Introduction to TMSFIT

1.1 Prolegomena

E. Burke and coworkers say "Timetabling manually is a complex activity that is time-consuming and stressful because a large number of high and soft constraints need to be satisfied; there is therefore the need to automate the timetabling process" [1]. A well-planned and clash-free timetable is a   censorious element in running a university or any other academic environment. Previous days when technology was not in wide use, the timetable administrator manually created academic timetables. Thus, the task was very time consuming, University identified necessity of an automated timetable management system. This research directed because of that real importance of the University.

1.2 Background and Motivation

According to Cambridge English Dictionary, timetable is "a detailed plan showing when events or activities will happen" [2]. Constructing timetables and maintaining them is often a very complex task for software as well as people[3]. However, today, timetabling process has been simplified by fully automatic or semi-automatic solutions based on timetable generation applications such as Mimosa, TimeTabler and Open Course Timetabler.

Every academic year, faculty of IT face the rigorous task of preparing timetables that satisfies the various courses and their respective examinations being offered by the three different departments which are Department of Information Technology, Department of Computational Mathematics, Department of Interdisciplinary Studies.

Current timetable management system with graph coloring heuristic technique is efficient enough to carry out the courses without clashes manually. Nevertheless, problems occur due to insufficient lab resources and hall facilities. The problem is more complex when some batches have more than three hundred students while the largest hall can be allocated only two hundred and twenty two students.

Motivation to this research is due to the necessity of an automated web based Timetabling System to faculty of Information Technology at the University of Moratuwa which is designed and developed to optimum utilization of the resources and lectures offered by the University.

1.3 Aim and Objectives

1.3.1 Aim

The major purpose of this work is to develop a web based Timetable Management System to optimize the resources of IT faculty at University of Moratuwa.

1.3.2 Objectives

Following are the objectives of the research to achieve the above mention aim.

- Investigate the available lab capacity and required resources.
- To study number of scheduling algorithms
- Conduct a comparative study of Genetic Algorithm used in the timetabling problems to develop a timetable management system using the most suitable Genetic Algorithm.
- Study the development technologies for the automated timetabling.
- Build a prototype to gather and evaluate the user requirements
- Develop the automated web based timetable management system.

1.4 Problem Domain

Even the currently available system can generate timetables; still have issues with constructing a clash-free, optimal and complete timetable. The tedious tasks of data introduction and revision of usually incomplete solutions are the bottleneck in these cases [4]. Normally, educational institutions such as the University of Moratuwa have utilized to manual generation of their timetables. To get completed and optimal solution it takes long time. Even at the optimal stage of the manually generated timetable, there are still a few clashes available Sometimes timetable admin has to ask students to change their preference to avoid the clash. It makes them uncomfortable.

1.4.1   Research Problem

Can an Automated Timetable Management System use to resources optimization of IT faculty?

1.5 Proposed Hypothesis

Formulate an automated Timetable Management System to the faculty by using Genetic Algorithm as a technique to solve the problem, as it is able to produce a feasible timetable and fulfill as many constraints imposed.

1.6 The Proposed System

TMSFIT is an abbreviation for Timetable Management System in Faculty of IT. This new system will provide the facilities for the hall reservation information on the availability of the halls laboratories in the admins module. Lectures and students must register through the TMSFIT before they start using the system. Hence, the security is very high, only admin TMSFIT can update the timetable. There will be an authenticating using the users passwords. The students of the other faculties cannot allow accessing the system.

The proposed system will use to generate timetable automatically. This ensures the following features

- Easier slot assigning
- Less time consumption
- Minimum slot clashes
- User friendly

1.6.1   Features of the Proposed TMSFIT

A website built in order to improve the current system. The proposed system is suggest be called as Timetable Management System Faculty of Information Technology (TMSFIT). Features of the new system are outlined as follows. Some features of the existing system are improved and some are very significant to the proposed system.

- This proposed system provides an attractive graphical front-end and it is the main interaction point with user.

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- The system also improves the flexibility of timetable construction.
- It will be able to generate printouts on timetabling.
- Upgraded versions of the timetable management system must be introduced
- To increase the optimization, generated timetables can be fine-tuned
- The system should save the time.
- Productivity is improved.

1.6.2 Users, Inputs, Processes and Output of the System

1.6.2.1 Users

- Timetable administrator
- Lecturer
- Student

1.6.2.2 Input

- The system is able to take number of inputs from the user (Admin TMSFIT) such as Student list, Lecture list, Course list, Semester list, Hall list, Laboratory list and Timeslot as well as various and constraints such as lecturer preferred time using web based forms.
- User levels are defined and different kind of user interfaces are produced

1.6.2.3 Process

- Design and develop various kind of user interfaces according to the user access level such as view admin profile, view lecturer profile, view student profile
- Develop methods to generate timetables automatically
- Design and develop a method to view timetables, view list of students, view allocated resources
- Design and develop methods to insert, update, delete data from the ttms database
- Develop methods to create student, create lecturer, create batch, create degree, upload students, student enrolment and lecturer assignment for the subjects.
- Design and develop a user Interface to accumulate lecturer preferred time

1.6.2.4 Output

- Display the generated timetable for a specific semester.
- Printable timetables
- Web based system will show the availability of the resources such as labs and courses.

1.6.2.5 Technology

- TMSFIT web based application (PHP 5.6)
- The language implementing the TMSFIT is PHP and MYSQL
- The framework used to implement the system is Yii with MVC architecture

1.7 Research Methodology

Milestone approach from Professor Karunananda, was used as the main research methodology in this work. Figure1-1 will illustrate that Milestone Approach.
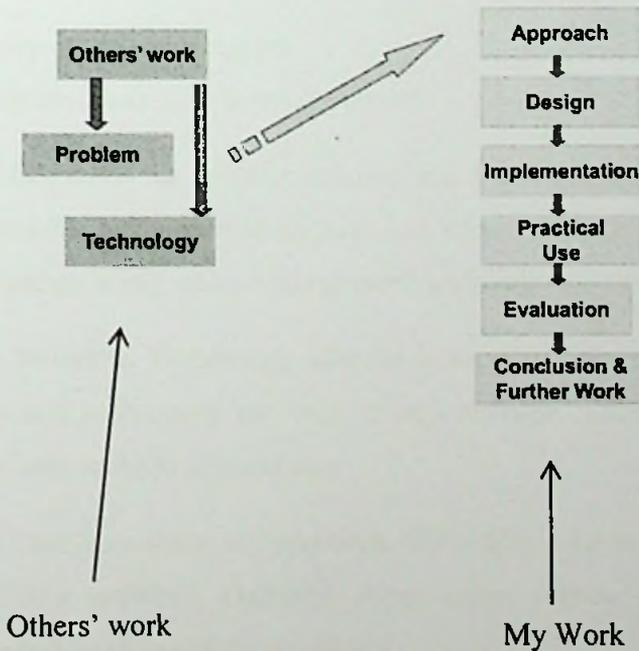

Figure 1-1 Milestone Approach

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In requirement elicitation phase, other than the interviews as said some more information about subjects offering by each department, credit system and semester information were gathered from student handbook [5]and the faculty website.

Then, a literature survey was conducted to seek the best approach to develop the new system.

PHP language was used to develop the system. Commonly, it is combined with databases written in the SQL language.
The output was a prototype of the TMSFIT.

1.8 Research Scope
- Used only requirements of IT faculty
- Used two main degree programs offered by the IT faculty
- Used only the information of under graduates
- Used only the lecturers information of the IT faculty
- Took the details of the IT faculty resources

1.9 Structure of the Dissertation
This dissertation contains following chapters.

Chapter 2: Describes the problem domain and it will discuss about the issues of the current timetable management system and some other approaches for solve the problem. Further, it will address the strength and weakness of those approaches.

Chapter 3: Describes Technology adapted in proposed TMSFIT. Provide how these technology and techniques are used in my research. Literature review of others approaches with refers to my problem.

Chapter 4: Describes about my approach. Show how I adopt the technology to solve the timetabling problem. Describe about users, inputs, outputs, processes and technology that implements the solution.

Chapter 5: Describes system analysis and design of the proposed system with diagrams. Describes about each module

Chapter 6: Describes the implementation of the TMSFIT. Implementation details of each module. It state about, software, hardware, flowcharts, algorithms, pseudo codes, code segments as per each module in the design

Chapter 7: Describes how the system works. It will act as a user guide for this system.

Chapter 8: Describes about the discussion of testing and evaluation of the system.

Chapter 9: Describes conclusion and further work of the system. Further, it will be discussed if this research achieved its goal and objectives.

1.10   Summery

This chapter describes the brief and overall description of the project. It contains sub sections as background and motivation, aim and objectives, problem domain and some more.

Next chapter will discuss about review of the others work. It gives a full description about background information of the project. Based on a literature survey, statements about others' approaches to solve similar problems and highlight my problem. It has provided a table for comparison of different approaches.