**MODERNIZING PUBLIC TRANSIT: AN IOT-ENABLED RFID PAYMENT SYSTEM FOR FLEXIBLE AND ON-DEMAND BUS SERVICES**

**Chapter 1: Introduction**

**1.1 Background of the Study**

      Urban public transportation systems have faced mounting challenges in delivering efficient, adaptable, and user-friendly services. Many traditional payment systems, such as cash and physical tickets, create inefficiencies and delays that impact both transit operators and passengers. As urban areas continue to expand, modernizing these systems has become essential.

      Emerging technologies like the Internet of Things (IoT) and Radio-Frequency Identification (RFID) offer promising solutions. This study investigates the potential of an IoT-enabled RFID payment system to facilitate a more flexible, on-demand bus service, aiming to enhance commuter experiences, optimize operations, and contribute to the modernization of public transit.

**1.2 Objectives of the Study**

**General Objective**: Develop an IoT-enabled RFID payment system that supports a flexible, on-demand bus service.

**Specific Objectives**:

* Design a contactless payment system using RFID technology integrated with IoT for real-time data processing.
* Evaluate the system's effectiveness in improving convenience and satisfaction for commuters.
* Assess the operational benefits for public transit agencies, such as cost efficiency and reliability.

**1.3 Scope and Limitation of the Study**

      This study is focused on developing an RFID payment system powered by IoT for a bus service model. It covers system design, testing, and analysis of user feedback in a controlled or pilot setting. The primary emphasis is on the payment process and improving service flexibility.

      Limitations include hardware costs, limited pilot testing, and reliance on existing technological infrastructure.

**1.4 Significance of the Study**

      The research is significant as it aims to introduce a modern payment system that could reduce wait times, enhance service accessibility, and improve operational efficiency in public transit. Commuters are expected to benefit from a smoother payment process, while transit agencies may see streamlined operations, potentially increasing ridership and reducing operational costs.

**1.5 Definition of Terms**

**Internet of Things (IoT)**: A network of interconnected devices that communicate and share data in real-time.

**RFID (Radio-Frequency Identification)**: A technology that uses radio waves to read and capture information stored on a tag attached to an object.

**On-Demand Service**: A service model that allows users to access transportation as needed, as opposed to following fixed schedules.

**Public Transit**: Publicly available transportation services, including buses, trains, and subways.

**Chapter 2: Review of Related Literature**

2.1 Review of Related Literature

      Studies have shown that IoT and RFID are valuable tools in creating more efficient transit systems. Research on IoT-enabled systems suggests potential improvements in tracking, data collection, and real-time updates for public services. RFID technology has been widely adopted in various fields for contactless payment, with applications in toll gates and retail. However, there is a lack of studies that combine IoT and RFID for flexible, on-demand public transit, especially in bus services.

**2.2 Synthesis**

      The literature reviewed indicates a growing trend toward integrating technology into public transit to enhance service delivery. Existing studies support the feasibility of IoT and RFID in making systems more user-friendly and efficient. This study brings together these insights to propose an integrated RFID and IoT system, targeting flexible bus services as a unique contribution to the field.

**2.3 Concept of the Study**

      The study conceptualizes an RFID payment system augmented by IoT, designed to provide a seamless, contactless experience for users. By leveraging real-time data, the system aims to enable flexible bus scheduling, accommodating demand fluctuations and reducing the need for cash-based transactions, thus improving efficiency.

Chapter 3: Methodology

3.1 Conceptual Framework / Theoretical Framework

This study is guided by:

Technology Acceptance Model (TAM): Focuses on understanding user acceptance and adoption of the IoT-enabled RFID payment system.

Systems Theory: Assists in integrating IoT, RFID, and data analytics into a cohesive system for modernizing public transit.

These frameworks help ensure the solution addresses technical and user-related challenges effectively.

3.2 Gantt Chart

The project timeline is now compressed into a 4–5 month period to streamline development and testing:

Activity Month 1 Month 2 Month 3 Month 4 Month 5

Literature Review ✓ ✓

System Design ✓ ✓

System Development ✓ ✓

Testing and Evaluation ✓ ✓

Data Analysis and Interpretation ✓ ✓

Final Report Writing ✓ ✓

3.3 Budgetary Requirements

The table below reflects the previously adjusted budget to fit PHP 20,000–30,000:

Item Quantity Unit Cost (PHP) Total Cost (PHP)

RFID Tags 100 50 5,000

RFID Reader 1 3,000 3,000

IoT Modules 2 2,500 5,000

Development Tools 1 6,000 6,000

Software License - 4,000 4,000

Total 23,000

3.4 Organizational Structure with Duties

Role Responsibilities

Project Leader Manages the project, ensures timely completion, and oversees collaboration.

Systems Developer Designs and implements the IoT-enabled RFID payment system.

Data Analyst Collects and evaluates user feedback and system performance metrics.

Technical Writer Prepares all project documentation and writes the final report.

3.5 Summary

This revised methodology outlines a shorter timeline, condensing activities into 4–5 months while maintaining a realistic and efficient workflow. The revised budget and schedule align with the project’s goals, ensuring timely delivery without compromising quality.

3.4 Organizational Structure with Duties

      The following roles and responsibilities are a

ssigned for the project:

Project Leader: Responsible for overseeing the project and ensuring all objectives are met.

Systems Developer: Designs and develops the RFID payment system and its integration with IoT.

Data Analyst: Analyzes user data and system performance.

Technical Writer: Documents the project findings and prepares the final report.

3.5 References

      The references used in this study are as follows:

Author, A. (Year). Title of the Source. Publisher.

Author, B. (Year). Title of the Source. Publisher.

Author, C. (Year). Title of the Source. Publisher.