Faculty of Computing Staff Research Performance Dashboard

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Abstract—The Faculty of Computing Staff Publication Dashboard is a comprehensive web-based platform designed to track and analyse publication metrics for the faculty members and research staff. The dashboard provides a centralized repository for storing, managing, and visualizing various publication-related data, including indexed and non-indexed publications, H-index, citation counts, grant information, income generation, commercialization activities, and networking collaborations. The project aims to streamline the process of monitoring and evaluating the faculty's publication performance, enabling better insights into research productivity and impact. By aggregating and presenting the publication metrics in the form of graphs and charts, the dashboard offers an intuitive and interactive interface for users to explore and understand the faculty's scholarly output. The system utilizes a database to store the publication data, which is scraped and processed through various data preprocessing methods. The data is then organized and displayed on the dashboard in real-time, ensuring up-to-date information for faculty members, research staff, and other stakeholders.

Keywords — Publication, Dashboard, Graphs, Real-Time, Web-Based

I. INTRODUCTION

Over the years, technology has advanced to a stage where we are able to make everything organized into a single platform with different components that have been able to solve many real-life problems. Data is one of the most important factors in the advancement of technology in the modern world. Modern technology is dependent on data. It is without a doubt that technology has simplified our lives and has made changes in the way people used to work or think before. Without proper data collection, no system can be developed whether it is related to technology, science, or any other relevant fields. Data is extracted and refined using certain techniques and methods. Web Scraping is one such technology. Web Scraping is the process involving the extraction of data from a source using automated software and tools. It has grown more popular over the years since its utilization boosts the businesses of different organizations or individuals. In recent years, it has helped different organizations and individuals gain access to useful information that can be used for a wide range of tasks like marketing, research, analysis, etc. For businesses looking to gain a competitive edge in the industry, web scraping has become an essential tool for them.

Web scraping-related technology has advanced significantly over time. Web scraping was a labour-intensive manual procedure in the early days of the internet that entailed manually copying and pasting data from webpages into spreadsheets. Technology evolved in tandem with the growth and complexity of the internet. Various organizations and companies use this technology to analyse their data over the years and work on improving their system in the future. For universities like UTM which is a research-intensive institute, it is very important to keep track of the publications made by the staff of different faculties. One of the main faculties of UTM is the faculty of computing. Web Scraping is one of the very good approaches to keeping track of the publications made by the faculty of computing staff. With this approach, we can analyse the research output and evaluate the current state. A dashboard created with the data collected from web scraping will be more insightful for viewing the outputs of research and publications made by the staff from the faculty of computing,

In a nutshell, a dashboard can assist faculty members with keeping track of faculty publications, identifying patterns in research output, and automating the process of updating publication data by giving them a comprehensive and up-to-date perspective of research output.

II. PROBLEM BACKGROUND

One of the cornerstones of UTM is the Faculty of Computing. The staff of the faculty of computing not only excels in academic teaching but also in research. University Teknologi Malaysia (UTM) is a research-intensive university. The Faculty of Computing at the Universiti Teknologi Malaysia (UTM) has many faculty members who publish their research papers, articles, and other academic works. Keeping track of all the publications from each faculty member can be a challenging task, particularly when this information is dispersed over numerous websites and databases. It is important to keep track of the publications to do an analysis of the results from the staff of the computing staff. Through this approach, the faculty members can keep track of their latest research updates and can analyze them accordingly to make better progress in the future. It can be challenging to obtain an accurate picture of the faculty's research output because of discrepancies in data and inaccuracies caused by manual reliance on individual faculty members. Through this, faculty members may risk missing out on funding or partnership opportunities as well as possible avenues for research advancement without a thorough and current perspective of research output.

III. PROJECT AIM

The purpose of this project is to extract data and develop a web-based dashboard system that will highlight publications, indexed publications, non-indexed publications, and citations to improve the decision-making process and can assist faculty members with keeping track of faculty publications, identifying patterns in research output, and automating the process of updating publication data by giving them a thorough and current perspective of research output. The dashboard will also display other numerous data like trainings conducted, conferences organized, and agreements done by the faculty.

IV. PROJECT OBJECTIVES

Setting up the objectives is a key step for developing any project. The objectives of the project are given below:
   a) To extract data on the research performance of faculty members in the Faculty of Computing at UTM.
   b) To develop a Web-Based Dashboard system that will display different research performance data outputs in the form of charts that may include bar chart, pie chart etc.
   c) To validate the data and test the Dashboard system to check if it matches the user requirements gathered from the stakeholder.

V. PROJECT IMPORTANCE

The main idea of this project is to provide real-time information on faculty activities using web scraping techniques. The main aim of this project is to give an idea to improve the decision-making process by providing accurate and timely information to the administration and faculty. In today's world, many organizations use the data acquisition technique to make future decisions on the improvement of the system. The type of data that will be collected and included are grants, publications, indexed publications, non-indexed publications, and citations. This sort of data is important for analyzing the effectiveness of the research published by the faculty of computing staff. With web scraping, the analysis of the information gathered can be used to identify trends, patterns, and insights to make informed decisions. The Dashboard developed during the project can be used for a variety of purposes, including monitoring faculty performance, identifying areas for improvement, tracking research activity, and fostering collaboration among faculty. For example, a dashboard can provide information on the number of papers each faculty authored, the number of indexed and non-indexed publications, and the number of citations received. This data will help to identify highly productive faculty members and will guide the allocation of R&D resources. Additionally, the Dashboard can be used to monitor the status of grant applications. This information can facilitate effective communication and collaboration among faculty members, leading to successful research projects. The dashboard will also provide information about other resources such as income generation, training conducted, and conferences organized. This information will help the faculty members to work on their professional development and can increase the visibility of goals set by the faculty. The administration can also allocate resources more effectively. The dashboard will highlight the networking opportunities which will help the faculty members to recognize the collaboration standards and work on them. In summary, the project is an important attempt to boost decision-making processes, foster collaboration among faculty members, and enable effective resource management. This project uses web scraping techniques to collect real-time information from various sources that can be used to identify trends, patterns, and insights.

VI. LITERATURE REVIEW

The literature review assumes a very significant role for any research work as it makes a critical assessment of extant knowledge in understanding the subject matter of the study. The chapter also plays a very important role for the proposed research study by providing a literature review on pre-existing systems that resemble the proposed web-based application for the project. The chapter sources and elaborates on relevant facts to provide a deeper understanding of how the project is done. Comparing three related systems can help the developer to bring out the strengths and weaknesses to give an input to what development of Dashboard involves. Moreover, the literature review allows access to technologies and tools that are involved in building Dashboard; therefore, useful technical information can be obtained for the developer to make the right decision regarding technology and tools. After that, the knowledge of making some improvements would be undertaken in designing

a system that fulfills the requirements of both faculty members and research staff of the faculty of computing.

VII. COMPARISON BETWEEN EXISTING SYSTEMS

TABLE I: COMPARISON BETWEEN EXISTING SYSTEMS

Properties	System Pro	Scimagojr	Google Scholar	FC Dashboard
System Type	Web-based	Web-based	Web-based	Web-based
Interface	Data visualization is a limited	User-friendly Interface but lacks organization	Very user-friendly interface	User-friendly interface with beautiful themes and organized features
Language	English	English	English	English
Data Analysis	Yes	Yes	No	Yes
Reliability	Fair	Average	Average	Good

Based on the comparison Table 1, it can be concluded that the Dashboard developed for the faculty of computing staff to check on their publication performance is an excellent platform when compared to the alternatives. The faculty of computing staff will benefit to do a study of their publication works and thus think of further development. This project aims to help the faculty of computing staff to get an insight into their work and assess the current condition of their publication methods. In comparison to similar systems, it can be said that our system will be useful for a certain organization to follow up with their work in their own field.

VIII. METHODOLOGY

The system development methodology is an orderly process used in executing the basic steps necessary for analyzing, designing, implementation, and maintaining the system efficiently. Quite a few numbers of approaches can be utilized for effective project planning as well as execution. Considering the underlying system requirements, the Agile methodology would be the most feasible approach toward software development for this project. In Agile methodology, the project is broken down into small pieces of user functionalities. These functionalities can be organized by prioritizing their importance and setting a delivery time limit to complete them. They can be divided into weekly cycles which are known as iterations or sprints. The goal of the sprint needs to be specified before every cycle. By making an analysis of the requirements, the functionalities will be divided and developed sequentially by giving highest priority to the most important ones. In this way, the development process will be easier and smoother for the developer to develop. Agile methodology is best suited for our project because of its phases. It is easier to implement the agile methodology as well. The use of sprints to complete tasks in Agile methodology makes it more suitable for the implementation of the project since it will help in saving time, money and dividing the tasks according to their priority. It has been seen from previous projects that by embracing the Agile Methodology, organizations can experience numerous benefits. They include more adaptability, a shorter time to market, higher customer satisfaction, better software quality, and lower project risks. Due to its endless benefits, it can be concluded that Agile methodology is the best suited for my project.

IX. TECHNOLOGY USED

TABLE II. EXAMPLE OF TECHNOLOGIES

Technology	Purpose	Type
Windows	Operating System	OS
Google Drive	Documentation	Cloud Storage
Draw.io		UML Diagram Editor
Figma	Design	UI and UX Design
Visual Studio Code	Development	IDE
ReactJS		Frontend, JavaScript Library
Material Ui	Stack	UI component Library
Tailwind CSS		CSS framework
NodeJS		Backend, JavaScript Library
MongoDB		DBMS
Puppeteer	Scraping Tool	JavaScript Scraping Library

X. REQUIREMENT ANALYSIS

The functional and non-functional requirements of

the system are discussedin this section. These requirements were gathered from the stakeholders of thesystem.

A. Functional Requirements

Here's a description of the actors used in the use case for this project:

TABLE III. ACTORS FOR USE CASE

User	Characteristics
Faculty Members	This user is the main part of the system. The system is basically built for the usage of the faculty members. The faculty members will be able to get an insight of their research work and what measures can be taken to do improvement on research by the faculty of computing staff.
Research Officer	Research officer plays a crucial role in our system design. All the data that will be collected will have to go through the research officer for filtering it properly before displaying in the system. This role is one of the major parts of the project. Research officer will help in data filtering before displaying in the form of a dashboard.
Research Manager	Research manager will help in collecting the data that will be displayed in the dashboard. Research manager is the one who manages the data related to research. So, the role of the research manager is very important for carrying out the development of the system.

The description of the use case is given in the table below:

Table IV: Use case description

Module	Product Function	Description
Authentication and View	Login	It will allow the user to login to the system.
	View Dashboard Analytics	It will allow the user to view the dashboard analytics of different research related data.
Publication	Track Publication Metrics	This will allow the research staff to track the publication metrics by reviewing the data related to publication.
	Generate Indexed Publication	This will be generated by the system dashboard by using data science techniques for the users to view their update.
	Generate Non-Indexed Publication	This will be generated by the system dashboard by using data science techniques for the users to view non-Indexed publications.
	Generate H-Index	This will be generated by the system dashboard by using data science techniques for the users to view H-Index data generated.
	Generate Citation	This will be generated by the system dashboard by using data science techniques for the users to view Citations made data.
Commercialization	Generate & Track Trainings Conducted	This will allow the research staff to track the Income generation by reviewing the data related to trainings organized.
	Generate & Track Conferences Organized	This will allow the research staff to track and edit the Conferences data by reviewing the data related to Conferences.

	Generate Intellectual Property Filed	This will be generated by the system dashboard by using data science techniques for the users to view the number of intellectual property filed for the researchers.
Networking	Track Networking	This will allow the research staff to track and edit the Networking data by reviewing the data related to networking.
	Generate MoU/MoA/LoU data	The system dashboard will generate data related to the agreement/letter of undertaking by using data science techniques for the users to view and evaluate on the current condition.
Grant	Track Grant	This will allow the research staff to track and edit the Grant data by reviewing the data related to Grant management.
	Generate International grant Data	The system dashboard will generate data related to the international grant that has been received by using data science techniques for the research staff to view and evaluate on the current condition.

	Generate National grant Data	The system dashboard will generate data related to the national grant that has been received by using data science techniques for the research staff to view and evaluate on the current condition.

B. Non-Functional Requirements

The non-functional requirements are those requirements that help a system to work better. Some of the non-functional requirements required for our system are given below:

1) **Reliability:** Reliability: The system should be dependable, with consistent and accurate operation. It should elegantly manage mistakes and exceptions, recover from failures, and minimize data loss or corruption. The system should also have backup and recovery techniques to prevent data loss and assure system availability.

2) **Security:** The system must prioritize data and user information security. It should put in place proper authentication and authorization methods to ensure that only authorized people may access the data. In addition, the system should use secure data transmission methods to protect data during transit and comply with applicable data protection and privacy standards.

3) **Usability:** The system should be simple to use and intuitive, allowing faculty and research staff to explore and engage with the dashboard and its features. The user interface should be developed in a way that will ensure users can simply obtain needed information, perform actions, and comprehend visualizations without confusion or excessive complexity.

4) **Portability:** The system should be built to be portable, allowing it to work on multiple operating systems or

environments. It should make use of technologies and frameworks that are cross-platform compatible, ensuring flexibility in deployment options.

XI. RESULTS

The results have been discussed in this part of the paper. The development environment, implementation of the system and architecture that lead to the development of the dashboard will be discussed in this part of the paper.

A. Development Environment

The Faculty of Computing's Research Data Dashboard is a data-dependent system reliant on data extraction from target websites, followed by data analysis. The MERN Stack employed in this project involves MongoDB, Express.js, React, and Node.js. Among the libraries of Node.js, Puppeteer is preferred as the most suitable tool because of its usefulness in the extraction of data. Extracted data are stored in MongoDB in JSON format, which is further accessed by the backend and served to the frontend.

The design of the backend part will be based on Node.js using the Express framework. It will be implemented on the server side, providing necessary APIs. The React-based frontend will fetch values from it and plot, using the library React Chart.js to create interactive charts - bar charts, pie charts, doughnut charts, and line charts, depending on the requirements.

The frontend and backend are on two different ports; still, they use libraries like Axios on them to handle API requests and middleware like CORS to make the communication smooth between them.

Figure I.: Database Connection


```
// Middleware
app.use(cors());
app.use(express.json());

// MongoDB Connection
mongoose
  .connect("mongodb://127.0.0.1:27017/utm_scholars", {
    useNewUrlParser: true,
    useUnifiedTopology: true,
  })
  .then(() => console.log("Connected to MongoDB: utm_scholars"))
  .catch((err) => console.error("MongoDB connection error:", err));
```

B. System Implementation

The implementation stage means putting into code the system design and architecture mapped out through the requirement analysis such that the system can work and perform the intended goals set out for it. After setting up the backend and frontend, the development of the system commences. The front-end contains numerous React components that are spread across different pages to show different types of information. Many of these components have JavaScript logic that processes the data. The back end is basically the core of the Puppeteer scripts which are the living vital source of data for the whole system. These scripts form the basis of the Research Data Dashboard for the Faculty of Computing.

Figure II.: Grants By Year Page
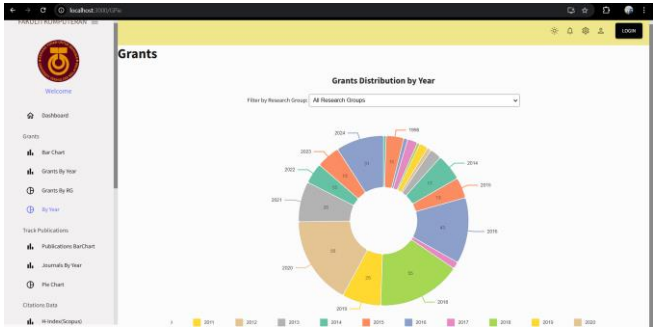
C. Architecture Implementation

The architecture followed by the Dashboard is the Model-View Controller architecture. A model holds the database models of the system. The controller holds the logic and enables communication between the front-end and back-end while the views are the React components.

Figure III.: Scholars Model for Database


```
Backend > Model > JS scholarsModel.js > [@] scholarSchema
 1   const mongoose = require("mongoose");
 2
 3   const scholarSchema = new mongoose.Schema({
 4     link: { type: String, required: true },
 5     GRANT_PI_MEMBERS: String,
 6     PUBLICATIONS: Number,
 7     INDEXED_PUBLICATION: String,
 8     TOTAL_STUDENTS: String,
 9     H_INDEXED_SCOPUS: String,
10     CITATIONS_SCOPUS: String,
11     INDUSTRY_GRANTS: String,
12     INTERNATIONAL_GRANTS: String,
13     NATIONAL_GRANTS: String,
14     UNIVERSITY_FUND: String,
15     TOTAL: Number,
16     NON_INDEXED_PUBLICATION: String,
17     OTHERS_PUBLICATION: String,
18     MASTER: Number,
19     PHD: Number,
20   });
21
22   module.exports = mongoose.model("Scholar", scholarSchema);
23
```

Figure IV: Architecture Model
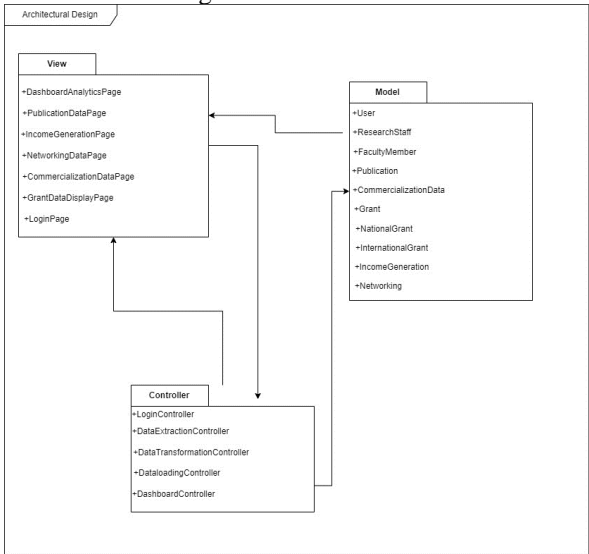
D. System Testing

The immediate vital activity after the implementation of the Research Data Dashboard for the Faculty of Computing would be the testing of the system for whether the system works as it was required and designed. Tests can be performed in several ways: black box testing, white box testing, and user acceptance testing. Each of them has different advantages and helps in making the system robust. Research Data Dashboard for the Faculty of Computing shall use Black Box Testing and User Acceptance Testing during the testing process

I.   Black Box Testing

Black-box testing is normally a software testing approach that focuses on assessment functionality based on application behavior. It doesn't require much use of the system code. It always involves investigations of input and output values of the software system regarding every test case. The objective of this testing is to ascertain whether the system acts as documented. Here's an example of a test case developed for login module:

Table V: Test Case

No.	Action	Test data	Expected result	Actual Result	Pass/ Fail
1.	The user opens the login page	-	System displays the login page	Page is Displayed	Pass
2	User clicks on the email field and enters his registered email	Email: example@gmail.com	Email field works correctly entered by the user	Email Field is Working	Pass
3.	User clicks on the password field and enters the password	Password: 1234admin	Password field is taking inputs	Password Field is Working	Pass
4.	User clicks on the 'Login' Button to confirm login	-	Login button is visible and working	Login Successful	Pass
5.	User is taken to their respective dashboard by the system	-	System verifies the user successfully by checking with the database	Page loaded successfully	Pass

REFERENCES

[1] Schwaber, K., & Sutherland, J. (2017). The Scrum Guide: The Definitive Guide to Scrum: The Rules of the Game. Scrum.org.

[2] Highsmith, J. (2004). Agile Project Management: Creating Innovative Products. Addison-Wesley Professional

[3] Cockburn, A. (2002). Agile Software Development. Pearson Education

[4] Pauwels, K., Ambler, T., Clark, B. H., LaPointe, P., Reibstein, D. J., Skiera, B., Wierenga, B., & Wiesel, T. (2009). Dashboards as a Service. Journal of Service Research, 12(2), 175–189.

[5] Matheus, R., Janssen, M., & Maheshwari, D. (2020). Data science empowering the public: Data-driven dashboards for transparent and accountable decision-making in smart cities. Government Information Quarterly, 37(3), 101284. https://doi.org/10.1016/j.giq.2018.01.006