# CHAPTER 2: LITERATURE REVIEW

## Introduction

This chapter gives an overview of the current applications, which are related to our project and it will give a brief description of the technologies that will be used to build this project in the background section.

## Related Work

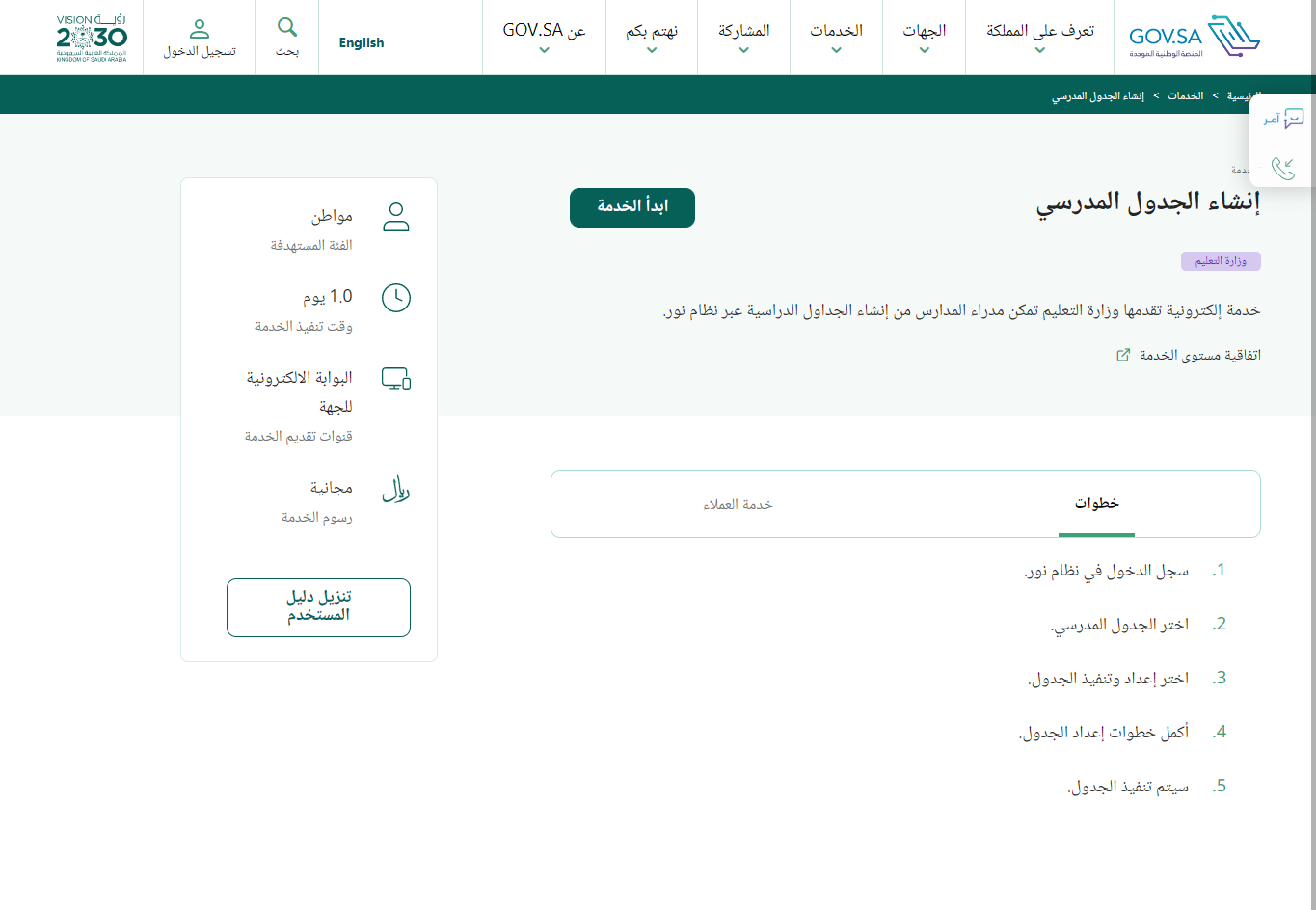
Creating schedules is not considered a recent problem. It has long been a challenge for everyone who needs to create a schedule to organize some work. Therefore, it is natural that we find some devised ways to solve this problem, and universities are not excluded from this issue. Many universities have developed programs that prepare schedules. The university and schedules for students.

### Making a School Schedule from GOV.SA

An e-service provided by the Ministry of Education in KSA, enabling school administrators to create study schedules through the Noor system.[1]

The steps to make a school schedule are:

* Login to the Noor system.
* Select the school schedule.
* Select (Prepare and implement the table).
* Complete the table setting steps.
* The schedule is complete.



**Figure 3**: generating schedule page on manger of school account

Figure 2: School Schedule page on manger of school account

Figure1: Making Schedule School page on GOV.SA website



### Scheduly

The goal of the software application is to provide a possible timetable solution with the minimum number of clashes between time slots. It relieves the user of much of the hard work required for generating a timetable manually, leaving him with more time to apply the skills and judgment where they are needed to produce a timetable of the highest quality.[2]

Figure 4Dashboard

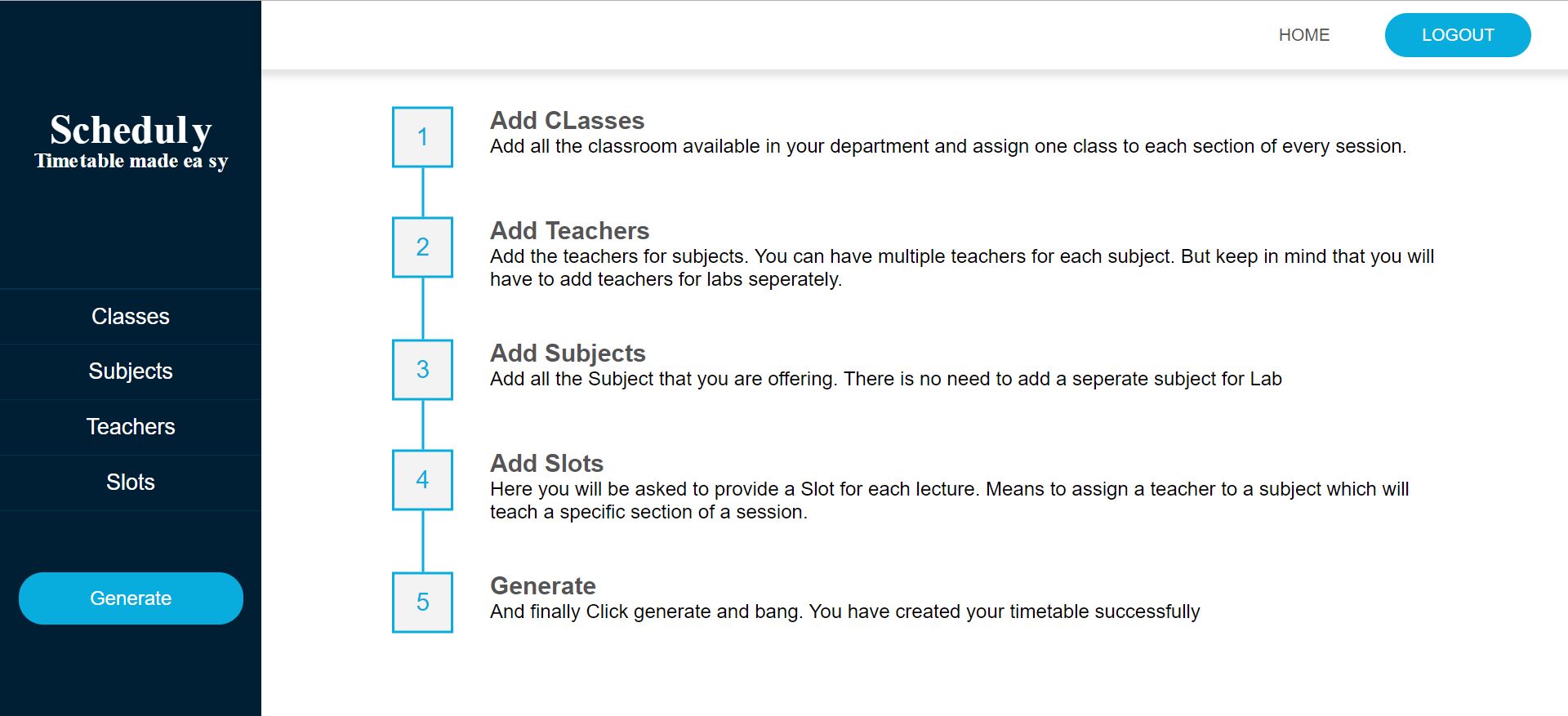
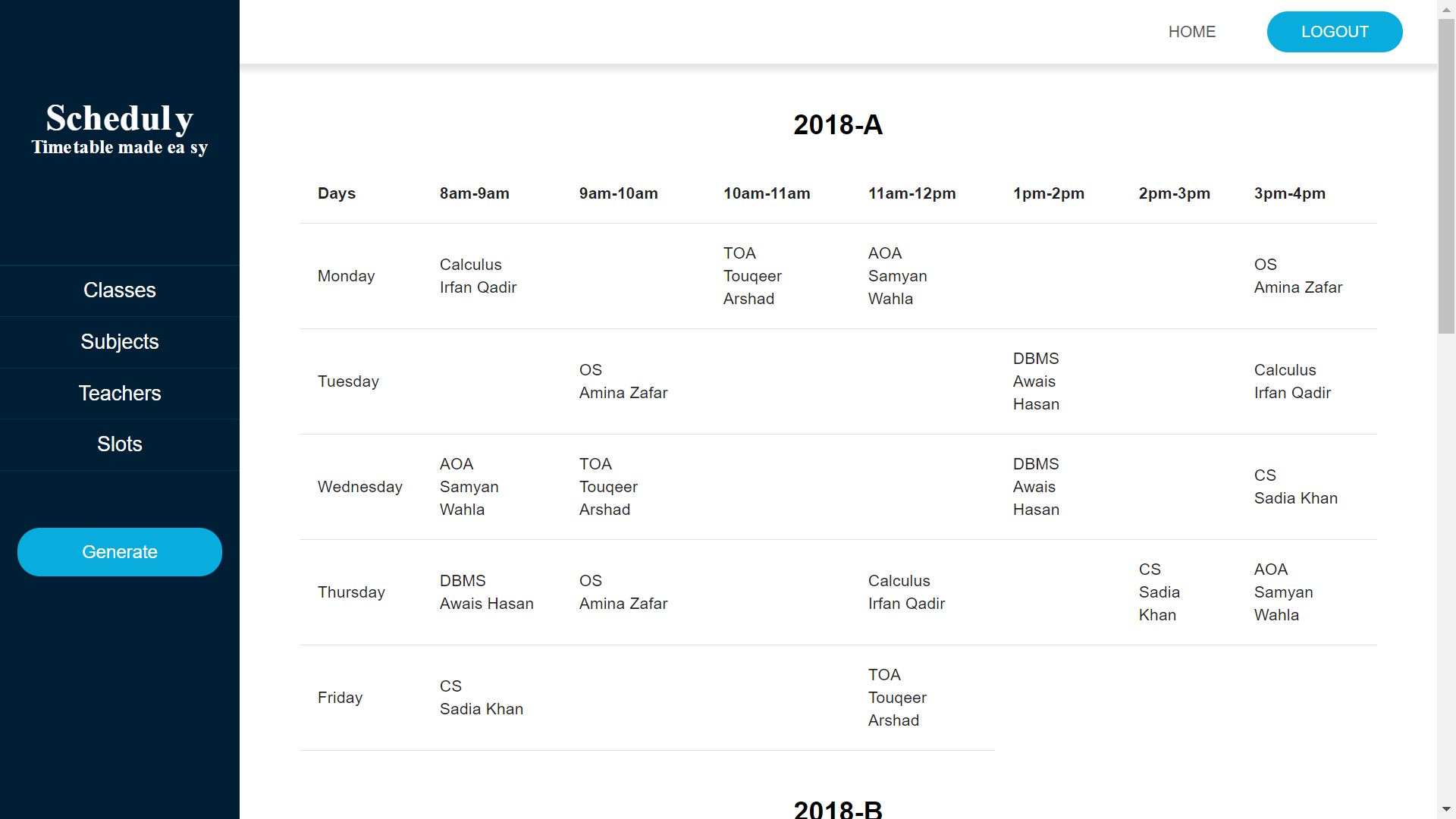


Figure 5 Output page



## Background

In this section we will give a brief definition of the technologies and tools we are using to build this project, mainly we are building web applications, and these applications will depend on an algorithm called a Tabu search. and the technologies we will use can be categorized into two main sections, Front End and Back End.

### Tabu Search

Tabu search is a metaheuristic optimization technique that is used to solve combinatorial optimization problems. It is a local search algorithm that is designed to avoid getting stuck in local optima by keeping a record of previously visited solutions called a "tabu list". The basic idea of tabu search is to iteratively improve a candidate solution by making small modifications to it while avoiding moves that are prohibited by the tabu list. The tabu list prevents the algorithm from revisiting recently visited solutions, which encourages exploration of the search space and helps to avoid getting stuck in local optima. Tabu search has been successfully applied to a wide range of optimization problems, including scheduling, routing, and packing problems. One of the strengths of tabu search is its ability to handle large and complex problems with many variables and constraints. There are many variations of tabu search, including adaptive tabu search, reactive tabu search, and parallel tabu search. These variations introduce additional techniques to improve the algorithm's performance and make it more efficient.[3], [4]

#### How Tabu Search Works

The basic idea of tabu search is to iteratively improve a candidate solution by making small modifications to it while avoiding moves that are prohibited by the tabu list. here are the steps of how tabu search works:

1. Initialize the algorithm with an initial solution to the problem.
2. Define a tabu list to keep track of the moves that have been made in previous iterations.
3. Define a neighborhood structure that defines the set of possible moves that can be made to the current solution.
4. Generate a set of candidate solutions by applying the neighborhood structure to the current solution.
5. Evaluate the quality of each candidate solution using an objective function.
6. Select the best candidate solution that is not prohibited by the tabu list.
7. Update the tabu list to include information about the move that was just made.
8. Repeat steps 4-7 until a stopping criterion is met (e.g., a maximum number of iterations is reached, or a satisfactory solution is found).
9. Return the best solution found during the search.[3], [4]

### Front End

The Front End of an application is the interfaces, and all that can the end user see or interact with on the screen of that application.

#### HTMLHTML

Figure ‎0‑1 Logo of HTML

HTML stands for Hyper Text Markup Language and it is the standard markup language for creating Web pages. HTML describes the structure of a Web page; elements of HTML tell the browser how to display the content.

A start tag, some content, and an end tag define an HTML element:

<tagname> Content goes here... </tagname>

To read HTML documents and display them we need to use a browser such as Chrome or Firefox.[5]

Figure ‎0‑2 Logo of CSS

#### CSS

CSS stands for Cascading Style Sheets and describes how HTML elements are to be displayed on the screen, paper, or in other media. CSS saves a lot of work it can control the layout of multiple web pages all at once.

HTML was never intended to contain tags for formatting a web page, it was created to describe the content of a web page, when tags like <font>, and color attributes were added to the HTML 3.2 specification, it started a nightmare for web developers. Development of large websites, where fonts and color information were added to every single page, became a long process.[6]

#### JavaScript

JavaScript is a programming language that is one of the core technologies of the World Wide Web, alongside HTML and CSS. Over 97% of websites use JavaScript on the client side for web page behavior, often incorporating third-party libraries. All major web browsers have a dedicated JavaScript engine to execute the code on users' devices. JavaScript is a high-level, often just-in-time-compiled language that conforms to the ECMAScript standard.

Figure ‎0‑3 Logo of Javascript

It has dynamic typing, prototype-based object orientation, and first-class functions. It is a multi-paradigm, supporting event-driven, functional, and imperative programming styles and it has application programming interfaces (APIs) for working with text, dates, regular expressions, standard data structures, and the Document Object Model (DOM).[7]

#### React.js

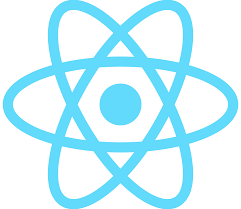
React, sometimes referred to as a frontend JavaScript framework, is a JavaScript library created by Facebook. React is a tool for building UI components.

Figure ‎0‑4 Logo of React

Instead of manipulating the browser's DOM directly, react creates a virtual DOM in memory, where it does all the necessary manipulating and is found out what changes have been made, and changes only what needs to be changed, before making the changes in the browser DOM.[8]

### Back End

On the opposite side of the Front End, The Back End is all the underneath structures and data management in the background of an application that is hidden from the end user, it is responsible for storing and organizing data, and the backend communicates with the frontend, sending and receiving information to be displayed.

#### Node.js

Node.js is an open-source and cross-platform JavaScript runtime environment.

Node.js runs the V8 JavaScript engine, the core of Google Chrome, outside of the browser. This allows Node.js to be very performant.

Figure ‎0‑5 Logo of Node.JS

A Node.js app runs in a single process, without creating a new thread for every request. Node.js provides a set of asynchronous I/O primitives in its standard library that prevent JavaScript code from blocking and generally, libraries in Node.js are written using non-blocking paradigms, making blocking behavior the exception rather than the norm. When Node.js performs an I/O operation, like reading from the network or accessing a database or the file system, instead of blocking the thread and wasting CPU cycles waiting, Node.js will resume the operations when the response comes back. This allows Node.js to handle thousands of concurrent connections with a single server without introducing the burden of managing thread concurrency, which could be a significant source of bugs.

Node.js has a unique advantage because millions of frontend developers that write JavaScript for the browser are now able to write the server-side code in addition to the client-side code without the need to learn a completely different language.[9]

#### MySQL

MySQL is one of the most recognizable technologies in the modern big data ecosystem. Often called the most popular database and currently enjoying widespread, effective use regardless of industry, anyone involved with enterprise data or general IT should at least aim for a basic familiarity with MySQL.

Figure ‎0‑6 Logo of MY-SQL

MySQL is a relational database management system (RDBMS) developed by Oracle that is based on structured query language (SQL). A database is a structured collection of data. It may be anything from a simple shopping list to a picture gallery or a place to hold vast amounts of information in a corporate network. In particular, a relational database is a digital store collecting data and organizing it according to the relational model. In this model, tables consist of rows and columns, and relationships between data elements all follow a strict logical structure. An RDBMS is simply a set of software tools used to implement, manage, and query such a database.[10]

### Development Environment

To be able to use these technologies all of them need an environment that hosts them and as we going to use the best technology, we will use the best environments.

#### VS CODEVisual Studio Code

Figure ‎0‑7 Logo of VS code

Visual Studio Code is a source-code editor made by Microsoft for Windows, Linux, and Mac OS. Features include support for debugging, syntax highlighting, intelligent code completion, snippets, code refactoring, and embedded Get. Users can change the theme, keyboard shortcuts, and preferences, and install extensions that add additional functionality.

**Features**

* Visual Studio Code is a source code editor that can be used with a variety of programming languages, including Java, Go, JavaScript, Python, and C++.
* Is based on the Electron framework, which is used to develop Node.js web applications that run on the Blink layout engine.
* Instead of a project system, it allows users to open one or more directories, which can then be saved in the workspace for future reuse.
* Visual Studio Code can be extended via extensions available through a central repository. This includes additions to the editor and language support, extending and customizing to your liking.[11]

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