RV College of Engineering, Bengaluru - 560059.

Fast Food Monitoring Using AR and Digital Twin

Go, change the world

Team No:31

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Theme:Manufacturing Processes

Introduction

This project integrates Augmented Reality (AR), Virtual Reality (VR), and Digital Twin (DT) technologies.

It creates an immersive, interactive model of food manufacturing operations.

The system provides a real-time virtual replica of the physical plant.

Users can monitor supply chain data within the digital environment.

The platform allows visualization of processes in real time.

Equipment such as valves can be remotely controlled via touch or voice commands.

Problem Definition

Problem Statement: AR/VR-enabled monitoring system with an AI voice assistant to enhance real-time decision-making and operational efficiency in industrial supply chains.

Context of the Problem: Manufacturing industries struggle with slow, manual monitoring and control processes, which can lead to inefficiencies and costly errors. AR/VR digital twin solutions offer real-time visibility and remote control, helping to improve safety, reliability, and productivity.

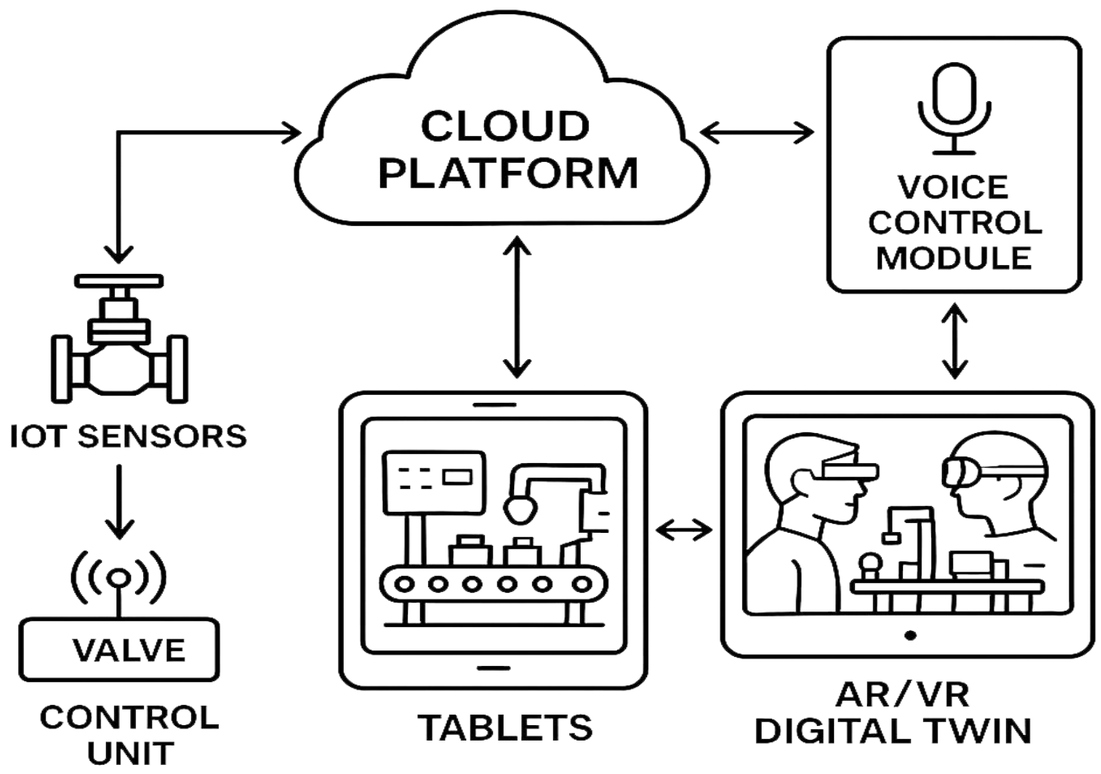
Objectives

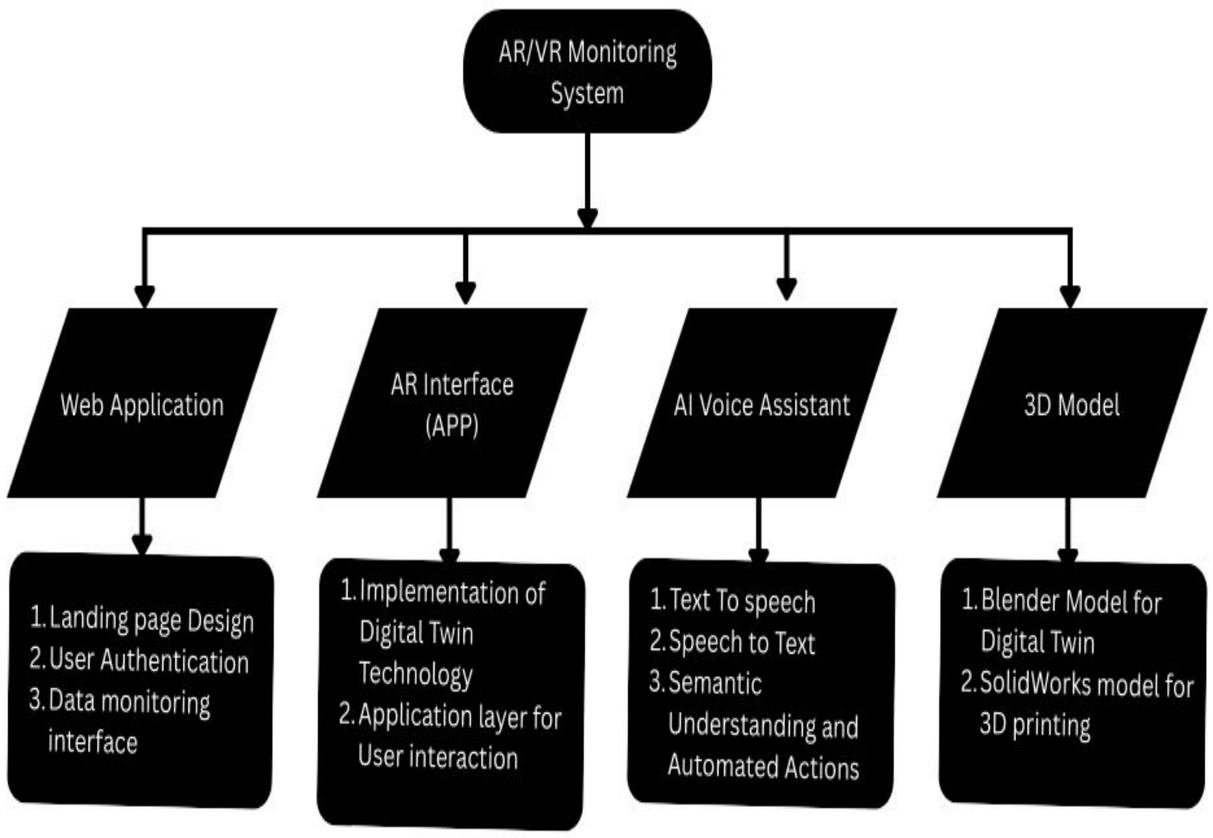
Real-Time Control: Enables instant monitoring and remote operation of equipment, improving response times.

Increased Efficiency: Optimizes processes, reduces downtime, and streamlines maintenance with predictive insights.

Enhanced Safety & Quality: Supports better training, quality control, and rapid problem detection.

Methodology





Tools used

—>Hardware

Raspberry Pi (ARM Cortex-A72, 4GB RAM) — edge computing gateways

IoT sensors — various types (temperature, proximity, etc.)

Voice modules / microphones — for voice control input

Network equipment — Wi-Fi 6 routers, Ethernet switches

—>Software and Programming

Unity — development of AR/VR models, digital twins, 3D visualization

JavaScript (JS) — web integration and interactivity

Python — sensor control logic, data pre-processing, backend scripts

MongoDB — database for storing IoT and AR/VR data

Adafruit libraries — sensor and hardware interfacing with Raspberry Pi

Gemini API (or similar) — generative AI for enhanced user interaction and NLP

Results and Discussions

Performance metrics show ±0.1°C temperature accuracy, 78.7% data reliability, ±2% RH precision, and 78.5% uptime, ensuring robust monitoring.

Pressure units achieve ±0.25% accuracy with sub-10s updates for critical safety.

AR-guided workflows cut manual intervention time from 45s to 12s, reducing errors.

Voice control works with 52% command recognition in noisy environments.

Edge computing with Raspberry Pi and cloud platforms like mongoDB enable real-time analytics and AR/VR digital twins.

Automated HACCP monitoring cut temperature excursions by 65% and audit prep time by 75%, boosting food safety and compliance.

Conclusions

The proposed AR enhanced digital twin system for food manufacturing offers a transformative solution that integrates real-time monitoring, remote control, and immersive visualization to optimize supply chain operations.

By combining IoT sensor networks, intuitive touch and voice interfaces, and advanced AR technologies, the system enhances operational efficiency, safety, and decision-making capabilities. Rigorous development, testing, and validation ensure reliability and compliance with industry standards, while the inclusion of a 3D printed model facilitates stakeholder engagement and practical demonstrations.

Overall, this innovative platform stands to significantly improve productivity and quality assurance in food manufacturing, paving the way for smarter, more connected industrial processes.

References

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DEMO VIDEO

PRESENTATION

REPORT