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IOT Based Smart Inventory Management System for Kitchen

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Abstract

This project presents the design and implementation of a smart kitchen monitoring system that automates the tracking of grocery stock levels and water tank levels. The system uses load cells paired with HX711 amplifiers to measure the weight of groceries stored in containers. An ESP32 microcontroller processes sensor data and sends real-time updates to a mobile application using Wi- Fi and the Blynk IoT platform. Additionally, a GSM module is integrated to send SMS alerts to the user when stock levels are low, ensuring timely replenishment. The water level in the tank is monitored using probes that detect when water reaches specific heights. This information is displayed using LEDs and shared via the mobile app. The entire system is powered using a 230V AC supply converted to 12V and 5V as needed for different components. Programming is done using the Arduino IDE, making the system easily modifiable and scalable. This project demonstrates a reliable, low-cost solution to automate kitchen inventory and water level monitoring, reducing manual effort and increasing convenience through IoT-based smart notifications.

Keywords: *Internet Of Things, Load Cell, ESP32, HX711 amplifier, GSM, Motor, Transistor.*

1. Introduction

In today's fast-paced world, automation and smart monitoring systems have become essential in managing household tasks efficiently. One such important area is the kitchen, where keeping track of grocery stock levels and water availability can be challenging. This project aims to develop a smart kitchen monitoring system that automatically measures the weight of stored grocery items and monitors the water level in a tank. The system uses load cells with HX711 amplifiers to measure the weight of various items, and ESP32 as the main controller to process the data. A GSM module and the Blynk IoT mobile application are used to send real-time updates and alerts to the user's smartphone, ensuring that they are notified when any item is running low or when the water tank needs attention. The use of sensors, microcontrollers, and wireless communication in this project helps to reduce manual checks, save time, and avoid unexpected shortages. This project combines both hardware and software components, including sensors, voltage regulators, a display unit, and the Arduino IDE for coding and uploading firmware. It provides a practical, low-cost solution for modern kitchen management and shows the power of IoT in daily life.

- **This project is presented as follows:** A detailed system overview of smart kitchen inventory is given in section III, results are shown in section V.

2. Literature Review

2.1. A Smart Kitchen Automation and Egg Tray Management System Using IOT [1]

This paper is about sending the Number of egg present in the tray details to the user. It operates by using sensors under the egg tray and sending the information to the user through IoT.

2.2. Smart Kitchen Wardrobe Based [2]

Monitoring the position of each product in the container Keep tracking and detecting the levels of grocery products in each container daily. Notify the user that the product level is low, when its level goes below its threshold and those products had to be bought and stored in the respective containers again.

2.3. Smart Home Monitoring and Controlling System Using Android Phone [3]

In this project, it describes a zig-bee module and

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android based home monitoring system for security, safety and healthcare for humans. This system is flexible and can be implemented in many research areas. This paper introduces a smart home system which could surprise household appliances remotely and realize real-time monitoring of home security status through mobile phones. The personal computer is used to monitor the various parameters in the proposed system. Android Phone is main advantage compared to personal computers for using any place.

2.4. Smart Kitchen Cabinet for Smart Home [4]

This paper describes the conceptual design of a smart kitchen cabinet. This system incorporates grocery item identification, inventory management of grocery items and automatic generation of shopping lists. The smart kitchen cabinet consists of two different sections each leveraging two sensing mechanisms: weight sensing section consists of fixed size container having RFID ta0g defining container size with product description RFID tag reader, and ultrasonic level sensor for measuring the level of contents in the container. RFID tag reader, and weight sensor meaning all the content on that shelf. The embedded sensor measures the weight or the level of the items which in updated to the database whenever grocery items are placed or taken out for cooking. When the item searches the predefined threshold level, the system generates the automated shopping list Shown in Figure 1.

2.5. IOT Based Grocery Monitoring System [5]

This paper provides an insight into the development of an IoT based prototype to monitor grocery levels at homes and supermarkets. A compatible and affordable wireless sensor network is implemented. Serving as an asset for research in the food industry, this implementation can be used to observe the food consumption patterns. Using this prototype as a base, real-time applications can be developed to manage our current inventory efficiently with its implications in food and ecommerce industry.

2.6. Homeautomation [6]

Although smart devices have been available in the past, their use has been restricted because they lack intercommunication. One suggested solution is to connect all smart devices using hard wiring; however, the resulting portability problem then creates a demand for a wireless network capable of accommodating the devices. Organizations have therefore developed 294 Al- Sumaiti et al.: Smart Home Activities: A Literature Review 295 management, additional services, and gateways for smart devices. Smart home network technology has been deployed in different systems, such as power lines and radio frequency systems. These developments enable the deployment of a network in smart devices but only with a high associated cost that has become a new challenge.

2.7. A Smart Kitchen Infrastructure- Ure [7]

In the future our homes will be increasingly equipped with sensing and interaction devices that will make new multimedia experiences possible. These experiences will not necessarily be bound to the TV, tabletop, smart phone, tablet or desktop computer but will be embedded in our everyday surroundings. To enable new forms of interaction, we equipped an ordinary kitchen with a large variety of sensors according to best practices. An innovation in comparison to related work is our Information Acquisition System that allows monitoring and controlling kitchen appliances remotely. This paper presents our sensing infrastructure and novel interactions in the kitchen that are enabled by the Information Acquisition System. Electromagnet and the plunger, which is located inside the coil, is attracted towards the center of the coil by the magnetic flux setup within the coil's body, which in turn compresses a small spring attached to one end of the plunger. The force and speed of the plunger's movement is determined by the strength of the magnetic flux generated within the coil. When the supply current is turned OFF (de- energized) the electromagnetic field generated previously by the coil collapses and the energy stored in the compressed spring forces the plunger back out to its original rest position. This back-and-forth movement of the plunger is known as the

3. Methodology

This project is designed to monitor the stock levels of groceries and the water level in a kitchen tank. It collects this data and sends it to a user's mobile application using an ESP32 microcontroller and a

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GSM module. The system also provides alert notifications when the stock level is insufficient. It includes both hardware and software components Shown in Figure 2 and 3.

3.1. Hardware Components

The hardware setup includes a load cell, an HX711 amplifier, an ESP32 microcontroller, a GSM module, a motor, and a transistor. The load cell, which is attached to a container, measures the weight of the stock. The entire setup, including the container and load cell, is mounted on a wooden board to ensure proper balance and accurate reading. A load cell is a sensor or transducer that converts mechanical force into readable electrical signals. Its primary function in this system is to measure the weight of the stock and detect the amount of load applied. The load cell sends this data to the HX711 module, a 16-bit analog-to-digital converter (ADC) commonly used in weighing scales and for directly interfacing with load sensors. The ESP32 continuously monitors the weight and sends a notification to the user when the stock is low. The ESP32 microcontroller is used to control the entire system. The load cell senses the weight and provides an analog electrical voltage to the HX711 amplifier. The HX711 then amplifies and digitizes this signal and sends it to the ESP32. The ESP32 processes the digital output and converts it into weight values in grams. The ESP32 and other components, such as the LCD display and sensors, require a 5V power supply. A 12V input is stepped down to 5V using two 7805 voltage regulators—one for the ESP32 and one for the LCD and sensors. The ESP32 receives four inputs in total: three from the load cells to measure the weight of the stock, and one from a motor used to monitor the water level in the tank. The output from the load cells is in analog form. This analog signal is converted to a digital signal by the HX711 module, producing values ranging from 0 to 65536. The ESP32 processes these values using conditional logic to calculate the corresponding weight in grams, which it stores in different variables. For displaying the data on the user's mobile phone, the Blynk IoT mobile application is used. It shows the weight of the grocery items in grams. The water level in the tank is also measured using the ESP32. When the water touches a probe, it completes an electrical circuit, which activates a corresponding transistor. This information is then displayed on an LED. If the water reaches the topmost probe, it indicates that the tank is full. If the water is below the bottom probe, it signals that the tank is empty. A GSM module is used to send SMS notifications when the stock is low. It uses a quad-band GSM connection to choose the most available base station. A 3G-compatible SIM card is used to enable communication through the mobile network. The module connects to the mobile hotspot and sends messages to the user's phone. The GSM module is a specialized device that enables wireless data transmission and reception. The load cell data is collected and sent to the ESP32 through the HX711 module. The data is then calibrated to ensure accurate measurement. The final weight values are transmitted to the ESP32 via serial communication. The ESP32 uses its built-in Wi-Fi capability to send the data to the user's mobile app over the internet. The programming for the ESP32 and GSM module is done using the ARDUINO IDE, which is open-source software commonly used for microcontroller development. The power supply is derived from a 230V AC source, which is stepped down to 12V AC using a transformer. This is then converted to 12V DC using rectifier diodes. A capacitor filter is used to smooth the output, converting pulsating DC into pure DC Shown in Figure 4 and 5.

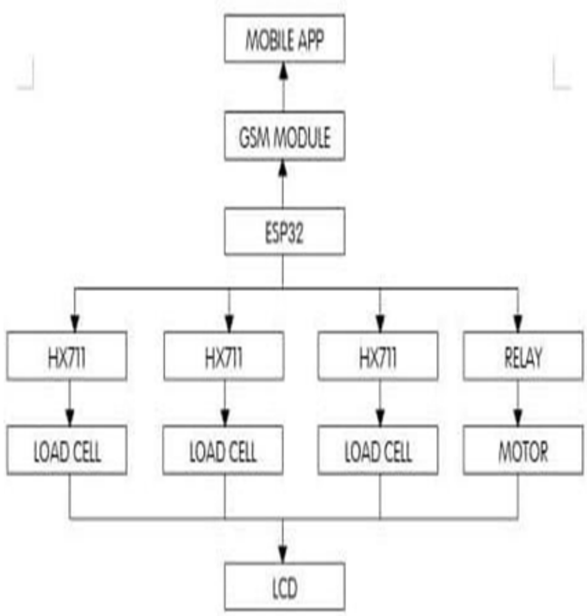

Figure 1 Block Diagram of Proposed Model

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4. Flow Chart

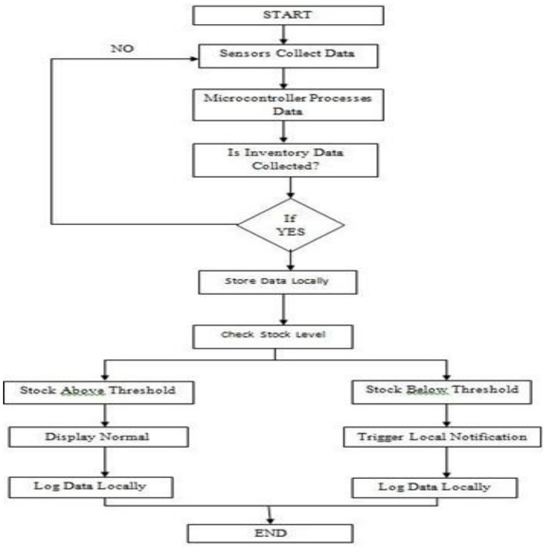

Figure 2 **Flow Chart**

5. Result

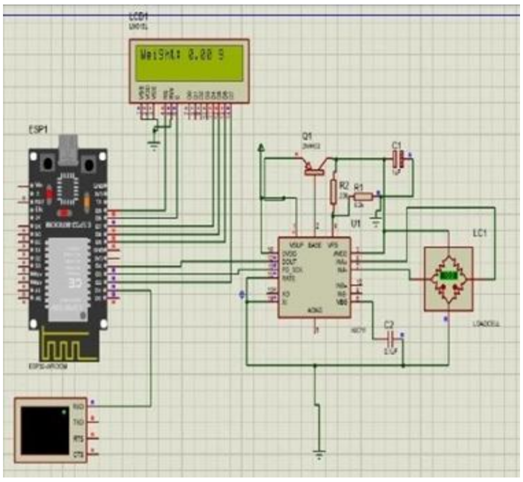

Figure 3 **Simulation Result**

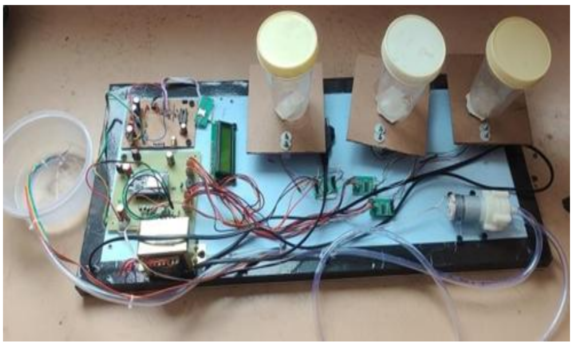

Figure 4 **Kitchen Wardrobe Model**

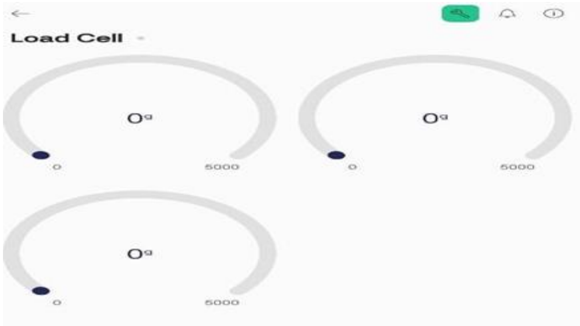

Figure 5 **App Result**

Conclusion

This project successfully demonstrates a smart and efficient system for monitoring grocery stock levels and water tank levels in a kitchen using IoT technology. By integrating load cells, the HX711 module, ESP32, and a GSM module, the system accurately measures and transmits real-time data to a user's mobile application. The use of the Blynk app provides an easy-to-use interface for viewing stock weights. The system automates stock level tracking and water monitoring, reducing manual effort and preventing shortages. It can be easily expanded to monitor more items or integrated into a larger home automation system. Overall, this project showcases the practical application of microcontrollers and wireless communication in developing smart kitchen solutions, enhancing convenience and efficiency in daily life. cost-effective, and reliable method.

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