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Research Grant Finder

Islam Mohammed Ruzhan
Faculty of Computing,
Universiti Teknologi Malaysia,
Skudai, Johor, Malaysia
ruzhan05@gmail.com

Abstract **- Many research activities are carried out by the researchers of a country. The development of a country, businesses and organizations sometimes depend on this research. So different organizations provide grants that are related to their sector. Normally for research, the researcher needs to look for grants for their project and it is a very hectic process to keep track of so many grants. There are many websites that provide grants and their details, but there is not a single platform to find grants from different sources. So, finding grants is a nightmare for the researchers. The Research Grant Finder system is a web-based application that provides analysis of the data obtained from the grant websites. The users of the system can get the list of grants from different websites, search and sort them. The users can also view the analysis and get an idea of the condition of grants. The system was developed following the agile methodology and the technologies used were Node JS, MongoDB and React. This system will assist the researchers in getting grants easily without less hassle.**

Keywords — research, grants, NodeJS, web-based, analysis, React

I. Introduction

Research refers to collection of data and then analyze it and conclude about any existing work or to propose any new idea. It is mainly done by university lecturers and professors and students under them. But research work is expensive. So, they have to take funding from various organizations. Furthermore, research funding may lead to continuous industry-science relations by making researchers more willing to collaborate and hence increase transfer of technological knowledge from science to industry which fosters and accelerates industrial innovations. (Bogler, 1994) There are many organizations that provide fundings for research for their own benefits. Researchers need to go through respective organizations' websites to look for research grants and whether the grants are relevant to their research.

As a research-oriented university, the lecturers and professors of UTM also has to do research and look for funding.

It is quite a hectic process, and it is not possible to look for each and every website for funding. So, a website that can gather all the grants provided by the funding organizations in a single system will be very beneficial for the lecturers and professors of UTM. For this reason, under the supervision of my supervisor, I plan to develop a system that will collect grant related information from the websites and store it in a single system using the technique of web scrapping. Through this, using a single system, the lecturers can find grants from different funding organizations. They can also filter and narrow their search and easily find the grants suitable for them. Web scrapping is the method of extracting data from a website. There is a JavaScript library that can be used for web scraping. It is called Puppeteer. In this way, a system can be developed that will enable the researchers to find fundings easily.

II. Related Works

There are many websites that provide grant related information and grant related details. These websites are usually developed by grant providing organizations or government organizations. They have a lot of grants in their database with detailed information about them and also a link for the researcher to apply for them. Some of the websites of this kind are Grants gov, NIH grants and grants watch. To develop a perfect system with the possibility of least errors, we have to analyse the existing systems that also use the same techniques and are used for the same application.

These websites are compared with the Research Grant Finder in terms of functionality so that the comparison can give rise to new ideas and features to the Grant Research Finder system.

Table 1: Comparison of the similar websites

	NIH Grants	**Grants.gov**	**Research Grant Finder**
System Type	Web	Web	Web
Web Scrapping	Partial	Partial	Full
Repository	No	Yes	Yes
Dashboard	No	No	Yes
Data Analytics	Not Used	Not Used	Used
Information	Organized information	Huge information, not organized	Well-structured and organized information
Subscription	Yes	No	No
Filter search	Yes	Yes	Yes
User Interface	Easy to navigate	Complex and hard to navigate	Simple and easy to navigate
Chatbot	No	Yes	No
Language	English	English	English
User friendly	Yes	No	Yes

In table 1 above, the websites NIH Grants and Grants gov are compared with the system Research Grant Finder in terms of functions. No other websites that provide the grants information have analytical dashboard from the data of the grants like the Research Grant Finder system which makes it stand out from the others. The advantages and shortcomings of the existing systems have been discussed and a comparison has been done with the developed system so that, a proper and impactful system can be developed

III. METHODOLOGY

Software development methodology describes a planned, conducted out, and managed approach to software development initiatives. The methodology that was chosen to be the most suitable for the development of the system is the Agile development methodology. It is a conceptual frame-work for software engineering that begins with a starting planning phase and follows the road toward the deployment phase with iterative and incremental interactions throughout the life-cycle of the project. (Al-Saqqa et al., 2020). Web scraping projects often require flexibility and adaptability due to the dynamic nature of websites and changes in grant criteria and in Agile method, the changes can be made easily in the next step as it is an incremental process.

The main advantage of the agile method is its iterative approach. In this method, the project is divided into smaller increments or sprints. Each iteration of the grant-finding algorithm can focus on collecting information from a certain website or applying a particular filter. This makes it possible to release functionality early and continuously, which makes it simpler to validate and get feedback from users or stakeholders.

A. Phases of Agile methodology

Concept Phase

In this phase a layout of the system is created, the scopes and objectives are identified, and the primary requirements are discussed with the stakeholder. For the Research Grant Finder system, it is necessary to define the objectives and vision of the system. The necessary documentation needs to be prepared and the features of the grant searching has to be identified with the stakeholder by discussions and brainstorming to provide an estimation of project completion date and coat will be provided to the stakeholders.

Inception Phase

This phase can start after the concept phase is completed. This phase marks the end of the planning stage of the project. The requirements, functionalities and objectives are researched and discussed in depth. The tasks are divided among the developers in a team and the tasks are prioritized. The project structure, the mockup user interface and the system development are designed in this phase. For the Research Grant Finder system, the different tasks for the development such as grant searching, filtering, grant dashboard etc. will be identified and will be prioritized in an order. The mockup user interface will be designed according to the proposed system and the development phase will begin.

Development Phase

The tasks are divided into sprints based on their priority. Each sprint has specific tasks and deadlines. The development progresses with the progress of the sprints. In this phase the coding starts, and the design is transformed to code. For Research Grant Finder system, the sprints will contain planning and execution of tasks, such as designing the front end, building the structure of the system, including search function, filtering grants.

Test Phase

The development team presents the functional features or software that have been developed throughout the iteration during the testing phase. This demonstration allows stakeholders to assess the progress made and provide their input. Stakeholders can provide feedback during this phase. They can express their ideas, concerns, and requests for any necessary modifications or improvements. After release, the Research Grant Finder app needs to be reviewed by the stakeholders. They need to check whether the system is working properly or not. They need to check if the website could extract grant information from the sources and do the filtering according to the user criteria.

Maintenance Phase

The maintenance phase begins when the software is released. Now that the system has been built completely, users may access

it. The software development team will continue to offer help during this stage to keep the system operating efficiently and fix any new issues. The Research Grant Finder system has to work with a lot of data and for every search for grants by the user it will use web scraping to extract information. To maintain smooth searching of grants including filtering and up-to-date grants, it is necessary to maintain the system to cope with the new changes.

IV. Analysis and Design

This part consists of the functional and non-functional analysis of requirements of the Research Grant Finder system. To develop software, it is very important to get the requirements and analyze them properly. This part includes the use case diagram which demonstrates how users of the system will interact with the system's features, as demonstrated in the requirement analysis. The class diagram, as well as the activity diagram, are used to depict human movement through the system. The use case consists of all the functionalities and the actors that are involved in the system. It gives a clear idea of how the system works and what are the roles of each actor in the system. The figure below represents the use case diagram of the Research Grant Finder system:

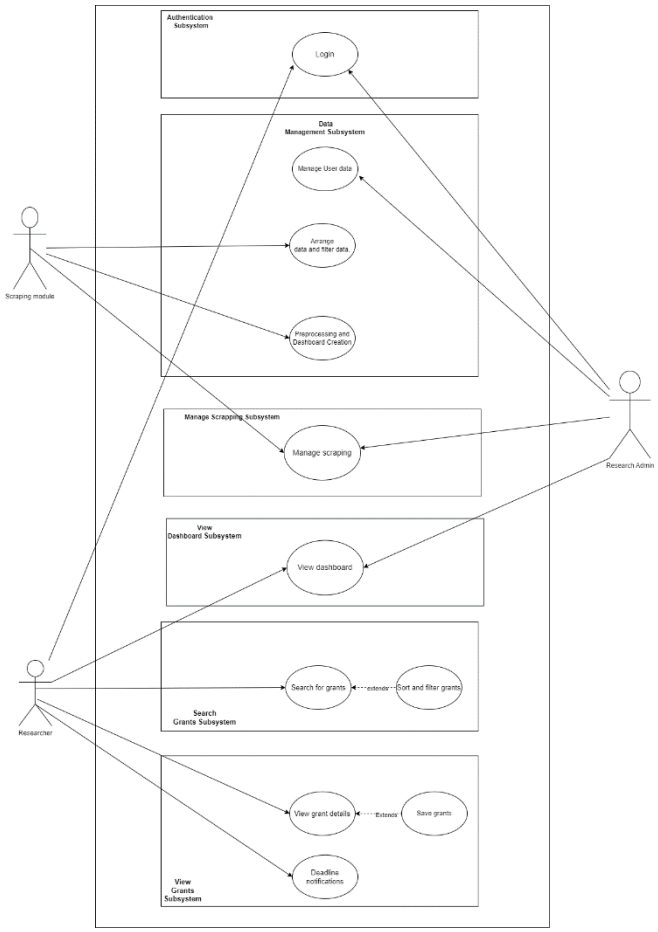

Fig. 1. Use Case Diagram of Research Grant Finder system.

The use cases define the functionalities of the system, and the actors are the one who will be using that system. The Research Grant Finder has 3 types of users.

Research Admin: It is the user that Oversees the system functionalities, create user, delete users, manage scrapping, view dashboard and other maintenance tasks. The credentials for the admin will be set in the system. The admin can create new users for the system.

Researchers/Users: They are the end users or the main users of the system. They can access all the functionalities of the system without the admin pages. They can view the dashboard, look for the grant listings and search for appropriate grants, view the visual analysis, apply for grants and also save them.

Scrapping Module: This is an automated module in the system with its own logic and independent functionality. So, it can be considered as an automated actor. Its main task is to scrape the data from the target websites and then clean, filter, process the grants data and then save it in the dashboard.

The Research Grant Finder system will have three database mongoose objects, which are Users, NIHGrant, GrantGovGrant.

V. Results

This part focuses on providing a more in-depth explanation of the system implementation, both during the process of developing and producing the web application for the Research Grant Finder system. This part also includes the testing of the system after the development which are black box testing and user-acceptance testing.

A. Deployment Environment

All the work of the Research Grant Fider system is done in the Visual Studio code IDE. The main language that was used for the system was JavaScript. For the extraction of the data from the websites, Puppeteer a library of JavaScript was used to extract data from the dynamically loading websites. The frontend is made with react components and the backend is supported by the express framework of NodeJS. The database that is used to store the data of the grants is MongoDB.

B. Implementation

Implementation is the phase where the system design and the architecture deviated from the requirement analysis are converted into codes so that the system can start working and perform the identified objectives. After the backend and frontend are initialized, the development of the system is started. The front end contains numerous React components which can be reused in different pages and provide different information. Some frontend components also have JavaScript logic to process data. The backend contains the main Puppeteer files which are

the main source of the data of the whole system. These files are the backbone of the Research Grant Finder.

The puppeteer files are responsible for getting the data of the system. The API from the backend is used to execute the different functions in the backend. The front-end react components call the API and visualize the data after filtering them according to the requirement, The data is then saved to the database for future needs. Many NodeJS and react libraries and other dependencies are imported to run the system smoothly.

The The system architecture that will be used for this system is MVC or Model-View-Controller. This architecture contains 3 layers which are model, view and controller.

Model**:** The Model represents the application's data and business logic. It contains the data of the application and defines how it may be accessed, edited, and validated. It's in charge of data manipulation, storage, and retrieval.

View**:** The View is in charge of displaying the application's user interface to end users. It specifies how data will be displayed and how users will interact with it. The Model sends data to the View, which formats it for presentation by producing HTML templates or showing GUI elements.

Controller**:** The Controller functions as a go-between for the Model and the View. It processes user input and events, changes the Model, and picks the appropriate View to present the changed data. The Controller takes user input, such as button clicks or form submissions, and converts it into actions that change the state of the Model.

C. System Testing

After the implementation of the Research Grant Finder, the most important task is to test if the system is working as per the requirements and the design. Different types of testing can be conducted on a system that has been developed. Such as: black box testing, white box testing, user acceptance testing. Each of these techniques has their unique features and this testing helps the system to become more robust. The testing that will be carried out for the Research Grant Finder are Black Box Testing and User Acceptance Testing.

Black-box testing is a software testing technique which involves reviewing the functionality of an application by testing. It does not need the code of the system to do black box testing. Mainly for a test case the inputs and outputs of the software system are examined. This testing ensures that the system behaves as it has been described in the documentations. By this testing technique, all the functionalities of the Research Grant Finder system is tested so check if any of the functionalities are missing.

User Acceptance Testing or UAT is a type of testing where the stakeholder himself tests the desired functionalities of the system and checks if it has met their requirements. For the UAT of Grants Research Finder, the stakeholder was asked to test the functionality of scrapping.

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