A Centralized Web-Based Dormitory Management System for University Residential Operations at UKM

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Abstract

Projek UKM Dorm-Net bertujuan untuk merevolusikan pengurusan asrama di Universiti Kebangsaan Malaysia (UKM) dengan membangunkan satu platform digital berpusat. Pada masa ini, proses pengurusan asrama masih bergantung kepada operasi manual, yang menyebabkan pelbagai ketidakefisienan seperti pengurusan bilik yang kompleks, tindak balas penyelenggaraan yang lambat, dan penjejakan pelawat yang tidak mencukupi (Klochan et al., 2021). Isu-isu ini menimbulkan cabaran besar kepada pelajar dan pentadbir, termasuk proses pertukaran bilik yang rumit, pengendalian permintaan penyelenggaraan yang perlahan, serta risiko keselamatan akibat ketiadaan sistem pengurusan pelawat yang sesuai.

Bagi menangani cabaran ini, UKM Dorm-Net mencadangkan satu penyelesaian menyeluruh yang merangkumi pengurusan bilik secara automatik, sistem permintaan penyelenggaraan yang dipermudahkan, modul pendaftaran pelawat, dan ciri pengumuman untuk pentadbir. Fungsi pengurusan bilik automatik akan membolehkan penjejakan masa nyata terhadap penghunian bilik serta memudahkan proses pertukaran bilik. Sistem permintaan penyelenggaraan pula akan menambah baik proses penghantaran dan penjejakan isu, seterusnya memastikan penyelesaian yang lebih pantas. Modul pengurusan pelawat akan meningkatkan tahap keselamatan melalui rakaman dan pemantauan maklumat pelawat. Sistem pengumuman pula akan menyediakan saluran komunikasi langsung bagi pentadbir untuk segera menyampaikan maklumat penting.

Projek ini menggunakan pendekatan pembangunan secara berperingkat, yang memastikan pelaksanaan mengikut fasa serta maklum balas berterusan untuk penambahbaikan, meningkatkan pengalaman hidup pelajar, dan kecekapan pentadbiran. Platform ini juga direka bentuk dengan mengambil kira kebolehskalaan bagi menyokong pertumbuhan universiti dan operasi pelbagai kampus pada masa hadapan. Dengan menggabungkan penyelesaian ini, UKM Dorm-Net akan meningkatkan kecekapan pengurusan asrama secara signifikan, sekaligus mewujudkan persekitaran kediaman yang lebih selamat dan tersusun untuk para pelajar.

Abstract

UKM Dorm-Net project aims to revolutionize dormitory management at the National University of Malaysia (UKM) by developing a centralized digital platform. Currently, the dormitory management process relies on manual operations, leading to various inefficiencies such as complex room management, delayed maintenance responses, and inadequate visitor tracking (Klochan et al. 2021). These issues pose significant challenges for both students and administrators, including cumbersome room change processes, slow handling of maintenance requests, and security risks due to the lack of an appropriate visitor management system. To address these challenges, UKM Dorm-Net proposes a comprehensive solution that includes automated room management, a simplified maintenance request system, a visitor registration module, and an announcement feature for administrators. The automated room management function will enable real-time tracking of room occupancy and simplify the room swapping process. The maintenance request system will streamline the submission and tracking of issues, ensuring faster resolution. The visitor management module will enhance security by recording and monitoring visitor information. The announcement system will provide administrators with a direct communication channel to quickly publish important updates. The project adopts an incremental development approach, ensuring phased implementation and continuous feedback for improvement, improved student living experiences, and increased administrative efficiency. The platform is designed with scalability in mind to support the university's future growth and multi-campus operations. By integrating these solutions, UKM Dorm-Net will significantly enhance dormitory management efficiency, creating a safer and more organized living environment for students.

1.0 INTRODUCTION

With the annual growth of student enrolment at the National University of Malaysia (UKM), the traditional, manually based dormitory management model is no longer able to meet the demands for efficiency, safety, and convenience. Current issues include cumbersome room change procedures, delayed responses to maintenance requests, and missing visitor records, severely impacting student accommodation experience and administrator efficiency(Klochan et al., 2021).

To address these challenges, the UKM Dorm-Net project was launched to develop a centralized digital dormitory management platform. This platform integrates core functions such as room management, maintenance requests, visitor registration, utility bill payments, and announcements to improve information flow between students and administrators. The project

utilizes an agile development model, with continuous optimization throughout each iteration to ensure the system can be flexibly adjusted and improved based on user feedback .

2.0 LITERATURE REVIE

The literature review section analyses the functional strengths and weaknesses of three existing platforms, providing reference and inspiration for the design of the UKM Dorm-Net. The selected comparison platforms include the Hilton hotel booking website, the UKM SMP course selection website, and the Malaysian accommodation platform Mudah.my.

The Hilton hotel website excels in interface design and information presentation, utilizing HTML5, CSS3, and JavaScript technologies, and employing SSL encryption to ensure user information security(He et al., 2024). However, in terms of user experience, the process is complex due to the requirement to fill in a large amount of personal information. The UKM SMP system, as UKM's internal service platform, is user-friendly but prone to system crashes during peak hours (Wasilewski & Research, 2024). Mudah.my, while featuring a simple interface and robust filtering capabilities, suffers from excessive advertising and a lack of vetting of listings, which undermines user trust.

Table 1: Comparison of the functions of different platforms

Platform	Advantage	Disadvantage
Hilton Hotel Information Website	1. Clear and easy-to-use interface. 2. Real-time update data.	1. Non-member functions are limited in some areas. Booking process is complicated and requires a lot of information to be filled in.
UKM SMP Course Registration Website	1. Efficient and convenient and can update data in real time. 2. Open to all UKM students which no need memberships.	Website crashes are common during peak hours.
Malaysia Mudah Rental Website	Extensive search and filtering capabilities.	1. Real-time data update function is poor. 2. A lot of advertising occurs during using.

Figure 1: Interface of Hilton room selection website

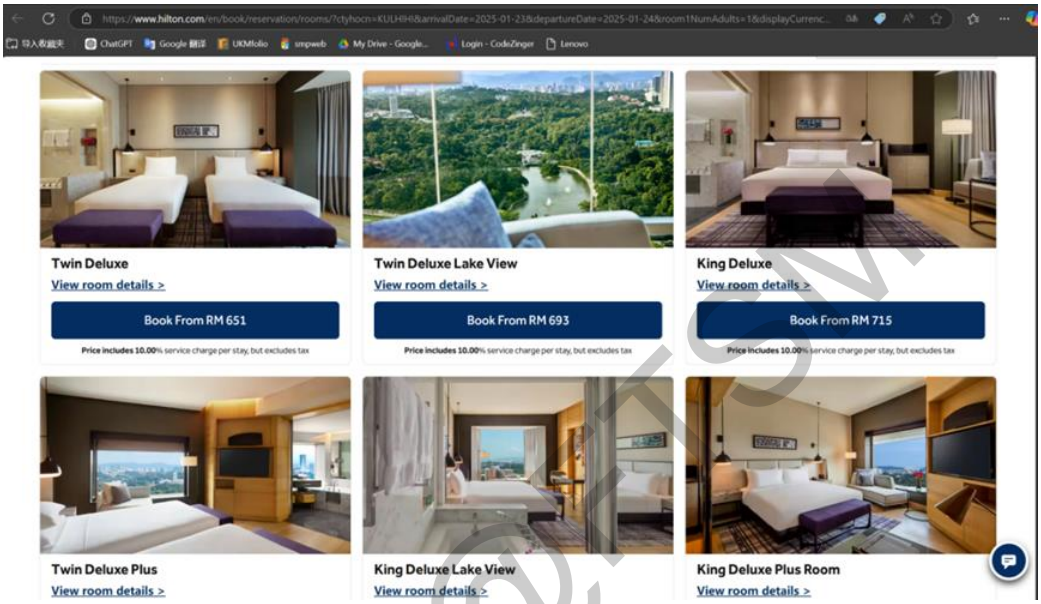


Figure 2: UKM SMP Course Registration Website

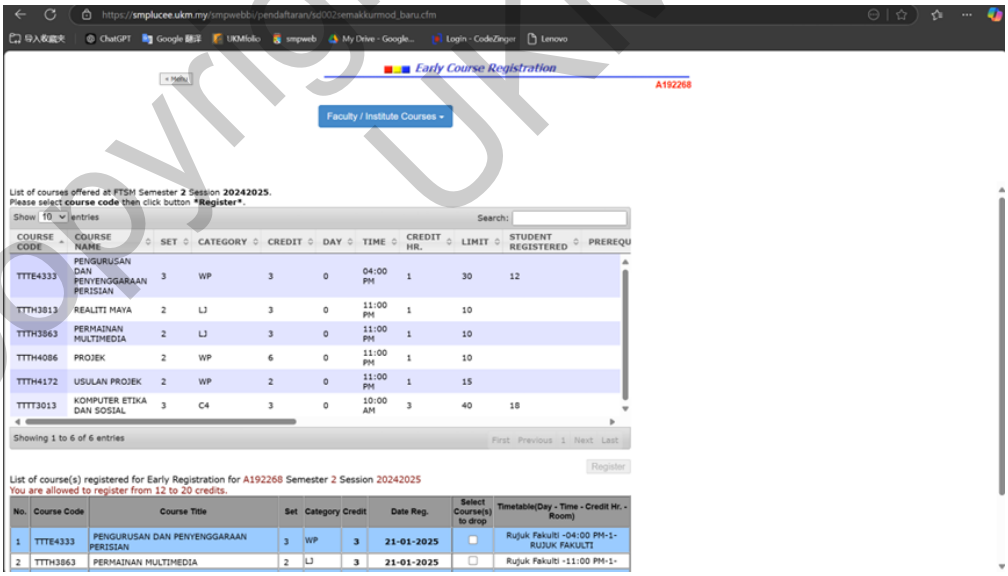
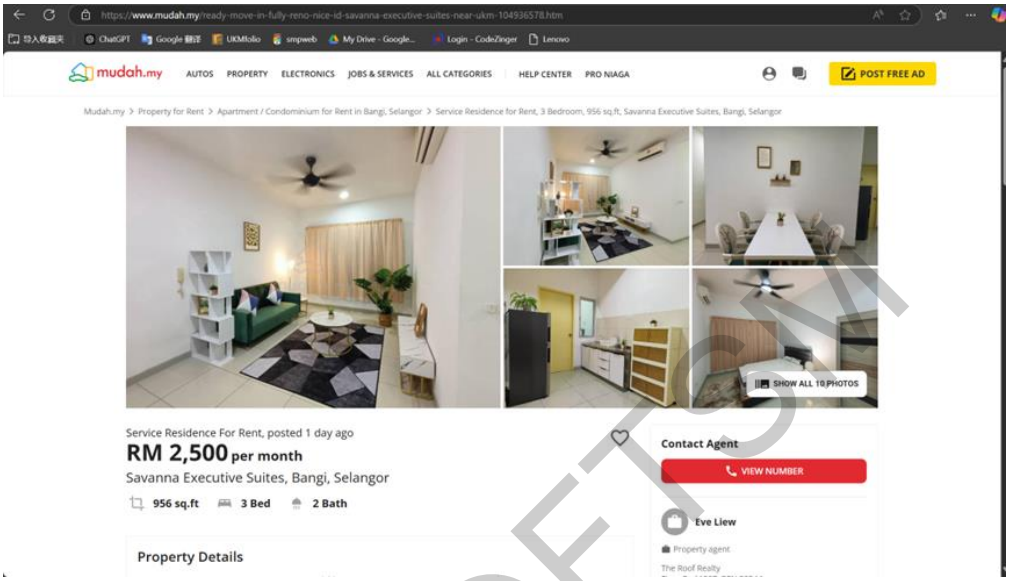


Figure 3: Malaysia Mudah Rental website



After comprehensive analysis, UKM Dorm-Net, drawing on the experience of the aforementioned platforms, adopted a simple and intuitive page layout, a real-time data update mechanism, and eliminated advertising interference. This improved operational fluidity and the platform's credibility, ensuring that students and administrators can quickly obtain the information they need and complete related operations.

3.0 METHODOLOGY

The UKM Dorm-Net system was designed with user needs at its core. A questionnaire survey was conducted to collect feedback and suggestions for improvements from students and administrators regarding the existing dormitory management system. The results showed that users were most concerned about issues such as an unclear repair reporting process, the inability to pre-process visitor registration, and the inability to access payment data. Over 63% of students requested an "online repair reporting" feature, while another 30% requested support for "visitor pre-registration" and "online viewing of utility bills".

The system's functional division covers two core user groups: the student side includes registration and login, room application, repair registration, visitor submission, and announcement viewing; the administrator side is responsible for room allocation, repair approval, visitor review, and announcement posting. The system adopts a modular architecture

with a clear structure, facilitating future functional expansion. Data flows connect modules to achieve unified authentication and permission management.

In the modelling phase, the system uses use case diagrams, sequence diagrams, and activity diagrams to clearly demonstrate the interaction paths and processing logic between users and the system.

Figure 4: Use Case Diagram

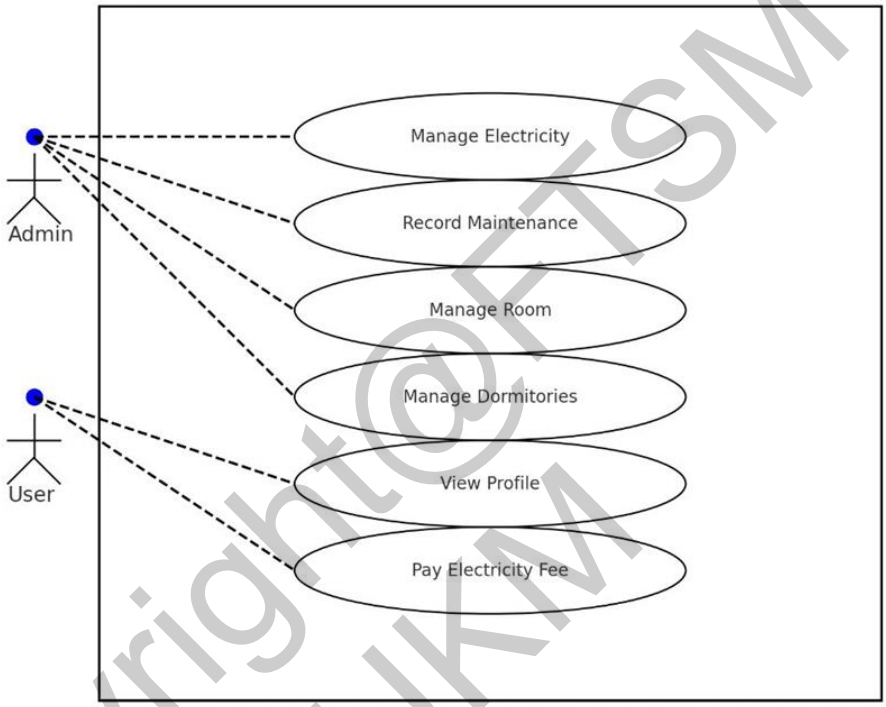


Figure 5: Sequence Diagram for UKM Dorm-Net

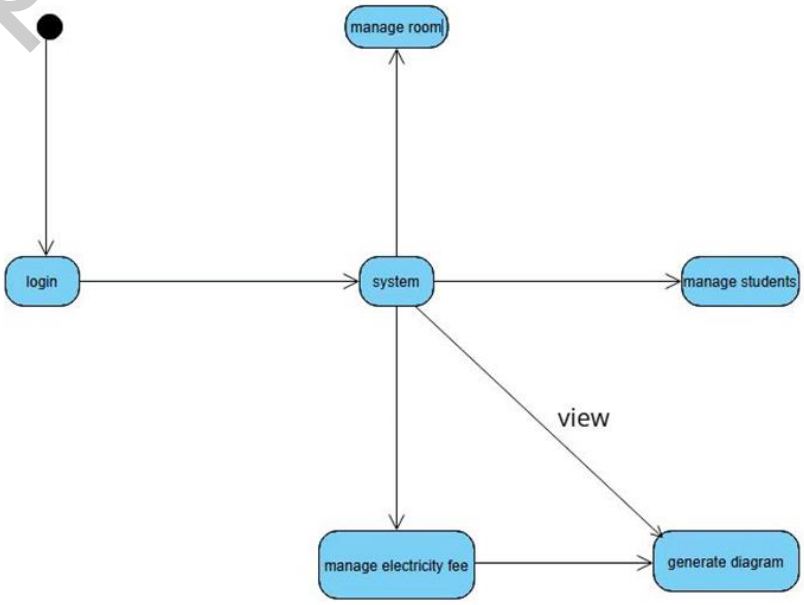


Figure 6: Activity Diagram for UKM Dorm-Net

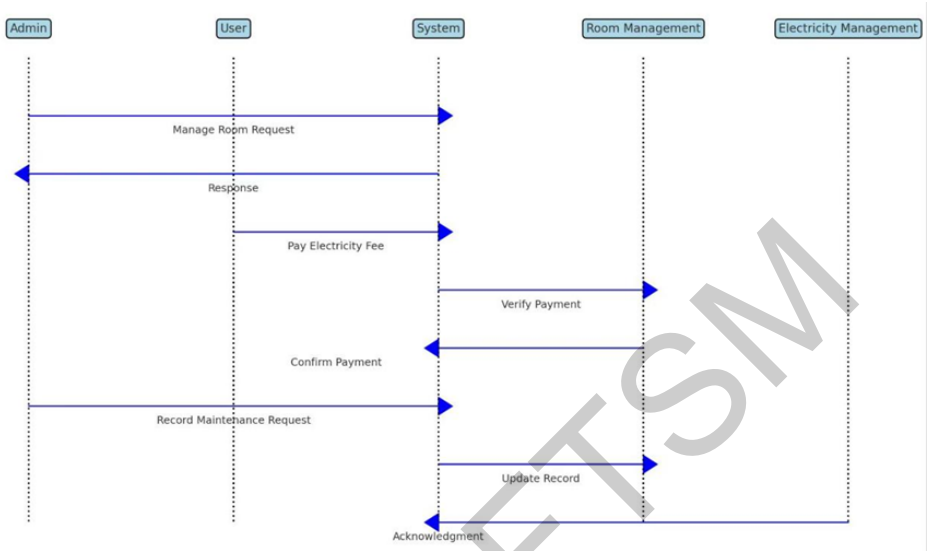


Figure 7: Module Structure Diagram

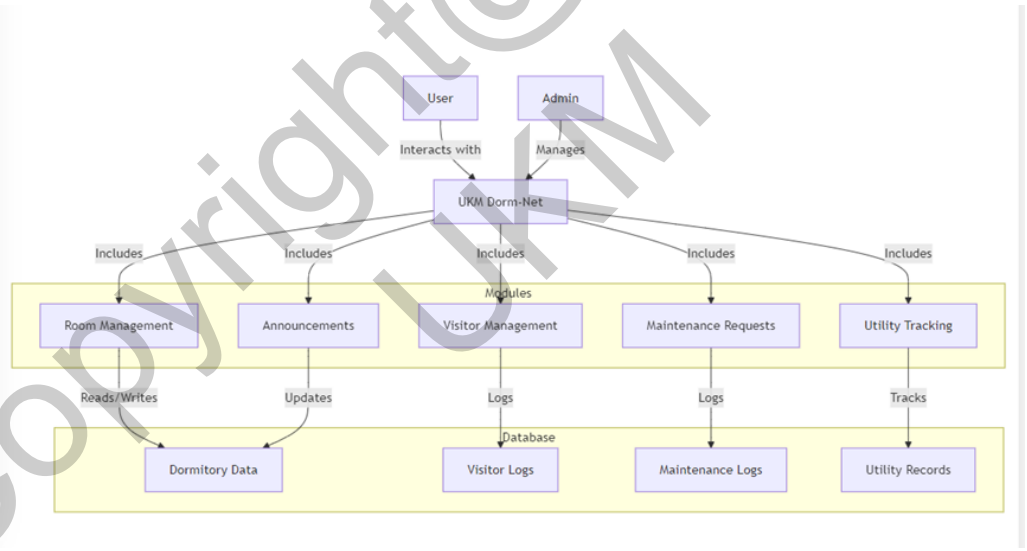
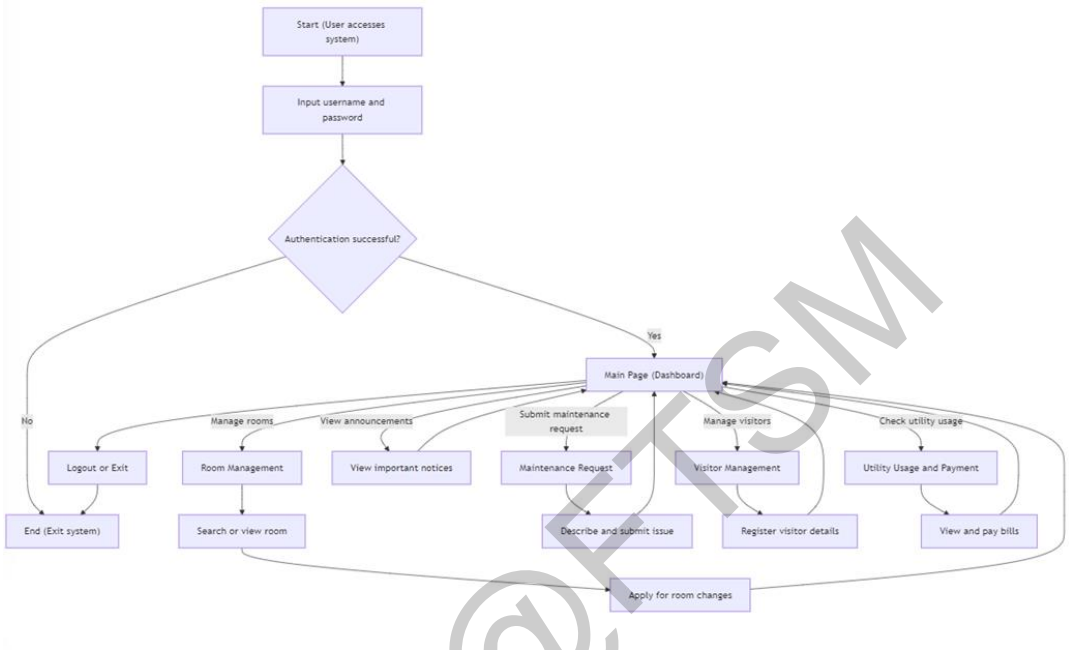
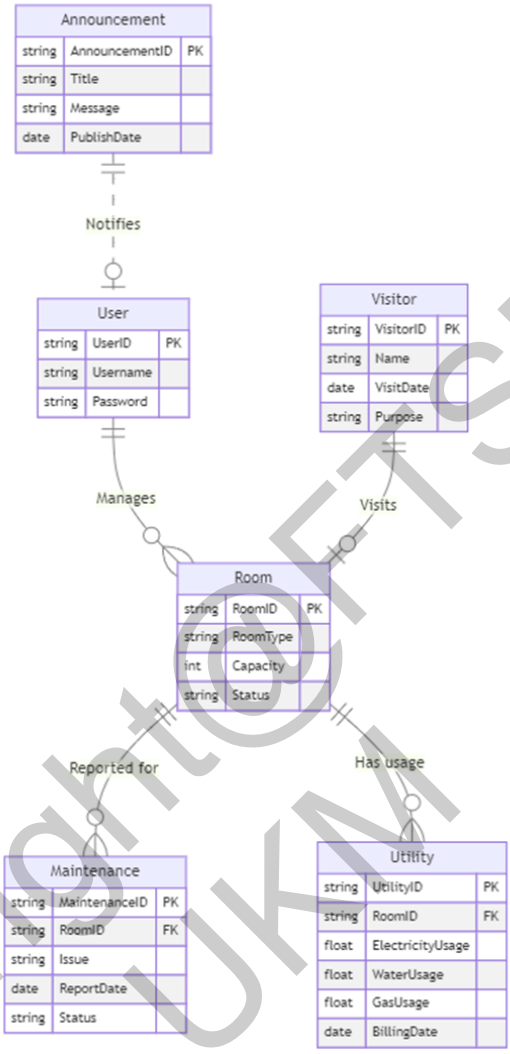


Figure 8: User Interaction Flowchart



The database design used an ER model to establish five main entities: users, dorm rooms, repair reports, visitor records, and billing records. Clear relationships were established between these entities. For example, each repair report could be traced back to thecorresponding student and room number, and each billing record was associated with a specific dorm room and payment status.

Figure 9: ER Diagram



Through the above modeling and design methods, UKM Dorm-Net built a digital platform with a clear structure, independent functions and mutual collaboration, providing a comprehensive solution for dormitory management processes.

4.0 RESULTS

The system was developed using the Vue.js and Java technology stack, resulting in an intuitive and concise front-end interface and rigorous back-end logic. The system successfully implemented functions such as student registration and login, room search and request, maintenance upload, visitor registration, bill viewing, and announcement posting.

Figure 10 show the user registration interfaces, where admin can input personal information to create an account. This page validates the input, encrypts the password, and stores the data in the database.

Figure 10: User registration code segment

```
public void register(Account account) {  no usages
    Admin admin = new Admin();
    BeanUtils.copyProperties(account, admin);
    add(admin);
}
```

Figure 11 presents user login functionality, the system verifies the entered credentials against the data records, if valid, grants access to the user dashboard.

Figure 11: User login code segment

```
public Account login(Account account) {  1 usage
    Account dbAdmin = adminMapper.selectByUsername(account.getUsername());
    if (ObjectUtil.isNull(dbAdmin)) {
        throw new CustomException(ResultCodeEnum.USER_NOT_EXIST_ERROR);
    }
    if (!account.getPassword().equals(dbAdmin.getPassword())) {
        throw new CustomException(ResultCodeEnum.USER_ACCOUNT_ERROR);
    }
    // token
    String tokenData = dbAdmin.getId() + "-" + RoleEnum.ADMIN.name();
    String token = TokenUtils.createToken(tokenData, dbAdmin.getPassword());
    dbAdmin.setToken(token);
    return dbAdmin;
}
```

Figure 12 and Figure 13 display the code segment for student to check the information of each dormitory and each building.

Figure 12: Dormitory information code segment

```
@GetMapping("/selectPage")
public Result selectPage(Dormitory dormitory,
                         @RequestParam(defaultValue = "1") Integer pageNum,
                         @RequestParam(defaultValue = "10") Integer pageSize) {
    PageInfo<Dormitory> page = dormitoryService.selectPage(dormitory, pageNum, pageSize);
    return Result.success(page);
}
```

Figure 13: Dormitory building information code segment

```
@GetMapping("/selectPage")
public Result selectPage(Building building,
                         @RequestParam(defaultValue = "1") Integer pageNum,
                         @RequestParam(defaultValue = "10") Integer pageSize) {
    PageInfo<Building> page = buildingService.selectPage(building, pageNum, pageSize);
    return Result.success(page);
}
```

Figure 14 presents code segment for admin to manage the dormitory building information, can edit the building name, dormitory position.

Figure 14: Dormitory building management code segment

```
public void add(Building building) {
    buildingMapper.insert(building);
}

public void deleteById(Integer id) { buildingMapper.deleteById(id); }

public void deleteBatch(List<Integer> ids) {
    for (Integer id : ids) {
        buildingMapper.deleteById(id);
    }
}

public void updateById(Building building) { buildingMapper.updateById(building); }
```

Figure 15 contains the detailed information of database, including electronic bills, notice publishing, fix apply and so on.

Figure 15: Database table

Name	Auto I...	Modified Date	Data Len...	Engine
electro	4		16 KB	InnoDB
notice	4		16 KB	InnoDB
admin	2		16 KB	InnoDB
exchanges	9		16 KB	InnoDB
visit	3		16 KB	InnoDB
fix	5		16 KB	InnoDB
building	6		16 KB	InnoDB
dormitory	11		16 KB	InnoDB
student	7		16 KB	InnoDB
stay	12		16 KB	InnoDB

Figure 16: Login Interface of UKM Dorm-Net

Figure 17: Fix Applying Interface of UKM Dorm-Net

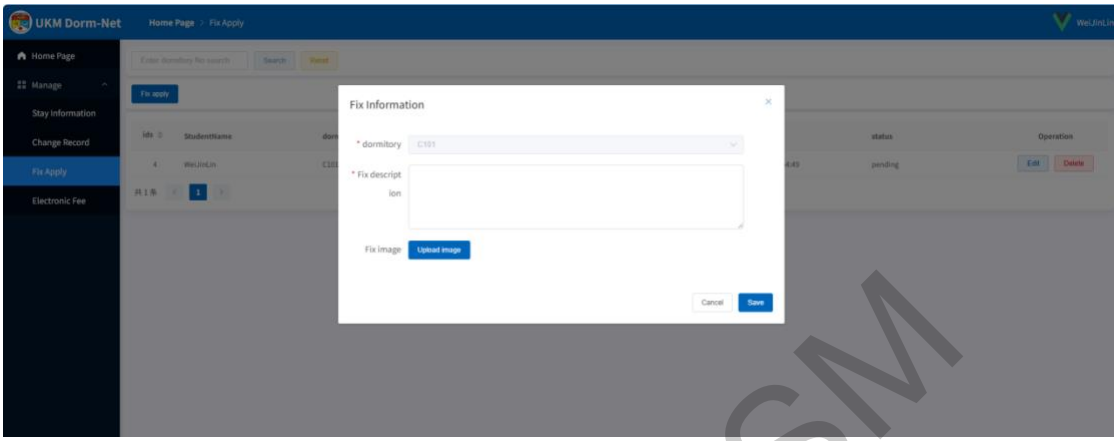


Figure 18: Announcements Publishing Interface of UKM Dorm-Net

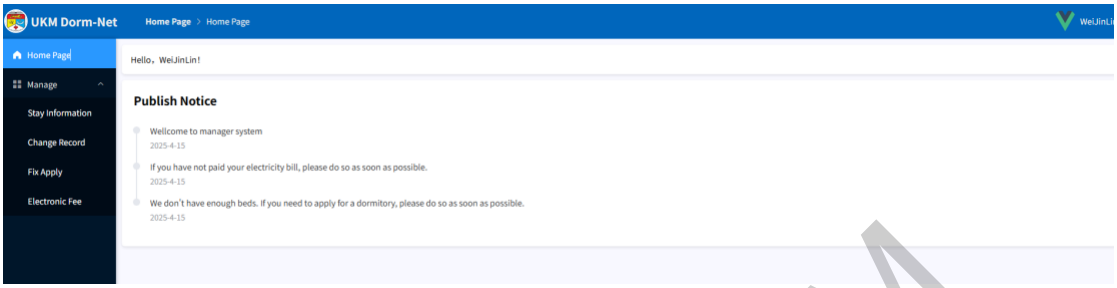


Figure 19: Dorm Basic Information Interface of UKM Dorm-Net

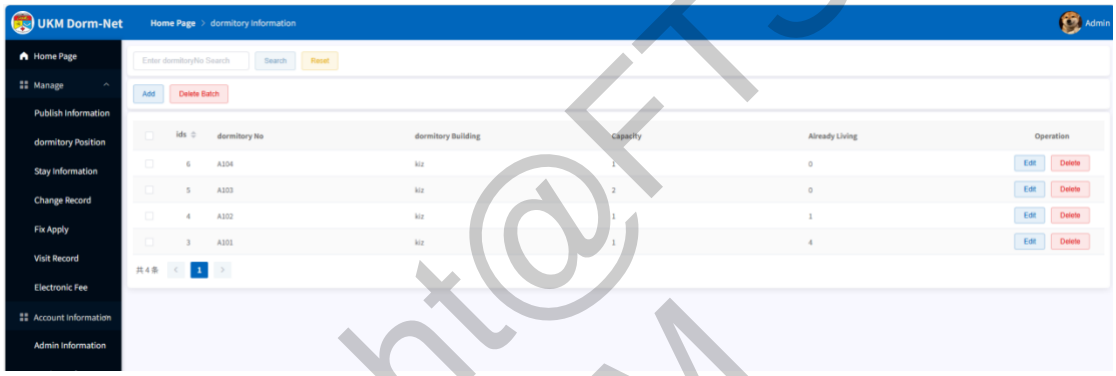


Figure 20: Student Information Interface of UKM Dorm-Net

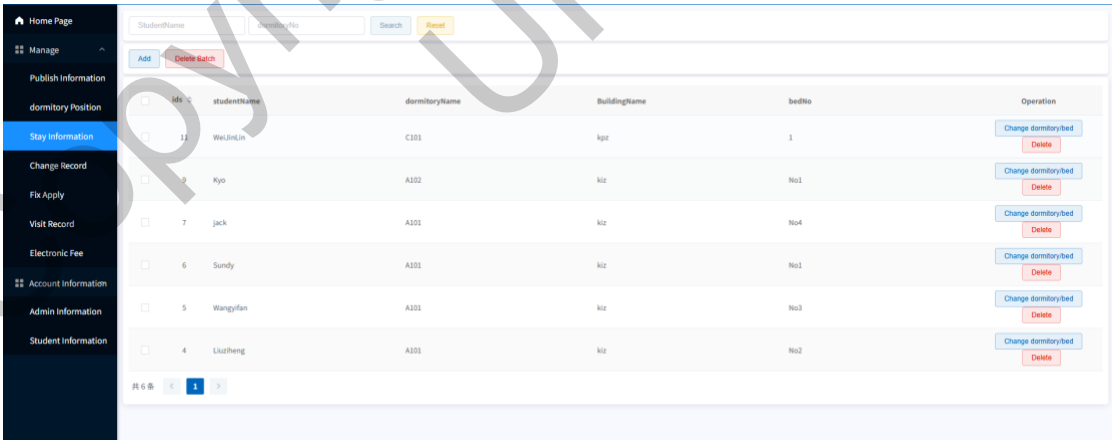
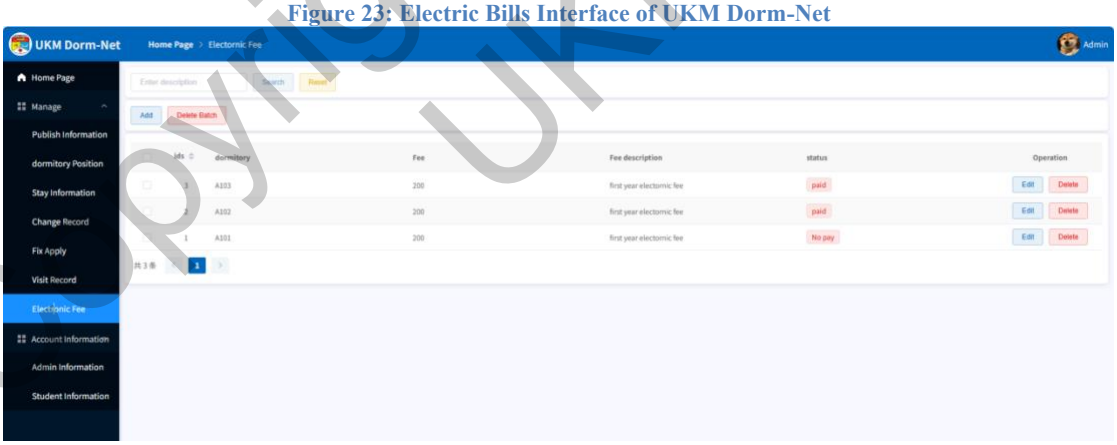


Figure 21: Fix Apply Interface of UKM Dorm-Net

Figure 22: Visitor Record Interface of UKM Dorm-Net

Figure 23: Electric Bills Interface of UKM Dorm-Net



During the actual testing phase, 12 functional test cases were designed, including user registration, login, maintenance request, and visitor registration. Each successfully passed black box testing on Windows 11 and major browsers. The system demonstrated high compatibility, fast response, and excellent user experience, with no data loss or functional interruptions, meeting the standards for online deployment.

Table 2: Use Case TC-001 User Registration Successfully

Use Case TC-001	**User Registration Success**
Test Objective	Verify that the user can successfully register after entering valid information.
Pre-conditions	The system is on the registration page and the user is not logged in.
Test steps	1. Open the registration page. 2. Enter a valid name and password. 3. Click the "Register" button.
Input data	Name: WeiJingLin, Password: 123123.
Expected result	Display “Registration successful” then redirect to the login page.
Actual result	Registration successful, then system automatically redirects.
Test Status	Passed

Table 3: Use Case TC-002 User Login Failure (Incorrect Password)

Use Case TC-002	**User Login Failure (Incorrect Password)**
Test Objective	Verify the system shows the correct prompt when the password is entered incorrectly.
Pre-conditions	The user WeiJingLin already exists.
Test steps	Open the login page. 2. Enter the account and incorrect password. 3. Click the login button.
Input data	Name: WeiJingLin Password: 123456
Expected result	Display “Incorrect username or password” prompt.
Actual result	The incorrect prompt is displayed.
Test Status	Passed

Table 4: Use Case TC-003 Password Change Successfully

Use Case TC-003	**Password Change Successfully**
Test Objective	Verify that the user can securely change the password using the old Password.
Pre-conditions	User already logged in.
Test steps	1.Go to the "Personal Information" page. 2.Enter the old and new passwords, then click "Save".
Input data	Old Password: 123123, New Password: new123123
Expected result	Display "Password changed successfully"
Actual result	The password was changed successfully, and the prompt was show
Test Status	Passed

Table 5: Use Case TC-004 View Personal Information Page Successfully

Use Case TC-004	**View Personal Information Page Successfully.**
Test Objective	Verify that the user can view and edit their basic information.
Pre-conditions	The user is logged in.
Test steps	Click the “User Manage button” and go to “Admin/Student” information. View the name, password and apply or other information.
Input data	None
Expected result	The page displays the current account information correctly.
Actual result	Content accurate and correct.
Test Status	Passed

Table 6: Use Case TC-005 Successfully Publish Announcement Successfully

Use Case TC-005	**Publish Announcement Successfully.**
Test Objective	Verify that admin can publish announcement and show in the system.
Pre-conditions	User login role is admin.
Test steps	Login as admin. 2. Click the "Publish Announcement" button on the left side. 3. Add title and content of the announcement then click save and publish.
Input data	Title: Safety Drills. Content: Date & Place.
Expected result	Display "Upload Successfully" and show in the homepage.
Actual result	Upload was successful and can view on the homepage.
Test Status	Passed

Table 7: Use Case TC-006 View Announcement Successfully

Use Case TC-006	**View Announcement in Student Homepage Successfully.**
Test Objective	Verify that student can view announcement that published by admin.
Pre-conditions	Login as student.
Test steps	Login as a student. 2. Click the "View announcement" button.
Input data	None
Expected result	Student can check same announcement sent by admin and at the same time.
Actual result	The announcement is displayed clearly and timely.
Test Status	Passed

Table 8: Use Case TC-007 Upload Information of UKM Dormitory Successfully

Use Case TC-007	**Upload Information of UKM Dormitory Successfully.**
Test Objective	Verify that admin can upload details of UKM dormitory, such as Dormitory location, Dorm-name and capacity。
Pre-conditions	Login as admin.
Test steps	Login as admin. 2. Click "Dormitory Information" button. 3. Upload the new information such as changing the capacity and so on. 4. Click upload button.
Input data	Dormitory location: Kiz Room capacity: 8
Expected result	The new details of dormitory "Kiz" is uploaded.
Actual result	New information is successfully uploaded by the admin.
Test Status	Passed

Table 9: Use Case TC-008 Search Dormitory Details Successfully

Use Case TC-008	**Search Dormitory Details Successfully.**
Test Objective	Verify that student can successfully check the new details uploaded by the admin.
Pre-conditions	Login as student.
Test steps	1. Login role as student. 2. Click "Dormitory Information" button. 3. View information.
Input data	None
Expected result	Students can view the newest uploaded information of each dormitory.
Actual result	All data show in this interface.
Test Status	Passed

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Table 10: Use Case TC-009 Send Fix Apply of Dormitory Successfully

Use Case TC-009	**Send Fix Apply of Dormitory Successfully.**
Test Objective	Verify student successfully upload fix apply.
Pre-conditions	Login as student.
Test steps	1.Login as student. 2. Select "Fix Apply" button on the left side. 3. Add title and content of apply. (picture if needed) 4. Send the apply.
Input data	Room: 101 Fix: Table, Because of the wet weather, the table was damaged and need to change with a damaged table picture.
Expected result	Apply is sent successfully.
Actual result	Students applies can be viewed inside UKM Dorm-Net.
Test Status	Passed

Table 11: Use Case TC-010 View and Approve Apply Successfully

Use Case TC-010	**View and Approve Apply Successfully.**
Test Objective	Verify that admin can view and then approve students' applies successfully.
Pre-conditions	Login as admin
Test steps	1. Login as admin role. 2. Select the Fix apply button. 3. Check the status of the apply. 4. View the details such as room number, which kind of reply then approve.
Input data	None
Expected result	Admin view and then approve the reasonable apply.
Actual result	Approve successfully.

Test Status	Passed

Table 12: Use Case TC-011 Upload the Electric Fee and Details Successfully

Use Case TC-011	**Upload the Electric Fee and Details Successfully.**
Test Objective	Verify admin can update each dormitory electric bills and check payment status.
Pre-conditions	Login as admin role.
Test steps	1.Login as admin. 2. Click “Electric Payment” button. 3. Add new information then update.
Input data	Room 101, Fee 100rm Status unpaid
Expected result	Admin uploaded successfully.
Actual result	Payment and the status is showed in the homepage.
Test Status	Passed

Table 13: Use Case TC-012 Checking Electric Fee Payment Successfully

Use Case TC-012	**Checking Electric Fee Payment Successfully.**
Test Objective	Verify student can get their room electric fee correctly.
Pre-conditions	Login as student.
Test steps	Login as student role. 2. Click “Electric payment” button. 3. Check the bill.
Input data	None
Expected result	All the information that showed in student interface is same as that published by admin. Student get the bill correctly.
Actual result	Students get the bill correctly.
Test Status	Passed

Table 14: Use Case TC-013 Apply Visitor Record Successfully

Use Case TC-013	**Apply Visitor Record Successfully.**
Test Objective	Verify students can successfully update the visit information for admin to check.
Pre-conditions	Login as student.
Test steps	Login as student. 2. Click "Visitor Record" button. 3. Add details of visitors then submit.
Input data	Visit date, target dormitory and other details.
Expected result	Student successfully send data to the system for admin checking.
Actual result	All details are uploaded successfully.
Test Status	Passed

Table 15: Use Case TC-014 Approve Visitor Apply Successfully

Use Case TC-014	**Approve Visitor Apply Successfully.**
Test Objective	Verify admin can view all the apply sent by students and approve the reasonable ones.
Pre-conditions	Login as admin.
Test steps	1.Login as admin. 2. Click the "Visitor Request". 3. Check the details and approve.
Input data	None
Expected result	Admin can view all the requests and approve the correct one.
Actual result	All the applies and approves are updated correctly in the system.
Test Status	Passed

5.0 CONCLUSION

The UKM Dorm-Net project effectively addresses the current challenges of cumbersome manual operations, delayed information, and inefficiency in dormitory management, particularly in areas such as room changes, repair requests, visitor registration, and utility billing, improving workflow efficiency and student satisfaction (Xu, 2021). Through its modular design and agile development model, the system offers excellent scalability and flexibility, enabling functional expansion and upgrades based on future needs.

Furthermore, system testing results demonstrate that Dorm-Net is stable and highly compatible in practical operations, making it suitable for deployment and expansion. Future efforts could include integrating additional intelligent management features, such as dormitory occupancy predictions and mobile app development, to further enhance the development of a smart campus.

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