MSW MANAGEMENT -Multidisciplinary, Scientific Work and Management Journal
ISSN: 1053-7899
Vol. 36 Issue 1s, 2026, Pages: 3395-3398

ENHANCING RATION MANAGEMENT SYSTEM ALERTS IN PUDUCHERRY

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Abstract
Ensuring efficient communication of government food distribution schemes to economically disadvantaged communities is crucial for food security. Many individuals remain unaware of the availability of essential commodities like grains and oil at ration shops due to ineffective information dissemination. This project aims to address this challenge by developing an automated voice-based notification system using Voice over Internet Protocol (VoIP) and networking protocols. The system will make automated phone calls in Tamil, ensuring that residents, including those who are illiterate or lack access to text-based notifications, receive timely information about ration shop supplies. By integrating modern telecommunication technologies, this project enhances accessibility and ensures that government-provided food supplies reach those in need without unnecessary delays.

Keywords—Voice over Internet Protocol (VoIP)

Introduction

In Tamil Nadu, the government provides subsidized essential food items to lower-income families through a public distribution system (PDS) operated via ration shops[1]. However, a significant number of beneficiaries miss out on these supplies due to a lack of timely and clear information. Many individuals rely on word of mouth or local notices, which can be unreliable and inconsistent. This project proposes an automated calling system that ensures real-time, clear, and direct communication about the distribution schedules of ration shops. By delivering messages in Tamil, the project aims to overcome language and literacy barriers, improving the effectiveness of government welfare programs. This approach enhances inclusivity by ensuring that even individuals with limited literacy or digital access receive crucial information in a timely manner. The system also reduces manual workload on government authorities by automating communication, ultimately improving efficiency in the food distribution process.

Objective

The primary objective of this project is to develop an automated calling system that notifies beneficiaries about the availability of essential commodities at their respective ration shops[2]. The system will:

1. Automate notifications regarding ration shop schedules using VoIP technology[3].
2. Deliver messages in Tamil, making them accessible to all, regardless of literacy levels.
3. Ensure timely updates to prevent people from missing their allocated supplies.
4. Reduce dependency on unreliable information channels like manual notices or word of mouth.
5. Improve efficiency and reach of government food distribution programs.
6. Enhance scalability to expand the system across different regions.
7. Provide real-time tracking of message deliveries and optimize communication effectiveness.

Scope of the Project

This system is designed to benefit communities that rely on government-subsidized ration shops for their daily food needs. The key areas covered by the project include:

1. Target Audience: Low-income households, particularly those with limited access to digital communication.
2. Scalability: The system can be expanded across multiple regions to ensure widespread coverage.
3. Customization: Messages can be personalized based on locality, ration shop details, and specific food items available.
4. Integration: Potential for integration with government databases to update call lists dynamically.
5. Adaptability: The system can be further enhanced to include multi-language support and interactive response options for user engagement.

Literature Survey

Naveen et al. (2022) proposed an automatic dispenser for ration distribution at the Panchayat level, aiming to minimize human intervention and corruption. Their system incorporates an automated dispensing mechanism that ensures fair distribution of essential commodities. The model integrates electronic verification, reducing the chances of fraudulent activities. By utilizing IoT and cloud-based data storage, the system ensures accurate record-keeping of transactions. Additionally, the automation process enhances efficiency, reducing manual errors in ration allocation. The study highlights the impact of automation in bridging gaps in rural ration distribution.

Prabhu et al. (2024) introduced a modernized ration distribution system with integrated mobile accessibility, emphasizing user convenience. The system enables beneficiaries to check their ration availability and transaction history through a mobile application. By leveraging digital authentication techniques, such as OTP verification, the solution enhances security and transparency. The authors emphasized the importance of remote access to ration allocation, allowing users to track their entitlements. This approach minimizes long queues at ration shops and improves efficiency. The study also suggests scalability for nationwide implementation.

Murugan et al. (2023) developed a smart ration distributor integrated with database management, ensuring efficient tracking and monitoring of ration supply. The system enables real-time data synchronization, reducing discrepancies in stock management. By integrating biometric authentication, the distribution process becomes more secure and accurate. The authors highlight the importance of automation in reducing wastage and improving accountability in public distribution. Their research suggests that database-driven ration systems can prevent unauthorized withdrawals. The study also discusses potential challenges, including system maintenance and data privacy concerns.

Sharma et al. (2021) and Hebbar et al. (2018) explored automatic ration management systems to reduce delays and enhance efficiency. Their research focuses on eliminating human errors in ration allocation through digital intervention. By using RFID-based authentication, the proposed models ensure that only eligible beneficiaries receive their entitled commodities. The studies highlight how real-time monitoring can enhance stock replenishment processes. The authors also address the role of smart rationing in reducing long wait times at distribution centers. The research provides insights into optimizing ration shop operations using digital tracking mechanisms.

Wakade et al. (2015) presented a smart ration distribution and control system to mitigate corruption and ensure fair distribution. Their study

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Vol. 36 Issue 1s, 2026, Pages: 3395-3398

focused on developing an automated solution that reduces fraudulent activities and ensures that ration reaches the intended beneficiaries. They integrated biometric authentication with RFID technology to prevent unauthorized access and duplication of ration cards. The proposed system allowed for real-time monitoring and tracking of ration allocation, improving transparency in the supply chain. Additionally, it aimed to eliminate manual errors and streamline the distribution process by automating inventory management. The findings emphasized the importance of technology-driven solutions in addressing inefficiencies in the traditional rationing system.

Benzell et al. (2020) studied rationing social contact during the COVID-19 pandemic, focusing on transmission risks and social consequences. Their research analyzed different locations in the United States, evaluating the trade-offs between minimizing infection rates and ensuring social interaction. They used epidemiological models to estimate the impact of restricting movement and interactions in high-risk areas such as public transport and shopping centers. Their findings highlighted that while strict rationing of contact reduced transmission rates, it also had significant psychological and economic drawbacks. The study proposed that a balanced approach, incorporating strategic location-based rationing, could optimize public health benefits while minimizing social disruptions. This work provided insights into policy-making for future pandemics and crisis situations.

Pinto et al. (2021) presented an automated ration material distribution system, utilizing advanced technologies to streamline processes. Their model incorporates GSM technology for real-time communication between ration shops and consumers. By integrating IoT sensors, the system detects stock levels and sends automated alerts for restocking. The research also examines the impact of automated rationing on reducing corruption and fraud in distribution. Additionally, the study suggests that adopting such technologies can lead to a more transparent and efficient PDS. The authors emphasize the potential of integrating AI-based predictive analytics for further optimization

Problem Statement

A large segment of Tamil Nadu's population lacks timely access to information about ration shop supply distribution schedules. This communication gap often leads to missed opportunities for beneficiaries to collect essential food supplies, directly impacting their food security. Additionally, it diminishes the efficiency of government food distribution programs, as resources may remain unclaimed or underutilized.The reliance on outdated and inconsistent communication methods further exacerbates the problem, causing confusion and frustration among residents. Many individuals are left uncertain about distribution dates, leading to overcrowding at ration shops on incorrect days or, conversely, empty queues when supplies are available. This places an increased burden on local authorities, who must repeatedly clarify schedules and manually spread information, diverting time and effort from other critical administrative tasks. An automated system is essential to streamline this process and ensure that all eligible beneficiaries receive accurate and timely updates.

Existing System

Currently, information about ration shop supplies is primarily shared through traditional communication methods, each with significant drawbacks. These methods include:

1. *Word of Mouth and Manual Announcements:*In many regions, shopkeepers or local authorities verbally notify people about food distribution schedules.This approach is often unreliable, as information can be misinterpreted or altered as it spreads from person to person.It fails to reach everyone, particularly individuals who do not frequently visit community gathering points.
2. *Local Notice Boards:*Notices regarding ration shop supplies are usually posted at government offices or ration shops.[4]However, many beneficiaries do not check these boards regularly, leading to missed updates.Delays in updating notices may result in confusion and misinformation among the public.
3. *SMS Notifications:*Some government agencies use text messages to inform registered beneficiaries about ration shop distribution schedules.This method is not effective for illiterate individuals, as they may struggle to read or understand the messages.Additionally, some low-income families lack mobile phones capable of receiving SMS notifications.Network issues in rural areas can lead to delays or failed message deliveries, preventing timely communication.

Limitations of Traditional Methods

- Delayed Communication: Information does not always reach beneficiaries in time for them to collect their supplies.
- Lack of Consistency: Paper-based notices and word-of-mouth methods do not guarantee widespread and uniform information dissemination.
- Exclusion of Marginalized Groups: Illiterate individuals, elderly citizens, and those without mobile phones often remain uninformed about ration distribution schedules.
- Manual Effort Required: Authorities and shopkeepers must continuously update and distribute information, increasing their workload.

Proposed System

To improve communication with ration shop beneficiaries, we propose a VoIP-based automated voice notification system. This system will efficiently deliver timely and accurate supply schedules, overcoming limitations of current methods, reducing manual workload, and ensuring broad reach, including to those with literacy challenges. [5]

The system will feature key components and functionalities to ensure smooth and efficient operation.

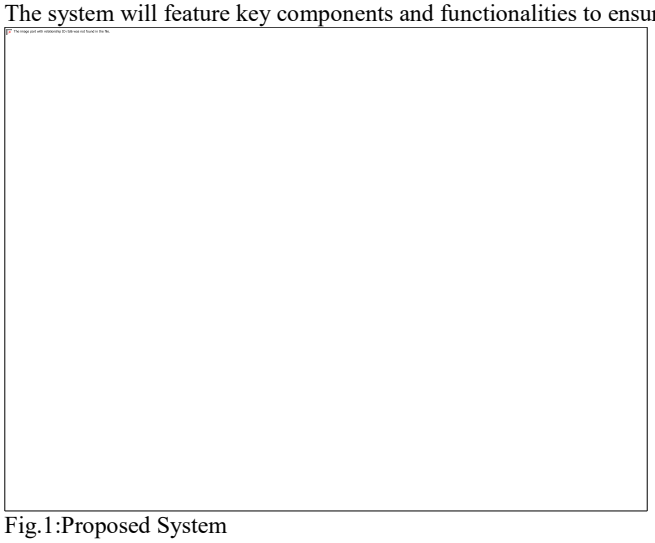

Fig.1:Proposed System

1. Automated Phone Calls

- The system will automatically place voice calls to registered beneficiaries, delivering important updates about ration shop distribution

MSW MANAGEMENT -Multidisciplinary, Scientific Work and Management Journal
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schedules.

- The calls will feature pre-recorded Tamil voice messages, ensuring accessibility for those who cannot read SMS notifications.
- Residents will receive clear and concise details about supply availability, collection dates, and other relevant information, minimizing confusion.
- Calls will be scheduled strategically to ensure that beneficiaries receive updates well in advance of distribution days.

2. VoIP and RTP (Real-time Transport Protocol) for Reliable Communication

- VoIP technology enables cost-effective and scalable automated calling, eliminating the need for manual interventions.
- RTP (Real-time Transport Protocol) ensures high-quality and uninterrupted voice transmission over the internet, maintaining message clarity even in areas with weak network coverage.
- The system will be capable of handling multiple calls simultaneously, allowing large-scale communication without delays.

3. Pre-trained NLP Model for Natural Tamil Voice Generation

- A pre-trained Natural Language Processing (NLP) model will be used to generate clear and natural-sounding Tamil voice messages.
- This approach ensures that the voice messages are not robotic or monotonous, making them easier to understand.
- The system can be customized to generate location-specific messages, addressing beneficiaries based on their assigned ration shop and region.
- In addition to NLP-based voice generation, local voice recordings in MP3 format may be used for enhanced clarity and personalization.

4. Automated Call Scheduling for Timely Notifications

- Calls will be scheduled automatically based on predefined ration shop distribution timelines.
- The system will analyze peak response times and optimize call schedules to maximize answer rates.
- Residents will receive reminder calls if they fail to answer the initial notification.
- A retry mechanism will be implemented to redial unanswered calls at different intervals, ensuring message delivery.

5. Call Log Management for Performance Tracking

- The system will maintain detailed logs of all outgoing calls, tracking:
- Call success rates (whether the recipient answered or not).
- Call completion status (whether the full message was delivered).
- Number of retries attempted in case of unanswered calls.
- Analytics dashboards will provide insights into call effectiveness, helping authorities improve outreach strategies.
- Failed calls will be rescheduled or marked for follow-up, ensuring that no beneficiary is left uninformed.

6. Interactive Voice Response (IVR) for Future Enhancements

- The system will be designed for future upgrades, including Interactive Voice Response (IVR) functionality.
- Potential IVR features include:
- User response options allowing residents to confirm receipt of information.
- Multilingual support in case additional languages need to be included.
- Feedback collection, enabling users to report concerns or request further details about ration distribution.
- The IVR system could also allow beneficiaries to check supply status by calling a toll-free number.

Implementation Steps

Effective project execution needs a well-planned approach. These steps detail the creation, rollout, and improvement of the voice notification system.

1. Data Collection: Good data ensures notifications reach the right people. This step includes:

a) Getting Contact Information:

- Collect mobile numbers of people with ration cards. Use government or Public Distribution System (PDS) records.
- Update contact details to avoid wrong or outdated calls.
- Store location data, including each person's ration shop.

b) Managing Schedules and Shop Details:

- Use a central database to store:
- Ration shop addresses and contacts.
- Monthly food schedules.
- Supply details like type and amount.
- Control who can change data. Only allow authorized staff to make updates.

2. System Setup: This part sets up the server and telecom links for the system to work.

a) Setting Up Servers with VoIP and RTP:

- Use a VoIP system on a cloud server like Google Cloud or AWS. You can also use a local server.
- Set up Session Initiation Protocol (SIP). This manages call start and end times.
- Add Real-time Transport Protocol (RTP) to keep voice clear during calls.

b) Building Call Management:

- Get scheduled notifications from the database.
- Process call requests based on location and shop schedules.
- Send call requests to the VoIP system.
- Use APIs for real-time updates. This lets officials quickly change call lists.

3. Voice Generation: The system must create clear Tamil voice messages for good communication.

a) Using an NLP Model or Voice Data:

- Create a Tamil Text-to-Speech (TTS) model using AI. This makes automated voice messages.
- Use pre-recorded human voices. This improves clarity and makes the message sound more natural.

b) Storing Voice Messages by Region:

- Change Tamil voice messages for local dialects. This improves understanding.
- Keep many voice message versions to avoid repetition.

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- Store pre-recorded emergency alerts. These can be sent out instantly.

4. Automation: Automation makes sure calls are on time and the system is efficient.

a) Scheduling Calls by Shop Times:

- Set up a scheduler to start calls one or two days before distribution.
- Time calls to avoid busy hours. This increases response rates.

b) Retrying Missed Calls:

- Track call statuses like answered, missed, busy, or rejected.
- Reschedule failed calls at different times to improve success.
- Limit retries to avoid too many call attempts (like three tries).

5. Testing and Deployment: Test thoroughly before expanding. This ensures reliability, efficiency, and user satisfaction.

a) Pilot Testing in Some Areas:

- Start a trial in a few shops or districts.
- Make test calls and get feedback from people.
- Fix tech issues with voice quality, call connections, and data accuracy.

b) Scaling Based on Results:

- Check Key Performance Indicators (KPIs):
- Call success rate (answered calls).
- User feedback on message clarity.
- System uptime and technical problems.
- Adjust call scheduling based on how people respond.

Conclusion

This initiative presents a novel and effective approach to improve access to government food distribution programs. Utilizing automated phone calls in Tamil, the system guarantees that crucial details are delivered to the targeted recipients in a prompt, precise, and dependable way. In contrast to SMS or notice-based methods, this strategy successfully closes the communication gap, making sure that everyone is informed about their rights. By streamlining the notification process, the initiative boosts efficiency, lessens manual tasks, and bolsters food security efforts, reaffirming the state's dedication to fair distribution of vital resources. Prospective upgrades might incorporate support for multiple languages, collection of feedback via IVR, and AI-enhanced scheduling of notification delivery.

Acknowledgement

I would like to express my gratitude to the unnamed reviewers for their helpful feedback that improved this document. I am also thankful to my mentor for their crucial assistance and guidance during the process of finishing this project.

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