C_ITSP200 – Final Deliverable

Cover page

Group number and name:	1 – Lorium Technology Enterprises
Group member details:	MB2013-0483 – Lin; Liang-Shih (leader) MB2013–0747 – Ludidi; Nolufefe MB2013–0497 – Ikatlholeng; Isabelinha
Project title:	Final Deliverable
Submission date:	16 October 2015
Signature of group leader:	林良士

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Deliverable 1

System Proposal

1. **Group and customer information**

Group members (Lorium Enterprises Technology):

Names	**Skills**	**Student Numbers**
Nolufefe Ludidi	HTML, CSS & Java	MB2013-0747
Liang-Shih Lin	Java, PHP &Java Script	MB2013-0483
Isabelina Ikatlholeng	Java	MB2013-0497
Ryan Bloch	Java & Python	MB2014-1022

Customer's Profile:

Name: John Smith

Name of the company: Linha Properties

Industry: Student accommodation

Location: Rondebosch

2. **System Proposal**

2.1. Overview

Customer company:

Linha Properties was established by John Smith in the year 2003, the company catered accommodation for students. Linha Properties then expanded to several properties accommodating students and working class people.

Our company:

The business is only owned by the founders and still looking for investors to invest into the company. In the beginning of 2013 the company focuses in the technology field and more particularly developing programs. The business is devoted to creating considerable value for its customers.

Lorium Enterprise Technology was formed in a garage by Liang-Shih Lin along with Nolufefe Ludidi, Ryan Bloch and Isabelinha Ikhatlholeng in the middle of 2013 whilst they were busy with their first year studies. The purpose of the business to create innovate programs that will provide solutions for enhancement on current outdated systems.

Problems:

- The current system does not appeal to students.
- Students does not have knowledge of how they are being rated.
- Students cannot keep track of their balances.
- No notification is being sent to them.
- Landlord won't be able to keep track of when the tenant is on vacation.

Solutions:

- The system will be implemented in the residence to reduce the latency and internet cost unlike an online system.
- System will appeal to students due to inexpensive residential fees which is within their budget.
- With every student having their own accounts, they will be able to log in the system and check their current amount (fee) for that specific month. This will also teach them to manage their money.
- A notification will be sent via e-mail if the water and electricity usage exceeds a certain amount.

2.2. Aim

The aim of this project is to develop and implement an accommodation fee calculator system to help make accommodation more affordable to students and manage the business better so that landlord can manage his/her business more efficiently.

2.3. Objectives

- The opinion on our system will be collected using a questionnaire that we create for our target market.
- Research on similar systems to differentiate between how our system is better/different to the current system.
- Research on the technologies that we can use, this can help us better understand the best what we must do to achieve our aim.
- To design a user requirement document, that will help the landlord use the system.

- Research on how to make the login and logout system more solid so that students won't be able to exploit the login and logout system.

2.4. User requirements

2.4.1. Functional requirements:

- The system will send a notification in the form of an e-mail or an SMS to the tenant, whenever the tenant uses more than the set amount of water and electricity.
- The system will check user credentials whenever they login and logout of the system.
- The system will be able to periodically back-up the database and the data stored on the server.
- The system will display descriptive user-friendly error messages if the user enters the wrong details.
- The system will send an invoice to the tenants to notify them about their balance.
- The system will record and electricity usage from the Automatic meter readings, get the current cost from the internet, do the calculation and include it in the tenants' monthly fee.

2.4.2. Non-functional requirements

- The notification will be sent to the tenant regarding to the over usage of water and electricity should be sent within an hour.
- The manipulation of the cost per hour due to water and electricity price change should be done manually within 12 hours.
- The database will be backed-up to an external server every 24 hours.

- There will be an option for the user to reset their password if they have forgotten their password, i.e. by passing various security checks.
- Tenants' information will be securely stored in the server, only landlord has access to them.
- The information displayed to tenants will be in simple HTML format.
- The server will be safe from hackers.
- The entire system will cost around R10000.

2.4.3. Technical requirements

- Netbeans with GlassFish Server
- Microsoft Excel
- Internet connection for both landlord and tenants
- Computer
  - Intel Core i5-4200H, 2.8GHz
  - 8GB RAM
  - 1TB HDD space with 128GB SSD
  - Windows 8.1
  - Microsoft Server 2012

2.5. Required hardware and software

2.5.1. **For developers:**

- Computer that are compatible to run Netbeans
- Netbeans with GlassFish server installed

2.5.2. **For customers:**

2.5.2.1. **Hardware:**

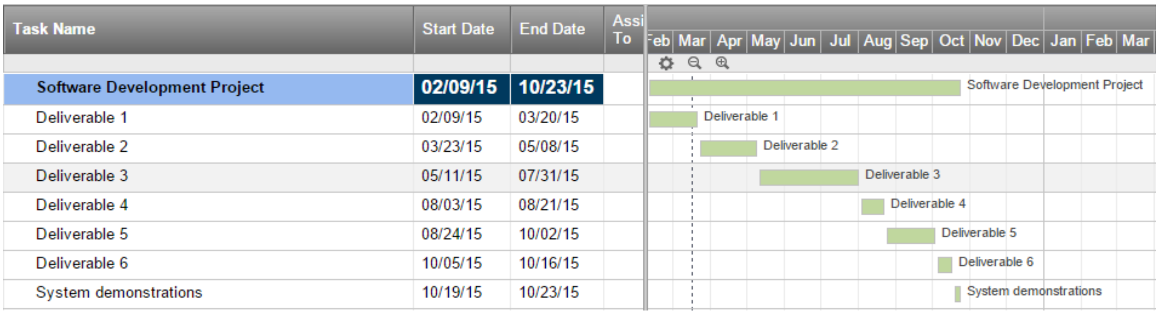
- Server Machine
- Backup server machine
- Generator for the system
- Ethernet cable
- Wireless router
- Suppressors for when the power surges
- Automatic Meter Reader to get the reading for water and electricity usage

- NFC reader for swiping cards to login and logout of the facility

2.5.2.2. **Software:**

- Server operating system
- Web browser

2.6. Schedule



Task Name	Start Date	End Date	Assi To
Software Development Project	**02/09/15**	**10/23/15**	
Deliverable 1	02/09/15	03/20/15	
Deliverable 2	03/23/15	05/08/15	
Deliverable 3	05/11/15	07/31/15	
Deliverable 4	08/03/15	08/21/15	
Deliverable 5	08/24/15	10/02/15	
Deliverable 6	10/05/15	10/16/15	
System demonstrations	10/19/15	10/23/15	

2.7. Constraints and Assumptions

- Assumptions
  - We will have access to necessary resources to produce final product.
  - We will encounter numerous amounts of errors during coding and setting up the server.
  - We will be learning how to set up a server from tutorials found online.
  - The login or logout section will require the tenant to swipe a card
- Constraints
  - Group members will have different schedules, which will be difficult to schedule meetings.
  - Group members have basic knowledge of coding, therefore more time will be required to learn more coding concepts.
  - Power failures can result in loss in data.
  - We may not have enough time to complete the project.

- Lorium Enterprises Technology

- The cost of the hardware may be too high for the customer to pay.

2.8. Feasibility Study

The system that we will be comparing our system with is called Buildium Property Management software, which is similar to our system in ways that it enables managers of residential and associated properties to take complete control of every aspect of their business. This includes them to manage rent, vacancy as well as maintenance cycles.

Feasibility criteria	Ranking	System option 1: develop system in-house	System option 2: buy system
Operational feasibility:	30%	**Functionality:** The system should meet all the user requirements listed above. Our proposed system has Graphic User Interface that is user-friendly to the tenants, so that they can navigate the system with ease to find their information. When they sign in or out, the system will provide methods to make it clear what they need to enter and if an error occurs, the system should provide feedback. Such feedback will include user friendly error/notification messages if the user has entered the wrong password or user name, For example: ● "you have entered the wrong password, please try again" or, ● "please enter the correct user name", will be shown on the screen. Our system will also have an alternative method of retrieving or resetting th	**Functionality:** The Buildium system keeps track of the tenants rent cycle, lease as well as the administrators full general accounting ledger, and an automated rent and late fees calculator. Online payment can be received by the property managers via Buildium's tenant portal with it's ease-of-use interface(Software Advice, 2015). However, the company didn't keep the students in mind when they developed the system. The cost for the accommodation will be fixed rate instead of hourly rated based on when the tenant is in or out of the facility. The landlord will need to pay when purchasing this system(Software Advice, 2015)..

		e user's password if the user is to ever forget his or her password or login details. The method will be easy to follow as the systems interface is graphical, thus allowing and making it easier for the user to follow the simple steps into resetting their passwords. The use of dialog messages that guide the user and notifies the user of any requested information, may it be of the electricity bill or rental bill will be sent via email at the request of the tenant whenever they would like to see if they are overspending or not. Administrators will also have the ease of navigating through the system, the data is digital, thus less paper work, rather only the contracts the tenants need to sign will be paper based (Pham,A & Van Pham,2012). **Score:** 70	**Score:** ?
Technical feasibility:	30%	**Technology:** Our system uses hourly rates based on inflation, water and electricity costs. While the student is not in the facility, he/she will only be charged with the base amount for occupying that space, if he/she is in the facility the cost will go up with the municipal cost included because he or she will be using electricity and water during this time. To make this possible, we will implement a server machine on-	**Technology:** The system that is currently being used in the industry is different from the system that we are designing. The system currently in the industry uses a fixed rate to charge the students. Buildium's system will be online where clients will be able to access their account, make changes, and save them onto

		site for the landlord to use so that he/she may register a new tenant into the facility as well as change the hourly rate based off daily expenses that the facility will face. With this in mind, we will also need to implement a system that allows the tenants to sign in and sign out with ease. The best probable solution for this, is to use NFC technology as this technology can have the user swipe when they need to exit and enter the facility(Pham,A & Van Pham,2012).. **Expertise:** We don't have the required skills to develop this system, we will need to outsource the required knowledge from the internet or through hardcopy documents which relate to the technology we will be using. The first thing we will need to do research on is how to create a Server/Client software so that the tenant can access the server and information that is on the server. The next thing we need to do research on is how to make the server functional since we will be using Microsoft Server. I believe the server will be the most problematic because we will need to understand the web services and servers that is available in Microsoft Server 2012. Since our system has a	Buildium's server(Software Advice, 2015).. **Expertise:** Buildium has specialists who has the skills to create such a system and maintain them, but that is on the server side. If the client is using this system, the client may not be computer literate so if something goes wrong he/she won't be able to find the problem and solve it (Software Advice, 2015). The experts also determine the amount of profits the system may bring into the business annually. **Score:** ?

		user friendly interface with functions that are very straight-forward, the user are able to fix the problem with ease without having to consult someone who is computer literate(Pham,A & Van Pham,2012).. **Score:** 45	
Economic feasibility:	30%	**Costs:** HP ProLiant Gen8 MicroServer: R3475.00 Ubuntu 14.04.2 server: Free Acer V196HQLAB 18.5" LCD Monitor: R1090.00 Hot sell 13.56mhz usb sdk: R427.10 **Benefits:** Our system should benefit the host and the tenant in many ways such as: -the host can have more control over the managerial side(our system will come with a database as well as data base application software which will allow him to add, remove and update all tenants information as well as make tailored search queries.) - this system will give him the ability to track tenant expenses as well as monitor if each room is vacant or occupied. - on the tenant side they can log on to the system and check their balances. They will also receive notifications if the cost of any given entity has cha	**Costs:** these costs are based on the "On-premise" price charge **Licence and subscription** license type: perpetual License fee: R732, 35. Additional license costs each year: R 73, 24. Years until major upgrade: 5. **Installation and Set-up** Year-one install and setup costs: R91 544, .24 Major upgrade install and setup costs: R3 514, 75. **Customization and integration** Year-one customization plus integration costs: R6 1029, 49. Major upgrade related costs: R24 411, 80. **Data Migration** Year-one data migration costs: R18 308, 85. **Training** Year-one training costs: R36 617, 70. Additional costs each year: R9 154, 42.

		nged. The system will also allow them to manage their appliances .they can enter all their electrical appliances into the system, it will then access an online database and retrieve all information for all their appliances` electricity usage. The system will then give them hints on how to lower their electricity consumption to save money. These system functions will give tenants the opportunity to save money and learn better financial skills. It will also give them more control in which previously they had none (they would pay a static fee which would be deducted from their bank account). Our system now gives them the chance to manage their use of resources as well as pay less in the process (Pham,A & Van Pham,2012).. The reason we think that the system will be a success with students (advertised mainly towards students) is because many of them are on a tight budget. The reason being many of them/their guardians pay for student loans and other college expenses. They then have to survive, so they pay for food, medical bills and other expenses. If they are studying full time they may not have enough time in the day to work and even if they do the pay	**Maintenance and support** Year-one maintenance plus support costs: R14 6470, 79. Maintenance contract term in years: 1 Price increase at the end of each term: 2.5%. **Hardware** Year-one new hardware required: R305 147, 47. Hardware life expectancy in years: 5 Additional costs each year: R30 514, 75. **Other costs:** Year-one other costs: R0 Recurring other costs: R30 514, 7 **This section is based on the cost of the Software as a Service** Subscription fee (annual): R305, 15. Subscription in term in years: 3. Price increase at end of each term: 15%. Years until major upgrade: 0 **Installation and set-up** Year-one install and setup costs: R6 1029,49. **Customization and integration**

		will be minimal. Our system is primarily focused on students saving money which should attract many struggling students to accommodations that implements it(Pham,A & Van Pham,2012).. Now you may ask, “how is the land lord going to benefit?”. Well he will by using a system that many students and other people really need in today’s expensive environment. Meaning that he will attract business to his apartment buildings (Pham,A & Van Pham,2012).. With regards to the analysis it is safe to say that this project is economically feasible and should financially benefit both the host and the tenant. The predicated success of our system would mean that we make a profit in the end and the costs and time spent creating it would be worth it (Pham,A & Van Pham,2012).. **Score:** 100	Year-one customization and integration costs: R24 441, 80. **Data Migration** Year-one migration costs: R18 308, 85. **Training** Year-one training costs: R24 411, 80. Additional training costs each year: R6 102, 95. **Maintenance and support** Premium support costs: R36 617, 70. Premium support contract in years:1. Price increase at end of each term: 2.5%. **Hardware** Year-one new hardware required: R12 2058, 99. Hardware life expectancy in years: 7. Additional hardware costs each year: R18 308, 85. **Other cost** Year-one other costs: R0 Recurring other costs (annual): R12 205,90 **Benefits:** users interested in trying the software can sign up for a 15-day trail of which is free. The On-Premise option has an advantage over the Software as

<table>
<tr><td></td><td></td><td></td><td>a Service option, whereby the annual increase in profits and interests growth is faster in the On-Premise option. And the annual profit increase is slower on the Software as a Service package option, as it steadily increases annually 50% less than the On-Premise option.

<b>Score:</b> ?</td></tr>
<tr><td><b>Schedule feasibility:</b></td><td>10%</td><td>30 weeks

We have been allocated with a start and finish date to design, create and implement our system. We need to take into consideration the time frame to accomplish all major activities within the project to meet the client’s deadline, and constraints that might negatively affect system development.

Due to our limited knowledge in programming, database development and server configuration, we will encounter many difficulties while developing the system. However, with the resources that is available to us, we should be able to finish the system in the 30 weeks that were given for us

<table>
<tr><th>Task Name</th><th>Duration</th><th>Start</th><th></th><th>Finish</th></tr>
<tr><td><b>Aim, Objectives and User requirements</b></td><td><b>5 days</b></td><td><b>Mon 15-02-09</b></td><td></td><td><b>Fri 15-02-13</b></td></tr>
<tr><td><b>Objectives</b></td><td><b>5 days</b></td><td><b>Mon 15-02-16</b></td><td></td><td><b>Fri 15-02-20</b></td></tr>
</table>
</td><td>30 weeks

<b>Score:</b> ?</td></tr>
</table>

User requirements	5 days	Mon 15-03-23		Fri 15-03-27
Required hardware and Software	5 days	Mon 15-03-02		Fri 15-03-06
Typing of deliverable	5 days	Mon 15-03-09		Fri 15-03-13
Gantt Chart	5 days	Mon 15-03-16		Fri 15-03-20
Scheduling	31 wks	Mon 15-03-23		Fri 15-10-23
Downloading and install of the Microsoft server 2012	24 hrs	Sat 15-03-14		Tue 15-03-17
Modifying the deliverable	16 days	Tue 15-02-24		Tue 15-03-17

		Score: 80	
Ranking:	100%	73	?

2.9. Recommendations

- System option 1: In-house development is recommended for the customer because if the system is online, then there will be latency and internet fee that comes into consideration so having your own server is the best solution.
- System option 2: The NFC reader should be implemented by the entrance to the building, this way the user can only enter or leave. This system needs to have 2 validation checks, first is within the building, the second is outside the building.

3. Customer sign-off

____
Customer name and surname

____
Customer Signature

林良士
____
Group leader name and surname

20 March 2015
____
Group leader signature

Deliverable 2

Planning

Methodology

The waterfall model is the earliest models used for software development and it is also called linear-sequential life cycle model. The waterfall model is quite easy to use and understand. Each phase has to be completed before the next phase can begin, and thus there is no overlapping in the phase. Where the requirements have been well defined and the development methods are well understood, the waterfall model allows for forecasting project completion times. The phases that take place in the Model are; requirements, analysis, design, coding, testing and acceptance.

- Requirements – we have to specify and define all the systems requirements and thus analyse the systems requirements to be certain enough that we move on to the analysing phase.
- Analysis - as soon as the systems requirements have been met, the next step is to analyse the requirements and Design the system from the analysed requirements to meet our systems goals.
- Designing - the system and planning for the coding part of the designing phase of the model. The design layout has to meet the requirements specified for the system we have described.
- Coding - the Coding phase is where we will code the systems interface and operations using Java.
- Testing - the code will be tested for errors and any malfunctions in the code preventing the system to run. The methodology of walkthrough can be used for testing the code, as the code will be analysed step-by-step for error.
- Acceptance - after the code has been tested and everything is running error-free then the systems design can be accepted for implementation.

The waterfall model is shown in figure 1 below.

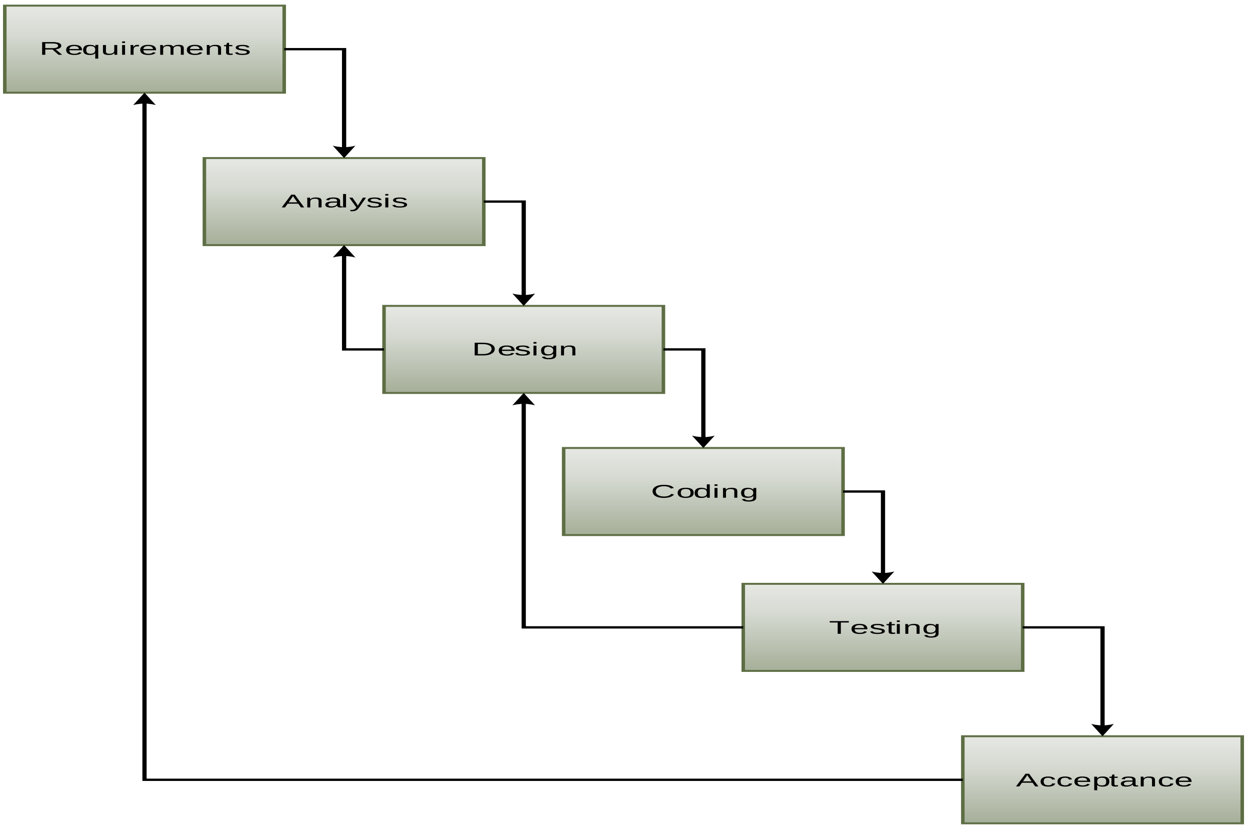


Figure 1.

1 Introduction

This URD is based in the requirements from our first deliverable (C_ITSP200 Deliverable 1, 2015).

The purpose of this URD is to give sight of a clearer and much better perspective of our system, Lorium Enterprise System. The URD allows us and the end user, in this case the customer to navigate through the document to see the standards we have set and are willing to reach for our final product. This includes the user requirements which specify and identify the functions and non-functional requirements of the product which is being developed. The system is of which is an accommodation fee calculation system. These requirements lists the different functions and features included in the system design as well as how the end users will interact with the interface of the system, and whether they will be able to navigate through it.

Lorium Enterprise system is the best system for our customer as it renders a calculating system of which the fees are affordable for students and other tenants, thus making it one of its kind in the market and will increase business profitability. The technical requirements needed we need as the developers of this system are;

- SQL – SQL code to create the database, the tables and to manipulate the data in the tables.
- Java- will be the language we use to code the client application and also the server application is HTML which will link with 2 other languages such as CSS and Javascript HTML will be used as an interface for the user to interact with when they need to get the information from the server.

As mentioned in the scope, the system will be mostly used by the manager of accounts, and the business owner. The other users will only be able to review their account balances – whether they have exceeded their water or electricity usage and rent. The user (student/tenants) will have to login to the system by password and username of which is linked with their personal details, thus allowing them to access their 'apartment- based' information (in this case the tenants account details). The interface will be user- friendly (error messages) and have help functions that will help the users navigate and interact with the system better. The tenants will also be sent a notification by e-mail whenever they exceed their water or electricity usage.

Specified **user requirements included in the systems development**

Functional requirements (only mentioning few of the requirements)

- The system will check user credentials whenever they login and logout of the system.
- The system will be able to periodically back-up the database and the data stored on the server.
- The system will display descriptive user-friendly error messages if the user enters the wrong details.
- The system will send an invoice to the tenants to notify them about their balance.
- The system will record and electricity usage from the Automatic meter readings, get the current cost from the internet, do the calculation and include it in the tenants' monthly fee.

Non-functional requirements

- The notification will be sent to the tenant regarding to the over usage of water and electricity should be sent within an hour.
- The manipulation of the cost per hour due to water and electricity price change should be done manually within 12 hours.
- The database will be backed-up to an external server every 24 hours.
- There will be an option for the user to reset their password if they have forgotten their password, i.e. by passing various security checks.
- Tenants' information will be securely stored in the server, only landlord has access to them.
- The information displayed to tenants will be in simple HTML format.
- The server will be safe from hackers.

Technical requirements

- Netbeans with GlassFish Server
- Microsoft Excel
  - Internet connection for both landlord and tenants
  - Computer
  - Intel Core i5-4200H, 2.8GHz
  - 8GB RAM
  - 1TB HDD space with 128GB SSD
  - Windows 8.1
  - Microsoft Server 2012.

Acronyms

SQL – Structured Query Language- is a special-purpose programming language designed for managing data held in a relational database management system (RDBMS), or for stream processing in a relational data stream management system (RDSMS).

ERD – entity relationship diagram.

Context DFD – data flow diagram (high level diagram).

AMR – Auto Meter Reader.

CPU – Central Processing Unit

NFC – Near Field Connection

CSS – Cascading Style Sheet

HTML Hyper Text Mark-up Language

1.1 Purpose

The purpose of our system is to create an accommodation fee calculating system of which will make student accommodation more affordable and efficient to manage. The system will also make it more proficient for the manager/ administrator as well as the owner to manage the business and keep track of the tenants rent accounts. The system has to reduce internet cost and latency by charging the tenants a certain amount during peak hours and a normal rate at non-peak hours.

Therefore the main readers of this document are Mr. John Smith, and his founding shareholders.

1.2 Scope

The Lorium Enterprise system, will be mostly used by the manager of accounts and owner of the business, as well as by the students and tenants, allowing them to check and manage their accounts in term of their rent balance as well as the water usage, electricity usages, thus helping them manage and spend money more effectively

The students/ tenants will have to access their system account by providing a password and user name to login and view their accounts, thus in return the system will notify them by e-mail about outstanding accounts and whether the students have used their water or electricity limit.

The system will also have a user friendly interface with error messages as well as the systems help function during login and account payment, or when the user forgot the password, they can receive an e-mail or SMS with the link to reset their password/username.

The main benefits and also form part of the functional requirements of the Lorium Enterprise System are: [Deliverable 1, pg 5. 2015)

- The system will send a notification in the form of an e-mail or an SMS to the tenant, whenever the tenant uses more than the set amount of water and electricity.

- The system will check user credentials whenever they login and logout of the system.
- The system will be able to periodically back-up the database and the data stored on the server.
- The system will display descriptive user-friendly error messages if the user enters the wrong details.
- The system will send an invoice to the tenants to notify them about their balance.
- The system will record and electricity usage from the Automatic meter readings, get the current cost from the internet, do the calculation and include it in the tenants' monthly fee.

Therefore; The Lorium Enterprise system will have to solve the clients' current systems problems and better the systems functionality and usability.

1.3 Definitions, acronyms and abbreviations

- URD – User Requirements Document: a document that tells the user what the system can do.
- DFD – Data flow Diagram: a graphical view of how data flows in an information system.
- ERD – Entity Relationship Diagram: a graphical design of how entities relate to each other.
- AMR – Auto Meter Reader: A reader that is attached to water meter and electricity meters.
- CPU – Central Processing Unit: It is a powerful chip in an electronic device which processes data that is sent to it.
- NFC – Near Field Connection: uses an electronic field to send data over it
- CSS – Cascading Style Sheet: A file that is attached to a specific HTML file to give it a more appealing layout
- HTML Hyper Text Mark-up Language: a set of text tagged into a file to be displayed on the world wide web

- SQL – Structured Query Language - is a special-purpose programming language designed for managing data held in a relational database management system (RDBMS), or for stream processing in a relational data stream management system (RDSMS).

1.4 Overview

Now that the systems purpose, scope and document requirements have been met, we move on to identify and create the Systems Requirements. These requirements are:

- The system perspective.
- Functional requirements – consisting of;
    - A context diagram (high-level DFD)
    - An Entity relationship diagram (ERD).
- The non-functional requirements.
- Technical requirements.
- User characteristics,
- And the Operational environment.

The requirements listed above will help us as the creators of the Lorium Enterprise system to create and develop our systems capabilities more efficiently. This takes us a step further in identifying the materials and requirements needed for our system, which will also help us assess and measure the customers' acceptance of the System.

2. System requirements

2.1 System perspective

This system (Lorium Enterprise system) is related to other calculating systems such as Buldium software (Software Advise, 2015) however, this system (Lorium Enterprise system) does not only calculate the rent amount but it calculates the tenant's duration stay in the premises, it checks-in and checks-out a tenant. When the tenant is the premises the system then calculates the stay of the tenant and when the tenant is out of premises, the system does not calculate the tenants' absence. This system also calculate the amount of space the furniture occupies. This system is more appealing to students' who cannot afford expensive accommodations. Each tenant will have their accounts, of which they will use to login to the system and check their balance for that specific month. Notifications will be sent to tenants when and if they have exceeded their water and electricity usage. Lorium Enterprise Technology calculating system may be there same with other accommodation systems but has its own add-on features.

High Priority	Backing up database periodically on the server.
Source	The system developers
Unique ID	Username ID and Password Server ID
Exceptions	N/A
Frequency use	Periodically (24/7)

2.2 Functional Requirements

High Priority	Checking user credentials whenever they login and logout of the system.
Unique ID	Username ID and Password
Source	System developers
Exceptions	Incorrect credentials
Frequency use	Whenever the user wants to access the system

Medium Priority	Sending an invoice to the tenants to notify them about their balance.
Unique ID	Invoice number and Tenant ID
Source	
Exceptions	N/A
Frequency use	Every month end

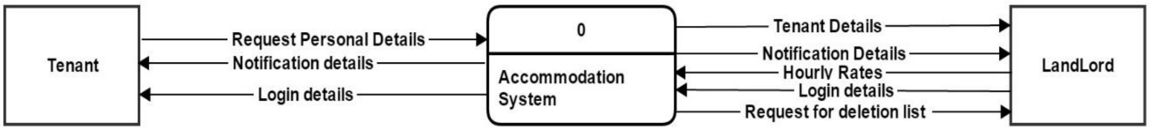
Medium Priority	Recording, getting electricity usage from the Automatic meter readings, getting the current cost from the internet and calculating tenants' monthly fee.
Unique ID	
Source	
Exceptions	Correct monthly fees and electricity usage.
Frequency use	Whenever the user wants it from the system.

Description	
Medium Priority	Sending a notification in the form of an e-mail or an SMS to the tenant,
Unique ID	Tenant ID
Source	
Exceptions	Correct details
Frequency use	Whenever the tenant uses more than the set amount of water and electricity.

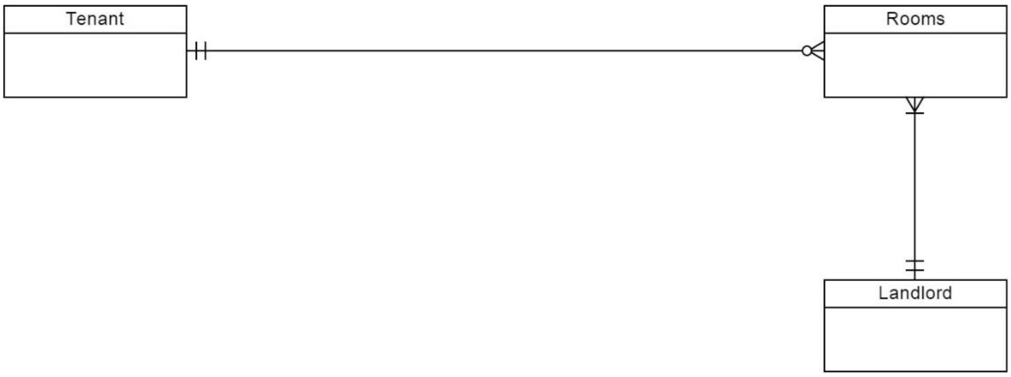
Description	
Low Priority	Displaying descriptive user-friendly error messages.
Unique ID	Article ID
Source	
Exceptions	An error message
Frequency use	Every time the user enters wrong details

2.2.1 A context diagram (high-level DFD)

Data Dictionary	
Request Personal Details	Requesting for their personal details.
Notification details	Receiving notification.
Login details	Login in the system.
Tenant details	Retrieving tenants' information.
Hourly rate	Input or change rates hourly.
Request for deletion list	Delete tenant and apartment list.



2.2 An Entity Relationship Diagram (ERD)



2.3 Non-functional requirements

- **Reliability requirements** – The ability of which a system can deliver what has been requested by the end-user without any sort of complications if there be, an error message should display. The system should perform the required functions under stated for a specific period of time.
- **Usability requirements** – it is easy to navigate on the system and whether end-users will not have troubles to learn how the system operates.
- **Security requirements** – The data of the system may only be changed by an administrator, the system data should be backed up within every 24 hours. Unauthorized access to the system will not be allowed, thus making sure that external communications between the system's data server and clients' is encrypted.
- **Performances requirements** – This concern's the speed of operation of the system, how fast the system responds to the users input, and how much the system can finish a task within a certain amount of time and **where the services is available when** it is requested by the end-users.
- **Supportability requirements** - The ability that a system can adapt once there is an additional application domain concepts, the ability the system can deal with new technology and of which the system can deal with additional international conventions such as styles

2.4 Technical Requirements

There will be three languages that will be used during the construction of this system. For the database, we will be using SQL code to create the database, the tables and to manipulate the data in the tables. Java will be the language we use to code the client application and also the server application. Since java is platform independent, it can be developed once and be used on many different platforms which can be an advantage if the end system is to be requested for mass production. The last language that we will be using is HTML which will link with 2 other languages such as CSS and Javascript. The HTML will be used as an interface for the user to interact with when they need to get the information from the server. The reason we want to use a website as an interface instead of a program is because the server is already on the site, so the latency wouldn't be high and therefore fast website loading times. The other reason to use a website as an interface is so that the software won't need to be installed on every machine to access the server, if you have the address to the server then it will let you access the server.

The hardware isn't as complex as the software, since it is a simple client to server kind of set up. We will need a server machine that is filled with hardware specification that depends on the size of the company and also what kind of company it is. If the company is big then you will need faster servers and servers with large storage capacities. To check if the tenants are within the facility or not, there will be a revolving door which can help with verification that the student is either in or out of the building so they can't cheat the system. On the door will be a RFC reader which will allow students to use a card that can be scanned by the RFC reader to sign in or out of the building. The Automatic Meter Reader will be installed on the water and electricity meters to help record how much the tenant is using the resources.

2.5

The host should be experts with the system that we are developing because they need to know how to operate the system and what to do if the system fails. Before the system goes into operation, the host will be provided with tutorials and a user manual to educate them on how the system works. The tenants are made up of mostly students, most of them are novices who have basic knowledge of how a computer works and others who are studying anything related to using a computer will have more advanced knowledge so the technical expertise are both novice and experts. For the novice tenants, they will be able to find help in the help function of the website that allows them to have access to the website or they can find the information on where to access the website on the notice board around the facility.

2.6

There will be a numerous amount of machines that his system will need to operate on. Firstly is the server, the server will contain many different hardware parts that creates the server for example; hard drive, the CPU, and so on. The Auto Meter Reader will be placed on the electricity meters and water meters of each tenant's apartment/room to help calculate what that specific tenant needs to pay. The RFC reader will be attached to the revolving door at the entrance to the building so that tenants can't cheat the system. The RFC reader will read the cards that each tenant holds which will help with sign in and sign out the building. The way to check how much the tenant needs to pay, they will be given a website address to access the server and check their information and balance on the website.

3 Customer sign-off

Customer name and surname

Customer Signature

Liang-Shih Lin

林良士

Group leader name and surname

Group leader signature

Deliverable 3

Designing

1. Information Systems Design

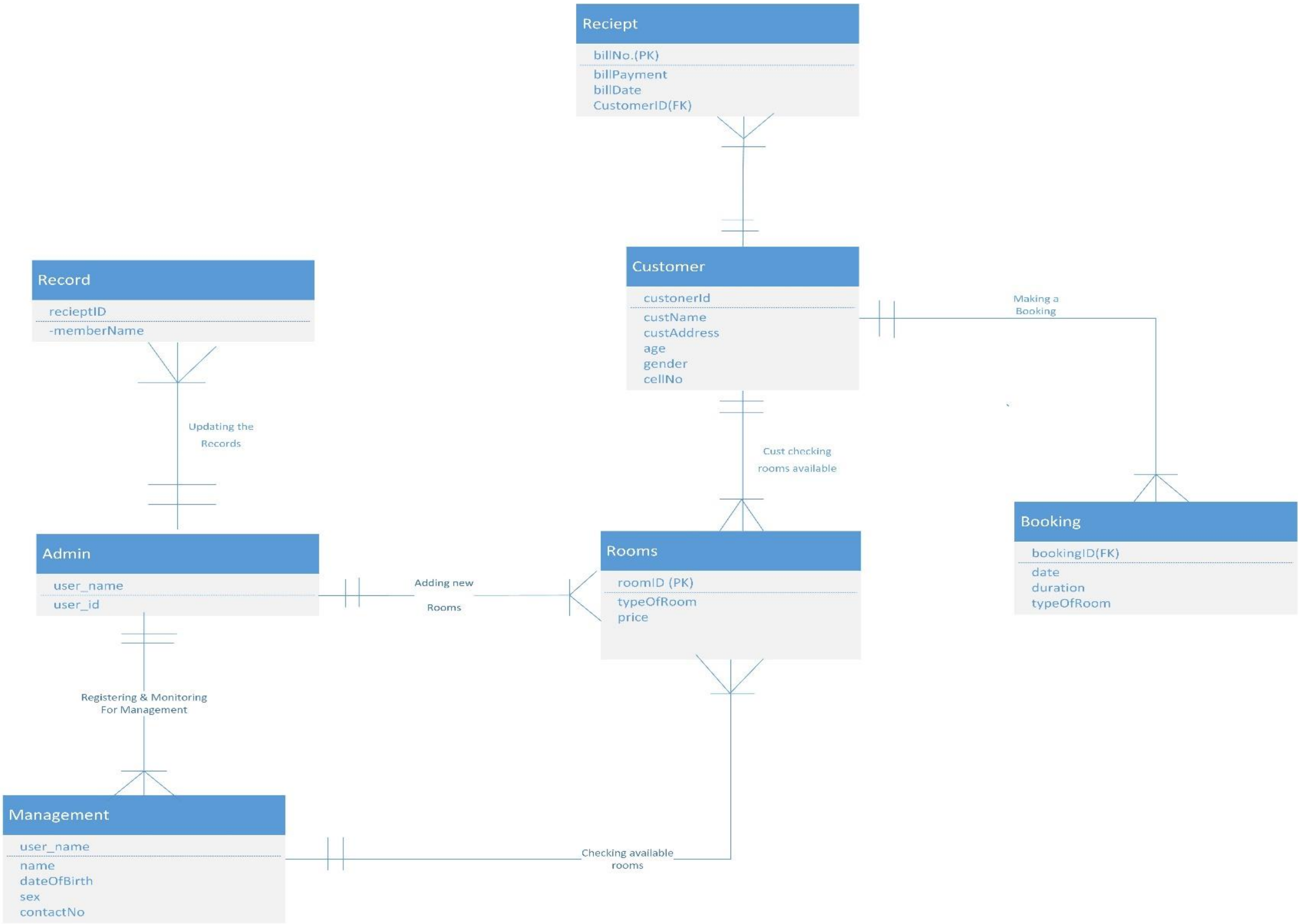
1.1 Logical Design

A logical design is more based on the business ideas, looking at the logical relationship among the objects. When designing a logical design, the designer has to be oriented toward the needs of the end-users that will be using the system. The design should be primarily driven by end-users' utility, even though they may not know what until they see it. If the design is planned carefully, it can be changed as the needs of users change and evolve.

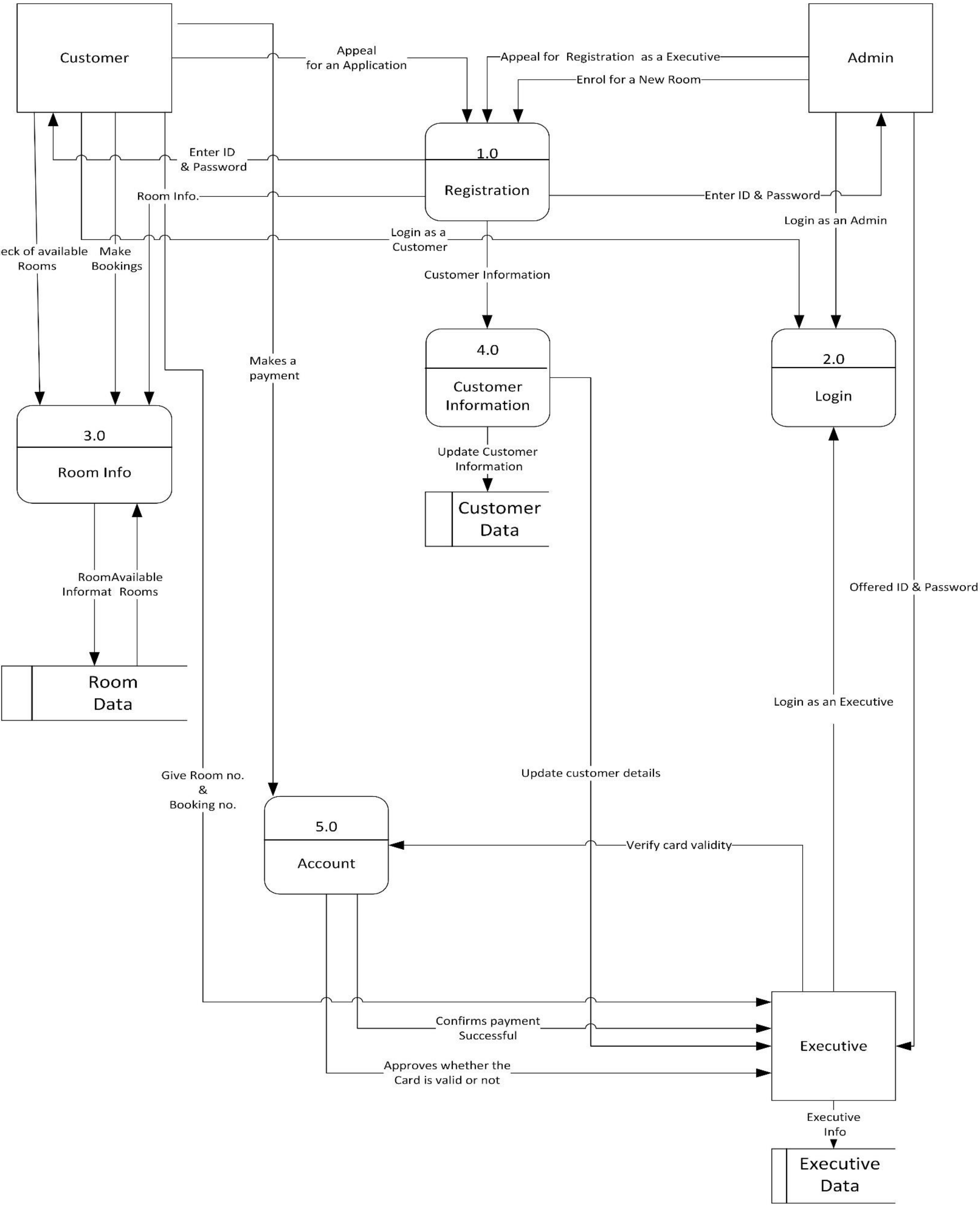
By starting with logical design, the designer need to concentrate on the requirement without getting begged down when implementing detail. The purpose of the logical design is to build a relation plan that correctly and efficiently represents all of the information described by an entity relationship plan that is made during the stage at coming up with ideas.

A logical design can be paper-based (using a pen and paper), or a designer can utilize a design tool as Visio. When creating a logical design data has to be arranged into a series of logical relationship known as entities and attributes.

1.1.1 Create a logical data model (ERD)



1.1.2 Create a logical process model (DFD)



1.2 Physical design

The physical aspects of an information resources are understood by us; as developers to be the computer hardware, computer software, manual files, DBMS files, reports screens, and etcetera. The physical components describe “how” the system will be implemented.

For example, many companies and organisations have been implementing payroll systems for many years prior the advancement of computers. These payrolls can be instigated manually, with punch cards and clocks, followed by the automation on mainframes, personal computers (PCs) and minis, innovations such as the account payment, “direct deposit” to expedite paying employees and tenants payment and account balance.

All of these devices are a physical variation of a theme. The physical implementation is ultimately based on the available technology and thus such changes dynamically. In contrast the logical side represents the inherent nature of the business in this case, Linha properties and only changes if the business changes, which is considerably less volatile than the physical.

It is however imperative that to understand that the logical design is a precursor to the physical design. Therefore, the physical implementation must serve the business and not the other way around whereby money is spent on the components to implement the system, of which will not be feasible to the business.

1.2.1 Investigation of technologies to be applied

During the construction of this system we will be using three languages. For the database, we will be using SQL code to create the database, tables as well as to manipulate the data in the tables. To code the client application as well as the server application, we will be using Java. Since java is an independent platform, it can be developed once and be used on many diverse platforms which can be an advantage if the end system is to be requested for mass production. The last language to be used is HTML or JSP, which will link with two other languages such as CSS and JavaScript. The HTML will be used as an interface for the user to be able to interact with when they need to get information from the server.

We will need a server machine that is filled with hardware specifications that depends on the size of the company and also the kind of company it is. As, if the company is big then it will need faster servers as well as servers with large storage capacities. To check whether the tenants are within the facility or not, there will be a revolving door which can help with the verification of the students’ presence or absence in the building, in this way they will not cheat the system. On the door, there will be a NFC reader which will allow students to use a card that can be scanned by the NFC reader to sign in or out of the building.

The Automatic Meter Reader will be installed on the water and electricity meters to help record how much the tenant is using the resources.

There will be numerous amounts of machines that this system needs to operate on, such include:
- The server: which will contain many different hardware components that create the server, for example: the hard drive, CPU, and all the components on the motherboard. The Auto Meter Reader will be placed on the electricity and water meters of each tenants' apartment to assist in the calculation of which specific tenant needs to pay. As mentioned the NFC reader will be placed at the entrance of the building, and each tenant will have to scan their access cards as the NFC will read the cards

The technical requirements we need as the developers to create the Lorium Enterprise System are (as specified in the previous deliverable):

- SQL (Structured Query Language): is a special-purpose programming language designed for managing data held in a relational database management system (RDBMS), or for stream processing in a relational data stream management system (RDBMS). (C_ITSP200 – Deliverable 1, 2015

- Java: The reason we choose to work with java is because it is the foundation for virtually every type of network application and is the global standard for developing and delivering web-based content, mobile applications as well as enterprise software. Java is designed to enable development for portable, high performance applications for the widest range of computing platforms possible. Thus making applications available across heterogeneous environments, we as a business can provide more services and boost end user productivity, communication and collaboration and dramatically reduce the cost of ownership of both enterprise and customer applications. Java will enable us as the developers of the Lorium system to:

# Write software on one platform and run it on virtually any other platform.
# Create the programs that can run within a web browser and access the available web services within the site.
# Develop server-side applications for our systems online forums, HTML forms processing and more.
# Combine applications or services using the java language to create highly customized applications or services.
# Write powerful and efficient applications for remote processors, wireless modules, sensors, gateways and practically any electronic device we will be implementing in our system.
[https://www.java.com/en/about/
accessed Online: 23 July 2015]

- Hypertext Mark-up Language (HTML): describes the structure of a website semantically along with the signals for presentation, thus making it a language for our interface than a programming language. HTML elements form the building blocks of our systems website. HTML allows images as well as objects to be embedded and we can use it to create interactive forms. Thus it provides a means to create structured documents by denoting structural semantics for text such as headings, paragraphs, links and other items. HTML can also embed scripts written in languages such as JavaScript which will affect the behaviour of the HTML web pages.

- Web browser: is the software application used to locate, retrieve and display the content on the World Wide Web, including web pages. As a client/server model, the browser is the client run on a computer that contacts the web server and requests information. The web server then sends the information back to the browser which displays the results on the computer.

- Near Field Communications (NFC) is a set of protocols that enable smartphones, cards as well as other devices to establish radio communication with each other by having the devices touch or at a proximate distance of typically 10 cm or even less. The reader is placed on the outside of the door as it will be separate from the controller on the inside so that no one can bypass the security by breaking open the reader trying to short circuit the reader. The controller receives serial data from the Reader and thus controls the RGB led and door lock. The circuit is made of three separate parts, a Reader to read the Radio Frequency Identification (RFID) tags, a Controller to accept data from the reader and control the output of the RGB led as well as the Electric door lock. This will enable the system to know who is in the facility and who is not and the last time they were in the premises.

- Automatic Meter Reader (AMR): is a technology that we will use to automatically collect consumption data from the water and electricity meter. The data collected will be used for billing purposes, to analyse usage and manage consumption for/' of the tenants. The AMR is also used to identify and resolve any technical problems. AMR systems promote more cognisant electricity and water usage by revealing exactly how the tenants are using the resources, and either where reduction can be made to improve efficiency thus lower costs for the tenants. The AMR incessantly gathers data and can thus provide this information on a real time-basis. The usage data can therefore be viewed at any time, and once the data is collected, it is immediately stored in a repository of historical consumption information for either comparative or analysis purposes. Also with the continual data readings, it enables the user to monitor where energy is being highly used, and encourages the tenants to regulate their water and electricity usage, for example, unplugging any applications that are not in use.

- Server: which will contain many different hardware parts that creates the server, for example; the hard drive, CPU, and all the components on the motherboard.

- Netbeans with GlassFish: to create our java programs as well to compile and run it. NetBeans comes with the glassfish server of which is used to connect our client program with the server to use the web services and to access the data on the database.

1.2.2 System testing

Unit Testing

This testing will be done for each class it is fixed (static) or not. The test cases should cover all the fundamental inputs. The correct test cases will be resulting from pre-conditions and post-conditions of each method and performance obligations if essential.

Functional Testing

This testing if the user can use the system by accomplishing different goals with different key ins, which will mainly be on the inputs and outputs, the changes of the system due to actions.

Test Case:	Add a room
Actor:	Administrator
Pre-conditions:	Database will be created, Interface will be created
Description:	Tests if the room will be created in the database.
Test Procedure:	Key in required information into input fields (room type, price , book-free)
Expected Results:	The room will be generated into the database with the details submitted thru the input fields from the interface.
Expected Interface Output:	
Needed Tools:	
Test Results:	

Test Case:	Add a room
Actor:	Administrator
Pre-conditions:	Database will be created, Interface will be created
Description:	Tests if the room will be created in the database.
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Expected Interface Output:	
Needed Tools:	
Test Results:	

Test Case:	Add a room
Actor:	Administrator
Pre-conditions:	Database will be created, Interface will be created
Description:	Tests if the room will be created in the database.
Test Procedure:	Key in required information into input fields (room type, price , book-free)
Expected Results:	The room will be generated into the database with the details submitted thru the input fields from the interface.
Expected Interface Output:	
Needed Tools:	
Test Results:	

Test Case:	Adding a booking
Actor:	Administrator/Staff
Pre-conditions:	System is up and running and rooms have been setup
Description:	Tests the system whether it is going to deny addition of reserving an invalid booking ID.
Test Procedure:	Submit the reservation addition request within an invalid booking ID.
Expected Results:	Changes not made in the system
Expected Interface Output:	Reservation add unsuccessful – invalid reservation ID given.
Needed Tools:	
Test Results:	

Performance testing
Since load testing is fundamental. The metrics are:

	Minimum	Good	Excellent
The number of users utilizing the system	3	5	8
The number of concurrent operations	3	5	8

Test Case:	Load Testing
Actor:	Testing team members
Pre-conditions:	Integrated and the system is working
Description:	Test the abilities of the system to interact and server a lot of clients at the same time.
Test Procedure:	Login as an Administrator. Maneuver to the tabs and screens.
Expected Results:	Metrics
Expected Interface Output:	If the system fails, the system will stop accepting request and the administrator and user will receive a message explaining the issue.
Needed Tools:	Stress testing
Test Results:	

Test Case:	Creation of User Interface
Actor:	Administrator/Owner
Pre-conditions:	Database created, Web server configured
Description:	Web view is created.
Test Procedure:	Login as an Administrator. Maneuver to the tabs and screens.
Expected Results:	Web forms must be all be appropriately served, with an appropriate error message
Expected Interface Output:	Forms shows
Needed Tools:	Web Browser
Test Results:	

Test Case:	Icon Representation
Actor:	Administrator/Owner
Pre-conditions:	Database created, Web server configured.
Description:	Icons in the web forms are shown correctly.
Test Procedure:	Login as an Administrator. Maneuver to the tabs and screens. Validating that all icons appear and that the correct icons appear in the correct locations.
Expected Results:	Web forms must have all the icons in appropriate places.
Expected Interface Output:	Forms shows
Needed Tools:	Web Browser
Test Results:	

Test Case:	Website Performance
Actor:	Administrator/Owner
Pre-conditions:	Database created, Web server configured
Description:	The web server should server within 10 seconds
Test Procedure:	Maneuver to all the pages in the website. Fill in the correct data for the page. Give the requested.
Expected Results:	Server requested should be given within 10 seconds.
Expected Interface Output:	Server shows the correct pages with the appropriate information with 10 seconds
Needed Tools:	Web Browser.
Test Results:	

Test Case:	Link Reliability
Actor:	Administrator/Owner
Pre-conditions:	Database created, Web server configured
Description:	Links should direct to the right targets
Test Procedure:	Login as an Administrator. Maneuver to the tabs and screens. Shadow all the links to make sure they have correct targets to the appropriate page.
Expected Results:	The web forms should have all the correct icons appears in the appropriate places.
Expected Interface Output:	Server shows the correct pages with the appropriate information with 10 seconds
Needed Tools:	Web Browser.
Test Results:	

Entry and Exit Criteria

Unit testing

Entry Criteria:

*At least 90% complete and has been accepted and to-date

*Technical Design have been confirmed and approved

*Code Development for the module is accomplished

Exit Criteria:

* There are no identified major or critical flaws that prevents any units from moving to System Testing

* A testing meeting of change has been held and the developer has signed off

* Leader approval has been received

Performance testing

Entry Criteria:

* System testing has been concluded and signed off.

* Unresolved issues and faults have been identified and recorded.

* Test scripts and to-do list are ready.

Exit Criteria:

* The load, stress and compatibility test have been acceptably conducted.

* Unresolved issues and flaws are recognized and documented.

* A testing meeting of change has been held and the developer has signed off.

System Testing

Entry Criteria:

* System testing has been concluded and signed off

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* A testing meeting of change has been held and the developer has signed off

User Acceptance Testing (UAT)

Entry Criteria:

* UAT test scripts are ready to be executed

* Security requirements has been recorded.

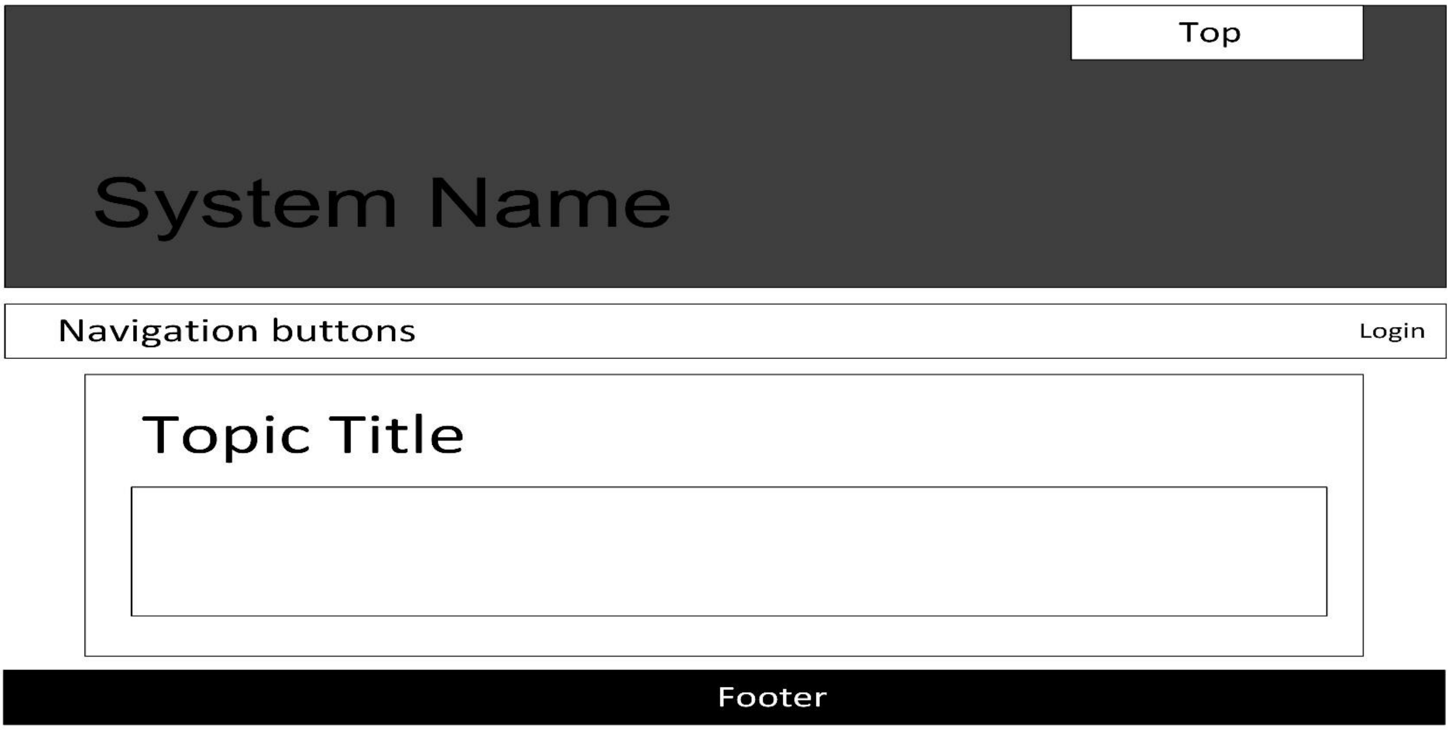
Exit Criteria:

* UAT has been accomplished and accepted by the user community in the change meeting

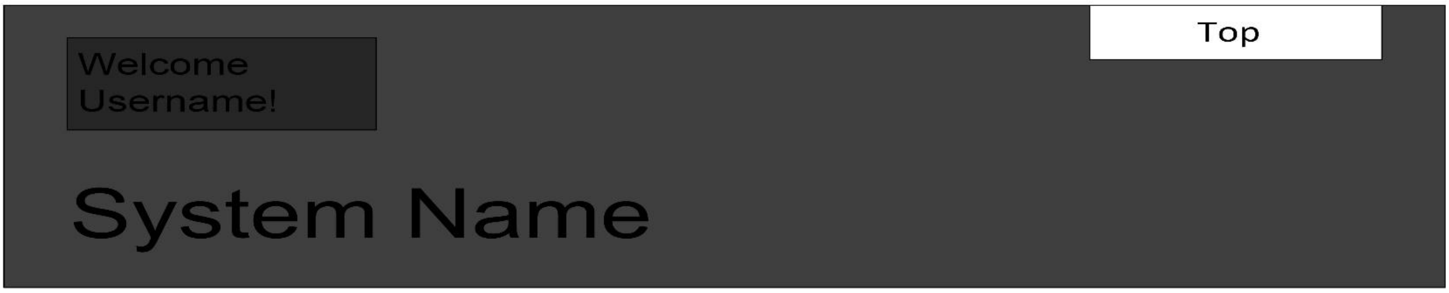
* Do Clients agrees that the identified flaws do not have an impact to the system

1.2.3 System interface design

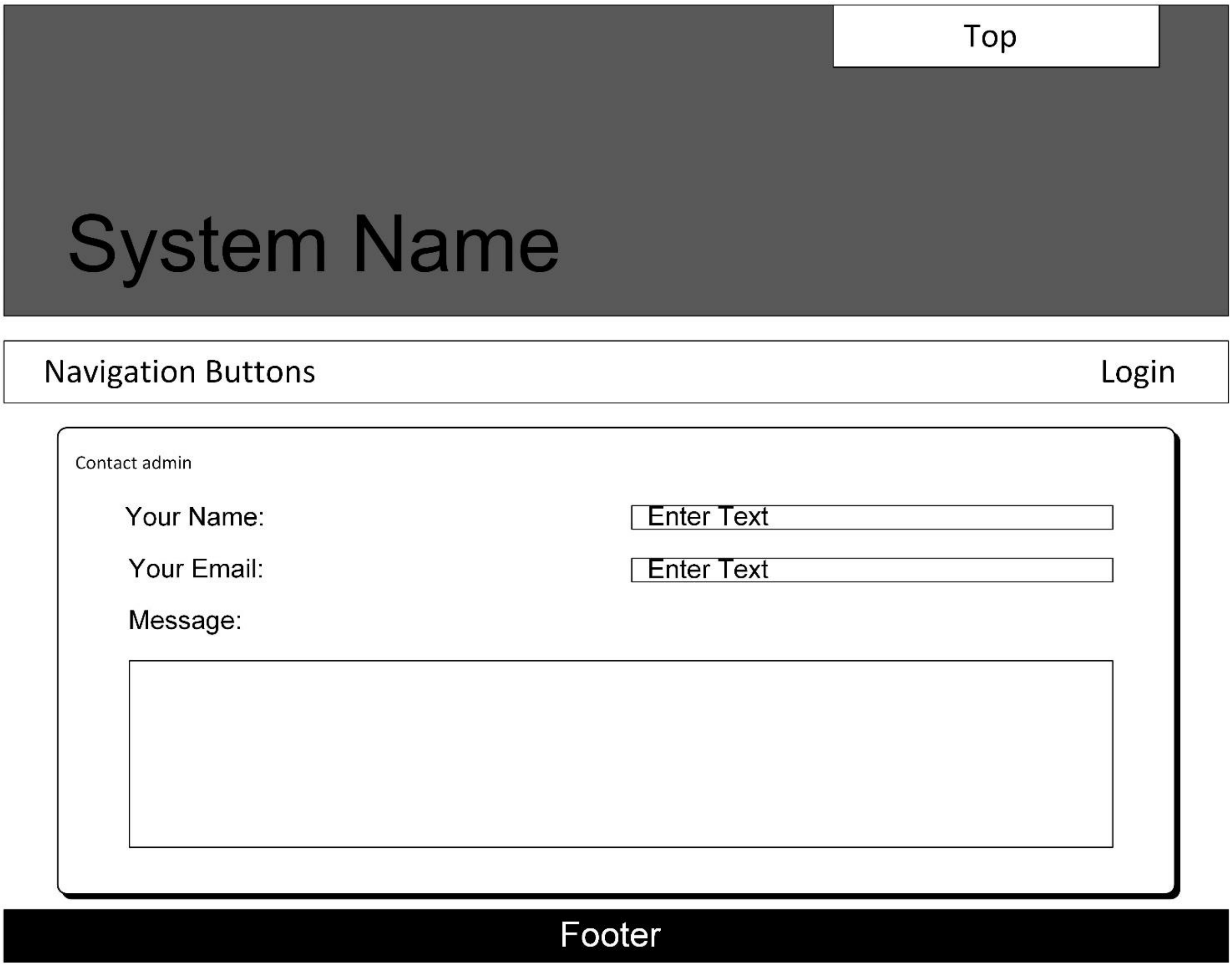
Website header when not logged in



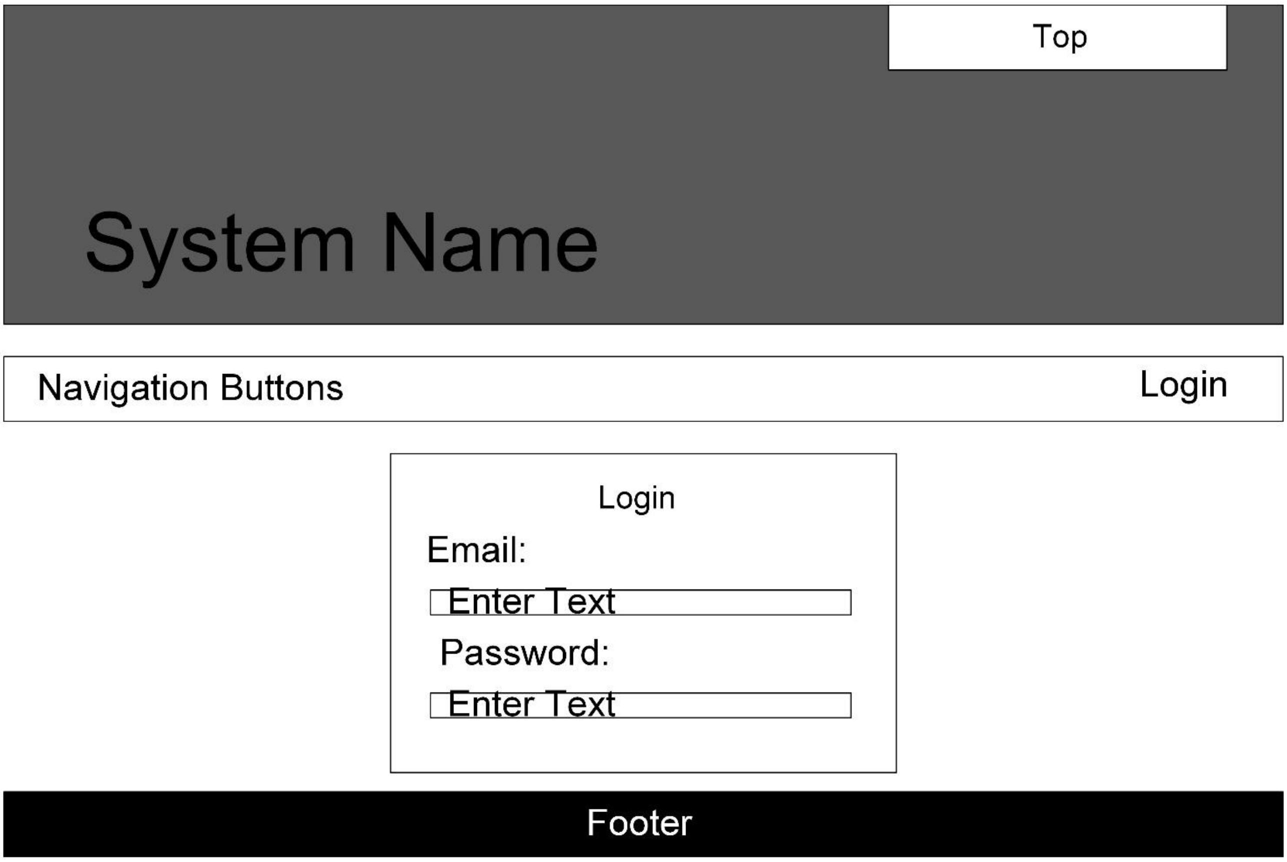
Website header when logged in



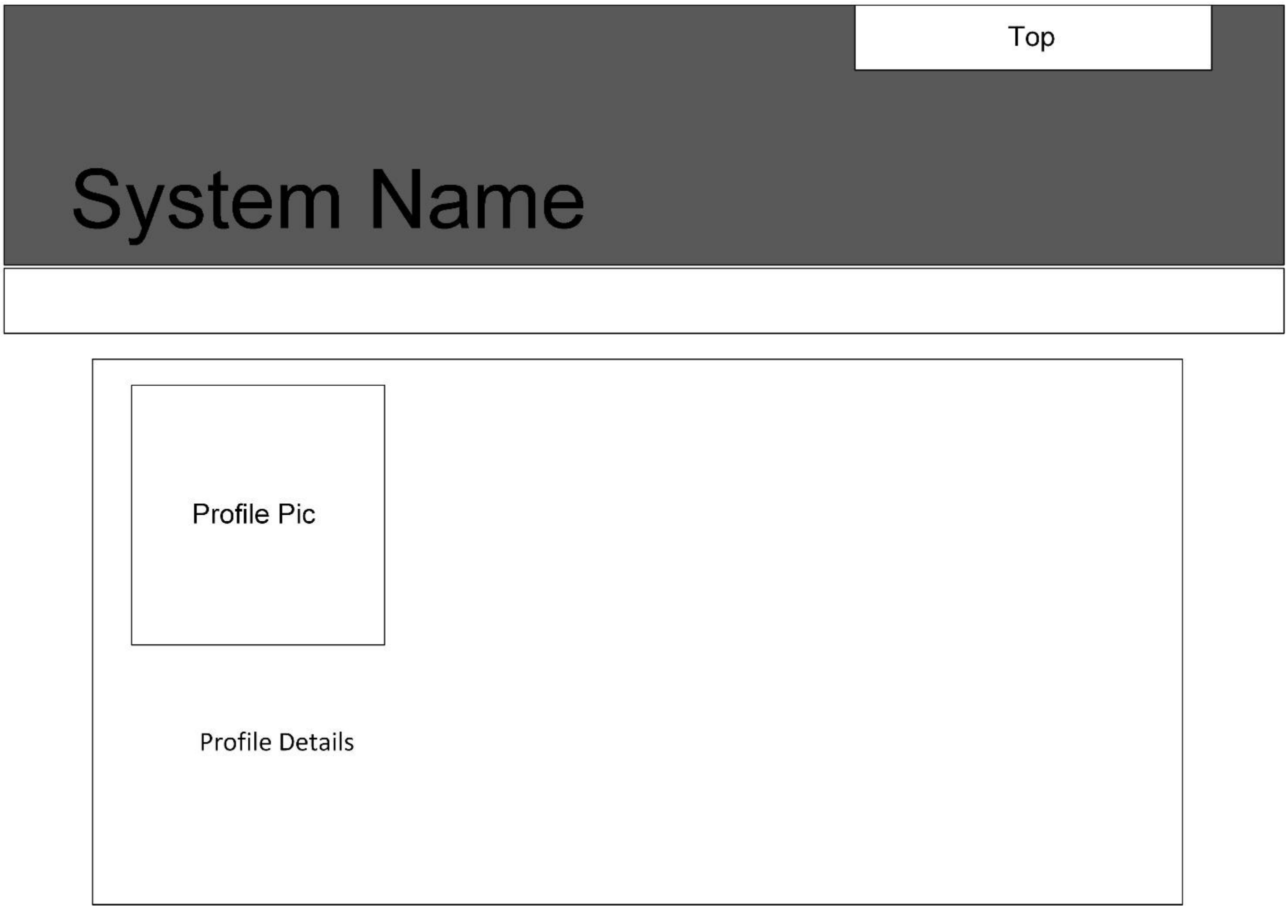
Contact admin page



Login Page


Top
System Name
Navigation Buttons
Login
Login
Email:
Enter Text
Password:
Enter Text
Footer

User Profile



2. **Customer sign-off**

Customer name and surname	Customer Signature
Liang-Shih Lin	林良士
Group leader name and surname	Group leader signature

Deliverable 4

Testing

Testing Templates

Unit Testing

This testing will be done for each class it is fixed (static) or not. The test cases should cover all the fundamental inputs. The correct test cases will be resulting from pre-conditions and post-conditions of each method and performance obligations if essential.

Functional Testing

This testing if the user can use the system by accomplishing different goals with different key ins, which will mainly be on the inputs and outputs, the changes of the system due to actions.

Reset password

Test Case:	Reset password
Actor:	Administrator and Tenant
Pre-conditions:	Database will be created, Interface will be created
Description:	If the user's email exists and if the secret answer matches their secret question, then the user is allowed to change their password
Test Procedure:	The user will have an option to reset their password on the login page, which will take them to a page that ask the user for their details to check their identity. If they pass the identity test, then they are allowed to change the password
Expected Results:	The database should be updated and the user can login with his or her new password
Expected Interface Output:	The user should be redirected to the index patch with a text saying that the password has been changed
Needed Tools:	Glassfish server, web browser, and netbeans
Test Results:	Working

Test Case:	Enter fee
Actor:	Administrator
Pre-conditions:	Database will be created, Interface will be created
Description:	The administrator should be able to enter the amount of water, electricity used and the amount of minutes that the user isn't in the building
Test Procedure:	The administrator enters the new details into the form, the database updates. Then login into a tenant account to see if the information is updated
Expected Results:	Room details will be updated into the database for that specific tenant

Expected Interface Output:	The user will be redirected back to the homepage with the message stating that the database has been updated
Needed Tools:	Glassfish server, web browser, and netbeans
Test Results:	Working

Test Case:	Sending a message
Actor:	Administrator and tenant
Pre-conditions:	Database will be created, Interface will be created
Description:	Tests if the message is successfully sent to the right user
Test Procedure:	The user sending the message will enter the details of the recipient and the message will be sent when the user selects the “Send” button.
Expected Results:	The room will be generated into the database with the details submitted thru the input fields from the interface.
Expected Interface Output:	The room should be removed from the database bestowed the requested room number. No changes should be made in the database.
Needed Tools:	Web Browser
Test Results:	Working

Test Case:	Registering the tenant
Actor:	Administrator/Staff
Pre-conditions:	System is up and running and rooms have been setup
Description:	If the user’s email exists then it will show an error message. If the user’s email doesn’t exist then it will allow the user to register. Updating the database
Test Procedure:	Submit the required information into the form on the register page.
Expected Results:	The database should be updated, and the user should be able to log in onto their account
Expected Interface Output:	The administrator will see a message showing that the user has been registered.
Needed Tools:	Stress testing
Test Results:	Working

Performance testing

Since load testing is fundament. The metrics are:

	Minimum	Good	Excellent
The number of Users utilizing the system	3	5	8
The number of Concurrent Operations	3	5	8

Test Case:	Load Testing
Actor:	Testing team members
Pre-conditions:	Integrated and the system is working
Description:	Test the abilities of the system to interact and server a lot of clients at the same time.
Test Procedure:	Login as an Administrator. Maneuver to the tabs and screens.
Expected Results:	Metrics
Expected Interface Output:	If the system fails, the system will stop accepting request and the administrator and user will receive a message explaining the issue.
Needed Tools:	Stress testing
Test Results:	Working

User Acceptance Testing

Test Case:	Creation of User Interface
Actor:	Administrator
Pre-conditions:	Database created, Web server configured
Description:	Web view is created.
Test Procedure:	Login as an Administrator. Manoeuvre between different pages
Expected Results:	Errors should be shown on the error page with messages that are descriptive
Expected Interface Output:	Forms shows
Needed Tools:	Web Browser
Test Results:	Working

Test Case:	Server running
Actor:	Administrator
Pre-conditions:	Database created, Web server configured.
Description:	If the server isn’t running, any operation related to the server will generate will generate an error and be redirected to the error page
Test Procedure:	Stop the server, and load the homepage
Expected Results:	The website should display an error message stating that the server is down
Expected Interface Output:	Red error message

Needed Tools:	Web Browser
Test Results:	Working

Test Case:	Server online
Actor:	Administrator
Pre-conditions:	Web server configured.
Description:	Test the abilities of the system when the server is online.
Test Procedure:	Load the homepage
Expected Results:	Show homepage
Expected Interface Output:	If the system fails, the system will stop accepting request and the administrator will receive a message explaining the issue.
Needed Tools:	Web Browser
Test Results:	Working

Test Case:	Edit User
Actor:	Administrator and User
Pre-conditions:	Database created, Web server configured.
Description:	Test profile editing
Test Procedure:	Login as an Administrator or User. Go to their respective profiles, select the “edit profile” link, then edit the information that needs to be edited.
Expected Results:	Profile picture changed, password changed or username changed and the user will be redirected back to their homepage
Expected Interface Output:	The user should see the change on their profile page
Needed Tools:	Stress testing
Test Results:	Working

Test Case:	Check cost
Actor:	User
Pre-conditions:	Database created, Web server configured
Description:	Calculate user expenditure
Test Procedure:	Login as a tenant. Manoeuvre to their profile. Check for fee.
Expected Results:	The cost of the accommodation displayed in the tenant's profile under their respective headings.
Expected Interface Output:	Display a message of the amount owed.
Needed Tools:	Web Browser
Test Results:	Working

Test Case:	Enter table rate
Actor:	Administrator
Pre-conditions:	Database created, Web server configured
Description:	Calculate user rate.
Test Procedure:	Login as an administrator. Manoeuvre to the tabs and screens.
Expected Results:	The cost applying to the rates.
Expected Interface Output:	Rates applicable to costs.
Needed Tools:	Web Browser
Test Results:	Working

Test Case:	Website Performance
Actor:	Administrator
Pre-conditions:	Database created, Web server configured
Description:	The web server should run within 10 seconds
Test Procedure:	Manoeuvre to all the pages in the website. Fill in the correct data for the page. Give the requested data.
Expected Results:	Server requested should be given within 10 seconds.
Expected Interface Output:	Server shows the correct pages with the appropriate information with 10 seconds
Needed Tools:	Web Browser.
Test Results:	Working

Test Case:	Link Reliability
Actor:	Administrator
Pre-conditions:	Database created, Web server configured
Description:	Links should direct to the right targets

Test Procedure:	Login as an Administrator. Maneuver to the tabs and screens. Shadow all the links to make sure they have correct targets to the appropriate page.
Expected Results:	The web forms should have all the correct icons appears in the appropriate places.
Expected Interface Output:	Server shows the correct pages with the appropriate information with 10 seconds
Needed Tools:	Web Browser.
Test Results:	Working

Entry and Exit Criteria

Unit testing

Entry Criteria:
*At least 90% complete and has been accepted and to-date
*Technical Design have been confirmed and approved
*Code Development for the module is accomplished

Exit Criteria:
* There are no identified major or critical flaws that prevents any units from moving to System Testing
* A testing meeting of change has been held and the developer has signed off
* Leader approval has been received

Performance testing

Entry Criteria:

* System testing has been concluded and signed off.

* Unresolved issues and faults have been identified and recorded.

* Test scripts and to-do list are ready.

Exit Criteria:

* The load, stress and compatibility test have been acceptably conducted.

* Unresolved issues and flaws are recognized and documented.
* A testing meeting of change has been held and the developer has signed off.

System Testing

Entry Criteria:

* System testing has been concluded and signed off

* Unresolved issues and faults have been identified and recorded

* Test scripts and to-do list are ready

Exit Criteria:

* The load, stress and compatibility test have been acceptably conducted

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User Acceptance Testing (UAT)

Entry Criteria:

* UAT test scripts are ready to be executed

* Security requirements has been recorded.

Exit Criteria:

* UAT has been accomplished and accepted by the user community in the change meeting

* Do Clients agrees that the identified flaws do not have an impact to the system

Deliverable 5

User Manual

User manual – Lorium

Introduction

The Lorium Enterprise System is in its own a new, integrated accommodation system calculator which also measures the amount of water as well as electricity usage the tenants uses per month/ day. The system calculator will also be able to charge and calculate the tenants “time-in” his/her apartment or room, thus charging them per minute in the premises. And the system will keep record of the tenant’s absence in the building, thus not charging them, however there is a rate payable for the accommodation itself for the business to be profitable and affordable at the same time.

With the user-friendly interface website, the administrators as will be able to navigate and enter tenant’s water, electricity and rental fees with ease. The tenants themselves are able to update their profile for example they will be able to change their passwords and update their profile pictures. The tenants will also be able to view their accounts (water and electricity including time-in cost).

The administrators to the system will also be able to update their profile and manage the tenants’ accounts and rental fees.

With the easy to use navigation interface, new tenants will be able given the opportunity to view the FAQ tab and ask the admin any questions regarding the accommodation, fees as well as any queries they may have regarding the system. This way the admin will be able to respond to any queries the tenants may have saving time, and improving efficiency.

For more information and queries regarding the website/system, tenants are welcome to send an email (which can be sent within the website by clicking on the “contact us” bar on the home page).

Or email the administrators at the following email address provided:

Liang-Shih Lin @: liangshihlin@yahoo.com

Isabelinha Ikatlholeng @: isabelinhaikatlholeng@gmail.com

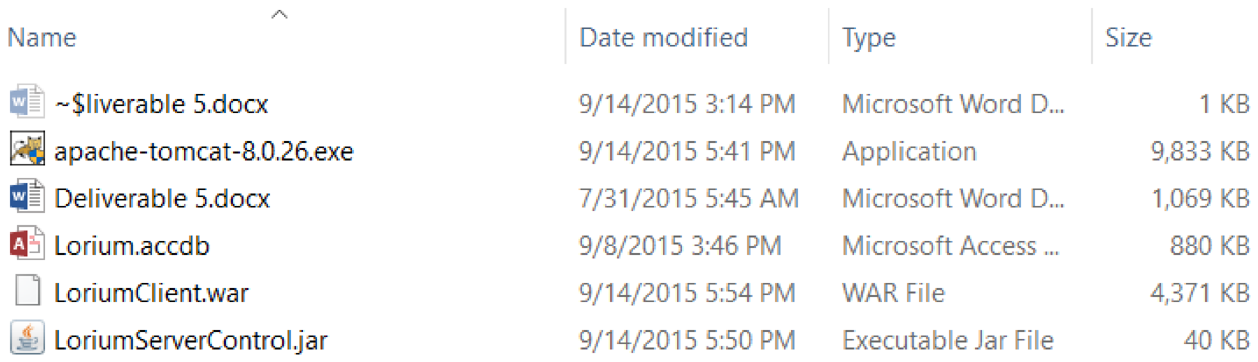
Nolufefe Ludidi @: nolufefe.ludidi@gmail.com

Telephone: +27 79 754 4460.

Getting Started

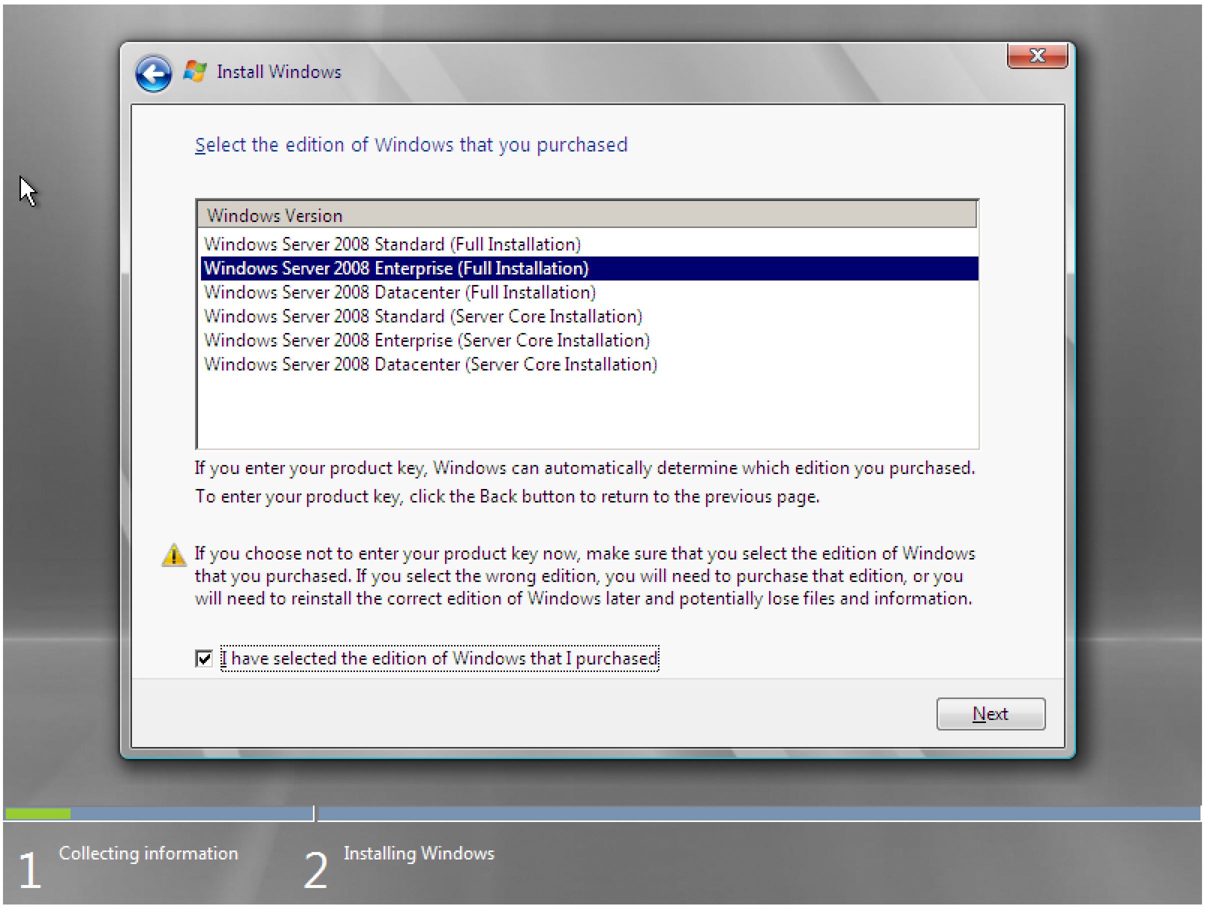
How to install

These resources are given to the server host:



Name	Date modified	Type	Size
~$liverable 5.docx	9/14/2015 3:14 PM	Microsoft Word D...	1 KB
apache-tomcat-8.0.26.exe	9/14/2015 5:41 PM	Application	9,833 KB
Deliverable 5.docx	7/31/2015 5:45 AM	Microsoft Word D...	1,069 KB
Lorium.accdb	9/8/2015 3:46 PM	Microsoft Access ...	880 KB
LoriumClient.war	9/14/2015 5:54 PM	WAR File	4,371 KB
LoriumServerControl.jar	9/14/2015 5:50 PM	Executable Jar File	40 KB

1. To install the system you should have a working server machine with a server operating system installed.



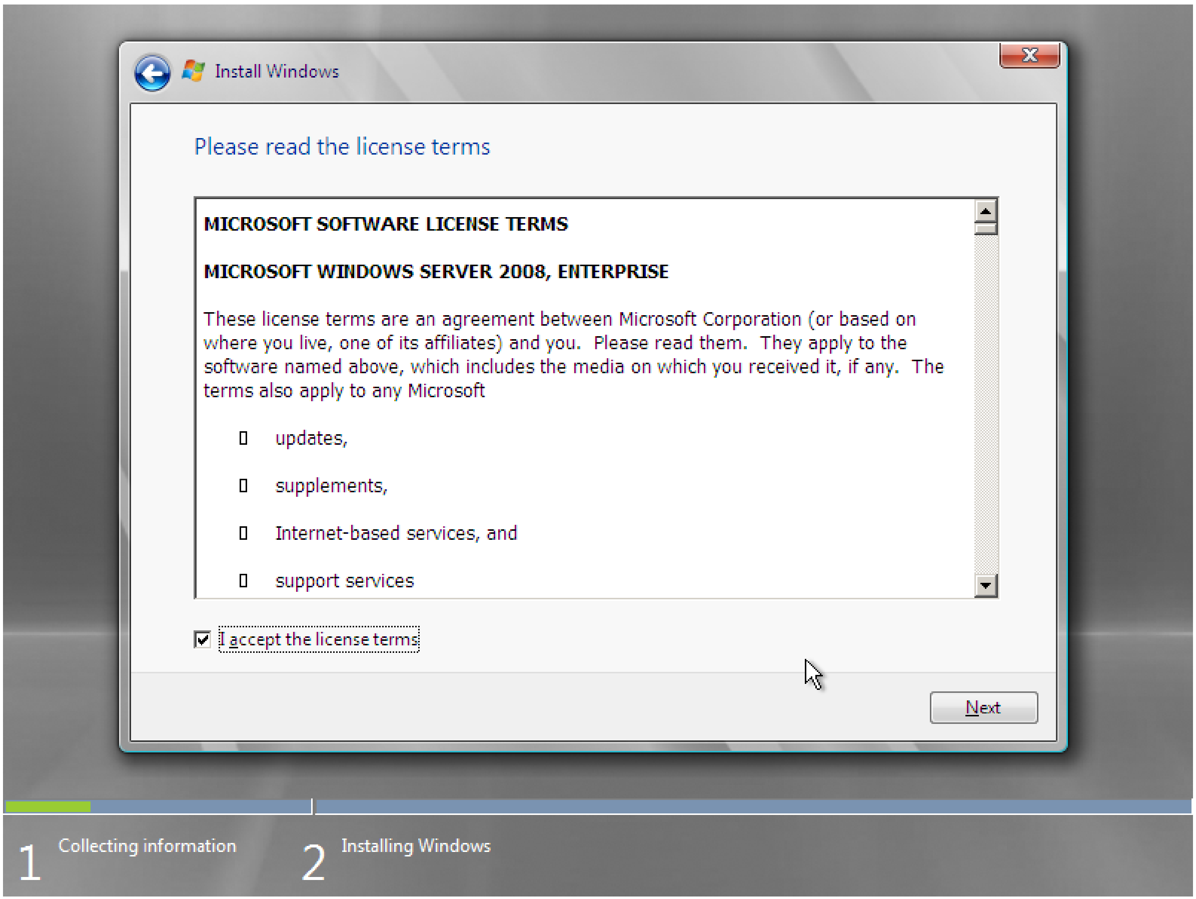
Select the edition of Windows that you purchased

Windows Version
Windows Server 2008 Standard (Full Installation)
Windows Server 2008 Enterprise (Full Installation)
Windows Server 2008 Datacenter (Full Installation)
Windows Server 2008 Standard (Server Core Installation)
Windows Server 2008 Enterprise (Server Core Installation)
Windows Server 2008 Datacenter (Server Core Installation)

If you enter your product key, Windows can automatically determine which edition you purchased. To enter your product key, click the Back button to return to the previous page.

⚠ If you choose not to enter your product key now, make sure that you select the edition of Windows that you purchased. If you select the wrong edition, you will need to purchase that edition, or you will need to reinstall the correct edition of Windows later and potentially lose files and information.

☑ I have selected the edition of Windows that I purchased



Please read the license terms

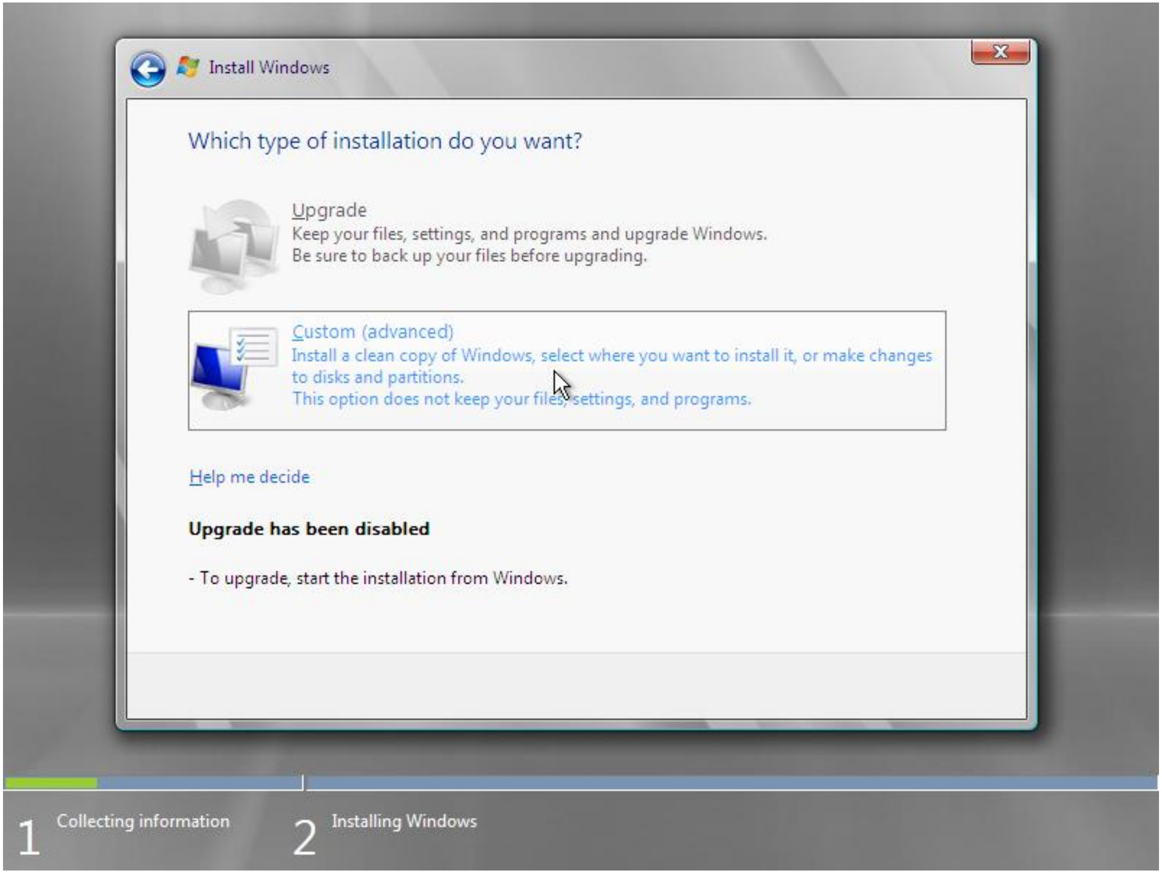
MICROSOFT SOFTWARE LICENSE TERMS

MICROSOFT WINDOWS SERVER 2008, ENTERPRISE

These license terms are an agreement between Microsoft Corporation (or based on where you live, one of its affiliates) and you. Please read them. They apply to the software named above, which includes the media on which you received it, if any. The terms also apply to any Microsoft

- updates,
- supplements,
- Internet-based services, and
- support services

☑ I accept the license terms



Which type of installation do you want?

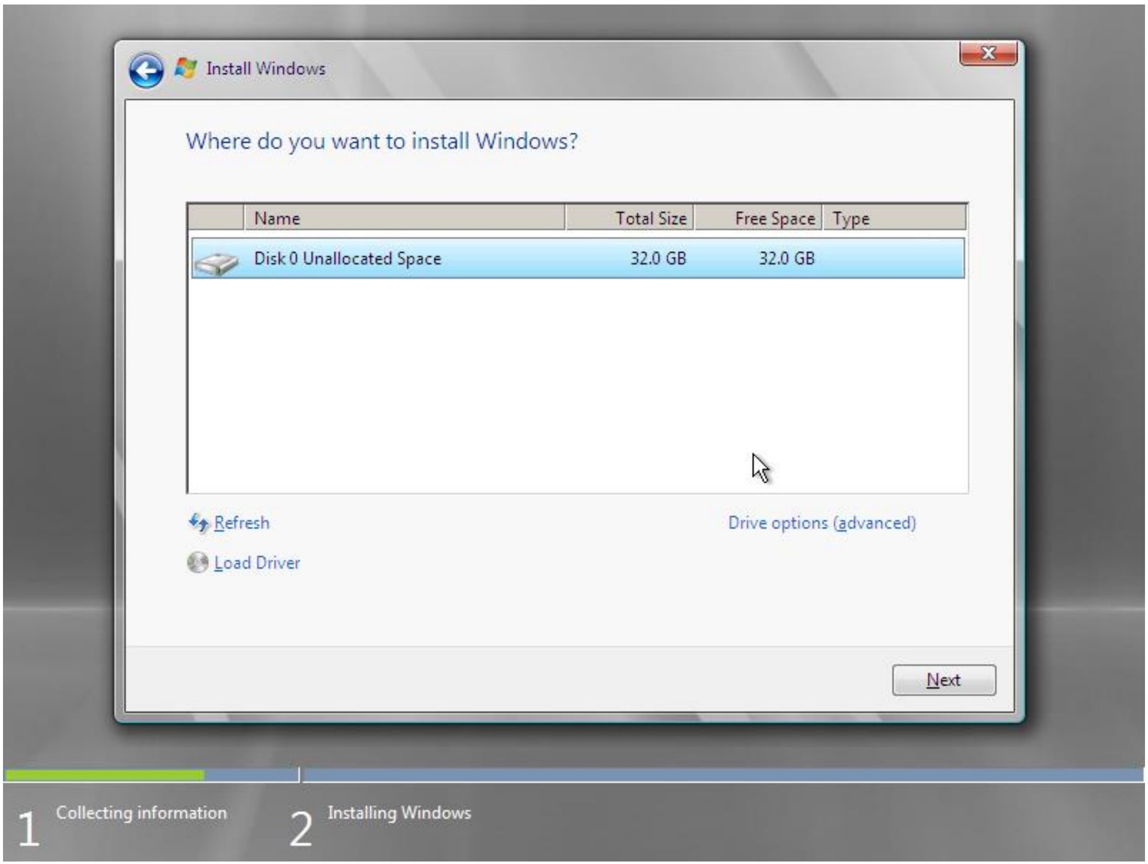
Upgrade
Keep your files, settings, and programs and upgrade Windows.
Be sure to back up your files before upgrading.

Custom (advanced)
Install a clean copy of Windows, select where you want to install it, or make changes to disks and partitions.
This option does not keep your files, settings, and programs.

Help me decide

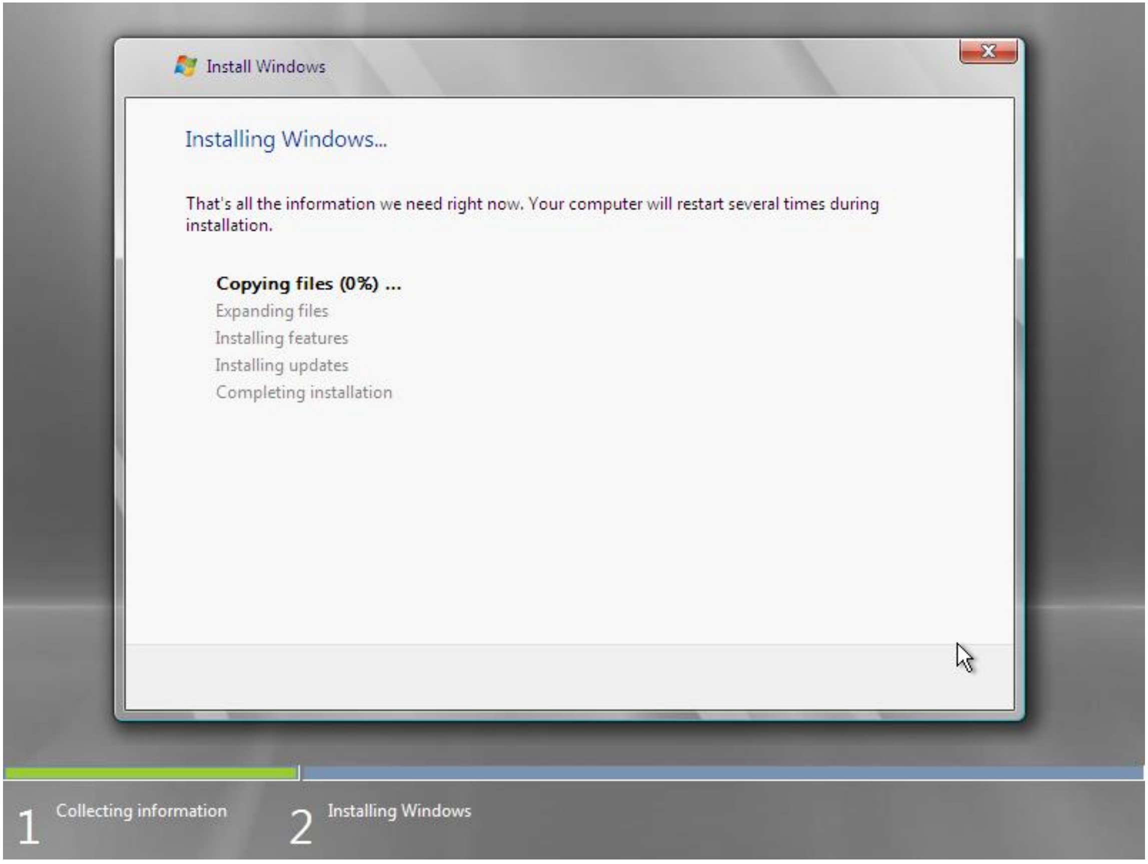
Upgrade has been disabled

- To upgrade, start the installation from Windows.



Where do you want to install Windows?

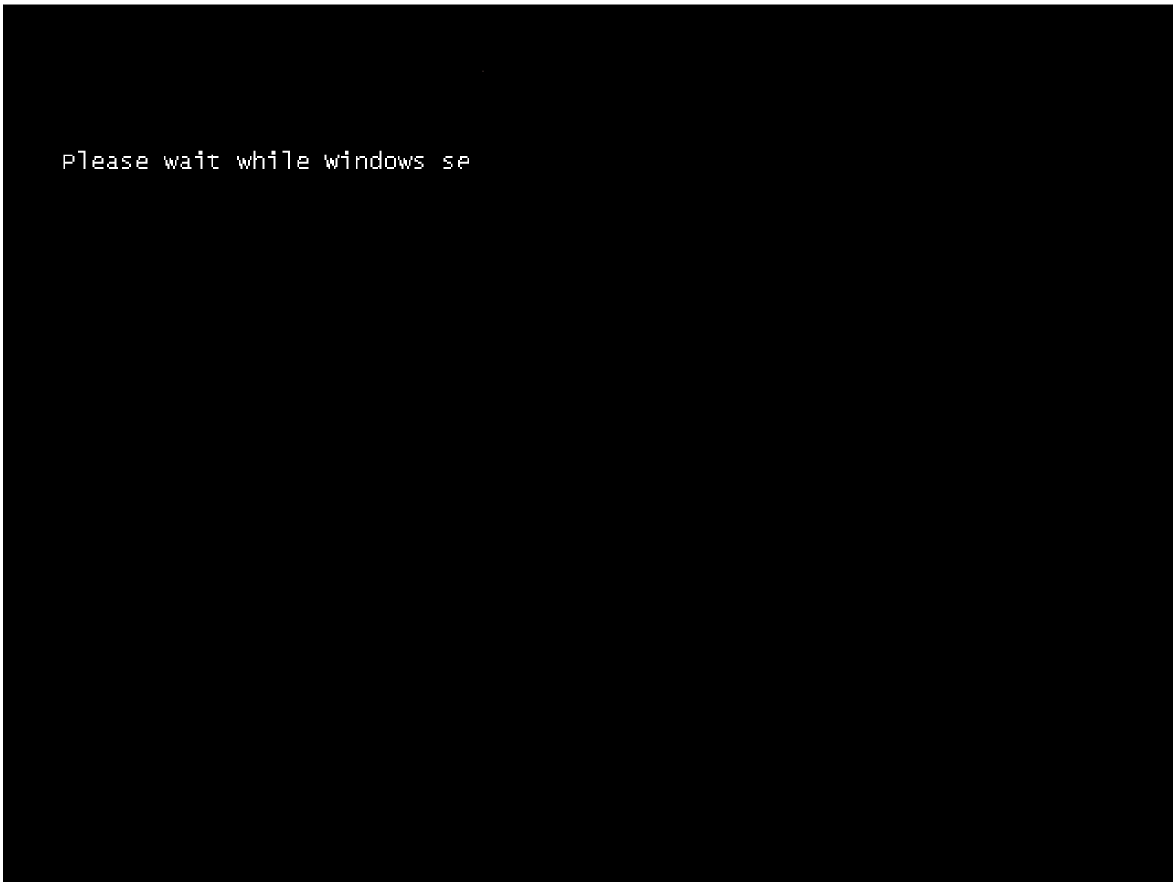
Name	Total Size	Free Space	Type
Disk 0 Unallocated Space	32.0 GB	32.0 GB	



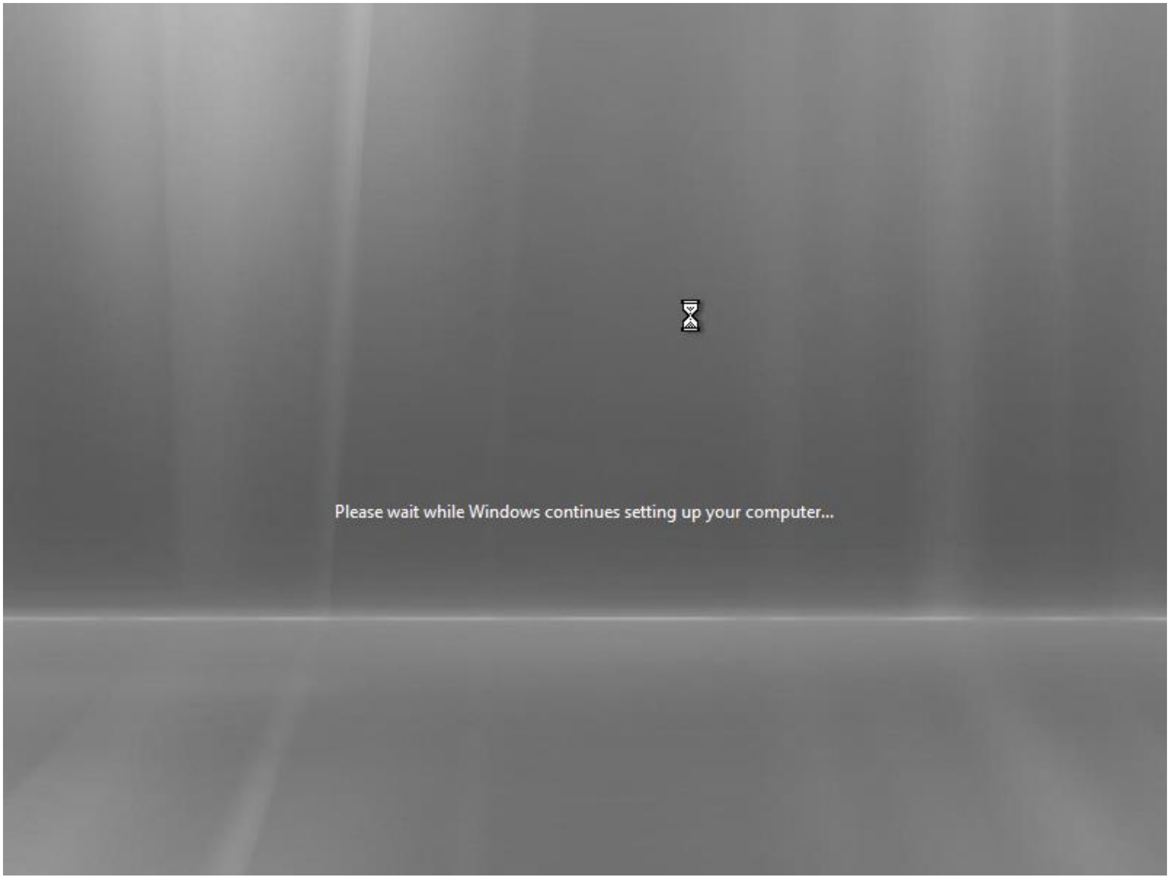
Installing Windows...

That's all the information we need right now. Your computer will restart several times during installation.

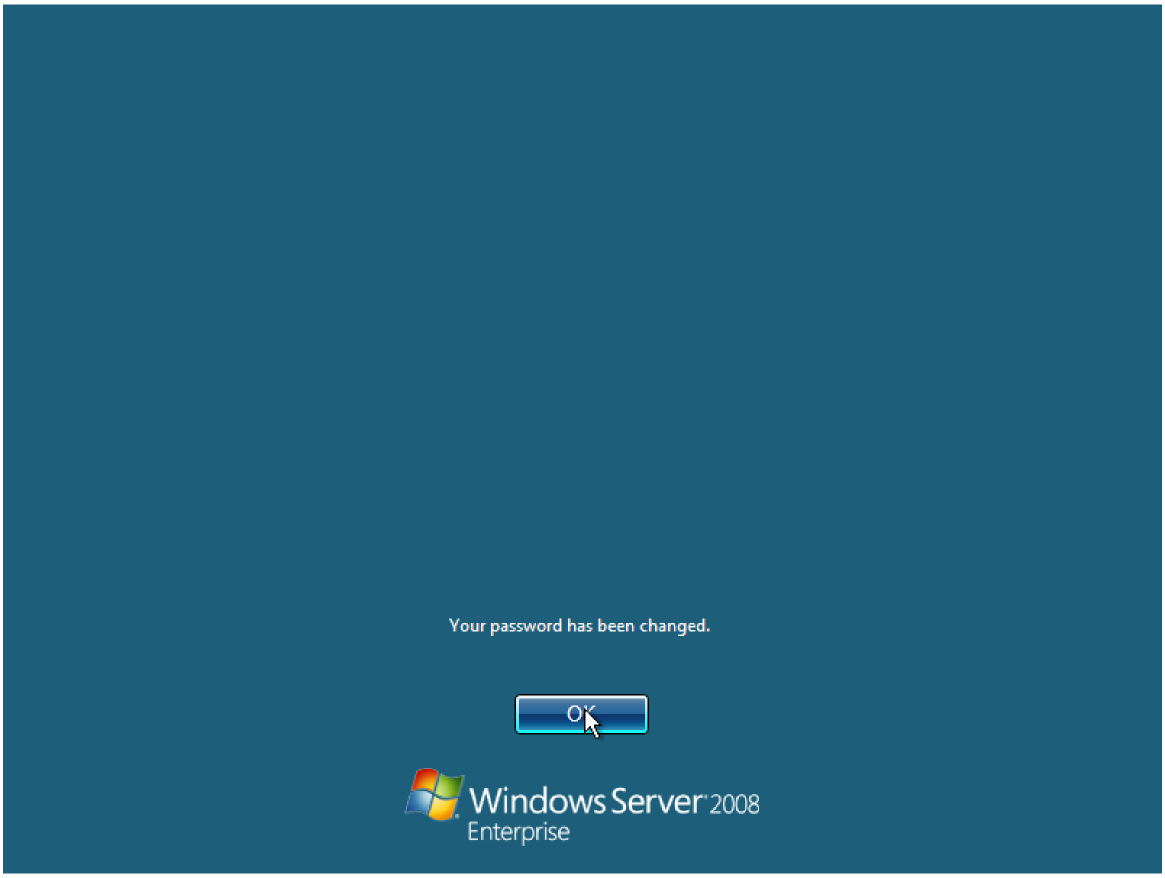
Copying files (0%) ...
Expanding files
Installing features
Installing updates
Completing installation



```
Please wait while Windows se
```

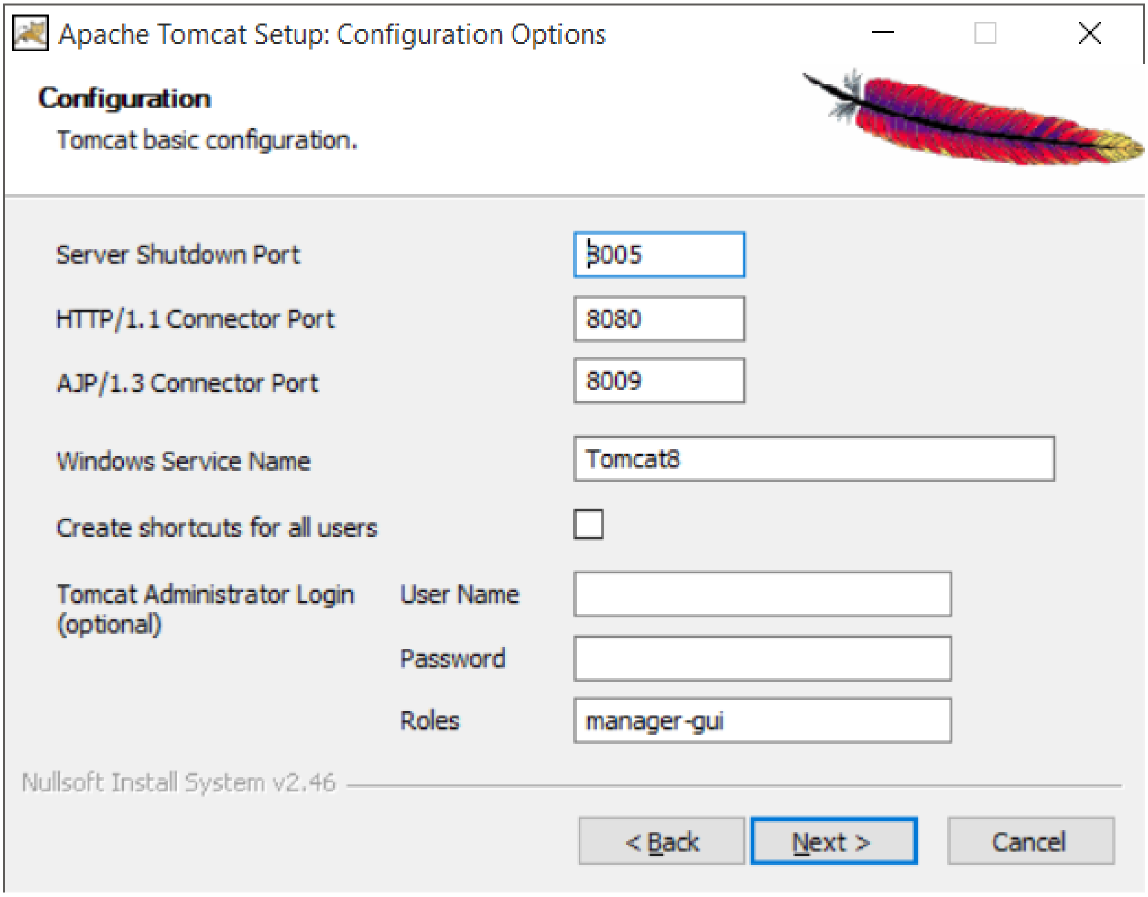


Please wait while Windows continues setting up your computer...



Your password has been changed.

2. Download the Apache Tomcat server, follow the onscreen instructions and install it.



Apache Tomcat Setup: Configuration Options

Configuration

Tomcat basic configuration.

Server Shutdown Port: 8005

HTTP/1.1 Connector Port: 8080

AJP/1.3 Connector Port: 8009

Windows Service Name: Tomcat8

Create shortcuts for all users: □

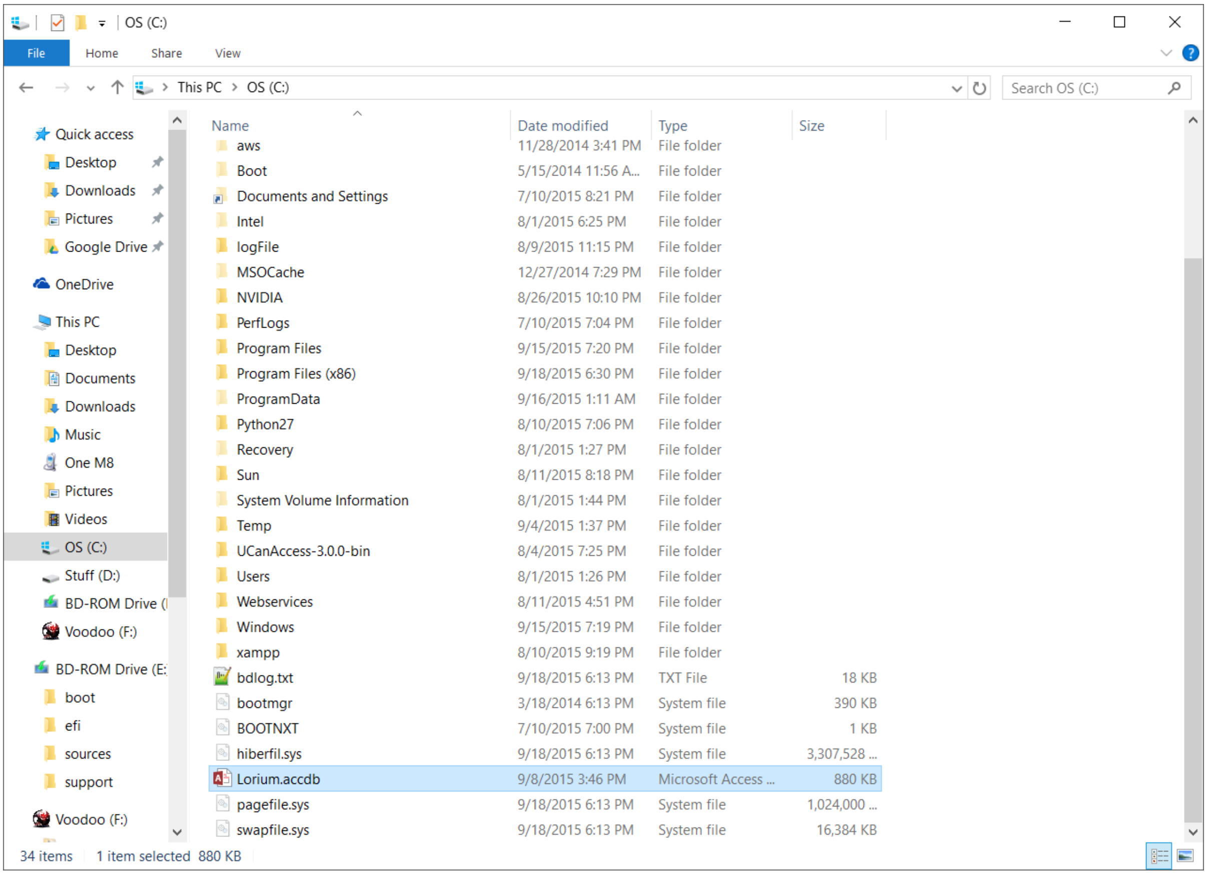
Tomcat Administrator Login (optional) User Name:

Password:

Roles: manager-gui

Change the HTTP/1.1 Connector Port number if it is already occupied

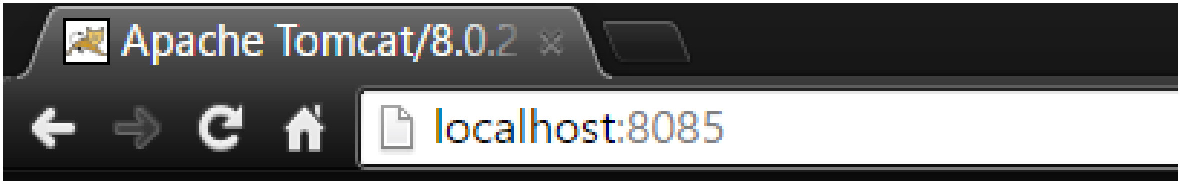
3. Place the “Lorium.accdb” file in your C drive.



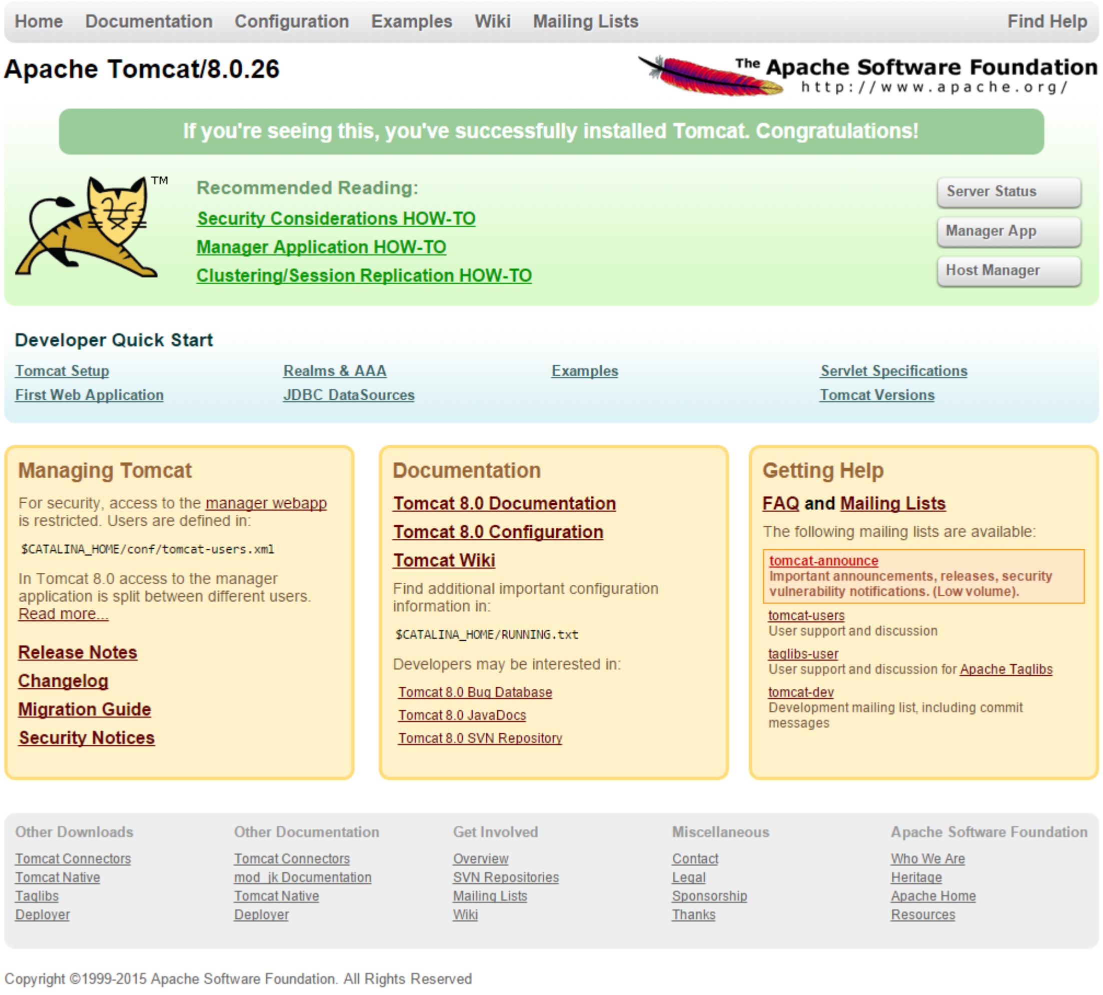
Name	Date modified	Type	Size
aws	11/28/2014 3:41 PM	File folder	
Boot	5/15/2014 11:56 A...	File folder	
Documents and Settings	7/10/2015 8:21 PM	File folder	
Intel	8/1/2015 6:25 PM	File folder	
logFile	8/9/2015 11:15 PM	File folder	
MSOCache	12/27/2014 7:29 PM	File folder	
NVIDIA	8/26/2015 10:10 PM	File folder	
PerfLogs	7/10/2015 7:04 PM	File folder	
Program Files	9/15/2015 7:20 PM	File folder	
Program Files (x86)	9/18/2015 6:30 PM	File folder	
ProgramData	9/16/2015 1:11 AM	File folder	
Python27	8/10/2015 7:06 PM	File folder	
Recovery	8/1/2015 1:27 PM	File folder	
Sun	8/11/2015 8:18 PM	File folder	
System Volume Information	8/1/2015 1:44 PM	File folder	
Temp	9/4/2015 1:37 PM	File folder	
UCanAccess-3.0.0-bin	8/4/2015 7:25 PM	File folder	
Users	8/1/2015 1:26 PM	File folder	
Webservices	8/11/2015 4:51 PM	File folder	
Windows	9/15/2015 7:19 PM	File folder	
xampp	8/10/2015 9:19 PM	File folder	
bdlog.txt	9/18/2015 6:13 PM	TXT File	18 KB
bootmgr	3/18/2014 6:13 PM	System file	390 KB
BOOTNXT	7/10/2015 7:00 PM	System file	1 KB
hiberfil.sys	9/18/2015 6:13 PM	System file	3,307,528 ...
Lorium.accdb	9/8/2015 3:46 PM	Microsoft Access ...	880 KB
pagefile.sys	9/18/2015 6:13 PM	System file	1,024,000 ...
swapfile.sys	9/18/2015 6:13 PM	System file	16,384 KB

34 items 1 item selected 880 KB

4. Open your web browser (ie. Google Chrome, Mozilla Firefox). Type http://localhost:8080 into the address bar. If you have installed the Apache Tomcat server with a different port number, please change it to that port number.



I have my proxy settings set to “8085”. This is what you should see on the webpage:



Home Documentation Configuration Examples Wiki Mailing Lists Find Help
The Apache Software Foundation
http://www.apache.org/
Server Status
Manager App
Host Manager

Apache Tomcat/8.0.26

If you're seeing this, you've successfully installed Tomcat. Congratulations!

Recommended Reading:

Security Considerations HOW-TO

Manager Application HOW-TO

Clustering/Session Replication HOW-TO

Developer Quick Start

Tomcat Setup
First Web Application
Realms & AAA
JDBC DataSources
Examples
Servlet Specifications
Tomcat Versions

Managing Tomcat

For security, access to the manager webapp is restricted. Users are defined in:

```
$CATALINA_HOME/conf/tomcat-users.xml
```

In Tomcat 8.0 access to the manager application is split between different users. Read more...

Release Notes
Changelog
Migration Guide
Security Notices

Documentation

Tomcat 8.0 Documentation
Tomcat 8.0 Configuration
Tomcat Wiki

Find additional important configuration information in:

```
$CATALINA_HOME/RUNNING.txt
```

Developers may be interested in:

Tomcat 8.0 Bug Database
Tomcat 8.0 JavaDocs
Tomcat 8.0 SVN Repository

Getting Help

FAQ and Mailing Lists

The following mailing lists are available:

tomcat-announce
Important announcements, releases, security vulnerability notifications. (Low volume).

tomcat-users
User support and discussion

taglibs-user
User support and discussion for Apache Taglibs

tomcat-dev
Development mailing list, including commit messages

Other Downloads	Other Documentation	Get Involved	Miscellaneous	Apache Software Foundation
Tomcat Connectors	Tomcat Connectors	Overview	Contact	Who We Are
Tomcat Native	mod_jk Documentation	SVN Repositories	Legal	Heritage
Taglibs	Tomcat Native	Mailing Lists	Sponsorship	Apache Home
Deployer	Deployer	Wiki	Thanks	Resources

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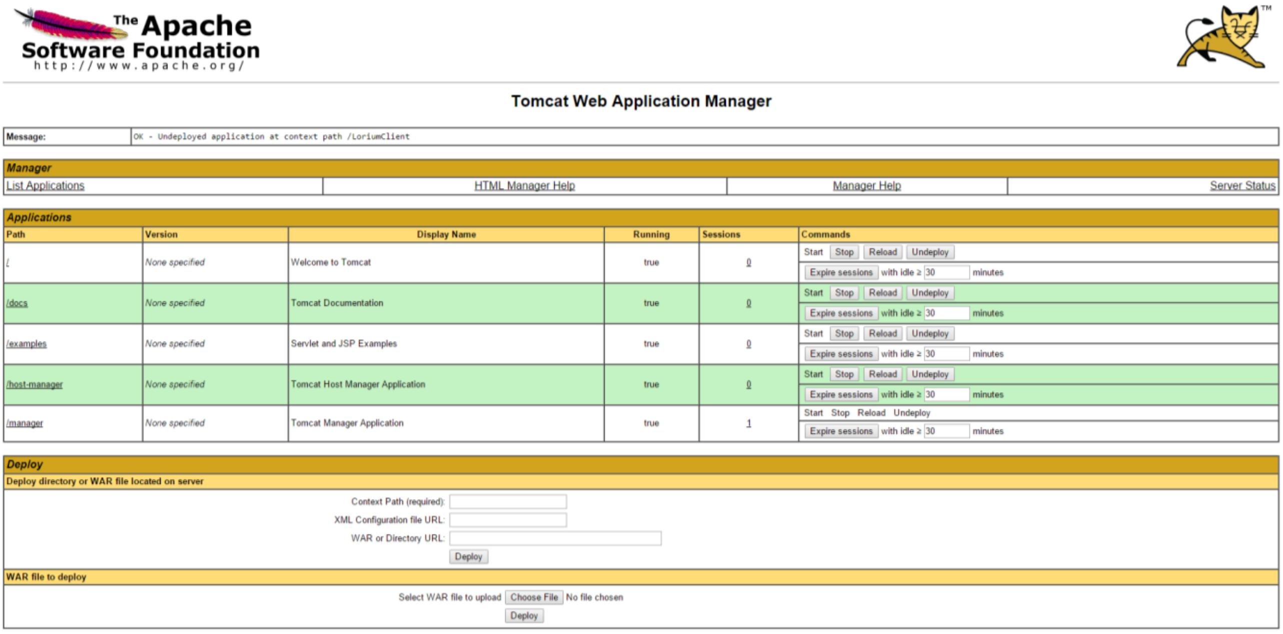
5. Select “Manager App” on the top right corner of the page and it should take you to a page with all the Web Applications that is already deployed on the server. If you have set a username and password during installation, you will be asked to enter it to proceed to the next step.



Tomcat Web Application Manager

Message: OK - Undeployed application at context path /LoriumClient

Manager

List Applications | HTML Manager Help | Manager Help | Server Status

Applications

Path	Version	Display Name	Running	Sessions	Commands
/	None specified	Welcome to Tomcat	true	0	Start Stop Reload Undeploy Expire sessions with idle ≥ 30 minutes
/docs	None specified	Tomcat Documentation	true	0	Start Stop Reload Undeploy Expire sessions with idle ≥ 30 minutes
/examples	None specified	Servlet and JSP Examples	true	0	Start Stop Reload Undeploy Expire sessions with idle ≥ 30 minutes
/host-manager	None specified	Tomcat Host Manager Application	true	0	Start Stop Reload Undeploy Expire sessions with idle ≥ 30 minutes
/manager	None specified	Tomcat Manager Application	true	1	Start Stop Reload Undeploy Expire sessions with idle ≥ 30 minutes

Deploy

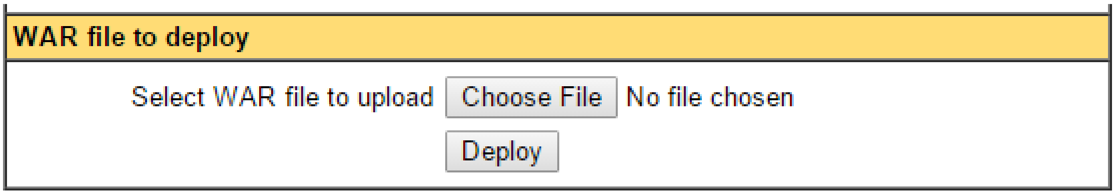
Deploy directory or WAR file located on server

Context Path (required):
XML Configuration file URL:
WAR or Directory URL:
Deploy

WAR file to deploy

Select WAR file to upload Choose File No file chosen
Deploy

6. At the bottom of the page there should be a heading “WAR file to deploy”.

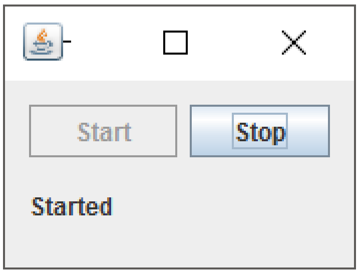


WAR file to deploy

Select WAR file to upload No file chosen

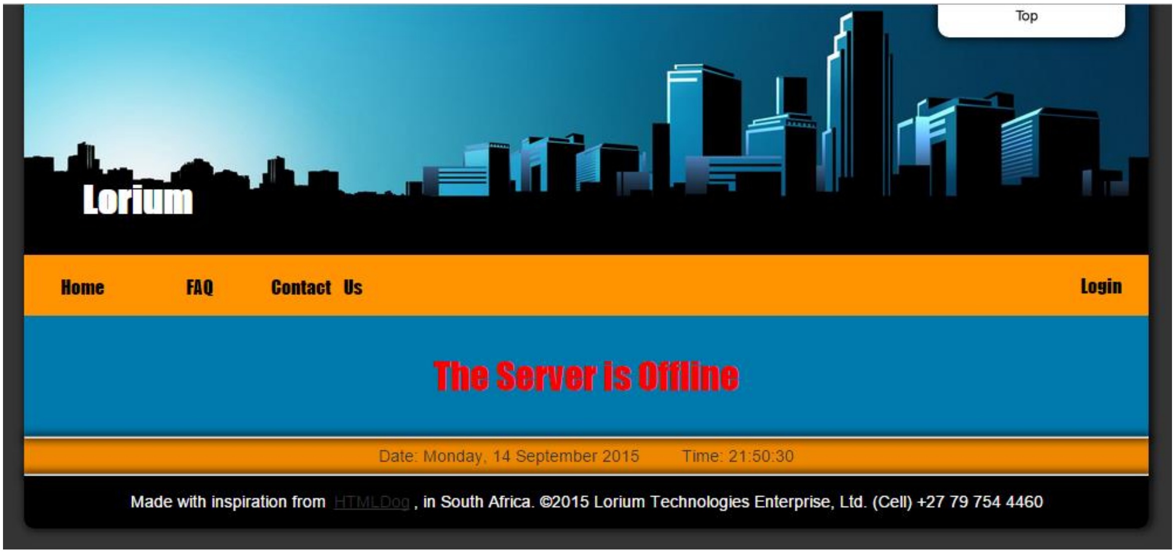
Choose the .war file from the resource folder and select “deploy”. This should unpack all the files inside the .war file and deploy it onto the server to be used.

7. Lastly, you need to run the “LoriumServerControl.jar”. Login with the administrator details that you enter into the “Lorium.accdb” database then start the server.



Started

If this step is skipped or unsuccessful, the following page will appear:



The Server Is Offline

Date: Monday, 14 September 2015 Time: 21:50:30

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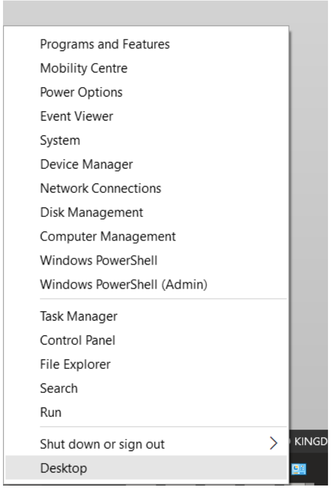
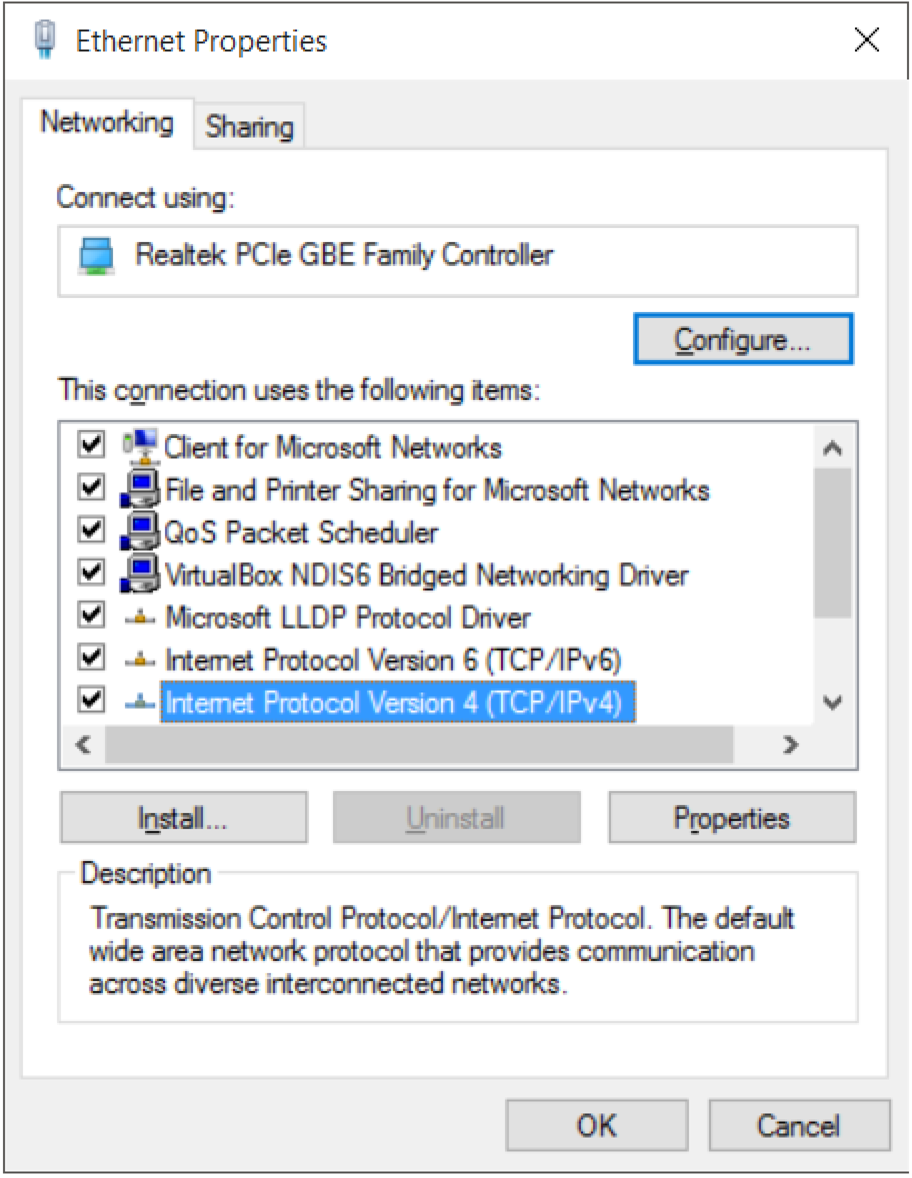
8. For the tenants to access the website, the administrator needs to first make a static IP address to the server. To do so right click your start menu:



Select control panel >> Network and Sharing Center >> Change Adapter Settings, then right click on the one which says “Ethernet” and select “Properties”.


Ethernet Properties

Networking | Sharing

Connect using:

Realtek PCIe GBE Family Controller

Configure...

This connection uses the following items:

☑ Client for Microsoft Networks
☑ File and Printer Sharing for Microsoft Networks
☑ QoS Packet Scheduler
☑ VirtualBox NDIS6 Bridged Networking Driver
☑ Microsoft LLDP Protocol Driver
☑ Internet Protocol Version 6 (TCP/IPv6)
☑ Internet Protocol Version 4 (TCP/IPv4)

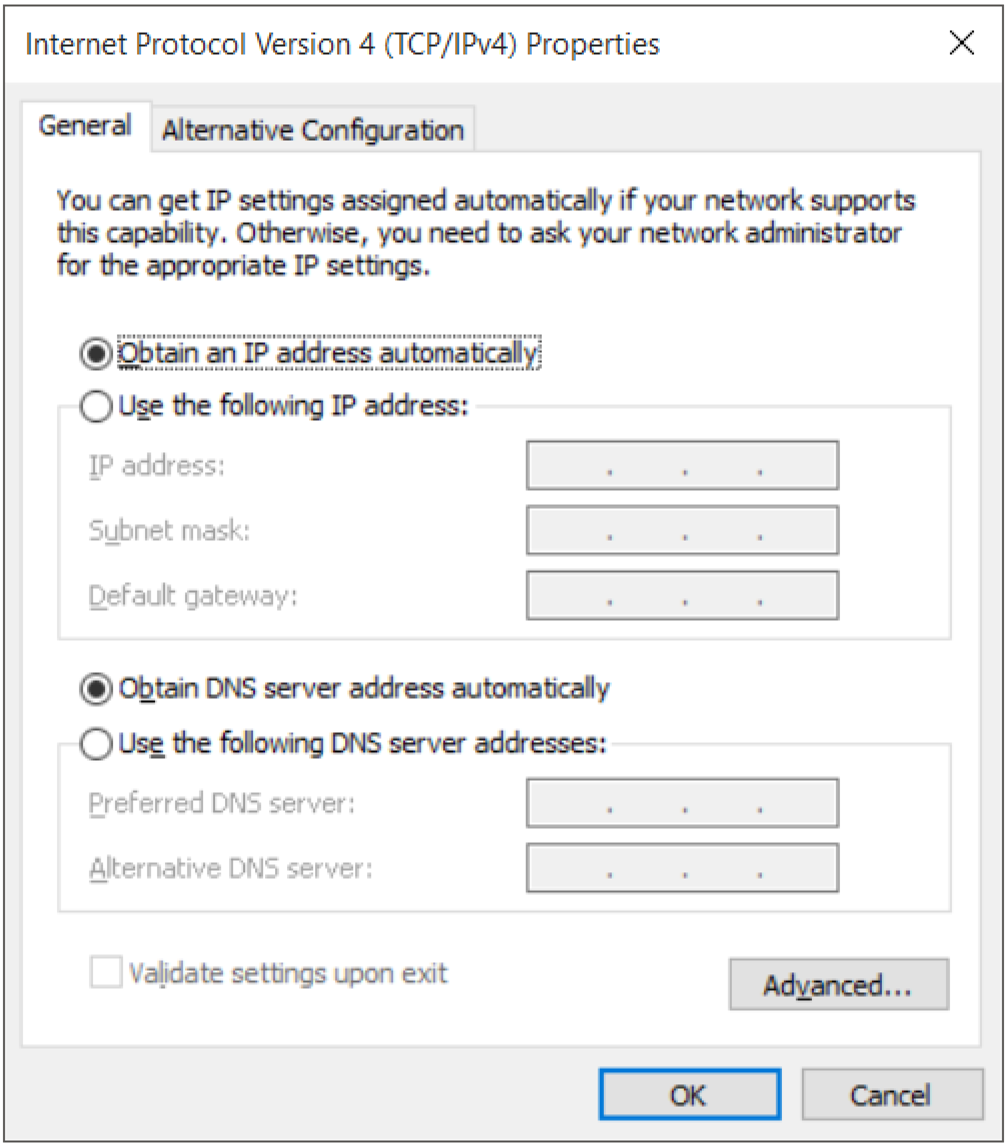
Install... | Uninstall | Properties

Description

Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.

OK | Cancel

Select Internet Protocol Version 4 (TCP/IPv4), and press “Properties”.



Internet Protocol Version 4 (TCP/IPv4) Properties

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

● Obtain an IP address automatically

○ Use the following IP address:

IP address: . . .

Subnet mask: . . .

Default gateway: . . .

● Obtain DNS server address automatically

○ Use the following DNS server addresses:

Preferred DNS server: . . .

Alternative DNS server: . . .

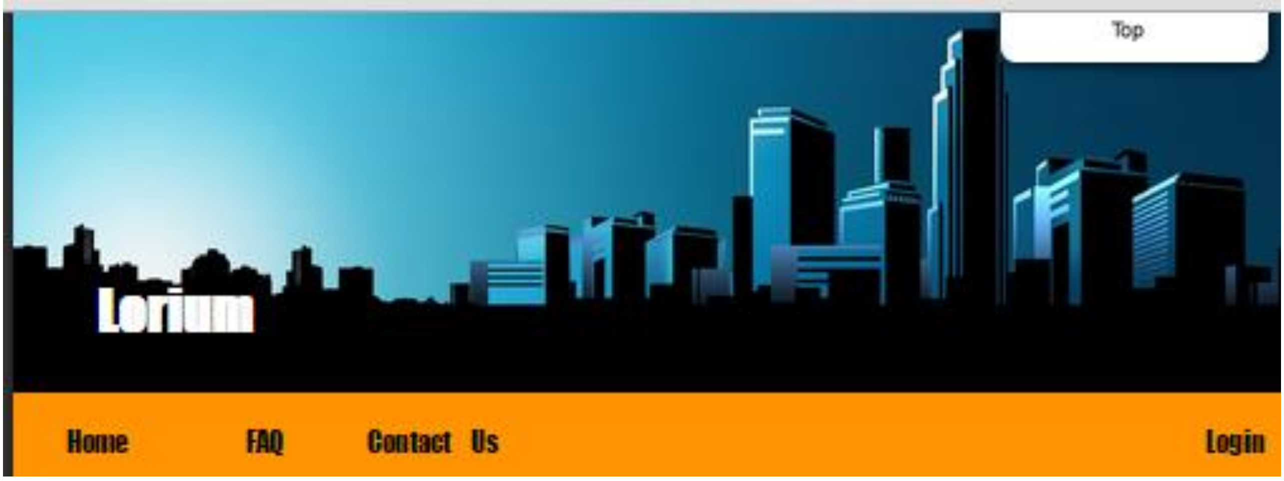
□ Validate settings upon exit

Change the IP address accordingly to your default gateway and subnet mask. To check your default gateway and subnet mask. Press Win Key + R, type in “cmd” then “ipconfig”.

How to Login

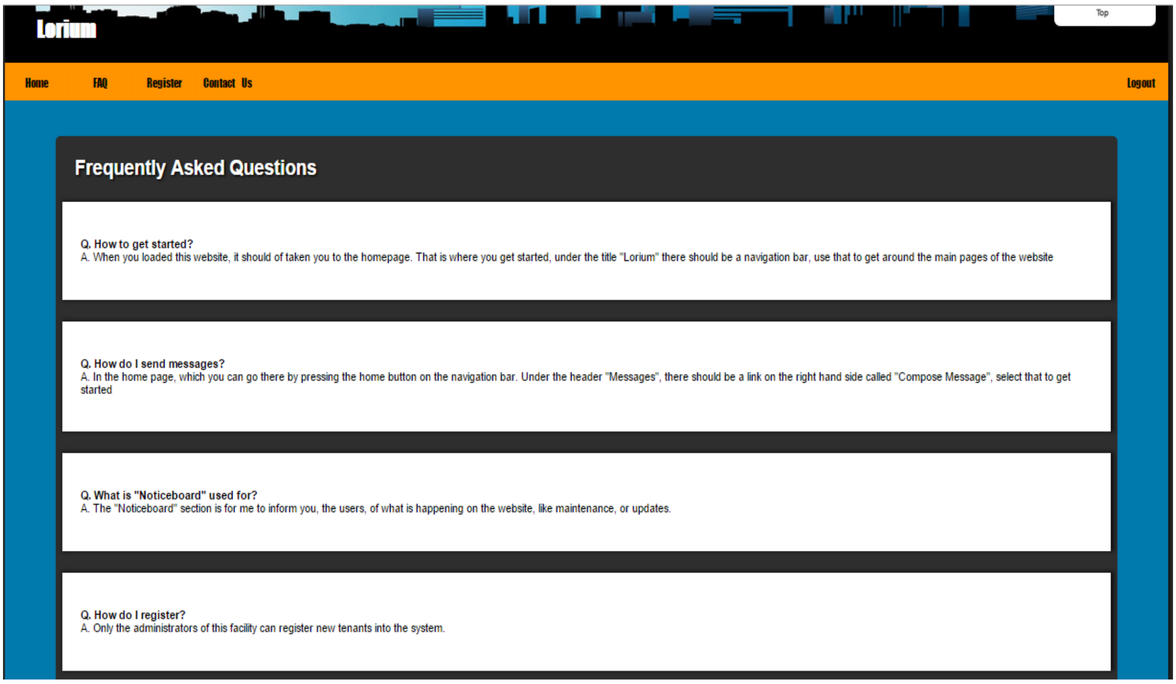
1. Open any web browser (for example Chrome, Internet explorer) and type localhost:8085/LoriumClient and press Enter.

   <u>The Lorium Homepage will display.</u>



The Lorium Homepage appears as the image below. Under the Lorium logo homepage, you will find five links that will help you navigate through our website. The destinations on the website are as follow:

- **Home**: This tab will always bring you back to the Lorium homepage.
- **FAQ**: This page contains frequently asked questions about the website and answers to the questions.



Frequently Asked Questions

Q. How to get started?
A. When you loaded this website, it should of taken you to the homepage. That is where you get started, under the title "Lorium" there should be a navigation bar, use that to get around the main pages of the website

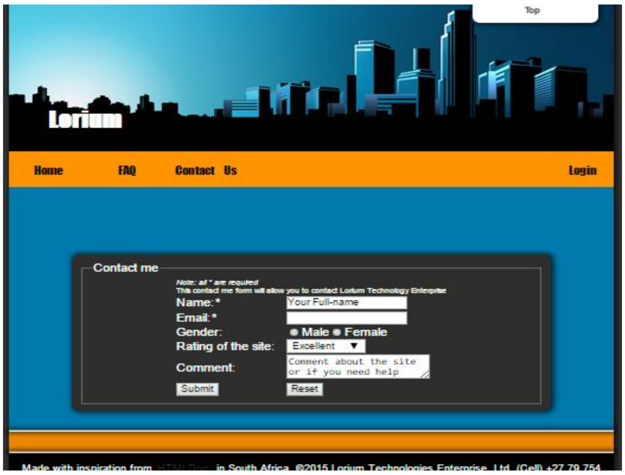
Q. How do I send messages?
A. In the home page, which you can go there by pressing the home button on the navigation bar. Under the header "Messages", there should be a link on the right hand side called "Compose Message", select that to get started

Q. What is "Noticeboard" used for?
A. The "Noticeboard" section is for me to inform you, the users, of what is happening on the website, like maintenance, or updates.

Q. How do I register?
A. Only the administrators of this facility can register new tenants into the system.

- **Register**: This page will only display once an administrator is logged in the system. The administrator will register each tenant registering

- **Contact Us**: This page gives will give you the platform to contact Lorium Technology Enterprise, which you will rate the site, comment about the site or anything that you need, giving your full name and email address so Lorium Technology Enterprise can contact you back.



Contact me

*Note: all * are required*
This contact me form will allow you to contact Lorium Technology Enterprise

Name:* Your Full-name
Email:*
Gender: ○ Male ○ Female
Rating of the site: Excellent ▼
Comment: Comment about the site or if you need help

Submit Reset

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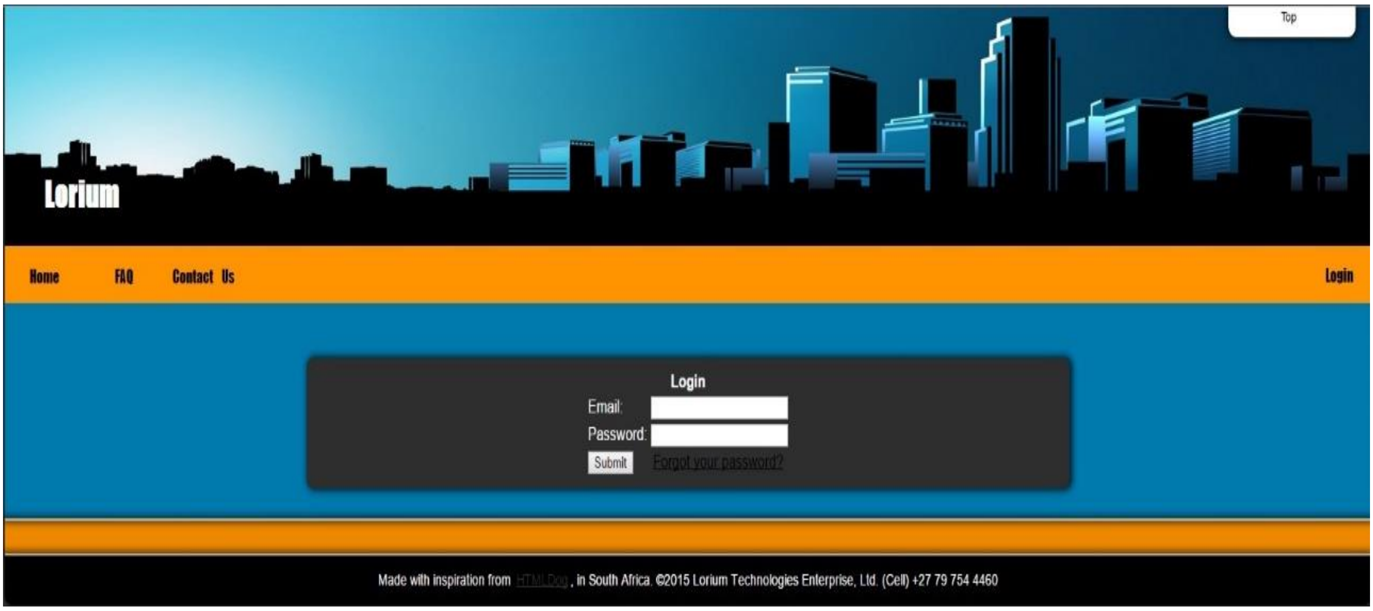
- **Login**: This page will allow you login the system.
- **Log out**: This tab will display once you have to logged in the system, to able you to log out

2. On the Lorium Homepage, the Email and Password prompt displays.
3. Enter the following:
   - **Email:** Your Email will be the same as you utilized your normal e-mail account.
   - **Password:** Password (utilize the same as your original e-mail account).
     Note: passwords are case sensitive
   - The Submit button is when the user have finished entering his/her credentials.
   - **Forget your password?** : When you have forgotten your password, click on the link and your new password will be sent to your email address.


Top
Lorium
Home
FAQ
Contact Us
Login
Login
Email:
Password:
Submit
Forgot your password?
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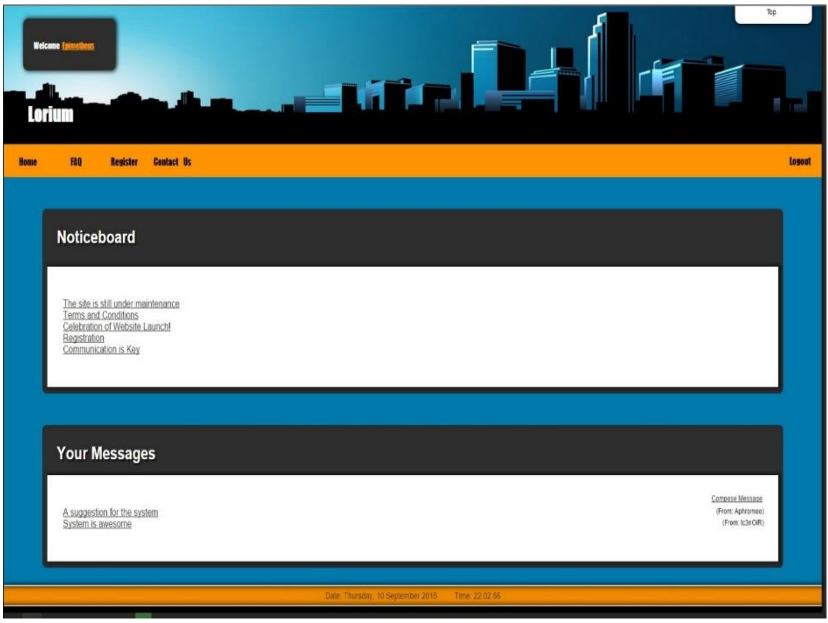
Logged in the system

4. When you are logged into the system you will find the Noticeboard and Your Messages in the middle of the page. When you are not logged in the system, only the Notification section will display

- **Noticeboard**: The Noticeboard will be updating administrators on what is happening on the system.
- **Your Messages**: These links will have state the subject of the message and on the left, it will show who composed the message. .



Noticeboard

The site is still under maintenance
Terms and Conditions
Celebration of Website Launch!
Registration
Communication is Key

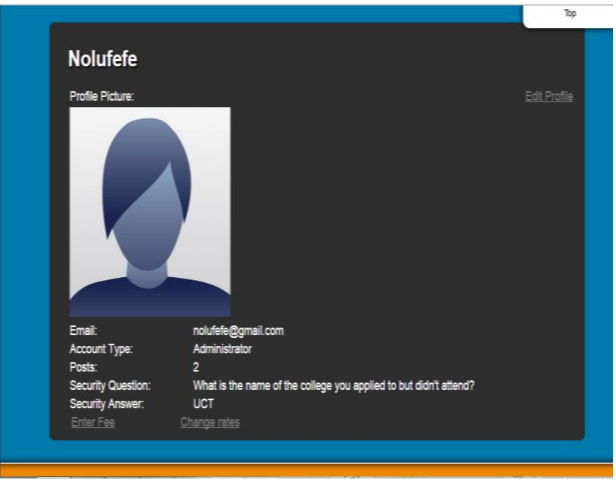
Your Messages

A suggestion for the system
System is awesome

Compose Message
(From: Aphromoo)
(From: Ic3nOiR)

Date: Thursday, 10 September 2015 Time: 22:02:56

Administrator's Profile



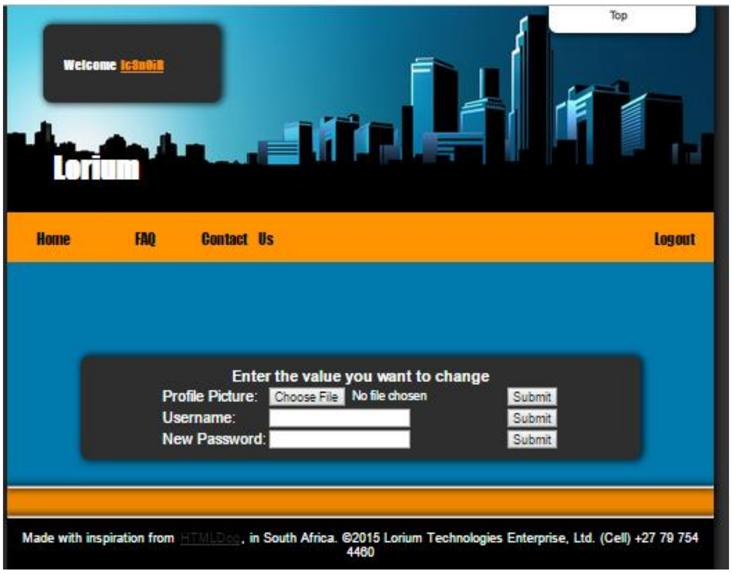
Nolufefe

Profile Picture:

Email:	nolufefe@gmail.com
Account Type:	Administrator
Posts:	2
Security Question:	What is the name of the college you applied to but didn't attend?
Security Answer:	UCT

– On the top left corner of the homepage, it will read "**Welcome**" with the user's name. When the user clicks on their name, the link will send them to their profile.

– To edit your profile you click **edit profile** on the right of the corner. In the **Enter the value you want to change** box, you will enter what you want change and click the submit button to make the changes.



Enter the value you want to change

Profile Picture: No file chosen
Username:
New Password:

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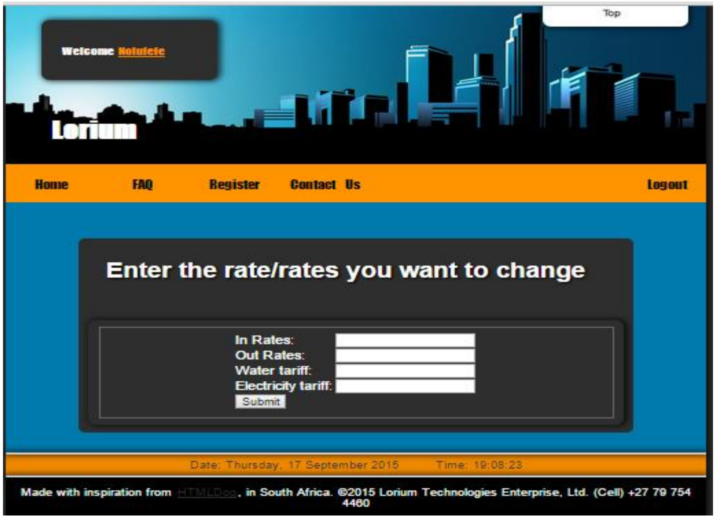
- Enter Fee: When you click on the **enter fee** you will be able enter the fees of the tenants'.
- Change rates: This link will able you to changes water tariff, electricity tariff, the in and out rates



Enter the rate/rates you want to change

In Rates:
Out Rates:
Water tariff:
Electricity tariff:

Date: Thursday, 17 September 2015 Time: 19:08:23

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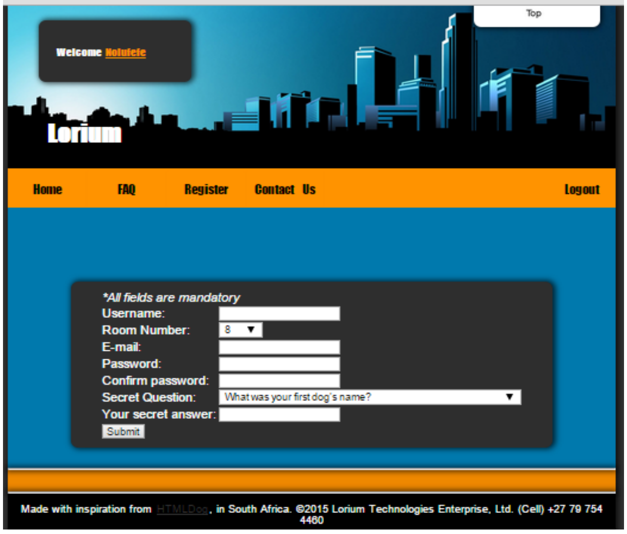
Register

The administrator will register each tenant on this page. The will enter what each label requires them to input.



All fields are mandatory
Username:
Room Number: 8
E-mail:
Password:
Confirm password:
Secret Question: What was your first dog's name?
Your secret answer:

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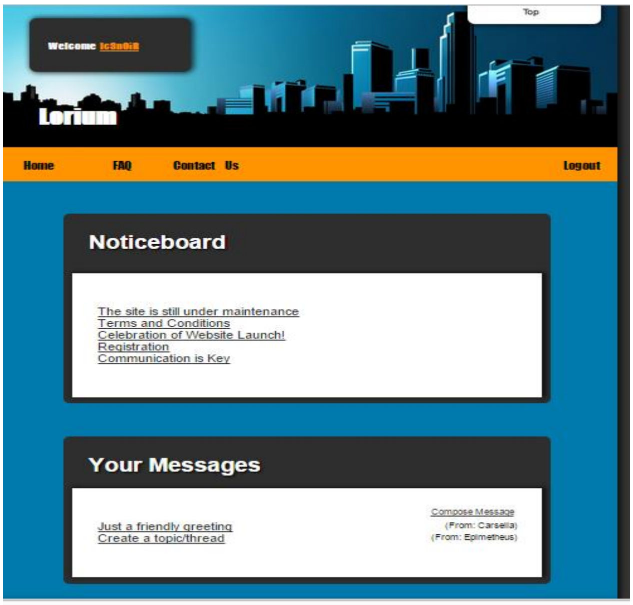
Logged in the system

When you are logged into the system you will find the Noticeboard and Your Messages in the middle of the page. When you are not logged in the system, only the Notification section will display

- **Noticeboard**: The Noticeboard will be updating the tenant on what are the changes on the system.
- **Your Messages**: These links will have a subject on what the message is on about and tenants can create topics of which they want to talk about. At the left corner it, the message will be stated who it from is.



Noticeboard

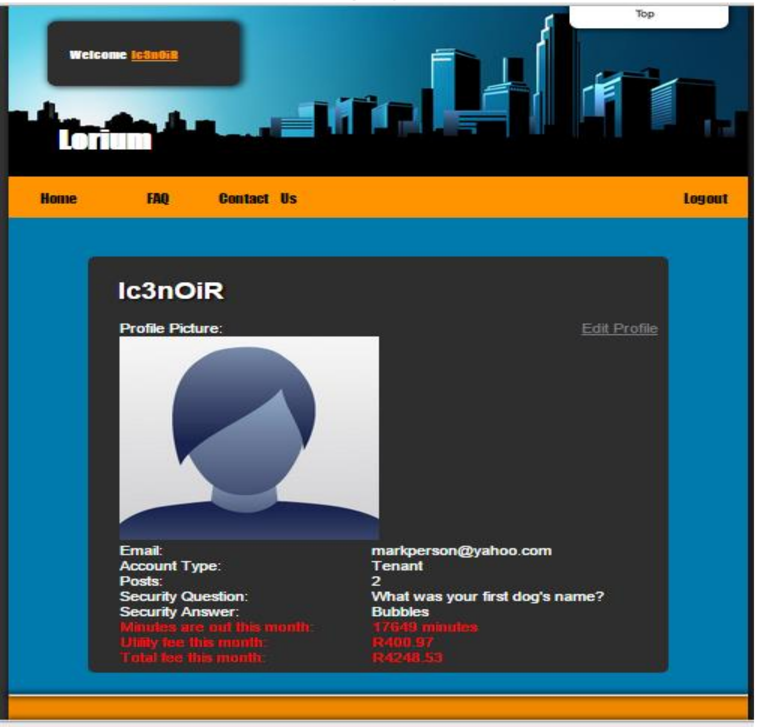
The site is still under maintenance
Terms and Conditions
Celebration of Website Launch!
Registration
Communication is Key

Your Messages

Just a friendly greeting (From: Carsella)
Create a topic/thread (From: Epimetheus)

Tenants Profile

- On this page, the tenant will view their profile and on the profile, it will state how much the tenant owes which will be showing in red.



Ic3nOiR

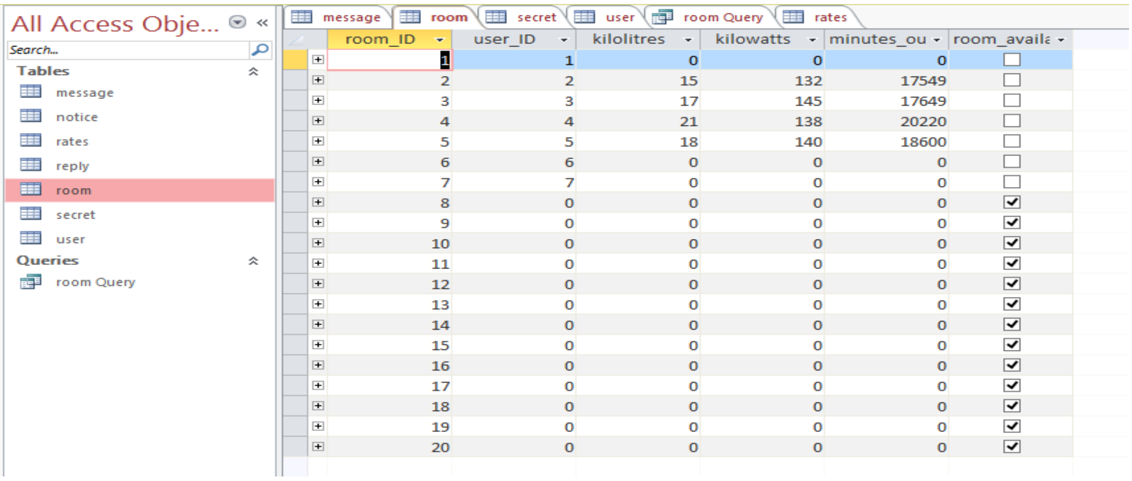
Profile Picture:

Email:	markperson@yahoo.com
Account Type:	Tenant
Posts:	2
Security Question:	What was your first dog's name?
Security Answer:	Bubbles
Minutes are out this month:	17649 minutes
Utility fee this month:	R400.97
Total fee this month:	R4248.53

- To edit your profile you click **edit profile** on the right of the corner. In the **Enter the value you want to change** box, you will enter what you want change and click the submit button to make the changes.

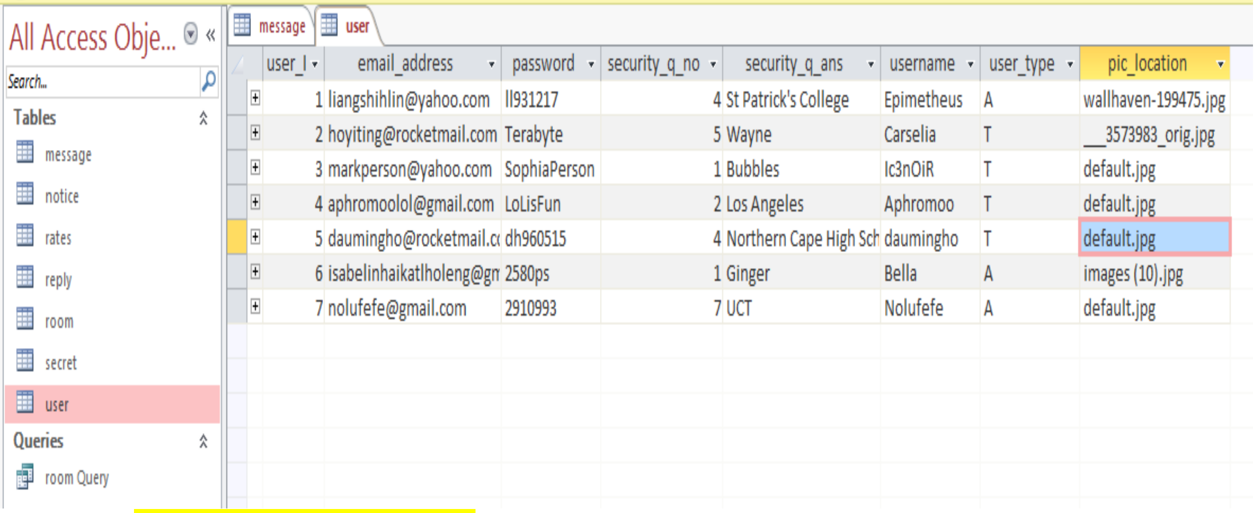
2 Member record maintenance

Database showing the vacated roomID, along with the UserID(tenant) and the electricity and water ussage.the screenshot also shows the minutes for tenant(s) time-in his/her room.



room_ID	user_ID	kilolitres	kilowatts	minutes_ou	room_availa
1	1	0	0	0	☐
2	2	15	132	17549	☐
3	3	17	145	17649	☐
4	4	21	138	20220	☐
5	5	18	140	18600	☐
6	6	0	0	0	☐
7	7	0	0	0	☐
8	0	0	0	0	☑
9	0	0	0	0	☑
10	0	0	0	0	☑
11	0	0	0	0	☑
12	0	0	0	0	☑
13	0	0	0	0	☑
14	0	0	0	0	☑
15	0	0	0	0	☑
16	0	0	0	0	☑
17	0	0	0	0	☑
18	0	0	0	0	☑
19	0	0	0	0	☑
20	0	0	0	0	☑

The screenshot below shows the tenants and administrators information record to the system (including security questions, user name, user type, pasword, and email address).



user_I	email_address	password	security_q_no	security_q_ans	username	user_type	pic_location
1	liangshihlin@yahoo.com	ll931217	4	St Patrick's College	Epimetheus	A	wallhaven-199475.jpg
2	hoyiting@rocketmail.com	Terabyte	5	Wayne	Carselia	T	__3573983_orig.jpg
3	markperson@yahoo.com	SophiaPerson	1	Bubbles	Ic3nOiR	T	default.jpg
4	aphromoolol@gmail.com	LoLisFun	2	Los Angeles	Aphromoo	T	default.jpg
5	daumingho@rocketmail.c	dh960515	4	Northern Cape High Sch	daumingho	T	default.jpg
6	isabelinhaikatlholeng@gn	2580ps	1	Ginger	Bella	A	images (10).jpg
7	nolufefe@gmail.com	2910993	7	UCT	Nolufefe	A	default.jpg

Glossary (add if u guys have any)

Time-in	This is the time spent by the tenant in his/her room.
Admin	The administrators who have high level access to the tenants accounts and record. They also manage the system

.

Customer sign-off

Customer name and surname	Customer Signature
Liang-Shih Lin	林良士
Group leader name and surname	Group leader signature

Deliverable 5

Evaluation Report

1.1 Introduction

The evaluation of The Lorium Enterprise System is based on the systems capabilities itself. These capabilities as far as the systems testing have proved, the Lorium Enterprise System will be sure to render the services/functions it is developed to do. These functions will not only improve efficiency, it will also make water, electricity usage, including tenants rent calculations match easier for the administrators. The system will also allow the tenants to communicate by a sending e-mail to the systems website, as well as viewing their monthly rental fees including updating their profile (e.g. changing their profile picture).
This evaluation report will focus on the journey of the developers (group members) working as a team to create the Lorium Enterprise System. The evaluation report discusses the following topics/aspects:

- The customers' requirements- as this will entail on the outcome based on the customers' expectations.
- The team's collaboration – which discusses the team efforts as-well as well as challenges.
- Time management – how time was used or rather spent on the project during the development stages, and challenges.
- Lessons learned – this is to be elaborated by each of the team members on their own personal lessons/experiences learned and gained.
- The conclusion of which will summarise the group's performance.

1.2 The final system and the customer's requirements

As mentioned in the introduction, the Lorium Enterprise System meets all the customer's requirements of which were expected of the system. The systems calculator of which will calculate the tenant's water, electricity and monthly rental fees has been tested and approved. The systems usability and accessibility have also been tested and approved to be of good standards.
In addition the systems website for admin control (calculating tenants resource usage and rental fees) as well as tenants accounts allow the tenants to interact with the administrators, by asking questions regarding their accounts or profile update.

1.3 As a team, time management was the core to everything that we did. It helped us to manage to increase productivity and efficiency of the work. There were times where we had to redo our work because of some mistakes made. We may not have worked according to our Gantt chart that estimated the time, day, week, and month a specific task needed to be completed. However, the activities that were required to be completed were accomplished before the due date of each deliverable.

The method we followed was to meet the deadlines of each deliverable there was no specific method that we followed. We did not slowdown in any of our work; we managed to hand in everything on time. The team was very dedicated and punctual.

Meetings we held every now and then, we only had two sit-ins but most of the time we met Tuesdays in our Software Project Development classes to discuss work that needs to be done. Tasks were divided among each other and no one had a problem with work being assigned to them however, most of the time the team members volunteer on the on what they will do. In those meetings there were no quarrels, we trusted each other.

In order for our activities to be completed, we divided the work among each other setting a deadline for an activity to be completed. During the time of task completion, if a team member was unsure of what they were doing. We would communicate through our group chat on WhatsApp created by Liang-Shih and other platforms such as Facebook, smses, and e-mails.

We met every Tuesday or chat on our WhatsApp group (most of the time things were discussed on the group) to discuss what needed to be accomplished and the changes needed to be completed. There were times when come to campus on a Friday to complete a deliverable due. None of did not show up, we all made it a point to show up however, Nolufefe was late but communicated that she was going to be late through the means of WhatsApp.

As a team, we depended on each other to complete a deliverable, if one delayed on delivering an activity; we would not have met the deadlines of each deliverable of which it did not happen. What we could have improved was to help Liang-Shih in the development of the system even though we contributed, we could have done much more than what we (Isabelinha and Nolufefe) contributed.

1.4 Time management

The time spent on the system was/still is managed in such a way that the systems tasks are divided amongst the group members. In that way, as a team were able to get the "job" done may it be at campus or at home. However on campus (work area) we are to meet four hours a weeks on every Tuesday (of which some of the group members where sometimes late), but sometimes the team stayed after hours to work together to help each other and "fill in the gap" on the system.
Various communication methods were used such as social media and exchanging emails, for instance; a Whatsapp group chat was/is created to allow us to always communicate and check the progress amongst ourselves as the group members.

To resolve the punctuality problem, the group members could have tried not to be late and stick to the time schedule. However as long as the job, tasks/work is completed and well-done, the group had no problems.

1.5I, Isabelinha Ikatlholeng have learned a lot about team work and task delegation, as most of the time I prefer to be the leader and do my own work. Dong my own work gave me a sense of accomplishment and assurance of what I have done. Through this project I have learned to trust in my team mates and trust their knowledge, as they have taught me a lot. I have learned to develop a system of which I have never done! And it's been and still a pleasure to know that it is much better to work in a team, as tasks are divided and equally delegated amongst the group, and with great communication an awesome system can be developed.

Nolufefe: Working in a team is better working than working individually because the work can divided among each other. Lesson learned is that we depend on each other because if one backslides, the whole team suffers (we did not have any problems of work not delivered in time). Working in a team helped me realized to deliver a task you must have a schedule to eliminate risks such as not handing work in time such risk can build conflict in the team.

Liang-Shih Lin: Working as a group leader really was a challenging task for me since I've never really took that role before, I was never used to kicking someone out of the group, I didn't know how to motivate my group nor how to be organised and keep the work progression to the schedule that we initially set up. I was always just one of the group members, but now it gave me the chance to understand how it works. It was a challenge for me, but we pulled it off. I learnt that if one member is to slack off, then the entire group's progress will decline. I have learnt that if things don't go according to plan, you need to take action to resolve the issue. Working as a group leader wasn't an easy task, but this experience has taught me a bit more of what a leader is required to achieve his goals.

1.6 Conclusion

Overall performance of the group was and still is great. All the group members aim on not letting any team members down and get the job done. The group has great communication skills, although there were some arguments on what is to be done or changed to the system. However through good communication and trust in each other, the group managed to resolve and get/be on the same boat at all times.

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