

## Storeroom Management Module (SMM) Development for ARCA Web-based System

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### HIGHLIGHTS

- ARCA system was initially developed for tracking attendance of college activities and equipped with a few modules.
  - QR-Code generated by Storeroom Management Module (SMM) helps college students in the process of checking in and out goods at storeroom.
  - Results from testing indicated that most of respondents are satisfied with SMM and it had achieved good overall means score for all components in technology acceptance model.
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### ABSTRACT

*Storeroom is the most important storage area and it must be kept secured as it will be used by college students to keep their goods during semester break. They need to clear up the room before leaving the campus. To impose the security measure of storeroom, college management unit require students that are using the storeroom to write details and particulars before checking in and out the storeroom. This paper presents a development of Storeroom Management Module (SMM) for integration with Attendance Record for College Activities (ARCA) system. The module offers easy process when college staffs and students are dealing with storeroom. Module development involved three main phases which are feasibility study, design and development and module testing. Four components that comprises 17 questionnaires were included in technology acceptance model for module testing. Out of four components tested, component perceived user satisfaction (PUS) had received the highest mean score. This indicated that the developed SMM satisfied users in dealing with storeroom management module.*

**Keywords:** Web-based Application, College Management System, Storeroom Management Module

### INTRODUCTION

Attendance Record for College Activities (ARCA) was initially developed to record attendance of college students' activities in UiTM Perlis Branch. Previously, paper-based coupon method is used as attendance for activities in college. Students need to collect the coupons as prove of their rate of participation in activities and this can be used to support their college application for the following semester. This method may lead to fraudulent in issuing coupons and certain student tends to lose it. First module developed is



focusing on attendance records by scanning barcode on student matric card and weightage of students participation in college activities (Hashim, 2020). The development continued with enhanced college application scrutinization and report generator (Zulkhafri, 2020). Succeeding module development for the system includes room allocation module, where students may make selection on the available college and roommate, this can be done by college students after the college application for the following semester is accepted (Wahab, 2021).

Realizing that the system can be enhanced and improved, therefore, we proposed another module for managing storeroom in colleges. Every semester break, college students have to clear up their room inclusive of their goods. This is because the room can be used for other activities by outsiders or different agencies. The students have options either to bring their goods home or keep in college. College management unit has prepared a few storage rooms for students to keep their stuff during semester break. To access the storage room, students must fill up paper-based logbook to keep track the one who uses the room, this is also to ensure the goods stored are secured. The logbook filled-up by students may helps later during the opening of the semester especially when there is problem like goods are misplaced at wrong storeroom or when student's room are placed in different college.

In this paper, we present the development of web-based Storeroom Management Module (SMM) integrated with existing ARCA system. The module allows students and college staffs to ease the process of keeping student's goods in predetermined storeroom locations, tracking goods and report usage logs. The system can generate QR Code to represent the corresponding storeroom location and should be printed and displayed at the entrance of storeroom. The students are required to check in or out their good from the storeroom by scanning the QR Code. Besides, the systems also provide information about the availability of storeroom before students bring their items.

## LITERATURE REVIEW

### Storeroom

The general definition of storeroom is a place where temporarily individuals can store their belongings. Storeroom is a secure, enclosed space allocated for the exclusive storing items or supplies, tools and operating instruments, and other inventory items (Airport Company of South Africa, 2014). The storeroom is not only available in a house or a company but also in a college. In UiTM Perlis, this amenity is managed by Student Residential & Non-Resident Management Unit which is under Student Affairs Division. Storeroom is one of additional amenity for students who are going for semester break to keep their belonging during semester break (UTM Student Affairs Division, 2022). Technically, the students who participate in using this amenity need to record their usage.

Generally, facilities such as libraries, toilets can be found in every campus. In the last decade, the practise and use of facilities management has evolved rapidly around the world (Fadahunsi et al., 2019). The management of facilities is data driven and necessitates the use of efficient media to store and manage data. Thus, various system that is used to track and manage data can be seen in this era of technology to reduce the issues of data lost.

All systems need information registration to keep the data. In college, it can be found that most of the organization has already use online platform. Thus, helps every student and staff do their tasks such as applying for college hostel which ease both parties. The need to speed up the registration processes at institutions of higher learning has never been more demanding, and there is a need to automate the process and move away from manually visiting the institution which leads to time and money



consumption as some students travel just to register, and others have failed to follow the deadlines (Chaka & Mungadzi, 2013).

## Barcode

Barcoding system was invented in the early 1940s (McCathie, 2004). It is known as Automatic Identification which is a technique of representing data in visual form. A barcode is a combination of spaces, adjacent bars and parallel lines that comes with different data. It is commonly known as linear of one-dimensional (1D) usually scanned by optical scanners. The use of this system supports large retail in processing goods especially in store to reduce the time consumption in tracking and identifying goods. Processing stock using manual system is slow-moving and require few workers to do the job (Singh, 2003) and reduce the human mistakes (Várallyai, 2012).

The one-dimensional or linear barcodes usually referred as the earliest generation compared to two-dimensional (2D) barcode. Figure 1 shows the difference between 1D and 2D barcodes. The 2D matrix barcode is usually referred as QR Code, where QR is short for Quick Response. This type of coding system can be decoded very quickly at high speed and capable of storing larger amount of data from text, URL and other data compared to 1D barcode (Tiwari, 2016). QR-Code was initially developed by Denso Wave in 1994, intended to overcome limited data capacity of 1D barcode and to be used in tracking parts in vehicle inventory (Sarkar et al., 2017). It also capable of generating a series of error correction code word which is useful for error recovery while reading the QR-Code that is exposed to stain or damaged. The error correction is based on popular mathematical error-correction technique, known as Reed-Solomon codes (Tiwari, 2016).



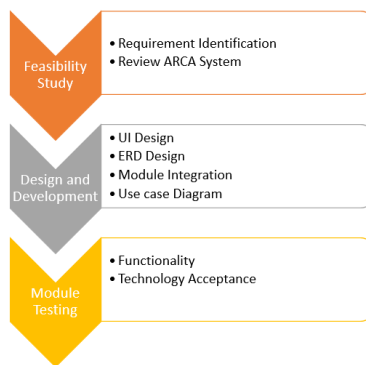
**Figure 1:** Two types of barcodes.

QR-Code is widely accepted nowadays due to its large data storage capacity, error resistance against damages and fast reading time by handheld devices equipped with camera. The QR-Code is being used in many fields which are not limited to tracking goods in inventory system (Kar et al., 2022), tracking in-store goods, healthcare for tracking patients and medical devices, transportation, parcels, advertising and e-ticketing, but also in tourism industry (Ekundayo et al., 2020), educational process to support independent and collaborative learning environment (Tretinjak, 2015), carpark reservation system (Bagadiong et al., 2020) and contact-tracing for COVID-19 cases (Mobo & Garcia, 2020; MySejahtera App, 2022).



## METHODOLOGY

The module development involves three phases that are adapted from waterfall model as shown in Figure 2. First phase is Feasibility Study that gather required criteria for module development whether it is possible to be integrated with ARCA system. Second phase, known as Design and Development intended for preparing the module with required designs, technology implementations and integrations, while the last phase is to evaluate the developed module.



**Figure 2:** Three phases in Storeroom Management Module development

### Feasibility Study

This phase begins with determining whether the storeroom management module to be developed is possible. It involves reviewing documentations of previous work on ARCA system development. Technical aspects of the system are also considered by reviewing and understanding workflows and backends of the existing system. This step is vital for module development as it will assists in module integration in later phase. Consultation session with college staffs is carried out to gain information related to current method of management of storeroom and student's item in college. All identified and analysed requirements are documented. Review of literature are also done to establish foundation as guides for design and development. This involves QR codes technology, PHP frameworks and related works.

### Design and Development

Two activities concerned in second phase are design and development. Design activity includes preparing drafts for user interfaces, entity relationship (ER) and use case diagram. Two new tables are added to the existing database for this module development which are storeroom usage log and storeroom availability which total up to 20 tables. This is essentials for storing data related to storeroom such as opening, closing date, location, status, corresponding student's id, semester session and availability status. Use case diagram is prepared to confirm with actors and functions available in the module. Two actors are college staff and student will interact with the module. Use case diagram for this module is depicted in Figure 3.

In development activity, technologies and proposed designs are combined and implemented to produce expected functional module for this applied project. Software and tools used are based on previous development on ARCA system. Databases are employed by MySQL and managed by PhpMyAdmin for amendment of tables. Code igniter PHP framework is utilized for module development and the coding is implemented in Microsoft Visual Studio Code IDE. Barcode generated by the system is utilizing the Endroid QR Code Generator package.



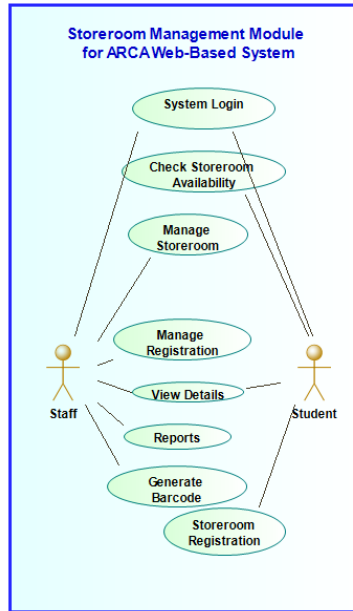


Figure 3: Use case diagram for Storeroom Management Module

## Module Testing

Final phase employs module testing that evaluates the developed module. In this phase, it begins with simple functionality testing, that test on every function and feature available in the developed module. This also includes the preparation of test scripts utilized for checking the functionality and the success of every operation that involve interactions with the database. Results of functionality testing are for the developer to ensure all functionality offered are working as expected. Following activity in this phase is testing the user's acceptance of the developed module using technology acceptance model (TAM). A set of questionnaires are prepared to assess four components of TAM which are Perceive Usability (PU), Perceived User Satisfaction (PUS), Attitude (A) and Intention to Use (IU). This involves 17 questions with four sections distributed to 30 respondents who are students living in college. Respondents are given time to use the module to complete given tasks such as checking storeroom availability, register storeroom and scan the QR-code without any guidance. The questionnaires are given right after they have used the module. Feedbacks from all respondents are gathered and documented.

## Site Map

Storeroom Management Module incurs two additional sub-menus in ARCA system. Figure 4 shows the site map for college staff. Menu *Store Records* will display records of current usage of storeroom while *Store Availability* display pages for staff to set the storerooms and its availability. While for student, only one menu will be displayed that is *Store*, that displays the room availability and allow students to check in and out of their goods.



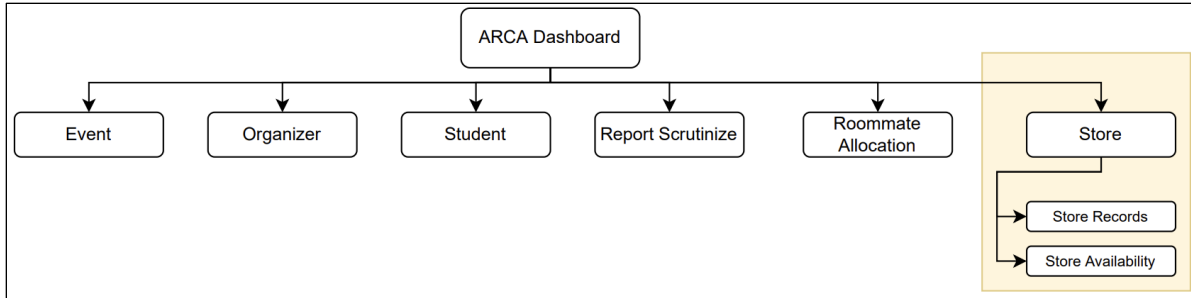


Figure 4: Menu for storeroom management module highlighted in yellow colour

## User Interfaces

### User Interfaces for College Staff

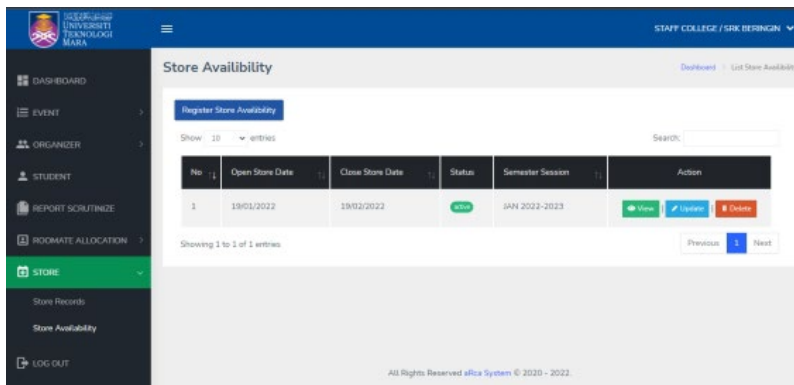


Figure 5: Main interface for Store Availability page

Figure 5 shows the default page for Storeroom Management module. In this page, college staff is allowed to view created storeroom records, update availability status, view the usage logs, update and remove storeroom records. To create new storeroom records, user needs to click on *Register Store Availability* button. In the form, the college staff needs to fill up the information for creating storeroom record such as opening and closing dates and room number. Created storeroom record displays information entered and the module generates the QR code to represents the storeroom (Figure 6 (a)). The QR code should be printed and displayed at the entrance of storeroom. Second menu that is *Store Records* displays the occupancy of storerooms. College staff may view list of students that occupy on specific storeroom, check in and check out dates as shown in Figure 6 (b).



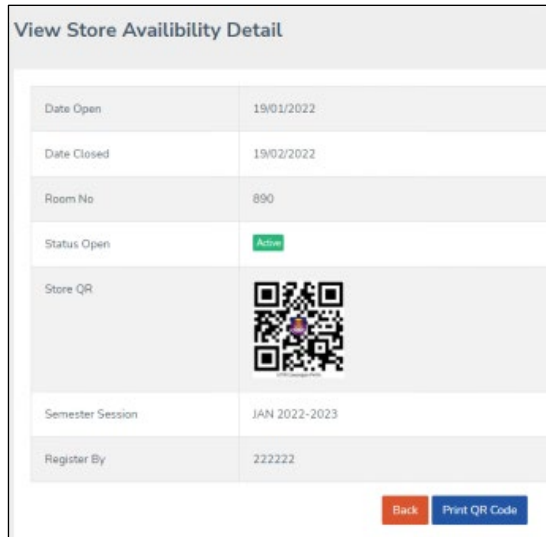


Figure 6 (a): Details of created storeroom record with generated QR Code

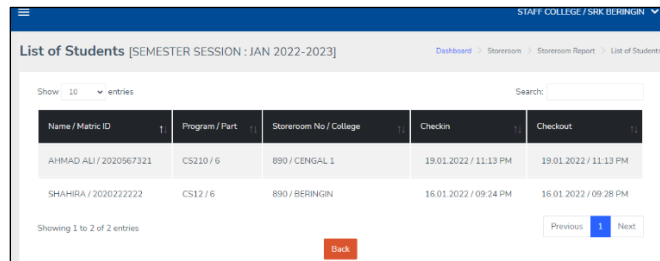


Figure 6 (b): Details of created storeroom record with generated QR Code

### User Interfaces for Students

The following Figure 7 (a) shows the dashboard interface for student once successful login into ARCA system. From the page, user may click on the QR Scanner, to check in and out of the storeroom. Alternatively, QR Code scanning function also can be accessed from the storeroom default page by clicking on the button *Click to Record* as depicted in Figure 7 (b). The page also displays usage log of current student, location of the items stored.

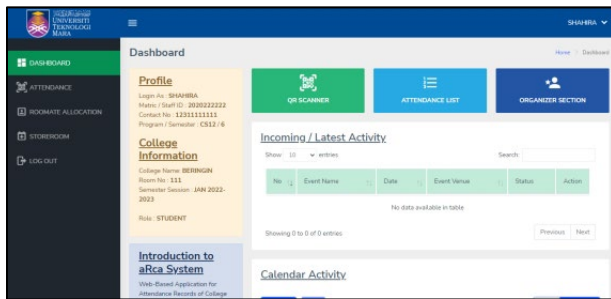


Figure 7 (a): Dashboard interface for student

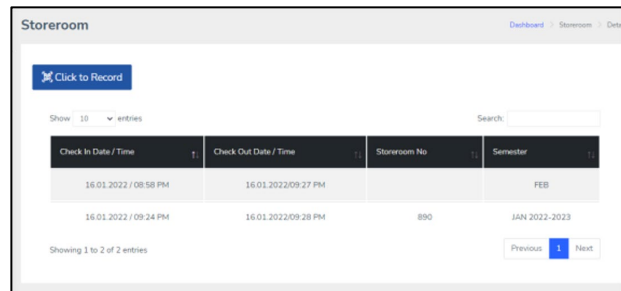


Figure 7 (b): Default storeroom page for student

## FINDINGS AND DISCUSSIONS

Four components of TAM comprising 17 questions are distributed to 30 respondents to answer the questionnaire. All respondents were UiTM Perlis college students from various background of study and faculties. For each question, five level of ranks (between 1 to 5) were given to complete the questionnaire, refer Table 1.



**Table 1:** Rankings for questionnaire

Rank Value	Description
5	Strongly agree
4	Agree
3	Neutral
2	Disagree
1	Strongly Disagree

Results obtained from the questionnaire are gathered and documented. Table 2 shows the summary of mean score for each question, component and overall. First component of the testing is Perceive Usability (PU) shows that most of question achieved more than 4.5 mean score except for one question related to the use of module for tracking the belonging in storeroom obtained 4.47 mean score. For second component which is Perceived User Satisfaction (PUS), questions related to how the developed module is organized scored lowest in this component with 4.47. However, majority of respondents are satisfied with the overall module developed that achieved highest score among questions from questionnaire. PUS component also scored highest among all other components with 4.55. The third and fourth components which are Attitude (A) and Intention to Use (IU), each of these components have one question that scored the lowest with 4.43 mean score. The questions are related to the use of developed module as platform for tracking items and intention to use the module when dealing with storeroom respectively. Total overall mean score out of four components obtained by the storeroom management module is 4.51.

**Table 2:** TAM components, questions and its mean score

TAM Components / Questionnaires	Mean Score
<b>Perceive Usability (PU)</b>	
I found the module was easy to use.	4.53
I think I would use this module to track my belonging in the UiTM storeroom.	4.47
I found the functions on this module were well integrated.	4.50
I felt very confident using this module.	4.50
I would imagine that most people would find this module are easy to use	4.57
I assume interacting with SMM module would be clear and understandable.	4.57
<b>Total Mean (PU)</b>	<b>4.52</b>
<b>Perceived User Satisfaction (PUS)</b>	
It was easy to track my storeroom usage using this module.	4.50
This module has all the functions and capabilities I expect it to have.	4.53
I believe I could save more time to record my belongings details using this module.	4.53
The organization of this module was clear.	4.47
Whenever I made a mistake using the module, I could recover easily and quickly.	4.57
Overall, I am satisfied with this module	4.67
<b>Total Mean (PUS)</b>	<b>4.55</b>
<b>Attitude (A)</b>	
I like the idea of using SMM module as platform to record any details.	4.60
I have generally favorable attitude toward using SMM module.	4.57
I believe it is (would be) a good idea to use SMM module as a platform to track my details after scanning the QR-code.	4.43
<b>Total Mean (A)</b>	<b>4.53</b>
<b>Intention to Use (IU)</b>	





Assuming I have access to SMM module with ARCA system, I intend to use it for recording my details whenever I need to use the storeroom.	4.43
It would be one of my favorite module to record and track my usage details.	4.47
<b>Total Mean (IU)</b>	<b>4.45</b>
<b>Total Overall Score</b>	<b>4.51</b>

## CONCLUSION AND RECOMMENDATIONS

This paper presents the development of Storeroom Management Module for integration with ARCA system. SMM is an additional module to ARCA system that expands functionality and capability. The module developed ease college staffs and students dealing with storerooms and goods management. It also allows tracking the location of goods especially when goods are misplaced, report usage logs, generate QR-code and supports in terms of security of the items that are stored in storerooms. TAM assessment carried out on college students indicated that most of them were satisfied with the developed module. Three components surpassed 4.5 means score except for IU, however, the total overall score yields good result. Future directions for this module development will be directed towards improving the IU, that include adding more useful functions and features, especially on email notifications regarding opening and closing date for storeroom, reminder for taking the goods in storeroom and improvements in terms of unique QR code labelling for each good kept in storeroom.

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## CONFLICT OF INTEREST DISCLOSURE

All authors declare that they have no conflicts of interest to disclose.

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