GENERATIVE AI FOR TRADITIONAL FORM CONVERTER

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A PROJECT SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR
THE DEGREE OF BACHELOR OF ENGINEERING (COMPUTER ENGINEERING)
FACULTY OF ENGINEERING
KING MONGKUT'S UNIVERSITY OF TECHNOLOGY THONBURI
2024

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A Project Submitted in Partial Fulfillment
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Abstract

In a multihop ad hoc network, the interference among nodes is reduced to maximize the throughput by using a smallest transmission range that still preserve the network connectivity. However, most existing works on transmission range control focus on the connectivity but lack of results on the throughput performance. This paper analyzes the per-node saturated throughput of an IEEE 802.11b multihop ad hoc network with a uniform transmission range. Compared to simulation, our model can accurately predict the per-node throughput. The results show that the maximum achievable per-node throughput can be as low as 11% of the channel capacity in a normal set of α operating parameters independent of node density. However, if the network connectivity is considered, the obtainable throughput will reduce by as many as 43% of the maximum throughput.

Keywords: Multihop ad hoc networks / Topology control / Single-Hop Throughput

หัวข้อปริญญานิพนธ์	เว็บแอปพลิเคชัน AI สำหรับการแปลงฟอร์มกระดาษเป็นเว็บฟอร์ม
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บทคัดย่อ

Generative AI for Traditional Form Converter เป็นโครงการที่จัดทำขึ้นผ่านการพัฒนาผ่านเว็บแอปพลิเคชั่นในชื่อ PaperlessTransform Application เพื่อแก้ไขปัญหาการใช้ระยะเวลานานในการแปลงแบบฟอร์มกระดาษเป็นรูปแบบเว็บแอปพลิเคชัน โดยการพัฒนาเว็บแอปพลิเคชันนี้ได้มีการใช้ประยุกต์ใช้ปัญญาประดิษฐ์สำหรับการวิเคราะห์เกี่ยวกับประเภทของข้อมูลของคำถาม ตามความต้องการที่เพิ่มขึ้นของการแปลงแบบฟอร์ม ดังนั้นนักพัฒนาระบบจึงจำเป็นต้องวิเคราะห์แบบฟอร์มและออกแบบระบบฐานข้อมูลพร้อมทั้งการออกแบบหน้าเว็บแอปพลิเคชัน รวมไปถึงการพัฒนาระบบขึ้นมาใหม่ จึงส่งผลให้ต้องใช้ระยะเวลาในการทำงานที่เพิ่มขึ้น นอกจากนี้ นักพัฒนาระบบต้องเผชิญกับปัญหาภาระงานที่มากขึ้น ส่งผลให้บุคคลากรใช้เวลาในการทำงานอย่างไม่มีประสิทธิภาพ โดยโครงการของเรามุ่งเน้นการพัฒนาเว็บแอปพลิเคชันที่สามารถแปลงเอกสารในรูปแบบของฟอร์มกระดาษ หรือ ไฟล์อิเล็กทรอนิกส์ให้เป็นรูปแบบของเว็บแอปพลิเคชัน โดยใช้เทคนิคการรู้จดจำอักขระด้วยแสงในการแปลงภาพข้อความให้เป็นรูปแบบข้อความเพื่อนำข้อความดังกล่าวจากการแปลงภาพข้อความนำมาประมวลผลในการตรวจจับคำถามในรูปแบบฟอร์ม ทางคณะผู้จัดทำโครงการมีการเน้นการพัฒนาเว็บแอปพลิเคชันที่มีความสามารถในการตรวจจับคำถามและความสามารถในการเก็บข้อมูลของเว็บฟอร์ม โดยมีวัตถุประสงค์เพื่อลดภาระของนักพัฒนาระบบ โดยผลลัพธ์หลังจากมีการทดลองใช้เว็บแอปพลิเคชั่นดังกล่าวในการทำงานแสดงให้เห็นว่าเว็บแอปพลิเคชันสามารถตรวจจับคำถามในแบบฟอร์มและเก็บข้อมูลได้ในระดับที่น่าพึ่งพอใจ ดังนั้นสรุปได้ว่าโครงการสามารถแก้ไขปัญหาการใช้ระยะเวลาในการทำงานที่เพิ่มขึ้น ของนักพัฒนาระบบได้อย่างมีนัยสำคัญ

คำสำคัญ: เว็บแอปพลิเคชัน / การรู้จดจำอักขระด้วยแสง / ออกแบบระบบฐานข้อมูล

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Finally, we would like to express our thanks to everyone, including our family, friends, and everyone who has contributed and supported this project. All the support and encouragement have been integral to its successful completion.

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LIST OF SYMBOLS

SYMBOL		UNIT
α	Test variable	m^2
λ	Interarival rate	jobs/ second
μ	Service rate	jobs/ second

LIST OF TECHNICAL VOCABULARY AND ABBREVATIONS

ABC	=	Adaptive Bandwidth Control
MANET	=	Mobile Ad Hoc Network
Test	=	Lorem ipsum dolor sit amet, consectetur adipiscing elit. Nullam non condimentum purus. Pellentesque sed augue sapien. In volutpat quis diam laoreet suscipit. Curabitur fringilla sem nisi, at condimentum lectus consequat vitae.

CHAPTER 1 INTRODUCTION

1.1 Problem Statement

PLEASE WAIT

1.2 Potential Benefits

COMING SOON NA

1.3 Objectives

- To reduce the workload and development process for developers.
- To acquire the knowledge and skills necessary for developing an AI-powered web application
- To acquire proficiency in utilizing a Large language models and adapt its capabilities to suit the requirements of this project.
- To be the secure all data and form management website

1.4 Scope of Work

The scope of this project involves the development of a web application that enables users to upload a PDF or image file. The web application will process text extraction using optical character recognition (OCR). The primary function of the web application includes creating a form, editing a form, deleting a form, and filling a form. The final deliverable of this project will be a responsive web interface web application that allows users to manage the form and view the data, including ensuring data privacy and security measures to protect sensitive information by implementing authentication for the creator and a normal user. The project involves research of optical character recognition (OCR) for the text extraction from the image and the development of generative AI for data type generation, also a Thai language translation to English.

1.5 Limitation of Project

The limitation of the project will addresses a possible constraints and challenges that might affect its scope, execution, or outcomes. the limiting factor are include time, cost and risk etc.

- **OCR Accuracy:** The accuracy of OCR text extraction may vary depending on the quality of the uploaded document, such as low-resolution images, poor lighting, and the project does not support handwritten text.
- **Language Support:** While the system has the ability to translate text, the accuracy and availability of supported languages may be limited, with the project currently supporting Thai and English form only.
- **Required User Reviewing:** After the text extraction and layout detection, the system required a user to review and correct a input label that the system have process. The limitation required of user reviewing because of the lack of OCR accuracy and the system error.
- **Data Privacy and Security:** Despite the implementation of verification and security measures, there may still be vulnerabilities related to handling sensitive data, which are continuously checked and updated.

1.6 Project Schedule

For the first semester, our project focus on researching and design phase, We have researching all core fundamental concept and define a problem and background of the project. In the design phase, we have design a database design, UX/UI design, architecture design. And this phase also including a Optical Character Recognition proof of concept.

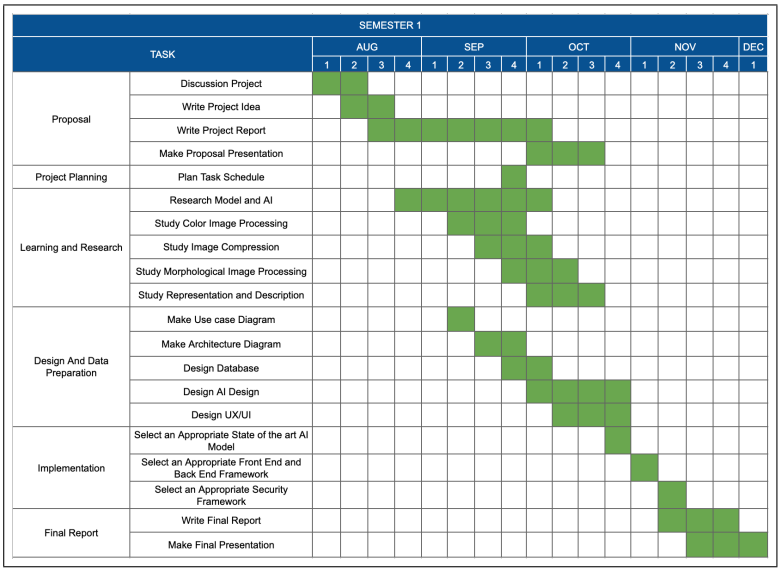

Figure 1.1 Schedule for first semester

For the second semester, our project focus on implementing the form extractor and generative AI for the process of detect a form. We also focus on web application development and integrate a web application with the form extractor. And Th

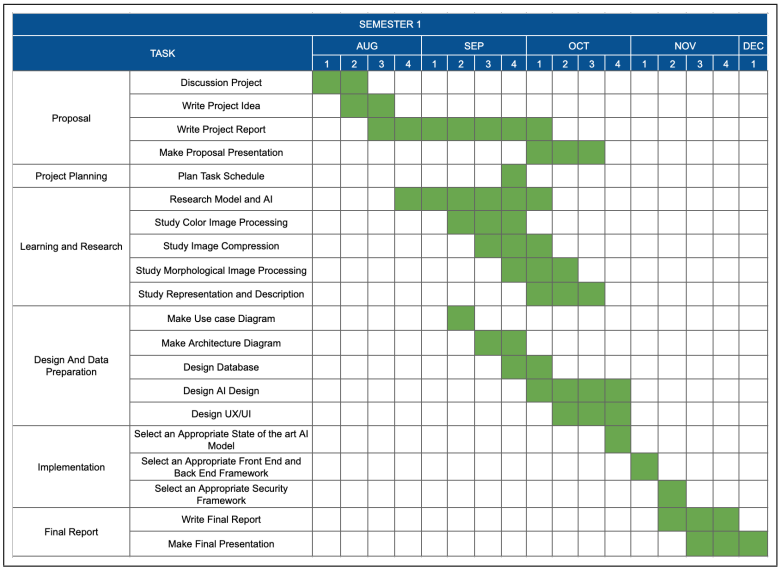

Figure 1.2 Schedule for second semester

1.7 Expected Outcomes

This project aims to develop a fully functional web application that able to converting a paper-based form or pdf form into a web-based form by utilizing a generative AI for generate a data type of form label. And the web application should reduce a time developer have spend when they converting a form.

CHAPTER 2 BACKGROUND THEORY AND RELATED WORK

THIS IS AN EXAMPLE. ALL SECTIONS BELOW ARE OPTIONAL. PLEASE CONSULT YOU ADVISOR AND DESIGN YOUR OWN SECTION

หัวข้อต่าง ๆ ในแต่ละบทเป็นเพียงตัวอย่างเท่านั้น หัวข้อที่จะใส่ในแต่ละบทขึ้นอยู่กับโปรเจคของนักศึกษาและอาจารย์ที่ปรึกษา

This is how you add website url. -> http://www.cpe.kmutt.ac.th

Explain theory, algorithms, protocols, or existing research works and tools related to your work.

You can cite your references like this -> [1] or multiplie cite like this -> [2, 3]

2.1 Recommender Systems

Table 2.1 test table method1

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Center	Center	left aligned	Right	Right aligned
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Center	Center	left aligned	Right	Right aligned
Center	Center	left aligned	Right	Right aligned

Tables should always on the left.

2.2 Text Processing Algorithms

2.2.1 Algorithm I

2.2.1.1 test

You can place the figure and refer to it as Figure 2.1. The figure and table numbering will be run and updated automatically when you add/remove tables/figures from the document.

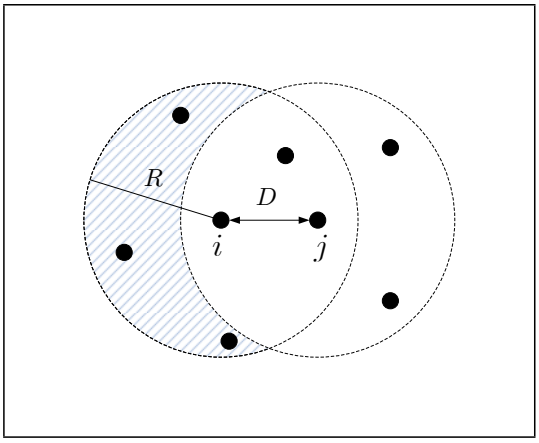

Figure 2.1 The network model

2.2.2 Algorithm II

Add more subsections as you want.

2.2.2.1 Step I

2.2.2.2 Step II

This is the farthest level of subsection we permitted. (We support only 4th level)

2.3 Development Tools

CHAPTER 3 PROPOSED WORK

THIS IS AN EXAMPLE. ALL SECTIONS BELOW ARE OPTIONAL. PLEASE CONSULT YOU ADVISOR AND DESIGN YOUR OWN SECTION

หัวข้อต่าง ๆ ในแต่ละบทเป็นเพียงตัวอย่างเท่านั้น หัวข้อที่จะใส่ในแต่ละบทขึ้นอยู่กับโปรเจคของนักศึกษาและอาจารย์ที่ปรึกษา

Explain the design (how you plan to implement your work) of your project. Adjust the section titles below to suit the types of your work. Detailed physical design like circuits and source codes should be placed in the appendix.

3.1 System Architecture

Table 3.1 test table x1

SYMBOL		**UNIT**
α	Test variable	m^2
λ	Interarrival rate	jobs/ second
μ	Service rate	jobs/ second

3.2 System Specifications and Requirements

3.3 Hardware Module 1

3.3.1 Component 1

3.3.2 Logical Circuit Diagram

3.4 Hardware Module 2

3.4.1 Component 1

3.4.2 Component 2

3.5 Path Finding Algorithm

3.6 Database Design

3.7 GUI Design

CHAPTER 4 IMPLEMENTATION RESULTS

You can title this chapter as **Preliminary Results** or **Work Progress** for the progress reports. Present implementation or experimental results here and discuss them.

ALL SECTIONS IN THIS CHAPTER ARE OPTIONAL. PLEASE CONSULT YOU ADVISOR AND DESIGN YOUR OWN SECTION

หัวข้อต่าง ๆ ในแต่ละบทเป็นเพียงตัวอย่างเท่านั้น หัวข้อที่จะใส่ในแต่ละบทขึ้นอยู่กับโปรเจคของนักศึกษาและอาจารย์ที่ปรึกษา

CHAPTER 5 CONCLUSIONS

Figure 5.1 This is how you mention when figure come from internet https://www.google.com

This chapter is optional for proposal and progress reports but is required for the final report.
THIS IS AN EXAMPLE. ALL SECTIONS BELOW ARE OPTIONAL. PLEASE CONSULT YOU ADVISOR AND DESIGN YOUR OWN SECTION
หัวข้อต่าง ๆ ในแต่ละบทเป็นเพียงตัวอย่างเท่านั้น หัวข้อที่จะใส่ในแต่ละบทขึ้นอยู่กับโปรเจคของนักศึกษาและอาจารย์ที่ปรึกษา

5.1 Problems and Solutions

State your problems and how you fixed them.

5.2 Future Works

What could be done in the future to make your projects better.

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APPENDIX A

FIRST APPENDIX TITLE

Put appropriate topic here

This is where you put hardware circuit diagrams, detailed experimental data in tables or source codes, etc..

Figure A.1 This is the figure x11 https://www.google.com

This appendix describes two static allocation methods for fGn (or fBm) traffic. Here, λ and C are respectively the traffic arrival rate and the service rate per dimensionless time step. Their unit are converted to a physical time unit by multiplying the step size Δ. For a fBm self-similar traffic source, Norros [4] provides its EB as

$$C = \lambda + (\kappa(H)\sqrt{-2\ln\epsilon})^{1/H} a^{1/(2H)} x^{-(1-H)/H} \lambda^{1/(2H)} \tag{A.1}$$

where $\kappa(H) = H^H(1-H)^{(1-H)}$. Simplicity in the calculation is the attractive feature of (A.1).
The MVA technique developed in [5] so far provides the most accurate estimation of the loss probability compared to previous bandwidth allocation techniques according to simulation results. Consider a discrete-time queueing system with constant service rate C and input process λ_n with $\mathbb{E}\{\lambda_n\} = \lambda$ and $\mathrm{Var}\{\lambda_n\} = \sigma^2$. Define $X_n \equiv \sum_{k=1}^{n} \lambda_k - Cn$. The loss probability due to the MVA approach is given by

$$\varepsilon \approx \alpha e^{-m_x/2} \tag{A.2}$$

where

$$m_x = \min_{n \geq 0} \frac{((C-\lambda)n + B)^2}{\mathrm{Var}\{X_n\}} = \frac{((C-\lambda)n^* + B)^2}{\mathrm{Var}\{X_{n^*}\}} \tag{A.3}$$

and

$$\alpha = \frac{1}{\lambda\sqrt{2\pi\sigma^2}} \exp\left(\frac{(C-\lambda)^2}{2\sigma^2}\right) \int_C^\infty (r-C) \exp\left(\frac{(r-\lambda)^2}{2\sigma^2}\right) dr \tag{A.4}$$

For a given ε, we numerically solve for C that satisfies (A.2). Any search algorithm can be used to do the task. Here, the bisection method is used.
Next, we show how $\mathrm{Var}\{X_n\}$ can be determined. Let $C_\lambda(l)$ be the autocovariance function of λ_n. The MVA technique basically approximates the input process λ_n with a Gaussian process, which allows $\mathrm{Var}\{X_n\}$ to be represented by the autocovariance function. In particular, the variance of X_n can be expressed in terms of $C_\lambda(l)$ as

$$\mathrm{Var}\{X_n\} = nC_\lambda(0) + 2\sum_{l=1}^{n-1}(n-l)C_\lambda(l) \tag{A.5}$$

Therefore, $C_\lambda(l)$ must be known in the MVA technique, either by assuming specific traffic models or by off-line analysis in case of traces. In most practical situations, $C_\lambda(l)$ will not be known in advance, and an on-line measurement algorithm developed in [6] is required to jointly determine both n^* and m_x. For fGn traffic, $\mathrm{Var}\{X_n\}$ is equal to $\sigma^2 n^{2H}$, where $\sigma^2 = \mathrm{Var}\{\lambda_n\}$, and we can find the n^* that minimizes (A.3) directly. Although λ can be easily measured, it is not the case for σ^2 and H. Consequently, the MVA technique suffers from the need of prior knowledge traffic parameters.

APPENDIX B

SECOND APPENDIX TITLE

Put appropriate topic here

Figure B.1 This is the figure x11 https://www.google.com

Next, we show how $\mathrm{Var}\{X_n\}$ can be determined. Let $C_\lambda(l)$ be the autocovariance function of λ_n. The MVA technique basically approximates the input process λ_n with a Gaussian process, which allows $\mathrm{Var}\{X_n\}$ to be represented by the autocovariance function. In particular, the variance of X_n can be expressed in terms of $C_\lambda(l)$ as

$$\mathrm{Var}\{X_n\} = nC_\lambda(0) + 2\sum_{l=1}^{n-1}(n-l)C_\lambda(l) \tag{B.1}$$

Add more topic as you need

Therefore, $C_\lambda(l)$ must be known in the MVA technique, either by assuming specific traffic models or by off-line analysis in case of traces. In most practical situations, $C_\lambda(l)$ will not be known in advance, and an on-line measurement algorithm developed in [6] is required to jointly determine both n^* and m_x. For fGn traffic, $\mathrm{Var}\{X_n\}$ is equal to $\sigma^2 n^{2H}$, where $\sigma^2 = \mathrm{Var}\{\lambda_n\}$, and we can find the n^* that minimizes (A.3) directly. Although λ can be easily measured, it is not the case for σ^2 and H. Consequently, the MVA technique suffers from the need of prior knowledge traffic parameters.