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IoT-Based Smart Weighing and Automated Digital Billing Web Solution

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Abstract
This project suggests making a smart, IoT-enabled app. This device connects directly to digital weighing scales via Bluetooth or Wi-Fi. This would reduce the need for extra microcontroller units. The system has three main functions—quantity verification, cooking assistance, and smart billing—that are meant to make retail, cooking, and inventory management more efficient. The quantity verification module makes sure that products or materials are measured and checked correctly, which makes it useful for inventory control and business transactions. The cook aid module contains a carefully selected database of recipes with fixed quantities for every ingredient. The app advances the weight of ingredients on the scale as food is made. This ensures that the baking processes are consistent and precise. Smart billing module also calculates how much goods are bought and based on the total generated bill a QR code for easy billing.

Keywords: *Web operation, QR Code, IoT, ESP32, Weight cell, Smart import, fast API, and Billing.*

1. Introduction
The present work provides a novel solution by integrating IoT based digital weighing system and a smart mobile application. This is in pursuit of increased accuracy, speed, and user experience at home or in business environments. The system implements wireless connection via Bluetooth or Wi-Fi to facilitate seamless communication between a digital scale and a mobile application. It brings real-time weight data into a variety of reality. The system automates three major tasks: quantity verification, recipe assistance and automatic billing.

Quantity Validation
The system make-sure that the weight of any item—whether it is an ingredient in a kitchen or a product in a store—is measured and checked against expected values. This is particularly helpful for reducing waste, maintaining consistency in recipes, and verifying product quantities during purchase. The app can alert users if the weight is outside the desired range, making it useful for both quality control and compliance.

Smart Recipe Assistance
The app has a built-in recipe assistant for food prep. The recipe assistant will guide the user step-by-step through the food preparation process. The app tracks the weight of each ingredient added and gives instant feedback to indicate if the measurement is correct. Users will choose a recipe and choose to scale it depending on the serving size and the app will adjust ingredient weights for the user. This can help provide better cooking accuracy, less error, and help novice users follow complex recipes.

Smart Billing and Checkout
The system tracks how much each item weighs in a retail or self-service environment and calculates a per unit rate and price within the app. Once the weighing is finished and the total price is determined, the app generates a smart digital bill and provides a QR code to enable quick, secure, and contactless payment. This can also allow the option for smart digital payment to eliminate the need for implementing a manual billing process to speed up checkout and

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enhance customer convenience. The app may also be integrated with digital wallets or POS systems for a seamless bill pay process.

1.1. Objectives

The proposed mobile application aims to transform conventional digital weighing systems used in kitchens and for retail purposes by integrating ease of use, instant feedback and smart automation. The objectives are below, followed by a detailed explanation of each:

- **To develop a smart, friendly person application with Bluetooth or Wi-Fi connection to the digital weighing scale eliminating the need of a microcontroller:** The mobile application was designed to make the simplest interaction with the digital weighing scale with a connection to either Bluetooth or Wi-Fi module eliminating the need to connect with the microcontroller such as an Arduino etcetera. This greatly simplifies overall architecture of the system and removes the hardware barrier and technology concerns making the system more cost and knowledge accessible by small businesses or individuals.
- **To verify quantity in real-time for inventory and/or product authenticity:** Real-time quantity verification allows users to be alerted if the specified weight for a product or ingredient being weighed does not meet threshold specified. This verification is important in retail shops because discrepancies affect pricing or are detrimental to inventory systems.
- **To reduce human error in billing and weighing, especially in kitchen and retail environments**: Errors in manual weighing and billing are common and can include inaccurate price calculations, mismeasured ingredients and inaccurate billing. By reducing human intervention in these crucial tasks, the intelligent system minimizes errors. This guarantees consistent and dependable cooking results in kitchen settings in addition to boosting customer trust in retail settings.
- **To offer a modular and scalable application framework for use in industrial applications, home kitchens, and small shops:** Because of its scalable design, the application can be used in a variety of settings, including homes, small businesses, and even larger industrial setups.

1.2. Purpose, Scope and Applicability

1.2.1 Purpose

This project is an effort to create smart mobile application with IoT integration that brings accuracy, ease of use and efficiency to weighing, recipe, and billing tasks. By connecting directly, the digital weighing scale to a mobile application via Bluetooth or Wi-Fi, without an intermediary microcontroller, automation can replace manual, error-prone, and time-consuming processes. This project consists of three functional domains:

- **Inventory Management:** As items are weighed it will log and confirm quantities of each item to accurately track inventory levels, and validation of products made or sold.
- **Cooking Assistance:** It will automatically guide through recipe preparation and verify if the right amount of ingredients has been weighed at each step to provide the greatest degree of accuracy and consistency in cooking.
- **Smart Billing:** It will determine the price of items based on their weight and generate a QR code for seamless, contactless payment. The aim is to create an expandable, modular platform in a variety of contexts, from households and small retail shops to industrial food processing applications. The intention of integrating smart software and IoT hardware is to mitigate human error, reduce overhead, and create seamless experiences for the user in either home or commercial contexts.

1.2.2 Scope

The reach of this project extends to design, development, and deployment with the digital weighing scale with IoT technologies. In terms of the weight-based applications domain, the solution will solve real-world problems related to determining the

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size of and reporting on ingredient portions, tracking inventory, and determining price (domestic and small to medium commercial units).

- **IoT Integration:** Digital weighing scales will communicate directly to the mobile application by means of Bluetooth or Wi-Fi technology, and there will be no need for micro-controllers or additional hardware configuration.
- **Live weight monitoring:** The device will continuously capture weight measurements from the weighing device and process the weight measurements for operations that require live purposes such as verification of food quantity, cooking and function and price calculations.
- **Inventory assessment for quantity verification:** The device will indicate the level of the items (input/output) existing in weighing process in retail or kitchen inventory management systems, automatically recording and verifying weight.
- **Cookery recipe guidance:** The device will provide an interactive process for users to engage and follow the recipe order of instructions with the live feedback from each weight provision to ensure that the ingredient amounts and avoid common ingredient usage mistakes in cooking processes.
- **Automated billing system:** The device will account for item cost by determining weight and unit prices and produce a digital invoice with QR codes to allow users to pay.
- **User experience (UX) and user interface (UI):** The mobile application will have a clear, easy-to-use interface.

1.2.3 Applicability

Smart IoT-enabled digital weighing scale with a mobile application can be valuable in many real-life situations. The intelligent functionality and flexibility of this application can ideally be used in:

- **Retail and Grocery Stores:** To offer self-service weighing, automatic pricing and quick contactless payments while maintaining real-time inventory levels.
- **Smart Kitchens and Home Cooking:** To help users verify the weights of ingredients through cooking and maintain portion control for weight or dietary needs.
- Food Startups and Cloud Kitchens: To standardize ingredient measurements for consistent food quality and enable easy pricing on direct customer sales.
- **Educational institutions:** To serve as practical support for IoT and automation concepts along with accurate measurements in laboratory experiments.
- **Food Processing and Manufacturing:** To provide accurate weighing of ingredients for quality control and automate batch tracking for quality and compliance. With the use of IoT, together with some intelligent software, this project proves useful as a scalable solution for use in an environment where accurate weight, real-time feedback, and automated billing are required, improving efficiency, accuracy and convenience for users across many industries and everyday situations.

2. Method

2.1 System Architecture

The proposed system combines IoT-enabled weighing sensors, a microcontroller unit (MCU) for data collection, and a web-based application for automated billing. The workflow includes four stages:

- Data captures using load cell sensors linked to an HX711 amplifier.
- Data processing and transmission through an ESP32 microcontroller with Wi-Fi connection.
- Cloud storage and backend processing with a real-time database.
- Automated billing and display via a web application accessible to both vendors and customers.

2.2 Automated Digital Billing Workflow

- **Weight Measurement:** When an item is placed on the scale, the load detects the weight.
- **Item Identification:** Each product was pre-

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mapped in the database with a weight-to-price mapping (price per unit weight).

- **Real-time Processing:** ESP32 sends the measured data to Firebase.
- **Bill Generation:** The web app calculates the item price, updates the cart in real-time, and generates a total bill.
- **Customer View:** Both vendor and customer can view the bill simultaneously on connected devices.

2.3 Experimental Setup & Testing

Standard weights were used for calibration, and tolerance levels were kept below ±2 g. To guarantee real-time performance, the sensor-to-web update response time (averaging less than 1.2 seconds) was measured [1].

2.1.1 Tables

Table 1 The table summarizes customer checkout performance under three methods: Manual, RFID Trolley, and IoT Weighing-Based Billing System.

Table 1 Customer Checkout Performance Method

Customer ID	Billing Method	Items Scanned	Checkout Time (min)
C001	Manual	12	11.2
C002	Manual	8	9.5
C003	Manual	15	13
C004	RFID Trolley	10	7.2
C005	RFID Trolley	14	6.8
C006	RFID Trolley	9	7.5
C007	IoT-Weighing based bill System	11	6.1
C008	IoT- Weighing based bill System	13	5.9
C009	IoT-Weighing based bill System	10	6

2.1.2 Figures

Figure 1 Smart App Integration for IoT-Enabled Weighing Scales [2]

Figure 2 IoT-Enabled Smart Weighing System with Quantity Verification, Cooking Assistance, and Automated Billing [3]

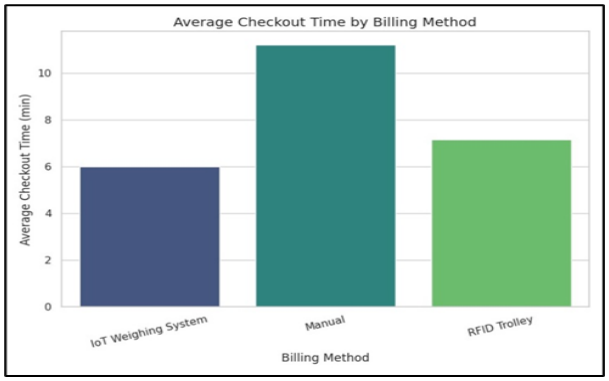

Figure 3 Realistic Assumptions and Trends Seen in Retail Environments [4]

3. Results and Discussion

3.1 Results

The system is connected to digital weighing scales via Wi-Fi and Bluetooth without needing extra hardware. All three functions such as Quantity checking, cooking helper and Smart billing also performed correctly. The Quantity option was used as a weight option during retail and stock processes. The recipe module allowed precise calculation of the necessary amount of ingredients when cooking. The billing option provided instant QR-code bills. Too, the tests performed well and contained only minor errors.

3.2 Discussion

The outcomes suggest that weighing facility with IoT rolled in an app will make human effort less along with increase in accuracy. Not requiring separate micro controllers made for a super easy to build design with a low-cost. Its quantity check feature may also prevent businesses from making errors in stock monitoring. The

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cooking assistance guarantees stable recipes, and the billing component accelerates the procedure. Upon the whole, the project indicates that simple IoT integration may bring much sense in both home and working environment [5].

Figure 4 Process of the dataset

Conclusion

The project demonstrated an IoT-enabled app that interfaces with the digital weighing scales over Wi-Fi and Bluetooth. With quantity verification, cooking aid and intelligent billing all combined into one solution – it was easy, it was precise, and it was affordable. The findings underline the potential of IoT integration in saving manual labor, enhancing the report consistency and organizing the daily work on the retail and home scales. This work lays the groundwork for further improvements, such as expanding the recipe database, adding payment gateways, and applying the system to large-scale inventory management.

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References

[1]. Patel, H., & Shah, P. (2021). Development of IoT-based digital weighing scale with cloud connectivity for smart retail applications. The International Journal of Innovative Technology and Exploring Engineering (IJITEE), 10(8), 45–50.

[2]. Reddy, A., & Kumar, S. (2020). Smart kitchen solutions using IoT-enabled sensors and recipe recommendation systems. The International Journal of Emerging Trends in Engineering Research (IJETER), 8(9), 602–608.

[3]. Sharma, V., & Nair, R. (2019). Wireless communication enabled weighing systems using ESP32 and HX711 modules. International Journal of Recent Technology and Engineering (IJRTE), 8(3), 1124–1128.

[4]. Inamdar, O. M. A., et al. (2024). IoT-Based Smart Trolley for Automated Billing. International Journal of Innovative Research in Science, Engineering and Technology, 13(2), 789–795.

[5]. Fernandes, R., et al. (2021). Intelligent IoT-Based Product Dispenser and Billing System. In Advances in Intelligent Systems and Computing (pp. 51–63). Springer.