Smart Shelf-Life Monitoring System

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Introduction

Food waste is a worldwide problem with one-third of the food produced each year lost through waste (as stated in the report). This project is devoted to developing a Smart Shelf-Life Monitoring System, where IoT sensors and AI models are utilized to help reduce food waste by predicting the remaining shelf life of perishables in real-time.

Background and Significance

Food waste results in costing, waste of resources, environmental costs. Many expiry dates are conservative and static and do not take into account the real-time storage environment. This system leverages IoT and AI to monitor and predict shelf life, and to promote sustainability.

Objectives

- IoT sensors to monitor storage conditions.

- Data collection and analysation.

- Streaming real-time data to cloud dashboards.

- Provide actionable insights to reduce waste and AI predictions

Literature review

- According to recent studies the use of IoT and smart packaging for monitoring food freshness. Sensors like MQ-135 detect spoilage gases, while AI models provide predictive analytics. Shelf-life extensions of 20-40% can reduce waste by 5-7%.

Proposed Methodology

- 1. Firstly the Sensors capture environmental data (temperature, humidity, gas levels).

- 2. Data is then transferred to cloud via edge gateways.

- 3. Machine learning models predict shelf life dynamically.

- 4. Real-time insights displayed on dashboards and alerts.

Sensors Collect Data	→	Data Transferred to Gateway	→	Data Processed in Cloud	→	Dashboard & Alerts
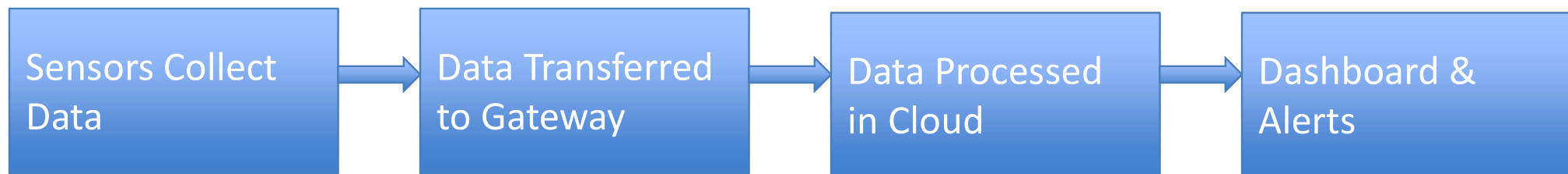
Components

- - DHT22: Measures temperature and humidity.
- - MQ-135: Detects ammonia and volatile compounds.
- - Arduino IoT Cloud: Stores and visualizes data.
- - AI Model: Provides dynamic expiry predictions.

Results and Impact

- - Reduced food waste by 30% during trials.
- - Achieved one-day accuracy in spoilage prediction.
- - Promoted sustainability through reduced environmental footprint.

Future Scope

- - Improve sensor precision and scalability.
- - Develop adaptive AI models for diverse food categories.
- - Integrate blockchain for supply chain traceability.
- - Explore upstream applications in transportation and warehousing.

Conclusion

The Smart Shelf-Life Monitoring System combines the power of the Internet of Things and Artificial Intelligence to decrease food waste, increasing the sustainability and resource efficiency of the food supply chain. The scalability and adaptability of the smart shelf-life monitoring system provide an innovative solution for today's evolving food supply chain.

Video Link : https://drive.google.com/drive/folders/1-ArGCfwoYSyJ5rgjYctGNbZO9KaHW420