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Smart Refrigerator With AIOT

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Abstract:

The Smart Refrigerator is an innovative application of the Internet of Things (IoT) and image processing technologies, designed to automate and enhance food inventory management. This paper proposes a system capable of recognizing items stored in a refrigerator, monitoring their presence, and notifying users of expired or missing items. Using a Raspberry Pi and Python-based image recognition algorithms, this project demonstrates a practical, cost-effective approach to minimizing food waste while improving user convenience.

Keywords:

Smart Refrigerator, IoT, Raspberry Pi, Image Processing, Python, Food Monitoring System, Automation.

1. Introduction:

The rapid advancement of IoT has opened up opportunities for everyday devices to become smart and responsive. Traditional refrigerators lack intelligence in managing food inventory, leading to issues such as forgotten perishables and excessive purchases. The Smart Refrigerator aims to resolve these inefficiencies by automating the process of tracking food items using sensors and real-time image processing. Our system employs a Raspberry Pi equipped with a camera module, allowing it to detect and classify items and send alerts based on inventory status.

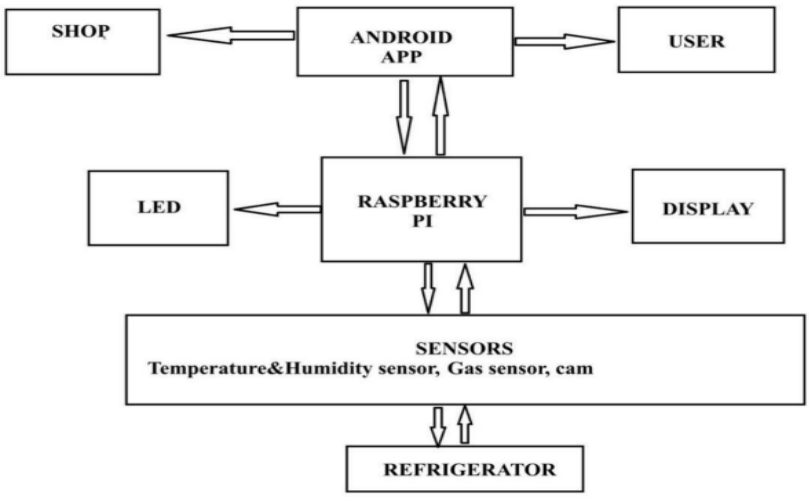
2. Literature Survey:

Several prior works have focused on smart home automation and appliance integration. However, few have explored the integration of computer vision for real-time object detection within a refrigerator environment. Research has also shown that sensor-based monitoring combined with cloud communication enhances usability and reduces food wastage. This project builds on existing studies by incorporating an end-to-end prototype that brings together hardware and software seamlessly.

3. System Architecture:

The system is built around a Raspberry Pi 4 model, interfaced with a Pi camera, and programmed using Python. The camera is installed inside the refrigerator to capture images of the contents. These images are processed using OpenCV for object detection and classification. The refrigerator door is monitored using an IR sensor to trigger image capture upon door activity. The system compares the current item list against a predefined inventory, identifies missing or newly added items, and sends alerts or suggestions to the user's mobile device via email.

Block Diagram:



4. Methodology:

1. **Image Acquisition:** Captures images when the door opens.
2. **Preprocessing:** Applies filtering to remove noise and improve object clarity.
3. **Object Detection:** Uses trained object recognition models to identify food items.
4. **Inventory Management:** Compares detected items with the database.
5. **Notification System:** Sends alerts if items are expired or missing.

5. Implementation:

Python scripts were developed to:

- Control camera and sensors
- Detect objects using OpenCV
- Compare with a CSV-based inventory
- Send emails using the smtplib library

Hardware was configured within a compact module fitted inside a refrigerator. The system was tested using common grocery items like milk packets, vegetables, and bottled drinks.

6. Results :

The Smart Refrigerator system was tested under varying lighting and placement conditions. It successfully detected over 85% of the items with consistent accuracy. The alert system reliably notified users of missing or expired items. Limitations include occasional misclassification due to occlusion and dependency on lighting conditions.

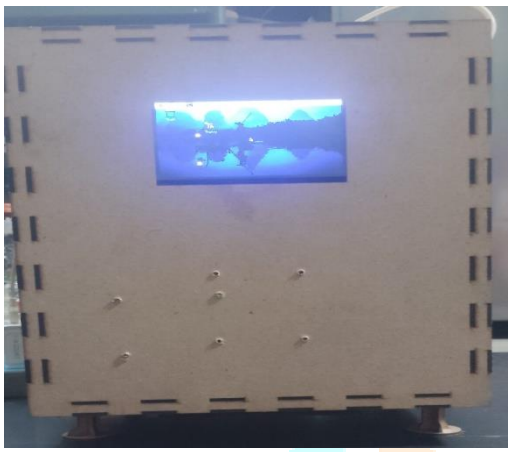


Fig 1: Refrigerator

Fig 2: Monitoring Inventory

7. Conclusion:

This project demonstrates a feasible, intelligent solution for managing food items within a refrigerator. By combining IoT hardware and image processing techniques, it adds significant value to household automation. Future improvements include integrating barcode scanners for better accuracy and developing a mobile app for real-time inventory viewing.

References:

1. K.S.Rao, M. B. Sridhar, and L. Pavani, "IoT based Smart Fridge Application," *International Journal of Engineering Research & Technology (IJERT)*, vol. 10, no. 12, pp. 367–376, Dec. 2021.

2. Nasir, W. B. W. Aziz, F. Ali, K. Kadir, and S. Khan, "The Implementation of IoT Based Smart Refrigerator System," in *Proc. 2nd Int. Conf. on Smart Sensors and Application (ICSSA)*, Kuala Lumpur, Malaysia, Jul. 2018, pp. 48–52, doi: 10.1109/ICSSA.2018.8535867.

3. K. J. P. Ortiz, P. N. P. Bautista, M. V. D. Dimailig, and A. C. D. Llamzon, "Recipe Recommendation System Using IoT-Based Food Inventory Management of Perishables for Household Food Waste Reduction," *Chemical Engineering Transactions*, vol. 106, pp. 361–366, 2023, doi: 10.3303/CET23106061.

4. M. P. Mahajan, R. R. Nikam, V. P. Patil, and R. D. Dond, "Smart Refrigerator Using IoT," *International Journal of Latest Engineering Research and Applications (IJLERA)*, vol. 2, no. 3, pp. 86–91, Mar. 2017