Web-based Paperless Clearance System

with Violation Management using QR Code

in Concepcion Holy Cross College Inc.

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A Thesis Presented to

The Faculty of the College of Computer Studies

Concepcion Holy Cross College Inc.

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Bachelor of Science in Computer Science

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# Introduction

In many institutions, a person who is ready to leave must go through a clearance procedure in order to find out if they will be allowed to sign off or not. The person will receive a clearance if permission was granted. [1].

Since technology has developed, many schools are enhancing their administrative functions by automating nearly all manual procedures, including the clearance system. The administration is assisted in the performance of public tasks. Improving internal procedures and practices, through institutional computerized systems and automation which promotes transparency and accountability [2]. To make sure that the student has no prior records of violations before graduating, student violations may also be included in clearance. Students who deliberately collaborate with others to violate university laws and/or regulations are subject to disciplinary punishment, according to the National University Student Code of Conduct. Students must however resolve their violation records before graduating. [3].

QR codes are utilized for physical access control. According to Kao et al., ~~a~~ safe authentication system is possible by combining QR codes and the One-Time Password technique. QR codes are also used to share information between people who participate in the same social event or to share information in order to support the learning process [4].

Some universities still implement the traditional way of signing clearance: the student needs to visit the office, receive the clearance form and fill out related fields. The student is also required to hand over his/her ID for verification and obtain approval from different offices such as the library office, dean’s office, etc. [5]

Thus, the researchers conducted a study entitled Web-based Paperless Clearance System with Violation Management using QR Code in Concepcion Holy Cross College Inc. It is a clearance system that can store and manage student violations. Using this system, they can reduce the usage of paper, improve the way of managing clearance, and prevent data loss.

## Project Context

Traditional Clearance forms are made accessible by academic institutions to students upon graduation. These must be signed in paper copy and brought to the various departments for approval, which when properly completed, indicate that the student has satisfied all criteria and is not owed to any of the departments or units that the student was affiliated with inside the university. The document must be delivered in a hard copy to designated offices, personally, making this method time-consuming.

In Concepcion Holy Cross College Inc., is currently implementing a clearance system, but this clearance they are implementing is still a manual procedure. Until now the process of managing student violations is still in the traditional way. Records of violation are kept only on paper, and there are instances that these might be lost. According to Nwachukwu Prince Ololube, school records are of great importance to school guidance counselors as these records can provide counselors with a holistic picture of the students they counsel and disciplinary measures taken and can help counselors track student progress [6].

Physical presence, time consumption, and forged signatures are oftentimes the problems encountered during the signing of clearances. Using the Web-based Paperless Clearance System with Violation Management using a QR Code, the management of clearance will be automated, and there will be no requirement for the offices or departments to sign the document, so the clearance system will become signatureless. The organization of violations will also be automated, which will result in paperless improvement. With this, the institute's information will be accurate and will help to prevent the loss of data. This will be also beneficial to the students by using the QR Code they can now easily look into their clearance and violations by scanning through it.

## Purpose and Description

The purpose of this study is to develop a Web-based Paperless Clearance System with Violation Management using QR Code in Concepcion Holy Cross College. The researchers want to develop it to improve the clearance system of Concepcion Holy Cross College Inc.

The Web-based Paperless Clearance System with Violation Management using QR Code will be used for graduating students to request clearance and monitor their clearance progress. It also manages student violations. The system will provide a unique QR code to students and department staff. With this, monitoring student clearance progress and violation records will be easy with the help of the QR Code feature.

This system will be beneficial to:

**To the** **Office of Student Affairs** **(OSA).** This research can improve their clearance system, and manage violation records.

**To the Registrar.** He/she will immediately view the students’ clearance progress, as well as see if the student is cleared.

**To the Student.** This researchwill be also beneficial to them in terms of monitoring clearance progress as well as their violations.

**To the Researcher.** The researcher would acquire new knowledge, abilities, and research-planning techniques.

**To the Future Researchers.** This research will be beneficial to future researchers as their guide while gathering data regarding the Clearance Management System.

## Objectives

The general objective of this research is to design and develop a paperless clearance management system that will help graduating students get their clearances quickly. This will also help students that are currently enrolled monitor their violations.

This research aims to achieve the following:

1. To design and develop a Web-based Paperless Clearance System with Violation Management using QR Code in Concepcion Holy Cross College Inc. associated with the following features:
   1. Admin
      1. View List of User Accounts
      2. Add Student Account
         1. View Student Information
         2. Update Student Information
      3. Add Office of Student Affairs (OSA) staff Account
         1. View Office of Student Affairs (OSA) staff Information
         2. View Office of Student Affairs (OSA) staff Information
      4. Add Library Staff Account
         1. View Library Staff Information
         2. Update Library Staff Information
      5. Add Academic Staff Account
         1. View Academic Staff Information
         2. Update Academic Staff Information
      6. Add Registrar Staff Account
         1. View Registrar Staff Information
         2. Update Registrar Staff Information
   2. Office of Student Affairs (OSA)
      1. Deploy Student Clearance
         1. Approve/Disapprove Student Clearance
      2. View Student Violations
         1. Update Student Violations
   3. Library Staff
      1. View Pending Student Clearance
         1. Approve/Disapprove Student Clearance
   4. Academic Staff
      1. View Pending Student Clearance
         1. Approve/Disapprove Student Clearance
   5. Registrar Staff
      1. View Pending Student Clearance
   6. Student
      1. View Clearance Progress
      2. View Violation Records

## Scope and Delimitation

The aim of this study is to develop a computer software system to replace the Office of Student Affairs' current manual procedures. As well as for the students to easily monitor the clearance progress and violation records in Concepcion Holy Cross College. The Web-based Paperless Clearance System with Violation Management using QR Code was exclusive to Concepcion Holy Cross College only.

The process of this system covers the creation of individual student and department staff QR Codes which will be printed. These QR Codes have a URL in them that can be used to access their individual webpage, once they are on their own page, the system has a pin authentication that prevents an unauthorized person to access it.

The following are the user roles of the system: Admin can (add, edit, and delete) a student account and department staff account. Department staff (Registrar, Library, Academic) can only approve/disapprove student clearance and no other than that. The Office of Student Affairs (OSA) can add, edit, remove violations, and deploy student clearance, it can also approve/disapprove student clearance. Lastly, the Students can only view their clearance progress and violation records in real-time.

# RELATED LITERATURE

This Chapter presents the related information and previews research works for the realization of this study. It aims to review the literature and studies related to the “Web-based Paperless Clearance System with Violation Management using QR Code in Concepcion Holy Cross College Inc”.

## Discussion of Model

The Web-based Paperless Clearance System with Violation Management using QR Code in Concepcion Holy Cross College is an online clearance system that the researchers propose for the CHCCI students and offices. It implements pin authentication for users and encryption of web content; and evaluates the functionality, reliability, usability, and portability of the system. This web application has the capability to guarantee the security of the data it stores.

1. **Foreign Literature**

The study entitled. “Development of Online Clearance System for an Educational Institution” aims to create an online clearance management system to overcome the issue of manual processing. It will also reduce the amount of time and effort. With this, students can monitor their clearance whenever they are online. [9]

Both systems aim to address the issue of the manual process of taking and monitoring student clearance and improving the way of taking and monitoring clearance.

Additional interactive information about the museum artifacts will be provided through this application. By scanning the QR code that is attached to the museum object, visitors can access this information. The scanning process will be completed by the program utilizing only the camera on a mobile device. This QR code ID is then transmitted to the server to obtain more artifact data including text, image, sound, and video. [20]

The article stated above creates an application for museum artifacts, this application uses a QR code to distinguish easily the information of the artifact by scanning through the camera of the mobile device. This article was related to the study, both use a QR code to speed up the process of monitoring and taking information.

The major goal of this literature, "Predictors of Zero Tolerance Policy Violations Among High School and Middle School Students," was to find a set of characteristics that may help determine the situations that cause a student to break zero-tolerance rules. This literature investigated whether the qualification variable, zero-tolerance policy violation, can be predicted by a set of five risk factors: (i) grade level, (ii) retention, (iii) suspension, (iv) race, and (v) gender. [13]

This literature aims to know whether the following criteria have an effect when it comes to the student who violates the rules of the school. This will also can be used in the researcher’s literature when giving clearance to students.

Meanwhile, "Implementation of QR Code and IMEI on Android and Web-Based Student Presence Systems" aims to know the effects of using the Android operating system and a QR code. The QR code is displayed using the Generate QR Code program, and students can read it using a QR Code Reader. In order to prevent other students from using mobile devices, the International Mobile Equipment Identity (IMEI) is also utilized to verify the owners of mobile devices. The QR Code can also be read by the Internet via the web. [14]

The literature above also uses a QR Code operated on a mobile phone and read with the use web-based system. To secure the QR code using IMEI the system will know who the user is and who wants to access this QR code.

Based on a purposive sampling technique, 200 students were given a questionnaire, and the data were then analyzed statistically using Partial Least Squares Structural Equation Modelling (PLS-SEM). Initial findings indicated that students' attitudes toward using QR codes for course-related activities were overwhelmingly positive, which eventually affected their intentions to adopt this technology. [21]

This article points out the importance of QR codes and their positive outcomes for the system. The article shows that 200 students agreed to use QR codes for their activities.

1. **Local Literature**

According to (Caroro, R. A., & Hernandez, A. A.), the research is about determining the level of green IT implementation at a university for the purpose of achieving environmental sustainability and a decrease in operational costs. In order to contribute to an ongoing effort to increase green IT stewardship and implementation. [24]

When it comes to migrating to paperless improvement, this body of literature aims to do the same thing that our study will undertake in order to fulfill its goals. Its goal is to reduce the amount of damage that is caused to the natural world by information technology operations by promoting environmentally responsible practices in all aspects of the industry.

According to Mark Kevin V. Rimando and Reynaldo R. Corpuz, schools' top concerns are about the use of paper-based forms and how they track their progress and location. This literature investigated the use of watermarking algorithms and QR code-based tracking systems. In addition, it discusses the structure, applications, security, and strategies for using QR codes. According to related research, existing watermarking techniques may be developed in terms of discreetness and durability in the future. [15]

This article is related to using the Real-Time tracking System. It is used to track all the violations that a student has disobeyed and to the general concern about the use of the manual process for tracking, what the researcher wants to do is to improve this process so that the user will not have difficulty using it.

This “QR codes as mobile learning tools for labor room nurses at the San Pablo Colleges Medical Center” examines the use of QR codes as a mobile learning tool and examines the factors that influence the usefulness, acceptability, and feasibility of QR codes in supporting nurse learning. Research data in the form of observations and insights into experiences using QR codes were collected from participants through individualized face-to-face semi-structured interviews. We found that QR codes, phone numbers, and URL links to mobile websites that encode textual information all have a high level of functionality, usability, and usefulness. [16]

This is related to the study that uses URL links to the mobile website to protect the said system. The effective use of the QR code is to facilitate the processing of information and protection.

Sending information via SMS while utilizing a QR Code to track down papers will be possible. The management of student grants and scholarships would be significantly improved by the integration of these features under this criterion. Using tiny printed codes, such as QR codes, that point to materials and information relevant to their position around the library is an easier choice. [22]

This article shows the use of QR codes and SMS notifications in the scholarship management system.

1. **Foreign Study**

According to Rochmawati, N. et al, Laboratory Clearance Form application using QR codes utilize the Bootstrap framework, which supports responsive web design. The framework enables access to the application through a mobile device. The final product is anticipated to be a design of the application to make it easier for students who will graduate to obtain their Laboratory Clearance Form in the Departments of Engineering faculty of UNESA. [10]

Both studies use QR codes to make the URL (Uniform Resource Locator) dynamic. It also supports web responsive design, making the system more interactive.

According to Albert, M. B. G., the primary goal was to create an online clearance system that would replace manual forms in a reliable, efficient, effective, and transparent manner. As long as the devices they are using can access the internet, this system enables final-year students to check the status of their clearance forms online. [11]

Both studies have a clearance management system that allows ~~the~~ users to monitor the status of their clearance forms online. The use of the Clearance System will eliminate the manual process of taking clearance. Due to that, future users can save time, and prevent data loss.

Gandasari Vocational School pupils are still recording violations using paper media, which slows down the dissemination of information to parents concerning student behavior. In order to address this, the Gandasari Vocational School requires a student monitoring information system that will use computerized data processing and a web-based system to tell parents of students about the status of their children at school. [23]

This research wants to address the issue of manual processes in recording student violations by creating a Web-Based Student Violation Monitoring Information System.

Constructing a new system or changing an existing system in accordance with stakeholder requirements is the goal of system implementation. A student requests clearance, and an SMS message is delivered to the administrative staff handling the department's student clearances. [12]

This study aims to design and implement a Web-Based SMS-Notification Clearance System. The student will apply to the clearance system and receive an SMS text for confirmation. Both studies have clearance management systems that can help students in school to reduce the time and efforts that consume by manual processes.

1. **Local Study**

The researchers developed an e-clearance system that automates and centralizes the clearance system. The system was designed to facilitate the fast processing of student clearance, allow users to access the system online, and save the cost that paper clearance entails. [7]

The study tells about paper-based forms that need to have a solid monitoring system to ensure that forms are stable and reliable. It is quite obvious that papers are a big part of business, office, and especially in schools. But somehow, once you keep those paper-based forms might be time-consuming. Just like the study "Web-based Paperless Clearance System with Violation Management using QR Code in Concepcion Holy Cross College," it helps the locale to go paperless to save time and easy access to records, especially student violations.

The study describes the use and predicted consequences of the Secured CCSPC Web-Based Student Clearance System. For students and designated offices, this system includes two-factor authentication. A Secure Socket Layer (SSL) for data transit, as well as a software firewall and anti-SQL Injection attack, were proposed and implemented in the clearance system. [8]

This research is related to the study because it encrypts data information the same way we do in the system. This is a good approach when it comes to the clearance system, to prevent unauthorized persons to steal important data.

In Olipas, Cris Norman P.’s study, the goal ~~of this project~~ was to create and implement a Student Information and Violation Management System (SIVMS) for a higher education facility in Central Luzon, Philippines. It made use of a descriptive developmental research approach, in which the researcher described and discussed the procedures used to create the prototype system. [17]

This research is related to the study because both studies have a student information and violation management system where students can view their information as well as their violations in school.

According to the study of Rochmawati, N. et. al, the goal is to present an example social studies activity that is supported by a QR code application and to gauge the reactions of teachers and students to this experience. The study was designed as a case study, with a two-week implementation period. The researchers' semi-structured student interview form and unstructured teacher interview form were used as data collection tools in the study. The findings were obtained through data analysis using content analysis. The findings revealed that social studies instruction supported by QR code application improved the learners' cognitive and affective behaviors. It was also discovered that, aside from their use of the smartboard, students did not frequently use QR code applications in their learning activities. [18]

Both studies supported QR codes, and both teachers and students can use this to view the information inside the QR code, which will speed up the process of viewing their information.

In Susada, R.A., and Sobejana, N.P.’s study, they created an android-based classroom monitoring system for teachers that uses QR code technology for classroom management of the institution's administration and quick access to information for frequent report generation. The study is basically the development and testing of a system that has been tested and deployed successfully. The primary objective of this study is to (1) create a module for scanning QR codes on smartphones, (2) create a module for saving information to the device locally, and (3) create a module for retrieving information from the local server. [19]

The two studies are similar because they both make use of QR codes, which can be scanned to display user data and provide easy access to information through the digital camera.

**Table 1. Literature Matrix**

|  |  |  |  |
| --- | --- | --- | --- |
| **References** | **Description** | **Strength** | **Weakness** |
| Cadiz et al. (2017) [7] | The researchers developed an e-clearance system that automates and centralizes the clearance system. The system was designed to facilitate the fast processing of student clearance, allow users to access the system online, and save the cost that paper clearance entails. | The paperless clearance system eliminates those disadvantages of the  manual system. Hence, e-clearance offers academic constituent convenience in the processing of  student clearance. | It is not mobile responsive. Users can access it via mobile, but the user interface is difficult to understand.  It does not consist of violation management.  so students who violate can easily and quickly escape.  Since it lacks Basic Encryption, it's possible that data submissions could be manipulated by an anonymous user. |
| Daud et al. (2022) [8] | The study describes the Secured CCSPC Web-Based Student Clearance System's used and predicted effects. This system includes two-factor authentication for students and designated offices. In the clearance system, a Secure Socket Layer (SSL) for data transit, as well as a software firewall and anti-SQL Injection attack, were offered and implemented. | No need for account creation as it relies on the CCSPC Portal to get information by using a Web API | It does not include violation management, so students can easily bypass violations.  It is not responsive to mobile devices. Mobile users can access it, although the user experience is confusing. |
| Jonathan et al. (2019) [9] | This study proposes a system that overcomes the issues with manual processing while improving on the identified automated ones. The study adopts a case study approach of a complete manual system for leading institutions of learning in Southwest Nigeria, with the existing procedure being carried out. The new system will reduce the amount of time and effort wasted on students’ clearance as well as reduce costs incurred on paper by the institution. | The system encrypted the entire data. Which prevents hackers from accessing their important files. The only thing the hackers can see is jumbled nonsense (random characters, numbers, and symbols) that is meaningless to them. | It does not consist of violation management with this student who can easily leave violations. |
| Rochmawati et al. (2018) [10] | The researchers developed a system that creates a Laboratory Clearance Form. To create a license from this application, the student needs to request the license by accessing this web application and filling out the request form with their registration number. If it is successful, each subhead and head laboratory will receive notification from the system about students who request the license. If all of the subhead laboratories confirm, the head of the laboratory will receive a notification. After the head of the laboratory confirms, the student then can download the Laboratory Clearance Form. | It has a unique way of validating the users, by using QR Code technology. | The department does not have the ability to approve the student and cannot track their clearance progress.  It lacks Basic Encryption, which means that the information submitted can be corrupted by an anonymous user. |
| Albert et al. (2019) [11] | The Researchers' main objective was to develop a reliable, effective, efficient, and transparent Online Clearance System to eliminate the challenges stated. This system enables final-year students to monitor the progress/status of their clearance forms online as long as the technologies they are using can access the internet. | It covers a lot of functions, such as the student module and administrator module. The student module can monitor their clearance progress. And in the administrator module, they can monitor the overall student clearance progress with a bar chart | It also lacks Basic Encryption, which means that data submitted could be manipulated by someone with an anonymous user.  It is not responsive on mobile. Mobile users have access to it, but it is still challenging to understand the user interface.  The program does not consist of violation management with this student who could also easily avoid violations. |
| Tunde at el. (2021) [12] | The purpose of system implementation is  to create a new system or modify an existing  system in compliance with stakeholders’ requirements. The student applies for clearance, an SMS notification is sent to the admin personnel in charge of clearing students in the department. | The system sends a notification to students who might have issues in the department. The system automatically fetches the student’s number and sends an SMS notification. The same format applies to other units | The system does not have student information management. In case the student that applies for clearance made mistake, the system cannot revise it.  This does not consist of violation management from this student who could really easily ignore violations.  It does not work on mobile devices. Mobile phone users can use it. But even so, the user interface is difficult to comprehend.  Since it lacks Basic Encryption, it might be possible for anonymous users to manipulate provided data. |

1. Student Information Management (e.g., add, delete, edit, save, search, and update database).
2. Violation Management
3. Log In System
4. User/Admin Module
5. Web Based
6. Mobile Responsive
7. Data Encryption
8. QR Code

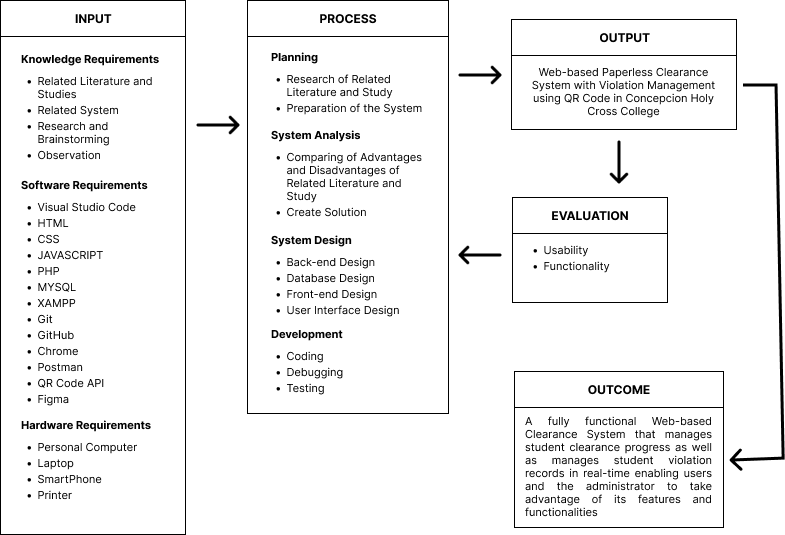
**Table 2. Functionality and Feature Matrix**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Software | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Moving Towards Global Technological Advancement: Basis for the E-Clearance  Program Development | ✔ | ✖ | ✔ | ✔ | ✔ | ✖ | ✖ | ✖ |
| Secured Cotabato City State Polytechnic College Web-Based Student Clearance System | ✔ | ✖ | ✖ | ✔ | ✔ | ✖ | ✔ | ✖ |
| Development of Online Clearance System for an Educational Institution | ✔ | ✖ | ✔ | ✔ | ✔ | ✔ | ✔ | ✖ |
| A Responsive Web-Based QR Code for Laboratory Clearance Form | ✔ | ✖ | ✔ | ✔ | ✔ | ✔ | ✖ | ✔ |
| ONLINE CLEARANCE SYSTEM | ✔ | ✖ | ✔ | ✔ | ✔ | ✖ | ✖ | ✖ |
| Design and Implementation of a Web-Based Sms-Notification Clearance System: A Case Study of Federal Polytechnic,Ile – Oluji, Ondo State. | ✖ | ✖ | ✔ | ✔ | ✔ | ✖ | ✖ | ✖ |

*Synthesis*

In table 2, most of the studies that the researchers found about online clearance systems have some common features. They prominently display a basic function, but they differ in the more detailed feature they offer. The analysis of other systems, such as the clearance system, revealed that they lack QR Codes and the functionality of violation management. The Researchers decided to design and develop a Web-based Paperless Clearance System with Violation Management using QR Code in Concepcion Holy Cross College where students can monitor their clearance progress as well as monitor their violation records.

## Conceptual Framework



**Figure 1. Conceptual Framework**

This conceptual framework demonstrates the researchers’ process for coming up with the following idea and developing a solution to the issue. There are three components to the input. Knowledge Requirements are where we obtain the underlying problems we are now attempting to solve, together with how we came up with the solution plan. Software requirements and hardware requirements are the tools and devices that we are going to use with regard to achieving our desired system. The overall process is getting the idea and putting it into action in order to solve the problem. Putting it into action means implementing it in the system from designing it up to development. To put it simply, the process is the preparation of the system. Output is the exact expected system that has been designed. And the outcome will be the benefits and main feature of the system.

# TECHNICAL BACKGROUND

## Network Architecture

*Synthesis*

In order for the user to access the system, users can use any device that has a browser which was mentioned in the hardware requirements, but the most recommended device is a smartphone since it usually has a QR Code scanner. Once the link has been accessed through the browser, the browser then sends an HTTP request message to the server, asking it to send a copy of the website to the client. Then after the client inputs data, all other data sent between the client and the server is sent across your internet connection using TCP/IP.

## Software Development Requirement

**Table 3. Software Requirements**

|  |  |
| --- | --- |
| **SOFTWARE** | **DESCRIPTION** |
| **Windows 10** | Operating System on the Developer's Computer or Laptop |
| **Visual Studio Code** | It is a text or code editor that will be used for coding and modifying the system's programming codes. |
| **HTML** | The code that will be used to organize and display a web page's content |
| **CSS** | It will be used to design and layout web pages. |
| **JAVASCRIPT** | Will be used to construct highly responsive interfaces, in order to enhance the user experience and provide dynamic functionality |
| **PHP** | A programming language that will be used for the system back-end. |
| **SQL** | Is a query language that is required in order for MySQL to work. |
| **MYSQL** | To store and retrieve information from the database |
| **XAMPP** | Is a local host or server that will be used to test the website on computers and laptops before it is deployed to the main server. |
| **CHROME** | A browser to test and access the website |
| **POSTMAN** | Will be used to test APIs |
| **QR CODE API** | To implement the QR Code feature for the system |
| **FIGMA** | To design and layout the desired user-friendly interface (without code) |
| **MS Word** | Software that will be used to document the study |

Visual Studio Code will be used to create and debug the web-based application. The front-end stacks will be HTML, CSS, and JavaScript. PHP will be utilized for the backend. The database for the program will be provided by the researcher using MySQL databases.

## Hardware Development

**Table 3. Software Requirements**

|  |  |
| --- | --- |
| **HARDWARE** | **SPECIFICATION** |
| **Personal Computer** | Operating System: Windows 10  Processor: AMD Ryzen 2600  GPU: Nvidia GT710  RAM: 8.00gb Memory |
| **Laptop** | Operating System: Windows 10  Processor: Intel Core i3-2370M  RAM: 4.00gb Memory |
| **Smart Phone** | Operating System: Android  Processor: Octa-core (2.0GHz, 1.8GHz)  RAM: 4 GB  Storage: 64 GB  Display: 6.53 inches |
| **Printer** | Brand and Model: Epson L3110  Printing Resolution: 5, 760 x 1, 440 DPI  Printing Method: Epson Micro Piezo print head  Int Technology: Dye Ink |

This section demonstrates the hardware and devices that will be used to create the Web-based Paperless Clearance System with Violation Management using QR Code in Concepcion Holy Cross College. These are suitable computer hardware for running the application, and this type of specification will also be compatible with application testing. The application is compatible with Windows 7 and later versions of the operating system.

## Sources of Data

The data was acquired by the researchers through the reading of research, literature, and studies about the clearance system, violation management, and QR codes. The researchers acquired ideas and knowledge through literature and studies to help with the creation of new features and functionalities for Clearance System. Additionally, the researchers would use these references to improve the system's implementation and design.

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# APPENDICES

## Appendix A: Definition of Terms

**Query –**

**Front-end –**

**Back-end –**

**Git repositories -**

**API –**

**QR Code -**