

ID-Card Generator System For College Students

MINOR PROJECT REPORT

SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR
THE AWARD OF THE DEGREE OF
BACHELOR OF TECHNOLOGY

Information Technology



SUBMITTED BY:

Himanshu Mahajan(2104587)

Lakshmi(2004949)

Neelam sharma(2004962)

SUBMITTED TO:

Prof.Rupinder Kaur

Department of Information Technology,

Guru Nanak Dev Engineering College

Ludhiana-141006

Acknowledgment

I express my gratitude to the Principle Dr.Sehajpal Singh for having providing me facilities to do the project successfully.

I would like to express my special thanks of gratitude to our teachers Dr. K.S Mann who gave me golden chance to do this project on QR Code Recognition , which also helped me in doing a lot of research and I came to know about many new things. I am really thankful to them. Secondly I am thankful to my parents and friends who helped me a lot in finishing this project within a limited time period. I am not making this project only for marks but also to increase knowledge. I have given efforts to this project. However, it would not have possible without the help and kind support of many individuals and organizations would like to extend my sincere thanks to all of them.

I thank my God for providing me with everything that I required in completing my project. I would like to express my gratitude towards my parents for their kind co-operation and encouragement which help me in the completion of this project. I would like to express my special gratitiude and thanks to industry persons for giving me such attention and time. My thanks and appreciation also to our classmates in developing the project and to the people who have willingly help me out with their abilities.

Himanshu Mahajan (2104587)

Lakshmi Singh (2004949)

Neelam Sharma (2004962)

Abstract

The project is related to the student entry system in our college, our main focus for this project id to build a website which contains the data set of the current students in the college. Any student can visit the site and can login through his/her credentials and then he /she can download their id card which contains a unique qr code through which the entry of the students can be possible in the college premises. The main goal of this project is to create a safe environment and a proper disciplined place where student can learn more qualitatively.

This can help stopping the outsiders to enter in the college premises which is one of the major issues in our college. This can be achieved by providing students a unique qr codes for each student and qr code scanners are to be installed on the main gate of the college which checks for the authenticity of the qr code and it will then allow the student to pass through the gate.

For this project there will be a website from which a student can download their id cards which contain the unique QR codes. And there will be a admin panel which is for the college authorities which can check for the authenticity of the student and then can permit his/her inside the college.

Now a days it can be seen that any outsider can easily enter into our college as there is no proper security management in our college. And this thing disturbs the environment of the college and also many students gets disturbs from their studies. Also the outsiders are not good for the college environment so this can help the college in maintaining a proper decorum of the college. This technology restricts the outsiders to enter in the college and hence the discipline is maintained in the college. Also the outsiders cannot perform any kind of malicious things in our college premises.

1 Introduction

1.1 Introduction to Project

The project is related to the student entry system in our college, our main focus for this project id to build a website which contains the data set of the current students in the college. Any student can visit the site and can login through his/her credentials and then he /she can download their id card which contains a unique qr code through which the entry of the students can be possible in the college premises. The main goal of this project is to create a safe environment and a proper disciplined place where student can learn more qualitatively.

This can help stopping the outsiders to enter in the college premises which is one of the major issues in our college. This can be achieved by providing students a unique qr codes for each student and qr code scanners are to be installed on the main gate of the college which checks for the authenticity of the qr code and it will then allow the student to pass through the gate.

For this project there will be a website from which a student can download their id cards which contain the unique QR codes. And there will be a admin panel which is for the college authorities which can check for the authenticity of the student and then can permit his/her inside the college. Now a days it can be seen that any outsider can easily enter into our college as there is no proper security management in our college. And this thing disturbs the environment of the college and also many students gets disturbs from their studies. Also the outsiders are not good for the college environment so this can help the college in maintaining a proper decorum of the college. This technology restricts the outsiders to enter in the college and hence the discipline is maintained in the college. Also the outsiders cannot perform any kind of malicious things in our college premises.

1.2 Objectives of the project

1. To develop a system that can restrict the entry of outsiders into our college
2. The system can recognize college students and can be helpful in maintaining the proper discipline of the college.
3. To create a system that can also contribute to the student management system if it is implemented as per the college data-set of students.

1.3 Web Development

Web development refers to the building, creating, and maintaining of websites. It includes aspects such as web design, web publishing, web programming, and database manage-

ment. It is the creation of an application that works over the internet i.e. websites. The word Web Development is made up of two words, that is: Web: It refers to websites, web pages or anything that works over the internet. Development: Building the application from scratch.

- **Front-end Development**

A front-end developer creates websites and applications using web languages such as HTML, CSS, and JavaScript that allow users to access and interact with the site or app. When you visit a website, the design elements you see were created by a front-end developer.

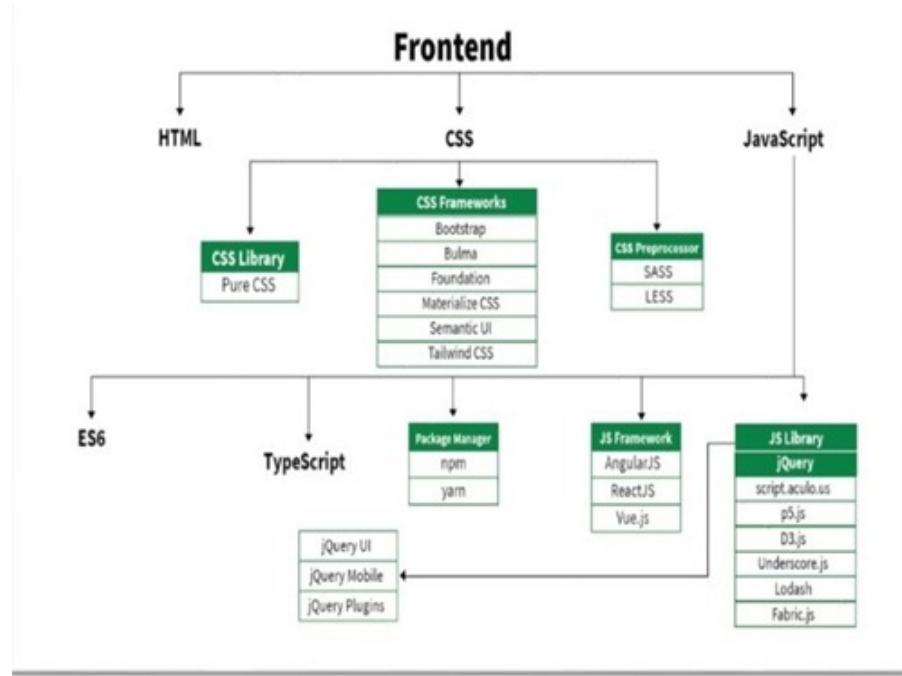


Figure 1: Front-end Development

1.3.1 HTML

HTML (HyperText Markup Language) is the most basic building block of the Web. It defines the meaning and structure of web content. Other technologies besides HTML are generally used to describe a web page's appearance/presentation (CSS) or functionality/behavior (JavaScript).

"Hypertext" refers to links that connect web pages to one another, either within a single website or between websites. Links are a fundamental aspect of the Web. By uploading content to the Internet and linking it to pages created by other people, you become an active participant in the World Wide Web.

Opening Tag	Closing Tag	Description
<h1> to <h6>	</h1> to </h6>	Headings. H1 is the main heading, H2 is secondary, etc.
<p>	</p>	Paragraph
<div>	</div>	A container for a <i>block</i> of content
		A container for <i>in-line</i> content, such as content inside a paragraph.
< <u>em</u> >	</ <u>em</u> >	Gives the contained text emphasis (usually as <i>italics</i>).
		Makes the contained text bold .
		Link
< <u>ol</u> >	</ <u>ol</u> >	Ordered (numbered) list
< <u>ul</u> >	</ <u>ul</u> >	Unordered (bulleted) list
		List item, must be nested inside a list element such as a < <u>ol</u> > or < <u>ul</u> >
<!--	-->	Comment. Anything between these tags is not displayed on the screen. This is useful for making notes to yourself or to others who may view the source code of the web page.

Figure 2: HTML Tags

1.3.2 CSS

A document is usually a text file structured using a markup language — HTML is the most common markup language, but you may also come across other markup languages such as SVG or XML.

Presenting a document to a user means converting it into a form usable by your audience. Browsers, like Firefox, Chrome, or Edge, are designed to present documents visually, for example, on a computer screen, projector, or printer.

1.3.3 Javascript

JavaScript is a scripting or programming language that allows you to implement complex features on web pages — every time a web page does more than just sit there and display static information for you to look at — displaying timely content updates, interactive maps, animated 2D/3D graphics, scrolling video jukeboxes, etc. — you can bet that JavaScript is probably involved.

It is the third layer of the layer cake of standard web technologies, two of which (HTML and CSS) we have covered in much more detail in other parts of the Learning Area



Figure 3: Javascript layring cake

1.3.4 Bootstrap

Bootstrap is a free front-end framework for faster and easier web development.

Bootstrap includes HTML and CSS based design templates for typography, forms, buttons, tables, navigation, modals, image carousels and many other, as well as optional JavaScript plug-in • Bootstrap also gives you the ability to easily create responsive designs. Responsive web design is about creating web sites which automatically adjust themselves to look good on all devices, from small phones to large desktops.

1.3.5 Php

Hypertext Preprocessor:- An extremely popular scripting language that is used to create dynamic Web pages. Combining syntax from the C, Java and Perl languages, PHP code is embedded within HTML pages for server side execution. It is commonly used to extract data out of a database on the Web server and present it on the Web page. Originally known as "Personal Home Page," PHP is supported by all Web servers and widely used with the MySQL database. See MySQL.

- Phpqr code library:-

PHP QR Code is open source (LGPL) library for generating QR Code, 2-dimensional barcode. Based on libqrencode C library, provides API for creating QR Code barcode images (PNG, JPEG thanks to GD2). Implemented purely in PHP, with no external dependencies (except GD2 if needed).

To install simply include: qrlib.php for full version (also you have to provide all library files form package plus cache dir) OR phpqr code.php for merged version

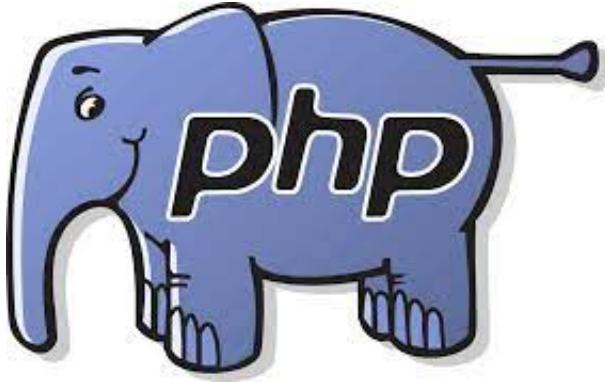


Figure 4: PHP Logo

(only one file, but slower and less accurate code because disabled cache and quicker masking configured)

Then use it as follows:

```
QRcode::png('code data text', 'filename.png'); // creates file QRcode::png('some othertext 1234'); // creates code image and outputs it directly into browser
```

Above examples show the most basic usage. For more features and customization see Detailed examples and PHP QR Code wiki or read INSTALL file in distribution package.

1.3.6 Python

Python is an interpreted, object-oriented, high-level programming language with dynamic semantics. Its high-level built in data structures, combined with dynamic typing and dynamic binding, make it very attractive for Rapid Application Development, as well as for use as a scripting or glue language to connect existing components together. Python's simple, easy to learn syntax emphasizes readability and therefore reduces the cost of program maintenance. Python supports modules and packages, which encourages program modularity and code reuse. The Python interpreter and the extensive standard library are available in source or binary form without charge for all major platforms, and can be freely distributed.

Often, programmers fall in love with Python because of the increased productivity it provides. Since there is no compilation step, the edit-test-debug cycle is incredibly fast. Debugging Python programs is easy: a bug or bad input will never cause a segmentation fault. Instead, when the interpreter discovers an error, it raises an exception. When the program doesn't catch the exception, the interpreter prints a stack trace. A source level debugger allows inspection of local and global variables, evaluation of arbitrary expressions, setting breakpoints, stepping through the code a line at a time, and so on. The debugger is written in Python itself, testifying to Python's introspective power. On the

other hand, often the quickest way to debug a program is to add a few print statements to the source: the fast edit-test-debug cycle makes this simple approach very effective.



Figure 5: Python Logo

- numPy:-

NumPy is the fundamental package for scientific computing in Python. It is a Python library that provides a multidimensional array object, various derived objects (such as masked arrays and matrices), and an assortment of routines for fast operations on arrays, including mathematical, logical, shape manipulation, sorting, selecting, I/O, discrete Fourier transforms, basic linear algebra, basic statistical operations, random simulation and much more.



Figure 6: Numpy Logo

- cv2 python :-

cv2 is the module import name for opencv-python, "Unofficial pre-built CPU-only OpenCV packages for Python". The traditional OpenCV has many complicated steps involving building the module from scratch, which is unnecessary. I would

recommend remaining with the opencv-python library.

The IDE probably doesn't recognize the cv2 commands because you are using a 64 bit version of opencv-python on a 32 bit version of Python or vice-versa. I believe this can be resolved by uninstalling your current OpenCV installation using pip uninstall opencv-python and then reinstalling it with the correct version following the linked tutorial.



Figure 7: OpenCV with Python

- Pyzbar:-

The pyzbar module is a module that is responsible for reading and decoding 1-D barcodes or QR codes easily and it requires PIL module in order to function properly. Before implementing the modules, we first need to import both modules. Installation for pyzbar is slightly complicated and depends on the operating system of your machine. For Windows user, zbar DLL comes together with the Windows Python wheels. pip install pyzbar



Figure 8: Qr code scanner with Pyzbar

• Backend Development

Back-end development means working on server-side software, which focuses on everything you can't see on a website. Back-end developers ensure the website performs correctly, focusing on databases, back-end logic, application programming

interface (APIs), architecture, and servers. They use code that helps browsers communicate with databases, store, understand, and delete data.

On a team, back-end developers collaborate with front-end developers, product managers, principal architects, and website testers to build the structure of a website or mobile app. Back-end developers must be familiar with many kinds of tools and frameworks, including languages such as Python, Java, and Ruby. They make sure the back-end performs quickly and responsively to front-end user requests.

1.3.7 MySQL

- What is Database?

It is very important to understand the database before learning MySQL. A database is an application that stores the organized collection of records. It can be accessed and managed by the user very easily. It allows us to organize data into tables, rows, columns, and indexes to find the relevant information very quickly. Each database contains distinct API for performing database operations such as creating, managing, accessing, and searching the data it stores. Today, many databases available like MySQL, Sybase, Oracle, MongoDB, PostgreSQL, SQL Server, etc. In this section, we are going to focus on MySQL mainly.

- What is MySQL?

MySQL is currently the most popular database management system software used for managing the relational database. It is open-source database software, which is supported by Oracle Company. It is fast, scalable, and easy to use database management system in comparison with Microsoft SQL Server and Oracle Database. It is commonly used in conjunction with PHP scripts for creating powerful and dynamic server-side or web-based enterprise applications.

It is developed, marketed, and supported by MySQL AB, a Swedish company, and written in C programming language and C++ programming language. The official pronunciation of MySQL is not the My Sequel; it is My Ess Que Ell. However, you can pronounce it in your way. Many small and big companies use MySQL. MySQL supports many Operating Systems like Windows, Linux, MacOS, etc. with C, C++, and Java languages.

MySQL is a Relational Database Management System (RDBMS) software that provides many things, which are as follows:

It allows us to implement database operations on tables, rows, columns, and indexes. It defines the database relationship in the form of tables (collection of rows and columns), also known as relations. It provides the Referential Integrity between rows or columns of various tables.

- How MySQL Works?

MySQL follows the working of Client-Server Architecture. This model is designed for the end-users called clients to access the resources from a central computer



Figure 9: MySQL Database

known as a server using network services. Here, the clients make requests through a graphical user interface (GUI), and the server will give the desired output as soon as the instructions are matched. The process of MySQL environment is the same as the client-server model.

The core of the MySQL database is the MySQL Server. This server is available as a separate program and responsible for handling all the database instructions, statements, or commands. The working of MySQL database with MySQL Server are as follows:

MySQL creates a database that allows you to build many tables to store and manipulate data and defining the relationship between each table.

Clients make requests through the GUI screen or command prompt by using specific SQL expressions on MySQL.

Finally, the server application will respond with the requested expressions and produce the desired result on the client-side. A client can use any MySQL GUI. But, it is making sure that your GUI should be lighter and user-friendly to make your data management activities faster and easier. Some of the most widely used MySQL GUIs are MySQL Workbench, SequelPro, DBVisualizer, and the Navicat DB Admin Tool. Some GUIs are commercial, while some are free with limited functionality, and some are only compatible with Mac OS. Thus, you can choose the GUI according to your needs.

2 Requirement Analysis and System Specification

2.1 Feasibility Study

During the system analysis the feasibility study of the proposed system is to be carried out. This is to ensure that the purposed system is not a burden. For feasibility analysis, some understanding of the major requirements for the system is essential.

Three key considerations involved in the feasibility analysis are –

2.1.1 Economic Feasibility

This project is economical feasible because this project is almost completely build using the free tools and software, also the website will be hosted on the free platform and after the proper implementation it will be hosted on the college server. The only thing which is to be purchased is a qr code scanner.

2.1.2 Operational Feasibility

This project is expected to solve the problem of the outsiders entry in the college premises which is now a days a very major problem of the college. It is also very good thing to maintain a proper decorum of the college.

2.1.3 Resource feasibility

This involves questions such as how much time is available to build the new system, when it can be built, whether it interferes with normal business operations, type and amount of resources required, dependencies, etc. Contingency and mitigation plans should also be stated here.

2.1.4 Technical feasibility

The study is carried out to check the technical feasibility, that is, the technical requirements of the system. Any system developed must not have a high demand on the available technical resources. This project is built on small scale so it does not have any high demand on resources, hence it technical feasible.

2.2 Requirements of the system

Software requirements :- :

- VS Code :- This is a code editor which is used to write the code in any language and we will use this to write our code for the whole project. It can be used to write the code in the python and also in web development languages.
- Apache Server :- The Apache HTTP Server Project is an effort to develop and maintain an open-source HTTP server for modern operating systems including UNIX and Windows. The goal of this project is to provide a secure, efficient and extensible server that provides HTTP services in sync with the current HTTP standards.

Hardware requirements :-

- CPU – i3 5th generation or above.
- RAM – 4 Gb or more
- Disk Space – 20Gb or more
- Operating System – Any

3 System Design

3.1 Data-Flow Diagram

This flowchart explains the data flow between the student id card generator website.

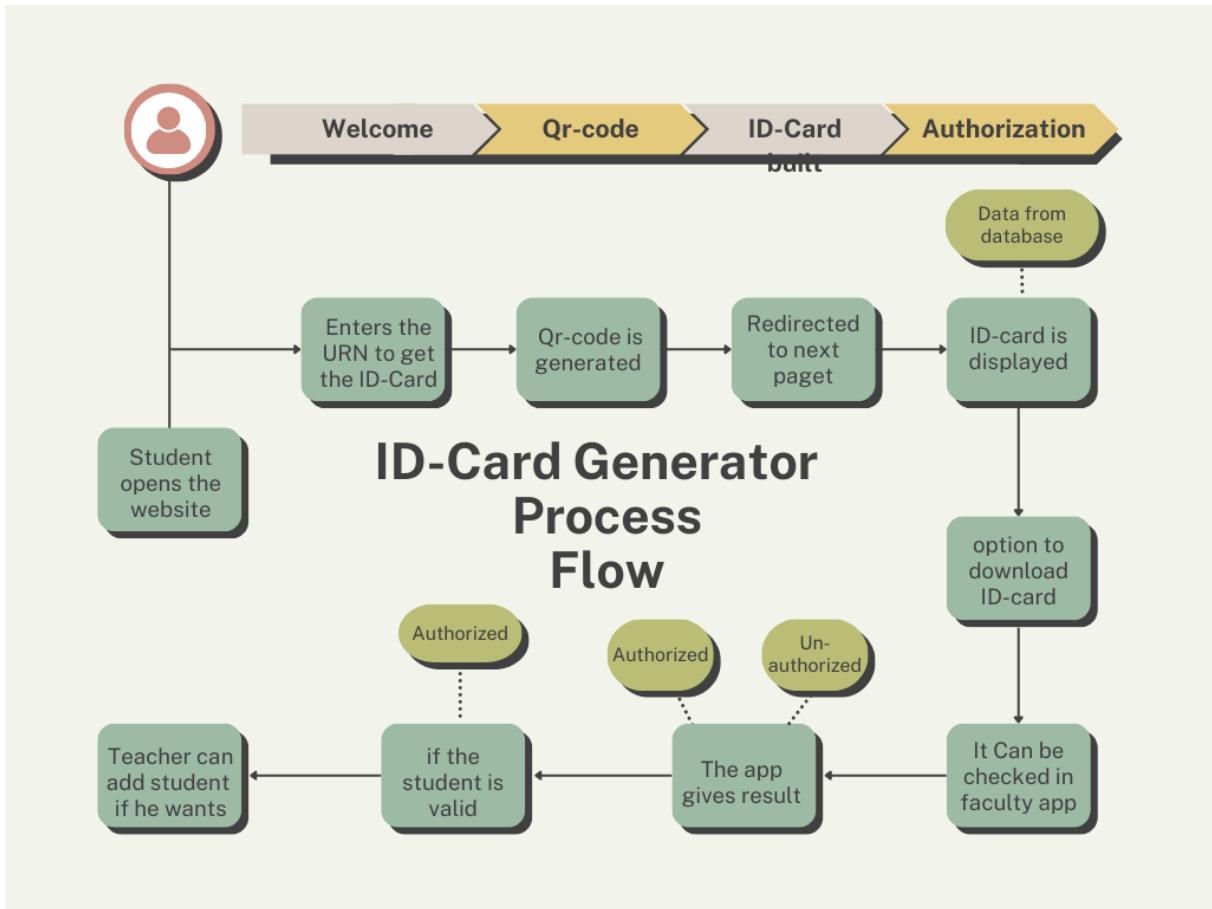


Figure 10: Data Flow Diagram of the project

The first phase of the website is that the student opens the website and then it sees the main index.php page which asks the user or student his/her university roll number. When the student clicks on generate the user will be redirected to the idcard.php page which will display the idcard of that student which is also downloadable. The qr code on the idcard can also be scanned by the faculty application.

3.2 Database design

Database name:- ID card

The screenshot shows a MySQL database interface with the following details:

Showing rows 0 - 3 (4 total, Query took 0.0007 seconds.)

SELECT * FROM `cards`

Profile [Edit inline] [Edit] [Explain SQL] [Create PHP code] [Refresh]

Options

sno	name	fname	program	email	phone	address	cm	urn	exp_date	image
72946	Neelam Sharma	Rajesh Sharma	B.Tech(IT)	sejalsharma3919@gmail.com	7626920311	Shaheed karnail singh nagar,Shree shiv durga mata ...	2021083	2004962	30.06.2023	assets/uploads/neelam.jpg
72945	Lakshmi Singh	Bhola Singh	B.Tech(IT)	lakshmisingh4112@gmail.com	9463863117	#4321/5, st no. 4 , SAS Nagar, Ludhiana, Punjab	2021070	2004949	30.06.2023	assets/uploads/lakshmi.jpg
72944	Himanshu Mahajan	Yogesh Mahajan	B.Tech(IT)	himanshumahajan3737@gmail.com	9283403019	#6248, street no - 5, Hargobind nagar, near hanum... 2021150	2104587	30.06.2023		assets/uploads/himanshu.jpg
0	Shan Rukh Khan	Mir Taj	Btech(IT)	shahrukhbudda@gmail.com	9876543210	Mannat,Mumbai	2021080	2004950	2024-07-19	assets/uploads/download.jpeg

With selected: Edit Copy Delete Export

Show all | Number of rows: 25 Filter rows: Search this table Sort by key: None

Figure 11: Database design of our website

Table name:- Cards This database id card only contains one table which has all the information about the student which is useful in generating the id card of that student

4 Implementation, Testing and Maintenance

4.1 Implementation

Implementation is one of the most important tasks in project implementation is the phase, in which one has to be cautious, because all the efforts undertaken during the project will be fruitful only if the software is properly implemented according to the plans made. The implementation phase is less creative than system design. It is primarily concerned with usertraining, site preparation and file-sites, the tests of the network along with the systems are also included under implementation. Depending on the nature of the systems extensive user training may be required. Programming is itself a design works. The initial parameters of the management information systems should be modified as a result of programming efforts.

Programming provides a real test for the assumption made by the analyst. System testing checks the readiness and accuracy of the system to access, update and retrieve data from the new files. Once the programs become available the test data are read into the computer and processed. In most conventions parallel run was conducted to establish the efficiency of the system.

Implementation is used here to mean the process of converting a new or revised system in to an operational one. Conversion is one aspect of one implementation.

- index.php

The index.php page is the main or the first page of our website this is the main page which opens when the user enters our website. This page asks the user to enter their University Roll Number by using which the Id-card of that particular student is generated

- id-card.php

The id-card.php page is the second page of our website this is the id-card page that opens when the user enters his/her University roll number and clicks on generate on the index.php. This page will display the id-card that is generated by using the University roll number entered by the student. The id-card also contains a unique Qr-code for every student.

- addition.php

The addition.php page is the page that is only allowed to be used by the faculty members to add new data of the students. This page is used to add new entries of student data which is useful in generating their id-cards.

- config.php

The config.php page is the page that is used to connect the application with the database it includes the servername, user, password, database name and also the query to connect the application with the database.

4.2 Project Management Approach:-

To make Sure we follow the most efficient path towards our final product, there are specific steps that we must aware of. these are present in the project life cycle which we consist of a slow-rapid-slow total towards project completion. The project follows waterfall approach to management. The project approaches certain phases:- The design part of the Association of Computing Machinery Project is divided into two sections which consist of the hardware and the software part. Before the software The design part can be developed, the hardware part is first completed to provide a platform for the software to work. Before the software part we need to install some libraries for effective working of the application. We install Xamp , Wamp , Mysql and Phpmyadmin , Apache.

4.3 Test Environment :-

The test environment will consist of Server

- Microsoft Windows
- Visual Studio Code
- XAMPP Control Panel
- localhost/phpmyadmin
- MySQL Database

4.4 Maintenance :-

- Refresh the database continuously to get the entries which are filled by the users.
- Update the version of the application if you want to change something
- Get the api key of the new version to connect with the new version of the pyzbar library.
- Always have an updated version of Python to run the code smoothly

5 Results and Discussions

5.1 User Interface Representation (Of Respective Project)

A screenshot of a web form titled "University Roll Number". It contains a single input field labeled "Enter University Roll Number" with the value "2104587" entered. Below the input field is a note: "Every student's should have unique URN". At the bottom is a blue "Generate" button.

Figure 12: This is the index.php page of our website.

A screenshot of a web form titled "University Roll Number". It contains a single input field labeled "Enter University Roll Number" with the value "2104587" entered. Below the input field is a note: "Every student's should have unique URN". At the bottom is a blue "Generate" button.

Figure 13: The Student has to enter University roll number and click on generate button.



Figure 14: This shows the id-card.php page which is opened when we click on generate in index.php page. This shows the id-card generated for the student.



Figure 15: This image shows the id-card that is generated by the website.

Guru Nanak Dev Engineering College, Ludhiana
 An Autonomous College U/s UGC Act-1956 [2(f) and 12(B)]
 AICTE Approved, ISO 9001:2015 CERTIFIED
 Affiliated to I.K. Gujral Punjab Technical University, Jalandhar.
 IEI ACCREDITED UG PROGRAMMES
 Institute Accredited by NAAC (A Grade) & TCS.

S.No	Name	University Roll No.	Class Roll No.
1	Neelam Sharma	2004962	2021083
2	Lakshmi Singh	2004949	2021070
3	Himanshu Mahajan	2104587	2021150
4	Shah Rukh Khan	2004950	2021080

Figure 16: This image shows the addition.php which is used by the faculty members to add new data of the students in the database.

Guru Nanak Dev Engineering College, Ludhiana
 An Autonomous College U/s UGC Act-1956 [2(f) and 2(B)]
 AICTE Approved, ISO 9001:2015 CERTIFIED
 Affiliated to I.K. Gujral Punjab Technical University, Jalandhar
 IEI ACCREDITED UG PROGRAMMES
 Institute Accredited by NAAC (A Grade) & TCS.

Intertek

S.No	Name	University Roll No.	Class Roll No.
1	Naeem Sharma	2004962	2021083
2	Lakshmi Singh	2004949	2021070
3	Himanshu Mahajan	2104587	2021150
4	Shah Rukh Khan	2004950	2021080

Figure 17: The data entered by the teacher is stored in the database to generate an id-card for the students.

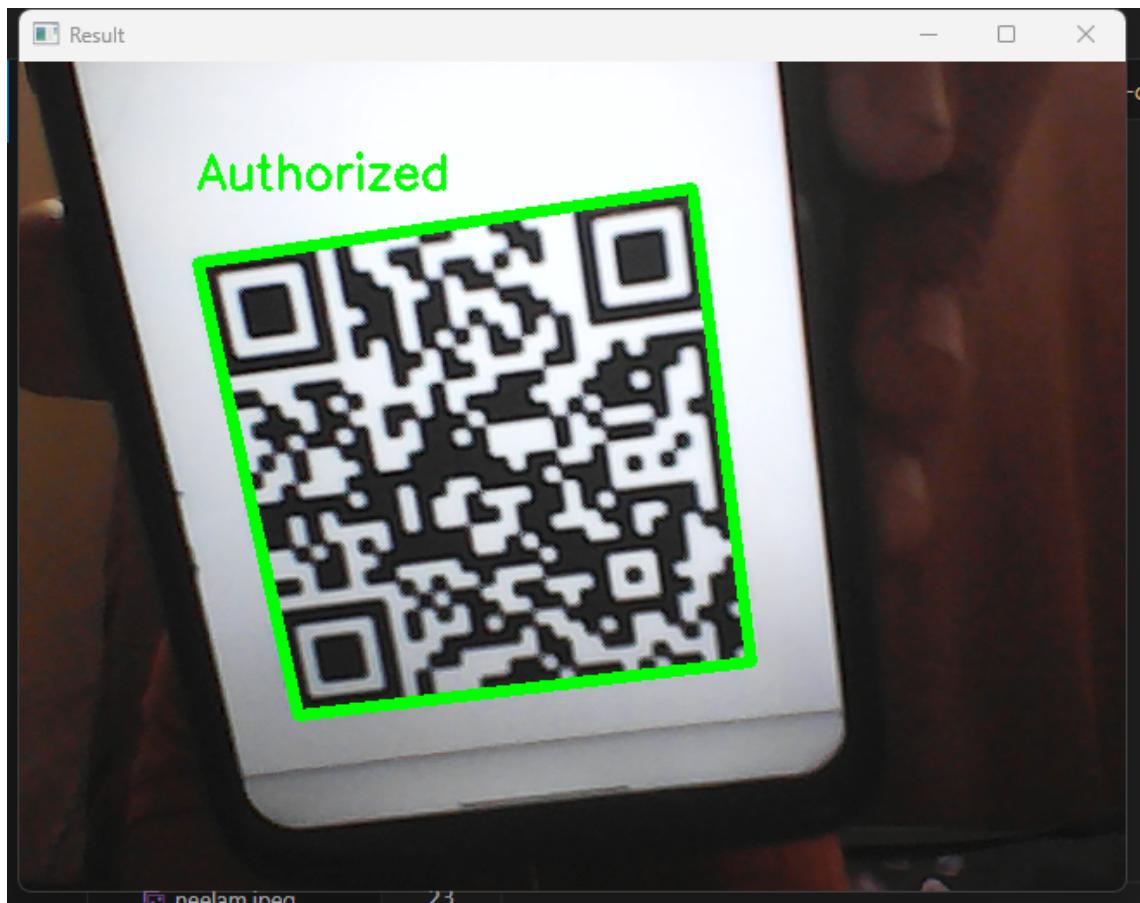


Figure 18: This image shows the working of authorize.py file which is used by the staff members. When a qr-code which is generated by the website is shown it gives us an output as authorized

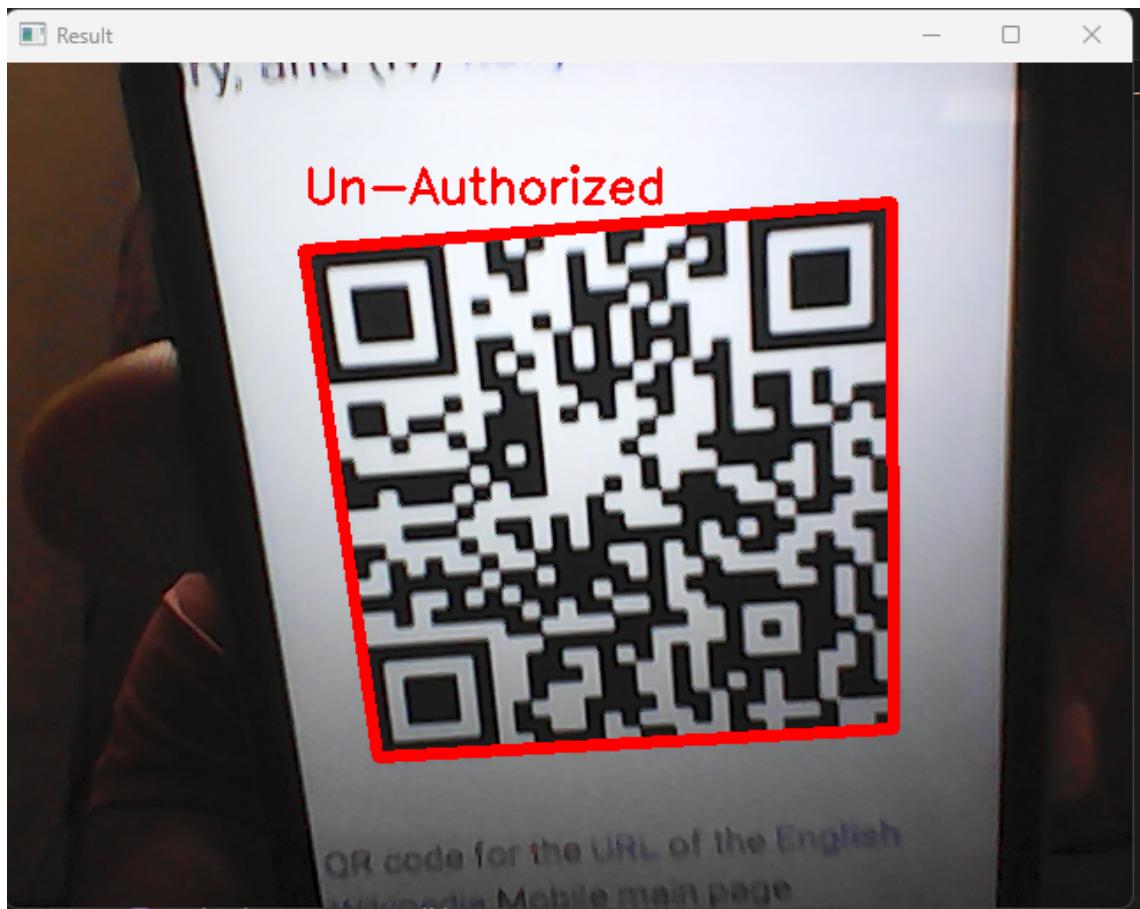


Figure 19: This image shows the working of authorize.py file which is used by the staff members. When a qr-code which is not generated by the website is shown it gives us output as un-authorized

6 Conclusion

Theoretical knowledge without proper practical knowledge is waste. Making a project doesn't just help in clearing the concepts but also eradicate the problem in implementations. This project helped us to learn about designing and procedure of "ID-card generator For College Students". This project give me a chance to explore many more new things regarding to my field which I can't come to know without participated in creation of this project.

This project helps me to understand the languages which I used in this project. I theoretically learnt these languages in the college but while making this project I feel the use of each language. Also I came to gain some experience in working on a project and working on two or more languages at the same time. With the help of many links and tools, I am able to make a application which is completely working and can be implemented if needed. At last I want to say that I am capable of making a application which I think to make at the very first time when I started making this project.

7 Future Scope

- The major future scope of our project is to implement it on the college database so that it is capable of generating Id-cards for every student that is studying in the college. The student just wants to enter our website and enter the university Roll Number to get his/her id-card that contains Qr-code which is unique for each student.
- Another future scope that can be fulfilled in our project is implementing it on the hardware level in the college which will include a qr-code reader installed on the main gate of the college and it will give us with the response whether the qr-code scanned is an authorized entity or it is an outsider which means it is an un-authorized person.

8 References

- Mahajan, H. (2022) Generate QR code using qrcode in Python, GeeksforGeeks. GeeksforGeeks. Available at: <https://www.geeksforgeeks.org/generate-qr-code-using-qrcode-in-python/> (Accessed: March 20, 2023).
- Hingu, P. (2020) Build your own barcode and QRcode scanner using Python, Medium. Towards Data Science. Available at: <https://towardsdatascience.com/build-your-own-barcode-and-qrcode-scanner-using-python-8b46971e719e> (Accessed: March 20, 2023).
- Qrcode (2022) PyPI. Available at: <https://pypi.org/project/qrcode/> (Accessed: March 20, 2023).
- Getting started with react - learn web development: MDN (no date) Learn web development | MDN. Available at: <https://developer.mozilla.org/en-US/docs/Learn/Toolsandtesting/Client-sideJavaScriptframeworks/Reactgettingstarted> (Accessed: March 20, 2023).
- How to develop a progressive web app using reactjs ? (2021) GeeksforGeeks. GeeksforGeeks. Available at: <https://www.geeksforgeeks.org/how-to-develop-a-progressive-web-app-using-reactjs/> (Accessed: March 20, 2023).