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Designing Web-Based Research Publications Information System using Laravel Framework

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Abstract: Over the past years, Research Publications Information Systems have faced a number of problems with Data Collection of all kinds of papers written by multiple authors and miscalculation of collective research funding on higher levels. Some of these problems include data redundancy, data validation, and security of the portal. These problems can be solved with the proper designing of the information system.

Our research provides a   collective solution to these problems and an efficient information system design and also focuses on the report generation for elementary analysis of the data generated in every academic year. Some of the solutions are directly achieved by choosing the perfect framework to develop the portal.

Laravel, which is a PHP based framework solves most of its problems straightforwardly using its built-in features like Eloquent ORM, Validation framework. The portals modules are simplified and easily understood using UML diagrams such as sequence diagrams, system architecture, use case diagrams.

The purpose of our project is to mainly explore Laravel functionalities which will help us to define the future scope for this framework along with reducing the data collection problems and also putting forth a much more efficient design for the information systems of research publications. The outcome of this research is a web-based portal using Laravel, that allows the users to store and update all their academic accomplishments and allows easier report generation for various academic requirements.

Keywords: Information system, Research publications, Research journal, Research paper, MVC, Laravel, JSON, Web-based, Portal

I. INTRODUCTION

Research Publications are an integral part of academic development and research. The sole purpose of these documents is to provide a united front to the research community to pool all their intellect together and that all the responsible scholars get their credit effectively. Today there is a huge number of scientific journals that support academic publishing and there is a growing need for better and efficient documentation of these documents at the university as well as the journal level which publishes these documents.

Today there are systems which account and document for research publications but they are very redundant and optimality is low too. Manual documentation and the usage of these systems lead to redundancy and excessive funds being allocated which collectively can lead to a great loss both financially and intellectually. Also, the current systems are not necessarily user-friendly and this, in turn, increases the problems for the researchers who want to document this information.

Research publications can be efficiently documented using information systems and using a portal based on MVC Framework for easy and fast collection of data.

The usage of information systems can facilitate the usage of the collected data for various kinds of purposes and efficient recapitulation. If the system is restricted to a particular university then various kinds of insights can be provided on the basis of hierarchy.

The portal comprises an effective and attractive front end using technologies of HTML, CSS, Bootstrap, etc. for the collection of data easily and insights for the collected data. For the insight generation, the portal acts as a bridge and converts the data from the backend or database server to the JSON data-interchange format[3]. The system is developed on the lines of institute or university basis and can account for data restricted to that university itself but can be used in multiple universities concurrently. The system uses the Laravel MVC framework for the collection and storage of data from students as well as professors. Various insights such as detailed graphical reports can be provided to the head of departments or the director of the university. This paper discusses the design of a publication information system which can make the documentation faster and easier.

II. RELATED WORK

There are multiple portals already existing for research publications but they are riddled with quite a few problems. The main problem being that of data redundancy, with an increased focus on education expenditure of resources on research has been higher than ever. This, in turn, is creating a lot of data and there should be effective means to store all of this. With data redundancy being a problem there is a lot of wastage of storage and processing space which increases the expenditure. For a particular university, the documentation gets all wrong due to redundancy and grants are allocated inappropriately due to multiple instances of the same project which can cause some worthy research to go unfunded due to lack of funds. Hence we are proposing a much more efficient system that will solve this problem of redundancy and consequently also result in better and more powerful processing speeds. We used Laravel framework for development as it has a lot of advantages and gives a proper MVC structure to efficiently manage Databases, Backend and Frontend separately. Here are some examples of Laravel based information systems:

The SISAPKH (Spatial Information System for the utilization of forest area) is one of the prominent examples of usage of information systems for proper documentation. The paper describes the problem of how potential investors were missing out on suitable forest areas for development as the whole documentation was paper-based and no means to give proper insights. Moreover, the process to obtain a business license is described to be very exhaustive and tiring. The information system discussed in this paper is a web-based system for providing effective insights into how much area is available and easing the process of applying for business licensing by making it online. RAD (Rapid Application Development) method is used here to develop this system. Unified Modeling Language (UML) is used for system modeling[5].

In this paper the problem of Academic information getting ineffectively distributed is first highlighted by the fact of how important this information is and that due to the ratio of students to teachers being very large this information cannot be dispersed on a person to person basis. It is usually done in the form of flyers and bulletin boards and fails to reach most of the students. The research in the paper aims to develop a multiplatform application both android and web-based for ease of information access to the students and also effective distribution by the professors. Representational State Transfer (REST) which is widely known for its capability to handle multiple platforms is used to develop the system in this paper. Data is sent in Javascript Object Notation (JSON) format, where client applications only have to parse it and present it to the students. This results in a very effective information system being developed for both the students and the teachers which facilitates effective communication and data storage which can be later used for providing insights[2].

This paper highlights the shortcomings of the present information systems used across the world which include and are not limited to database errors and also the errors which are the consequences of display and design being faulty. The solution presented in the paper for these shortcomings is that of proper structuring and designing of an information system using Use Case Diagrams, Data Flow Diagrams, Sequence Diagrams, and Entity Relationship Diagrams. The paper uses the example of problems faced by internship monitoring in an engineering department. The problem is specified to be that of how its tedious and ineffective if an information system is fallacious and paper-based. The paper comes up with an effective design for an internship monitoring system based on the Laravel framework[3].

III. METHODOLOGY

The Research Publications Information System is designed for various users, such as HODs, Faculty, Director, Student, Researcher, etc. Every role has a different type of access to report generation of IPRs, conferences, journals, workshops.
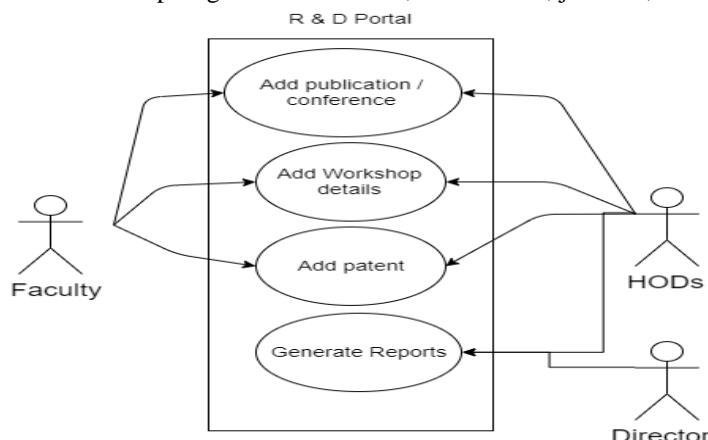

Fig. 1 Use case diagram of Research Publications Information System

According to Fig. 1, every user can add patents, copyright, conference or journal details, or workshop details after logging into the system. If the user tries to bypass the authentication system, the website redirects the user again to the authentication page. Such a secure and robust system collects all the data related to the research and development and also gives collective and analyzed reports to the user.
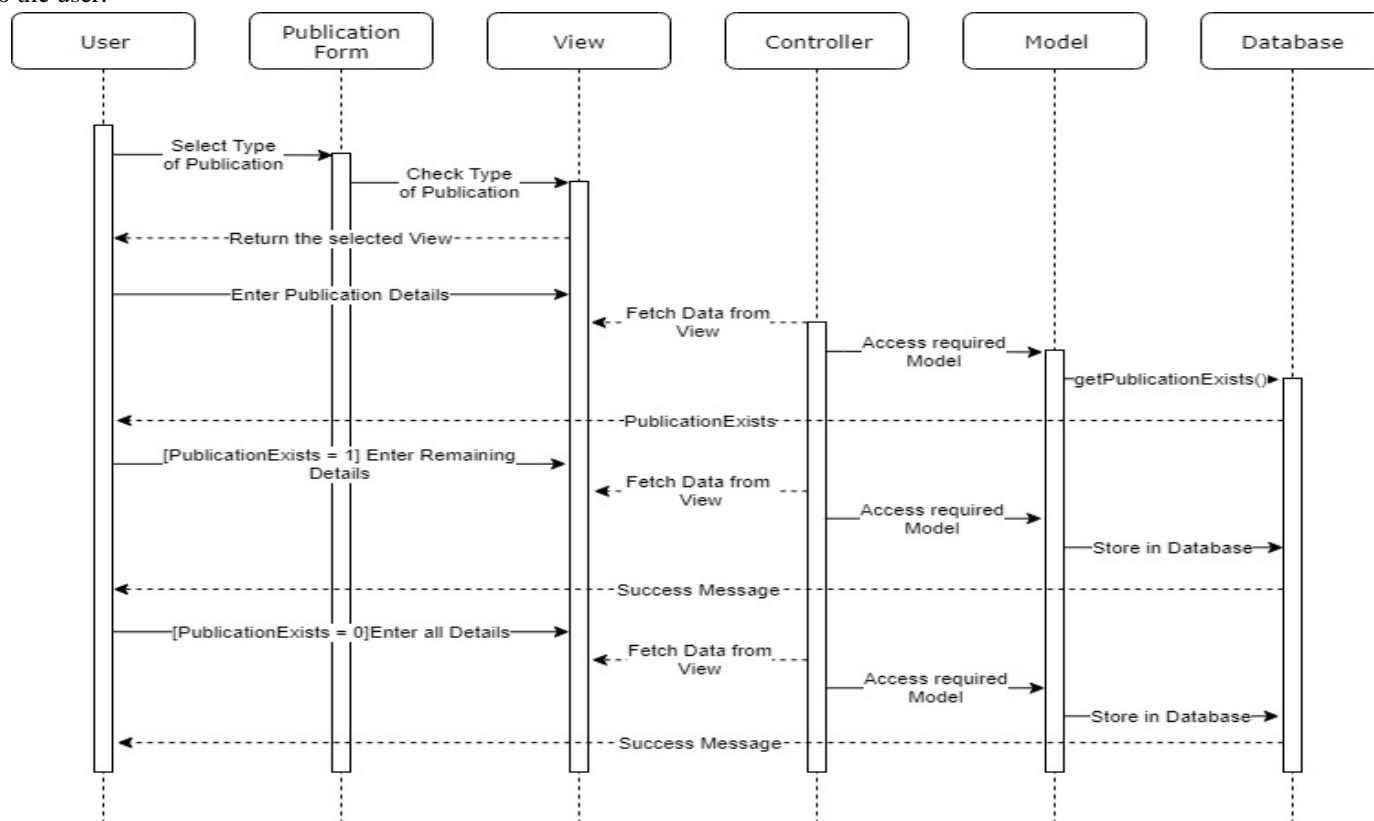

Fig. 2 Publication module sequence diagram in Research Publications Information System
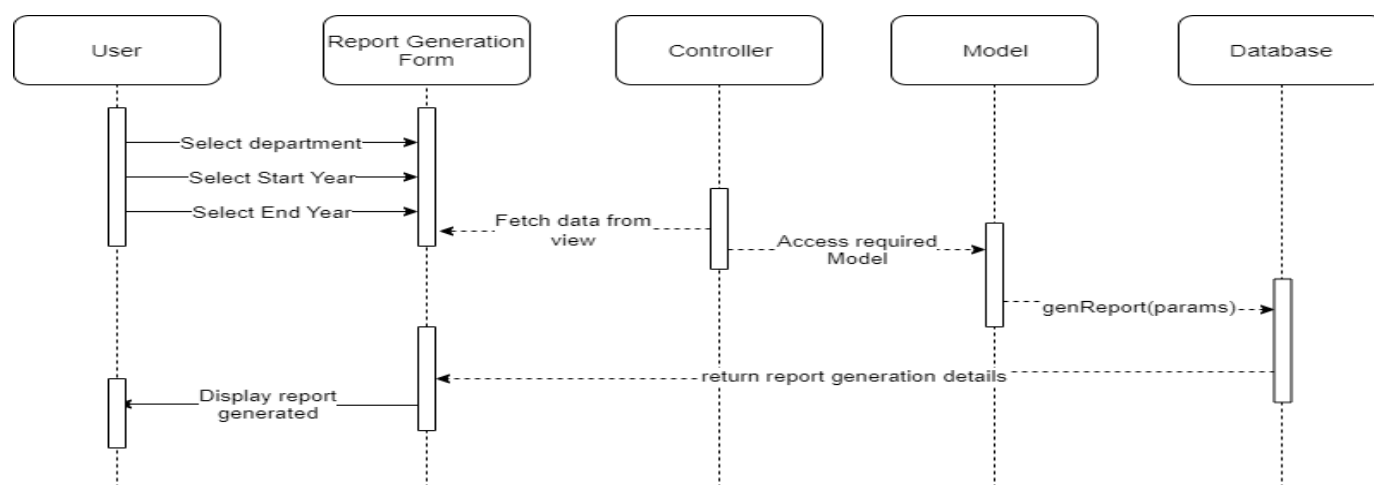

Fig. 3 Report Generation Sequence Diagram

According to Fig. 2, the Publication module is created to collect data from all the users about their different kind of publications which can be a research paper published in a journal or a conference or a book. The system has different modules for each different type of publication. If the publication exists then the system only fetches the view wherein the user can add or change some non-essential information. This avoids tampering with the data. Bootstrap modals can be used for the confirmation of the main author which can be made dynamic by using jarrays to populate the selectbox in the modal. If the publication is completely new then the system will take all the information required for it from scratch.

As per Fig. 3, Report generation is one of the main features of this project. This system gives reports in a well-arranged tabulated format on the basis of the parameters like type of department, start year and end year which are provided by the user. The data in reports generated is from the start year to the end year respectively. Firstly, for report generation, the User selects department, start, and end of the academic year. Then, Controller fetches data from the view for data manipulation without any kind of redundancy. The model fetches data from the database as required by the user by using the query builder. Then the database returns the values to display to the view.Similarly, other data collection and report generation modules are created and deployed. The data collection modules are the Publication module, IPR module, Research project module, Consultancy module, MOU module. The Report Generation modules consist of every report module which is associated with the data collection.
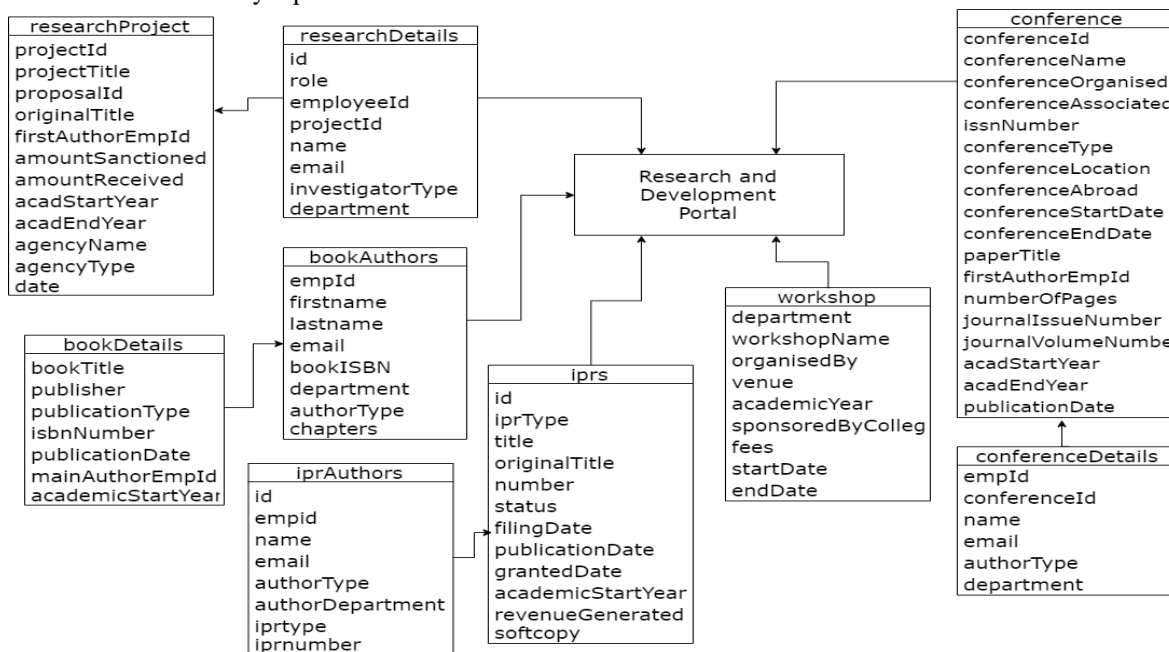

Fig. 4 Database Schema Diagram

IV. ADVANTAGES OF LARAVEL

The important factor to develop any application is not only creating it, but also making it faster. Laravel uses in-memory cache such as Memcached or APC to have faster communication between backend and frontend. This PHP framework comes with its own features which are associated with the MVC framework, Authentication, and Authorization, Mailing Protocols, Validation and Verification, Eloquents framework, Routing Configuration, etc. These features made developing websites easier and most importantly, made them faster. Some of the features are listed down below:

A. Validation Framework

Validation through forms is directly supported by the Laravel framework as it checks each field in the HTTP response as stated by the developer. Error messages can be thrown by overriding the message method. The "Validate" method is used for validation of various fields according to the rules associated with it.

For eg.

Function name store:

```
        function store(Request $request) {
                $request->validate([
                        'email' => 'required',
                        'date' => 'required|date',
                ]);
                //rest of the code
        }
```

In the above example, if validate method passes the rules for the fields in the forms, then the rest of the code runs. If not then Error messages are thrown[7], [8].

B. Eloquent ORM

The Eloquent ORM is one of the main features of Laravel to integrate database system with the application[7]. Every database table has a model associated with it, which is then used for the communication between the database and application. Some of the advantages are listed:

1) Migration of data from the application is managed by the artisan command, make: migrate.
2) Every model searches for its plural form of model-name as its table in the database. e.g. if the model name is "publication" then it searches for "publications" as the table.
3) If the table name is different than the plural-form of model-name, we can specify the table-name in $table attribute in the model created by make:model artisan command.
4) Timestamps and primary key of the database can be managed from the model itself by attributes such as $timestamps, $primaryKey with access specifier as protected.
5) Eloquent ORM also provides various functions such as save(), fresh(), get() and other query builder functions for saving and retrieval of data[8].

C. URL Routing Configuration

This framework provides a simplistic way to define routes that accepts the URI and closure method. For returning a view, get() function can be used, which is located in the route directory. get() and post() function are same as the GET and POST HTTP methods. These routes can connect functions in the controller to the views or simply return a view. The web.php file contains all the web routes and routes can be easily tracked through it[8].

D. MVC Architecture

As the framework uses MVC i.e. Model, View and Controller, this segregation of the Business logic code, presentation logic helps the developer to have a complete flow of the code. Model is associated with a table in the database and it is a residing layer between the data and the application. The model manages the data flow between the database and the application. The controller contains the business logic that is calculation or manipulation of the data obtained from the database or from the view.

It also verifies and validates the data obtained and returns the manipulated data to the view. View is the visual representation of our application which is then referred to as the presentation layer. This contains all the HTML, CSS, Bootstrap, etc. elements which are all client-side scripting languages. Data could be procured from the controller to display through the view[6].

E. Make Auth

Make: auth is one of the most powerful artisan commands which develops the whole Login system just by executing it. It creates users_table in the given database by itself for storing the new users with email, password, timestamps as some of its fields[8].
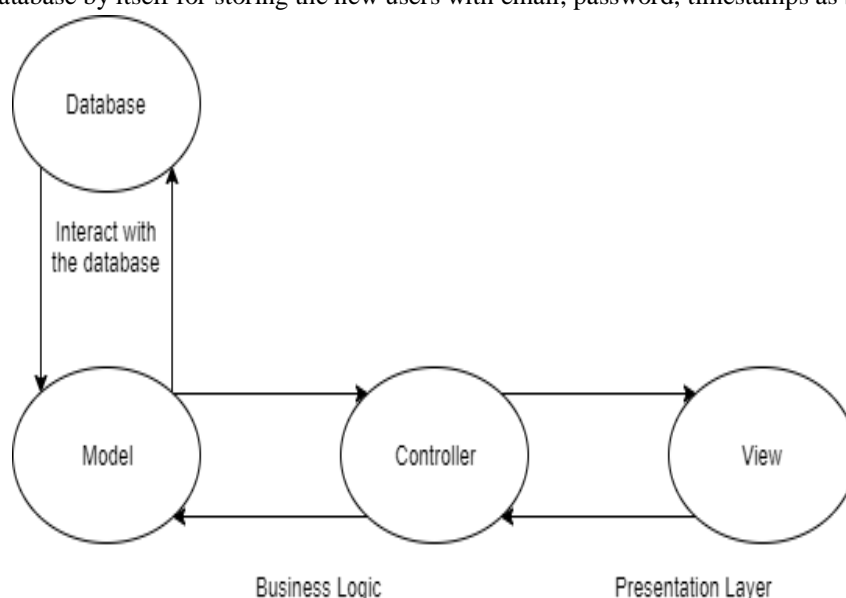

Fig. 5 MVC architecture

V. FUTURE SCOPE

As discussed earlier, the advantages of the Laravel framework and the problems of any web application, and especially the problems of the Research Publications Information System which are related to the data collection and data redundancy, Laravel helps the developers to resolve such problems. The functions of the Laravel framework and its advantages indicate the scope of this framework and why it should be used for most of the web applications. The proposed method for the Research Publications Information System using Laravel resolves the problems; and reports for conferences, journals, books, IPRs can be obtained easily through it. This easy retrieval of the reports and other information will be useful for authors, researchers, or anyone who wants to procure information of a particular concept.

VI. CONCLUSION

From the research that has been done, it can be concluded that MVC architecture frameworks are very efficient and easier for the developer to code. Laravel, being the MVC framework, is faster, powerful, technically vulnerable, secure and robust. The Research Publications Information System can be used by researchers, authors for easier access to vast data of research papers, patents, copyrights, and journals.

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