**BITI: ARTIFICIAL INTELLIGENCE**

# PROJECT TYPE I: ANALYSIS



*An analysis-type project in the context of a bachelor’s degree final year project typically involves the exploration, examination, and interpretation of data, information, or phenomena to derive*

*meaningful insights, patterns, or conclusions. This type of project often focuses on understanding or comparing existing systems, processes, or datasets, and drawing conclusions based on analytical*

*methods.*

**CHAPTER 1. INTRODUCTION**

**1.1 Introduction**

1.1: Project Overview

The issue of hospital overcrowding has been a recurring issue, leading to long waiting hours and delayed admissions to intensive care wards. This has been identified as a major challenge facing hospitals globally [1]. Overcrowding occurs when the healthcare is forced to operate beyond its capacity due to a shortage of medical staff and an excessive number of patients seeking medical treatment [2]. Hospital overcrowding is primarily caused by factors such as unnecessary patient visits, lack of inpatient beds, and prolonged waiting times for available beds in wards. Research indicates that unnecessary visits often stem from inadequate standard procedures, while a shortage of inpatient beds exacerbates delays in emergency departments (EDs) and contributes to increased mortality rates among vulnerable populations, such as chronic kidney disease patients [3]. To mitigate these effects, healthcare systems can implement several strategies. Enhancing bed management and fostering departments can streamline patient flow and reduce boarding times [4]. Additionally, optimizing staffing levels in outpatient departments and employing queuing models to manage patient arrivals can significantly decrease wait times and improve overall operational effectiveness [3]. These measures can help alleviate overcrowding and enhance patient care quality.

Patient flow plays a critical role in hospital overcrowding, as inefficient management of patient movement can lead to significant delays and negative outcomes. Research indicates that effective patient flow management, including the use of artificial intelligence (AI) tools, can enhance the forecasting and monitoring of patient admissions, transfers, and discharges, thereby alleviating overcrowding in hospitals [5]. For instance, the implementation of discharge lounges has been shown to improve patient flow by increasing discharge rates and reducing turnaround times, which directly correlates with decreased overcrowding [6]. Additionally, systematic reviews highlight that managing patient flows across various hospital departments is essential, as disruptions in one area can impact the entire system. Factors such as prolonged waiting times and inadequate staffing in emergency departments exacerbate overcrowding, underscoring the need for targeted interventions to streamline patient flow [7]. Overall, optimizing patient flow is vital for improving hospital efficiency and patient care quality. The emerging technique of Artificial Intelligence (AI) has made it possible to manage overcrowding in emergency departments hence getting more attention in community.

This project proposes k-Nearest Neighbor (KNN) model of Machine Learning to be employed and trained using hospital admission data encompassing attributes such as diagnosis, consultancy episodes, number of admission and demography. The model will identify patterns and trends to predict which diagnosis requires the patient to have longer hospital stays or readmissions to help stakeholders to prioritize resource allocation accordingly. Apart from that, this project also emphasizes on data visualization as it is essential for understanding and addressing the relationship between diagnosis and overcrowding in hospitals. It can help identify patterns, bottlenecks, and trends in the data, offering actionable insights for improving patient throughput and resource management. Data visualization using Python with libraries such as Matplotlib, Seaborn, and Plotly is a powerful approach to transforming raw data into meaningful insights through graphical representation.

## 1.2 Problem Statement (PS)

1. Insufficient Understanding of Diagnosis-Specific Flow Patterns: The absence of data visualized of how specific diagnoses contribute to patient flow dynamics creates challenges in identifying which medical conditions are most closely associated with overcrowding at different times.
2. Difficulty in Integrating Historical Data for Predictions: Hospitals face challenges in integrating historical patient diagnosis data to create accurate prediction models, limiting their ability to anticipate and mitigate future overcrowding effectively.
3. Lack of Explainability in Prediction Models: Stakeholders struggle with interpreting and understanding the predictive models used for anticipating overcrowding. The absence of explainability makes it difficult for healthcare professionals to trust and act upon the predictions, which limits the effectiveness of these models in decision-making and patient flow management.

## 1.3 Objectives

1. To conduct data visualization of diagnosis-specific flow patterns in order to identify which medical conditions are most closely associated with overcrowding during different times. This will aid in targeted resource allocation and improve patient flow management.
2. To develop robust methods for integrating historical patient diagnosis data into predictive models, enhancing the hospital's ability to accurately forecast diagnosed patient influx and manage future overcrowding proactively.
3. To improve the explainability of predictive models used for forecasting patient flow and overcrowding, ensuring that healthcare professionals can trust and comprehend the outputs, leading to better-informed decisions and improved management of hospital resources.

## 1.4 Project Scope

* Research domain
* Experimental setup (e.g. Tools used)
* Case study used
* Data used
* Target User:

The target user of this study are hospital executives who aim to manage resources effectively to reduce overcrowding in hospitals and improve the quality of healthcare services. They can use data and analysis to plan strategies for resource management and enhance operational efficiency. Additionally, it includes healthcare providers (doctors and nurses) who need in-depth information about patient flow, which will help them make better decisions in patient care.

## 1.5 Project Contribution (PC)

* Describe who/what may benefit from the project and how it will benefit them ? You can infer it back to your objectives.
* Describe what is expected from your project and the significant contribution of your project.

**1.6 Report Organisation**

* Give a summary of each chapter presented in this report. For example:

## Chapter 1: Introduction

This chapter discusses about . . . . . .

. . . . . .

. . . . . .

**Chapter 6: Project Conclusion**

. . . . . .

**1.7 Summary**

Give a summary of this chapter and the next activities to be developed.

## CHAPTER 2. LITERATURE REVIEW

*(Notes: In this chapter, you are expected to cite previous work, especially in Section 2.3 which is previous research for a minimum of 20 citations and make sure to list them in your Reference list. Make sure you are using Harvard Styles of referencing)*

## 2.1 Introduction

Preview the literature review of your project. Provide a brief overview of the literature that is being reviewed, along with the topic and research aims to set the context for the reader.

## 2.2 Related Work/Previous Work

* Identify the domain related to your project with explanations from general to specific.
* Explain any issues related to your domain problem for example its platform, architecture, algorithm etc.
* You can provide any evidence or statistics which can help to verify your domain problem.
* Explain several terms that are being used in your project.

## 2.3 Critical review of current problem and justification

* Study of theory/algorithm/method that can contribute towards solving the problem.
* Justification of chosen theory/algorithm/algorithm/method
* Every sub-topic within the domain must have a review.
* Cite the source/s if you refer the approach/es from published materials.
* Conclude for the above fact and finding.

**2.4 Summary**

Summarize the chapter and explain the next activities to be developed.

**CHAPTER 3. PROJECT METHODOLOGY**

**3.1 Introduction**

Preview to the project methodology and how it would be carried out.

## 3.2 Operational Framework/ Research Workflow

* Follow common phases of methodology: Analysis, Design, Implementation, and Evaluation.
* Details of each research phase with regards to the research objectives.
* Describe each stage of the selected methodology and describe the activities that have been done in every stage and relate it with your project. Draw the framework of your project methodology.
* Analysis category: experimental, testbed, simulation, pilot test, survey.
* Data Collection: Describe the data sources you utilized for your project (e.g., datasets, surveys, interviews, etc.). Explain how the data was collected, including any pre-processing steps and considerations for handling noise in the data.
* Describe and justify the tools/techniques used.
* All forms of data collection must be attached by appendix.
* Make data collection by using appropriate software.

## 3.3 Project Activities and Milestones

* Explain your action plan prior to the end of the project. Apply from what you have learnt from project management.
* List and describe stage by stage of your activities.
* Attach your project timeline for the Gantt Chart for PSM 1 and PSM 2.
  1. **Performance Measurement/ Evaluation Metrics**

List and describe the performance measurement. Give justification for the selected measurement.

* 1. **Summary**

Summarize the chapter and explain the next activities to be developed.

**CHAPTER 4. PROPOSED METHOD**

**4.1 Introduction**

Introductory preview to this chapter. Provide outline of Chapter 4.

## 4.2 Proposed Solution

• Explain the possible solution (can be in the form of an algorithm/method/approach) and give justification for the proposed solution.

## 4.3 Experiment Design

* Identify and explain the overall flow
* Identify and explain the testbed/simulation setup
* Comparison of Techniques/Modeling (if applicable)

**4.4 Summary**

Summarize the chapter and explain the next activities to be developed

**CHAPTER 5. RESULTS AND DISCUSSION**

* 1. **Introduction**

Introductory preview to this chapter. Provide outline of Chapter 5.

* 1. **Results**
* Elaborate about the results based on the methodology.

## 5.3 Analysis and Discussion

* This section should consist of graphical results using the collected data from the implementation phase.
* A critical analysis of the graphical results should also be represented in this section.
* Use suitable representation (e.g. Tables, Graphs, etc.) to explain the findings.
* Provide discussion with the technical justification of the results. Relate with the proposed technique.

**5.4 Summary**

Summarize the chapter and explain the next activities to be developed.

**CHAPTER 6. CONCLUSION**

**6.1 Introduction**

Introductory preview to this chapter.

## 6.2 Project summarization

Summarize your project based on the set objectives. Describe how the objective has been achieved by integrating the information that you have reported in the implementation and testing phase. Conclude the significant result that you have gained in this project. State the weaknesses and strengths of your project.

## 6.3 Project Contribution

• State your project contribution to the university/faculty/company/individual. Your contribution must be aligned with the contribution that you have mentioned in Chapter

1.

**6.4 Project Limitation**

State your project limitation.

## 6.5 Future Works

* Present your suggestions on how your system can be further improved.
* Elaborate each of your suggestions in a paragraph.

## 6.6 Summary

* State whether you think your project meets your set objectives conclusively.
* Concluding phrases to conclude the project.

## REFERENCES

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