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# Automated Grocery Monitoring System for Elderly People

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**Abstract:** The Automated Grocery Monitoring System for Elderly People is an IoT-based solution developed using the ESP32 microcontroller to intelligently manage household grocery inventory and enhance kitchen efficiency. The system continuously monitors the weight of two essential grocery containers using load cells, while also tracking environmental parameters such as temperature and humidity through the DHT11 sensor, and food spoilage gases using an MQ2 gas sensor. Real-time data is displayed on an LCD screen and communicated via Telegram, allowing users to receive instant updates on grocery availability, environmental conditions, and potential spoilage alerts. When the weight of an item falls below a predefined threshold or spoilage is detected, the system sends an automatic notification to prompt refilling or replacement. Furthermore, based on the available grocery items, the system provides intelligent recipe recommendations, helping users plan meals effectively. This smart Ordering approach reduces food waste, ensures timely grocery management, and introduces a personalized cooking assistant feature, all integrated through a user-friendly Telegram interface.

**Keywords:** Grocery Monitoring, ESP32, Load Cell, DHT11, MQ2 Sensor, Telegram Alerts, Recipe Suggestion.

## I. INTRODUCTION

As the world's population ages, it's more crucial than ever for senior citizens to maintain their independence while staying safe. Daily challenges can arise from grocery management, which is frequently disregarded. Nutritional deficiencies or possible health risks may result from failing to replenish necessary supplies or from failing to recognize spoiled food. Elderly people may also experience mobility problems that make it challenging to go grocery shopping frequently. The need to automate routine household tasks has significantly increased as a result of the quick development of smart home technologies. Grocery inventory is one such area that is still mainly unmanaged. Users frequently neglect to keep track of their stock levels, which can result in situations where necessary items run out unexpectedly or food spoils as a result of carelessness. Grocery tracking done by hand takes a lot of time and is prone to mistakes, especially in busy or elderly households.

This study suggests an automated grocery monitoring system that continuously checks stock levels and environmental factors like humidity and temperature in order to address these problems. In order to automate inventory management and guarantee the longevity and safety of food items stored, the system makes use of Internet of Things (IoT) principles. When certain thresholds are reached, users or caregivers receive notifications via Telegram, a well-known platform. The ESP32 microcontroller, which powers the system, was selected due to its strong processing capabilities, low power consumption, and integrated Wi-Fi. To track the weight of grocery containers and ascertain the condition of the stock, the ESP32 gathers input from load cells (through HX711 amplifiers). It also uses a MQ2 gas sensor to detect gases like methane and ammonia that indicate food spoilage, and a DHT11 sensor to measure temperature and humidity.

While the Telegram Bot API enables remote monitoring and alerts, such as environmental data and spoilage warnings, a 16x2 LCD offers real-time local updates. This system's capacity to suggest recipes based on the available stock is one of its best features. For example, the system might recommend making a dish like "Khichdi" if there is enough rice and lentils available. The suggested system serves as a complete grocery assistant by combining wireless communication, sensor- based automation, and intelligent alerting. It minimizes food waste, improves meal planning, and lowers mental and physical strain. This system could be used in homes, hostels, restaurants, and rural areas in addition to by senior citizens, which would help create smart, sustainable kitchen ecosystems more broadly.

## II. LITERATURE SURVEY

A. Dr. R. Kalaiarasan et al

Dr. R. Kalaiarasan and co-authors conducted a study on the topic of "Automated Shopping with RFID-Enhanced Smart Technology." This system introduces RFID-enabled smart shopping carts designed to streamline the shopping experience by automatically tracking items placed into the cart through RFID tags and readers. To further enhance functionality and

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communication, the system utilizes ZigBee technology along with force sensors for improved security and coordination. A key feature of the solution is its ability to reduce waiting times at billing counters by automating the checkout process, thereby improving efficiency and user convenience. Additionally, it supports real-time inventory management, ensuring timely stock updates and preventing shortages or overstocking. This smart shopping system represents a significant step forward in retail automation and intelligent communication technologies.

B. S. M. Nahian Al Sunny, Xiaoqing “Frank” Liu, and Md Rakib Shahriar

S. M. Nahian Al Sunny, Xiaoqing “Frank” Liu, and Md Rakib Shahriar conducted a study on the topic of "An Integrated IoT Enabled On-Demand Grocery Shopping and Delivery Cloud System Using MTComm at the Edge." This research introduces a cloud-based Internet of Things (IoT) system that utilizes Machine Tool Communication (MTComm) for efficient data transmission and handling. The architecture employs Edge Computing Hubs (MEH), such as Raspberry Pi devices, to gather real-time data from both in-home smart appliances and automated warehouse robots. The edge-based data collection allows for faster processing and lower latency, enhancing system responsiveness and enabling smooth, on-demand grocery ordering and delivery. The proposed system emphasizes integration, scalability, and real-time communication, making it a practical solution for modern smart retail and home automation.

C. Boddu Manoj Kumar et al

Boddu Manoj Kumar and co-authors conducted a study on the topic of "Grocery Purchase through Blockchain System." This paper presents a blockchain- based framework aimed at establishing a transparent, secure, and efficient grocery purchasing process. By integrating smart contracts with IoT devices, the system ensures seamless tracking of grocery items throughout the supply chain—from vendors to consumers. It offers real- time inventory updates, enables quality control during transit, and facilitates automated payments, all managed through blockchain-powered smart contracts. Additionally, the system supports features like consumer feedback and dispute resolution, enhancing user trust and accountability. The core objective of this approach is to improve operational efficiency while fostering reliability and transparency in grocery transactions.

D. B. V. Ramana Murthy et al

“IOT-Based Smart Stale Food Detector” was the subject of research conducted by B. V. Ramana Murthy, C. Kishor Kumar Reddy, P. R. Anisha, and RajaShekar Sastry. The system focuses on detecting stale food in storage environments using IoT-enabled gas sensors. The design utilizes the MQ2 sensor to identify gases released from spoiled food items, thereby helping in early detection and prevention of food wastage. The approach incorporates continuous sensing and real-time alert generation to inform users about potential food spoilage. The system is integrated with a microcontroller and a cloud-based alert system, enabling both local monitoring and remote notification. It was tested in various food storage conditions and showed promising accuracy in identifying spoilage. This method enhances food safety and is particularly useful in homes, restaurants, and cold storage units where food quality must be maintained without constant manual checks.

E. Naresh Babu Muppalaneni et al

“A Secure Smart Shopping Cart Using RFID Tag in IoT” was proposed by Naresh Babu Muppalaneni and Ch. Prathima. The system introduces a smart shopping solution that uses RFID tags to automatically identify items added to the cart, minimizing human interaction and speeding up the billing process. The design integrates RFID readers, IoT communication modules, and a secure cloud-based billing system. A key focus of the system is on security, ensuring that data transmission between the cart and server remains encrypted and tamper-proof. The cart updates item details in real time, allowing customers to view the total cost and quantity instantly. This reduces queue time at the checkout counters and improves the overall shopping experience. The solution also reduces shoplifting and enhances inventory accuracy, offering benefits to both consumers and store owners.

## III. SYSTEM DESIGN AND METHODOLOGY

A. Architecture The system comprises load cells interfaced with the HX711 amplifier and ESP32 microcontroller, a DHT11 sensor for temperature and humidity, and an MQ2 sensor for gas leakage detection. Data is processed by ESP32 and sent to a cloud-based platform. A Telegram bot provides user interaction and alert messages.

B. Hardware Components

- ESP32: Serves as the central processing and communication unit.

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- Load Cells with HX711: Measure the weight of grocery items.
- DHT11: Monitors ambient temperature and humidity.
- MQ2 Sensor: Detects gas leakage.

C. Software Implementation

The microcontroller is programmed using Arduino IDE. Data from sensors is processed and thresholds are defined for alerts. Telegram bot integration allows real-time notifications via chat messages, including stock alerts and safety warnings. The design of the prototype consisting of hardware and software components, the fourth is related to the quality tests through the measurement of the patterns, the fifth is related to the tests on patients and the sixth to the evaluation with an entity that qualifies and issues the final authorization of use, we are considering these Sprint, where all the necessary requirements are considered in order to have a design that has a high probability of passing the evaluation and obtaining the authorization for clinical use.

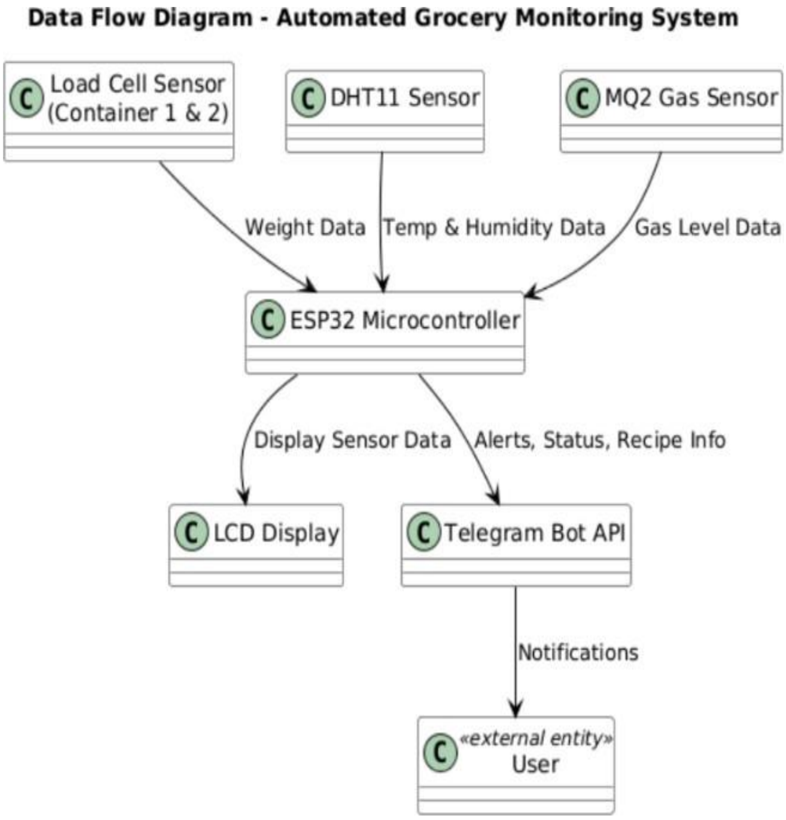


Figure 1. Data flow diagram.

The **Automated Grocery Monitoring System for Elderly People** is designed to assist users, particularly the elderly, by automating the process of monitoring grocery conditions through sensor-based technology. The system integrates a Load Cell Sensor (for two containers) to measure the weight of stored items, a DHT11 Sensor to record temperature and humidity, and an MQ2 Gas Sensor to detect the presence of harmful or spoilage-indicating gases. All sensor data is collected and processed by an ESP32 Microcontroller, which acts as the central processing unit. The ESP32 displays real-time sensor data on an LCD display for immediate visibility and simultaneously communicates alerts, grocery status updates, and recipe suggestions to the user through the Telegram Bot API. The Telegram platform then delivers these notifications directly to the user, ensuring timely action and reducing the need for manual checks. This system enhances convenience, promotes food safety, and supports independent living for elderly individuals.

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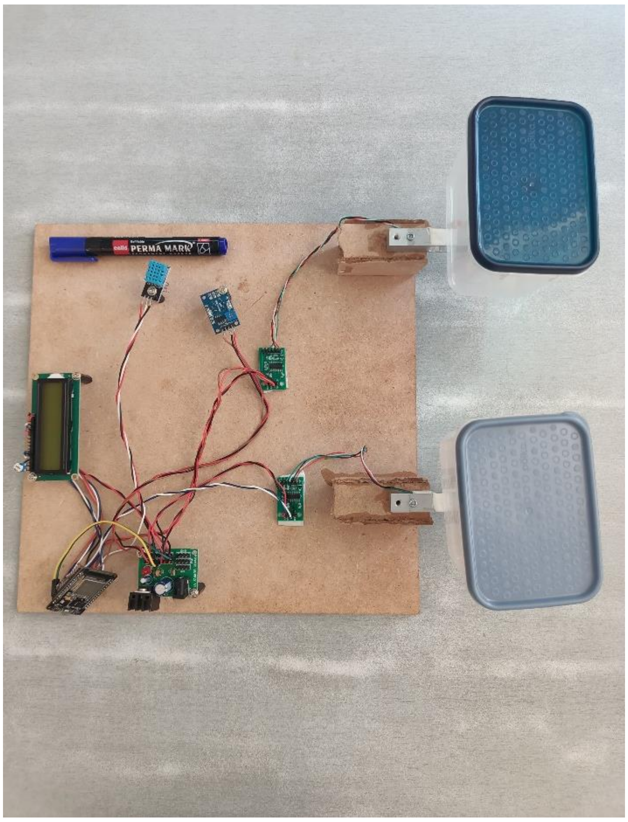


Figure 2. Model diagram.

The implementation phase of the Automated Grocery Monitoring System focuses on converting the design into a working, real-time system. This involves integrating various hardware components such as sensors, a microcontroller, communication modules, and a display, along with developing the necessary software to manage and coordinate the system's operations. During implementation, each sensor—load cell, humidity sensor (DHT11), and gas sensor (MQ2)—is connected to the ESP32 microcontroller, which acts as the central processing unit. The microcontroller is programmed to read sensor data, analyze it in real time, and determine when to trigger alerts. These alerts are then sent via the GSM module through SMS or over Telegram, depending on the chosen communication method. The system is also equipped with an LCD screen to provide live feedback to the user, showing current readings and system status. A stable power supply, either battery or adapter- based, ensures uninterrupted operation. The software implementation uses tools such as Arduino IDE and Python with PySerial to manage data flow and communication. This chapter describes how each component was set up, integrated, and tested to ensure the system operates efficiently and meets the functional goals outlined in earlier phases

## IV. RESULTS

The **Automated Grocery Monitoring System for Elderly People** was successfully implemented and tested across various real-time conditions. The system accurately monitored the weight of grocery items using load cells and detected when the quantity dropped below a predefined threshold, triggering instant alerts via the LCD display and Telegram bot. Environmental conditions such as temperature and humidity were effectively tracked using the DHT11 sensor, while the MQ2 gas sensor reliably identified the presence of spoilage-related gases, prompting alerts like "Smell Detected." These features ensured timely updates and allowed users to take preventive action, maintaining food quality and safety. The LCD provided local monitoring, while the Telegram bot enabled remote access to real-time data and notifications. Furthermore, using Telegram commands like /status for real-time grocery and sensor data and /Recipes for meal recommendations based on ingredient availability, the system showcased its interactive capabilities. By making everyday kitchen chores easier, this improved user engagement, particularly for senior users. The accuracy of load measurements, environmental sensing, gas detection, and communication efficiency were among the functional test cases that passed, confirming the system's dependability. The outcomes demonstrate that the system is a workable and affordable way to manage a smart kitchen, minimizing food waste, assisting with meal planning, and encouraging senior citizens to live independently.

  

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To confirm its accuracy, dependability, and functionality, the Automated Grocery Monitoring System was put through a rigorous testing process. The HX711 amplifiers and load cell sensors precisely measured the weight of groceries like rice and dal, sending updates to the Telegram bot and accurately displaying the readings on the LCD. The DHT11 sensor provided real-time data changes by efficiently tracking temperature and humidity in a variety of environmental conditions. When gas levels surpassed the threshold, the MQ2 gas sensor successfully activated a "Smell Detected" alert. The sensor was tested using spoilage simulations, such as overripe bananas. The GSM and Telegram bot were among the communication modules that were tested for alert delivery; they responded quickly with precise messages and recipe recommendations. The LCD display reliably displayed real-time sensor data, providing users with visual confirmation. The system's overall dependability in all test scenarios demonstrated its appropriateness for real-time household use, especially for senior citizens who need easy and automated grocery management. Users are guaranteed to receive precise and timely alerts when various sensors and communication channels are successfully integrated. With less manual labor, this improves everyday kitchen operations, lowers waste, and increases food safety.

| Test Case ID | Test Case Description | Input | Expected Output | Result |
|---|---|---|---|---|
| TC01 | Verify Load Cell weight reading | Weight placed in container 1 | Correct weight displayed on LCD and sent to Telegram | Pass/Fail |
| TC02 | Verify weight below threshold alert | Weight < threshold | Telegram alert: "Container 1 item low" | Pass/Fail |
| TC03 | Verify MQ2 Gas sensor alert | Expose to gas/smell | Telegram alert: "Possible spoilage detected" | Pass/Fail |
| TC04 | Check temperature and humidity reading | Normal room condition | Display temperature & humidity on LCD and Telegram | Pass/Fail |
| TC05 | Verify recipe suggestion based on available ingredients | Items detected: Rice, Onion | Telegram message: "Suggested Recipe: Onion Fried Rice" | Pass/Fail |
| TC06 | Verify data sent to Telegram | Any sensor activity | Corresponding message appears in Telegram | Pass/Fail |
| TC07 | Check LCD updates with live data | Vary any sensor input | LCD shows updated values in real-time | Pass/Fail |

## V. DRAWBACKS AND FUTURE SCOPE

The Automated Grocery Monitoring System has certain drawbacks despite its efficiency. It can only monitor two grocery containers at this time, which limits its scalability for larger homes or commercial kitchens. Additionally, the system is devoid of a specific mobile application that could improve user engagement outside of Telegram. Furthermore, the type and condition of food items may affect the accuracy of gas detection, and the lack of sophisticated machine learning algorithms restricts the ability to customize recipe recommendations. Because Telegram alerts rely on Wi-Fi, the system's intelligent features are reliant on reliable internet connectivity, which isn't always possible in rural or remote locations.

The system can be improved in the future to accommodate more containers, allowing for the monitoring of a greater range of food products. Users may find a more user-friendly interface for managing preferences, tracking groceries, and receiving alerts when mobile applications are integrated. Usability can be greatly enhanced by features like barcode scanning, voice assistant support (Google Assistant/Alexa), and AI-driven personalized recipe recommendations. Additionally, automatic grocery reordering might be possible by connecting the system to e- commerce platforms via APIs, offering a comprehensive end-to-end smart kitchen solution. These improvements would increase the system's usefulness and adaptability to contemporary smart home settings.

## VI. CONCLUSION

The Automated Grocery Monitoring System successfully demonstrates how IoT technology can be leveraged to enhance daily household management through smart Ordering and automation. By integrating ESP32 with load cells, DHT11, and a gas sensor, the system efficiently tracks grocery levels, monitors environmental conditions, and detects spoilage.

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Realtime data display on the LCD and Telegram-based notifications ensure that users are promptly informed of low stock or unsafe conditions, even when they are away from home. Additionally, the inclusion of recipe suggestions based on available ingredients adds practical value, promoting better food usage and minimizing waste. The project not only reduces the manual effort involved in grocery checks but also contributes to smarter, healthier, and more sustainable living. With scope for expansion, such as mobile app integration or AI-based recommendations, this system lays the groundwork for intelligent kitchen management in modern smart homes.

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