Development of an Online Integrated Library Management Information System: Case Study

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Abstract: The efficiency of any university management can be improved by solving various problems related to the manual system often adopted by various educational institutions. This is achieved by providing a transition from local manual university Management Systems to integrated automated Information Systems. Such an application often provides a major impact on the universities' social and economic satisfaction as it consists of various aspects of the educational process, automate administrative and business activities and financial management, assists in decision-making by supporting information flow within the university. UG-LMIS (University of Gitwe Library Management Information System) is a library automation web application, a sub-module of the University of Gitwe Integrated Management Information System (UGIMIS), a web-based and an online application automating the whole university's management. UG-LMIS was designed for the University of Gitwe to replace its existing manual record-keeping system. The new system controls the following information; student information, the catalog of the books, track of issues and return of books, book searching and tracking, e-mail services, notice about book issue status, reporting capabilities, etc. These services are provided in an efficient and cost-effective manner with the goal of reducing the time and resources currently required for such tasks. UG-LMIS is a UMIS with great user interface designs, more performance enhancements, and a number of enriched modules. It works for a big deal to bring value to the words 'care' and 'comfort' in this higher learning scenario. In addition, UG-LIMS is endowed with an advanced feature as it is a part of the university website, it can be accessed online anywhere at any time.

Keywords: -Automation, Information, PHP, MySQL Server, Professional Education.

I. INTRODUCTION

Much of the daily operations of a library can be automated using various currently available programming and networking technologies. Instead of dealing with files, the use of a good database coupled together with a proper front-end design would not only reduce the operating cost but also make the task of the librarian in charge easier. The most important thing is that an automated system of this sort can be customized to suit the needs of the patrons or users and provide good service to both of them.

A University Library Management is a software that manages and stores books information electronically according to library managers, staff's, and student's needs. The system helps both of them to keep a constant track of all books available in the library be it the ones borrowed or not. It provides the ability to search for the desired books as it is usually necessary for universities to keep a continuous check on the books issued by providing the issue date, last book return date, and even calculate fine which would be a tedious task to achieve with the manual system and the chance of various types of mistake occurrence would be high.

The aim of this application was to develop software that would automate the functioning of the University of Gitwe (UG)'s library and accessible over the Internet. The main use of this online application comes from its major advantages to staff and students of this university as previously it was not eager to find the information they were seeking. G-LMIS automates all those basic tasks like keeping the record of all book details, locations, issuals, returns, and fining, etc. Thus, this system reduces the manual work to a great extent by allowing smooth flow of the library activities and removing the chances of errors in the details.

The remaining part of this paper is organized as follows: Section II presents Related Work. A brief statement of the Problem Definition is provided in Section III. In section IV, the Proposed System is presented. The Methodology is discussed in Section V while the Implementation is presented in Section VI. Results and Discussions are provided in Section VII and Featured Case Study in Section VIII. We conclude our work in section IX.

II. RELATED WORK

S. Fu et al. (2013) stated that the level of maintaining a library is closely related to the quality of teaching in Universities as with the increase of number of students, maintaining a library using the old management methods is too much complex, time-consuming, and hardly possible to adapt to the development of times. To overcome this situation which appeared in most of the middle-level countries like Bangladesh, the authors developed an automated digital library management system. The main features of this software are user interactive graphical representation (using bar diagram and pie chart) of the total number of books requested, books uploaded, yearly books count, etc. Besides, notifications and reports are viewed instantly by corresponding users as they are able to find out books by searching using any one of these: title, author's name, subject, publication, series, ISBN/ISSN, etc. Thanks to these features, this library management software meet the needs of the growing students and teachers' demand.

To meet the problem of the rapid development of the digital library, the daily growing numbers of users who realize the rich network resources and the convenience exchange of information, Ying Nie (2011) designed a new automated compound billing and management system. The application uses SQL Server as the back-end software. It is equipped with various features such as forms, menus and control rooms provided by VB. Some additional features are also provided namely WINDOWS registry and API functions, as well as DAO and ADO data access and other advanced means. A good interactive interface was available and users could obtain a fresh and different feeling. Demonstrated by the application, the system provided accurate and reliable function and satisfied the needs of modern management. The system is suitable for the automatic billing of colleges and Internet cafes management.

To contain the problem often faced by librarians in actual practices where the current general ways to produce reports are to query related tables of library automation systems by appropriate designed SQL commands based on their own professional works which are time-consuming and inflexible, Y. T. Yang and J. C. S. Kumamoto (2016) developed a data warehouse applicable to library applications. They analyzed the report's requirements of Taiwan public city and university libraries and then designed the fact tables and dimension tables of the corresponding data warehouse. They implemented such a data warehouse from data of some public library automation system. The results showed that applying data warehouse to generate reports of libraries is feasible and efficient.

Asaduzzaman Noor and Md. Sharif Hossen (2018) developed an automated digital library management system whose main features are user interactive graphical of the total number of books requested, books uploaded, yearly books count, etc. Their application provides additional features such as notifications and reports viewed instantly for corresponding users. It also provides search by using one of the following criteria: title, author's name, subject, publication, series, ISBN/ISSN, etc. This application was developed using JAVA technology, any user without having any knowledge of Java can easily be able to understand the graphical reports of various transactions like availability of books, the number of copies, fine, etc. Proper security has also been maintained so that only authorized users permitted by the Admin could access a specific service. Being a highly efficient GUI-based software can be run on any operating system having a Java virtual machine. This library management system is working properly and meeting all user requirements according to the educational institutions. The authors finally stated that in the near future, mobile-based applications rather than web-based and desktop would be developed. Besides, this software will be extended by adding more features after getting feedback from the customers.

III. PROBLEM DEFINITION

Before implementing the new computerized system for library management, there was no software available for handling various libraries' operations. All the activities in the library were almost manually handled; only a small portion of automation was performed using inappropriate software such as word, excel, etc.

The new system has overcome various problems pertaining to the existing manual system. Some of these problems are highlighted in the next section.

3.1 Problem with the Existing system

The problem with the existing system includes:

- *Loss of files:* Using the manual system, various files were lost which often results in the loss of thousands of records.
- *The damage of files:* Files easily used to get damaged.
- *Difficult to search for records:* When it comes to the question of searching records, this was a tedious task. One could be searching for thousands of records looking only for one record, it required the librarian to go through all records one by one.
- *Space-consuming:* The file storage was another challenge as they often occupied some unnecessary space.
- *Cost-consuming:* Various files and other related items had to be regularly purchased for manually handling various library records.
- The manual system also required the use of inappropriate software such as word processing, spreadsheets, etc.

IV. THE PROPOSED SYSTEM

The new computerized management system overcomes all of the previously mentioned problems related to the existing manual system and using the features listed in the next section.

4.1 Key Features

According to the membership (Normal User/Librarian) of the user, he/she is able to access a specific service of the library. The Librarian is acting as the controller of the system and has all administrative privileges. The normal user can be either a student or staff of the university who usually accesses the Library System.

The new system is able to:

a. Maintain the catalog of the books and periodicals available in the library.
b. Keep track of the issue and return of books including the fine for the defaulters.
c. Enabling the users/librarian to search for the books based on author name, title, etc.
d. Automatic intimation to the defaulters through e-mail.
e. Notify the librarian about the user's suggestions and requests for new books.
f. Reservation of books which are limited in number.
g. Presenting the up-to-date status to the librarian.
h. Generate daily/monthly and annual reports.
i. The library system is part of the existing university system. There is no need to create users because they are already registered. The library software currently retrieves its necessary information for both students and staff from the existing online application. The basic information to be retrieved includes photos and the identification details.
j. Track the lost books.
k. Setup reminders (E-mail/SMS), etc.

The above-cited features are categorized according to the user type and rights, i.e. normal users and librarians (the administrator). These services are accessible to UG's registered students, academic staff, administrative staff, regular employees, and researchers.

Access to the library is also available to other users such visitors with borrowing possibility upon submitting a written request, but this facility is not available during exam periods as the access may be restricted. Below how many books or other items guests can borrow depending on their borrower type are mentioned. The university offers a standard loan, a one-week loan service and a short-loan service (for books in high

demand). Vacation borrowing information is posted at relevant times (vacation loans do not apply to staff).

The duties of the librarian/administrator are:

- To issue books to the library member (normal users)
- View different categories of books available in the library
- View the list of books available in each category
- Take back the book returned by students and staff
- Add books and book details to the database
- Edit details of existing books
- Check the report about the existing books
- Check the report about the issued books
- Access accounts of registered users, students, and staff, etc.

The features that are available to normal users (members) are:

- View different categories of books available in the library
- View the list of books available in each category
- Own an account in the library
- View the books issued to him/her
- Initiate a request for a new book
- View the history of books previously issued to him
- Search for a particular book, etc.

4.2 Library Procedure for borrowing books

- An up-to-date student ID, service card, or library ticket/ reading card
- Ordinary books can be lent on week-basis renewable once. Special cases as for permanent lecturers at UG, the loan's period can be extended to one month.
- Lecturers can never hold more than five volumes at the same time.
- Special books namely those frequently requested by many individuals can be lent

for at maximum two days depending on whether another user is waiting for the same book.

- During the loan period, the borrower is fully responsible for the documents he/she had borrowed from the library. The loss or deterioration of any borrowed document involves a double repayment of the initial price of the lost/damaged document.

4.3 Returning of borrowed documents/books

- Borrowed books are returned to the library with respect to the following schedule: Monday to Thursday; 8:00am to 5:00pm. On Friday, Borrowed books are returned between 8:00am and 1:00hrs. Borrowed books are not returned during weekends.
- Each document returned late, the borrower is liable to a fine of one hundred (100RWF) Rwandan francs per day up to the double purchase of the document for books on general collection.
- Each document returned late, the borrower is liable to a fine of one (200RWF) Rwandan francs for books on special collection per one extra day up to double purchase of the book.
- Access to the books' location on the shelves should be carefully done conforming to the library's regulations.
- Silence is to be maintained in the library. Smoking, eating or drinking are strictly prohibited inside the library. Those regulations are strictly posed by the librarian on duty any unconformity is liable to the punishment including a definitive loss of the library's access privileges.

4.4. Users Activities

The following figure illustrates various activities of users in the UG-LMIS depending on the user's access level.
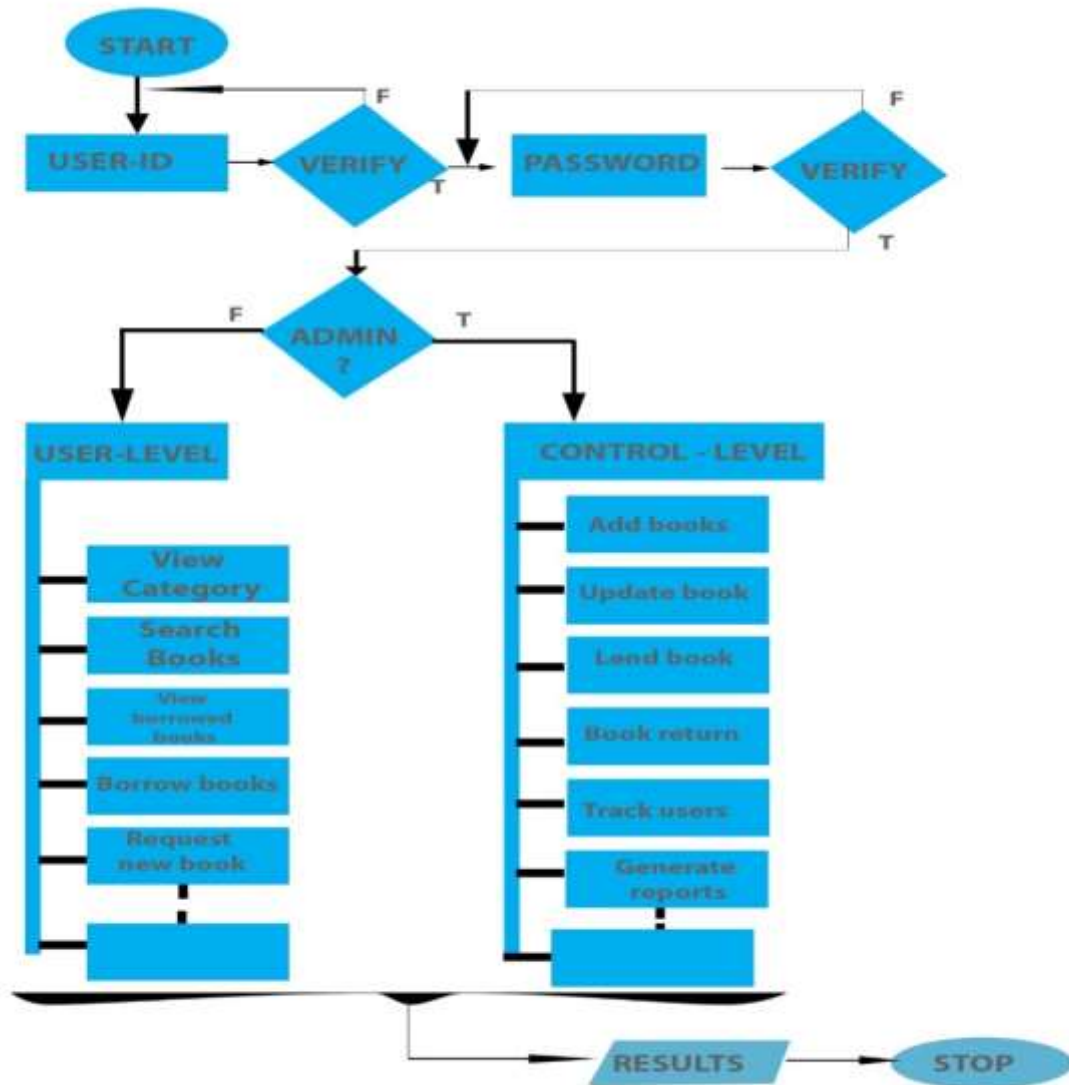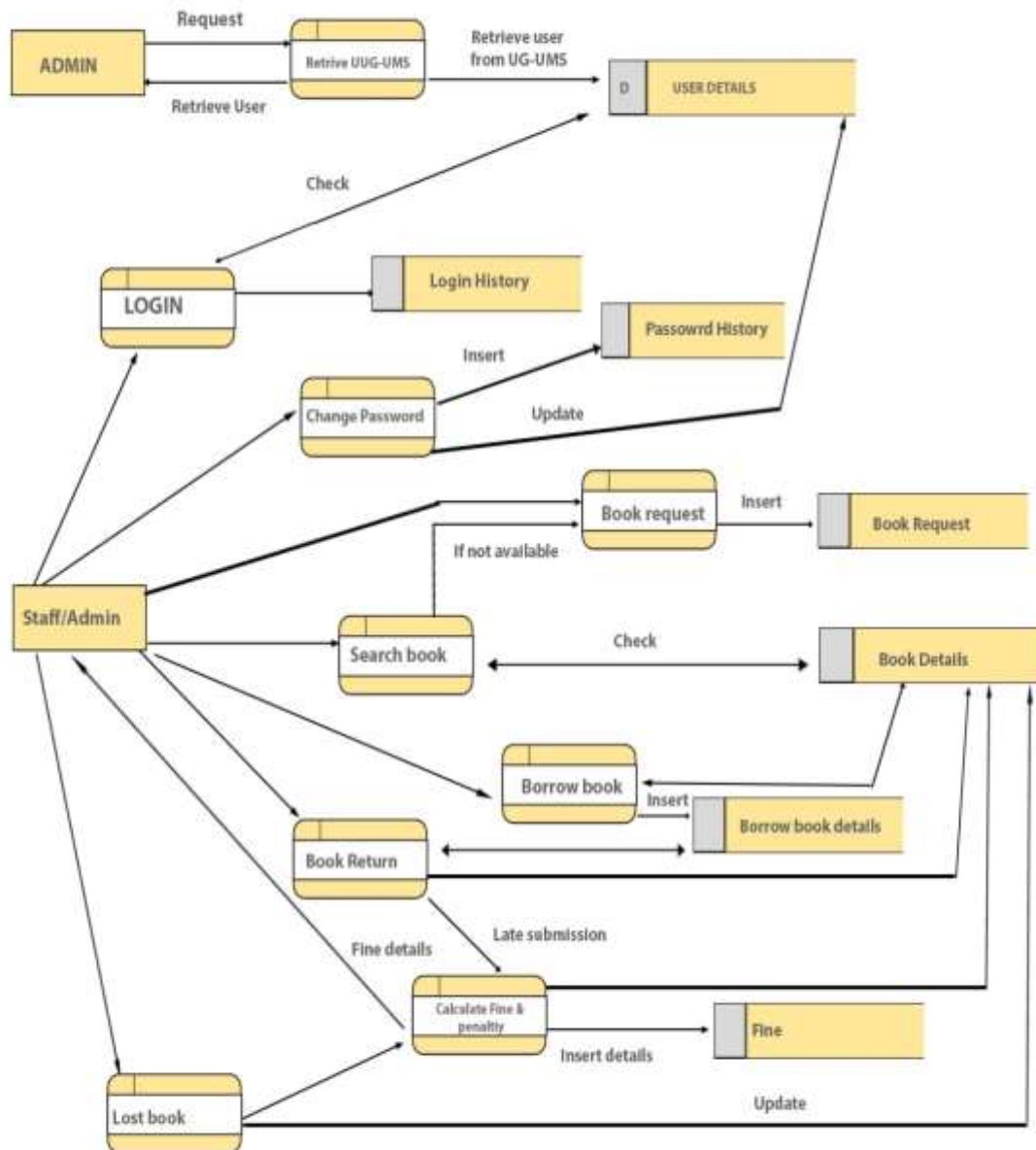
Fig. 1: Working process of UG-LMS

Fig. 2: Detailed work-flow on the UG-LMS

4.5 System Functional Features

- The coding is error-free
- The system has a beautiful user-friendly interface
- The information about users, books, and library are currently stored in the university's database currently accessible online

- Being online, the system is equipped with more storage capacity and provides fast access to the database.
- It provides an efficient search facility and support for quick online transactions
- The library system is running 24/7.
- Users access the system anywhere at any time, from any computer that has an Internet connection.
- Users have to enter correct and valid credentials to access the system.

- Etc.

4.6 Modules

- **Admin Login:** Admin is the administrator of the system, he/she can add or remove e-books into and from the system respectively.
- **User login:** Students and staff have to register themselves into the system to create their accounts. After successful registration, they can then login to the system by entering 10-digit mobile numbers or their respective e-mail ids and passwords.
- **Add and Update Books:** The admin can add books to the system by entering the book details and then modify them.
- **Search option:** Both Admin and Student/staff can search for books by entering the name of the same.

The system provides different types of search:

- ✓ **Fast**: By author, title, subject, publisher, series, classification, ISBs, ISSN.
- ✓ **Advanced**: by Author, title, subject, publishing, and list selection.
- ✓ **Numerical**: By barcode, acquisition number, number of tabs and items, control number, classification, ISBS, and ISSN.
- ✓ **Other**: For HTTP, web search, and XML services.

- **View book rentals-** The admin is able to view rentals status of books.
- **Borrow Books-** Students and staff are able to borrow books and the quantity of the book borrowed is immediately decremented then.
- **Calculate Fine-** The student/staff are able to view the issue and expiry date for the book and even calculate the corresponding fine.
- **Generate reports:** With the new proposed system, the librarian is able to generate daily, monthly, and annual reports.

4.7 Advantages

- The system eliminates the use of paperwork by electronically handling the library information.
- Admin is able to keep an up-to-date system by displaying the new arrival books, this often helps students/staff to be aware of the new book availability.
- The system saves time in book searching process either to student/staff or librarian
- It eliminates paper purchases and other cost-consuming items required for the manual system.
- Thus, it saves time, human efforts, and resources.
- Etc.

4.5 Interface

The advantage of the user interface of the new system is that it is platform-independent i.e. it is accessible online with any Internet and browser-equipped devices.

4.6 Devices

The program is currently accessed by using either computers or mobile phones:

- Computers (Desktops or Laptops): Using any Internet web-browsers
- Tablets or Mobile Phones: The system is designed with advanced technology to run on small handhelds such as tablets and mobile phones.

V. METHODOLOGY

- UG-LMIS is based on the database, object-oriented programming language, and networking techniques. This system uses PHP as the front-end software which is an object-oriented programming technique and has connectivity with MySQL, the back-end software, and some advanced client-side technologies.

VI. RESULTS AND DISCUSSION

As seen in the following figures, this research study shows that all user expectations were fully supported as UG-LMIS meets user requirements relating to registering new users, displaying users and book information, etc. The provided figures are simply samples as the system itself

computerizes the management of the whole university.

As shown in Fig. 3, Fig. 4, Fig. 5, and Fig. 6, welcome screens are initially displayed to the user which contains useful information about the university such as its mission, past, current and future events in the institution.

After a successful login (Fig. 7), a global access-redirection screen (Fig. 8) is displayed where the user is provided with library screen where she can perform various tasks such as searching students who borrowed various books (Fig. 9), print the results (Fig. 10), display book categories (Fig. 11) and book store (Fig. 12). As seen in Fig. 13, the librarian can also manage book renting operations to students and rent the same to staff and display their profiles in Fig. 14 and perform other tasks such as calculating fines, etc.

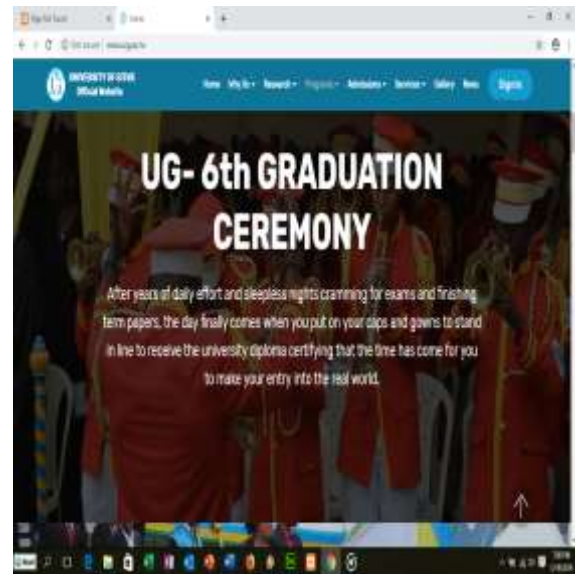## 6.1 UG-LMIS Website Welcome Screen
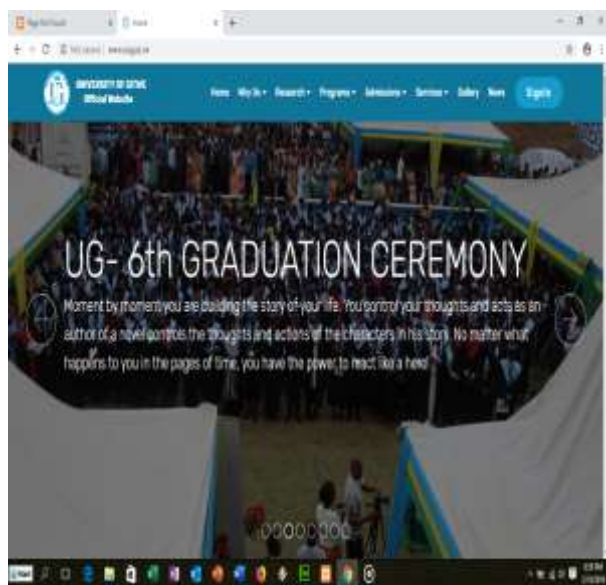
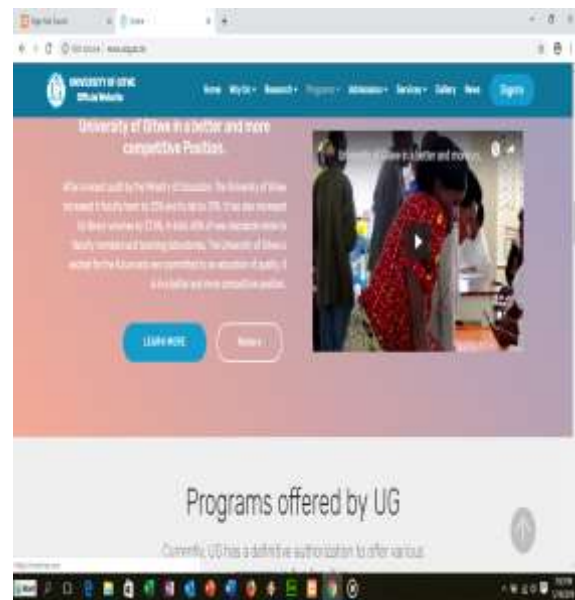**Fig. 3:** Main Screen -1

Fig. 4: Main Screen -2

Fig. 5: Main Screen -3

Fig. 6: Main Screen -4

6.2 Login to the Library

Fig. 7: Library Login Screen

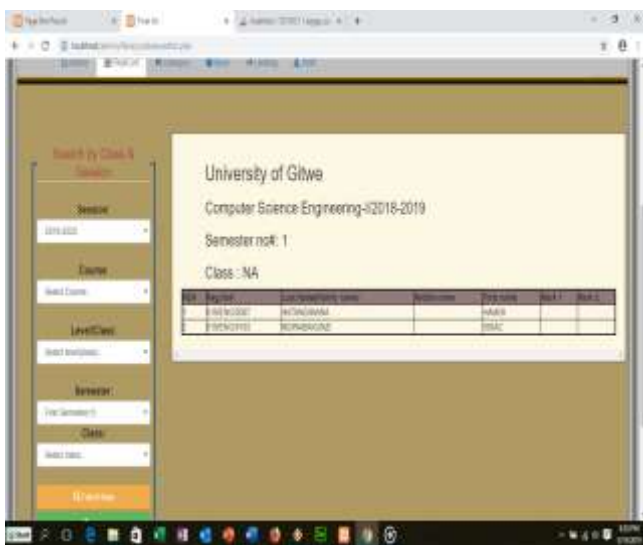

Fig. 8: First Login

6.3 Different Types of Search
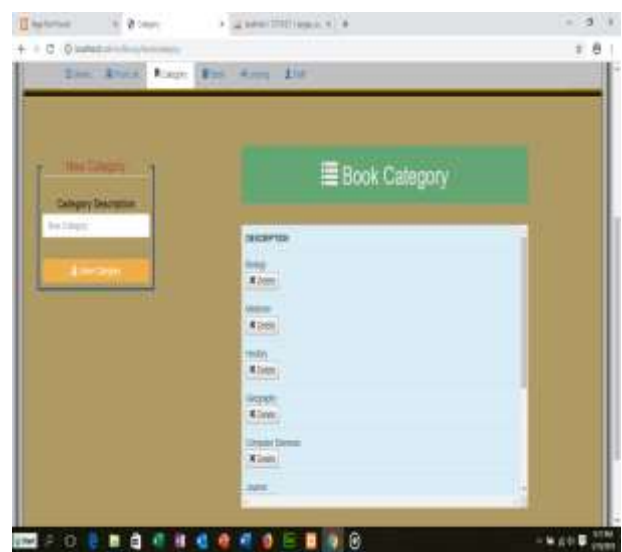

Fig. 9: Student Search

Fig. 10: Results Printing

Fig. 11: Book Categories

Fig. 12: Book Store

6.4. Book Renting to Students

Fig. 13: Borrowing of Books

6.5. Staff Profile

Fig. 14: Book Borrowing Staff Profile

VII. FEATURED CASE STUDY

UG-LIMS is currently available online as a sub-module of University of Gitwe Integrated Management Information System (UGIMIS) website with:

- 40 Visitors per day
- 1600 Users (Students)
- 150 Users (Staff)
- 15000 Books
- Average of 60 borrowed books per month
- Average of 59 returned books per month
- Automation of processes: All
- 30 % of operational cost reduction
- 100% reduction in paperwork
- 90% improvement in patron care
- 90% reduction in information flow-time
- Enhanced competitive advantages

- 100% timely & accurate information
- 100% of student/staff/guests delights, etc.

VIII. CONCLUSION

The UG-LMIS with the functional modules has been successfully developed as a secured, digitalized, and user-friendly system for the University of Gitwe. Manually maintained operations are computerized. Thus the new system which is a highly efficient GUI-based component is currently working properly and meeting all user requirements. It was created to overcome the problems effectively without any corrupted data or information.
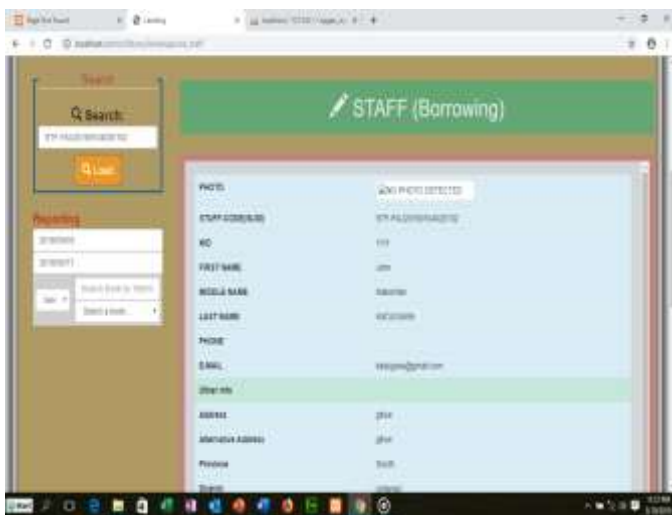
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