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1.0 Management Summary

A US consortium, Rosie's Bar and Grill Inc. is planning to enter Australian food and entertainment industry, SITP are responsible for submitting an IT solution for Rosie's Bar and Grill Inc. to evaluate the possibility to expand business to Australia. By 4 July 2020, 3 restaurants in Sydney and 2 restaurants in Melbourne will be firstly launched. Accordingly, the total estimated length of SITP's (Strategic IT Project) proposal is 12 months.

In SITP proposal, technologies suggested to be used for solution and hardware, network infrastructures will be demonstrated as well as the plan of implementation of database and software, project management process will be explained, cost is estimated for further discussion. For business issues, SITP suggestions regarding organizational impact, risk management, business continuity, staff training, support and agreement issues will be illustrated.

To give an overview of management system, first of all, a cashless payment system is designed to meet the requirements, where customers are able to book any restaurants' table in Australia and order food without need of paying cash, face recognition devices would be used to identify customers' membership identity when they are visiting one of the bars, a website and mobile app will be developed to provide custom with product information and booking portal and will allow to customer to register as member and manage their accounts.

For restaurant goods supply, inventory management system and procurement management system will be designed to supervise the amount of food and get contact local providers to give order.

From the restaurant operations' perspective, a set of robot chiefs and robot waiters is expected be adopted which can be sourced from robot company, human service are also available and custom can choose human or AI service based on their own preferences, 20 tablets are approximately needed purchased for staff and waiters' daily operation.

To support this solution, a network structure is designed so that Australia locations will be able to communicate with each other via a local area network, US headquarter has the authority to access Australia outlets' data include all sorts of data like transaction record and CCTV camera record and financial cost. A database is designed to manage stock and customer's information with MYSQL database management system. Other devices like routers and tablets will be illustrated and the purpose would be justified.

An IT maintenance and upgradation system could be implemented to deal with machine faults and system failure and network connection issues, AI fault detection system and cyber security solution can be used to support daily maintain and inspection. Information will be forwarded to control centre and then technician will be noticed to address problems. An IT help desk is suggested to be established to help staff and customers out with general questions. Staff training process is planned to provide company with qualified waiters and manager regularly. Emergency alarm system will be implemented to protect people from fire and natural disasters, stealing will be caught by this system as well.

The whole estimated cost of SITP proposal comes down to \$4,410,799, which can be break down to three sections, infrastructure cost, labour cost and device purchasing cost. Detail will be illustrated in the cost section of this report.

Further details will be demonstrated in following sections in this document relevant to various aspects for SITP IT solution proposal.

2.0 Case study background

The background will be explained in three aspects: Rosie's Bar and Grill Inc., SITP and Australia restaurant industry.

Rosie's Bar and Grill Inc., named after a television show, a company owned privately by an American consortium and has its' business across 50 states in US, each bar with similar operational mode, menu and layout, now recognizes a potential niche in Australian food and entertainment field. Rosie's Bar and Grill Inc. is looking for IT solution providers to evaluate the possibility to sprawl its' business to Australia.

Locations in Australia will be operating alone while American organizations would provide initial fund to support Australian locations to set up, after 12 to 18 months of first establishment of Australia location, repayment is needed, plus Australia operation should be paying US based operation with 20 percent of annual profits for the first 20 years. Besides budget should be calculated carefully and wisely.

Five bars would be opened in Sydney and Melbourne and if initial launch has been proved to be successful, four more locations will be conducted in Brisbane, Surfers Paradise, Adelaide and Perth. There should be a head office in Sydney to manage all locations in Australia. SITP is responsible to achieve above obligations and regulations.

SITP is an IT and business solutions provider which will be efficiently carried out sophisticated IT-related business project with a competitive edge in the use of state-of-the-art technologies. SITP is aiming for meeting client's needs with precise analysis and provide satisfactory service to clients in order to improve client's business practices. In this project, SITP is responsible for providing an applicable and profitable project plan of conducting Rosie's Bar and Grill project in Australia so that the requirement of client can be met. Team needs to mainly provide a solution with a high-tech IT system to support the operation of restaurants and bars.

All IT related solutions should be presented, for instance, hardware, software, database, network and security solutions, thus flexibility and expandability are very important aspects to consider, services operate 24 hours a day, 7 days a week. As this is a technically sophisticated project, regular maintenance and upgrades are also required to be done by Australia operations. Rosie Bar and Grill Inc. also has special management protocol for SITP to comply as American bourbons and rye whiskies and soft drinks and snacks must be obtained via USA companies.

As Australia has highly diversified population with different cultural background, the customers' needs and tastes vary, for Australian restaurant industry, new business model need to be implemented with fancy ideas, good services, convenient operations, attractive environment and good-quality food and beverages in order to attract more customers and take up more market share, in regard to this point, SITP' s proposal which consists of several efficient and convenient operational and management strategies designed for catering both customers and clients could be helpful to Rosie's Bar and Grill Inc. to enter Australia restaurant and recreation market. New technologies such as AI, IOT will be included in the proposal to provide customers with creative and impressive dining experience, thus contributing to build the business success.

Decision made by solution providers should clearly discussed with Client Project Manager and make agreement.

3.0 Scope and Assumption

3.1 Scope

3.1.1 In Scope

The following list of contents indicates the solution within the scope and requirement by the Rosie's Bar and Grill. These contents cover all our high-level design and solution for the project. Our goal is to fulfil and accomplish all the needs and requirements for our customers, stakeholders and the whole company.

- Security & Safety Issue & Solution mainly focuses on protecting the system and the users' data from being stolen and breached by hostile servers and hackers.
- Software/Hardware Solution includes all the software and hardware needed in this entire project and our system. Hardware mainly consists of POS machines, mobile devices, computers, servers, etc. Software includes development tools, operating system, database, mobile applications, etc.
- Database Management, Data Integrity and DBMS.
- External Service/Technology Support
- Communications with the supplier and stakeholders
- Project Management is about advanced planning, cost control, milestones, tasks allocation and time management of the project.
- General Cost includes labour cost, implementation cost, software installation cost and hardware purchase cost.
- Budget Limit is within our scope but in our case the budget is unlimited in this project.
- IT Staff (for solution) Recruitment and Staff Training

3.1.2 Out of Scope

The following list of contents is regarded out-of-scope in our project since these contents do not belong to any part of our solution. They will not be discussed in our project solution either.

- Staff Recruitment and Staff Training that are outside the solution (such as chef, waiter) is not our concern in this project as well as Administration staff.
- Building furniture and office telephones.
- Financial issues and any business goal are considered out of scope.
- Government policy, Law violation or any potential illegal act will not be our responsibility, the Rosie's will take care of it. They must make sure they are strictly obeying the law and respect the government policy.
- Taxation is another aspect that is not our concern. We only provide technology-based solutions.
- Corresponding Licence.

3.2 Assumption

- The price unit is Australian dollar.
- All the payments are cashless and can be done by card.
- Every customer should have a smartphone.
- There is no delay in oversea goods supply.
- Apart from English, multiple languages are allowed to use in our application and website.
- Customers should have sufficient IT skill sets.

- Electricity and sufficient power are always provided.
- Refrigerator is always fully functional.
- Customers' smart phones are either iOS or Android operating system.
- Robot chefs and robot waiters are already programmed to work.
- All the software we use is off-the-shelf.

4.0 Objectives

- Provide IT solution for the Rosie's Bar and Grills project.
- Build a database management system.
- Develop an inventory management system.
- Develop a mobile end application in iOS and Android system.
- Develop a web end application.
- Support cashless payment in our application.
- Provide innovative robot service.
- Order Robot waiter and robot chef as our intelligent staff.
- Provide unique dining experience.
- Provide external service such as Uber, Water Taxi and Food Delivery
- Purchase appropriate and necessary hardware facilities.
- Purchase essential servers, devices and machines.
- Successful Installation and implementation of our software.
- Restaurant emergency management.
- Complete in-scope staff training and recruitment.
- Balance the cost and reduce budget.

5.0 Final Solution Overview

5.1 Solution Introduction

The main solution of our project consists of several type of ‘restaurant management and customer management system we build for “Rosie’s Bar and Grill project”. The most amazing thing about this project is that we offer robotic kitchen combined of ‘Robot chef and services’ for the consumers and make high technology system solution for the new state of art for our Australian customers. It’s not only can cook variety of estimated hundred dishes and meals automatically but also dishwasher or clean services provided after cooking .The “robotic AI system” simple is that it is also arm with ‘3D motion camera capture technology ‘ which the machine can learn the recipe from human chef and then uploaded to the databases and then follow up cooking procedures. Not only that we offer also for ease of access for our valuable customers for Self-check in Kiosk, Smart App/web so that customer get full attention and enjoyable experience for the “Rosie bar and grill” project. To get the deeper high-level details about this project the following section describes the our propose solution.

Furthermore, there is several technologies is going to be use in this project which is the best available solution in the market.

5.2 Solution High Level Description

The high level of our solution designed is proposed and discuss in this section below:

Smart Robot services kitchen:

The main blueprint of our robot kitchen solution is that it is integrated with two state-of-arts humanoid made arms with five fingers limbs for high tech savvy for the solution offering of this project for robotic kitchen and waiter. Customer can order using the robot pad which is connected through ‘Internet of things” (IOT) and select the different variety of food and experience the amazing dining experience in the restaurant. It serves as a chef and waiter role for the customer’s estimated error free experience, which is take order from the kitchen to table (Holt 2018). And integrated with the latest Artificial intelligence (AI) technologies and sensor to automaticity detect near customer and talk, chat automatically using the “AI” and machine learning algorithms for speech recognition attract new customer and promote promotion or discounts. It is integrated with chatbots which is ideal for place an order, providing feedback and any issues on making the orders and payment.



Figure 1 : Robot waiter (Holt 2018)



Figure 2 Robot Chef (Medi 2018)

Smart Kiosk\booth:

This is another solution for our project, which is a quick solution for counter service the customer who is rush. They can select different kind of Menus and order promptly. It is attached with the artificial intelligence technology algorithm, which is automatically shows the best deal and promotion on the go in the system. It will record and analysis customer buying behaviour and customers can personalise their choice of menus and dishes. It also embedded with recognition or recommendation system which can better help customer discover and potential menus for next order and can add 'wish-list' for the items which can be bought later and also track the history (Tabsquare.Ai 2018). It's also attached with differ kind of payment technology such as "apple pay, google pay, WeChat pay and even face recognition payment too.

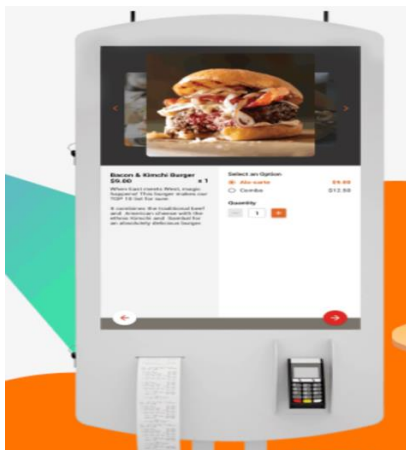


Figure 3 Smart app (Tabsquare.Ai 2018)

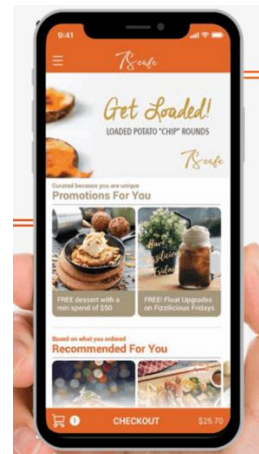


Figure 4 Smart Kiosk (Tabsquare.Ai 2018)

Smart WEB\Tab:

Another of our solution is make website and app for the restaurant site which will operate 24X7 days and customer can make seamlessly order from the website within inside the restaurant or outside. Customer can choose different kind of foods and dishes and it's also attached with home delivery service. And customer can make payment secure online payment

technologies and get food delivery by “UBER eats” etc services. Also, can reserve ‘table or special food requirements such as (allergic or dieting info.) in advance to satisfy the consumers specific request.

5.3 Business Brief

As Rosie bar and restaurant will be a started-up company based in Australia, even though the Headquarters is located in CA, USA. The solution and business plan are proposed using the most efficient and High-tech savvy feature in the market to interact not only the Australian customers but also communicate with the also headquarter in USA. They need to expand their business in Australia zone.

So according to their needs, the new Technology solution is to provide such as secure payment system, Robot services, fully customer management checkout system and restaurant or employee management system is to be built according to the requirement.

The goals of the project are:

- Improve the customer satisfaction and services by implementing robot chef and waiter services
- Obtain cost saving by implementing the highest technology system order entry and payment process
- Obtain the cost saving supply or inventory management system process
- Implement the employee’s productivity improvement by introducing the AI Functionality system and Robot services.

The system will provide the customer to access the checking order process such as add food item, place order, secure payment gateway technology and can save the ‘account history’ data. They can choose variety of ‘menu items ‘’ using smartphone in or outside the restaurant. And also, can interact with real time robot system service to place order which increase the dining experience and cost and time saving techniques. Customer can add item for pickup and delivery at the any time. Supplier also can be contacted via the system.

The Rosie bar and restaurant will be located several parts of the Australia zone comprise of Sydney and Melbourne. As a independent system of its own database will be locate at the main headquarter in the back office. All the system application monitor and control by the core legacy system at headquarter in Sydney branch.

6.0 Stakeholders

Stakeholder refers to "an individual, group, or organization, who may affect, be affected by, or perceive itself to be affected by a decision, activity, or outcome of a project" (Rose 2013).

In this project stakeholders include:

Managers team:

- Project manager
- Financial office manager
- Human Resource manager

Developers team:

- Business analyser
- Software Developers
- Software Testers
- Database administrator
- Hardware instalment staff
- Hardware vendors
- Subcontractors of the project

Restaurant team:

- Restaurant managers
- Waiters
- Chefs
- Sales
- Trainers
- Food procurement purchaser
- Food and beverage Vendors

Other stakeholders:

- Government
- Local councils

7.0 Solution Technologies

There are variety of technology is included in this project in order to make the best fit in the market and customer demand. The solution mainly consists of four implementations options to satisfy the 'Rosie bar and grill project' customers which is:

1. Robotic Kitchen chef and waiters
2. In store smart Kiosk
3. In the store smart tab
4. Smart web and app

The following section briefly explain the potential technology and features will be used in this project for the solution.

7.1 Artificial Intelligence

All of the solution discussed above is integrated with the AI technology for faster response and personalize dining experience for the customer in this project. All the devices attached with self-ordering AI system which reduce the time and cost effective and reduction of staff. This technology with the system collects millions of data and process it for better customer experience and predict the future performance. And automatically detect any fraud transaction and recommend the best dishes and menus for the customers own personal of choice.

The machine learning algorithm will be used to make recommendation and any fraud detentions too to detect and monitor any unusual activity going on or not. While the customer also can touch the screen of the tab and use voice or speech recognition technology to add order or make suggestion and promotion. The chatbots function of the robot waiter services will be used to proceeding with order, getting valuable feedback from customers and answer any questions users might have. In the kiosk system this technology will also going to be use without any error or delay with the placing order and making payment. In the robotic system, after receiving the order it will automatically prepare for making dish and assigned some task to restaurant employees and then start preparing the food. But another amazing about this technology is that it can adapt or co-up with another technology. The 3D Motion capture technology will be used such as use the live movement of the human chef and then the movement is uploaded to robotic database and the robotic chef can cook and download the variety of recipes which is uploaded.

7.2 SAAS cloud technology

Software as service or cloud technology will the used in the project to connect multiple location with restaurant and also vendors. Though in this project focus only the five restaurants across Australia , so the easiest way to connect with the remote restaurant for food ordering inventory and staff management is the SAAS cloud system.

It can be access from anywhere in the world. Though the main headquarter is in the USA, so must use this technology for quicker customer management, security and quick implementation process. Use this technology to interact with the USA databases and can check Inventory. Not only that, the customers also can manage their account through 'web ordering system'. There is lot of features such as "Home Menu, my cart, my Account and the "Menu management system will be divided into subcategories features such as "add category, add or edit or delete product. It will also allow user to save items to the cart, allow users to check out and make payment promptly using credit or debit card and after it users can see the message after successfully place an order.

Another potential features will be used by this technology which is “order retrieval system” which will display all related details of the order information in the cloud. The customer not only check the ‘order information’ but also the restaurant employees or admin can see the all order information.

7.3 IOT technology

This the most interesting technology, we going to use in this project. All the devices going to connect through the Internet of things (IOT) sensor devices because it capable of collect tremendous amount of data such as take order and process payment. All the robot sensor and displays tablet and kitchen application also connected through IOT. The kitchen chef or employee can see promptly the coming order and also the inventory status through this technology. And also, not only can make payment with IOT technology with credit card or wallets to pay but also can use facial recognition payment gateway with the help of the IOT technology.

It helps faster operation and workflow and increased the speed of table ordering process which is save the energy cost by automation the process. Besides it is also integrated with the main system with security camera to capture the footage of any suspicious behavior on restaurant. In case of emergency, such as fire, steal, equipment malfunction, it will automatically reach and contact the fire brigade or police to control the any unexpected situation going to happen on restaurants.

7.4 NFC technology

Near field communication technology (NFC) will be use in this project. NFC enable application in the restaurant can help reduce the cost and boost the customer dining experience. Customer can see the NFC enable interactive ads and promotion within the restaurant. And even can place order with NFC enable devices smartphone. With this technology not only improve customer satisfaction but also better employee’s communication.

In this project, with this technology the staff can update the menus items, customer can place an order from the table without waiting for long queue at the counter ,just tap and pay with secure payment gateway and another potential feature will use by this technology for ‘social marketing and promotions such as ‘like or share button’ function will be used for the restaurant. It will also allow users to connect the restaurant app promptly. And after connecting, it will be going to show and comes up with list of actions such as the ‘coupons’ and ‘view website’, ‘request bill’ buttons and which enable the users to see the best deals and discounts for the restaurant products. And see the all the ‘Menus items on restaurant, place an order of foods of choices and after it also can ‘request bill’ features and make payment on the go using this technology.

7.5 Business Intelligence

This software and technology will help to see what going on in the system such as interactive monitoring and how to solve the problems within the system. In the main restaurant application system Business Intelligence technology software will be installed. It will also predict the customer desires and future performance improvement and analysis the customer feedback sentiment. The main feature will be the track the customer dining experience and give the best possible “Menus’ for the upcoming order.

Specially for this solution is consist of the main features and technology is used for restaurant “management teams’ back of the office they can see analytics of how often different set of

actions is requested within several hours and notify the management team with the real data and can monitor the overall process of restaurant and sales using the business analytics dashboards.

The more details using the most technology and software specification is mentioned in the section 9 of this project.

8.0 Hardware and Network Infrastructure

8.1 Overview

To perform the project successfully, a list of hardware is highly suggested to be purchased because the restaurant's daily operation will rely on the support of items like POS machine, LED screen, PCs, switches and routers etc. The reason of why these items are estimated to be used during business and their functionalities will be justified in the following section. Specifications and related information will be appended in the Appendix.

8.2 Servers

Total expenditure of hardware

Table 1 Products quantities and prices shows the exact quantities and prices for each product purchased.

Table 1 Products quantities and prices

Product	Suggested quantity	Price
Server	1	\$8489.00
Router	6	\$5994.00
Kiosk	5	\$2760.00
Projector screen	5	\$4999.00
Tablet PC	10	\$4788.00
Desktop	6	\$6290.00
Audio speaker	10	\$6290.00
Walkie-talkie	15	\$1302.75
Robot waiter	10	\$30000.00
Robot chef	5	\$75000.00
POS Machine	5	\$15023.50
Security camera	16	\$960.00

8.3 Network

In this project, through the system the main connection will be built through Internet service providers (ISP) and then dividing into subnetwork. Which is then break it down the into Five network and routed with the gateway by routers subnet is necessary to interact with different system in this project more securely. In this project, the internet gateway support IPv4 and IPv6. The location of the network will available through the Sydney, Melbourne and USA. The highest bandit and traffic will be provided for smoothly running the system. And after each gateway the firewall will be integrated with the networking to improve and increase the security. And then add network Switches for multiple to forward data to end users to connect and control computer, phones etc devices.

The detailed network topology diagram is shown in Appendix A.

8.4 Other Hardware

Server

Table 2 Server information explains the reason why a server is included in the proposal and the features of this server that suit the project

Table 2 Server information

Server	
Supplier	DELL
Model	DELL PowerEdge R840 Rack
Description	<p>The PowerEdge R840 accelerates business insights and provide excellent performance for business analytics. Delivering large memory and consistent results for demanding applications. Open-Manage Enterprise system makes IT infrastructure management easy so that business objectives can be focused. High security and reliability maximize uptime in enterprise data centre.</p> <p>Supported by direct-attached NVMe drives, four Intel Xeon Scalable processors and 112 processing cores, latency is minimized while performance is maximized, data transition with ultra-path interconnects. Reducing many IT effort using predictive technology from ProSupport Plus and Support-Assist.</p>
Justification	<p>The DELL PowerEdge R840 Rack Server provides enough processing ability, high reliability, processing speed and data security which are features that meet all requirements, it supports data intense workload for AI applications in this project. Based on the descriptions, the functionalities and performance PowerEdge R840 can provide is sufficient for hosting the Australian based operations. One server is needed to provide network services and processing large amount of data.</p>

Table 3 Router information shows the information of router selection and explanation.

Table 3 Router information

Router	
Supplier	Cisco
Model	Meraki MX64W
Description	<p>Cisco Meraki MX provides Unified Threat Management (UTM) solution with Application-aware traffic control and bandwidth policies. It's installation and management are totally run through cloud service which enables convenient remote management. Meraki MX can provide a</p>

	comprehensive set of network services, no need for complicated multiple network devices. MX has services include SD-WAN capabilities, application-based firewalling, content filtering with CIPA-compliant content filter, web search filtering.
Justification	Meraki MX64W are capable of providing good quality of network services through branch gateways services, site-to-site SD-WAN, Amazon cloud management and UTM capabilities. Ensures the network connection of this IT solution to be stable, secure and fast for staff and customers to use. Installation is convenient and the price is relatively cheap because it reduces the demand of other network devices. One MX64W would suits network needs of one branch. As there is 5 locations and one head office,6 routers may be needed for appropriate network routing.

Table 4 Desktop computer information explains the usage of desktop and its' specification.

Table 4 Desktop computer information

Desktop	
Supplier	HP
Model	24-F0036A
Description	For office work, the HP 23.8-inch 24-F0036A Desktop shows a capability of processing technology, spacious storage, and user-friendly interface to help staff boost their productivity. This desktop is bundled with a USB mouse and keyboard, having a package for engaging daily computing tasks. USB 3.0 and USB 3.1 interfaces are equipped, this all-in-one desktop make sure the smooth connectivity over multiple devices
Justification	For desktop, manager has the need to access the inventory information and staff and customers' management information which justifies the reason of needing desktops, day-to-day tasks need to be completed via computer and messages from control center and AI, IoT applications will be received to address relative questions. The HP desktop is capable of perform these tasks and the price is quite affordable. Each one of sites may need one computer to maintain regular work.

Table 5 Tablet information demonstrate the suggested tablet and the reason of purchasing.

Table 5 Tablet information

Tablet	
Supplier	Apple

Model	IPAD Air
Description	<p>IPAD Air has A12 Bionic chip with Neural Engine to support performance. A 10.5inch Retina display with True Tone of apps and pictures. Weight of one pound and 6.1 mm thin makes this product very portable for people to hold.</p> <p>iPad Air features a large 10.5inch Retina display. And with up to 10 hours of battery life, reduce the effort of charging frequently.</p> <p>With WiFi speeds up to 866 Mbps and Gigabitclass LTE, iPad Air ensures the quality and speed of network connectivity.</p>
Justification	The need of purchasing tablet is that customers need a device to give order and to avoid congestion,2 tablets for one location may be possible for reducing customers' waiting time. It has retina displaying features which will boost customers' appetite by great visual effect.

Table 6 Kiosk information show basic information of the chosen kiosk.

Table 6 Kiosk information

Kiosk	
Supplier	Wallaby
Model	E062324 ELO self-service stand desktop
Description	The Wallaby self-service stands enables interaction in high-traffic public environments. Providing a comprehensive approach to all sorts of customer experiences in terms of sale and self-service applications such as self-ordering, loyalty programs, brand experience, patient check-in and etc. With the Wallaby stands, a 22-inch Windows or Android based self-service touch screen solution will be available also with printing features.
Justification	For demand of kiosk the reason can be justified when there are huge customer volume and service could not be provided to customers in time, kiosk can be as another option for custom to give order and do operations,5 kiosks may be needed for each site.

Needed information of POS system is listed below.

Table 7 POS information

POS system

Supplier	BCI
Model	BCI Restaurant-Bar-Standard
Description	This is a complete POS payment system with touchscreen, receipt printer, kitchen printer, credit card reader, software, receipt paper, cables, and payment processing option. Installation and usage are very easy. Configurations have already been done. The POS-X combination simplifies and streamlines operations to increase efficiency.
Justification	Each one of the locations may needs a POS system to support cashless payment requirement and receive card payment.

Information of robot chef and robot waiter is shown below.

Table 8 Robot waiter information

Robot waiter	
Supplier	AOBO Robot
Model	Robot LELE
Description	For control function, this robot has functionalities of remote controlling walking, remote software upgradation, ultrasonic parameter adjustments, multi-point navigation, dialog system activation mode, obstacle detection and avoidance, Lidar navigation walks, voice control, to ensure safety, pedestrian detection and self-balance system have been deployed
Justification	Implementation of robot waiter is because it provides a new interesting option for customers to choose with reducing cost of human service, thus has a lower payment. This robot has convenient control system for multiple purposes including voice control and motion control, safety can also be ensured.

Table 9 Robot chef information

Robot chef	
Supplier	Moley
Model	Moley
Description	The robot chef integrates several cutting-edge technologies including machine learning and Artificial Intelligence, learn how to cook by wired

	groves and 3D cameras and capturing human chef's motion around the kitchen.
Justification	5 robot chefs is suggested to attract custom in each location, the robot chef can also reduce the need of human force and thus has a lower bill for people to pay

Table 10 Screen information shows justification and description of screen.

Table 10 Screen information

Display Screen	
Supplier	Philips
Model	BDL8470EU
Description	This projector provides diagonal screen size of 84 inch / 213.5 cm and IPS Panel technology. The optimum resolution: 3840 x 2160 @ 60Hz. Brightness is 500 cd/m ² . Contrasting ratio (typical): 1400:1. 3D MA deinterlacing, Dynamic contrast enhancement, deinterlacing, progressive scan. With these features, the quality of presenting will be good.
Justification	In this proposal, 5 projectors are likely to be included for each site. Purpose of setting up screen is to show customers with product video and advertisement or necessarily sport games.

Table 11 Audio speaker information shows the information of audio speaker.

Table 11 Audio speaker information

Audio speaker	
Supplier	MACKIE
Model	Thump 15A2
Description	<p>The Thump 15A2 features class-leading performance and reliability chest-thumping low-end and versatility.</p> <p>1,300 watts of high-output power in a portable package. Class D amplifier with Dynamic Bass has strong audio effects. Equipping with 15" low-frequency driver and 1.4" titanium dome compression driver. Built-in 2-channel mixer features multiple playing purposes. XLR thru output for wired connection to other Thump speakers ensures flexibility.</p>

Justification	Two audio speakers for each branch may be needed to play music or sound goes with video. This product has outstanding sound quality to satisfy diners and reliability and safety which makes it easy to use and set up and reduces the risk of fire.
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Table 12 Walkie talkie information shows the information of selected walkie talkie.

Table 12 Walkie talkie information

Walkie Talkie	
Supplier	ESYNIC
Model	ESY66x2
Description	<p>This model has 4 pack two-way radio with 16 Memory Channels and up to 5 Kilometers Range, Can Work Together with Other BF-888s.</p> <p>The Charger is USB Cable Version, many devices can charger this product which is flexible.</p> <p>1500mAh Li-ion Rechargeable Battery supports capacity allows 2-3 hours charging and 8-9 hours of using.</p> <p>All products come with 18-Month-Warranty and Lifetime Customer Support.</p>
Justification	Walkie talkies are suggested for restaurant staff to communicate in case there is any safety problem occurring that may threaten people's safety. And they can also be used for staff to maintain the normal operation of restaurants.

Table 13 Camera information

Camera	
Supplier	SV3C
Model	SV3C Wireless Outdoor camera
Description	<p>This camera ensures WIFI set up and stable WIFI connection.</p> <p>SV3Ci camera will alert customers through mobile phone or send snapshots to email when motion is detected. This camera supports motion detection recording to SD card.</p> <p>The SV3C camera supports SD card with spacious storage up to 128GB. Motion detection area and alarm sensitivity can be adjusted.</p>

	Equipped with 36 pcs IR led light, providing a clear night vision. Quality of night images is ensured by adjust the IR sensitivity.
Justification	For security and surveillance reasons, three cameras will be needed for each 5 sites and one camera need to be placed in the head office. This camera can detect motion and inform user to proof theft and ensure security. Storage is enough for recording daily operations in restaurants.

9.0 Software

9.1 Application

This section will demonstrate how our system and application work and how our software is built and installed. One of the innovative ideas we use in our solution is Robot service, so we have combined Robot service with our application. Our proposed solution mainly focuses on building a mobile-end application on smart phone because smart phone has become a necessity in nowadays life. Therefore, we decide to build an App that can fulfil any customers needs on it. User of our mobile application can either order food online, self-order food and service in restaurant, pick up take-away food or order food delivery. More explanation about our software and system features and structure will be in the Appendix section (Appendix B, C & E).

9.1.1 Develop a mobile-end Application

Table 14 Mobile Application System

iPhone Operating System (iOS) Application	
Description	<ul style="list-style-type: none">• Use X-code, a top iOS system Integrated Development Environment (IDE), to develop the iOS App on mobile-end using programming language Swift.• Support latest version of Swift and Mac OS system.• X-code supports the latest Software Development Kits (SDKs) and latest simulators for testing iPhones, iPads and iWatch.
Android System Application	
Description	<ul style="list-style-type: none">• Android Studio, a developer tool and an excellent IDE for programmers and developers to use programming Java language, to develop android mobile-end Application.• Support the latest Android Studio version and 64-bit operating system.• Support the latest version of Java IDE Standard Edition (SE) Development Kit (JDK) 8 which is provided by Oracle Technology Network.

9.1.2 Common Application functions

Table 15 Common Application Functions

Guest login & Member login	Guest login doesn't require username and password, for users who don't have an account before and new to the restaurant. Member login for old customers, it requires a registration process and all the personal information will be stored in our database, such as payment methods, feedback, ranking food, drinks and service.
A foldable dynamic Menu Bar	Locate on the top-left corner of the screen, which contains Settings, Profile, Menu, Self-order, Reservation, Location, Payment and Log Out labels. Settings: 1) Reset password

	<ul style="list-style-type: none"> 2) Receive notification 3) Instructions to teach users how to use this App <p>Profile:</p> <ul style="list-style-type: none"> 1) Individual profile modification 2) Save personal information <p>Menu:</p> <ul style="list-style-type: none"> 1) View the menu including pictures 2) Differentiate food categories for users <p>Self-order:</p> <ul style="list-style-type: none"> 1) Browse the food and add it in a shopping cart 2) Confirm an order and inform the chef to prepare and cook the meal 3) Add extra orders before the bill is checked 4) Choose a favorite payment method (can be saved in the setting). If a user is a guest user, he/she may ask a waiter to proceed payment <p>Reservation:</p> <ul style="list-style-type: none"> 1) Select a preferable date and time for a reservation 2) Check availability at that time 3) Successful booking confirmation send via email <p>Location:</p> <ul style="list-style-type: none"> 1) Real-time location through a map 2) Distance between user and restaurants <p>Payment:</p> <ul style="list-style-type: none"> 1) Credit card/Master card/Debit card all accepted 2) Save favorite payment method 3) Allow to use Apple Pay <p>Log out:</p> <ul style="list-style-type: none"> 1) Log out the system at any time 2) Guest Login cannot log out
Rank your favorite food and the restaurant service	<p>After checking the bill, customers are able to leave comments and feedbacks for the food and service they have. A list of high-ranked food/drinks and most-ordered can be viewed in the Menu, customers are more willingly to try these highly-recommended food when they are difficult to choose what to eat.</p>

9.1.3 Tablet (iPad) on the Table:

For customers who do not feel like using a smart phone, they can always feel free to use a tablet provided which is attached on their table. It has installed our mobile application and customers can use all its functions with same interface to order different service on it. No extra time needed to learn how to operate the App.

- For customers to order food, snacks and drinks.
- Check bill after finishing the meal.
- Ring a bell on screen to call waiters or robots for service.
- Timer count down before food is served to the table.
- Have the same interface and function as mobile application.

9.1.4 Web-end Application (Website):

Browsing our Website is very convenient for customers who want to order food delivery at home, since it is very easy to operate on a desktop or a laptop. Our Website shares the same interface and user functions so that users do not need extra time learning how to operate.

- Website which supports all kind of browsers such as Chrome, Firefox, Safari and etc.
- Can be viewed on laptop, PC, smart phone, tablets.
- Use Microsoft Visual Studio as developer tool
- Use language C/C++, C# and Python
- Use frame and front-end technology including (PHP, AJAX, JS, HTML, CSS).

9.1.5 Food Delivery Function and External Services:

Food delivery riders are all from UberEats and Deliveroo because they are professional food delivery companies and have a very skilled procedure in food delivering. People can also view our food and delivery menu on these two food delivery Apps.

- Cooperate with Deliveroo and UberEats.
- Transportation service is provided such as Uber and water taxi
- Delivery address must be within 5km from any one of the Rosie's locations.
- Can only order food delivery during the open time of the Rosie's

9.2 Operating Systems (OS)

There are several types of mainstream operating systems in the world which are Windows (Microsoft), Mac OS (Apple) and Linux. Each of the system has its best use in different circumstances and of course, has its own strength and weakness as well. In our case, we need a strong and powerful system to handle our database, backup data storage, data recovery, application development, software installation and maintenance, inventory management, robot programming, robot maintenance, software testing and security system. Hence, we analyze the pros and cons for these systems and determine where they should be used and installed in our business as our solution.

9.2.1 Windows OS

Table 16 Pros & Cons of Windows OS

Pros:	The most popular operating system in the world, approximately over 80% PC/laptop users know how to use this system. Easy to pick up for most of the users since they are very familiar with this system for a long time. It is very suitable to manage and edit the office document since Microsoft Office tools are all bonded products. Also, Windows supports lots of free applications.
Cons:	Quite insecure because it lacks sufficient Firewall. Vulnerable when being attacked by virus and hacking. It can neither support iOS application nor develop one. Closed resource for software development library and tools, which is very bad for developers to use it.

9.2.2 Mac OS

Table 17 Pros & Cons of Mac OS

Pros:	Mac OS system is basically a variant of Unix system. Software packages can be re-compiled and run on Linux OS. It has an enormous open source library which is free to use for all Apple developers. The only system to develop an iOS product and can integrate with other Apple product as well as Apple devices. Compared to Windows OS, Mac OS is fairly safe and secure so that virus finds it quite hard to penetrate the defense. App Store ensure all the application is protected from third-party source.
Cons:	It would take some time for new users to get used to the system such as interface and operating pattern. Apple devices are all very expensive in general so that this will definitely increase the budget in this project. Different file format form in this OS sometimes can cause format conversion error when using a Mac OS system to edit Microsoft Office document.

9.2.3 Linux OS

Table 18 Pros & Cons of Linux OS

Pros:	Very suitable and friendly for programming because it is free, open source and allow users to configure basically everything on a computer. Developers can use this OS to build the website for the company as well as a web-end application. In terms of security and anti-virus ability, it is safer than majority of other OS (including Windows and Mac OS). It can coexist with Windows OS so that you can install two OS in one machine as a virtual machine.
Cons:	Very hard to learn. Not a lot of people know how to use this OS. Do not really support latest hardware and drivers. There is few support Linux can get from other application.

9.2.4 Solution

In conclusion, Linux OS can coexist with Windows OS, so these two OS can be mainly used for programming the website and Android application. Windows has lots of hardware support

which in a way covers the disadvantages of Linux OS. Mac OS is of course necessary for iOS application. Individual Windows OS is also suitable for office staff to work on, mainly for financial reports, cost assumption, project management, statistics statements, etc. In terms of data backup which will be mentioned very soon in this report, Linux can be a very strong OS to handle all the data backup problems. The initial proportion of OS we are proposing to install would be 35%/35%/30% of our machine and devices for Linux/Mac OS/Windows system respectively. It is adjustable later on depending on the project requirements and plan changes.

9.3 Anti-Virus Software

Firewalls and Anti-Virus Software are absolutely essential for software and system protection especially for protecting enterprise level system and data resources. There are a couple of off-the-shelf Anti-Virus application and Firewall which are free to reach online. According to the latest ranking in 2019, Total AV, an Antivirus software, is regarded as the most popular Anti-Virus (AntivirusSoftwareGuide, 2019). Moreover, it can protect our device in all the major systems we are using such as Windows, Mac, Android and iOS. It saves us a considerable amount of time installing it. Not to mention about it is totally free to use, so that the project budget is also cut.

10.0 Data Management and Database

10.1 Data Management/Data Integrity

The Database Management System we choose to use is MySQL, an off-the-shelf software developed by Oracle Corporation. Except creating entity relationship between different entities in different data tables, developers must guarantee and be concerned with the importance of data integrity while creating these tables. Set up the correct constraints of each table such as Primary Key Constraint and Unique Constraint, the Database will automatically create index for the data and increase the searching efficiency which will allow a quick access to specific information. In other word, data integrity represents the accuracy and consistency of data. If the data is as neat as possible in the database, it would be fairly easy to maintain and clean it. Data Normalization technique is used to reduce redundant data which means no mess and no confusion in the database. Therefore, data is easy to trace and locate and can be encrypted nicely.

When the database system is implemented, the best way to create and insert tables is to build a conceptual data model in advance where we can initially establish some relationship between tables and entities. Therefore, this helps us define the structure of our database system and how we are about to address details in it. After that, we upgrade the conceptual model to a logical design model where we add constraints and define data type for each attribute. In the end, we finalize our model as a Physical Entity Relational Diagram (ERD) Model. This final step is how we relate our database model to our database management system (DBMS) and how we actually manage our database practically. Foreign Key Constraint is designed and used in this model to establish the connection and relationship between the corresponding tables. More details of the ERD diagram will be shown in the Appendix C.

10.2 Backup Strategy

Data Backup Strategy and Data Recovery Strategy is very critical and significant in managing business. Enterprises normally require a secondary device, or more likely an additional server apart from its primary one to backup data against unexpected situation (What is enterprise data backup software, 2016). This management strategy helps the company to protect its most important resources and the most valuable business data against unexpected accidents such as accidental operation, server breakdown, hardware aging, security breach, virus attack and some other emergency situations. In our case, these accidents could be mobile application crashes due to memory leak, customer's personal data leak, robot malfunction and breakdown, data loss in inventory management and affect food supply and etc. In order to prevent losing important data permanently, it is essential to implement a backup strategy as soon as possible in our device and application. We will need support from both hardware and software aspect. Normally enterprise-level servers and large memory storage disks are often stored in machine room. More details about hardware solution will be mentioned in hardware section.

First all, we have to decide what back up plan we want to use by considering these important factors:

- Cost (both money and time)
 - Mostly time consumption in our case
 - Budget is unlimited
- Identify the risks (Reference: section 12.5 risks)
- Where to backup

- Server, machine room
- Software or application self-backup function
- Database management system
- How to backup
 - Use one of the Backup plans we offer as a solution
- How often to backup
 - Once a week/Once a month maybe more often depends on the amount of the data
- How to recover
 - Best and the most appropriate recovery plan and method

Here are several common methods for enterprises nowadays to back up their data.

Table 19 Full Backup & Incremental Backup

Full Backup		
Description	Pros	Cons
It is very a straightforward and fundamental method which means we must back up the entire database including all the files, folders, tables and data models just like using copy-paste.	Backup the data without missing any details. Very easy to operate, no special skillset is needed.	It is very time consuming for recovery depends on the size of the database. Not efficient because backup needs to update regularly.
Incremental Backups		
Description	Pros	Cons
This is a method based on Full Backup. After a full backup is done, later on we only need to back up those additional contents. For example, if a Full Backup is done on day one, day two will back up incrementally all the files that have been changed since day one. And on day 3, it only backs up files that have been changed on day two and so on.	Shorter time to back up between Full Backups. Easy to operate, fewer files are copied. One of the most popular backup methods nowadays.	Hard to retrieve data because of so many subsequent backups Takes a lot of time to restore data

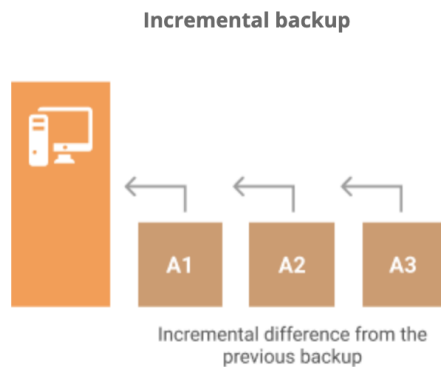


Figure 5 Differential Backup

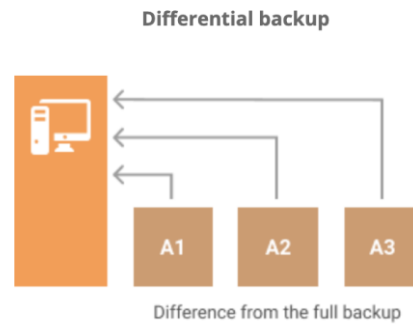


Figure 6 Incremental Backups

Table 20 Differential Backup

Differential Backups		
Description	Pros	Cons
This strategy is to back up files that have been changed or modified since the last full backup took place, which is quite similar to Increment Backups. For example, if a Full Backup is done on the day one, day two will differentially backup all those files that have been changed since day one. It's doing the same on all the following days after the last full backup.	Save a lot of time. Store data differentially instead of doing multiple full backups. Easy to restore because of differential copies are made.	Size of the differential copy increases each time after the former one is taken.

Table 21 Synthetic Backup

Synthetic Backups		
Description	Pros	Cons
It is an advanced solution which is basically re-assemble Full Backup, Incremental Backup and Differential Backup as a new Full Backup. It is identical to a normal full backup solution.	Easy to recover and restore the data, saves a lot of backup time. A combination of different backup methods.	Complicated to combine all three types of backups together, need a lot of extra space in the memory disk.

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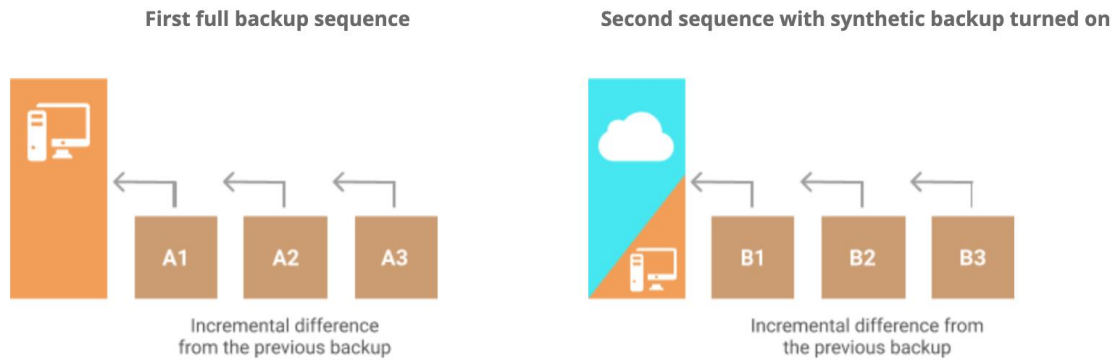


Figure 7 Synthetic Backup

Google Cloud Service (off-the-shelf)

Table 22 Cloud Backup

Cloud Backups		
Description	Pros	Cons
Copy the database and send it to an external network and server. User can access to the data at any time. It has encrypted both the dynamic data and static data. Google Cloud Service is off-the-shelf service for Cloud backup solution.	Very good strategy for recovery. Less cost compared to other plans. Good backup storage investment because it is configured by the cloud provider.	Still developing and improving, not at its best yet. Very few trustworthy companies are providing Cloud Tech and limit our control of it.

10.2.1 Conclusion & Final Solution:

Considering all these backup plans, Full Backups is essential because it is the basis and fundamental of the other backup strategies. I would propose to run Full Backups on not only customers data, inventory data, transaction data but also backup Robot data. Robot service is the core service in the Rosie's Bar and Grills therefore we cannot afford the data leak of our Robot configuration parameters. Transaction is protected by the banks, so we do not need to worry too much about that. We more likely intend to protect customers' personal information and our inventory updates. I propose to use Incremental Backups for daily data backup and have a Full Backup twice every month. Using cloud server will also be our best solution

because the cloud technology is getting better and better. Most of the companies are investing in Cloud Computing Storage because it has less cost. Combine it with our Backup Strategy, make sure our data is safely stored and can always be successfully recovered if any accidents happen.

10.3 Database Management System (DBMS)

As we have mentioned in the last section, we decide to use MySQL (NoSQL + SQL), as our main database system which is developed by Oracle Technology Network. Here is a list of the reason why we choose it as our solution:

- Trustworthy product, very popular and practical
- Offers Cloud service
- Off-the-shelf software, easy to install
- Enterprise Edition for a stronger and bigger database storage
- Perform enterprise-grade backup, realize our backup plan

Moreover, because we already have a database in local server and a cloud server for each restaurant in Australia. We need to build a DBMS to help us manage the database and connect it with our application interface. So that data can be retrieved via SQL commands that are called in our web application and front-end application. Users can retrieve information such as menu dishes, drinks categories, restaurant locations, reservation hotline and so on from our mobile application and the website. The corresponding queries have already been coded and implemented in our software. Also, senior developers and programmers are allowed to access to the internal system to make any modification or upgrades if needed. After all, we need support from hardware.

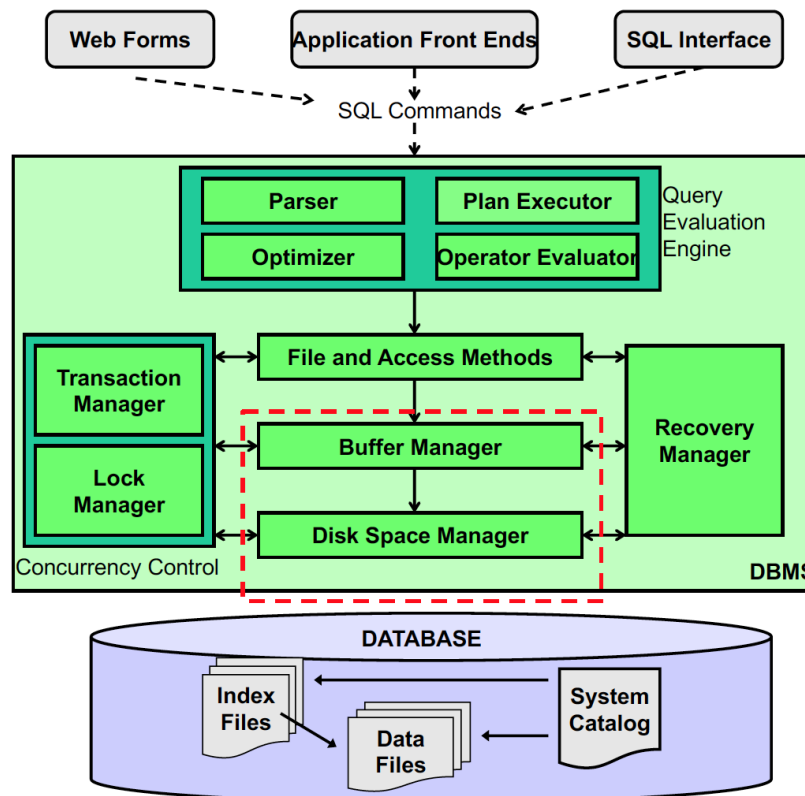


Figure 8 DBMS

10.3.1 Shared Data System

Goals for a shared data system, because customers are allowed to have a meal in one of the 5 restaurants but taking a drink after in another one. From customers perspective, his/her data must be saved and connected all the time. Therefore, based on the distributed system we propose to use, we need to handle the shared data problem. It must have a very strong consistency, high availability and partition tolerance. Data is normally stored in physical disks of a server, and processors have access to a common area of memory via transportation through an interconnection network. Shared memory system has an extremely efficient communication between processors, and they all work in parallel. Because queries work a lot faster in paralleled database.

10.4 Database Management (DM)

There are several effective ways to improve Database Management.

- Clear all redundant data
- Meaningful data naming
- Assign data to appropriate type
- Data Recovery Plan
- Prioritize security level
- Do not bury data

We have mentioned a lot of data backup strategies and recovery plan in the previous section, so we will not discuss how to recover our data in this section. For redundant data, we suggest

using data normalization technique to remove all the redundancy. Also, data normalization can determine the data dependency so that data is all logically stored in the database successfully. Once data is stored, we have to worry about naming and choose a data type for it. In our case, we have several big data tables and datasets for customers information, inventory, robots, applications parameters and configuration, staff member information, etc. Make sure we name each data correctly and reasonably so that when we use queries to look for specific data, we will not lose track of data. Hence, here comes another problem, what if data cannot be found in the database. We certainly do not want to deal with this situation. When a customer wants to have his/her password reset, we do not want to fail to look for his/her data. Make sure every data is named correctly and can always be found. Another way to prevent this from happening is to prioritize the security level. Physically, we can put backup server in an isolated and separated location in our company so that we can keep our data safely in one place. Logically, we add constraints to it. The most important piece of data will always come in the first place and of course, well encrypted, too.

11.0 Business Issues

11.1 Organisational Impacts

11.1.1 Overview

Restaurant have several departments. Therefore, this project will impact some of the departments. Although 'Rosie bar' currently fully operate in USA , they still currently facing several issues such as security and payment with cash causing error and harder to detect fraud. It also causing problem for less control of finance. And also need contact with supplier too for cashless payment. So, for the Australia based project we keep in mind all these issues for future and continuous improvement for the company.

11.1.2 Organisational Structure

This project will significantly impact on the overall structure of the company. In this section below table, discuss about the high level of organisation structure and how it will impact on the decisions problems going to face. The major department of the restaurant such as Owner, manager, Executive chef and IT staff potentially going to impact on the business departments of the company. The business owner need to hire and train most of the staff for adopting this solution because the "automation robotic solution" will change the business IT operation which will also impact on the organisation structure (Bianca 2017).

Table 23 Organisational structure of Impact

Role	Departments	Responsibility	Impact
Vice president/owner	Head of all departments	Hire, train, planning and growth of the business.	new process and new change requirements will be implemented.
Manager	Planning, designing , executing ,control and performance improvement	Project Approval	Project continuity and change management
Executive chef	Inventory, sales, order	Budget or order Approval	Project continuity and process.
Staff	Handle all IT and marketing and serving	Communicate and service the customers	New skills required for interact with the system.

11.1.3 Business Processes

Business process is the activities of the business done by the people or system to produce some output for the consumers who interact with. In the table below, mentioned about most of the process going to be interact with our solution when going to be implemented for this project and show some new impact is any problem may occurs. So, this is important to keep

in mind when running and implementation new solution for this project and get some estimated idea about the properly make the contingency plan later stage of the project management.

Table 24 Business Process Impact Analysis

Process Owner	Name of the process	New skill required	Impact (worst-case)
Manager	Point of Sale	Training on how to track financial transaction with the system.	Fail to track and keep up with the data
Robot Technician	AI self-ordering system	Need lot of data and proper training for run the system	Unable to place order through robot AI-system
Admin	Monitor and control the process	Training on how to use the system	Unable to detect fraud and solve customer issues
Consumers	Self-check in booth	Training on how to interact with the system	Unable to place order
customer	Payment of food and services	Training on how to pay on touchscreen	Unable to make payment such as food's price
customer	Facial recognition process	Training on how to verify user identity with the new system.	Unable to verify user identify and security verification

11.1.4 Change Management

To implement successful the project, change management is necessary to keep up with the latest trends and company to survive. To adapt and scale the business in the organisation. But it is significantly impact on the organisation structure and overall process.

To avoid all these problems in this project the 'Kotter's 8 steps change model will be introduced and used for successfully manage the change in this project for future (Mindtools 2012).

In below briefly discussed about the potential change management for this project (Petrescu 2010):

1.Create urgency

Manager and leader should inspire the people to current state to future state benefits. and Identify the top restaurant stakeholders that will be affected by the new system such as business Owner, Executive chef or general managers, and all associated technology expert employees restaurant.

2.Form a powerful coalition

Form and communicate with the powerful stakeholder for the change management process and get an approval from them to support the change such as senior management or owner of the restaurant.

3.Create vision for chance

Create vision short and understandingly and creative to make its relevant for the project by communicate low level of the stakeholders of the restaurant such as staff, supplier, finance department, security departments, administration department and consumers. Make it inspire and adoptable to for the project and benefits of the organisation.

4.Communicate the vision

Demonstrate the vision and communicate with the positive benefits to the restaurant's stakeholders and all the department to keep up in the line such as described in previous point above.

5.Remove obstacles

Listen to people and get feedback from the affected users of the system concerns and overcome the problem as early as possible to entire the operation run smoothly as expected. It can be improve several factors of the system for examples such as for 'financial departments' tracking of sales of the system operation.

6.Create short-term wins

Demonstrate the benefits early on and showcase the benefits and make it is divided able to process for successfully achieved the change requirement targets and most importantly negotiate with the stakeholders.

7.Build on the change

Keep repeating the above steps and keep deliver the benefits of the new proposed system and get rewards, feedback such as during the rollout of this project system all potential restaurant stakeholders must be communicate and informed to implement new system. So, let say if change is not possible then which can be early as soon avoidable.

8.Anchor the change

Make sure the change stays and embedded in the organisation business procedure and day to day work activities. Keep everyone on the same level and cerebrate the success of the change for future and continuous improvements.

In the following section in this report, we discussed some business continuity plan for this project.

11.2 Business Continuity

11.2.1 Overview

Business continuity allows the company to re-run after an interruption caused by an internal failure, cyber-attack, or the like. Once the plan is implemented, the company can continue to operate as it did before the interruption. The most basic business continuity requirement in this project is to keep the basic functions up and running during the disaster and to restore the bar's normal operation during the shortest possible downtime. Business continuity is important to any business, and business continuity in this project focuses on the most important functions and systems, such as emergency alert systems. There are three key elements to this business continuity: Resilience, recovery and contingency.

11.2.2 Risks

Unplanned IT and telecom outages

IT and telecommunications disruptions cost the bar in many ways. For example, the data center in the order system is experiencing an outage and may have lost more than a few hundred dollars per minute. This project relies on all aspects of technology: cloud access, credit card or payment processing, remote access, device monitoring and security. These methods can last a long way, but most importantly, when the computer goes down, the cost of the company can be very high.

Cyber attack

The purpose of cyber-attacks is to try to benefit from a vulnerable business system, and cybercrime is increasing every year. The system in this project may be spyware, viruses and worm attacks. These malware damages the network through vulnerabilities. Once inside the system, the malware can do the following: organize access to critical components of the network, install malware, and disrupt certain components and make the system inoperable. These are all cyber threats that are becoming more common.

Data crash

A data breach is a security incident in which information is accessed without authorization. Data breaches can hurt businesses and consumers in a variety of ways. There are four ways to be targeted: exploiting system vulnerabilities, password vulnerabilities, drive-by downloads, and targeted malware attacks. For example, the customer management system in the project stores a large amount of customer personal information, in which the phone number, date of birth and home address are private privacy information. If data leakage occurs, the data will go to the criminals, to the business and customers. Life poses a great threat.

11.2.3 Backup Strategy

A solid backup strategy is one of the key elements of bar operations. It takes time and money to develop a reliable backup plan, but it is far less than the heavy task of rebuilding no backup data. In this project, we have two backup methods: local backup and remote backup.

Local backup

Local backups, also known as on-premises backups, are in the on-premises setup where the administrator manually or periodically copies data to a second hard drive or shared drive. With this setup, we can grasp the value and risk of the bar. Managers can access information at any time, but information is lost.

Remote backup

When remote backups are heavy, the computer automatically sends the data to the remote centre at intervals. First, we need to install the software on each computer that needs to be backed up, set up a backup plan, and mark the files and folders to be copied. This software is then responsible for backing up the data.

With a remote backup solution, we don't have to pay for equipment, and we can still recover critical data, such as user personal information, in the event of an accident.

Also, consider the data that is currently only stored in the hard copy. For example: financial information, contracts and leases, which should be stored in a waterproof safe or filing cabinet and backed up electronically.

11.2.4 Disaster Recovery

In the post-construction operation, a large amount of data is generated and stored, which is very important for operation. Develop technology recovery strategies, as well as recover hardware, applications and data to meet business recovery needs.

Most of the data is important, and it is critical to the survival and ongoing operations of the business. Hardware failures, human errors, hackers or malware cause significant loss or damage to data. The problems that may be encountered during operation are the computer room environment. We need to install a secure computer room with climate control, conditional backup power, and the necessary hardware including network, server, desktop and laptop, wireless devices and peripherals. Cables, cables, and wireless, connected to service providers, also include many software applications, such as electronic database exchange software and enterprise resource management software. Some system applications can't run any downtime, such as an emergency alarm system, and any downtime on this system can harm the bar's operations and systems.

Data backup plays an important role in bar operations. We will prepare tapes with data backup software, tapes and a large number of USB drives as an important way to back up data. Many vendors offer online data backup services, including "cloud storage." This is a very effective solution for devices with network connections. Software installed on the client server or computer is automatically backed up.

11.2.5 Business Continuity Strategy During Implementation

Business continuity planning organization

When the process of business continuity planning is initiated, it is important to monitor the process, including the necessary steps to initiate, plan implementation, develop resources, test and review business continuity plans.

Business impact analysis

This feature helps organizations identify key processes at internal and external levels. In addition, business impact analysis must include an assessment of how long the disruption affects the service and how long the bar can operate without a specific service. For example, if the online order system is interrupted, it will inevitably cause a lot of losses. In order to reduce losses, the business continuity plan must restore the system operation in a short time, thus ensuring the smooth operation of the bar.

11.3 Staffing and Training

11.3.1 Overview

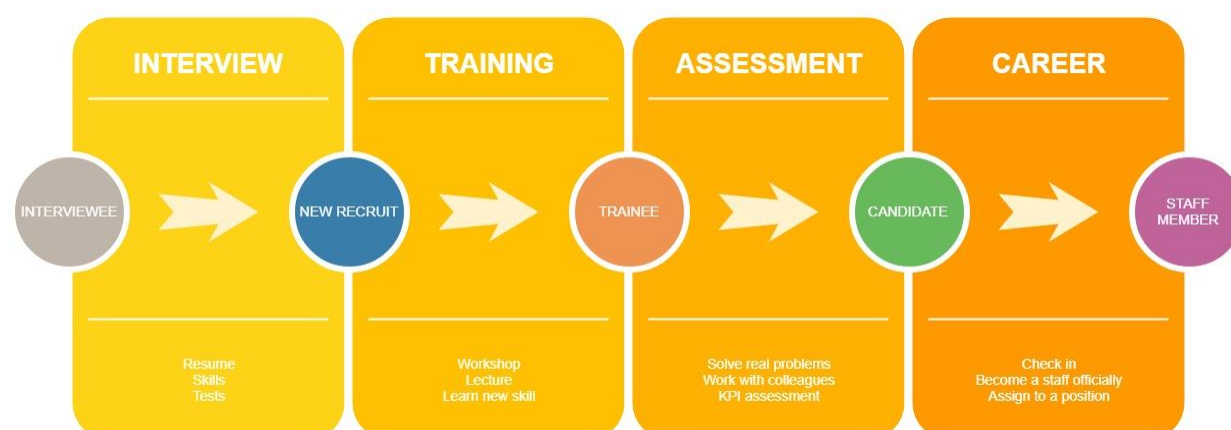


Figure 9 The general structure of staffing and training program

11.3.2 Staff Requirement

All the staff in ICT department is suggested to attend a regularly training when there is a new upgrade in the current operating system, especially for new recruits who are not familiar with the restaurant working routine and the system. For experienced new recruits, such as robot operators, information technology engineers and senior programmers, since they have been working for years in industry and acquire all the necessary skillsets. There is no need for them to accept any training, since we need them to get to their position as soon as possible.

Trainers are usually more experienced staff members in the company who have at least 3 years of working experience in the industry. They are in charge of organizing the training session and prepare the assessment for the trainees. Trainees will firstly learn how to operate our system in our devices and keep track with our development process. When the training session is complete, each staff has to take a test which determines whether they pass or fail. If anyone fails, he/she needs to retake the training session. For new recruits, if anyone fails twice in a row, they will not be offered a job in the company anymore and those who complete the training session will take his/her place. Regularly assessment is essential and is included as trainee's Key Performance Indicator (KPI).

11.3.3 Training Programs

Table 25 Training Routine

1. Lectures/Sessions by Trainers	Training includes workshops and lecture sessions. Trainers introduce the training contents, and allocate different class based on the new recruit's specialty.
2. Background about the solution	Introduce our system, software, application, hardware and database management.
3. Communication between teams and departments	All the department staff are working as a group, communication skills is critical when new staff

	will have to get involved in project team discussion and argument.
4. Learn to use and access to the internal system	Learn how to use command in our system, no unpermitted authorized operation is allowed. Only high-level operators have Write access of the internal system.
5. Handle challenging work and task	Trainees are put into real tasks and assignments, work with current active colleagues. To train the ability to solve practical problems in real life.
6. Improve individual skill and professional ability	Programmers and developers are suggested to learn more than one skillset other than his/her own specialty.
7. Complete assessments	Trainees, also known as new recruit, will finish the training session in a month. By solving real working tasks and learning skillset at the same time, their performance will be assessed and after that, officially start to work as an official staff member.

12.0 Project Management

12.1 High level overview of rollout

Project management aims to manage all the processes and activities of a project in a systematic way. In the early stage of this project, project charter is compiled and approved. After that, stakeholders should be identified. Next phase is definition phase, it involves determination of different project teams and the developing of project plan. In the design phase, all the software systems are designed and confirmed. After finishing all the designs, the development phase is started. During the development phase, procurement is processed parallel. When all software and hardware are ready, install them in a restaurant with a test process. Sign the acceptant signature if there is no problem of this restaurant. Repeat the same processes until all the five restaurants are accepted.

12.2 Project Implementation strategy

This project uses the following strategies (Teamweek 2017):

Start with a clear scope. Stating a project without a clear vision may cause unexpected difficulties. Project team should invest more time in collecting information, assigning tasks to specific people and having a good overview of the resources.

Put everything on a visual timeline. A visual timeline gives you a bird's eye view of the whole project and resource. The visualized steps and tasks help people figure out if you have set overly optimistic deployment dates, contributing people to focusing on delivering results.

Prepare to keep planning. Changes happen all the time. The team can have a basic plan for managing these changes. Set some expectations on how the team should manage unexpected issues, scope changes, risks, quality communications, etc.

Implement while keeping an eye on the metrics. A project manager should keep an eye on the following aspects:

- Check the project timeline regularly to have a clear vision of how the team is progressing.
- Update timeline in time and ensure team members are still focused on the plan.
- Monitor resources including money, time and human resources.
- Monitor team moral.
- Lack of communication.

Keep an eye on the quality. It is not enough to only get a project done on time and within budget. Delivering a qualified product is on top of everything else. Quality means making less mistakes and keeping the project on the right track to deliver the expected results.

12.3 Project Plan

12.3.1 Phase 1 – Initiation phase

Planned starting date: 3/11/2019

Planned ending date: 3/22/2019

This phase includes developing project charter, submitting project charter, reviewing project charter and approval of project charter. After that, all stakeholders relevant to this project are identified. These stakeholders need to be classified, because different stakeholders hold

different interests and attitudes to this project. The output of the stage is a stakeholder register. Then it follows a kick-off meeting, implying this project is formally commenced.

12.3.2 Phase 2 – Definition phase

Planned starting date: 3/25/2019

Planned ending date: 5/17/2019

This phase involves identifying the expectations and collecting of all parties involved with regard to the project result.

12.3.3 Phase 3 – Design phase

Planned starting date: 4/23/2019

Planned ending date: 5/16/2019

In this phase all systems' designs will be completed, including diagrams, sketches, flow charts, prototypes, etc(Indpro 2019).

12.3.4 Phase 4 – Procurement phase

Planned starting date: 4/29/2019

Planned ending date: 7/29/2019

The result of this phase is to procure needed hardware and software. This phase is processed parallel with development phase.

12.3.5 Phase 5 – Development phase

Planned starting date: 5/23/2019

Planned ending date: 5/6/2020

In development phase all systems should be completed.

12.3.6 Phase 6 – Installation phase

Planned starting date: 8/1/2020

Planned ending date: 5/13/2020

In this phase all the system and hardware are integrated and installed. Firstly, install all hardware and software in one restaurant, then accept this one and sign signature. Secondly, select next restaurant to install, then sign the signature. Repeat this process until all five restaurants are accepted.

12.3.7 Phase 7 – Test phase

Planned starting date: 5/13/2020

Planned ending date: 5/22/2020

Test hardware, software and the whole system in this phase. This phase is not isolated, it is processed parallel with installation phase.

12.3.8 Phase 8 – Follow-up phase

Planned starting date: 5/23/2020

Planned ending date: 6/30/2020

In this phase, all development and installation work should be completed. The ownership is transferred from development team to operations.

12.4 Project Management

12.4.1 Project Planning

Developing the scope statement. This section is defined in Section 3.1 Scope.

Identifying deliverables.

project charter, stakeholder register, project work plan, weekly status report, quality management plan, test strategy guidance, test summary report for each level of testing (i.e. unit, system, systems integration, performance, UAT), QA/Testing status reports, staff skills and training requirements, communication plan, implementation plan, risk management plan, configuration management plan, training plan, user documentation, post-implementation review plan and project exit report.

Work breakdown structure (WBS)

This project contains 8 phases, and every phase includes activities. These activities with time are shown in the WBS attaching at the end of Appendix I.

Gantt Chart

The relationship between activities and current schedule status is shown in Gantt Chart attaching in Appendix G.

12.4.2 Project Timeframe

This project is constituted by eight phases as listed in section 12.3 Project Plan and lasts almost two years. Some of these phases are processed parallel. And some of them must follow the finish-start restriction. The timeframe with important milestones is shown in Figure 10 Timeframe with milestones.

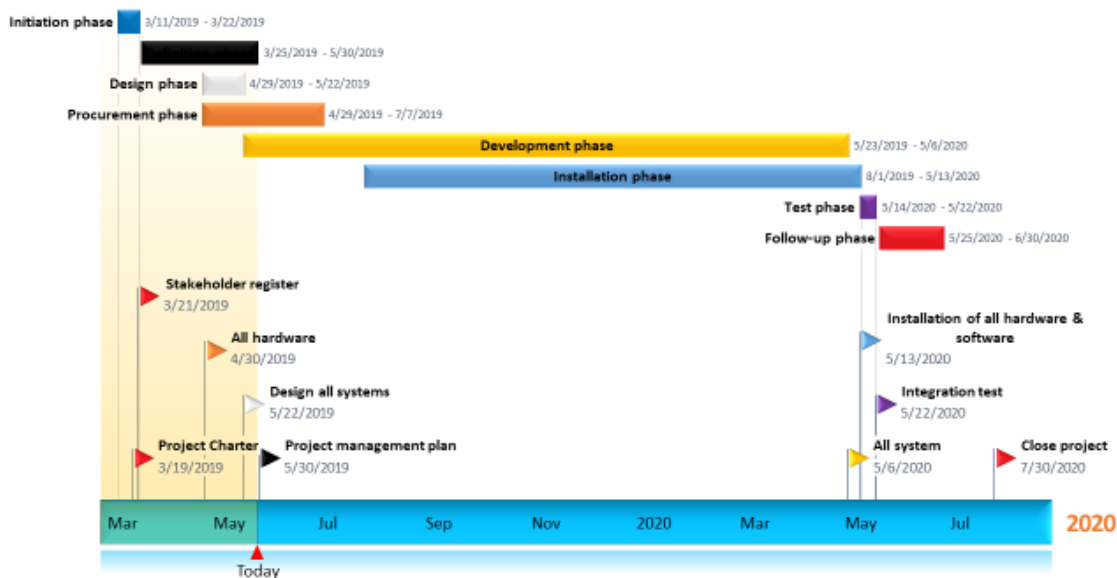


Figure 10 Timeframe with milestones

12.4.3 Project Monitoring

The purpose of project monitoring is to ensure that the project progresses are on the right track (Khare 2019). Steps for implementing project monitoring in this project are as follows:

- Monitor project planning parameters. These parameters involve schedule, timeline, effort, costing, defects, etc. Project manager is responsible for tracking these metrics for the project.
- Monitor project risks. Risks in the project should be monitored. These risks can be various from process, people, tools, and technology.
- Monitor stakeholder involvement. Project manager keeps track of involvement of different stakeholders. This is done by using different types of meetings and status reporting.
- Monitor commitments. Project manager tracks commitments of different stakeholders in this project. Commitments include completing a coding unit, testing, providing data / information, review, etc.
- Conduct progress review. Project manager conducts project progress reviews by using various techniques. These techniques include work progress from team members, client meeting, third party vendors' involvement, milestone reviews, etc.
- Monitor data management. Project manager or configuration controller in this project keeps track of all configuration items like software, hardware and documentation of the project.

12.4.4 Project Human Resources

12.4.4.1 Roles and responsibilities

Project Manager (PM), (1 position): responsible for overall success of the project. The PM must authorize and approve all project expenditures. The PM is responsible for evaluating the work performance of each member. The PM will report project status in accordance with the communication plan. The PM must have the following skills: leadership / management, budgeting, scheduling, and effective communication.

Design Engineer (DE), (2 position): responsible for gathering function requirements and designing software prototype. The Des will be responsible for reporting process status to PM by the required communication management plan. The Des will assist the implementation lead to install hardware and software.

Implementation Manager (IM), (1 position): The IM is responsible for the distribution and implementation, and monitoring of the new software upgrade. With the assistances of design engineers, the IM must make sure that all coding on new software conforms with organizational security regulations. The IM has the accountability to report project status to PM. The IM must be proficient in managing network architecture.

Training Lead (TL), (1 position): responsible for training all relevant staff using this system. The TL will coordinate training times / locations with each department's training advocate. The TL must provide training status to the PM according to the communication management plan.

The following RACI (responsible, accountable, consult and inform) matrix show the resources assigned for each work package. See Table 45 RACI Matrix.

12.4.4.2 Staffing management

Staff acquisition:

Project manager should negotiate with functional and department managers to identify and assign resources in terms of the project organizational structure. Before the resources commence working, all resources must be approved by the appropriate functional / department manager.

Resource calendar:

Use resource calendar to identify the availability of resource. This project will last almost two years, all resources should be required before the project can begin. Resource calendar includes staff's skills, vacations, different working days, or different shifts.

Performance review:

The project manager will review the tasks allocated to each team member and communicate expected outcomes with them. The project manager will evaluate each team member's performance and how effectively they are completing their allocated work.

Recognition and rewards:

- The staff who successfully finish the assigned tasks in time can get a \$100 gift card.
- The company will provide family movie tickets for the top two best staff.
- Give the best staff a certification.

12.5 Project Risks and Risk Management

12.5.1 Hardware Risks

12.5.1.1 Risk Identification and Description.

- **Poor Estimate Method.** When estimate how many devices project needs, engineers use inappropriate method, leading to incorrect needed number of hardware. If ordered devices are surplus, this is a waste of money. If the ordered devices are inadequate, engineers have to order again, which spends more time.
- **Insufficient Resource.** Hardware suppliers may have not enough devices.
- **Hardware suppliers delay deliver products.** When deliver the hardware, uncertain events could happen, which prolongs the hardware installation. These uncertain events include traffic accident, weather condition and natural disaster.
- **Electric static discharge (ESD).** ESD is when your body is little bit electrically charged when touching some hardware component which is made from metal people could damage it.
- **Physical damage to devices and cabling.** This results from not responsible treating hardware components. When Information and Communications Technology (ICT) professional do not obey the safety rules and endanger hardware to be broken or damaged, which can lead to a big problem.
- **Personal safety issues.** The environment hardware working in could cause some issues. Such as dirty and moisture environment, inappropriate operating by working staff.
- **Performance.** Bad hardware performance which slow down the work efficiency and often shut down.
- **Reliability.** Hardware reliability means the average time between failures. If the time is quite long, this could scientifically affect the regular work.

- Hardware security. It can relate to a equipment used to scan a system or monitor network traffic. It involves hardware firewalls and proxy servers and hardware security modules, which detects cryptographic keys for essential features such as encryption, decryption and authorisation for different systems.

12.5.1.2 Risk Analysis

In this section risks will be prioritized based on their likelihood of occurrence and degree of potential impact. This Project uses Risk Scoring Matrix which provides a standard method to calculate grading based on combination of probability and impact ratings. The ordered risks are listed in

Table 48. Hardware Risk Register.

Risks are initially analysed and evaluated in terms of probability and impact if they should occur. The probability can be rated as Very Low (VL), Low (L), Medium (M), High (H), or Very High (VH). The impact can be described as of Very Low (VL), Low (L), Medium (M), High (H), or Very High (VH) seriousness. See Table 46. Probability and Impact Matrix.

12.5.1.3 Risk Response Planning

- Poor Estimate Method: Hire qualified and supplicated engineers to evaluate the needed hardware requirements. Double check the estimated results.
- Insufficient Resource: Find more suppliers from worldwide instead of local area.
- Hardware suppliers delay deliver products: Schedule 2 more weeks buffer time. Buy delivery accident insurance.
- Electric static discharge (ESD): Wear ESD band connected to anti-static mat. Wear no electrostatic cloth or remove objects that can be easily charged, such as carped.
- Physical damage to devices and cabling: Follow the instructions strictly. Never use knife to remove screw. Wear non-conductive material shoes to avoid electrical shock.
- Personal safety issues: Keep work areas clean and tidy. Use appropriate tools for your work. Keep and liquid far from the hardware equipment.
- Performance: Follow the test standards to test the hardware. If the hardware not satisfied the standard, negotiate with the supplier.
- Reliability: Test the hardware several time to ensure it is the qualified one. If not, reclaim with the supplier.
- Hardware security: Run a simulation test and monitor if there is any data leak. If the hardware is not satisfied, reclaim with the supplier.

12.5.1.4 Risk Monitor and Control

a) Risk Escalation Procedures

If risks cannot be resolved by Team Lead level, escalate the risks to Management Lead level. Generally, these risks significantly impact the project's scope, schedule, budget, technical performance, and business performance objectives. These risks, in addition, involve cross-organization communication and require senior managements' decision.

b) Risk Management Team Meeting. In the meeting activities in Risk Monitor include:

- Conduct the meeting at 3:00 PM every Monday.
- Meeting attendants include all the stakeholder representatives.
- Make sure all requirements of the risk management plan are being implemented.
- Evaluate the effectiveness of actions taken.

- Show status of actions to be taken.
- Validate previous risk assessments.
- Identify and record new risks.
- Analyse new risks.
- Track risk response.
- Validate risk mitigation strategies and alternatives.
- Assess impact on the project of actions taken.
- Ensure risk management plan is maintained.
- Update risk register.

c) Feedback and Reporting Processes

Risk Management Team use standard reports to collect feedbacks from any stakeholders and report them at the meeting.

12.5.1.5 Risk Management Closeout

- Validate the completion of identified risks. Assess any open risks to see if there are ongoing operational risks and notify operational team.
- Produce final risk management metrics and evaluate process effectiveness against established benchmarks.
- Summary experience and archive them to Lessons learned documentation.

12.5.2 Software Risks

12.5.2.1 Risk Identification and Description.

- Estimation and scheduling. Project schedule gets delayed if software tasks and schedule release are not estimated properly. Schedule risks affect project crucially and lead to project failure.
- Sudden growth in requirements. Requirements can be added in the whole process of the project. The later requirements provided the more efforts engineers need to spend.
- Employee turnover. Every project is finished by staff. If one or some developers suddenly leave, this could delay the project.
- Breakdown of specification. Requirements may conflict and some specifications could be unclear and vague.
- Productivity issues. Software developing takes a long time. Developers often have a low moral if the process is too long, leading to low productivity.
- Gold plating and scope creep. Gold plating means intentionally adding extra features to the project. Scope creep refers to adding uncontrolled changes to the Project. Both of them add unrequired functions to the product's scope.
- Procedural risks. Activities are not scheduled in an appropriate order. Conflicting priorities and a lack of responsibilities may happen.
- Performance. Bad software performance which slow down the work efficiency and often shut down.
- Reliability. Software reliability means the average time between failures. If the time is quite long, this could scientifically affect the regular work.

12.5.2.2 Risk Analysis

Risk ranking see Table 49. Software Risk Register.

12.5.2.3 Risk Response Planning

- Estimation and scheduling: Hire experienced engineers. Track all resources including staff, systems, and skills of individuals.
- Sudden growth in requirements: Identify the issues earlier. Try to think comprehensively and anticipate the worst-case at the early stage of the project.
- Employee turnover: Ensure the developers have similar knowledge. Developers notify project manager at least one month early before leaving the team.
- Breakdown of specification: Double check the requirements. Make requirements with developers.
- Productivity issues: Set realistic schedule. Encourage and reward developers often.
- Gold plating and scope creep: Strictly follow the WBS and review the requirements weekly. Remove the out of scope functions in time.
- Procedural risks. Organize activities by using precedence cartography. Assign only one main responsible staff to every activity.
- Performance: Test and improve the software before releasing.
- Reliability: Test and improve the software before releasing.

12.5.2.4 Risk Monitor and Control

- a) Risk Escalation Procedures
Same as hardware risks
- b) Risk Management Team Meeting
Same as hardware risks
- c) Feedback and Reporting Processes
Same as hardware risks

12.5.2.5 Risk Management Closeout

Same as hardware risks.

12.5.3 Data Risks

12.5.3.1 Risk Identification and Description.

- Vendor lock-in. It means a software-as-a-service vendor use the data as a bargaining chip and prevent you from accessing it (Simplicable 2019).
- Data loss. A data storage device cannot store data. The problems can be caused by physical storage, logical storage, data corruption, transport, vendor issues and digital obsolescence.
- Data integration. Failing in integration process. Customers, as a result, cannot check their recent transactions on the website. It often happens between data sources that create copies.
- Dark data. Data is rashly accumulated that becomes disorganized and difficult to manage. It is collected by companies but does not use.
- Compliance. Customer details are accidentally leaked to a third party, violating local regulations.
- Data availability. A market data feed goes down in the middle of market hours, which lead to disruptions of trading operations at a bank (Simplicable 2019).
- Data remanence. Data is not wiped or deleted properly causing residual data in the device.

12.5.3.2 Risk Analysis

See

Table 50 Data Risk Register.

12.5.3.3 Risk Response Planning

- Vendor lock-in: Negotiate with vendor and sign a legal contract with this vendor. Have a backup vendor.
- Data loss: Take care of the physical storage. Update the malfunctioned input/output devices. Give feedback if the data is not stored. When update database, make sure the new one is compatible with the old one.
- Data integration: Work with Database Administrator. Identify the appropriate integration interface. Choose the right interface medium. Monitor the process closely. Set security policies and ensure security of the data.
- Dark data: Identify how the data is stored. Clean and reformat the existing dark data. Eliminate any useless, corrupted and redundant data.
- Compliance: Define a security policy that all employees follow. Monitor the network and secure backups. Keep passwords and devices secure. Provide security education to all employees. Maintain compliance with regulations.
- Data availability: Improve physical infrastructure such as servers and disks. Speed up recovery times, including replacing hardware, rebooting the operating systems and database services. Eliminate corrupted data (Syncsort 2019).
- Data remanence: Overwriting the data. Use Degausser to erase the disk. Physically destroy the disks.

12.5.3.4 Risk Monitor and Control

- a) Risk Escalation Procedures
Same as hardware risks
- b) Risk Management Team Meeting
Same as hardware risks
- c) Feedback and Reporting Processes
Same as hardware risks

12.5.3.5 Risk Management Closeout

Same as hardware risks.

12.5.4 Fraud Risks

12.5.4.1 Risk Identification and Description.

Asset Misappropriation. Asset misappropriate is a general term which describes a wide range of employee fraud schemes (i-Sight 2019). In this project these schemes include:

- Inventory theft. Products are stolen by employees, including physically taking or diverting it in some other way.
- Theft of services. An employee misuse company service. In other words, use company services or devices to do his personal job for free.
- Expense reimbursement fraud. It includes forging receipts, double claiming for expenses, inflated expense claims.

- Procurement fraud. For example, over-ordering product then returning some and pocketing the refund.
- Payment fraud. For example, altering payee details on payables. Self-authorizing payments. Colluding with others to process false claims for personal benefits.
- Commission fraud. A staff inflates sales numbers to receive higher commissions or colludes with clients to collect commissions on falsified sales.

Vendor fraud. It can be committed by vendors or in collusion with employees. Examples are:

- Billing schemes. An employee makes false payments to himself using company's vendor payment system.
- Overbilling. A supplier or vendor pads invoices to charge the company for more goods than it ships or to charge a higher price than agreed.
- Price fixing. It happens when competing vendors collude amongst themselves to set a minimum price or price range.

Data theft. Information is stolen by others. This can devastate a company which relies on its intellectual property for its product or service. It includes:

- Trade secret theft. Proprietary is stolen and sold to a competitor.
- Theft of customer or contact lists. Customer details are copied, sold and used by others.
- Theft of personally identifiable information. Customers' credit card numbers or other bank information is stolen and sold to other parties.

12.5.4.2 Risk Analysis

Risk analysis please see

Table 51 Fraud Risk Register.

12.5.4.3 Risk Response Planning

Asset misappropriation:

- Promoting a strong ethical culture across the organization.
- Emphasis on fraud-specific training.
- Make sure appropriate due diligence checks are undertaken on new and existing vendors.
- Reconciliation of purchase orders, booking confirmation, and goods received against invoices.
- Rotate duties of staff in accounts.
- Conduct random audits of company accounts, supplier records, files and transactions.
- Establishing and running systems and processes for managing conflicts of interest.

Vendor fraud:

- Conduct random audits of vendor files.
- Rotate duties of employees in procurement.
- Compare vendors' addresses with employee's address.
- Conduct a dual review process for vendor file management.
- Use data mining to analyse anomalies and patterns.

Data theft:

- Keep company proprietary information strictly. Open it to people who need it in the course of their jobs.
- Triggering alarm system if large data and other sensitive information is downloaded or transferred.
- Monitoring and tracking unauthorised access to sensitive information.
- Properly dispose of confidential information, for example, remove data from storage disk completely.
- Use strong password for all computers and devices that can access sensitive information.

12.5.4.4 Risk Monitor and Control

- a) Risk Escalation Procedures
Same as hardware risks
- b) Risk Management Team Meeting
Same as hardware risks
- c) Feedback and Reporting Processes
Same as hardware risks

12.5.4.5 Risk Management Closeout

Same as hardware risks.

12.6 Support

12.6.1 Overview

The overall support plan includes three main factors

- Hardware implementation plan
- Software implementation plan
- Hardware maintaining plan
- Software maintaining plan

During the implementation process, technical team will be responsible for the implementation and initial set up of database, kiosk, POS system, server, router ,audio speaker, kiosk, desktop, tablet, walkie talkie and robots, and will also design and develop the website and mobile app for customers to use.

For long term maintenance, all products that are suggested to purchase have warranty information which will be demonstrate in following section as well as be shown in appendix. Technicians are to be hired to address general problems like machine fault and equipment aging. Software and data team is going to address problems such as debugging and system iteration and data security and manipulation. Networking specialists will be checking and maintaining the quality of network connection.

12.6.2 Implementation Support

A technical team will be recruited for the design and implementation of network and software, include network structure, restaurant's website and mobile application, database. Cost of implementation will consist of device purchase and labour-cost, network specialists and software engineering specialists will be in charge of the support plan throughout the implementing stage of project.

To be more specifically, 3 years of warranty will be provided for servers, routers, speakers, screens, robots, computers and POS system while one-year warranty for cameras and walkie-talkies. If there is a quality problem among products, repairment or replacement will be conduct.

For implementation stage, contracts offered to all technicians and specialists will be ending before July 4, 2020, exact ending time for each contract will be varying depends on the planning strategy, however, long-term human resource plan has also been developed in order to do the long-term support which is demonstrated in the next section.

Network connection and Internet Service Provider will be firstly completed along with routers and server set up. Software, hardware and database will be implemented based on the initial set up.

12.6.3 Long Term Support

A support team will be held to be responsible for the support and maintenance of network, database, software and hardware. And an IT help desk will be established to address enquiries of customers and restaurant staff in case any technical problems are encountered.

If there is any problem regarding database and software and network connection, a long-term technical team will be running to maintain and address any run time problems, all hardware devices will have back up devices as one more set of hardware will be purchased to prevent any malfunctioning from influencing regular business operation.

Website and mobile application and database will be managed and maintained regularly. Conditions of server and routers and robots will be checked on a weekly basis to ensure they are running normally. Error detecting application will be nested in IT system to automatically report any error in network flows and devices. For example if one of the robots has been found that there is a small problem in his navigation system, a report will be send to support team which is supported by the build-in remote control system.

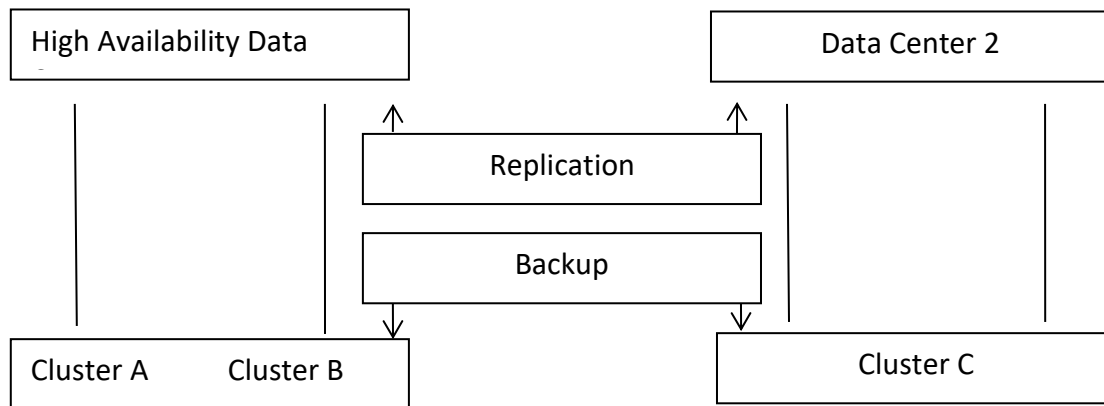
12.7 Service Levels and Agreements

12.7.1 Overview

The SLA is a contract between the service provider and the bar management department that records the services that the provider will provide and defines the service standards that the provider meaningfully meets. The bar management department can benefit from the SLA because the provider describes the performance characteristics of the service, can be compared to the SLAs of other vendors, and provides a solution to the problem of the service.

12.7.2 Application Availability

For high-availability workloads, our core infrastructure provides seamless disaster recovery protection by replicating customer data to disaster recovery sites in our geographically dispersed data centers. Built-in data backup and recovery options are also available for customers who do not require full disaster recovery.



12.7.3 Infrastructure Reliability

Writing effective and meaningful service level agreements is always a challenge. Determining certain important technical measurements as a means of ensuring satisfactory performance is relatively straightforward. However, this is an end-user experience, not a specific measure that SLAs should focus on.

Assuming an availability standard, the network uptime is 99.5%. This still allows a monthly downtime of 4 hours. An hour or two of disruption, especially non-working hours, may have little impact on the end user. If it is more than 4 hours, or even more than 9 hours, the network has 99.5% of the time available, but due to poor reliability, the end user has a serious impact during this time.

In bar operations, we negotiate with contractors to build, review, and improve SLAs. What really needs to be done is to ensure that the IT infrastructure fully supports the business goals and then the combination of technical metrics needed to achieve the business goals.

12.7.4 Transaction Times

Service Level Agreements (SLAs) typically specify response time criteria that must be met. While SLAs can have a wide range of metrics such as throughput, uptime, availability, etc., we will focus on response time in this article.

Average response time

This is the most common measure of response time, but it is usually flawed. The average response time simply sums all individual response times obtained in multiple measurements and divides them by the sample to obtain an average.

Median response time

The median is useful if the average is not a good representation of the distribution. The median helps eliminate outliers, but the key is a few outliers.

12.8 Project Critical Success Factors

12.8.1 Functional Success Factors

As for functional success factors, there are many factors can affect the project process, the factors have existed in different aspects.

Hardware solution:

The progressive hardware solution can improve the system performance and system can support to run several functions at the same time. For example, if there are many customers make orders at the same time, high system performance can ensure the order function works properly. Comprehensive software can help managers to improve work efficiency. There are different software solutions for different functions, which will make the best use of different functions.

Software solution:

Software solutions include different kinds of system, and each system needs to work together to achieve functions. For example, the online booking system and data management system need to work together, because two systems can achieve provide and produce orders. firstly, data management system collects data and analysis data, the system can choose the most suitable drinks to the customer. Then, customers can make the order by mobile devices or websites. By the way, it means that one function needs at least one system to achieve it.

Internet solution:

As for internet solution, it includes firewall, router, and server, hardware and software solution need to base on the internet solution. Successful internet solution can provide help for each system to achieve their functions. For example, if there is a theft, the anti-theft system is already connected, and the staff and the police can find a specific location through the GPS and positioning system. If there is no network, the specific information and clues will not be found, which will bring inconvenience to the management of the bar.

Data management:

Successful data management means that the solution can collect a huge amount of data and analyse the data to provides conclusions. Data management solution has closed relationship with other solutions, so it needs to work with other solutions to show its functions. Such as introducing means to different customers, the system can collect data from orders, divide and search what drinks were be order frequently by some special customers, so in the next time, the system can provide some drinks which are similar to those drinks to these customers. This function is based on data management which in order to provide high-quality service.

12.8.2 Non-Functional Success Factors

Staff training:

Issues of staff training is an important part of non-functional success factors, the staff is employed by a wide range of resource, so the education backgrounds are also different. For example, there are two people need to be trained, one is graduated from high school and another one is doctor, so it is hard to make them stay in the same level, because their knowledge, education background and thinks are different, such training could waste times and foundations.

Security issues:

Security issue is an important part of non-functional factors, security issues include employee security issues, customer privacy issues, data security issues, network security issues,

hardware and software security issues, security, and emergency measures for security risks. If any security issue could not be deal with, it will bring troubles to the whole project or even bring fail to project directly.

12.8.3 Project Success Factors

Project management:

One of the most important project success factor is projects management, the head office of bar is in the United States, so it is important for them to establish administrative department in Australia. Successful project management can provide better efficiency in delivering services, project management provides a “roadmap” that is easily followed and leads to project completion. It also can enhance customer satisfaction. Functional success factors in project management are embodied in enhanced effectiveness in delivering services, greater standing and competitive edge, better flexibility and increases risk assessment.

Stakeholders:

Some stakeholders may be involved for purely political reasons and are not important when it comes to projects. Another point to consider here is that it may not actually make all stakeholders happy; some may have objections. However, if you are managing internal projects, you may need to deal with stakeholders you may need to deal with later. The need for diplomacy is important, and the political environment can have a major impact on the ease of project delivery.

Value:

So far, we have talked about the obvious elements of the project; adding value to the business is not obvious. We may not have even asked the customer about this problem, they may not have asked themselves. The situation may be that the higher level people have decided to continue the project, the reasons for which are not fully understood. This may not matter; what you need to know is if this is the case. This means that you need to understand whether the project actually has to add value to the business, that is, to achieve a specific outcome for the business. If so, what happens if no results are provided? Does this lead to major problems? For example, loss of income? For content management projects, the success of a project depends on the people who manage the content; if they are not 'properly trained and able to manage content, it will impact business outcomes. Maybe this particular project is not important because it is a political project or a pilot project, but if it does matter, you need to know so that you can take the appropriate measures - such as training to ensure that the project increases the expected value. This is an essential part of the project's details that are easily overlooked.

Quality:

Quality seems to be the intangible aspect of the project; the quality of one person is mediocre for another. It doesn't matter; our goal is to understand the quality that our customers think and how important they are to them. For example, you can deliver projects on time, but you can't ensure cross-browser compatibility. This is something I think is important; your customers may not care if it works for the most popular browsers. Meeting the minimum accessibility criteria may be considered mandatory, depending on the importance to the customer. This is what needs to be established; is there a standard that must be met, and in worse cases, if it is not 'what will happen' is achieved? Are customers willing to take legal action or may lose revenue? Understanding quality requirements will help you determine functionality, budget and timelines to ensure your project is successful.

13.0 Cost

13.1 Overview

The cost of the whole project includes many parts, such as initial costs, solution infrastructure costs, solution implementation costs, recurring costs and total costs. Most of the costs should be in the solution infrastructure costs and solution implementation, because these two solutions have many detail costs needed to be budgeted. Also, the total costs are very important, which with many conditions.

13.2 Initial Costs

Initial costs include the fee of evaluation and recommendations, in the part, the total initial costs could be divided into four aspects, develop project charter, submit project charter, project sponsor reviews project charter and project charter signed. The initial costs could be \$2000 in this project.

13.3 Solution Infrastructure Costs

Cashless payment solution costs

Cashless payment solution includes POS machines, payment software, management system software, information center server and card readers.

Table 26 The cost of cashless payment solution

	POS machines	Payment software	Management system software	Information centre server	Card readers
Costs	\$4,800.00	\$2,000.00	\$2,000.00	\$2,000.00	\$900.00

Customer management solution costs

Customer management solution includes database, customer management system software, computers and fingerprint readers.

Table 27 The cost of customer management system

	Database	Customer Management system software	Computers	Fingerprint readers
Costs	\$5000.00	\$2000.00	\$12000.00	\$600.00

Network solution costs

Network solution includes firewall software, routers, servers, switches, laptops, wireless hub, tablets and desktops.

Table 28 The cost of network solution

	Firewall software	Routers	Servers	Switches	Laptops And desktops	Wireless hub	Tablets
Costs	\$2000	\$1000	\$20000	\$2000	\$20000	\$1500	\$4000

Online order solution costs

Online order solution includes mobile devices, desktops and database.

Table 29 The cost of online order solution

	Mobile devices	Desktops	Database
Costs	\$4,000.00	\$6,000.00	\$5,000.00

Automatic kitchen solution costs

Automatic kitchen solution includes mobile devices, robot waiters, robot chefs.

Table 30 The cost of automatic kitchen solution

	Mobile devices	Robot waiters	Robot chefs
Costs	\$4,999.00	\$150,000.00	\$150,000.00

13.4 Solution Implementation Costs

Cashless payment solution costs

Step 1: buy some needed requirements.

Step 2: establish high performance system in the payment machine.

Step 3: connect the system to internet.

Step 4: connect POS machine, screen and other devices with each other.

Step 5: check the system performance before using.

Costs: system designers

Customer management solution costs

Step 1: buy needed requirements.

Step 2: install related software to system.

Step 2: connect database to system.

Step 3: collect customers' information and store them in database.

Step 4: establish different customer functions.

Step 5: Sync these systems to website and mobile app.

Step 6: Check functions in the system before using.

Step 7: Chink functions on the website and mobile app.

Table 31 The cost of customer management solution implementation

	Network programmers	System designers	System Maintenance personnel
Costs	\$220,000.00	\$230,000.00	\$200,000.00

Emergency solution costs

Step 1: bug necessary requirements, such as visions and fire alarms.

Step 2: install camcorders, fire alarms and other devices.

Step 3: connect camcorders and fire alarms with the system.

Step 4: connect the system to emergency departments.

Step 5: check functions before using.

Network solution costs

Step 1: buy necessary requirements, such as routers, servers, switches, laptops, desktops, tablets and wireless hubs.

Step 2: connect each device to each other.

Step 3: keep network working.

Step 4: connect each device to the internet.

Step 5: check each devices working with high performance

Table 32 The cost of network solution implementation

	Network programmers	Server managers	System Maintenance personnel
Costs	\$200,000.00	\$210,000.00	\$200,000.00

Online order solution costs

Step 1: develop functions on the website and mobile app.

Step 2: check the functions on the website and mobile app.

Table 33 The cost of online order solution implementation

	System programmers	Server managers	System Maintenance personnel
Costs	\$190,000.00	\$200,000.00	\$190,000.00

Automatic kitchen solution costs

Step 1: buy robot waiters and chefs.

Step 2: install robot waiters and chefs.

Step 3: buy control center server.

Step 4: Check robot waiters and chefs working well.

13.5 Recurring Costs

staff salary

In this project, staff salary should occupy many costs, which includes operation and maintenance engineers' costs, network engineers' costs and software engineers. The major cost of operation and maintenance engineers are system operation and maintenance. For example, each system needs people to operate, robot waiters need staff to control all the time and check the performance of robot termly. Network engineers should keep the internet connected and prevent accidents. Software engineers need to programming and develop suitable software for our project and bar.

13.6 Total Costs

The total costs should include initial costs, solution infrastructure costs, solution implementation costs and recurring costs.

Table 34 The total cost in this project

Initial costs	\$2000.00
Solution infrastructure costs	\$96,800.00
Solution implementation costs	\$2,000,000.00
Recurring costs	\$1,840,000.00
Total costs	\$3,938,800.00

14.0 Benefits (of Solution / Proposal)

Our proposal is a combination of several cutting-edge technologies. It includes artificial intelligence, SAAS cloud technology, IOT technology, NFC technology and business intelligence technology.

As for the technology itself. Business intelligence helps to analyse customers' interests, and then propose recommendations to them, which is more appealing for customers.

It is good for customers. Take the online booking system as an example, customers can book the table and food in advance, reducing the waiting time for customers. All these five restaurants have connected each other and their data is shared, allowing customers to have food in one restaurant and pay it in another one, which is convenient and flexible for customers.

Apart from customers, investors can also enjoy benefits. Labour costs in Australia is quite high. By using robot services, costs can be saved considerably.

15.0 Recommendations and Conclusions

It is recommended that finish the restaurant one by one. To be more precise, do not finish all of the five restaurants at once time, other than finish one and sign the acceptant signature. Follow the same pattern, until all five ones are accepted consecutively for the reason of progressive improvement. Additionally, this solution involves lots of robots and electric devices and some of them are fragile, therefore gently operate these devices and check them regularly.

Cutting-edge and off-the-shelf technologies are used in this project, for example artificial intelligence, SAAS cloud technology, IOT technology, NFC technology and business intelligence. Extra hardware is purchased for backup. 7 software systems are developed by developers to meet the requirements.

This project takes nearly two years, costing \$3,938,800, and 20 developers are required. In addition, advanced technologies are applied in this project. The most noticeable feature of our solution is robot service. Overall, not only investors can benefit from this solution, but the customers as well.

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Appendix

Appendix A – Detailed Network Topology Diagram

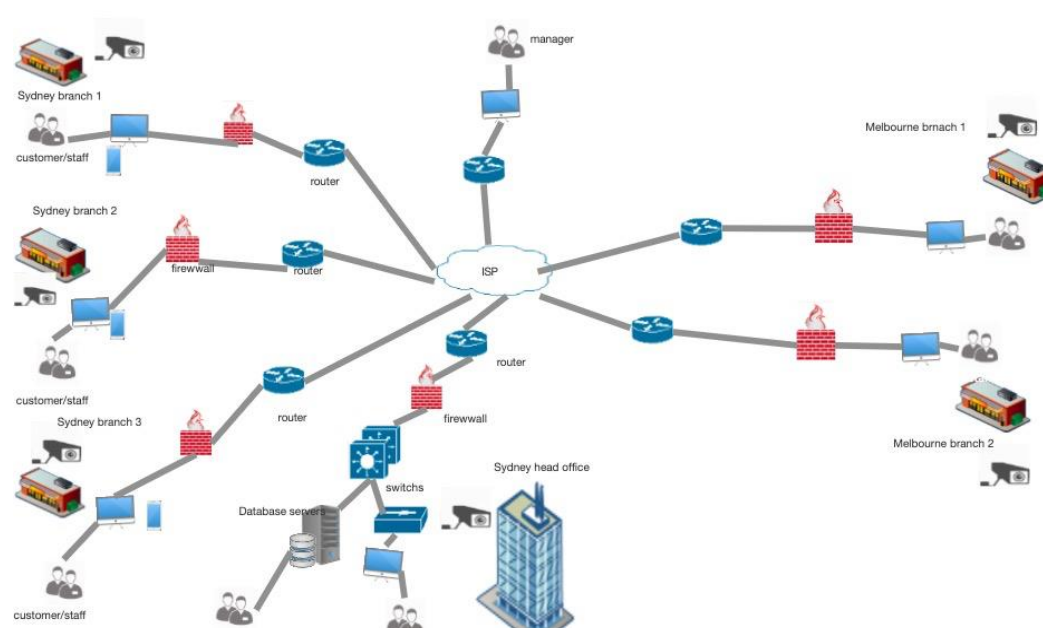
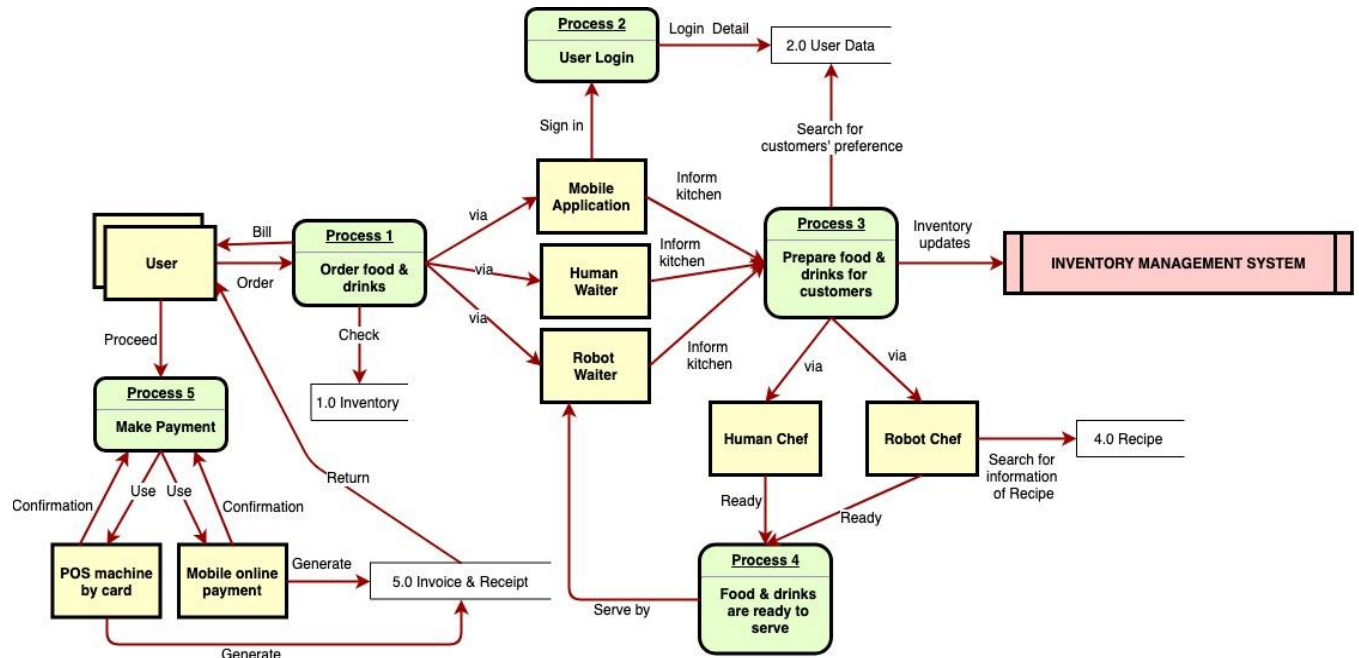


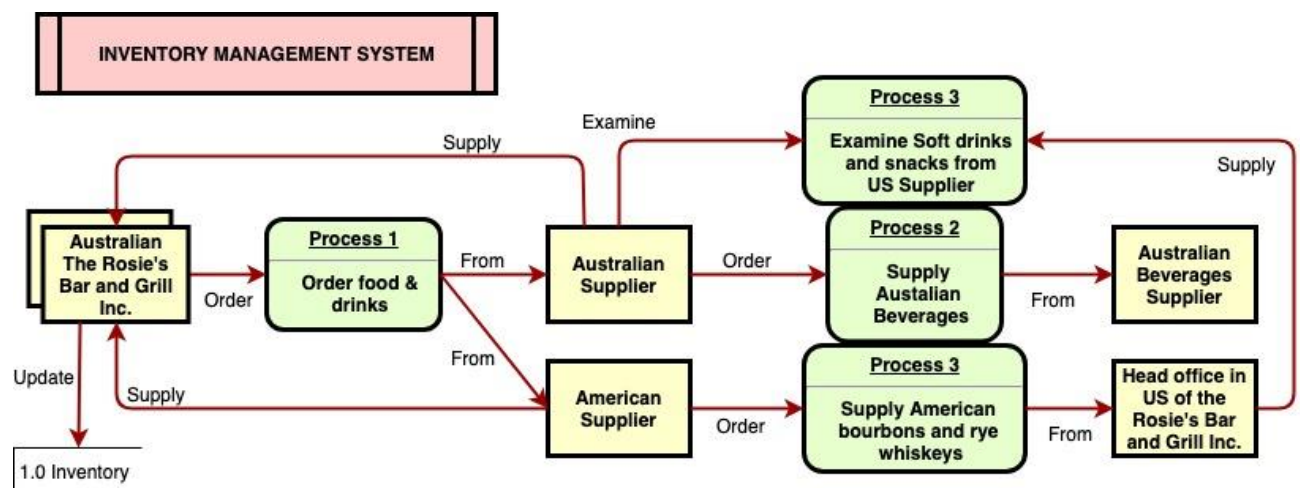
Figure 11 Network Topology Diagram

Appendix B – Data Flow Diagram

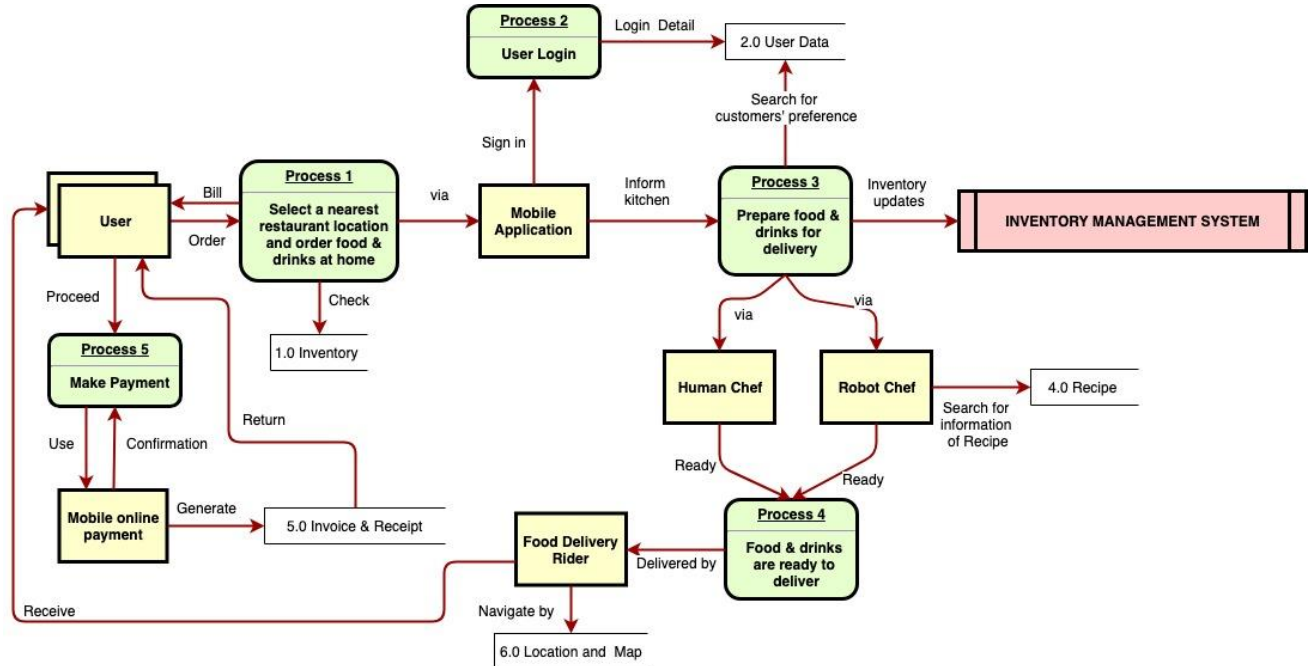
1) Order-Serve System



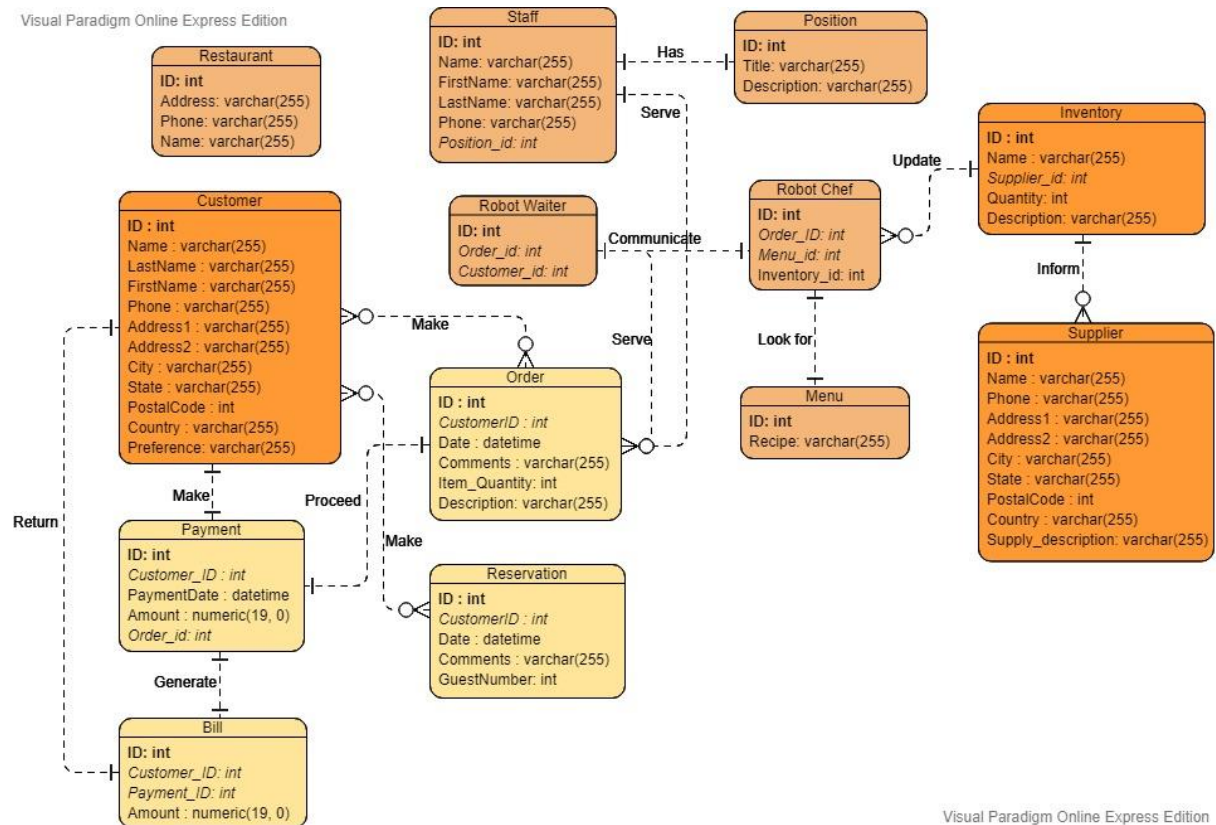
2) Inventory Management System



3) Online Food Delivery System



Appendix C – Entity Relationship Diagram



Appendix D – Hardware (Detailed Specifications)

Table 35 Server Specification

Server	
Memory*	48 DDR4 DIMM slots, supports RDIMM /LRDIMM, up to 2666MT/s, 6TB max
Processor	Up to four Intel® Xeon® Scalable processors, up to 28 cores each
Security	TPM 1.2/2.0 optional Secure Boot Lockdown and erase
Dimensions & Weight	Form factor: Rack
Drive Bays	Up to 8 2.5” SAS SATA (HDDs/SSDs) max 30TB
GPU:	NVidia Tesla
I/O and Ports	4x 1GE, 4x 10GE, 2x 10GE

Table 36 Router Specification

Router	
Hardware	250 Mbps 50 clients
Wireless	2-stream 802.11ac and 802.11n, up to 1.2 Gbps
Cloud based centralized system	Zero-touch, self-provisioning deployments
Networking and security	Stateful firewall
Traffic shaping and application management	Layer 7 application visibility Application prioritization
Advanced security services1	Filtering, IPS, AMP Cisco Threat Grid2

Table 37 Screen Specification

Display Screen	
Dimensions	1910mm x 1102mm
Display	3840 x 2160 @ 60Hz
Screen size	213.5 cm
Penal	IPS
Product weight	154 lb

Table 38 Desktop Computer Specification

Desktop	
Display	WLED-backlit three-sided borderless display (1920 x 1080)
Motherboard	Rhone
Memory	8 GB
Video graphics	Integrated graphics
Hard drive	1 TB
Power supply	External 65 W (100V-240V)

Memory card reader	3-in-1 Memory card reader
--------------------	---------------------------

Table 39 iPad Specification

iPad	
Operating system	IOS 12
Capacity	64GB
size	250.6mm 174.1mm 6.1mm
In the Box	iPad Air Lightning to USB Cable USB Power
Display	10.5" Retina display
chip	A12 Bionic chip with Neural Engine M12 coprocessor
Camera	8-megapixel photos <i>f</i> /2.4 aperture Five-element lens
Sensors	Ambient light sensor

Table 40 Kiosk Specification

Kiosk	
Weight	Weight Unpackaged: 21.77 lbs / 9.875 kg Packaged: 23.60 lbs / 10.705 kg
Dimension	11.6" x 9.72" x 21.9" / 295mm x 247mm x 557mm
In the box	QIG Small black tie-wrap, x2 Hex-wrench (ball-end L-key), 2.5mm, x1 Screws for Desktop Stand (refer to MS drawing for details)
Compatibility	22" I-Series Android/Windows in Portrait and Landscape mode 15" I-Series Android/Windows in Portrait mode only 15"/17"/19.5" X-Series AiO in landscape mode only

Table 41 Speaker Specification

Audio speaker	
Type	Powered Loudspeaker
Crossover Frequency	24 dB/octave @ 2kHz
Maximum Peak SPL	127 dB SPL @ 1m
Enclosure	Material Polypropylene with textured black finish
Power Configuration	Bi-amped, Class D
Weight	15.8 kg
Dimensions	686 x 442 x 356 mm
Power Source	Standard IEC AC cable
Mounting Options	Pole, Floor
Inputs	2 x XLR-1/4" combo
Outputs	1 x XLR (mix out)
Frequency Range	32Hz-23kHz (-10dB)
Signal Processing	4 x voice modes
Total Power	1300W Peak
HF Driver Power Amp	300W
LF Driver Power Amp	1000W

Table 42 Camera Specification

Camera	
Product Dimensions:	25 x 12 x 10 cm; 599 g

Boxed-product Weight:	612 g
Item Model Number:	SV-B06W-720P
ASIN:	B077889YRN

Table 43 POS Specification

POS system	
CPU	Celeron 2.7GHz
MEMORY	4GB
STORAGE	500GB
OPERATINGSYSTEM	Windows7 Pro x64
I/O	USBx6
DISPLAY	15" LED, 1024x768
DIMENSIONS	14.2? x 9.8? x 13.3?

Table 44 Robot Specification

Robot Chef	Currently not available
Robot Waiter	
scene	Hotel, restaurant, hospital, museum
functions	Say hi, navigation, remote control, route planning
Weight:	38kg
Screen:	10.1inch, HD colour LCD screen
Size(mm):	217*136 mm
Loudspeaker:	Dual

Appendix E – Software (Detailed Specifications)

Xcode - iOS Developer Document

<https://developer.apple.com/documentation/>

Android Studio - Android Developer Document

<https://developer.android.com/docs>

Windows – Microsoft documentation for developer

<https://docs.microsoft.com/en-us/windows/>

The Linux Documentation Project

<https://www.tldp.org/>

Mac OS developer

<https://developer.apple.com/macos/>

MySQL Documentation

<https://dev.mysql.com/doc/>

DBMS Documentation

<https://pythonhosted.org/dbms/>

Oracle Database

https://docs.oracle.com/cd/E11882_01/server.112/e40540/intro.htm#CNCPT001

Google Cloud Service Document

<https://cloud.google.com/docs/>

Microsoft Visual Studio for Website and Web Application Developer

<https://docs.microsoft.com/en-us/visualstudio/?view=vs-2019>

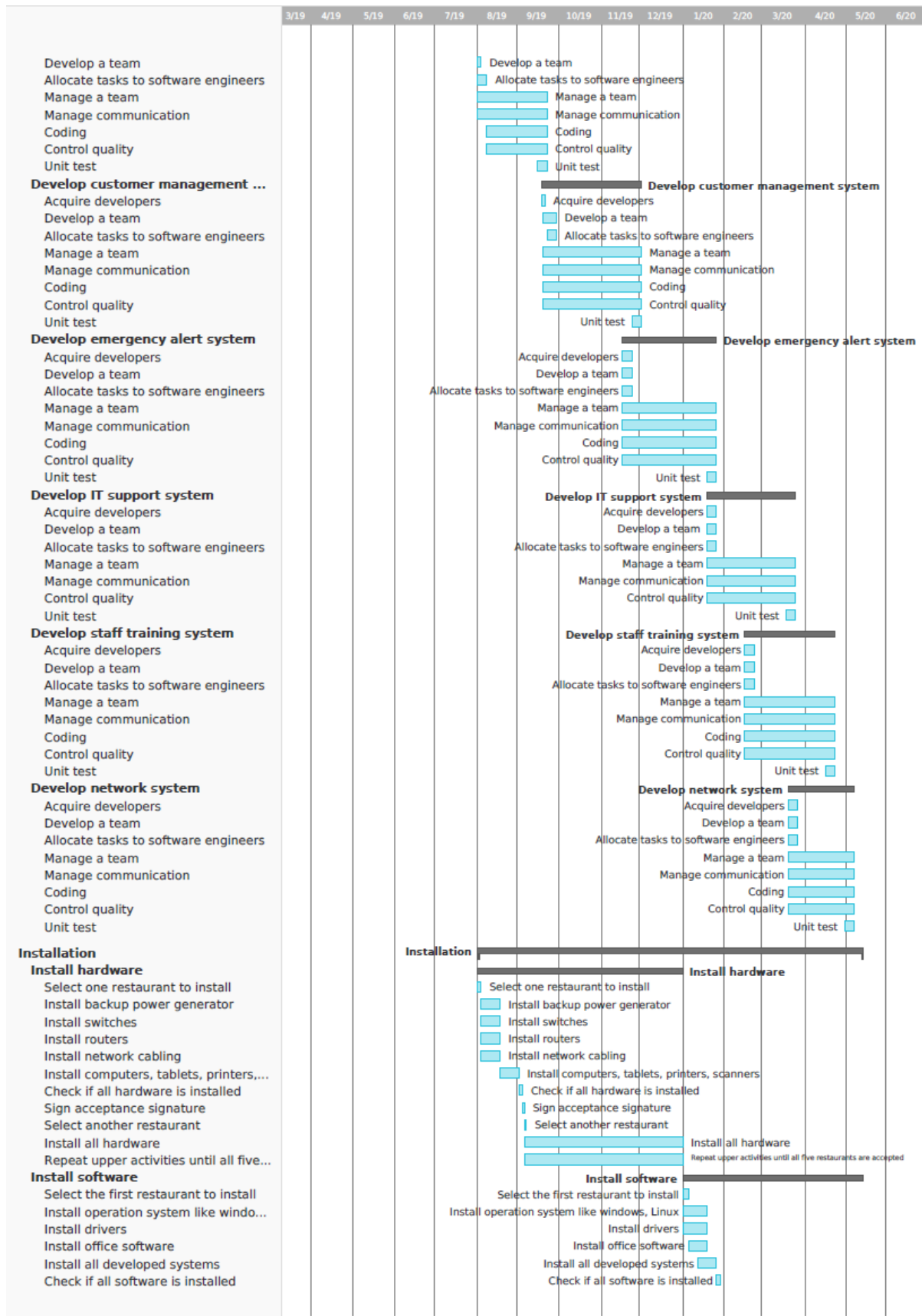
Appendix F – Detailed Breakdown of Costs

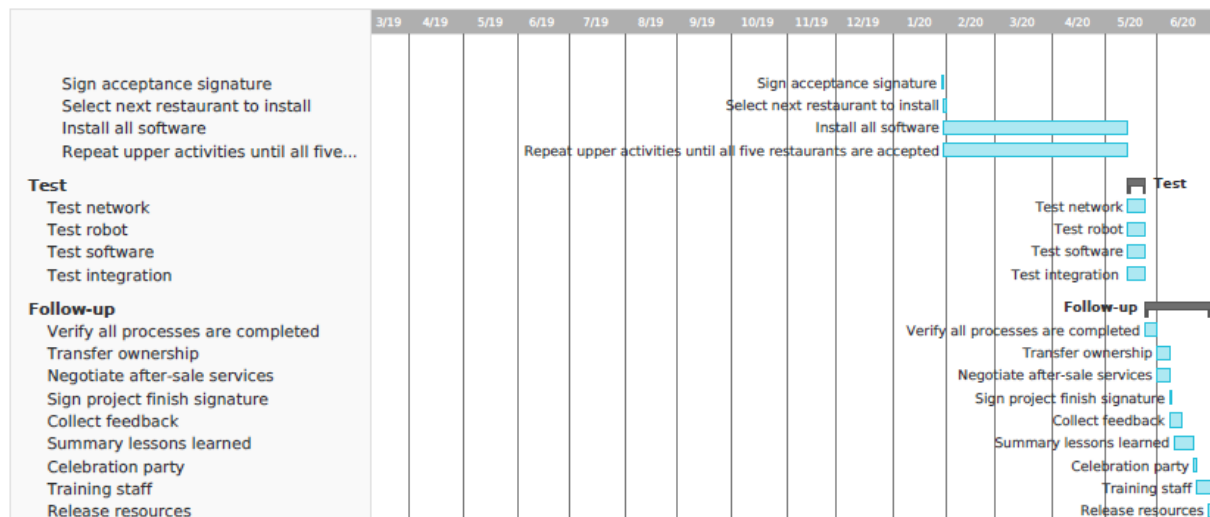
Total Costs	\$3,938,800.00
Initial Costs	\$2,000.00
Develop project charter	\$600.00
Submit project charter	\$400.00
Project sponsor reviews project charter	\$600.00
Project charter signed	\$400.00
Solution Infrastructure Costs	
Cashless payment solution costs	\$11,700.00
Customer management solution costs	\$19,600.00
Network solution costs	\$50,500.00
Automatic kitchen solution costs	\$304,999
Online order solution costs	\$15,000.00
Solution Implementation Costs	
Online order solution costs	\$580,000.00
Customer management solution costs	\$650,000.00
Network solution costs	\$610,000.00
Recurring Costs	
Operation and maintenance engineers	\$700,000.00
Network engineers	\$800,000.00
Software engineers	\$800,000.00

Appendix G – Implementation Gantt Chart

	3/19	4/19	5/19	6/19	7/19	8/19	9/19	10/19	11/19	12/19	1/20	2/20	3/20	4/20	5/20	6/20
Rosie's Bar and Grill Project																
Initiation																
Evaluation & Recommendations																
Develop Project Charter																
Submit Project Charter																
Project Sponsor Reviews Project Char...																
Project Charter Signed/Approved																
Identify stakeholders																
Identify who will be impacted by th...																
Identify who will be responsible for ...																
Identify who will have decision aut...																
Identify who can support the project																
Draw interest grid																
Analyse stakeholders' interest																
Notify stakeholders																
Compile a stakeholder register																
kick off meeting																
Definition																
Determine Project Team																
Search qualified engineers																
Connect the engineers																
Introduce the project																
Negotiate the salary																
Sign work contract																
Build the development team																
Build the management team																
Build the procurement team																
Build human resource team																
Develop Project Plan																
Define scope management plan																
Collect requirements																
Define scope																
Define schedule management p...																
Define activities																
Sequence activities																
Estimate activity durations																
Develop schedule																
Define cost management plan																
Estimate costs																
Determine budget																
Define quality management plan																
Define resource management p...																
Estimate activity resources																
Define communication manag...																
Identify stakeholders																
Identify communication channel																
Collect communication requirem...																
Document communication requir...																
Distribute communicatoin plan																
Define risk management plan																
Identify risks																
Define qualitative risk analysis																
Define quantitative risk analysis																
Plan risk responses																
Define procurement managem...																
Call up procurement team																
Analysis procurement requireme...																
Document procurements requir...																
Define stakeholder manageme...																
Review stakeholders																
Analyse stakeholder interests																
Submit Project Plan																
Design																
Design cashless payment system																
Graphic designers design prototype																
Software engineers design architec...																
Review the design																
Choose the best design																
Confirm the design																
Design online booking system																







Appendix H – Glossary

Artificial Intelligence (AI): The Artificial technology will be used in this project which is the ability to machine or computer to think and learn.

Internet Of things (IOT): Internet of things technology which integrated with computers devices and ability to transfer data without human or computer intervention.

Project Manager (PM): Project Manager is committed to initiating, planning, executing, controlling, and closing the work of a team in order to achieve specific goals and meet required success criteria during limited time.

Design Engineer (DE): The design Engineer in this project is responsible for designing software prototype.

Implement Manager (IM): Implement Manager in this project is the person who installs hardware and software in a certain place with his proficient skills.

Training Lead (TL): Training lead is the person who is responsible for coordinating times and places to train the staff who is short of a certain experience.

Business Analyst (BA): Business Analyst is the person who analyses an organization or business domain and records its business or processes or systems, assessing the business model or its integration with technology.

Service-level Agreement (SLA): Also known as service level agreements, service level agreements, is a formal commitment defined between service providers and customers. The service metrics that have been promised between the service provider and the service user - quality, availability, and responsibility.

Cyber Attack: A cyber-attack is any type of offensive manoeuvre that targets a computer information system, infrastructure, computer network, or personal computer device. An attacker is a person or process that attempts to access the system's data, functions, or other restricted area without authorization, and may have malicious intent.

Data Crash: In computing, a data crash occurs when a computer program such as a software application or operating system stops functioning and exits.

Software License: A software license is a legal instrument (usually the use or redistribution of software governed by contract law, with or without printed material).

Post-construction operation: over time, systems, components, devices, and components will tend to shift from their installed state.

Internet of Things (IOT): The Internet of Things refers to the constantly growing network which carries information of physical objects that are featured with unique IP and communications between those related objects are enabled by Internet.

Closed-circuit television (CCTV): A video surveillance system for security purposes, cameras strategically placed.

MYSQL: MYSQL is a relational database management system based on Oracle.

Machine Learning (ML): ML is a study of algorithms and data models to conduct certain tasks without giving instructive commands given by human.

Appendix I - Additional appendices

Table 45 RACI Matrix

	Project Manager	Design Engineers	Implementation Manager	Training Leads	Department Managers
Requirements Gathering	A	R	R	C	I
Coding Design	A	R	C		I
Coding Input	A	R			
Software Testing	A	R	C		I
Network Preparation	A	C	R		I
Implementation	A	C	R	C	C
Conduct Training	A			R	C

Key:

R – Responsible for completing the work

A – Accountable for ensuring task completion/sign off

C – Consulted before any decisions are made

I – Informed of when an action/decision has been made

Table 46. Probability and Impact Matrix

Probability (Likelihood)	Impact (Seriousness)					
		Very Low	Low	Medium	High	Very High
	Very High					
	High					

	Medium					
	Low					
	Very Low					

Table 47. Risk Grading

Score	Definition
High	An event has a great change to happen. Its occurrence will cause a tremendous extra cost even to threaten the project to terminate. This risk should be submitted to upper managers and reviewed routinely.
Medium	An event that has a half opportunity to happen. Noticeable cost will increase if it happens. And this risk should be regularly monitored.
Low	An event that has a little change to happen. Even if it happens, it will not cause an impact on the project.

Table 48. Hardware Risk Register

Id	Description of Risk	Impact on Project	Grading	Mitigation Actions	Individual/Group responsible for mitigation actions	Time for mitigation actions (week)
1	Hardware suppliers delay deliver products	See section 12.5.1	M	See section 12.5.1	supplier	2
2	performance	12.5.1	M	12.5.1	ICT	1
3	Reliability	12.5.1	M	12.5.1	ICT	1
4	Hardware security	12.5.1	M	12.5.1	ICT	1
5	Poor Estimate Method	12.5.1	L	12.5.1	Project Manager	2
6	Insufficient Resource	12.5.1	L	12.5.1	Project Manager	3
7	Electric static discharge	12.5.1	L	12.5.1	Every staff	1
8	Physical damage to devices and cabling	12.5.1	L	12.5.1	Every staff	1
9	Personal safety issues	12.5.1	L	12.5.1	Every staff	1

Table 49. Software Risk Register

Id	Description of Risk	Impact on Project	Grading	Mitigation Actions	Individual/Group responsible for mitigation actions	Time for mitigation
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						actions (week)
1	Estimation and scheduling	See section 12.5.2	H	See section 12.5.2	Project manager	2
2	Employee turnover	12.5.2	M	12.5.2	Project manager	1
3	Breakdown of specification	12.5.2	M	12.5.2	Project manger	1
4	Sudden growth in requirements	12.5.2	M	12.5.2	All stakeholders	1
5	Productivity issues	12.5.2	M	12.5.2	Project manager	1
6	Gold plating and scope creep	12.5.2	M	12.5.2	Project manager	1
7	Procedural risks	12.5.2	M	12.5.2	Project manager	1
8	Performance	12.5.2	L	12.5.2	developer	4
9	Reliability	12.5.2	L	12.5.2	developer	4

Table 50 Data Risk Register

Id	Description of Risk	Impact on Project	Grading	Mitigation Actions	Individual/Group responsible for mitigation actions	Time for mitigation actions (week)
1	Vendor lock-in	See section 12.5.3	H	See section 12.5.1	Project Manager	1
2	Data loss	12.5.3	H	12.5.1	Database Administrator (DBA)	1
3	Data integration	12.5.3	H	12.5.1	DBA	1
4	Dark data	12.5.3	H	12.5.1	DBA	1
5	Compliance	12.5.3	H	12.5.1	All employee	1
6	Data availability	12.5.3	H	12.5.1	DBA	1
7	Data remanence	12.5.3	M	12.5.1	DBA	3

Table 51 Fraud Risk Register

Id	Description of Risk	Impact on Project	Grading	Mitigation Actions	Individual/Group responsible for mitigation actions	Time for mitigation
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						actions (week)
	Asset misappropriation					
1	Payment fraud	See section 12.5.4	H	See section 12.5.4	Restaurant manger	1
2	Expense reimbursement fraud	12.5.4	H	12.5.4	Restaurant manger	1
3	Procurement fraud	12.5.4	H	12.5.4	Restaurant manger	1
4	Commission fraud	12.5.4	H	12.5.4	Restaurant manger	1
5	Inventory theft	12.5.4	M	12.5.4	Restaurant manger	2
6	Theft of services	12.5.4	M	12.5.4	Restaurant manger	3
	Vendor fraud					
8	Billing schemes	12.5.4	H	12.5.4	Restaurant manger	1
9	Overbilling	12.5.4	H	12.5.4	Restaurant manger	1
10	Price fixing	12.5.4	H	12.5.4	Restaurant manger	1
	Data theft					
11	Trade secret theft	12.5.4	H	12.5.4	Project manager	1
12	Theft of customer or contact list	12.5.4	H	12.5.4	Restaurant manager and DBA	1
13	Theft of personally identifiable information	12.5.4	H	12.5.4	Restaurant manager and DBA	1

Initiation	0%		Start	Due
Evaluation & Recommendations	0%	<input type="text"/>	Mar 11, 2019	Mar 12, 2019
Develop Project Charter	0%	<input type="text"/>	Mar 14, 2019	Mar 15, 2019
Submit Project Charter	0%	<input type="text"/>	Mar 18, 2019	Mar 18, 2019
Project Sponsor Reviews Project Charter	0%	<input type="text"/>	Mar 19, 2019	Mar 19, 2019
Project Charter Signed/Approved	0%	<input type="text"/>	Mar 19, 2019	Mar 19, 2019
Identify stakeholders	0%			
Identify who will be impacted by the project	0%	<input type="text"/>	Mar 12, 2019	Mar 12, 2019
Identify who will be responsible for the	0%	<input type="text"/>	Mar 13, 2019	Mar 13, 2019
Identify who will have decision authority on	0%	<input type="text"/>	Mar 14, 2019	Mar 14, 2019
Identify who can support the project	0%	<input type="text"/>	Mar 15, 2019	Mar 15, 2019
Draw interest grid	0%	<input type="text"/>	Mar 18, 2019	Mar 18, 2019
Analyse stakeholders' interest	0%	<input type="text"/>	Mar 19, 2019	Mar 19, 2019
Notify stakeholders	0%	<input type="text"/>	Mar 19, 2019	Mar 19, 2019
Compile a stakeholder register	0%	<input type="text"/>	Mar 21, 2019	Mar 21, 2019
Kick off meeting	0%	<input type="text"/>	Mar 21, 2019	Mar 22, 2019
Definition	0%		Start	Due
Determine Project Team	0%			
Search qualified engineers	0%	<input type="text"/>	Mar 25, 2019	Apr 8, 2019
Connect the engineers	0%	<input type="text"/>	Mar 25, 2019	Apr 8, 2019
Introduce the project	0%	<input type="text"/>	Mar 25, 2019	Apr 8, 2019
Negotiate the salary	0%	<input type="text"/>	Mar 25, 2019	Apr 8, 2019
Sign work contract	0%	<input type="text"/>	Mar 25, 2019	Apr 8, 2019
Build the development team	0%	<input type="text"/>	Mar 25, 2019	Apr 15, 2019
Build the management team	0%	<input type="text"/>	Mar 25, 2019	Apr 15, 2019
Build the procurement team	0%	<input type="text"/>	Mar 25, 2019	Apr 15, 2019
Build human resource team	0%	<input type="text"/>	Mar 25, 2019	Apr 15, 2019
Develop Project Plan	0%			
Define scope management plan	0%			
Collect requirements	0%	<input type="text"/>	Apr 1, 2019	Apr 19, 2019
Define scope	0%	<input type="text"/>	Apr 8, 2019	Apr 19, 2019
Define schedule management plan	0%			
Define activities	0%	<input type="text"/>	Apr 22, 2019	Apr 26, 2019
Sequence activities	0%	<input type="text"/>	Apr 29, 2019	May 3, 2019
Estimate activity durations	0%	<input type="text"/>	Apr 29, 2019	Apr 29, 2019
Develop schedule	0%	<input type="text"/>	May 6, 2019	May 10, 2019

Define cost management plan	0%			
Estimate costs	0%	<input type="text"/>	May 6, 2019	May 10, 2019
Determine budget	0%	<input type="text"/>	May 10, 2019	May 10, 2019
Define quality management plan	0%	<input type="text"/>	Apr 22, 2019	Apr 26, 2019
Define resource management plan	0%			
Estimate activity resources	0%	<input type="text"/>	May 13, 2019	May 14, 2019
Define communication	0%			
Identify stakeholders	0%	<input type="text"/>	Apr 8, 2019	Apr 12, 2019
Identify communication channel	0%	<input type="text"/>	Apr 9, 2019	Apr 12, 2019
Collect communication requirements	0%	<input type="text"/>	Apr 9, 2019	Apr 12, 2019
Document communication requirements	0%	<input type="text"/>	Apr 9, 2019	Apr 12, 2019
Distribute communicatoin plan	0%	<input type="text"/>	Apr 15, 2019	Apr 16, 2019
Define risk management plan	0%			
Identify risks	0%	<input type="text"/>	Apr 8, 2019	Apr 16, 2019
Define qualitative risk analysis	0%	<input type="text"/>	Apr 8, 2019	Apr 16, 2019
Define quantitative risk analysis	0%	<input type="text"/>	Apr 8, 2019	Apr 16, 2019
Plan risk responses	0%	<input type="text"/>	Apr 8, 2019	Apr 19, 2019
Define procurement management	0%			
Call up procurement team	0%	<input type="text"/>	Apr 22, 2019	Apr 23, 2019
Analysis procurement requirements	0%	<input type="text"/>	Apr 22, 2019	Apr 26, 2019
Document procurements requirements	0%	<input type="text"/>	Apr 22, 2019	Apr 26, 2019
Define stakeholder management	0%			
Review stakeholders	0%	<input type="text"/>	Apr 15, 2019	Apr 16, 2019
Analyse stakeholder interests	0%	<input type="text"/>	Apr 15, 2019	Apr 19, 2019
Submit Project Plan	0%	<input type="text"/>	May 16, 2019	May 17, 2019
Design	0%		Start	Due
Design cashless payment system	0%			
Graphic designers design prototype	0%	<input type="text"/>	Apr 29, 2019	May 9, 2019
Software engineers design architecture	0%	<input type="text"/>	Apr 29, 2019	May 9, 2019
Review the design	0%	<input type="text"/>	May 10, 2019	May 13, 2019
Choose the best design	0%	<input type="text"/>	May 14, 2019	May 16, 2019
Confirm the design	0%	<input type="text"/>	May 16, 2019	May 16, 2019
Design online booking system	0%			
Graphic designers design prototype	0%	<input type="text"/>	Apr 29, 2019	May 9, 2019
Software engineers design architecture	0%	<input type="text"/>	Apr 29, 2019	May 9, 2019
Review the design	0%	<input type="text"/>	May 10, 2019	May 13, 2019
Choose the best design	0%	<input type="text"/>	May 14, 2019	May 16, 2019
Confirm the design	0%	<input type="text"/>	May 16, 2019	May 16, 2019

Design customer management	0%			
Graphic designers design prototype	0%	<input type="text"/>	Apr 29, 2019	May 9, 2019
Software engineers design architecture	0%	<input type="text"/>	May 3, 2019	May 9, 2019
Review the design	0%	<input type="text"/>	May 10, 2019	May 13, 2019
Choose the best design	0%	<input type="text"/>	May 14, 2019	May 16, 2019
Confirm the design	0%	<input type="text"/>	May 16, 2019	May 16, 2019
Design emergency alert system	0%			
Graphic designers design prototype	0%	<input type="text"/>	Apr 29, 2019	May 9, 2019
Software engineers design architecture	0%	<input type="text"/>	May 3, 2019	May 9, 2019
Review the design	0%	<input type="text"/>	May 10, 2019	May 13, 2019
Choose the best design	0%	<input type="text"/>	May 14, 2019	May 17, 2019
Confirm the design	0%	<input type="text"/>	May 16, 2019	May 16, 2019
Design IT support system	0%			
Graphic designers design prototype	0%	<input type="text"/>	May 7, 2019	May 16, 2019
Software engineers design architecture	0%	<input type="text"/>	May 10, 2019	May 16, 2019
Review the design	0%	<input type="text"/>	May 17, 2019	May 20, 2019
Choose the best design	0%	<input type="text"/>	May 21, 2019	May 22, 2019
Confirm the design	0%	<input type="text"/>	May 22, 2019	May 22, 2019
Design staff training system	0%			
Graphic designers design prototype	0%	<input type="text"/>	May 7, 2019	May 16, 2019
Software engineers design architecture	0%	<input type="text"/>	May 10, 2019	May 16, 2019
Review the design	0%	<input type="text"/>	May 17, 2019	May 20, 2019
Choose the best design	0%	<input type="text"/>	May 21, 2019	May 22, 2019
Confirm the design	0%	<input type="text"/>	May 22, 2019	May 22, 2019
Design network system	0%			
Graphic designers design prototype	0%	<input type="text"/>	May 7, 2019	May 20, 2019
Software engineers design architecture	0%	<input type="text"/>	May 14, 2019	May 20, 2019
Review the design	0%	<input type="text"/>	May 17, 2019	May 20, 2019
Choose the best design	0%	<input type="text"/>	May 21, 2019	May 22, 2019
Confirm the design	0%	<input type="text"/>	May 22, 2019	May 22, 2019
Procurement	0%		Start	Due
Purchase hardware	0%			
Search hardware vendors	0%	<input type="text"/>	Apr 29, 2019	May 3, 2019
Identify potential vendors	0%	<input type="text"/>	Apr 29, 2019	May 3, 2019
Compare potential vendors	0%	<input type="text"/>	Apr 29, 2019	May 3, 2019
Select hardware vendors	0%	<input type="text"/>	May 6, 2019	May 10, 2019
Connect hardware vendors	0%	<input type="text"/>	May 6, 2019	May 10, 2019
Propose our requirements	0%	<input type="text"/>	May 6, 2019	May 10, 2019
Negotiate price	0%	<input type="text"/>	May 6, 2019	May 10, 2019

Identify after-sales service	0%	<input type="text"/>	May 13, 2019	May 17, 2019
Make a deal and sign contract	0%	<input type="text"/>	May 13, 2019	May 17, 2019
Deliver hardware	0%	<input type="text"/>	May 20, 2019	Jun 7, 2019
Purchase software	0%			
Search software vendors	0%	<input type="text"/>	May 6, 2019	May 10, 2019
Identify potential vendors	0%	<input type="text"/>	May 6, 2019	May 10, 2019
Compare potential vendors	0%	<input type="text"/>	May 6, 2019	May 10, 2019
Select software vendors	0%	<input type="text"/>	May 13, 2019	May 17, 2019
Connect software vendors	0%	<input type="text"/>	May 13, 2019	May 17, 2019
Propose our requirements	0%	<input type="text"/>	May 13, 2019	May 17, 2019
Negotiate price	0%	<input type="text"/>	May 13, 2019	May 17, 2019
Identify after-sales service	0%	<input type="text"/>	May 20, 2019	May 24, 2019
Make a deal and sign contract	0%	<input type="text"/>	May 20, 2019	May 24, 2019
Deliver Software	0%	<input type="text"/>	May 27, 2019	Jun 7, 2019
Development	0%		Start	Due
Develop cashless payment system	0%			
Acquire developers	0%	<input type="text"/>	May 23, 2019	Tomorrow
Develop a team	0%	<input type="text"/>	May 23, 2019	Tomorrow
Allocate tasks to software engineers	0%	<input type="text"/>	May 27, 2019	Tomorrow
Manage a team	0%	<input type="text"/>	May 23, 2019	Jul 31, 2019
Manage communication	0%	<input type="text"/>	May 27, 2019	Jul 31, 2019
Coding	0%	<input type="text"/>	Monday	Jul 31, 2019
Control quality	0%	<input type="text"/>	Monday	Jul 31, 2019
Unit test	0%	<input type="text"/>	Jul 29, 2019	Jul 31, 2019
Develop online booking system	0%			
Acquire developers	0%	<input type="text"/>	Aug 1, 2019	Aug 2, 2019
Develop a team	0%	<input type="text"/>	Aug 1, 2019	Aug 2, 2019
Allocate tasks to software engineers	0%	<input type="text"/>	Aug 1, 2019	Aug 7, 2019
Manage a team	0%	<input type="text"/>	Aug 1, 2019	Sep 20, 2019
Manage communication	0%	<input type="text"/>	Aug 1, 2019	Sep 20, 2019
Coding	0%	<input type="text"/>	Aug 8, 2019	Sep 20, 2019
Control quality	0%	<input type="text"/>	Aug 8, 2019	Sep 20, 2019
Unit test	0%	<input type="text"/>	Sep 16, 2019	Sep 20, 2019
Develop customer management	0%			
Acquire developers	0%	<input type="text"/>	Sep 18, 2019	Sep 19, 2019
Develop a team	0%	<input type="text"/>	Sep 19, 2019	Sep 27, 2019
Allocate tasks to software engineers	0%	<input type="text"/>	Sep 23, 2019	Sep 27, 2019
Manage a team	0%	<input type="text"/>	Sep 19, 2019	Nov 29, 2019
Manage communication	0%	<input type="text"/>	Sep 19, 2019	Nov 29, 2019

Coding	0%	<input type="text"/>	Sep 19, 2019	Nov 29, 2019
Control quality	0%	<input type="text"/>	Sep 19, 2019	Nov 29, 2019
Unit test	0%	<input type="text"/>	Nov 25, 2019	Nov 29, 2019
Develop emergency alert system	0%			
Acquire developers	0%	<input type="text"/>	Nov 18, 2019	Nov 22, 2019
Develop a team	0%	<input type="text"/>	Nov 18, 2019	Nov 22, 2019
Allocate tasks to software engineers	0%	<input type="text"/>	Nov 18, 2019	Nov 22, 2019
Manage a team	0%	<input type="text"/>	Nov 18, 2019	Jan 24, 2020
Manage communication	0%	<input type="text"/>	Nov 18, 2019	Jan 24, 2020
Coding	0%	<input type="text"/>	Nov 18, 2019	Jan 24, 2020
Control quality	0%	<input type="text"/>	Nov 18, 2019	Jan 24, 2020
Unit test	0%	<input type="text"/>	Jan 20, 2020	Jan 24, 2020
Develop IT support system	0%			
Acquire developers	0%	<input type="text"/>	Jan 20, 2020	Jan 24, 2020
Develop a team	0%	<input type="text"/>	Jan 20, 2020	Jan 24, 2020
Allocate tasks to software engineers	0%	<input type="text"/>	Jan 20, 2020	Jan 24, 2020
Manage a team	0%	<input type="text"/>	Jan 20, 2020	Mar 24, 2020
Manage communication	0%	<input type="text"/>	Jan 20, 2020	Mar 24, 2020
Control quality	0%	<input type="text"/>	Jan 20, 2020	Mar 24, 2020
Unit test	0%	<input type="text"/>	Mar 18, 2020	Mar 24, 2020
Develop staff training system	0%			
Acquire developers	0%	<input type="text"/>	Feb 17, 2020	Feb 21, 2020
Develop a team	0%	<input type="text"/>	Feb 17, 2020	Feb 21, 2020
Allocate tasks to software engineers	0%	<input type="text"/>	Feb 17, 2020	Feb 21, 2020
Manage a team	0%	<input type="text"/>	Feb 17, 2020	Apr 22, 2020
Manage communication	0%	<input type="text"/>	Feb 17, 2020	Apr 22, 2020
Coding	0%	<input type="text"/>	Feb 17, 2020	Apr 22, 2020
Control quality	0%	<input type="text"/>	Feb 17, 2020	Apr 22, 2020
Unit test	0%	<input type="text"/>	Apr 16, 2020	Apr 22, 2020
Develop network system	0%			
Acquire developers	0%	<input type="text"/>	Mar 19, 2020	Mar 25, 2020
Develop a team	0%	<input type="text"/>	Mar 19, 2020	Mar 25, 2020
Allocate tasks to software engineers	0%	<input type="text"/>	Mar 19, 2020	Mar 25, 2020
Manage a team	0%	<input type="text"/>	Mar 19, 2020	May 6, 2020
Manage communication	0%	<input type="text"/>	Mar 19, 2020	May 6, 2020
Coding	0%	<input type="text"/>	Mar 19, 2020	May 6, 2020
Control quality	0%	<input type="text"/>	Mar 19, 2020	May 6, 2020
Unit test	0%	<input type="text"/>	Apr 30, 2020	May 6, 2020

Install hardware	0%			
Select one restaurant to install	0%	<input type="text"/>	Aug 1, 2019	Aug 2, 2019
Install backup power generator	0%	<input type="text"/>	Aug 5, 2019	Aug 16, 2019
Install switches	0%	<input type="text"/>	Aug 5, 2019	Aug 16, 2019
Install routers	0%	<input type="text"/>	Aug 5, 2019	Aug 16, 2019
Install network cabling	0%	<input type="text"/>	Aug 5, 2019	Aug 16, 2019
Install computers, tablets, printers,	0%	<input type="text"/>	Aug 19, 2019	Aug 30, 2019
Check if all hardware is installed	0%	<input type="text"/>	Sep 2, 2019	Sep 3, 2019
Sign acceptance signature	0%	<input type="text"/>	Sep 4, 2019	Sep 4, 2019
Select another restaurant	0%	<input type="text"/>	Sep 5, 2019	Sep 5, 2019
Install all hardware	0%	<input type="text"/>	Sep 5, 2019	Dec 31, 2019
Repeat upper activities until all five	0%	<input type="text"/>	Sep 5, 2019	Dec 31, 2019
Install software	0%			
Select the first restaurant to install	0%	<input type="text"/>	Jan 1, 2020	Jan 3, 2020
Install operation system like windows, Linux	0%	<input type="text"/>	Jan 1, 2020	Jan 17, 2020
Install drivers	0%	<input type="text"/>	Jan 1, 2020	Jan 17, 2020
Install office software	0%	<input type="text"/>	Jan 6, 2020	Jan 17, 2020
Install all developed systems	0%	<input type="text"/>	Jan 13, 2020	Jan 24, 2020
Check if all software is installed	0%	<input type="text"/>	Jan 27, 2020	Jan 28, 2020
Sign acceptance signature	0%	<input type="text"/>	Jan 29, 2020	Jan 29, 2020
Select next restaurant to install	0%	<input type="text"/>	Jan 30, 2020	Jan 30, 2020
Install all software	0%	<input type="text"/>	Jan 30, 2020	May 13, 2020
Repeat upper activities until all five	0%	<input type="text"/>	Jan 30, 2020	May 13, 2020
Test	0%		Start	Due
Test network	0%	<input type="text"/>	May 14, 2020	May 22, 2020
Test robot	0%	<input type="text"/>	May 14, 2020	May 22, 2020
Test software	0%	<input type="text"/>	May 14, 2020	May 22, 2020
Test integration	0%	<input type="text"/>	May 14, 2020	May 22, 2020
Follow-up	0%		Start	Due
Verify all processes are completed	0%	<input type="text"/>	May 25, 2020	May 29, 2020
Transfer ownership	0%	<input type="text"/>	Jun 1, 2020	Jun 5, 2020
Negotiate after-sale services	0%	<input type="text"/>	Jun 1, 2020	Jun 5, 2020
Sign project finish signature	0%	<input type="text"/>	Jun 8, 2020	Jun 8, 2020
Collect feedback	0%	<input type="text"/>	Jun 8, 2020	Jun 12, 2020
Summary lessons learned	0%	<input type="text"/>	Jun 10, 2020	Jun 19, 2020
Celebration party	0%	<input type="text"/>	Jun 22, 2020	Jun 22, 2020
Training staff	0%	<input type="text"/>	Jun 23, 2020	Jun 30, 2020
Release resources	0%	<input type="text"/>	Jun 30, 2020	Jun 30, 2020