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IoT-Enabled Human Weight Monitoring System with RFID Identification and GSM Connectivity

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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, or seamless data integration for centralized management. [1]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. [2]By incorporating a load cell with an HX711 amplifier, the system ensures accurate weight measurement. An RFID module is employed to uniquely identify users, enabling the system to associate weight data with individual records.[3] 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, including remote locations or mobile setups. [4]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.

[5]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.

Existing System Problem Statement:
Traditional weight measurement systems are standalone devices that require manual operation and data recording, which can lead to inefficiencies and inaccuracies. These systems often lack the ability to associate measurements with specific individuals, making personalized health tracking difficult. Additionally, manual data handling increases the risk of errors and limits accessibility to real-time information, particularly in remote or mobile settings. There is a growing need for an automated, user-centric system capable of recording, storing, and transmitting weight data seamlessly while maintaining portability and reliability.

Innovation:
The IoT Human Weight Measuring Machine with RFID for Person ID is an innovative system that redefines traditional weight monitoring by integrating advanced technologies to automate and personalize the process. The proposed system addresses the inefficiencies of standalone weight-measuring devices by incorporating IoT, RFID, and GSM modules, offering a seamless and scalable solution for real-time health data tracking and management.
Key Innovations

I. Personalized Weight Monitoring with RFID Integration
The proposed system uses an RFID module to uniquely identify users. Each individual is assigned a unique ID linked to their RFID tag, enabling the system to record and store personalized weight data securely. This innovation eliminates the need for manual association of weight measurements with users, ensuring accuracy and reducing the scope of human error.

II. Real-Time Data Transmission via GSM
Unlike traditional systems that rely on local storage or manual logging, this system employs a GSM module to transmit weight data and user ID to a centralized cloud database. This ensures real-time data availability, making it possible for users, healthcare professionals, or fitness trainers to access and analyse records remotely through dashboards or mobile apps.

III. IoT-Enabled Scalability
By leveraging IoT technology, the system supports seamless data integration, storage, and analysis. It enables long-term tracking of individual weight trends and allows for future enhancements, such as predictive analytics, alert notifications, and integration with health monitoring platforms.

IV. Enhanced Accuracy with Load Cell Technology
The system integrates a load cell with an HX711 amplifier for precise weight measurement. This ensures reliability, making the system suitable for critical applications in healthcare and fitness industries.

V. Portability and Independence from Wi-Fi
The reliance on GSM connectivity ensures that the system can operate in diverse environments, including rural or remote locations where Wi-Fi infrastructure may not be available. This innovation enhances the system's portability and applicability in mobile setups, such as health camps or rural clinics.

LITERATURE REVIEW

Advancements in Weight Measurement Systems Using Arduino and IoT Technologies

The integration of Arduino microcontrollers and IoT technologies has revolutionized weight measurement systems, making them more efficient, user-friendly, and suitable for diverse applications. [6] This literature review explores various approaches and developments in weight measurement systems, emphasizing their design, functionality, and potential applications.

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.

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.[7] 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.

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. [8]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.

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. [9]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.

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.[10] 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

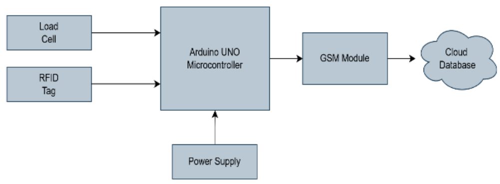

Fig 1: Block Diagram

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.

RESULT & DISCUSSION

The IoT Human Weight Measuring Machine with RFID for Person ID successfully automates weight monitoring by integrating load cell technology, RFID for user identification, and GSM for real-time data transmission. The system ensures accurate weight measurement, seamless user recognition, and reliable cloud-based data storage, enhancing accessibility and reducing manual errors. Its portability allows deployment in remote areas without Wi-Fi dependency, making it suitable for healthcare, fitness, and workplace 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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