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Development and Application of HIS Module for Biomedical Engineers

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Abstract: ***In the current era of technological advancements, software applications provide a very handy and user friendly environment to perform a particular task. A hospital information system (HIS) is an element of health informatics that focuses mainly on the administrational needs of hospitals. Its purpose is to manage the information that health professionals need to perform their jobs effectively and efficiently. Hence, an application is designed and developed specifically for the departments responsible for providing secondary healthcare functions. It is a comprehensive, integrated information system designed to manage all the aspects of a biomedical department including breakdown management, maintenance management and inventory management.***

Keywords: hospital information system, health informatics, breakdown management, maintenance management, inventory management

1. Introduction

Any Software has the major advantage of providing a handy and user friendly environment to perform any particular task. A *hospital information system* (HIS) is an element of health informatics that focuses mainly on the administrational needs of *hospitals*. It is a comprehensive, integrated information system designed to manage all the aspects of a hospital's operation, including medical, financial, and legal issues and the corresponding processing of services. Its purpose is to manage the information that health professionals need to perform their jobs effectively and efficiently.

A hospital information system (HIS) is designed to manage the administrative, financial, technical and clinical aspects of a hospital. They help in the evaluation of Hospital Performance, overall cost, and projection of the long term forecast. Every hospital undergoes the process of vigorous decision making, which require health professionals to apply their knowledge acquired with time and that derived from data describing the patient, or the hospital in order to make decisions related to treatment plan, administrative jobs, maintenance services etc. HIS takes on the tasks of collecting, storing, analysing, manipulating, and presenting the data which helps to generate the information needed to make the decisions in a hospital. An efficient and future-proof HIS is therefore, a key component of a viable health system as Healthcare business models are evolving rapidly. Therefore, it is the need of the hour to control processes that govern the healthcare sector as costs rise and there is a requirement to manage information needed by the health professionals.With the exponential growth of the IT sector and technological advancements in healthcare sector, it is of utmost importance that such medical applications must cater to the specific needs of different departments of the hospital that aid patient care secondarily.

The Biomedical department ensures quality functioning of all category of equipment in the hospital. They provide an efficient support in maintaining the various equipments in the hospital in a good working condition. The department functions round the clock to render emergency service support on breakdown/ failure of equipments. The biomedical engineering department plays an important role in aiding smooth and complete patient care.

The software developed is a hospital information system that aims to :

- Create a user friendly environment
- Cater to the needs of biomedical engineers in a hospital
- Help in implementing administrative duties
- Reduce paperwork

2. Overview of the Technologies Involved

Two technologies have been used in developing the software. They are:

2.1 JAVA

Java is a general-purpose computer programming language that is concurrent, class-based, object-oriented and specifically designed to have as few implementation dependencies as possible. Java is relate to C++, which is a direct descendent of C. Much of the character of Java is inherited from these two languages. However, thinking of java as the internet version of C is not correct, as Java has significant practical and philosophical differences. Software specifications- NetBeans IDE Dev JDK9 branch

2.2 MySQL

MySQL is an Open Source Relational database management system (DBMS) that used Structured Query Language (SQL). A Relational database management system (RDBMS) is a type of database management system (DBMS) in which data is structured in the form of database tables, fields and records. A single MySQL database can contain many tables at once and store thousands of individual records. MySQL provides a rich set of features that support a secure environment for storing, maintaining,

and accessing data. MySQL is fast, reliable, scalable alternative to most of the commercial RDBMS's available. Software specifications- MySQL Server 5.7

3. Software Design and Development

After studying the departmental needs and requirements of the biomedical engineering department of a hospital a software application was designed specifically for them. Along with the departmental needs, needs of the hospital organization as a whole were also considered and provision of evaluation by the management is also provided so that a continuous check on the department's performance can be kept.

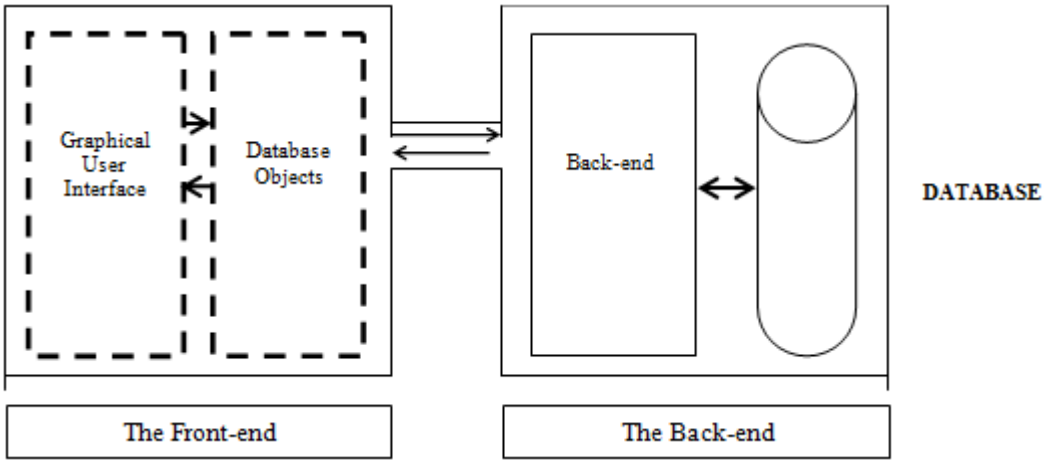

Figure 1: Front-end and Back-end architecture of an application

The software consists of three main modules:

- For administrator
- For Biomedical department
- For other departments

Each module is password protected, contains user specific features and internally communicates with each other to retrieve information and perform the desired task.

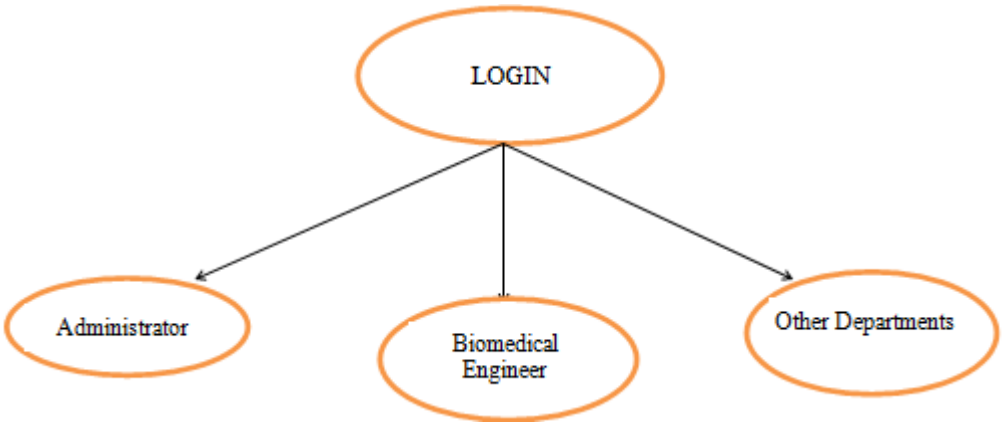

Figure 2: Main modules of the software

3.1 Administrator

The administrator has authority for the following tasks-

- Retrieving records of existing employees
- Adding/Deleting employee records from the database
- Creating new users in different departments
- Reviewing feedback and complaint status for management purposes.

Figure 3: Screenshot of Home Page

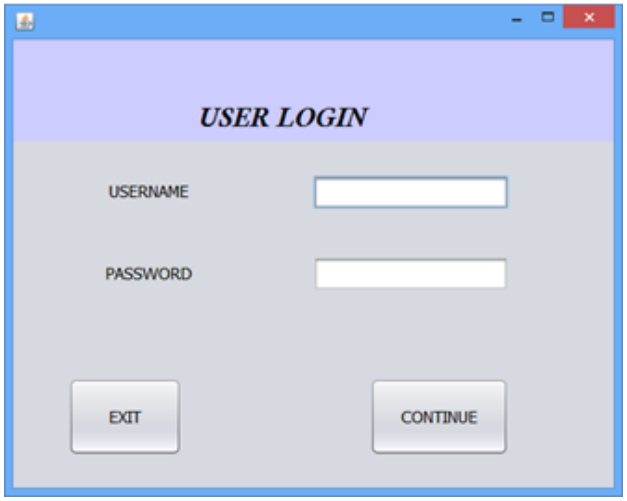

Figure 4: Screenshot of login page

Figure 5: Screenshot of Admin page: Retrieve Records

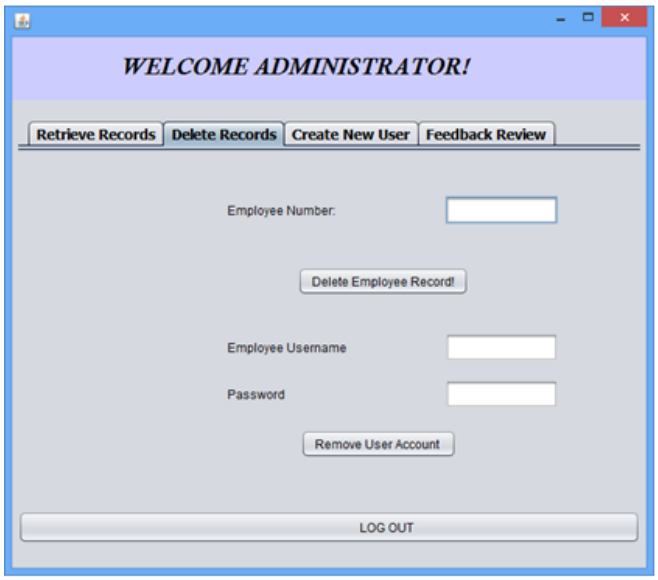

Figure 6: Screenshot of Admin page: Delete Records

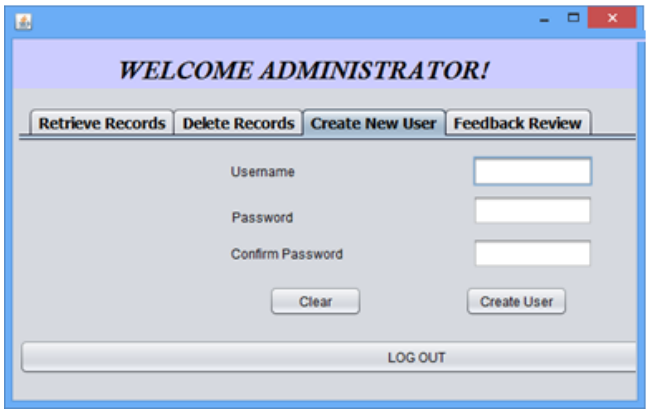

Figure 7: Screenshot of Admin page: Create New User

3.2 Biomedical Department

A member from the biomedical department can log into this module. The functionalities provided to the biomedical engineer are:

- **Inventory management**

It includes the management of all the devices and instruments that come under the biomedical department. The user can add details of any new instrument added into the inventory, delete an old entry shall the device be no longer in use and also retrieve information available about the existing devices. The software also provides the option of filtering these records on the basis of certain parameters.

- **Duty/Schedule**

The user can check for the duties that they have been currently assigned with.

- **Pending calls**

Under this tab the user can see the complaints posted by members of other departments.

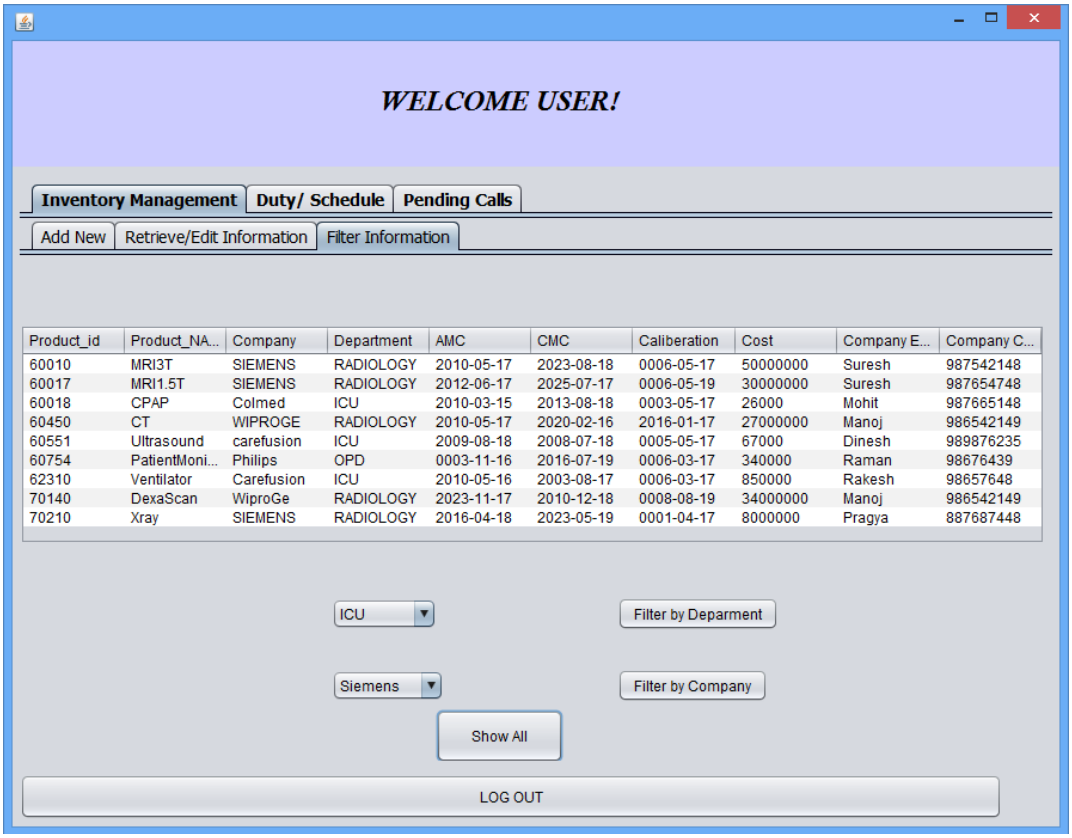

Figure 8: Screenshot of Biomedical department page: Filtering inventory information

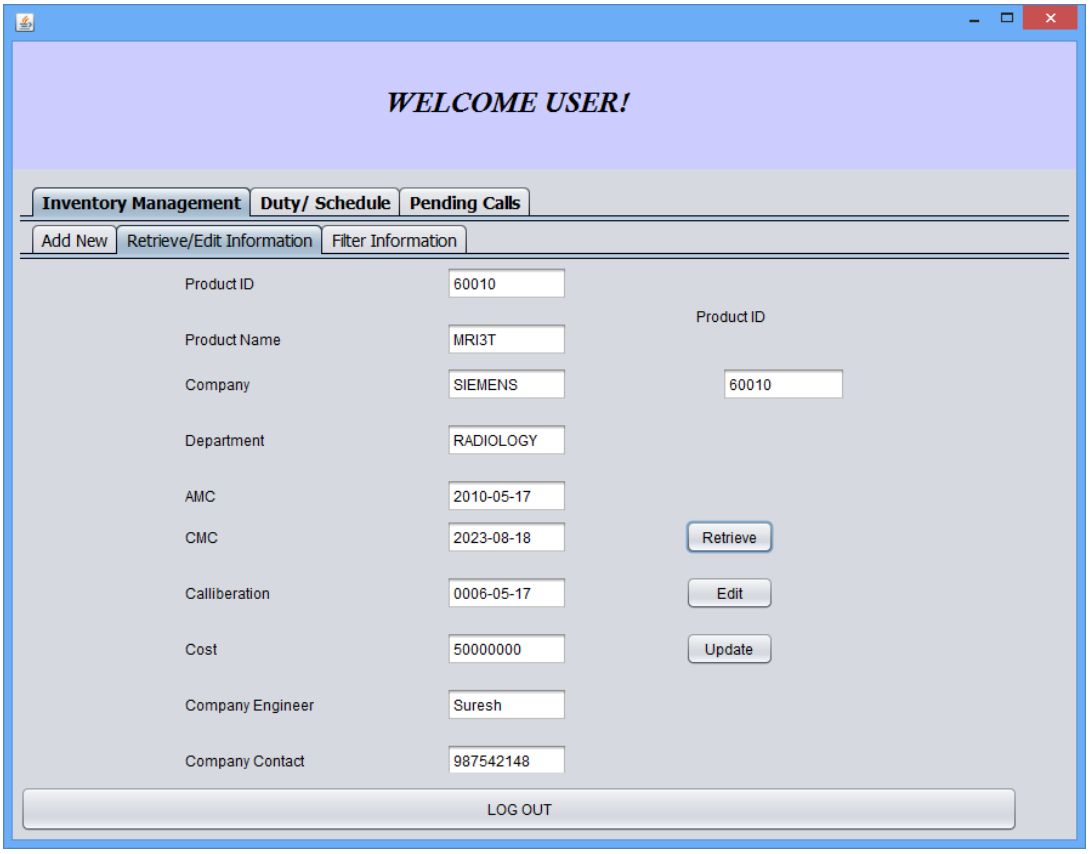

Figure 9: Screenshot of Biomedical department page: Retrieving inventory information

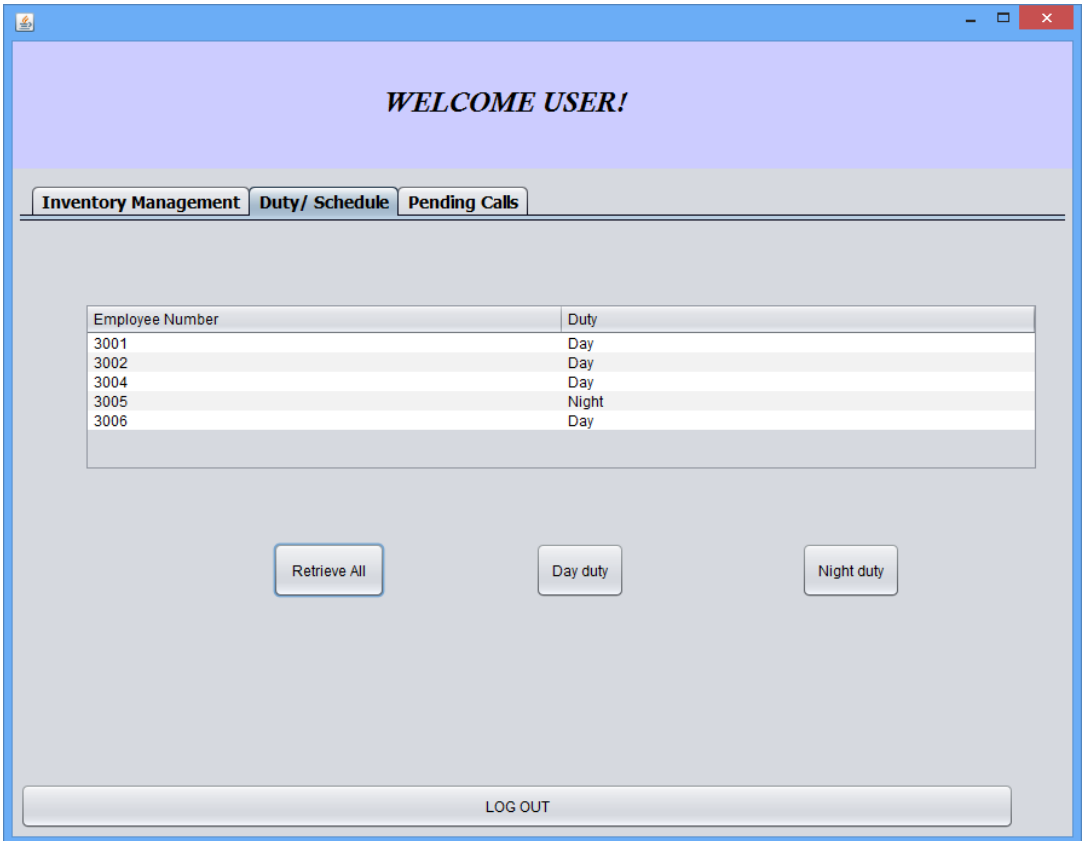

Figure 10: Screenshot of Biomedical department page: Duty/schedule retrieval

3.3 Other Departments

Other departments include ICU, Radiology and OPD for arbitrary purpose. It may include all the departments that communicate with the biomedical engineering department and may present the need to file a complaint or requirement regarding and biomedical equipment.

The options available for members of various departments are:

- Filing complaints
- Filling feedback with respect to previous experiences
- Option for retrieving information regarding the instruments present in the respective department.
- Progress of filed complaint.

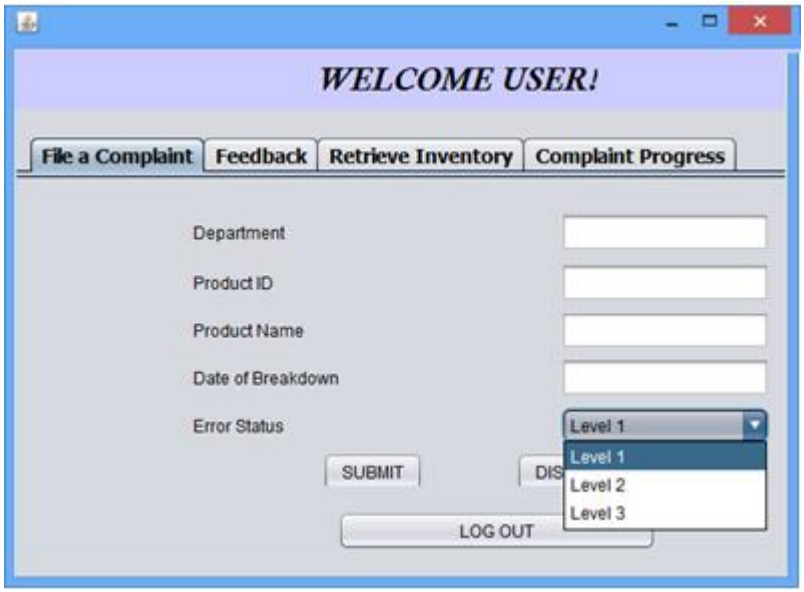

Figure 11: Screenshot for Other departments page: File a complaint

Figure 12: Screenshot for other department's page: Retrieve Inventory

4. Software Evaluation

4.1 Executable .jar file

The software is in the form of an executable jar file. A jar file contains source code or runnable software and the jar file can be made to be executable. When a file has a .jar extension, it should be associated with the Java runtime environment. Being a JAR (Java Archive) file, it is a platform-independent file format that can aggregates many files into one. Multiple Java applets and their requisite components (.class files, images and sounds) are be bundled into it. Subsequently, it can be downloaded to a browser in a single HTTP transaction, greatly improving the download speed. The software's format also supports compression, which reduces the file size, further improving the download time for the host machine.

4.2 Economical

The software is based on mainly two platforms, which are: JAVA and MySQL. The frontend GUI has been developed on NetBeans ® IDE (Integrated development environment) which is free and open source. Open source implies that the NetBeans Platform and IDE are free for commercial and non- commercial use. Same goes for MySQL as well which can also be considered free depending upon the function it is used for. MySQL is the most economical relational database management system when compared to its competitors. Such a combination of Java and MySQL makes the software a prototype that is free of cost and pave way for a final product that would cost a minimal amount making this software potentially economical and highly accessible.

4.3 Security

Safety of personal data and other sensitive information represents one of the most pressing challenges in design practice of digital health solutions and has implications on aspects relevant to both developers and medical experts alike. Every hospital information system holds a massive opportunity for a next generation of better and more sustainable healthcare but raises considerable concerns and challenges with respect to data protection and safeguarding of sensitive information. Keeping this in mind, the software is password protected and requires authentication in the form of username and password in order to access its features. Every user and administrator alike has been assigned a unique username and password that are required to be entered at the login page to gain entry into the software.

4.4 Feedbacks and Complaints

Performance feedback is the on-going process between employee and manager where information is exchanged concerning the performance expected and the performance exhibited. Constructive feedback can praise good performance or correct poor performance and should always be tied to the performance standards.

The Feedback option of the software allows the user from various departments to rate and comment on the job performed by the biomedical department. Comments can also be mentioned in the comments section. This information is reflected on the administrator's account in order to facilitate effective hospital management.

4.5 Reduced Paperwork

Large hospitals deal with multiple medical equipment and machinery that needs to undergo preventive maintenance and calibration at regular intervals. In the absence of digitization these schedules are maintained with the help of redundant files and papers that lead to an unmanageable amount of paperwork. This software provides features such as inventory management, calibration and preventive maintenance schedules along with the feature of reflecting the respective performances on the manager's account. Imagine all that paperwork being reduced that will in turn lead to a more efficient and economical organization.

5. Conclusion

The software was developed keeping into consideration the biomedical department of a hospital. The software can be further developed for more departments in the hospital in the future and biomedical department is a prototype of how each department would have its own personalized modules in such a hospital information system.

The software has been developed using JAVA and MySQL, both of which are open source software due to which the development cost of the project has been negligible. In India, government and other private rural hospitals still lack the availability of technological aids that could significantly improve the healthcare situation. Many companies have developed numerous HIS's over recent period of time however; their availability to rural hospitals and healthcare centers is still an issue due to cost factors. Such economical software can therefore act as a helping aid in advancing the current healthcare scenario of Indian hospitals in general.

Most of the HIS available in market focus mainly on patient-doctor relationships whereas this application has been developed as module dedicated to consider other departments of a hospital,such as the biomedical department, which works to support this patient-doctor relationship and the interactions between them.

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