

Design and Implementation

7.1 Introduction

This chapter focuses on the design and implementation of data collection methodology used to identify the parameters that explain emotions in e-Learning. As it is already explained, student's interactions with the e-Learning system are used to capture data for parameters. Figure 7.1, The Top Level Architectural Design Diagram of the entire system. This includes the modules and subsystems related to data analysis and design as well (Shaded in gray). All the other modules are explained in this chapter. In addition, interconnections between modules and subsystems are also explained.

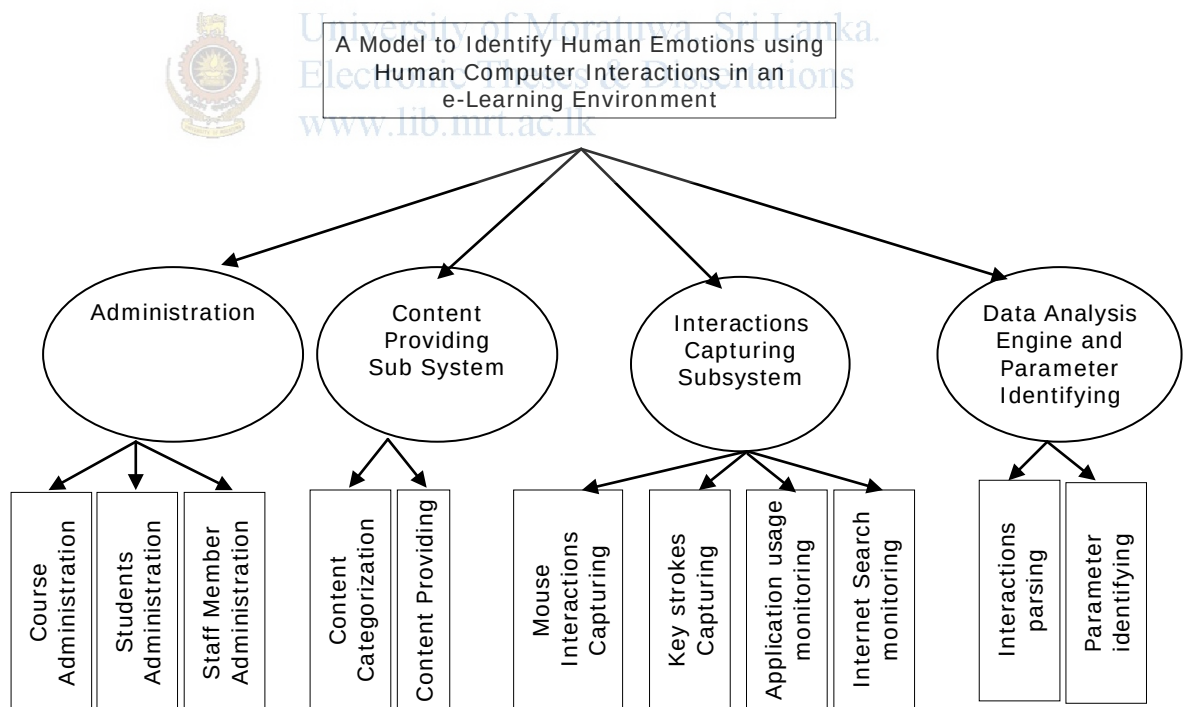


Figure 7.1, Top Level Architectural Design Diagram

7.2 Overview of Subsystems and Modules

The data collection system consists of administration subsystem that is used to administer courses, students and staff members. Content providing sub system consists of content categorization and content providing sub systems. Interactions capturing subsystem captures student interactions through Mouse and Keyboard and records them. These two modules capture application usage of the student. Internet Search monitoring module is not implemented, but once implemented, can be used to introduce additional parameters.

It is pertinent to mention that Administration and Content providing subsystems provide the essential infrastructure needed to carry out data capturing for the analysis.

A web based implementation is used for Administration and Content providing subsystems are web based. These are developed using PHP and JavaScript for the front end and MySQL as the back end. Web system runs on Apache web server. Interactions capturing subsystem is implemented using Microsoft Visual Basic 6.0, API Programming. KbdMouseHook.dll is used to capture interactions shown in Table 7.1. The dll file captures interactions using hooks. It also captures the active window application program. These values are included with the time and date stamps for time calculations. References [30, 32, 33, 35 36] were used in implementation of this module.

Output Device	Interaction	Captured Data
Keyboard	Key Down	Key Code
	Key Up	Key Code Switching between applications
Mouse	Mouse Movement	X, Y coordinates – Idle time.
	Left button click, Right Button Click	X, Y coordinates Switching between applications

Table 7.1, Interactions related details captured in the system

Analysis of the data is carried out using MS Excel, since it provides a powerful tool to carry out multiple regression analysis.

Figures 7.2 and 7.3 describe the classes, and their relationships for web based system.

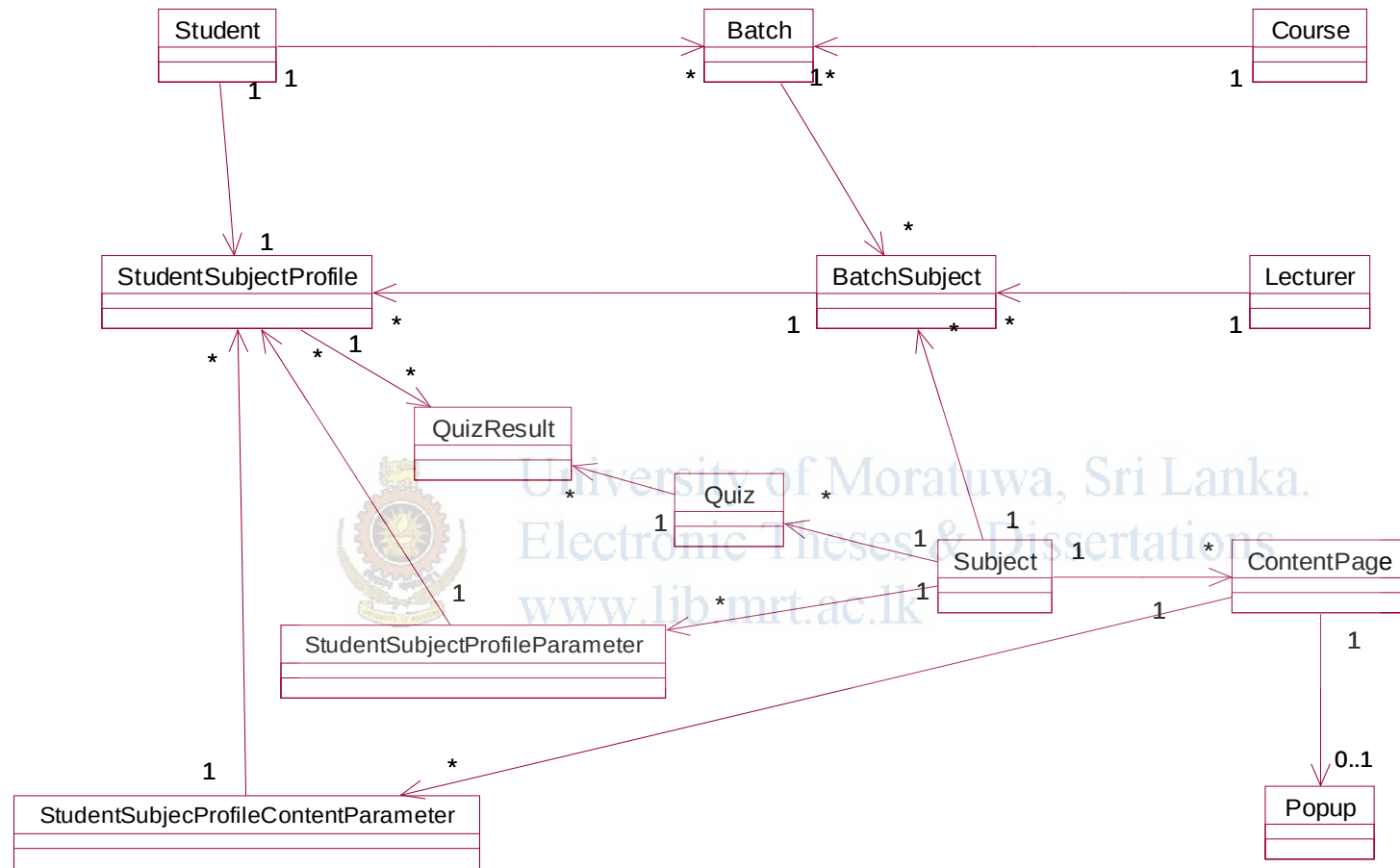


Figure 7.2 Class Associations

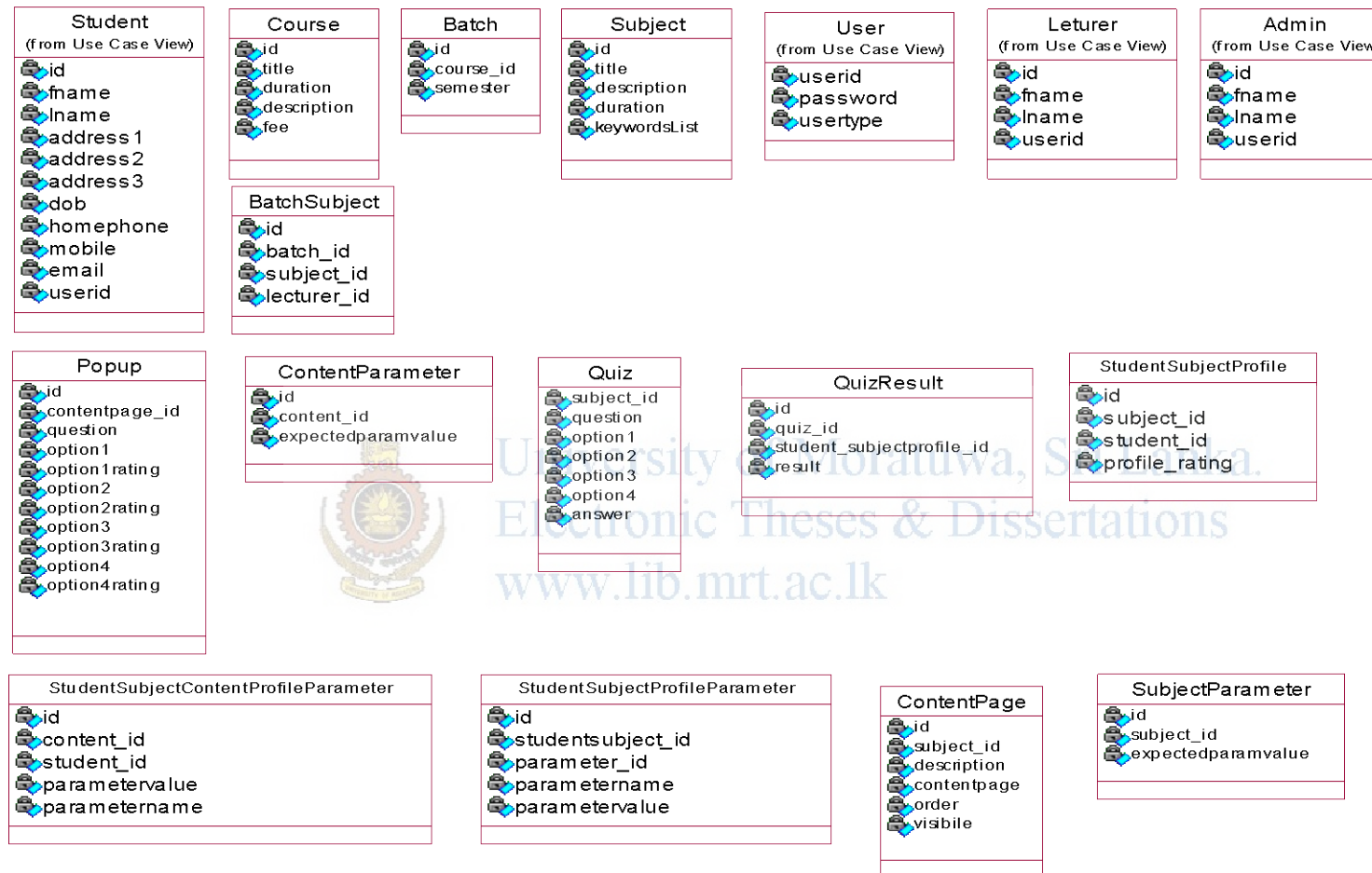


Figure 7.3 Classes with attributes

The above class diagrams are used to implement the database in MySQL. The design for the system is carried out for a system that automatically provides the suitability of the selected parameters online.

7.2.1 Administration Sub System

As shown in Figure 7.1, this subsystem manages and administers courses, students details and staff members.

7.2.1.1 Course Administration

Users of this module are Administrators and Lecturers.

The administrator enters Courses, Batch Information, Subject details, assign Subjects to Lecturers.

7.2.1.2 Students Administration

Users of this module are Administrators, Lecturers and Students.

The administrator registers students by entering their details into the system. Students are assigned their courses. The student can change their profile and update their personal information if needed. The Lecturer can view student information and also they can rate students according to the expertise and exposure to the subject they have mentioned in their profile.

7.2.1.3 Staff Member Administration

Users of this module are Administrators and Lecturers.

The administrator registers staff members, i.e. adds, modifies or deletes

Administrators and Lecturers in the system. Lecturer can change their personal details if needed through this module.

7.2.2 Content Providing Sub System

As shown in Figure 7.1, this subsystem manages study material and provides them in an ordered manner. The server side system that handles requests from students and provide study material for the subject they are learning.

7.2.2.1 Content Categorization

The Lecturer will order the content for the subject using Content Categorization sub system. Also facilities are available to add popup feedback questions for Content and emotions.

7.2.2.2 Content Providing

This subsystem will interact with the existing e-Learning system to obtain subject content. It is responsible for providing content pages to the student.

Appendix D contains the installation guide for the web system

7.2.3 Interactions Capturing Sub System

As shown in Figure 7.1, this subsystem captures and records interactions of a student made via keyboard and mouse. As explained in Table 7.1, this subsystem is responsible for capturing mouse movements, clicks, keys pressed and time and date stamps of these events happening.

7.2.3.1 Mouse Interactions Capturing, Keystroke Capturing and application usage monitoring

Mouse Interactions Capturing module and Keystrokes Capturing module capture switching between applications, navigations through content pages, keyword relevancy, etc. Also it is used to calculate the time spent on different pages, subjects. These are used to calculate the parameters defined in Chapter 5, that are under observation.

Following procedure is used to capture key strokes and combinations. Windows API programming is used.

- Define and declare low-level keyboard API methods
- Define an event handler to respond to low-level Windows keyboard events before Windows handles them
- Trap specific and varied keystroke combinations

- Conceal the complexity of the Windows API methods in a VB6 interface, facilitating reuse of this general keyboard-handling technique
- Safely call other handlers that may exist concurrently with your handler
- Unhooking the keyboard handler when you are finished

A similar approach was used to track mouse events and to capture application that is being used. A dll file was developed to handle low level API functions and it was called from the application program.

The dll file should be compiled for different versions of Windows for proper execution.

Installation guide for the system is given in Appendix D and sample coding of the system is given in Appendix C

7.2.3.2 Internet search monitoring

This module is proposed but not yet implemented, but included in this text as part of the total system, as it is expected to contribute to implementation of additional parameters.



University of Moratuwa, Sri Lanka.
Electronic Theses & Dissertations
www.lib.mrt.ac.lk

7.2.4 Data Analysis and Parameter Identifying Sub System

These subsystems are used to calculate values for the analysis and carry out the analysis.

7.2.4.1 Interactions parsing

The interactions captured in the modules described in section 7.2.3 are not in the format to be analyzed and derive conclusions. Hence, they have to be converted in to a format the system understands. This is carried out using this module. Since the system is initially implemented in an experimental basis in a laboratory, this will be done manually. The design is done for automation of this module if parameter identification in laboratory environment is successful.

7.2.4.2 Parameter identifying

After converting the data, regression analysis was used to find suitable parameters. Detailed functionality of module is described under Chapter 5. An inbuilt excel based regression analysis tool is used to identify parameters.

Automation of the above two modules will be carried out after finalizing the parameters.

7.3 System Testing

Administration, Interactions capturing and content providing sub systems were tested both in a single user environment and in multi user environment, in the laboratory. The intended audience were students pursuing BSc in Information technology and were in the first year. Hence final year students who have already learnt the subject tested the system.

7.4 Summary

This chapter described the overall functionality of the system, including functional requirements. The infrastructure system which is used to capture data for analysis and its functionality is discussed in detail. A brief introduction of the data analysis conducted to find parameters to identify the relevancy is also included. Software and hardware used in the system development is also included.



University of Moratuwa, Sri Lanka.
Electronic Theses & Dissertations
www.lib.mrt.ac.lk