

**MASENO UNIVERSITY**

**SCHOOL OF COMPUTING AND INFORMATICS**

**DEPARTMENT OF INFORMATION TECHNOLOGY**

# **AUTOMATED TIMETABLING SYSTEM**

**CIT 409: IT PROJECT I**

**PROJECT PROPOSAL SUBMITTED TO THE SCHOOL OF COMPUTING AND INFORMATICS IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY**

**MASENO UNIVERSITY**

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**JANUARY, 2023**

# **DECLARATION**

I the undersigned do hereby declare that this project proposal is my original work and where there's work or contributions of other individuals, it has been duly acknowledged and relevant citations are given. To the best of my knowledge, no material herein has been previously presented to any other academic institution for examination, award of a degree, or any other award(s).

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**KATUMO BENSON MAKAU Date**

**Admission No. CIT/00046/019**

**Supervisor**

I hereby certify that this project proposal was presented for examination with my approval as the university-appointed supervisor.

Supervisor’s Name: **Dr. MUHAMBE T. MUKISA**

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Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# DEDICATION

I dedicate this proposal first and foremost to Almighty God who has been there since the beginning to this far. Special dedication also to my supportive parents/guardians and friends who have shown total support and compassion towards my achievements. Again, I want to dedicate this proposal to my supervisor Dr. Muhambe Mukisa for his progressive impact on knowledge.

# ACKNOWLEDGMENT

# ABSTRACT

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# CHAPTER ONE: INTRODUCTION

## 1.1 Background Information

Over the recent past, there has been an increase in course offerings and enrollment surges in institutions of higher learning. This has raised the demand for more facilities for academic institutions. This has proven that the ability to work within the set constraints of time, facilities, and resources is the greatest asset of any learning institution. Therefore, problems relating to timetabling vary between different institutions depending on the constraints at hand. In most schools, timetables are manually designed by lecturers, an activity that requires them to set aside a week for that task. This manual way of timetabling is prone to human errors and is difficult to meet all the requirements.

Due to the inherent challenges, timetabling is still done manually. For example, for each semester, schools are forced to redo the timetables, thus making the task repetitive, tedious, and painful. This has however presented the need to have an automated timetabling system. Failure to have the timetabling problems addressed would lead to schedules with a maximum number of disputes that fail to meet several side restrictions, allocated time, and rooms within the restricted period (Henry, 2021, p.g 1). Therefore, it is within this context that the proposed timetabling system needs to assess and fill the gap by designing and implementing the proposed system to help manage the learning activities at Maseno University.

## 1.2 Problem Statement

Management of learning activities is a complex venture in institutions of higher learning. Lecture venues and laboratories are essential but scarce resources. Scheduling a class requires one to consider the nature of the class, the number of students, the time of the day, and whether or not the unit is common across different programs. Manual designing of timetables thus is a complex and time-consuming affair, which contributes to the loss of valuable time not to forget the complaints from both students and lecturers over errors in the timetables.

## 1.3 Study Objectives

### 1.3.1 Overall/Main Objective

* To develop a web-based automated timetabling management system for Maseno University.

### 1.3.2 Specific Research Objectives

1. To identify the required modules of the automated timetabling system.
2. To design an automated timetabling system prototype.
3. To code the designed automated timetabling system prototype.
4. To test the developed prototype.

## 1.4 Research Questions

1. What modules are needed for the implementation of this timetabling system?
2. What is the appropriate and suitable design for this system?
3. What implementation approach will be appropriate for this system?
4. What system testing and validation techniques will be suitable for this system?

## 1.5 Significance

The automation of timetabling activities at Maseno University will ensure the smooth management of learning activities and save time for both lecturers and students. It will ensure that lectures don't collide and lecturers aren't assigned two classes at the same time. It will also ensure that lecture halls are utilized well.

## 1.6 Limitations

1. The design and methodology selected to implement this system would be time-consuming.
2. The evaluation/testing of this system would not be ideal depending on the environment.

## 1.7 Assumptions

1. We assume that the system to be developed would run effectively on the laptops of the users of this system.
2. We assume that the entire process of developing this system would be cost-effective.
3. We also assume that this system would be integrated with the existing systems.

# CHAPTER TWO: LITERATURE REVIEW

## Introduction

This chapter covers a review of relevant and related literature. It gives a background of the application area and reviews and critiques similar systems, highlighting their functions, strengths, and weaknesses. It includes a review of local and foreign-related literature that can help gathering and ideas that guide the development of the proposed prototype. It gives an overview of the different study that has been done before and the proponents to collect some ideas from another survey to formulate a new concept to apply when developing the proposed prototype.

## 2.1 Timetabling

There are various definitions of the term timetabling. According to oxford dictionary, Timetabling is the act of arranging something to take place at a particular time (Cross, 2005). On the other hand, Burke (Burke, 2002, p.g 2) defines timetabling as the allocation, subject to constraints, of given resources to objects being placed in space time in a way that nearly or fully satisfies the set of desirable objectives. The Business Dictionary (Gibson, 2009) defines timetabling as the formal organization of teachers' and learners' time, and the allocation and coordination of timings, and other resources within an educational institution. From the above definitions, Timetabling can be described as the process of planning, and allocating resources to objects relative to the available time to satisfy the desirable objectives. This process should be carried out in a systemic manner with equity in resource allocation in mind. For this process to be efficient, there is need to have a system that puts into consideration the available resources and the objects in need of the resources before allocating the resources. Having an automated system will guarantee better resource allocation than having a human manually do the same.

## **2.2 Lessons Timetabling in Higher Learning Institutions**

Timetabling in Institutions of Higher Learning is an optimization problem that takes a large number of variables and constraints into account. Optimizing medium and large instances is a very challenging task. When the resources are limited, it is often difficult to even find a solution that satisfies the defined constraints and requirements. For example, in Brazilian schools, a schedule for teachers must meet two requirements: minimization of working days and avoidance of idle time slots (Dorneles, 2014 p.g 32). The timetabling problem is common in academic institutions such as colleges and universities. It is a problem that has seen to attract the interests of many researchers. This problem is difficult to address due to the existing hard and soft constraints and the size of the problem (Chen, 2021, p.g 106522).

## 2.3 Challenges In Timetabling

A number of approaches were proposed in tackling the timetabling problem, such as operational research, human-machine interaction, constraint programming, expert systems, and neural networks. However, there are still several challenges to be addressed: easily reformulated to support changes, a generalized framework to handle various timetabling problems, and ability to incorporate knowledge in the timetabling system (Lee, 2005, p.g 1150). The University Course Timetabling problem is a particular type of scheduling known as a difficult problem arising in academic institutions, and an application of combinatorial optimization. The problem consists of coordination of lecturers, students, and classrooms to avoid clashes between them.

## **2.4 Existing Timetabling Systems**

### 2.4.1 Manual Timetabling System

Using the manual system, lecturers have to manually evaluate lessons to ensure they don’t clash and resources such as lecture halls are allocated fairly. Different departments have to communicate to smoothen the process of resource sharing. This method may seem simpler however it wastes a lot of time and it is very complex. The possibilities of having errors is endless as it may not be easy to avoid lessons clashing. With the limited number of resources, lessons end up clashing and resources are never fairly allocated (Nguyen-HQ, 1980). All these challenges are because the timetable is made out of uninformed guesses which makes it unreliable. Every day several lessons clash on the use of lecture halls and lecturers have two lessons assigned to them on the same time slots.

### 2.4.2 UniTime Scheduling System

UniTime system is a timetabling system build to address the issue of allocating lessons to lecturers and lecture halls. This system also addresses the issue of exam timetabling where exams are planned and scheduled when to happen. The system has proven to address almost every problem with timetabling. However it has its own weaknesses. The system does not address the issue of fair allocation of resources where classes have to students get a fair allocation of lecture halls and lecturers or lab sessions. The system also does not address the issue of conflicts fully as it allows for conflict to happen only that it produces a report of the conflicts. The system is also complex to use as its user interface is difficult to understand and access the services it is destined to provide. There is a need to have an easy to use system where all services are easily accessible. The system does not provide easy to additional features such as class re-scheduling with notifications. These weaknesses make the system not efficient to rely on as time will still be wasted and thus proving the point of its unreliability. The system is also difficult to implement and train personnel due to the technologies used to develop it.

### 2.4.3 Utwente Timetabling System

Utwente is a system aimed at generating timetables for institutions. The system provides a calender which the user relies on to plan and build a timetable. The System however similar to the current manual system at Maseno University, it does not factor in the other variables such as equal measure on resource sharing such as halls, labs. The timetable is also build manually where the user has to manually enter a class and assign it to a specific time slot. The system does not in any way provide a mechanism to avoid or manage conflicts. The system does not provide an easy to use interface for class re-scheduling or requesting lab sessions. Therefore the system is not better placed to fill the gap at Maseno University. The system is not time conscious as the user manually feeds in the data instead of automating the process. The system doesn’t provide a fair resource sharing algorithm where students get a fair allocation of lecture halls and time slots. Therefore this system proves to be unreliable to solve the problem at hand as it’s not automated and thus it requires a manual entry of the data into the system which is the issue with the current system.

### 2.4.4 Sagenda Timetabling System

Just like the current manual system, Sagenda system simply provides a calender to which you assign a class or a lesson to a particular date and time. The system does not in anyway consider conflict management, or even automation of the whole process. The system does not even factor in other resources such as lecture halls, lecturers and number of students. Additionally, the system is likely to waste time as the users have to manually enter the lessons to a particular day and time instead of having the process automated. The system also does not provide a user interface that is appealing to the eyes of the user. It could waste a lot of resources training the users as its not user-friendly and simple to use. For this reason the system doesn’t quantify to be the best suited system to solve the problem at hand.

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# APPENDICES

## GANTT CHART

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **WEEKS**  **Deliverables** | WEEK  1 | WEEK  2 | WEEK 3 | WEEK 4 | WEEK 5 | WEEK 6 | WEEK  7 | WEEK  8 | WEEK  9 | WEEK  10 |
| Build a Gantt Chart |  | |  |  |  |  |  |  |  |  |
| Chapter One |  |  |  | |  |  |  |  |  |  |
| Chapter Two |  |  |  |  |  | |  |  |  |  |
| Chapter Three |  |  |  |  |  |  |  | |  |  |
| Final Copy and Presentation |  |  |  |  |  |  |  |  |  | |