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Development of an IOT Based Smart Electronics Weighing Scale

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Abstract

The IoT Human Weight Measuring Machine with RFID for Person ID is a comprehensive solution designed to automate weight measurement and user data management. By integrating a load cell for precise weight measurement, an RFID module for unique user identification, and a GSM module for real-time data transmission, the System enables personalized weight tracking and centralized data storage. This system is suitable for applications in healthcare, fitness centers, and workplace health monitoring, where accurate and accessible data are essential.The use of GSM connectivity ensures portability and functionality in diverse environments, including areas with limited infrastructure. This system simplifies the process of health data collection, enhances remote accessibility, and supports efficient data analysis, offering a robust solution for modern health and wellness management needs.

INTRODUCTION

Weight monitoring and health data management are critical aspects of modern healthcare, fitness, and occupational health programs. Traditional methods of weight measurement often fail to provide real-time data access, personalized tracking, [1]or seamless data integration for centralized management. These limitations can hinder efficient health monitoring and complicate record-keeping processes, particularly in scenarios requiring frequent or large-scale tracking.

The IoT Human Weight Measuring Machine with RFID for Person ID is designed to address these challenges. By incorporating a load cell with an HX711 amplifier, the system ensures accurate weight measurement. [2]An RFID module is employed to uniquely identify users, enabling the system to associate weight data with individual records. A GSM module facilitates data transmission, allowing the system to send user weight records to a cloud-based database for centralized storage and remote access. This eliminates the need for manual record-keeping, enhances data reliability, and simplifies management tasks.

The system's reliance on GSM connectivity ensures that it remains functional in diverse environments, includingremote locations or mobile setups.[3] This feature makes it particularly suitable for applications such as rural healthcare programs, fitness center memberships, and workplace health initiatives. The integration of IoT capabilities enables real-time data tracking and future scalability, supporting the development of additional functionalities like automated alerts or data analytics.[4]This project explores the design and implementation of the IoT Human Weight Measuring Machine with RFID for Person ID, emphasizing its applications in personalized health monitoring and efficient data management systems.

LITERATURE REVIEW

1. **Arduino-Based Automatic Weighing Machines:**
Asri et al. (2024) presented a design for an automatic weighing machine utilizing the Arduino Mega 2560 and load cells. The system demonstrated precision in weighing up to 20 kg, emphasizing automation's role in reducing errors and improving production efficiency in industries like agriculture and commerce. Their design optimized energy consumption, with a 12-second cycle for weighing and packaging 1 kg of rice. The system consumed only 0.2345 kWh for weighing 2000 kg of rice, showcasing its energy efficiency. This study highlights the potential of Arduino-driven automation in industrial scales, offering low power consumption and scalability.

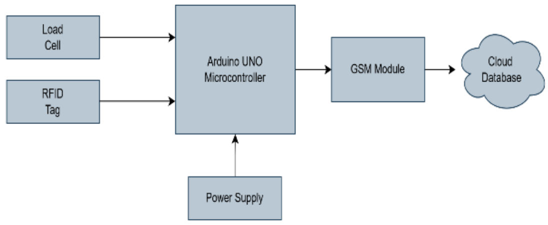
2. **IoT-Enabled Luggage Weight and Tracking Systems:**
Farooq et al. (2021) introduced "Easy-Weigh-Out," an IoT-based smart luggage system combining an Arduino Uno, load cell, GPS module, and ESP8266 Wi-Fi. The system allowed users to monitor luggage weight and track its location through a mobile application. By uploading data to a cloud server, it provided real-time monitoring and long-term data logging. The study demonstrated IoT's transformative role in travel, enhancing convenience and safety. Suggestions for future enhancements included incorporating alarms and cameras for additional security features.

3. **Portable Arduino Weighing Machines:**
Das et al. (2019) developed a portable Arduino-based weighing machine capable of measuring weights up to 20 kg using an HX711 ADC and load cell. The device emphasized accuracy, portability, and cost-effectiveness, making it accessible for small-scale applications. The study also explored alternative techniques to improve static weighing accuracy and throughput rates. This system was positioned as a practical solution for everyday commercial needs, with scope for scaling up its capacity.

4. **Weight and Height Measurement for Health Monitoring:**
Firdaus et al. (2023) combined weight and height measurement in a health-monitoring system using an Arduino Uno, load cell, proximity sensor, and LCD display. The system also integrated BMI calculations, making it valuable for fitness centers and households. The prototype achieved a 98.96% accuracy rate, demonstrating its reliability. Proposed enhancements included wireless connectivity for remote monitoring and trend analysis, which could make the system more versatile and user-friendly.

5. **IoT and Machine Learning in Retail Weighing Systems:**
Munna and Mallick (2024) advanced the concept of smart weight machines by incorporating machine learning with IoT. Their system used Raspberry Pi, TensorFlow for object recognition, and a web application for user interaction. It achieved 96% accuracy in object detection, facilitating automated pricing and invoicing in retail environments. The proposed government-backed implementation aimed to standardize pricing and improve transparency in the marketplace. This system showcased the potential of integrating AI and IoT in commercial weighing solutions.

METHODOLOGY AND WORKING PRINCIPLE



System Design

- Integrate an HX711 amplifier with a load cell for accurate weight measurement.
- Use an RFID module to read and identify user IDs.
- Implement a GSM module for data transmission to a cloud server.
- Develop a user-friendly interface using an LCD or OLED display for feedback.

Data Flow

- The system reads the user ID via RFID when a tag is scanned.
- The load cell measures the user's weight, and the data is processed by the Arduino.
- The GSM module transmits the user ID and weight data to the cloud.

System Testing

- Calibrate the load cell to ensure measurement accuracy.
- Test GSM connectivity in diverse environments.
- Validate the reliability of user identification and data transmission.

Working Principle

The system operates by combining three key modules:

1. Weight Measurement: A load cell and HX711 amplifier measure the weight of the user.

2. User Identification: The RFID module scans the user’s tag to retrieve a unique identifier.
3. Data Transmission: The GSM module sends the user ID and weight data to a cloud database for storage and monitoring.
   When a user scans their RFID tag, the system associates the measured weight with their ID.

APPLICATION AND ADVANTAGES

Applications

1. Healthcare: Patient weight tracking in clinics and hospitals.
2. Fitness Centers: Member weight monitoring and progress tracking.
3. Workplace Health Programs: Employee health data collection and management.
4. Remote Health Monitoring: Weight management in rural or underserved areas.

Advantages

1. Automation: Reduces manual effort and errors in data recording.
2. Portability: Functional in diverse and remote locations due to GSM connectivity.
3. Personalized Data: Links weight measurements to specific individuals for better tracking.
4. Real-Time Monitoring: Enables timely data analysis and decision-making.
5. Scalability: Can be integrated with advanced analytics and health applications.

CONCLUSION

The IoT Human Weight Measuring Machine with RFID for Person ID is a step toward automating weight monitoring and personalized data management. By integrating IoT and GSM technologies, the system addresses the limitations of traditional weight measurement methods, offering accurate, real-time, and user-centric data management. Its portability and scalability make it a versatile solution for healthcare, fitness, and workplace health applications. This project not only enhances operational efficiency but also contributes to improved health data accessibility and management.

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