MINISTRY FOR DEVELOPMENT OF INFORMATION TECHNOLOGIES
AND COMMUNICATIONS
OF THE REPUBLIC OF UZBEKISTAN
TASHKENT UNIVERSITY OF INFORMATION TECHNOLOGIES

Allowed to defense
Head of «IS» Department
Irgasheva D.Y. _____
«___» _____ 2015

Final work of bachelor

on theme: “ Automated library system”

Graduate _____ Maxmudjonov S.U.
Supervisor _____ Karimov M.M.
Life safety
consultant
_____ Borisova Y.A.
Reviewer _____ Axmedova O.P.

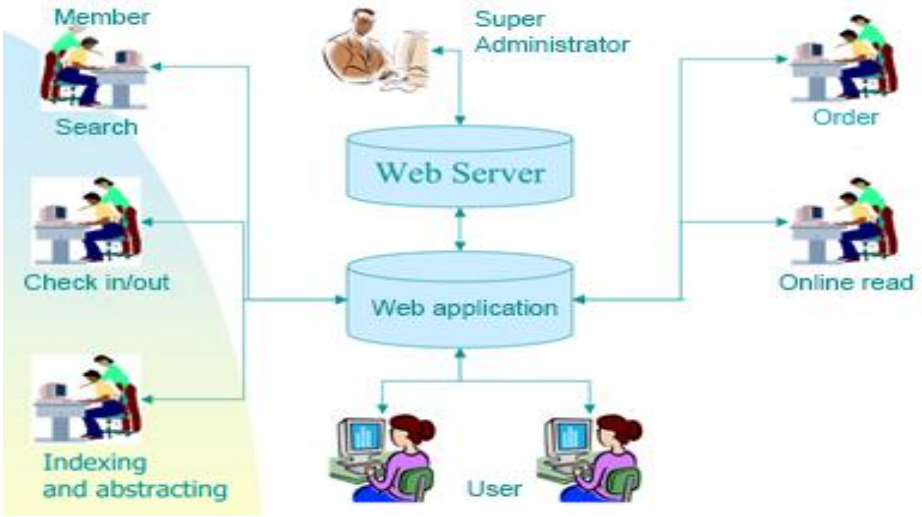
Tashkent – 2015

CHAPTER I. AUTOMATED LIBRARY SYSTEM

1.1. Description of Automated Library system

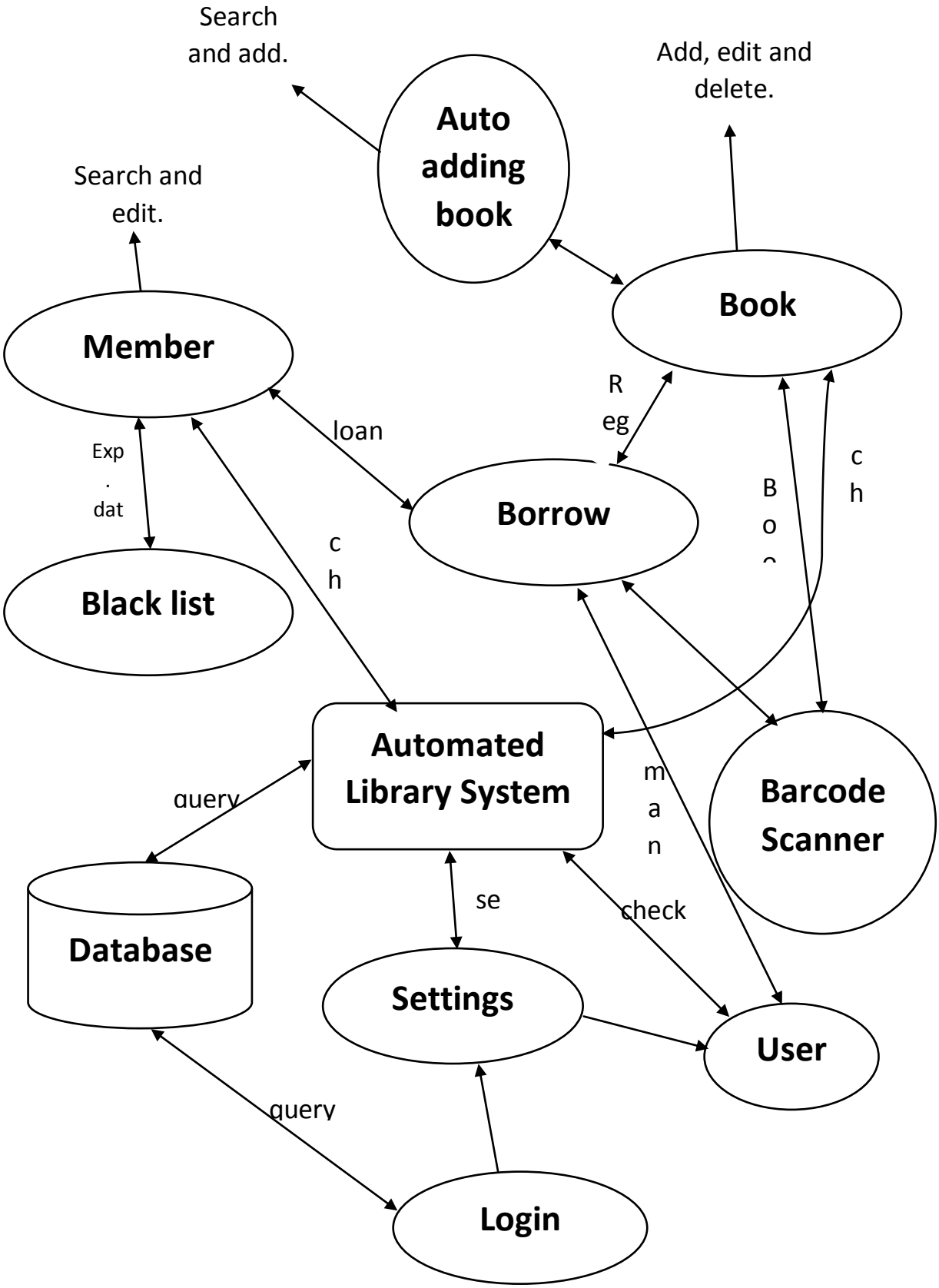
Library is a fast growing organism. The ancient methods of maintaining it are no longer dynamic and efficient. For expeditious retrieval and dissemination of information and better service for the clientele, application of modern techniques has become absolutely indispensable. A properly computerized library will help its users with quick and prompt services. Library automation refers to mechanization of library house keeping operations Predominantly by computerization. The most commonly known housekeeping operations are acquisition control, serials control, cataloguing, and classification and circulation control. Library automation or Integrated Library System (ILS) is an enterprise resource planning systems for a library, used to tracks items owned, order made and etc. Since the advent to the term automation in 1936 1, Plethoras of definitions are found in library literature. Sometimes the terms 'mechanization and automation' Looked overlapped, although there is a different of one degree between the two. Automation is the name gives to an automation system of working.

The Automated Library System (ALS) is a cost effective and space saving alternative to common document shelving technologies.



1.1 – pic. Library Management System

Main structure of automated library system



Addressing the need for space efficiency, secure and automated document and records handling. ALS is a turnkey design and software solution focused on reliability and maintainability. The solution developed by a team of experienced industry professionals is supported by comprehensive services including on-site maintenance, spare parts, modernizations, upgrades and expansions.

The Automated Library system will store all the books' and members' information that consist book number, book title, author name and racks to the system database. The system provides search function to help members find the book by number, ISBN number, ID, name and Author name of the book. Search function will search through the books database to look for the book and view where the book is situated. For the administrator user, only librarians have access to view or edit data from the system databases. Administrator user will handle administrative functions such create new LMS user account and decide the number of days allowed for the borrowed books. User needs to enter correct password and user ID before user can access this function. From here, user can add, delete or update user book and borrower databases.

Since the amount of students/borrowers and books is increasing, it is necessary to prepare a space to store them. After a long time, the record book will be stockpiled. It needs well organized and it is hard to find the record in short time because they need to find it one by one. This will cost extra time and is not efficient at all.

Based on present method, librarian needs to record the entire booklist and borrower list manually using a logbook. This manual system is currently misspend time and might cause mistakes while recording process. The library's inventory such as books is always changes within certain time because of additional or lost of those inventories. With the present manually system, the monitoring process for this inventory become complicated. For example, if one over hundreds of books is lost, they need to check one by one of novel name through list of hundreds from logbook to search for the lost book data.

Library Management System is an application which refers to library systems which are generally small or medium in size.

It is used by librarian to manage the library using a computerized system where he/she can record various transactions like issue of books, return of books, addition of new books, addition of new students etc. Books and student maintenance modules are also included in this system which would keep track of the students using the library and also a detailed description about the books a library contains. With this computerized system there will be no loss of book record or member record which generally happens when a non computerized system is used.

In addition, report module is also included in Library Management System. If user's position is admin, the user is able to generate different kinds of reports like lists of students registered, list of books, issue and return reports.

All these modules are able to help librarian to manage the library with more convenience and in a more efficient way as compared to library systems which are not computerized.

The Advantages of an ILS

- There is no duplication of records since the bibliographic database can be viewed before new records are encoded.
- Opportunities for errors are reduced since the record is entered only once. Library staff and patrons can view the status of the material from the Web-site.
- Library staff use the same masterfile for cataloguing, circulation and other services as needed.
- Librarian uses this application while transaction process. It makes easy to register books into member account in a few seconds.

1.2. **Automated Library system aims and objectives**

This chapter gives an overview about the aim, objectives, background and operation environment of the system.

Project aims and objectives

The project aims and objectives that will be achieved after completion of this project are discussed in this subchapter. The aims and objectives are as follows:

- Online book issue
- Request column for librarian for providing new books
- A separate column for digital library
- Controlling and monitoring transactions such as sorting books and member, loaning books.
- A search column to search availability of books. Librarian is able to search record by using few clicks of mouse and few search keywords thus saving his valuable time.
- Counting return the book date by the system and reminding the time to member.

Background of project

Automated Library System is an application which refers to library systems which are generally small or medium in size. It is used by librarian to manage the library using a computerized system where he/she can record various transactions like issue of books, return of books, addition of new books, addition of new students etc.

All these modules are able to help librarian to manage the library with more convenience and in a more efficient way as compared to library systems which are not computerized.

The goal of this thesis was to design a website with PHP and MySQL that support the additional functions listed below in addition to the basic functions which are to:

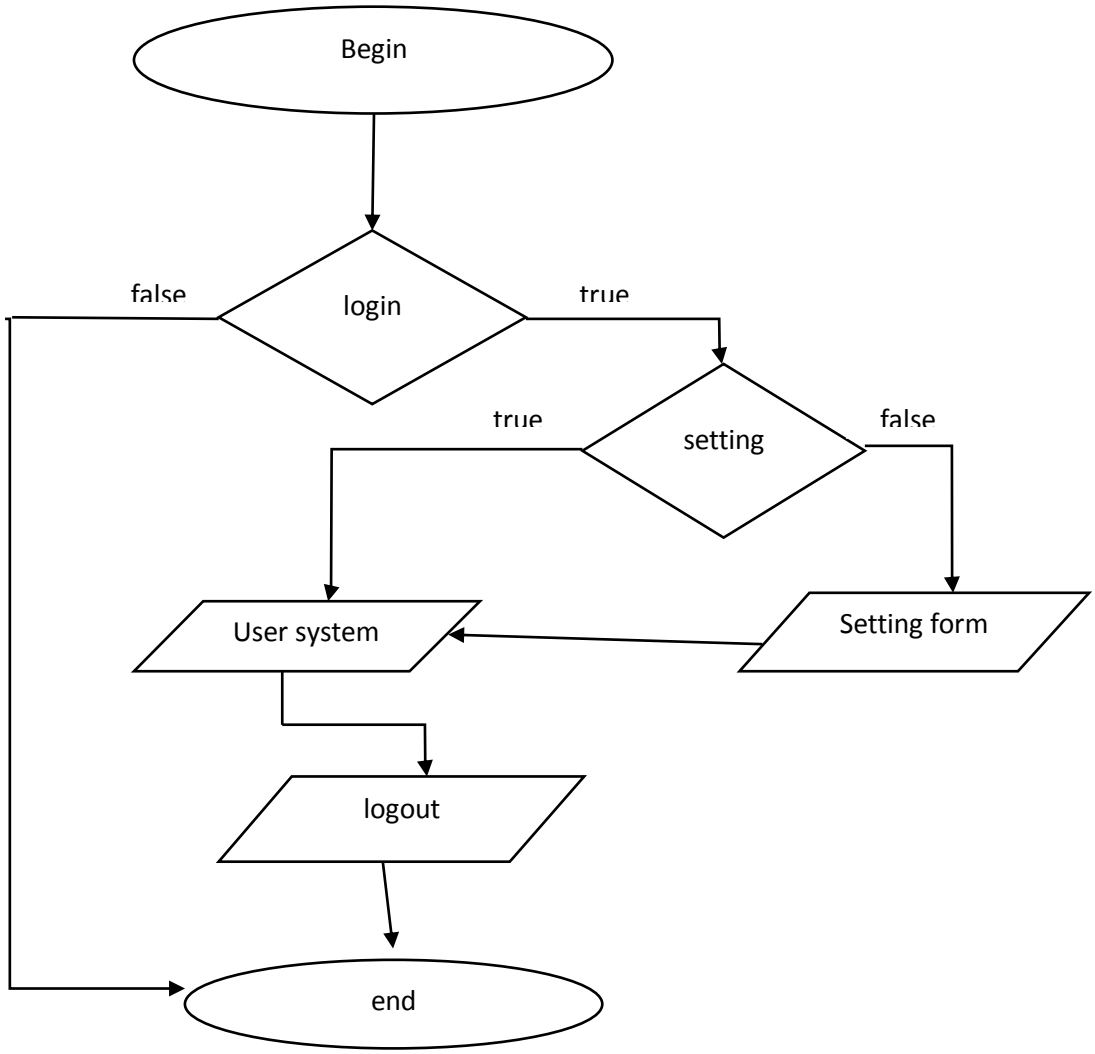
− Display specific location of books in search result
− Borrowing the book from library via Barcode Scanners
− Integrate E-mail service
− Fast and easy a new book registration
− Online management application
− Online management system

This solution was chosen because PHP could be embedded into HTML and its open source itself so that the developer would not need to recode the original source code with any extra funds. Even though the installation phase is discussed, the focus is more on empirical work. Bank negotiation is a part of the shopping cart; however, it is beyond the scope of this thesis. The feature and installation of development tools are introduced. Then the construction of this project is presented and ultimately each component of website is introduced.

Analyze the source, movement, and utilization of data.

The systems analyst working in a library will require a detailed education in library operations. As he examines the library as a total, integrated, functional system, he will gradually identify the essential elements of information needed actually to support the objectives of the system. An under standing of where data originate, how they move through the library, and what use is made of them in reports is fundamental to his learning process. Eventually, when he prepares flow charts of the entire process, he will give special attention to the data and decide on the minimum number of inputs and steps needed to do the job. A flow chart is as basic to a systems analyst as a blueprint to an engineer.

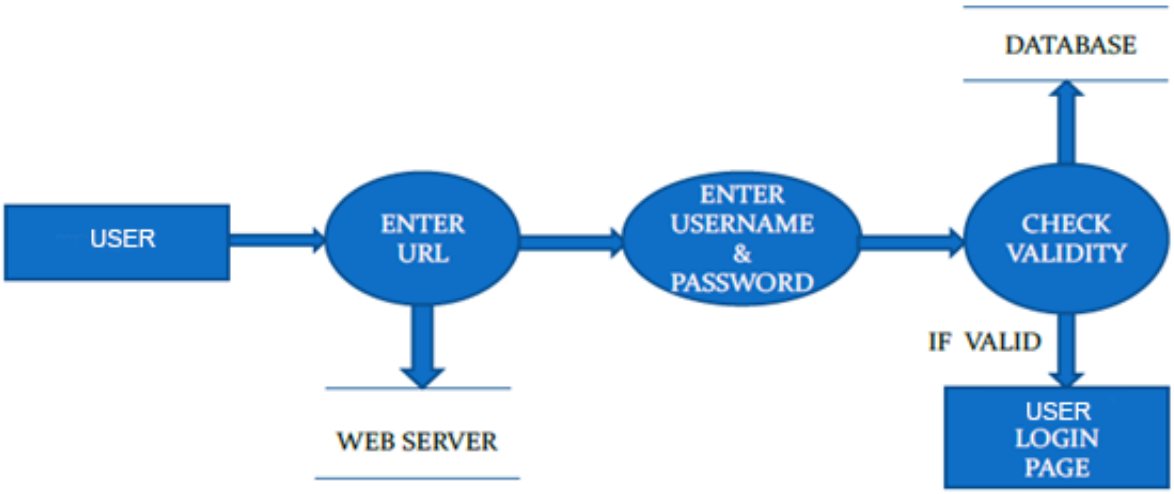
Main logical algorithm of the project.



This is a main structure which just tell how the system is organised. In this algorithm it is explained about working system of the project. Firts of all, the system requires user to log in and if it is true second step is for settings. All configurations of the system should be submitted as library's rules. So, it moves to user system part and user can use the system. More informations were given the following part in details.

1.3. **Automated Library data flow diagrams**

Data flow diagram for user login



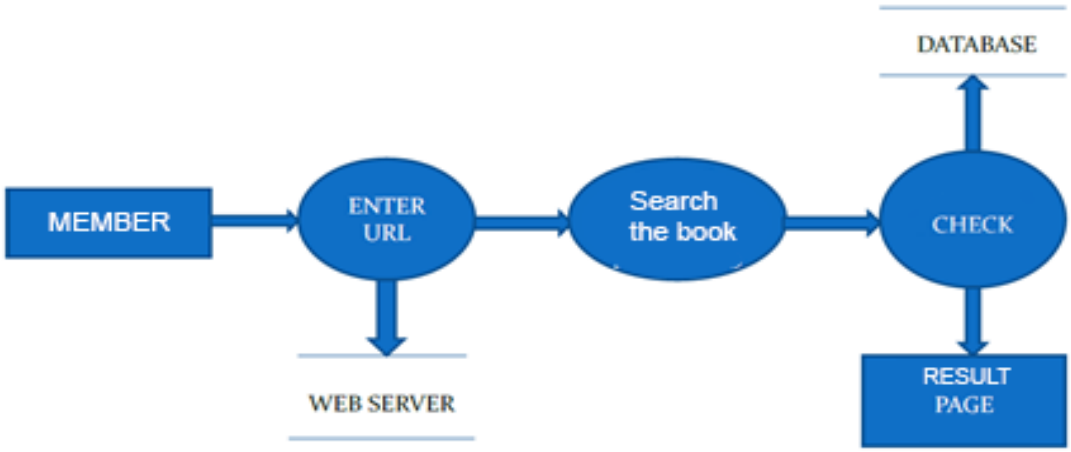
1.1 – scheme. Data flow diagram for user login

After entering to the home page of the website , user can choose the USER LOGIN option where they are asked to enter username & password , and if he/she is a valid user then a user login page will be displayed.

Library User Manage System

a) The user with valid user name and password can access the Automated Library System.
b) The system displays the user account information including user id and password.
c) The system shall give the response for invalid username and password.
d) The system allows only administrator to choice actions including removing, changing and adding user account and account information.
e) User can read and write information about any member.

Data flow diagram for member

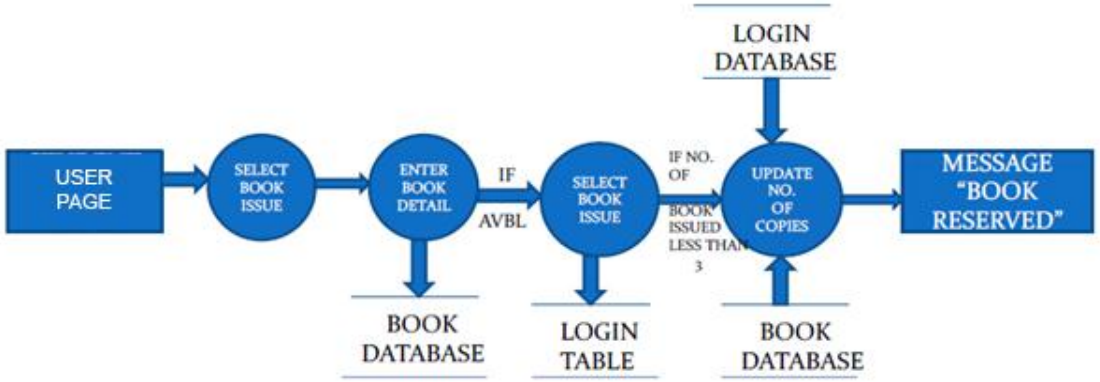


1.2 – scheme. Data flow diagram for member

After entering to the home page of the website , student can choose the searching the book option where they are asked to enter name of the book, title or ISBN and etc. then he/she can search then results will be displayed.

The Automated Library system will store all the books' information that consist book number, book title, author name and racks to the system database. The system provides search function to help members find the book by number, ISBN number, ID, name and Author name of the book. Search function will search through the books database to look for the book and view where the book is situated.

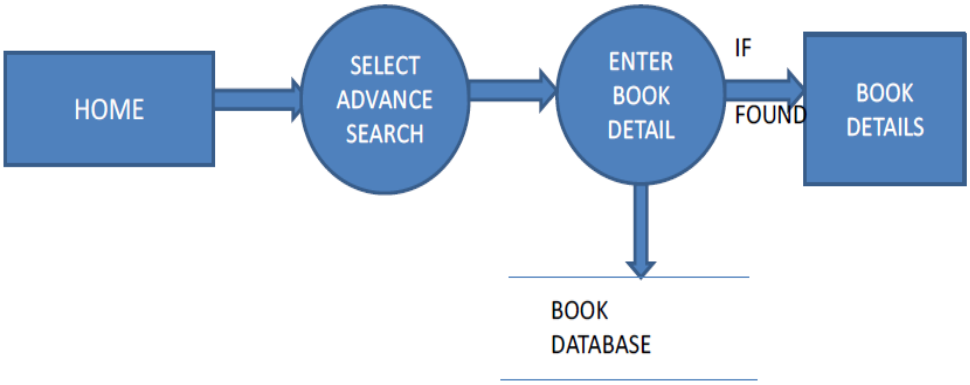
Data flow diagram for book issue



1.3 – scheme. Data flow diagram for book issue

It is a second level Data Flow Diagram where after entering BORROWER page he/she can select a book issue option where after entering the book detail, he/she can select the book issue option and if the maximum no of books issued limit is not crossed then a request will be sent to the librarian who will approve the book issue.

Data flow diagram for book search



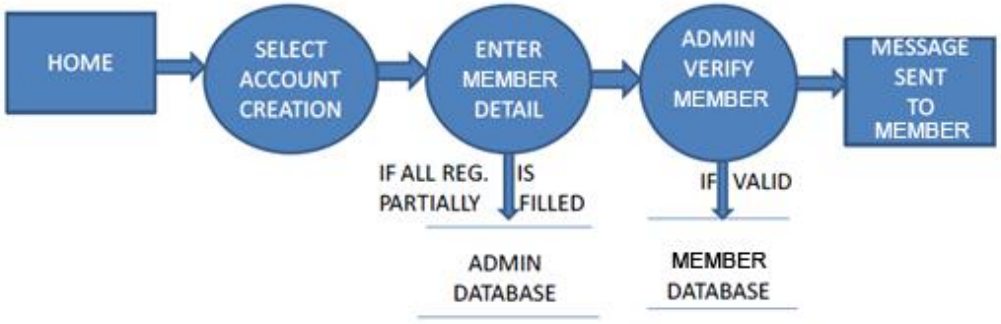
1.4 – scheme. Data flow diagram for book search

After the home page there will be an option of the book search where after entering book detail like author name, publication, book name etc. then the system will displeys books item such autor and publisher that are match the search criteria.

Extra options for book searching

- Member can read all information about any book.
- Online book searching.
- Member can order the book that she/he needs
- The system will give response for invalid search criteria.
- New books will be shown current page

Data flow diagram for account creation



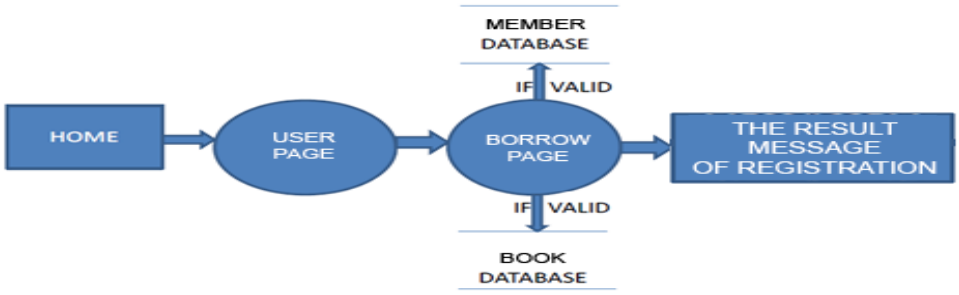
1.5 – scheme. Data flow diagram for account creation

After the home page login there will be an option of create an account where after entering member detail, if all the fields are filled then a request will be sent to the librarian who will approve him as a registered member of the library.

The process of keeping borrower information and books inventory become more sophisticated. Each operation for both functions is handle by the system to define the period of time for borrowing, penalty calcultation for late return book and total of books that still remain every for inventory check.

Moreover, if member forgets his or her borrowing date from library, the message will be sent to them to remember by email. Message contains book taken date and cost of each day if member does not return it on time.

Data flow diagram for book borrowing



1.6 – scheme. Data flow diagram for book borrowing

After the home page there will be an option of book borrowing where after choosing member who wants to take book. In this page all information about member will be displayed and there will be table of books witch member borrowed before.

Book borrowing system

a) When check the books required by librarians, the system shows the information about books witch is borrowed before and not returnet yet including book id and member id.
b) The system allows the user to specify a checking out book using its Id.
c) The system allows the user to specify a checking in book using its Id.
d) The system allows the user to specify that a penalty is paid after book is consider check out (return).
e) The system commits the check in and check out data to the database as soon as the data is entered.

Chapter one summary

In chapter 1 the analysis of object of automation – the project was carried out, the bases for creation of automated library system was analyzed; its functions and power are considered.

Considered data flow diagram of organizing and storing information and shown methods of information storage.

It is more efficient and makes the process of searching for books become ceasier. These because what they need to do is just insert information of book such book’s id and ect. Using this system, the operation of borrowing and managing inventories is paperless. It means we do not need to use any paper for the system and logbook is no longer will be library database. It will reduce the usage of papers.

CHAPTER II. DEVOTED INSTRUMENTAL MEANS FOR AUTOMATED LIBRARY SYSTEM

2.1. Software tools used

The whole Project is divided in two parts the front end and the back end. The front end is designed using of HTML, CSS, JAVASCRIPT. The front end part works in web page witch is generated by browsers and it does not contain much functionality. The back end is designed using of PHP and MySQL. The back part works in the back side of program, which is called Web Server. So, there are two parts: client side and Server side. All functionality of system is located in Server side.

Client side programming languages are HTML, CSS, JAVASCRIPT and the front end is designed using of them.

HTML – HTML or Hyper Text Markup Languageis the main markup language for creating web pages and other information that can be displayed in a web browser. HTML is written in the form of HTML elements consisting of *tags* enclosed in angle brackets (like <html>), within the web page content. HTML tags most commonly come in pairs like <h1> and </h1>, although some tags represent *empty elements* and so are unpaired, for example <img>. The first tag in a pair is the *start tag*, and the second tag is the *end tag* (they are also called *opening tags* and *closing tags*). In between these tags web designers can add text, further tags, comments and other types of text-based content. The purpose of a web browser is to read HTML documents and compose them into visible or audible web pages. The browser does not display the HTML tags, but uses the tags to interpret the content of the page.HTML elements form the building blocks of all websites. HTML allows images and objects to be embedded and can be used to create interactive forms. It provides a means to create structured documents by denoting structural semantics for text such as headings, paragraphs, lists, links, quotes and

other items. It can embed scripts written in languages such as JavaScript which affect the behavior of HTML web pages.

CSS - Cascading Style Sheets (CSS) is a style sheet language used for describing the look and formatting of a document written in a markup language. While most often used to style web pages and interfaces written in HTML and XHTML, the language can be applied to any kind of XML document, including plain XML, SVG and XUL. CSS is a cornerstone specification of the web and almost all web pages use CSS style sheets to describe their presentation.CSS is designed primarily to enable the separation of document content from document presentation, including elements such as the layout, colors, and fonts. This separation can improve content accessibility, provide more flexibility and control in the specification of presentation characteristics, enable multiple pages to share formatting, and reduce complexity and repetition in the structural content (such as by allowing for table less web design).CSS can also allow the same markup page to be presented in different styles for different rendering methods, such as on-screen, in print, by voice (when read out by a speech-based browser or screen reader) and on Braille-based, tactile devices. It can also be used to allow the web page to display differently depending on the screen size or device on which it is being viewed. While the author of a document typically links that document to a CSS file, readers can use a different style sheet, perhaps one on their own computer, to override the one the author has specified. However if the author or the reader did not link the document to a specific style sheet the default style of the browser will be applied.CSS specifies a priority scheme to determine which style rules apply if more than one rule matches against a particular element. In this so-called *cascade*, priorities or *weights* are calculated and assigned to rules, so that the results are predictable.

JAVA SCRIPT - JavaScript (JS) is a dynamic computer programming language. It is most commonly used as part of web browsers, whose implementations allow client-side scripts to interact with the user, control the browser, communicate asynchronously, and alter the document content that is

displayed. It is also being used in server-side programming, game development and the creation of desktop and mobile applications. JavaScript is a prototype-based scripting language with dynamic typing and has first-class functions. Its syntax was influenced by C. JavaScript copies many names and naming conventions from Java, but the two languages are otherwise unrelated and have very different semantics. The key design principles within JavaScript are taken from the Self and Scheme programming languages. It is a multi-paradigm language, supporting object-oriented, imperative, and functional programming styles. The application of JavaScript to use outside of web pages—for example, in PDF documents, site-specific browsers, and desktop widgets—is also significant. Newer and faster JavaScript VMs and platforms built upon them (notably Node.js) have also increased the popularity of JavaScript for server-side web applications. On the client side, JavaScript was traditionally implemented as an interpreted language but just-in-time compilation is now performed by recent browsers.

Server side programming languages are PHP, MySQL and the back end is designed using of them.

PHP - PHPis a server-side scripting language designed for web development but also used as a general-purpose programming language. PHP is now installed on more than 244 million websites and 2.1 million web servers. Originally created by Rasmus Lerdorf in 1995, the reference implementation of PHP is now produced by The PHP Group. While PHP originally stood for *Personal Home Page*, it now stands for *PHP: Hypertext Preprocessor*, a recursive backronym. PHP code is interpreted by a web server with a PHP processor module, which generates the resulting web page: PHP commands can be embedded directly into an HTML source document rather than calling an external file to process data. It has also evolved to include a command-line interface capability and can be used in standalone graphical applications. PHP is free software released under the PHP License. PHP can be deployed on most web servers and also as a standalone shell on almost every operating system and platform, free of charge.

One of the best things about PHP is the large number of Internet service providers (ISPs) and Web hosting companies that support it. Today hundreds of thousands of developers are using PHP, and it's not surprising that there are so many, considering that several million sites are reported to have PHP installed.

Another great feature of PHP is that it ' s *cross - platform* — you can run PHP programs on Windows, Linux, FreeBSD, Mac OS X, and Solaris, among others. What ' s more, the PHP engine can integrate with all common Web servers, including Apache, Internet Information Server (IIS), Zeus, and lighttpd. This means that you can develop and test your PHP Web site on one setup, then deploy it on a different type of system without having to change much of your code. Furthermore, it's easy to move your PHP Web site onto another server platform, if you ever need to.

Some of PHP's Strengths

Some of PHP's main competitors are Perl, Microsoft ASP.NET, JavaServer Pages (JSP), and ColdFusion.

In comparison to these products, PHP has many strengths, including the following:

- High performance
- Interfaces to many different database systems
- Built-in libraries for many common web tasks
- Low cost
- Ease of learning and use
- Strong object-oriented support
- Portability
- Availability of source code
- Availability of support

A more detailed discussion of these strengths follows.

Performance

PHP is very efficient. Using a single inexpensive server, you can serve millions of hits per day. If you use large numbers of commodity servers, your

capacity is effectively unlimited. Benchmarks published by Zend Technologies show PHP outperforming its competition.

Database Integration

PHP has native connections available to many database systems. In addition to MySQL, you can directly connect to PostgreSQL, mSQL, Oracle, dbm, FilePro, Hyperwave, Informix, InterBase, and Sybase databases, among others. PHP 5 also has a builtin SQL interface to a flat file, called SQLite.

Built-in Libraries

Because PHP was designed for use on the Web, it has many built-in functions for per-forming many useful web-related tasks. You can generate GIF images on the fly, connect to web services and other network services, parse XML, send email, work with cookies, and generate PDF documents, all with just a few lines of code.

Ease of Learning PHP

The syntax of PHP is based on other programming languages, primarily C and Perl. If you already know C or Perl, or a C-like language such as C++ or Java, you will be productive using PHP almost immediately.

Object-Oriented Support

PHP version 5 has well-designed object-oriented features. If you learned to program in Java or C++, you will find the features (and generally the syntax) that you expect, such as inheritance, private and protected attributes and methods, abstract classes and methods, interfaces, constructors, and destructors.You will even find some less common features such as built-in iteration behavior. Some of this functionality was available in PHP versions 3 and 4, but the object-oriented support in version 5 is much more complete.

Portability

PHP is available for many different operating systems.You can write PHP code on free Unix-like operating systems such as Linux and FreeBSD, commercial Unix versions such as Solaris and IRIX, or on different versions of Microsoft Windows.

Well-written code will usually work without modification on a different system running PHP.

Source Code

You have access to PHP's source code.With PHP, unlike commercial, closed-source products, if you want to modify something or add to the language, you are free to do so.

You do not need to wait for the manufacturer to release patches.You also don't need to worry about the manufacturer going out of business or deciding to stop supporting a product.

MySQL ("My S-Q-L", officially, but also called "My Sequel") is (as of July 2013) the world's second most widely used open-source relational database management system (RDBMS). It is named after co-founder Michael Widenius daughter, My. The SQL phrase stands for Structured Query Language. The MySQL development project has made its source code available under the terms of the GNU General Public License, as well as under a variety of proprietary agreements. MySQL was owned and sponsored by a single for-profit firm, the Swedish company MySQL AB, now owned by Oracle Corporation .MySQL is a popular choice of database for use in web applications, and is a central component of the widely used LAMP open source web application software stack (and other 'AMP' stacks). LAMP is an acronym for "Linux, Apache, MySQL, Perl/PHP/Python." Free-software-open source projects that require a full-featured database management system often use MySQL. For commercial use, several paid

editions are available, and offer additional functionality. Applications that use MySQL databases include: TYPO3, MODx, Joomla, WordPress, phpBB, MyBB, Drupal and other software. MySQL is also used in many high-profile, large-scale websites, including Wikipedia, Google (though not for searches), Facebook, Twitter, Flickr, and YouTube

Some of MySQL's Strengths

MySQL's main competitors are PostgreSQL, Microsoft SQL Server, and Oracle.

MySQL has many strengths, including the following:

- High performance
- Low cost
- Ease of configuration and learning
- Portability
- Availability of source code
- Availability of support

A more detailed discussion of these strengths follows.

Performance

Many of benchmarks show MySQL to be orders of magnitude faster than the competition. In 2002, *eWeek* published a benchmark comparing five databases powering a web application. The best result was a tie between MySQL and the much more expensive Oracle.

Ease of Use

Most modern databases use SQL. If you have used another RDBMS, you should have no trouble adapting to this one. MySQL is also easier to set up than many similar products.

Portability

MySQL can be used on many different Unix systems as well as under Microsoft Windows.

Source Code

As with PHP, you can obtain and modify the source code for MySQL. This point is not important to most users most of the time, but it provides you with excellent peace of mind, ensuring future continuity and giving you options in an emergency.

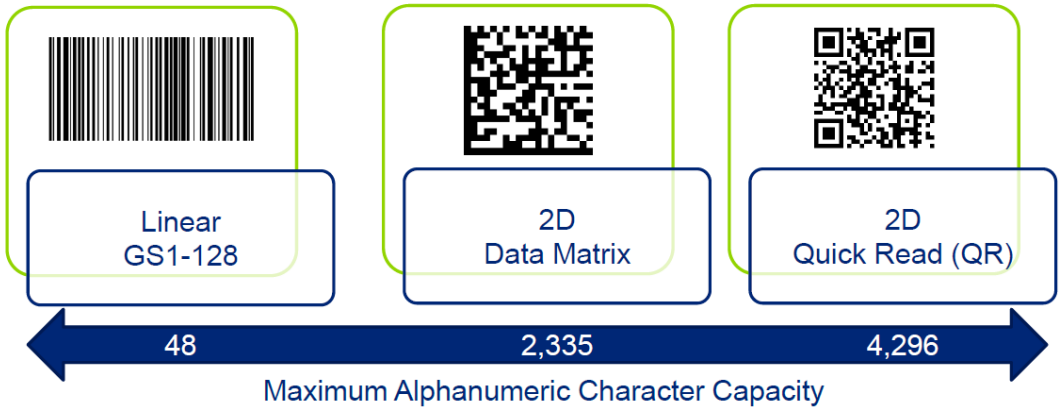
Availability of Support

Not all open source products have a parent company offering support, training, consulting, and certification, but you can get all of these benefits from MySQL AB.

2.2. Barcode. Types and Standards

History of barcode

As far back as the 1960s, barcodes were used in industrial work environments. Some of the early implementations of barcodes included the ability identify rail road cars.



In the early 1970s, common barcodes started appearing on grocery shelves. To automate the process of identifying grocery items, UPC barcodes were placed on products.

Today, barcodes are just about everywhere and are used for identification in almost all types of business.

When barcodes are used in the business process, procedures are automated to increase productivity and reduce human error.

Whenever there is a need to accurately identify or track something, bar-coding should be used. For example, in a data entry work environment, workers may be required to enter an enormous amount of data into a customer database system. Instead of manually typing a customer identification number into a database, if the information is contained in a barcode, a data entry operator may scan it in. This would increase automation and reduce human error.

Barcode types and use

The type of barcode to use for a particular situation depends upon:

- the use;
- the data encoded in the barcode;
- how the barcode will be printed.

There are several different types of barcode standards for different purposes - these are called symbologies. Each type of symbology (or barcode type) is a standard that defines the printed symbol and how a device, such as a barcode scanner, reads and decodes the printed symbol.

When multiple parties or companies are involved in the ID process, industry standards are usually established. Note that the standard is not necessarily the same as the barcode symbology. If an industry standard has been established for the customer's use of barcoding, then most likely there will not be a choice in selecting the barcode symbology.

Barcode standards define how to use the barcode symbology in a particular situation. For example, ISBN is a standard for labeling books and periodicals that uses the EAN-13 symbology.

There are two types of barcodes:

- Linear barcodes;
- 2D barcodes.

Linear barcodes		2D b rcodes	
C o d e 1 2 8		D a t a M a t r i x	
U P C		P D F 4 1 7	
I n t e r l e a v e d 2 o f 5		M a x i c o d e	

Some established barcode standards include:

Established Standard	Common Use	Symbology
AIAG	Automotive item identification	Data Matrix
EAN8 EAN13	Items for sale worldwide	UPC/EAN
MIL-STD-130L	US Department of defense	Data Matrix
SSCC-18	Shipping cartons	Code 128

Choosing the best barcode type to use

Determining the best type of barcode to use depends on the environment, requirements, application, and printer. When dealing strictly with barcode fonts, there are two types:

- Fonts that require encoding with use of a font tool (Code 128, UPC, Data Matrix, Code 93)
- Fonts that do not require encoding. Self-checking fonts (Code 39, Codabar)
- For fonts that require encoding such as Code 128, Data Matrix, UPC, and Code 93, a font tool must be used.

A font tool is a product that is used to format data for a barcode font. This may include calculating start/stop characters, a check character, and in some cases prepare data so that it can be altered for the specified barcode symbology. For example, encoding TEST123 using a font tool for Code 128 produces ÌTEST123}Î. Only after encoding, should the font be applied.

The IDAutomation.com Online Font Encoder is an example of a font tool.

It should be noted that if not a technical user or programmer, try to use self-checking barcode fonts such as Code 39 or Codabar. Self-checking fonts have checking code built-in so there is no need to calculate check characters. Check characters are used in more dense symbologies so the barcode scanner can verify it read the barcode correctly.

To create a Code 39 barcode using a font simply surround the data string with start/stop characters such as "*" or "!". For example, enter *MyData* or !MyData!, then convert the font to the IDAutomation Code 39 Font.

Products Available for Printing Barcodes

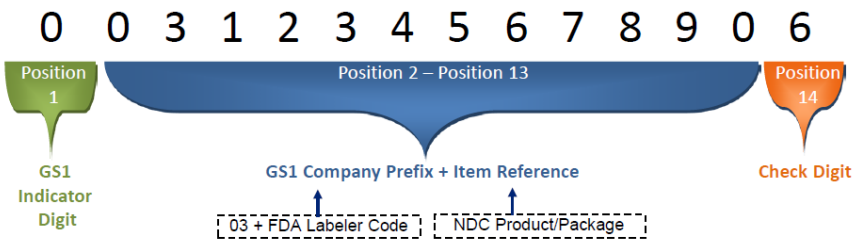
Determining the best product to use for printing depends on the environment, requirements, application and printer. Several methods for printing barcodes are provided below.

- Barcode Fonts
- Applications
- Components
- Hosted Services (Dynamic Barcode Generator Service or XML Barcode Web service)

Global Trade Item Number (GTIN)

• In 2D barcodes, the NDC is embedded in the GTIN.

GTIN with embedded NDC



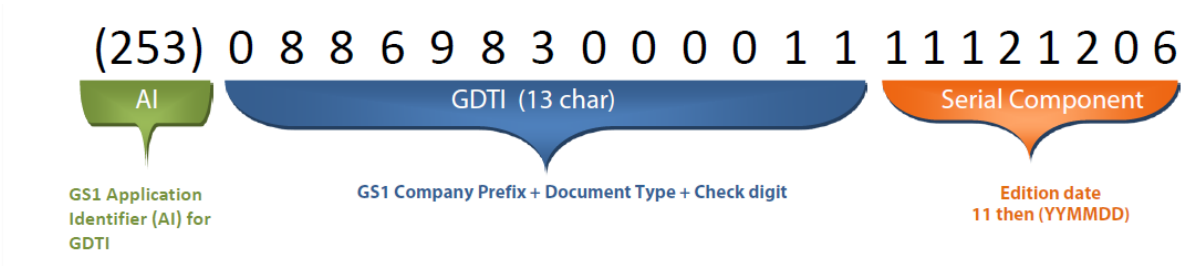
Scanned 2D Barcode Data example

- 01003492815890581713102810U4275AA is the 2D barcode data string
- GTIN = 00349281589058
- Expiration Date = 131028 (YYMMDD)
- Lot # = U4275AA
- 01, 17 and 10 are GS1 Application Identifiers

Global Document Type Identifier (GDTI)

- GDTI is a code that identifies a document by type. For instance the VIS for influenza and for MMR would have different GDTI codes.
- The GDTI for a specific VIS document will not change, even as new editions are published.
- Application Identifiers are bracketed in in the Human Understandable Interpretation. The parentheses are not part of the data and are not encoded in the barcode

GDTI Structure for VIS



2.3. Barcode Scanners and connection with PHP

Reading Barcodes

One of the most common tools for reading barcodes is the hand held barcode scanner. All of the barcode scanners recommended and sold by IDAutomation have built-in decoders that can read several different bar code types.

There are some low priced scanners available on the market, but they require complicated decoders. In the long run, after ordering and programming a decoder, more time will be spent using the decoder than if ordering a scanner with a built-in decoder.

Most of the scannerssold by IDAutomation receive their power from the PC keyboard or USB port so no external power supply is required. When a barcode is scanned, the data is sent to the PC as if it was typed using a keyboard.

There are low priced scanners available on the market, but they require complicated decoders. In the long run, after ordering and programming a decoder, more time will be spent using the decoder than ordering a scanner with a built-in decoder.

Not all scanners can scan barcodes that are printed at very small x dimensions (the x dimension is the width of the narrow bar in the code), so it is advisable to check the barcode scanner manual to make sure the scanner can read the small x dimension barcodes. Also, make sure the printer can accurately reproduce small x dimension barcodes.

The IDAutomation Plug ‘n Play Barcode Scanner will scan linear bar codes consistently at 4 to 32 mils in size and up to 4.2" in width from a distance of 4" to 8" at 200 scans per second and can be programmed to scan function keys from barcodes.

2D Barcode Scanner Considerations

A barcode reader (or barcode scanner) is an electronic device that can read and output printed barcodes to a computer. Like a flatbed scanner, it consists of a light source, a lens and a light sensor translating optical impulses into electrical ones. Additionally, nearly all barcode readers contain *decoder* circuitry analyzing the barcode's image data provided by the sensor and sending the barcode's content to the scanner's output port.

Barcode readers can be differentiated by technologies as follows:

Pen-type readers

Pen-type readers consist of a light source and photodiode that are placed next to each other in the tip of a pen or wand. To read a bar code, the person holding the pen must move the tip of it across the bars at a relatively uniform speed. The photodiode measures the intensity of the light reflected back from the light source as the tip crosses each bar and space in the printed code. The

photodiode generates a waveform that is used to measure the widths of the bars and spaces in the bar code. Dark bars in the bar code absorb light and white spaces reflect light so that the voltage waveform generated by the photodiode is a representation of the bar and space pattern in the bar code. This waveform is decoded by the scanner in a manner similar to the way Morse code dots and dashes are decoded.

Laser scanners

Laser scanners work the same way as pen type readers except that they use a laser beam as the light source and typically employ either a reciprocating mirror or a rotating prism to scan the laser beam back and forth across the bar code. As with the pen type reader, a photodiode is used to measure the intensity of the light reflected back from the bar code. In both pen readers and laser scanners, the light emitted by the reader is rapidly varied in brightness with a data pattern and the photodiode receive circuitry is designed to detect only signals with the same modulated pattern.

CCD readers

CCD readers use an array of hundreds of tiny light sensors lined up in a row in the head of the reader. Each sensor measures the intensity of the light immediately in front of it. Each individual light sensor in the CCD reader is extremely small and because there are hundreds of sensors lined up in a row, a voltage pattern identical to the pattern in a bar code is generated in the reader by sequentially measuring the voltages across each sensor in the row. The important difference between a CCD reader and a pen or laser scanner is that the CCD reader is measuring emitted ambient light from the bar code whereas pen or laser scanners are measuring reflected light of a specific frequency originating from the scanner itself.

Camera-based readers

Two-dimensional imaging scanners are the sixth and newest type of bar code reader. They use a camera and image processing techniques to decode the bar code.

Video camera readers use small video cameras with the same CCD technology as in a CCD bar code reader except that instead of having a single row of sensors, a video camera has hundreds of rows of sensors arranged in a two dimensional array so that they can generate an image.

Large field-of-view readers use high resolution industrial cameras to capture multiple bar codes simultaneously. All the bar codes appearing in the photo are decoded instantly (ImageID patents and code creation tools) or by use of plugins (e.g. the Barcodepedia uses a flash application and some web cam for querying a database), have been realized options for resolving the given tasks.

Omni-directional barcode scanners

Omni-directional scanning uses "series of straight or curved scanning lines of varying directions in the form of a starburst, a lissajous pattern, or other multiangle arrangement are projected at the symbol and one or more of them will be able to cross all of the symbol's bars and spaces, no matter what the orientation."[1]

Omni-directional scanners almost all use a laser. Unlike the simpler single-line laser scanners, they produce a pattern of beams in varying orientations allowing them to read barcodes presented to it at different angles. Most of them use a single rotating polygonal mirror and an arrangement of several fixed mirrors to generate their complex scan patterns.

Omni-directional scanners are most familiar through the horizontal scanners in supermarkets, where packages are slid over a glass or sapphire window. There are a range of different omni-directional units available which can be used for differing scanning applications, ranging from retail type applications with the barcodes read only a few centimetres away from the scanner to industrial conveyor scanning where the unit can be a couple of metres away or more from the code.

Omni-directional scanners are also better at reading poorly printed, wrinkled, or even torn barcodes.

Cell phone cameras

While cell phone cameras without auto-focus are not ideal for reading some common barcode formats, there are 2D barcodes which are optimized for cell phones, as well as QR Codes and Data Matrix codes which can be read quickly and accurately with or without auto-focus. These open up a number of applications for consumers:

- Movies: DVD/VHS movie catalogs
- Music: CD catalogs, play MP3 when scanned
- Book catalogs and device.
- Groceries, nutrition information, making shopping lists when the last of an item is used, etc.
- Personal Property inventory (for insurance and other purposes)ode scanned into personal finance software when entering. Later, scanned receipt images can then be automatically associated with the appropriate entries. Later, the bar codes can be used to rapidly weed out paper copies not required to be retained for tax or asset inventory purposes.
- If retailers put barcodes on receipts that allowed downloading an electronic copy or encoded the entire receipt in a 2D barcode, consumers could easily import data into personal finance, property inventory, and grocery management software. Receipts scanned on a scanner could be automatically identified and associated with the appropriate entries in finance and property inventory software.
- Consumer tracking from the retailer perspective (for example, loyalty card programs that track consumers purchases at the point of sale by having them scan a QR code).

A number of enterprise applications using cell phones are appearing:

- Access control (for example, ticket validation at venues), inventory reporting (for example, tracking deliveries), asset tracking (for example, anti-counterfeiting).

USB

Later barcode readers began to use USB connectors rather than the keyboard port, as this became a more convenient hardware option. To retain the easy integration with existing programs, a device driver called a "software wedge" could be used, to emulate the keyboard-impersonating behavior of the old "keyboard wedge" hardware.

In many cases, a choice of USB interface types (HID, CDC) are provided. Some have PoweredUSB.

Wireless networking

Some modern handheld barcode readers can be operated in wireless networks according to IEEE 802.11g (WLAN) or IEEE 802.15.1 (Bluetooth). Some barcode readers also support radio frequencies viz. 433 MHz or 910 MHz. Readers without external power sources require their batteries be recharged occasionally, which may make them unsuitable for some uses.

Evaluating Barcode Reading Technologies:

Laser vs. Imager

Choosing the right barcode reading technology is fundamental to achieving optimal performance from a data collection solution. As new symbologies and technologies are developed, the choices are more varied than ever. There has been much debate on

the merits of laser-based and camera-based barcode readers, and in fact, some have asserted that only image-based readers should be considered for new automation applications.

Choosing the right barcode reading technology is fundamental to achieving optimal performance from a data collection solution. As new symbologies and technologies are developed, the choices are more varied than ever. There has been much debate on the merits of laser-based and camera-based barcode readers, and in fact, some have asserted that only image-based readers should be considered for new automation applications. While 1D use is declining in some industries where the small size of 2D symbols makes them a more attractive option, linear barcodes remain a critical element in many applications and industries, including clinical diagnostics, pharmaceutical packaging, and shipping labels. With the benefits of simplicity, low cost, universal recognition, and ability to be printed and decoded easily, 1D symbols are still widely popular across the globe. Laser scanners can only decode in one dimension, so 2D symbols must be read with imagers or other camera-based products, which can also decode 1D symbols.

Imaging Technology

Developed in the 1990s, camera-based imaging technology uses rows of CCD or CMOS sensors arranged in a two-dimensional array to generate an image of the ymbol. This image processing provides the capability to decode both 1D and 2D ormats. 2D symbols such as the Data Matrix (invented in1994 by I.D. Matrix, now a art of Microscan) have been adopted in industries including electronics and automotive manufacturing because they allow large amounts of data within a small area. Information-dense 2D symbols are also favored for use in marking small items for tracking throughout their life cycle, a process known as direct part marking or DPM.

Choosing the Right Technology for Your Application

Laser products benefit from nearly 40 years of refining the technology, allowing the creation of technology standards, and perfecting the most cost-effective units. Today's products provide a high cost-performance ratio. Imaging products are a more recent development and provide reading solutions at a higher

cost and level of complexity due to their more sophisticated and expensive components.

While camera - based imagers must filter through captured pixels and experience slower decode rates (relative to laser scanners), they have the added benefit of quality validation and the flexibility to read a much wider variety of symbols.

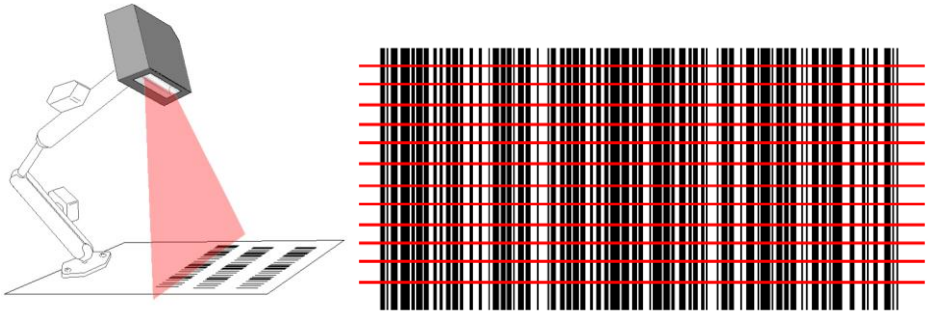


Figure 4: Laser scanners use only one row of pixels to perceive a 1D image and decode a symbol.

Manufacturers should assess the best technology and product to meet their specific application needs at an optimal cost-performance ratio. Below are some simple rules to use when evaluating a barcode application.

1. If an application is using a 1D barcode and/or a stacked symbol such as PDF417, a laser scanner will often prove more advantageous than an imager.

• Lasers provide reliable performance at a usually lower cost.

• Lasers are faster and typically provide decode rates of over 1,000 real-time decodes per second.

• Lasers provide a sharp, clear laser line which only focuses on the barcode.

• Lasers can read over long distances and provide greater depth of field (the inside and outside distance from the scanner).

• Lasers are less complex; they are easier to use and integrate into an instrument or a manufacturing line.

2. If the application includes 1D or stacked 2D symbols that are poorly printed, damaged, or vary dramatically, it is possible to use either laser or imaging products.

For high speed or high throughput applications, laser scanners may be the better option. In some cases, poor quality or damaged symbols can be read by laser scanners with advanced code reconstruction algorithms, such as Microscan's QX-830 with X-Mode (see Figure 6). Many laser products do have limited quality checking to assess readability, but if the barcodes are extremely damaged or if dramatic variation is expected in symbol orientations, use of imaging technology will be required.

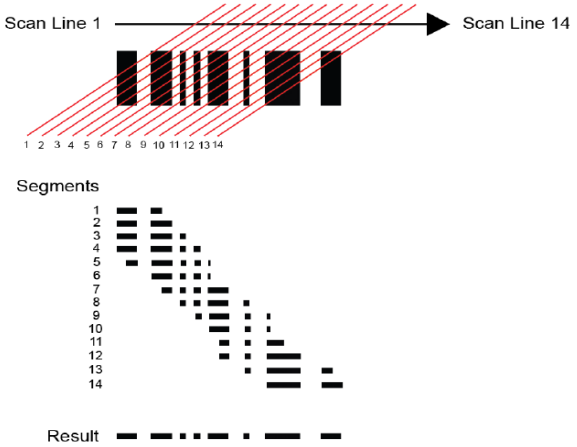


Figure 6: This example illustrates in general terms how Microscan's X-Mode decoding algorithm combines several incomplete segments of a poor quality or damaged symbol into the equivalent of a complete scan line to decode the data.

Interfacing a Barcode Reader to a PC

All application programs support barcode reading as long as you have the right equipment. Barcode readers are available with two types of output - either "keyboard wedge" output or RS232 output. The barcode readers with keyboard wedge output plug directly into the keyboard port on your PC and they also provide a pigtail connector so that you can plug in your keyboard at the same time. When you scan a barcode with the keyboard wedge barcode reader, the data goes into the computer just as if it were typed in on the keyboard. This makes it

extremely easy to interface the barcode reader to any application that is written to accept keyboard data.

The keyboard wedge interface is extremely simple however it has a few drawbacks. If you swipe a barcode, the cursor has to be in the correct input field in the correct application otherwise you end up reading barcode data into whatever application has the focus. This can cause all sorts of potential problems as you can imagine. The keyboard output also is limited in that you cannot modify the data in any way before sending it into the program that is to receive the data. For example, if you needed to parse a barcode message into multiple pieces or remove some of a barcode message or add in a date or time stamp you would not be able to with a normal keyboard wedge reader.

The other possible output option is to get a barcode reader with an RS232 or "Serial" interface. With these types of barcode readers, you connect the reader to an available serial port on the back of your PC. You would then need a program called a "Software Wedge" to take the data from the barcode reader and feed it to the application where you want the data to go. The disadvantage to this approach is that it is a little more complex however you gain much more control over how and where your data ends up when you read a barcode.

Our WinWedge product line is designed just for this purpose. WinWedge is an executable program that can pass serial data back and forth to other programs using either DDE (Dynamic Data Exchange) or by converting incoming serial data to keystrokes (i.e. it stuffs the keyboard buffer with the incoming serial data). With WinWedge, you can control exactly where the data goes in the target application and you can also perform all sorts of modifications on the data before it is sent to the application including parsing or translating the data as well as adding additional keystrokes or date and time stamps to the data.

WinWedge is extremely easy to use and is designed to have you up and running sending and receiving serial data directly from within your application in just a few minutes. Because WinWedge can pass data using DDE, you can set your application up to insure that the barcode data always goes where it is supposed to

go and you can also have your application running in the background and still accept barcode input while you run some other program in the foreground. WinWedge is without question the most robust way to interface a barcode reader to a PC with the least amount of effort.

Barcode scanners in PHP applications

PHP can be easily utilized for reading bar codes printed on paper documents. Connecting manual barcode reader to the computer via USB significantly extends usability of PHP (or any other web programming language) into tasks involving document and product management, like finding a book records in the database or listing all bills for a particular customer.

Following sections briefly describe process of connecting and using manual bar code reader with PHP.

The usage of bar code scanners described in this article are in the same way applicable to any web programming language, such as ASP, Python or Perl. This article uses only PHP since all tests have been done with PHP applications.

Bar code reader is a hardware pluggable into computer that sends decoded bar code strings into computer. The trick is to know how to catch that received string. With PHP (and any other web programming language) the string will be placed into focused input HTML element in browser. Thus to catch received bar code string, following must be done:

- just before reading the bar code, proper input element, such as INPUT TEXT FIELD must be focused(mouse cursor is inside of the input field).
- once focused, start reading the code
- when the code is recognized (bar code reader usually shortly beeps), it is send to the focused input field. By default, most of bar code readers will append extra special character to decoded bar code string called CRLF (ENTER). For example, if decoded bar code is "12345AB"**,** then computer will receive

"12345AB<ENTER>". Appended character <ENTER> (or <CRLF>) emulates pressing the key ENTER causing instant submission of the HTML form:

```
<form action="search.php" method="post">
<input type="text" name="documentID" onmouseover="this.focus();">
</form>
```

Choosing the right bar code scanner

When choosing bar code reader, one should consider what types of bar codes will be read with it. Some bar codes allow only numbers, others will not have checksum, some bar codes are difficult to print with inkjet printers, some barcode readers have narrow reading pane and cannot read for example barcodes with length over 10 cm. Most of barcode readers support common barcodes, such as EAN8, EAN13, CODE 39, Interleaved 2/5, Code 128 etc.

For office purposes, the most suitable barcodes seem to be those supporting full range of alphanumeric characters, which might be:

- code 39 - supports 0-9, uppercased A-Z, and few special characters (dash, comma, space, $, /, +, %, *)
- code 128 - supports 0-9, a-z, A-Z and other extended characters

Other important things to note:

- make sure all standard barcodes are supported, at least CODE39, CODE128, Interleaved25, EAN8, EAN13, PDF417, QRCODE.
- use only standard USB plugin cables. RS232 interfaces are meant for industrial usage, rather than connecting to single PC.
- the cable should be long enough, at least 1.5 m - the longer the better.
- bar code reader plugged into computer should not require other power supply - it should power up simply by connecting to PC via USB.
- if you also need to print bar code into generated PDF documents, you can use TCPDF open source library that supports most of common 2D bar codes.

Installing scanner drivers

Installing manual bar code reader requires installing drivers for your particular operating system and should be normally supplied with purchased bar code reader.

Once installed and ready, bar code reader turns on signal LED light. Reading the barcode starts with pressing button for reading.

Scanning the barcode

STEP 1 - Focused input field ready for receiving character stream from bar code scanner:

STEP 2 - Received barcode string from bar code scanner is immediatelly submitted for search into database, which creates nice "automated" effect:

STEP 3 - Results returned after searching the database with submitted bar code:

Chapter two summary

In chapter 2 chosen programming languages, devices and their connection were considered, their advantages were explained.

Utilization of PHP web programming language for scanning the bar codes has been quite overlooked so far. However, with natural support of emulated

keypress it is very easy to automate collecting & processing recognized bar code strings via simple HTML (GUI) fomular.

Using barcode Scanners are one of the best way when it is being built in automated library system. So it is decided to use this technologies for transactions while loaning book process.

CHAPTER III. CREATION OF COLECTION OF HARDWARE AND SOFTWARE FOR AUTOMATED LIBRARY SYSTEM

3.1. Requirements for devices and instrumental means

This project is devided in two parts, so the software has client-side and server-side program. That's why the following devices and instrumental means will be required:

- ❖ Web Server
- ❖ Personal Computer
- ❖ Browser
- ❖ Barcode Scanner
- ❖ ISBN barcode tagged on the book

Web Servers

A web server is a combination of the two things a computer machine and software installed on it such as Apache and IIS to process the HTTP requests from the client browsers. A web server is also known as the HTTP server. Client's software (browser) sends a request to the web server for the specific page and if the web server finds this page it sends back to the browser, which then displays it at the client computer. Web server can refer to either the hardware (the computer) or he software (the computer application) that helps to deliver content that can be accessed through the Internet.

The most common use of Web servers is to host Web sites but there are other uses like data storage or for running enterprise applications. The primary function of a web server is to deliver web pages on the request to clients. This means delivery of HTML documents and any additional content that may be included by a document, such as images, style sheets and JavaScript. A client, commonly a web browser or web crawler, initiates communication by making a request for a specific resource using HTTP and the server responds with the content of that resource or an error message if unable to do so. The resource is typically a real file on the server's secondary memory, but this is not necessarily the case and depends on how the web server is implemented. While the primary function is to serve content, a full implementation of HTTP also includes ways of receiving content from clients. This feature is used for submitting web forms,

including uploading of files. Many generic web servers also support server-side scripting, e.g., Apache HTTP Server and PHP.

This means that the behaviour of the web server can be scripted in separate files, while the actual server software remains unchanged. Usually, this function is used to create HTML documents "on-the-fly" as opposed to returning fixed documents. This is referred to as dynamic and static content respectively. The former is primarily used for retrieving and/or modifying information from databases. The latter is, however, typically much faster and more easily cached. Web servers are not always used for serving the World Wide Web. They can also be found embedded in devices such as printers, routers, webcams and serving only a local network. The web server may then be used as a part of a system for monitoring and/or administrating the device in question. This usually means that no additional software has to be installed on the client computer, since only a web browser is required (which now is included with most operating systems).

Browser

All modern browsers are supported for this project. Such as Chrome 10+, Mozilla 9+, Firefox 10+, IE 10+ and etc.

ISBN barcode tagged on the book

The most important requirement of this project is to tag barcode on each book. Then it becomes to be fast the borrowing and returning process by using barcode Scanners.

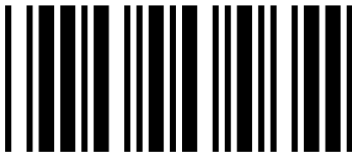
3.2. Setting Barcode Scanner for Software

To run software, Browser is required as well as Operation System(OS) is. Currently Windows 7 OS is used. Because it is easy to use and command used OS.

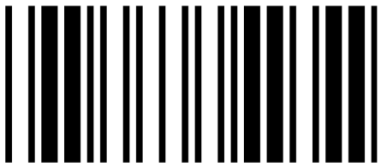
The type of Barcode Scanner is Advanced Handheld CCD/Laser Scanner witch was made in September 9, 2010 as Initial release version by CCD company.

For setting Barcode Scanner for Software, there are several steps to do:

1. To power up the Barcode Scanner connect it to PC via USB port.
2. Scan the Start of Configurationbarcode.



3. Scan the barcode for the desired feature. Multiple features can be enabled/disabled before scanning the End of Configurationbarcode.

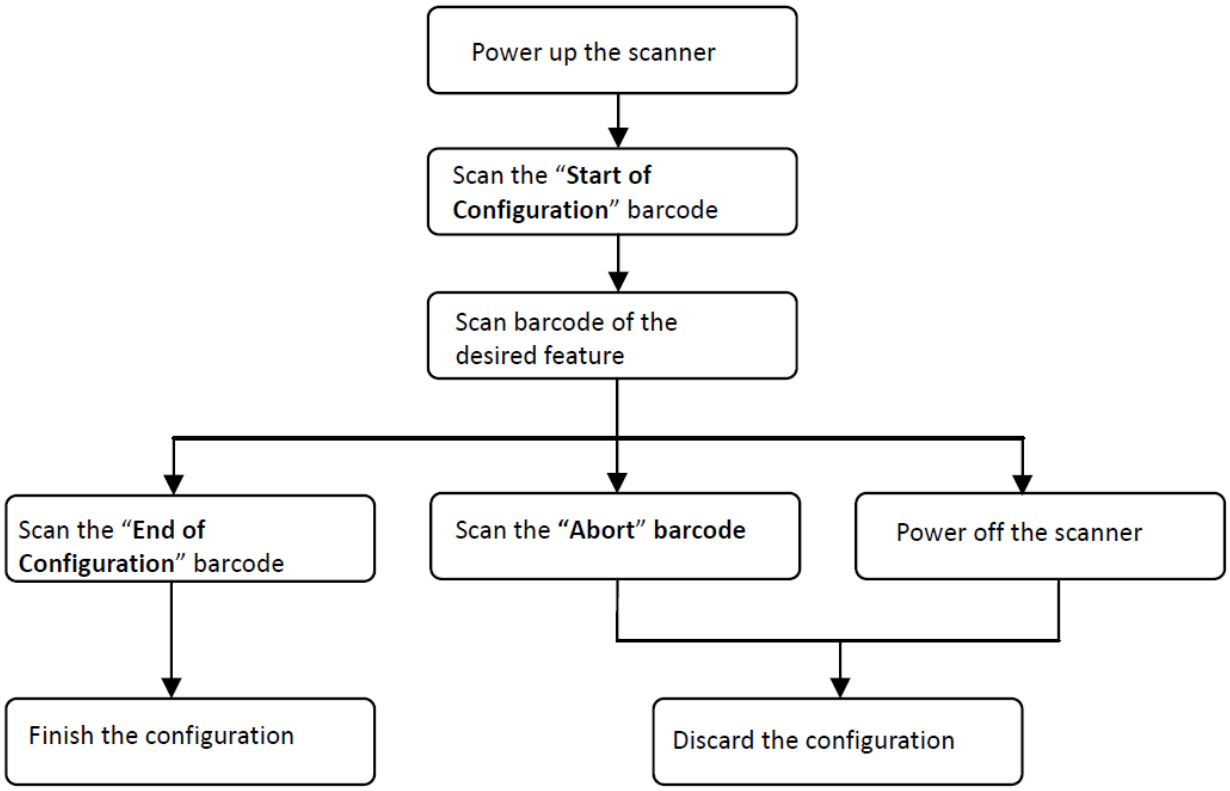


4. Scan the End of Configurationbarcode and save the new configuration.

5. To give up a configuration change, power off the scanner before scanning the End of Configurationbarcode or scan the Abortbarcode.

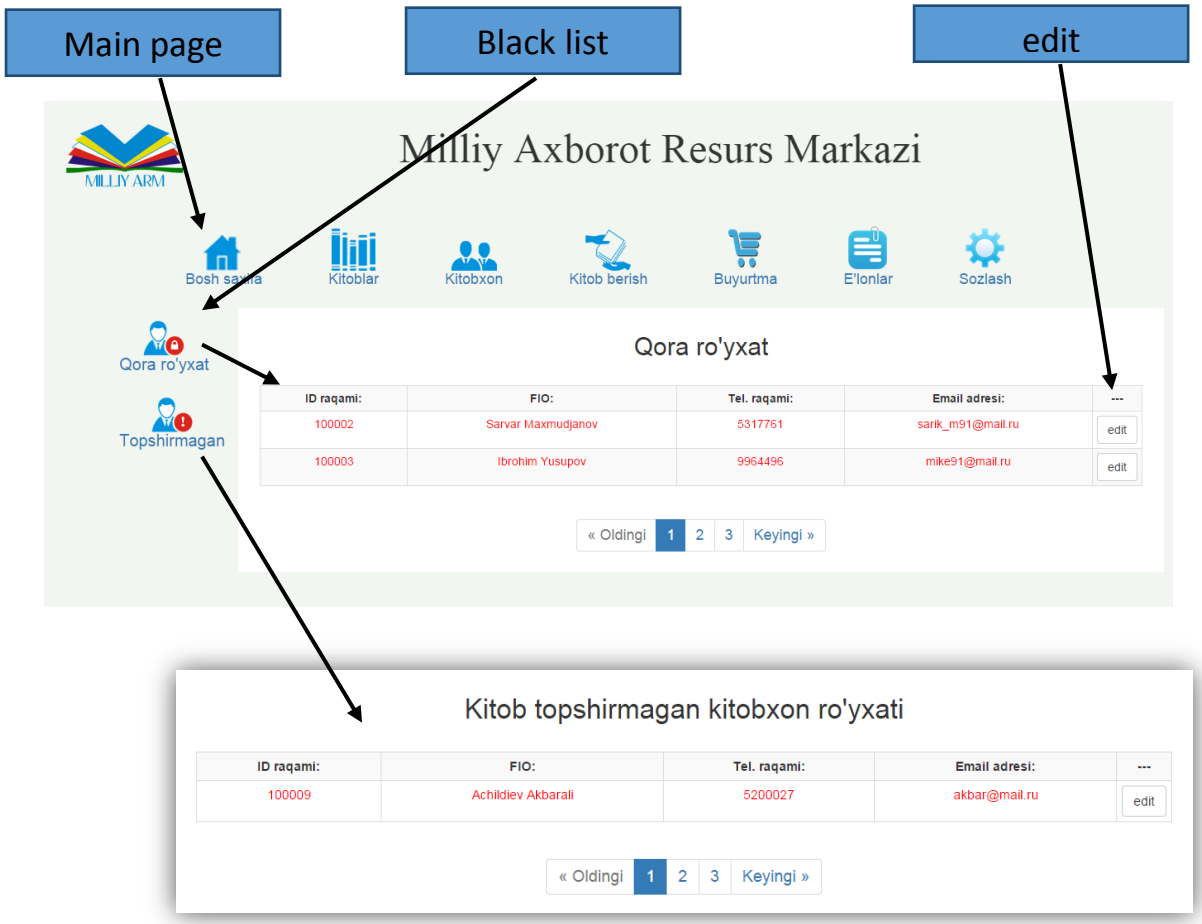
6. For some parameter setting, such as barcode length and identifier code, it is required to scan the Setbarcode to save the configuration.

Setting Procedure of Barcode Scanner

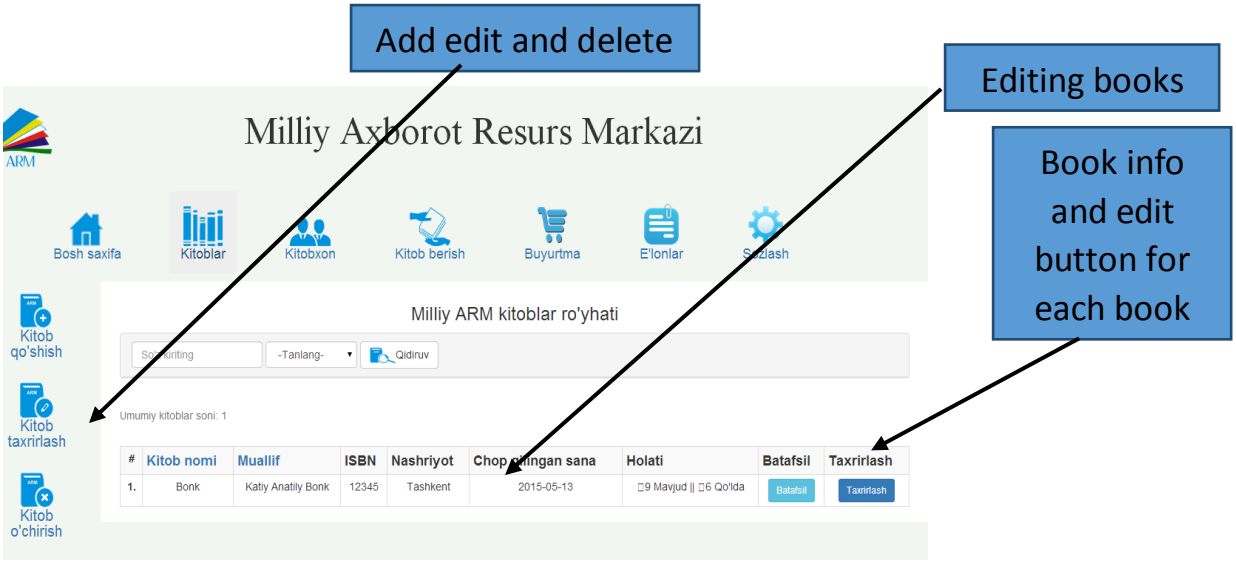


3.3. Software usage

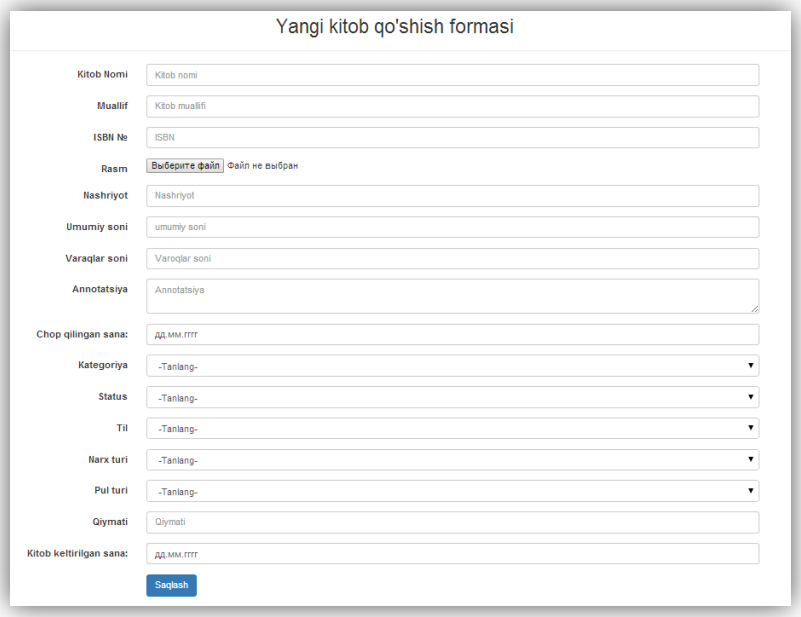
Main page called <Bosh saxifa> was given in this screenshot. It shows member's list who is in black list and there is <edit> button next to name table to edit.



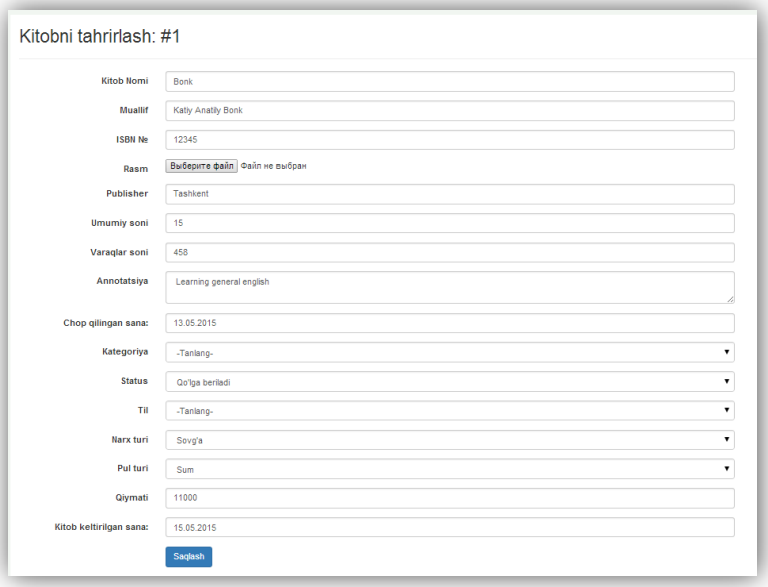
This is <Kitoblar> page and there are three buttons on the left side of the application such as: adding, editing and deleting. In the content of the page there is search functions by category and list of books order by data.



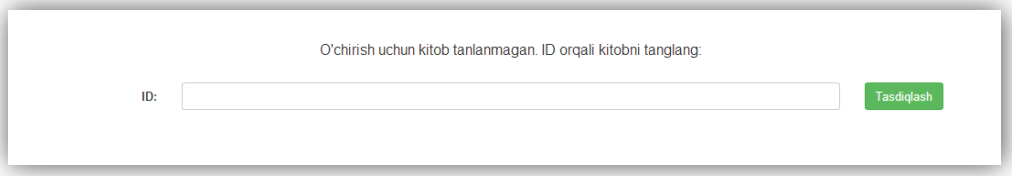
Adding a new book form



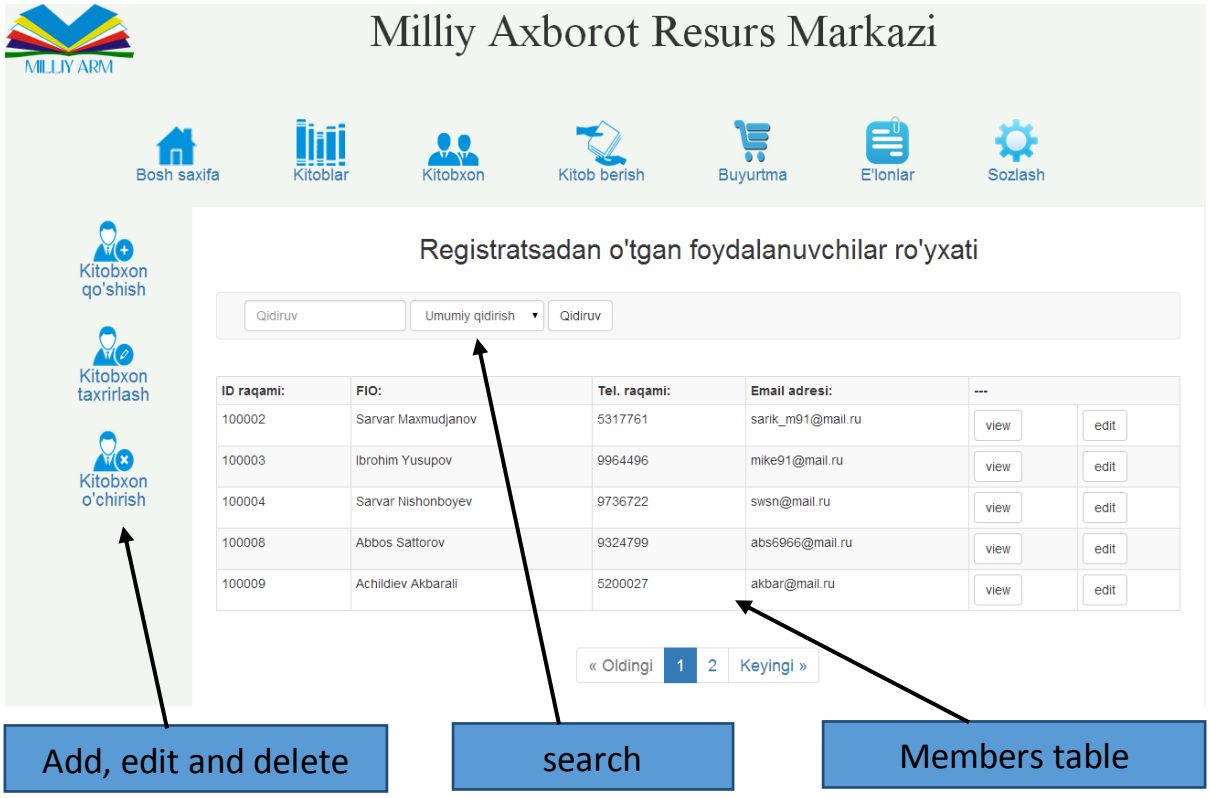
Editing a new book form



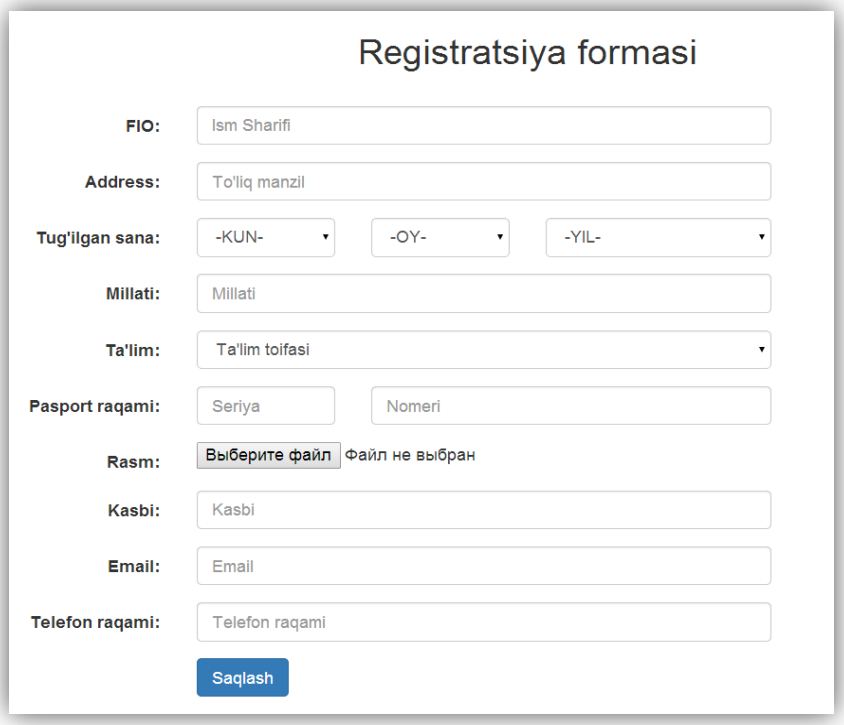
Deleting the book which is chosen



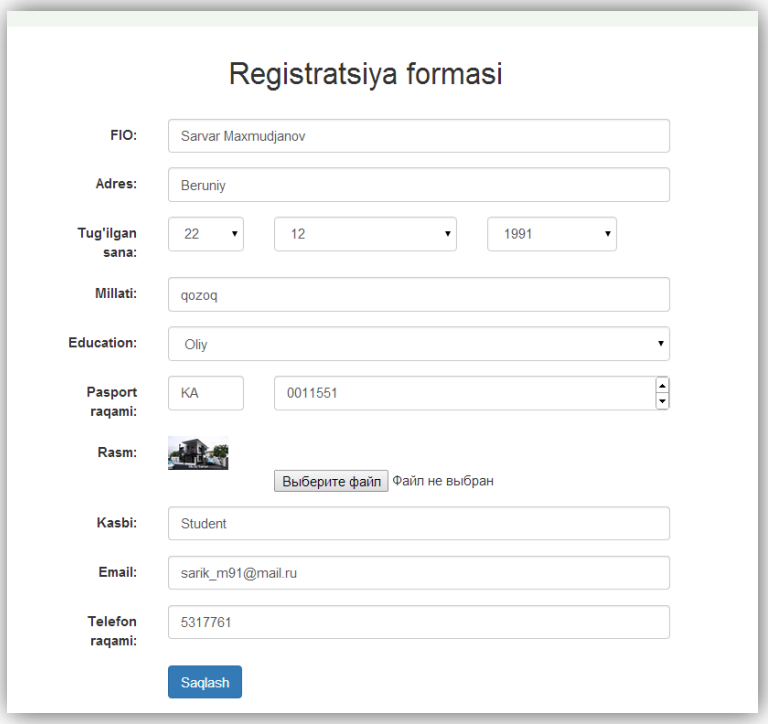
The step is to <Kitobxon> page. In this page all operations on member are implemented as <Kitoblar> page. So it is too similar precious page.



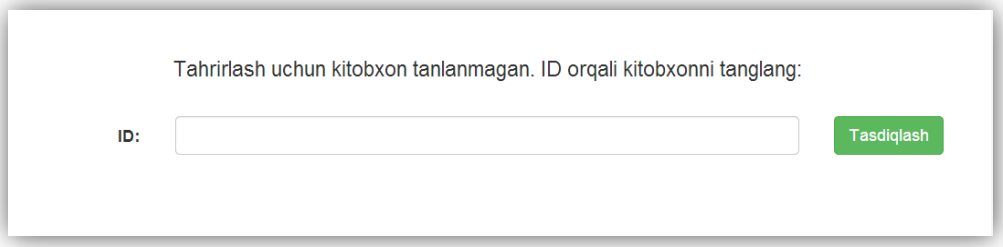
Adding a new member or registration form.



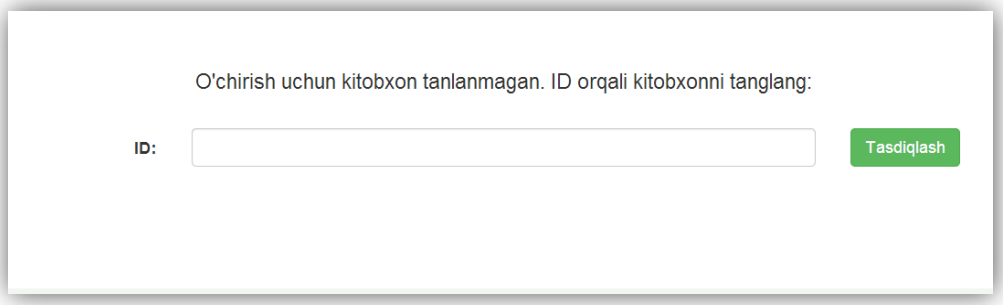
Editing chosen member or changing informations about the current member



If member is not chosen to edit the following page will be displayed

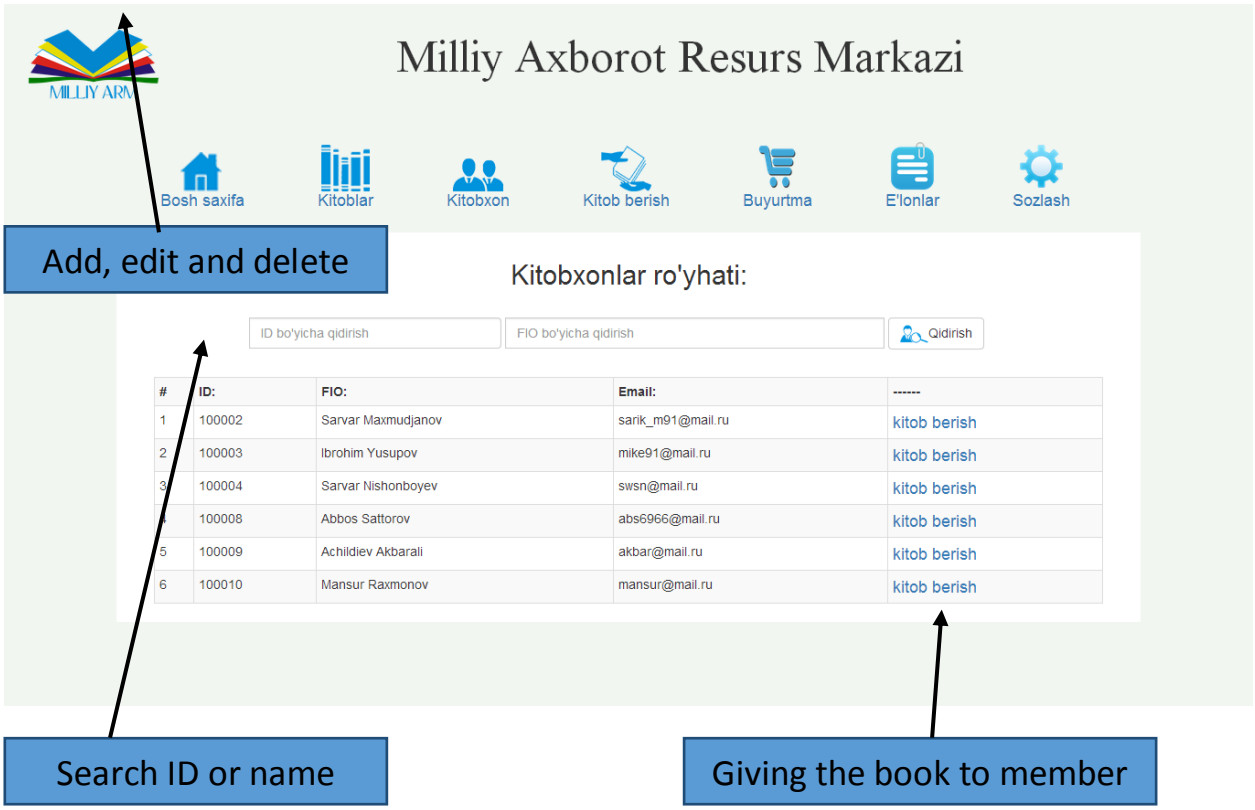


Deleting member from database that we chose. For this, ID number of member is required.

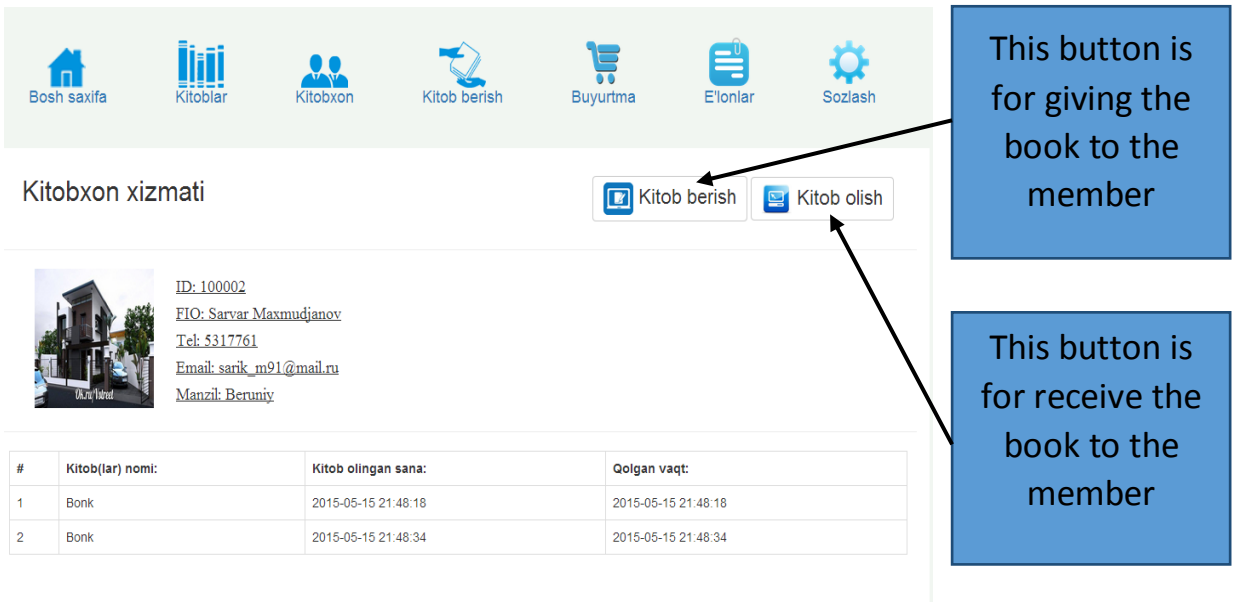


This page called <Kitob berish> is about transactions. Borrowing books and registrating them into members' account by using Barcode Scanners. When the

page is opened, the list of members will be diplayed order by date. There is also search ID member to give the book to the member whom he/she wants to take.

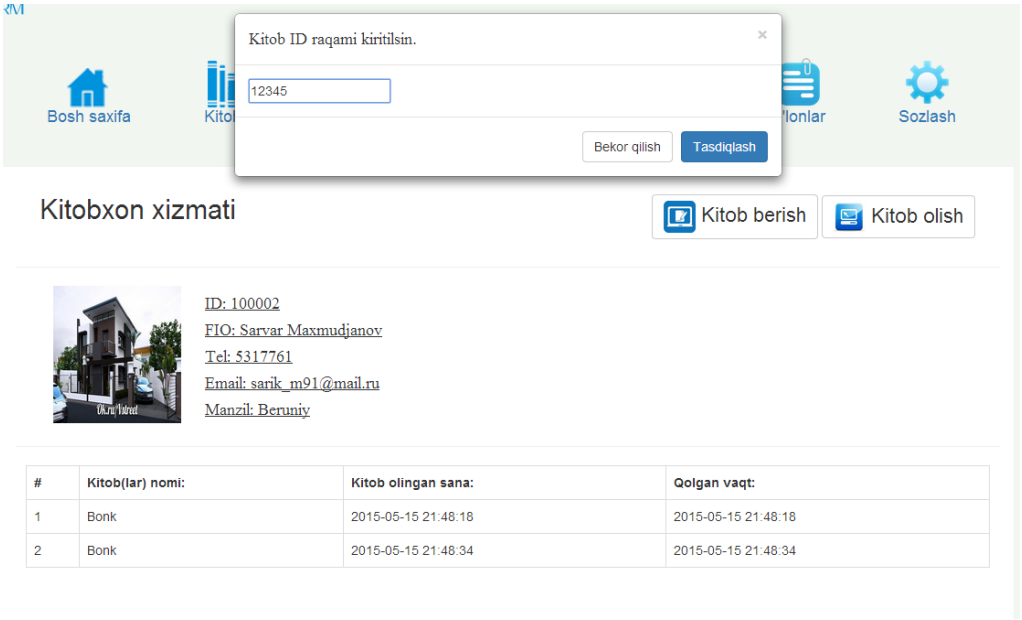


After pressing <kitob berish> button the following page will be dispaled. There is all information about member's history like loaned books' list if he/she does or other information as a table.



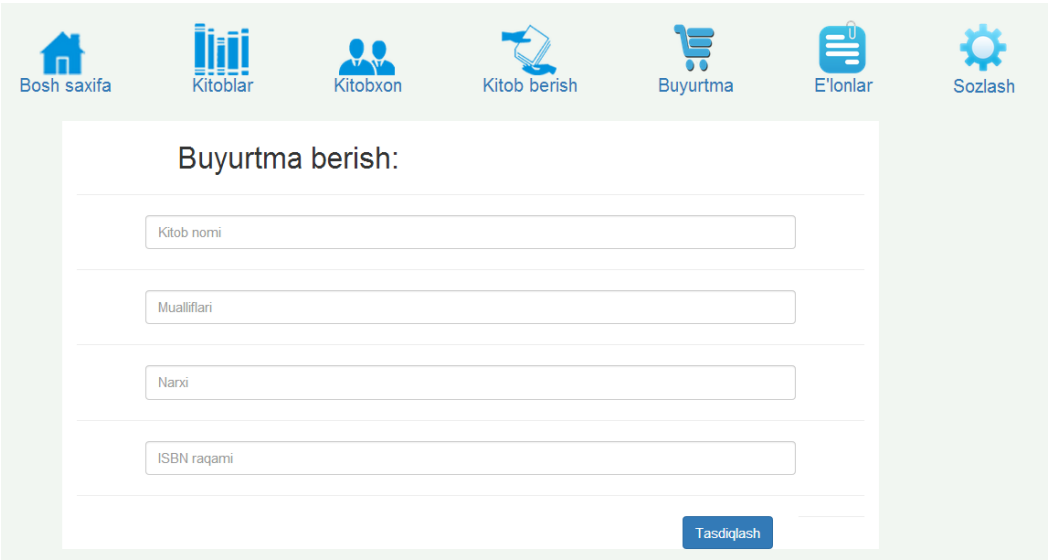
After choosing member who the book should be given to, on a new window two button will appear: giving the book and receiving the book. It is required to

choose one of them then, modal window will be shown and there is input form to enter ISBN number of the book via Barcode Scanner



To save transaction, it should be press <tasdiqlash> button or vise verse. Then the book will be registrated into member's account and it will be sored into database.

<Buyurtma> is order page. In this page user can save ordered book list from members. It is the best way to collect all orders and send them together to publisher as a list. There is a form to fulfill name of books, date and etc.



<E’lonlar> page is an announcement for member from library administration such as: news, new delivered books or other

Last page is <Sozlash> settings. It consists of a few input fields to set the whole system as it is required in library. Period of loaning time, allowed book number for each member and so on are situated in the form.

Chapter three summary

In chapter, Requirements for devices and instrumental means and Setting Barcode Scanner for Software were carried out, software usage of automated library system was explained; its functions and modulswere considered.

The system and development tools were chosen based on their specific features that benefit the system. Furthermore, all necessary components in the library management system were integrated and tested.

The understanding of the development tools directly affected the quality of the website. The system which was built in this project offered a high performance, secure, stable and an easy-to-maintain environment. In addition, the application improved the online management of automated library system.