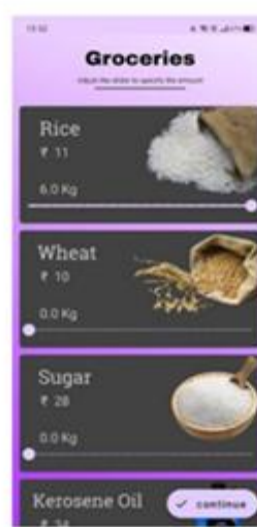

Fig.21. Date &Time selection

Fig.22. Grocery page

Fig.23. Bill summary

Fig.24. Payment page

Fig.25. QR code generated

Fig.5 describes the first page where the user needs to give a phone number to open a new account. Fig.6 shows the OTP verification of that phone number. Fig.7 takes the details of the customer for the new account. Fig.8&9takes the details about the location and address of the user and Fig.10 confirms the data entered in the previous pages for the user to check.Fig.11 does OTP verification for the ration card to be added to the customer account.

Fig.12 describes the user login page where the user has to login using phone number and password. Fig.13 shows the user dashboard where all the functions the user can perform is displayed. Fig.14 describes the page for adding more ration cards to the customer account to a max of 5 cards. Fig.15-18 shows the functionality of resetting the customer password incase the user forgets it using OTP verification through phone number.

In Fig.19 the account details page is shown where all the details of the account holder will be shown such as email, phone number and location details. Along with that all the ration card details which are linked to that account will also be shown in this page in separate cards. Fig.20 describes the transaction history to display all the transactions made previously. We can see from Fig. 21 that we have to select the date and time slot as our choice from the available slots and proceed to the grocery page.

In the Fig. 22 grocery page is displayed where we can select the items as per our requisition of that week. Maximum allotment of an item will depend on how many Ration cards is linked with that account. After selecting the groceries, we will proceed to the bill summary page as seen in Fig.23. Here our overall bill will be showed and we have to choose the mode of payment online/offline.
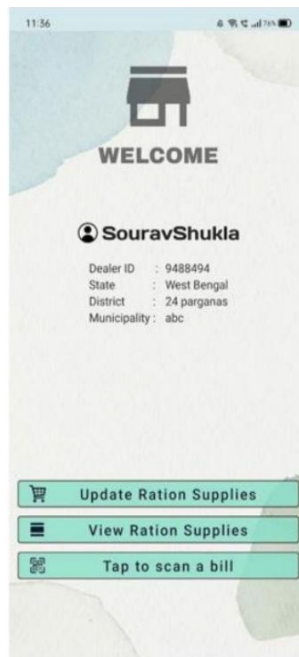
Fig.24 shows the online payment screen using cards as well as UPI and net banking is also available. Fig. 25 shows the QR code generated after successful payment and booking is done. Fig. 26 shows the alert notification which will appear on customer device on the day of ration collection for a reminder process.
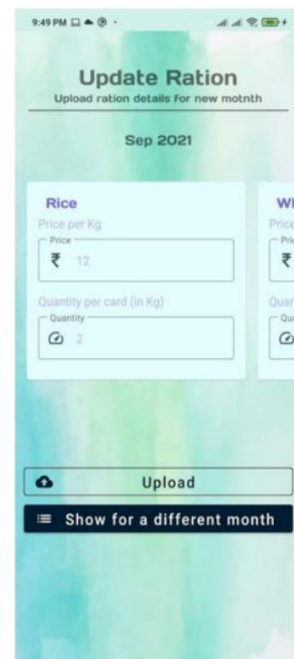
D. Dealer Android App:
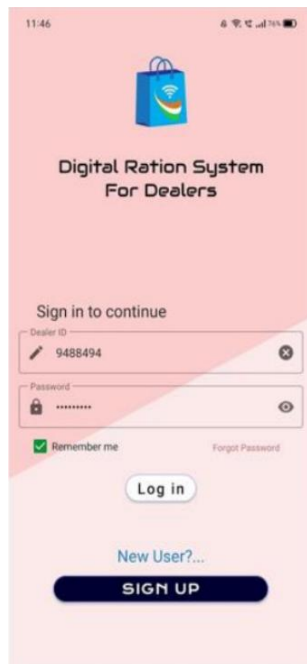
Fig.27. Dealer Login
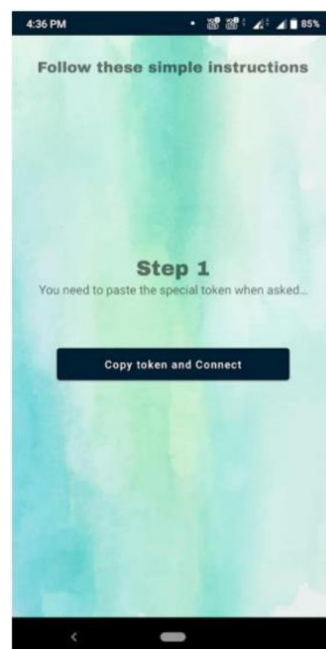

Fig.28. Dealer dashboard

Fig.29. Upload next month ration

Fig.30. View supplies

Fig.31.Scan QR code

Fig.32. Copy token

Fig.33. Send the token generated

Fig. 34. Bluetooth page
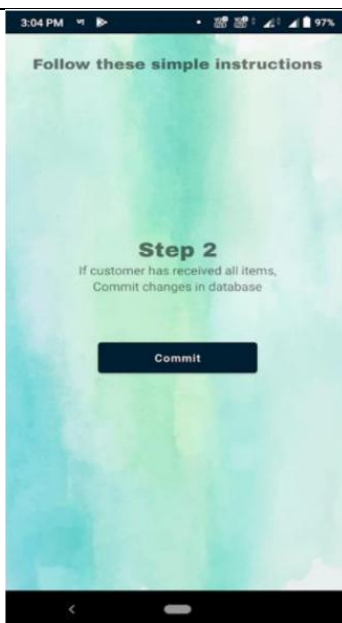

Fig. 35. Scanned devices

Fig. 36. Database update

Fig.27 shows the first page of the dealer's app that is the login page where the dealer has to login using his ID and password. Fig.28 shows the dealer dashboard where the details of the dealer is visible along with 3 functions buttons at the bottom. Fig.31 shows the scanning page of dealer used to scan the customer QR code. Fig.29 shows the provision for uploading the next month's ration details as per government regulations. Fig.30 shows the ration supplies of the current as well as previous months to the dealer as a mode to compare if necessary. Fig.32-33 helps the dealer to send a generated string to the controller of the automatic dispensing machine via Bluetooth of the dealer's phone which is shown in Fig.34-35. After successful completion of ration collection procedure, the dealer can press the commit button as shown in Fig. 36 to update the database about the transaction which has been completed.

CONCLUSION

In the conclusion we will highlight the features of the application and the benefits customers are going to have because of using the smart ration distribution system. There are many prevalent ways of ration distribution but most of them are complicated and not cost effective. So, we decided to propose a way to monitor and distribute the weekly ration allocated to individuals with minimal complication, and in a cost-effective way. Our project needs the minimum

manual support and is mostly automated, allowing users to book exclusive time slots for weekly ration collection, eliminating lengthy queues. There is a provision for adding ration cards inside one particular account which means that for a particular family, only one person can collect the ration of all the members of that family which is helpful for the senior citizens and the children. Moreover, for security purposes, we have used the mechanism of a QR code which prevents unauthorized collection, while a built-in alert system acts as a timely reminder for users. Our app will have both an online payment option in addition offline payment at the store. There is also a section that will show the transaction history which will help the customer to keep track of what types and what quantities of ration are being used by the family weekly/monthly.

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