Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF RFID SENSOR AS DIRECT PAYMENT AT PETROL STATION

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Bachelor of Electronics Engineering Technology (Telecommunications) with Honours

2023

UNIVERSITI TEKNIKAL MALAYSIA MELAKA
FAKULTI TEKNOLOGI KEJUTERAAN ELEKTRIK DAN ELEKTRONIK

BORANG PENGESAHAN STATUS LAPORAN
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Tajuk Projek : Development of RFID Sensor As Direct Payment At Petrol Station

Sesi Pengajian : SEMESTER 1 SESI 22/23

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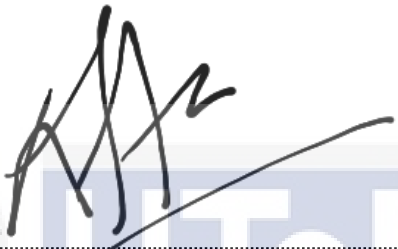
Signature : 

Supervisor Name : Ir. Dr. Mohd Muzafar Bin Ismail

Date : 16/1/2023

DEDICATION

To my beloved mother, Nor Ha'aishah binti Yusup and my father, Jone bin Mansor,

Thank you for supporting me and let me pursue my studies

For bachelor's degree in UTEM

To dearest brother, Syaffiq bin Jone,

Thank you for moral support and all the advice

To my supported friend, Syarmim Nabila binti Mior Khairul Niza,

Thank you for your motivation support.

ABSTRACT

The automation approach used in the proposed project overcomes all of the current system's shortcomings. RFID technology is used in these cards specially direct payment at petrol station. The major problem is petrol station in Malaysia uses a cash-only vehicle identification system. Collect the service charge and manually verify the memo (ticket) in the system from the database.The objective of the project is to design and develop of the control system using RFID technology. Secondly, the objective this project is to simulate and analyze the new control system as direct payment at petrol station. In this investigation, the design sprint technique was used in a design the project RFID (Radio-Frequency Identification) payment system at a petrol station typically involves the use of a special RFID card or tag. When the customer pulls up to a pump, they can wave their RFID card or tag near a reader, which will instantly and securely transmit their account information to the pump. By minimizing queue transaction wait time, the RFID Petrol station payment system aims to increase service capacity.

ABSTRAK

Pendekatan automasi yang digunakan dalam projek yang dicadangkan mengatasi semua kelemahan sistem semasa. Teknologi RFID digunakan dalam kad ini terutamanya pembayaran terus di stesen minyak. Masalah utama ialah stesen minyak di Malaysia menggunakan sistem pengenalan kenderaan tunai sahaja. Kumpul caj perkhidmatan dan sahkan secara manual memo (tiket) dalam sistem daripada pangkalan data. Objektif projek adalah untuk mereka bentuk dan membangunkan sistem kawalan menggunakan teknologi RFID. Kedua, objektif projek ini adalah untuk mensimulasikan dan menganalisis sistem kawalan baharu sebagai bayaran terus di stesen minyak. Dalam penyiasatan ini, saya menggunakan teknik pecut reka bentuk. Dalam reka bentuk sistem pembayaran RFID (Radio-Frequency Identification) projek di stesen minyak lazimnya melibatkan penggunaan kad atau tag RFID khas. Apabila pelanggan menarik ke pam, mereka boleh melambai kad RFID atau tag mereka berhampiran pembaca, yang akan menghantar maklumat akaun mereka dengan segera dan selamat kepada pam. Dengan meminimumkan masa menunggu transaksi beratur, sistem pembayaran stesen Minyak RFID bertujuan untuk meningkatkan kapasiti perkhidmatan.

ACKNOWLEDGEMENT

First and foremost, I would like to express my gratitude to my supervisor, Ir. Dr. Mohd Muzafar Bin Ismail, for his precious guidance, words of wisdom and patient throughout this project.

I am also indebted to Universiti Teknikal Malaysia Melaka (UTeM) for the financial support throughout the project development, which enabled me to accomplish the project. I will not forget my fellow colleague and housemates for their willingness to share their thoughts and ideas regarding the project.

My highest appreciation goes to my parents and family members for their love and prayer during the period of my study. Finally, I would like to thank all the staff at the Universiti Teknikal Malaysia Melaka (UTeM), fellow colleagues and classmates, the faculty members, as well as other individuals who are not listed here for being cooperative and helpful

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS

λ	-	Arrival level
μ	-	Service level
π	-	Pi
r	-	Radius

LIST OF ABBREVIATIONS

V	-	Voltage
dB	-	Decible

CHAPTER 1

INTRODUCTION

1.1 Background

One of nature's most precious and unique creations is petroleum. Due to the increasing number of vehicles utilized as a mode of transportation for our daily commute, it is now the commodity that is used the most often. As Malaysia becomes increasingly digital, the proposed system would support the Digital Malaysia initiative.

Because of the way petrol stations are currently set up, the process of filling a customer's car with gasoline and paying for the fill-up requires personal interaction. These station workers continue to breathe in fumes from gasoline, diesel, and highly polluted particulate matter, which negatively affects their respiratory system and lungs.

Figure1.1 Jammed at petrol station

All of the flaws in the present system are fixed by the automation strategy employed in the proposed project. Customers are given gas cards, which eliminates the need for a station attendant since the customer now interacts with the gas card reader, which provides

instructions on how to continue at each level on the LCD display. These cards employ RFID technology. Eliminating manual participation solves every problem bunk attendants confront. The automated method is set inside to determine the correct quantity of gasoline that needs to be filled and will be combined with the payment. As a result, there are fewer opportunities for the fraudulent transaction to occur. To enhance the automation of the gasoline filling process, several solutions have been suggested.

1.2 Problem Statement

Currently, the only vehicle identification system accepted at petrol stations in Malaysia is cash. Furthermore, it takes around 4 minutes to pay in cash at a petrol station using a cash payment system since every car is required to stop and wait for a turn. To collect the service charge and manually verify the memo (ticket) in the database, officers should occupy the cashier's booth.

1.3 Project Objective

1.3.1 General Objective

The main goal of this thesis was to create an RFID payment system for the petrol station in order to increase service capacity and ease traffic..

1.3.2 Objective

The objectives of this thesis works are.

- To design and develop of the control system using RFID technology
- To simulate anf analyze the new control system as direct payment at petrol station
- To develope a fast, secure, and convenient way for customers to pay for their fuel and other purchases at the station.

1.4 Significant Of Study

The goal of this research was to highlight the advantages of technology adoption in Ethiopia's self-service industry as well as the challenges involved. The results Designing and developing the study's control system will persuade other toll road operators to learn about the advantages of the tracking system and ultimately use it.

1.5 Delimitation (Scope)

The present gas petrol payment system is being examined, an electronic-based payment system is being built, and software is being used to imitate the current petrol station payment system, all of which are included in this thesis. Building a prototype as part of this project will demonstrate how the feature operates.

1.6 Beneficiaries

By reducing toll transaction wait times, the RFID petrol station payment system seeks to boost service capacity. The toll corporation, all motorists, and society all gain from this.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

A nation's economy may be greatly boosted by strengthening its transportation system. Mobility, the trade of manufactured products and services, high service standards, and social mobility are characteristics of modern transportation networks. The capacity of a nation to transport commodities is directly connected to its commercial success. A country's quick expansion has always been valued highly by the government, particularly when it comes to providing inhabitants with top-notch infrastructure and services. Major elements, including traffic congestion, air pollution, and other associated difficulties, are becoming increasingly common due to the increase in the number of vehicles on the road. All commercial workers will eventually go to work using a variety of forms of transportation. Therefore, improving carriage has a direct effect on the economy and output.

2.2 A brief History of RFID

In the first century, magnetic fields were initially used by the Chinese. The basis of scientific thinking on electricity, magnetism, and optics grew from the 1600s through the 1800s (An Introduction to RFID Tech, n.d.) RFID is attributed as being created by Charles Walton. Eleven patents were awarded to him in 2007, one of which was for a "portable radio frequency emitting identification." In 1983, the term "RFID" was coined. 2016 (Taylor). Based on findings made by Faraday and others in the middle of the nineteenth century, radiofrequency identification (RFID) was developed. Technological advancements in radio and radar were made between 1900 and 1940. The combined effects of these insights have

made a substantial contribution to the advancement of modern radio communications (Gupta et al., n.d.).

RFID launched a new research phase in 1980 with an emphasis on enhancing tracking and access applications in manufacturing and other industries. Implementing an RFID system stands out as a consequence (Mohandes et al., 2016). The development and use of RFID experienced a turning point in the 1990s.

2.2.1 RFID Equipped Mobiles, Working Out The Technology

A mobile device, such as a phone, incorporates an RFID reader. This is an entirely new approach compared to the majority of prior RFID implementations. The tags are believed to be mobile, whilst the readers are believed to be fixed. This will soon change. The usage of RFID in mobile telecommunications services would lead to a situation in which the readers (which are incorporated into the phone) are mobile but the tags are immobile. Additionally, there would be applications that would enable the phone to function as both a tag and a reader simultaneously (Tseng et al., n.d.).

(2010) (Zhou et al.)RFID technology may be used to customer service, marketing, and brand management, in addition to supply chain management, by incorporating RFID capabilities into mobile devices. In order to link offline items to data network information, RFID-based mobile telecommunications will be essential.

A "smart object" ecosystem will be developed by services that interact with other items and make use of the data contained on RFID tags. The best approach for people to communicate with these smart objects is via their mobile phones (Bag & Lee, 2021).

Future prospects for RFID technology use in mobile communication are promising. As mentioned before, Nokia and Verisign worked together to develop the first mobile phone with RFID functionality. The user may quickly activate services and access phone

functionality by just touching their phone against an RFID tag (Zhou et al., 2010b). The phone accesses the data when an RFID reader produces a short-range radio signal that powers a microchip on the tag, enabling the ID information and other stored data to be read (Amouzegar & Patel, 2013).

2.2.2 Mobile payment technologies in retail

Items may be electronically tracked as they make their way through the supply chain by attaching RFID tags to them at the outset. The tags share information by radio waves, so there's no need for close proximity or direct contact between them to do so (Blythe, n.d.). Almost immediately, RFID integrated in a counter or platform at the POS kiosk may read and deactivate tags for all items in the shopper's bag or basket (Viji Amutha Mary, 2018). Security antennas equipped with radio frequency identification technology are installed at shop exits, allowing them to detect and retrieve any tagged items that slipped past the scanners. While RFID may be simpler and cheaper to employ at the unit level in apparel than in FMCGs, at least one security expert sees it as an inevitable development. The next technological advancement will use radio frequency identification, or RFID. When I leave a shop after paying at the POS, but leaving an item behind, the RFID system flags the item as unpaid. In order to succeed, you must plan ahead (Taylor, 2016).

Researchers have shown that RFID's application in loss prevention may cut down on theft, supply chain fraud, and damaged goods, among other forms of shrinkage (Mesay et al., n.d.). There is a new method released to prevent "ticket-switching," a kind of retail theft in which a thief removes the price tag, bar code, or packaging and replaces it with one of a lesser value. Solution included combining RFID item-level tagging with authentication techniques (David & Imaduddin, 2018).

Patents and patent applications now in circulation include advancements in RFID linked to shrinkage, such as a system for merging bar code and RFID tag technology in retail dispenser shelving to offer real-time shelf inventory status. The same technology would be handy for keeping an eye on shelf-sweeping shoplifters. One of the barriers to widespread item-level RFID use in retail is the prohibitive price of the labels themselves. However, in the apparel industry, retailers are increasingly using RFID tags at the item level to enable total real-time visibility of all goods in the shop. RFID is predicted to become increasingly common due to better technology and significant per-label price reductions in recent years, resulting in cheaper expenses. However, further study is required to determine the optimum adoption models and methods for incorporating RFID into existing infrastructure. Taylor (2016)

2.2.2.1 RFID Based Toll Collection System

It would seem that the passive Radio Frequency Identification (RFID) tag-based automated toll collecting system is a practical replacement for the conventional tollgate-based toll collection system. Efficiency and promptness have been more valued in today's fast-paced society. Congestion in vehicles and wasted time are two major problems that RFID technology is attempting to solve (Ozturk, 2016). An RFID reader attached to the tollgate frame scans the tag fastened to the windscreen (or even a hand-held scanner in the manual lane if an RFID-tagged vehicle enters the manual toll-paying lane). Upon identification of an approaching vehicle's tag by the Reader's object detection sensor, the toll is automatically debited from the owner's prepaid card through RFID (R. Rao et al., n.d.).

The RTO office is where new automobile owners go to have their vehicles officially registered after making their purchase. The RTO will provide not just a licence plate but also

an RFID-enabled smart card or tag. That card's unique identification number will only work in that specific automobile. They will create a user account and maintain a database to record smart card transactions. The user is required to put a certain amount into this account (Radio Frequency Identification, 2005).

First, infrared sensors will pick up the approach of a vehicle that has already reported its existence. After that, the RFID circuit will be activated and the smart card in the windshield will be read. The transaction will begin, and the toll will either be automatically taken from the available balance, or the vehicle will be moved to a different lane where the driver may pay the tax by hand. Information on the centralized database server is also updated by the programme.

2.3 RFID Based Vehicle Identification During Collisions

RFID (Radio Frequency Identification) collision detection uses collision sensors to identify when two vehicles are about to collide. When an accident is detected, the RFID scanners in both cars are activated, and data is retrieved from the tags. This gadget helps auto owners track down reckless drivers who have struck their vehicles and then fled the scene. This data may be utilized for many different things, including filing insurance claims and giving evidence in legal proceedings (Wang et al., 2010).

The RFID-based vehicle identification system may be used to track down reckless motorists who cause hit-and-run accidents. A automobile insurance claim might be made in the event of damage. The microprocessor in the system communicates with the car's ECU (Electronic Control Unit) to record the car's speed just before collision. This may serve as proof in the case of an incident. This information may also be helpful to a traffic officer in the case of a traffic violation, since it might reveal common driving behaviours. In the end,

this inspires individuals to be more cautious behind the wheel. (The Seattle Chapter of the Institute of Electrical and Electronics Engineers and Associates, n.d.)

2.3.1 Centralized Automation of Petrol Bunk Management and Safety using RFID and GSM Technology

Automating the process of refueling at a petrol station is now possible with the help of RFID and GSM technologies. The transactions are designed to be user-friendly from the consumer's perspective, making full advantage of the convenience of the customer's mobile device. In order to facilitate the automation of this procedure, we provide each client a fuel card that functions similarly to a debit card. There is a gas card reader at the bunk. The fuel card reader is used to make the payment. At each stage of the swiping process, you will be required for information, such as the password and the fuel quantity in litres. Both the password and the available balance are verified before the transaction is allowed to proceed. If the fuel gauge and pump are both within acceptable ranges, fueling will begin automatically via the fuel line (Wang & Tang, 2012).

Once the precise amount of gasoline input by the customer has been pumped, the pumping process is stopped. A warning appears if the entered password is wrong. Like prepaid SIM cards, petro-cards may be reloaded with funds. If the balance on the card drops below a specific level, the customer may send an SMS to the GSM module in the charging station at the hostel to add funds to the card. Besides the obvious convenience of an automatically refilling gasoline tank, this proposed concept also features level and smoke monitoring. A level sensor detects when the gas tank is becoming low, and an alert saying "Low Fuel Level" is sent to the bunk owner's phone. The bunk owner's fancy smartphone. The authors (S. S. Rao and Siddeshwara Prasad)