

Electronic Project Proposal Management System for Research Projects Based on Integrated Framework of Spring and Hibernate

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Abstract- A lightweight e-Project proposal Management system based on Open sources spring and Hibernate has been designed and developed in this paper. The system is developed to overcome the lengthy and time consuming process of obtaining a research project proposal, getting them scrutinized, deciding on the reviewers, obtaining progress reports and required certificates, monitoring etc. Automating these processes using the web application will streamline all these activities. The Object Relation mapping of hibernate and the Inversion of Control management, Model-View-Controller design pattern of spring have been used in the architecture. Spring Provide best code reuse along with legible code structure. ORM characteristic of hibernate make it easy to implement the transplant and manipulation of databases. The developed system is a multitier system including presentation layer, Business layer, data persistence layer and database layer which can separate presentation logic from business logic and improves reusability, reliability, maintainability of the system along with low coupling.

Keywords— Spring, Hibernate, Object Relation Mapping, Multitier System, MVC Architecture, and Inversion of Control.

I. INTRODUCTION

The rapid development of internet technology, the web application project has been receiving great attention in last few years. The electronic solutions provided by web applications are valuable in terms of accuracy, transparency and efficiency but complexity of web applications is growing rapidly. Spring and hibernate are open source application frameworks based on J2EE, uses layered structure and provide good integrated framework for web application. The electronic Project Proposal Management system developed using these frameworks has almost achieved the standardization and paperless of proposal submission along with transparency. JSP (Java server pages) is used in presentation layer. The spring framework is used to deal with the business logic. Hibernate framework is used to deal with the persistence layer which is helpful in reducing the difficulty of business logic. JSP is a technology that helps in creation of dynamic and platform independent web pages. Spring is a Lightweight J2EE application development framework which uses MVC (Model-View-Controller) to separates business logic from the view and to separate the roles of controllers, models objects, handler objects and dispatcher, which makes them easier to be customized.

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It is relied on injection principle and programming thoughts of facing aspects, it's either an AOP (Aspect oriented programming) frame, or an IOC (Inversion of control) container. AOP is used to build Crosscutting Concerns, and make it insert into the code to make the code reusable. IOC container allows to be built an application context for the need of formation objects. Hibernate is an Object/Relational Mapping (ORM) tool for Java Environment developed by open source. ORM is a technique of mapping a java class with database tables. It also provides data retrieval facilities which can reduce development time. Hibernate encapsulates the SQL operation into objectified operation for to visit the database through Hibernate API conveniently. The figure shown below shows the major Layers involved in the system development:

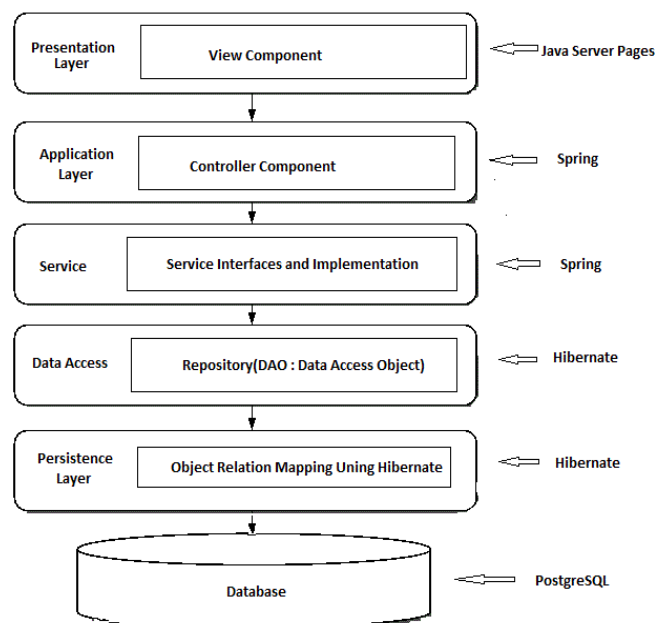


Figure 1: Layered Approach of Implementation

Section II of this paper discusses spring framework working mechanism. Section III discusses the hibernate work mechanism and its integration with spring framework. Section IV discusses the developed system design and implementation. Section V discusses conclusion.

II. SPRING WORK MECHANISM

There are 7 basic modules (AOP, ORM, DAO, Web MVC, Context package, Core package and Web package) of spring with each module having a jar file.

these activities. Comparing with the manual process the system has the following advantages:

- Provides flexibility for submission regardless of physical location.
- Transparency in Proposal Processing.
- Save up physical space by using electronic copy of submission.
- Easy and fast evaluation process.
- Email and SMS facility to know the status of proposal anytime.
- Maintain data integrity and security.
- Responsive design, works on mobile, tablet and Desktop.
- Role based Access.

The presentation layer of the system uses JSP and the spring tags to create user interactive pages. The spring tag libraries used are as follow:

```
<%@taglib uri="http://www.springframework.org/tags" prefix="spring"%>
<%@taglib uri="http://www.springframework.org/tags/form" prefix="form"%>
<%@taglib uri="http://java.sun.com/jsp/jstl/core" prefix="c"%>
```

The spring controller receives the request and decides which action will process the request. The controller is defined as follow:

```
@Controller
public class CommunicationAction
{
    @Autowired
    CommunicationService communicationService;

    @RequestMapping(value="/Communication", method=RequestMethod.GET)
    public String viewPage(CommunicationModel communicationModel, BindingResult result)
    {
        return "Communication";
    }
}
```

Business layer is also implemented using spring; it obtains the references of the DAO interfaces through service implantation class. Service Implementation class is coded as follow:

```
@Service
public class CommunicationServiceImp implements CommunicationService
{
    @Autowired
    CommunicationDao communicationDao;
    public void saveSentMessage(CommunicationModel communicationModel,int fromUserId)
    {
        CommunicationMapping cm=new CommunicationMapping();
        cm.setNumFromUserId(fromUserId);
        Date date=new Date();
        cm.setDtTrDate(date);
        cm.setbTrFlag(1);
        communicationDao.saveSentMessage(cm);
    }
}
```

DAO properties are loaded dynamically through the injection of spring to guarantees the loose coupling of the business layer and the persistence layer [4]. The persistence layer implementation is done using Hibernate framework. One Example of data persistence is as follow:

```
@Repository
public class CommunicationDao
{
    @Autowired
    DaoHelper daoHelper;

    public void saveSentMessage(CommunicationMapping cm)
    {
        daoHelper.persist(CommunicationMapping.class, cm);
    }
}
```

A relation mapping files of database tables and Java objects is created which will automatically create data table related to each object class defined. One example of mapping file of database table with java object is as follow:

```
@Entity
@Table(name="SERB_COMMUNICATION_MST")
public class CommunicationMapping extends TransactionInfoDomain
{
    @Id
    @GeneratedValue(strategy=GenerationType.TABLE, generator="generator")
    @TableGenerator(name="generator", initialValue=1, allocationSize=1)
    @Column(name="NUM_COMMUNICATION_ID")
    private Integer numCommunicationId;

    @Column(name="NUM_PROPOSAL_ID")
    private long numProposalId;
```

Spring provides a Hibernate Template which well encapsulates the operations of the Hibernate Session, we only need to write HQL (Hibernate query language) statements and call the appropriate template methods. The major modules of the system are User Registration, Proposal Submission, Proposal Evaluation, Financial Approval and Proposal Monitoring etc. The various stakeholders of the system are Principle Investigator, Member Secretary, Program Coordinator, Secretary SERB, Director SERB, Referees, Special Invitees, and Administrator etc. User Registration deals with the various stakeholders' registration. Proposal submission is done by PI (Principle investigator). Proposal Evaluation is done by Referees, Special Invitees, and Program Advisory Committee. Financial Approval is given by Director SERB. Proposal monitoring is done yearly by various Team members of SERB (Sciences and Engineering research Board). The major functionality of the system is described below:

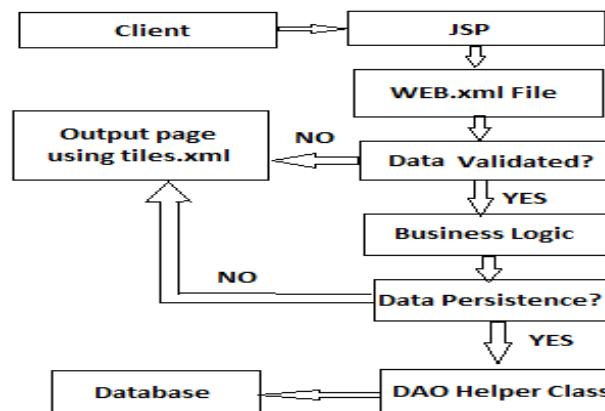


Figure 4: Integrated System Work Flow

The Home Page of electronic Project Proposal Management system is shown below:



Figure 5: Integrated System Work Flow

V. CONCLUSIONS

This paper presents a system based on spring and hibernate integrated architecture, and provides a multi-layer Web application development solution. Electronic Project Proposal Management system based on spring and Hibernate architecture has gone live from 1st Feb 2014 in India. The system is running highly stable and reliable. Practice shows that, Web applications based on spring and hibernate architecture have the stability, high reusability and easy maintenance. Spring and Hibernate architecture has been proved to be an effective lightweight J2EE application solution.

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