



GROUP ASSIGNMENT
TECHNOLOGY PARK MALAYSIA
CT046-3-2-SDM
SYSTEM DEVELOPMENT METHODS
UC2F1905CS

MUHAMMAD SARMAD AIDRUS TP050751
SHARON RUVIMBO WUTETE TP050904
SYED MEHDI AHMED ABIDI TP050431
MUSTAFA SAIFUDDIN SHAMSHUDDIN TP050422

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LECTURER NAME: LAI CHEW PING

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PART A: GROUP COMPONENT

1. PROJECT PLANNING

1.1. INTRODUCTION

It has been noticed that the businesses are more successful when technology plays a vital role in operating them instead of labor workforce. As, computer driven operations has fewer faults and is cost-effective. Owing to this fact many organizations adapt technology to run daily operations more effectively and efficiently. Nowadays more than 80% of the businesses are operated online which gives the organization a much wider reach than the old traditional ways. Moreover, the online services are available 24/7, which gives the organization an advantage over its competitors using traditional ways. The organization Waiter's on Wheels provide meal delivery services throughout the city, they are contacted by the customers that order food from restaurants they have contracted with. The driver accepts the order and makes sure that the meal is delivered to the customer on time. Due to rapid business expansion the company is in demand of such a computer system that tracks the whole process from the order processing to the delivery. The task for our team is to develop a system and a prototype that would meet the demands of both the employees of the company and their customers.

1.2. SCOPE AIM & OBJECTIVES

The objective of this project is to automate and computerize the system and to enable it to be scalable in the future. The current business operations that are carried out cannot maintain records and involve employees to do all operations manually. Tracking orders by customers and assigning them to different drivers at the same time may cause errors and time consumption. By doing this through an automated system will make it efficient and effective, increasing the revenue of the organization. Therefore, in this case an automated delivery tracking system would be of substantial need.

Currently the company has contracted with variety of restaurants. The customer's order manually. The desired restaurant prepares the meal to be ordered while it is delivered by the Waiter's on Wheels driver. The restaurant charges the company at a wholesale price while the customer pays the service charges, the tip and the amount to the company. So, throughout this process the company needs to track the orders from the restaurant to the customer, keeping in view the charges that has been received and locating the drivers that are delivering to the customers. With this

automated customer support system, the company can save time and cost, while increasing its profits.

Therefore, the purpose behind developing the new system is not only to provide convenience to the employees but also to have a system that deals better at managing the orders and saving time, and effort.

A frequent change is needed for the system to be well organized and adaptable as the Waiter's on Wheels wants to expand its business and wants to get the lead in market. The scope of this project is to develop an App-based login system that will allow the customers to register using their contact details. Personal accounts are given to the customers to order their meal by selecting through a variety of restaurants or track the driver's location and check the time on which it would arrive.

2. AGILE PRINCIPLES & IS METHODOLOGIES

2.1. AGILE METHODOLY

Agile Methodology is a development methodology that focuses on iterative improvement and development and customer satisfaction. It is a people-centered and results-oriented way to deal with programming advancement that regards our quickly evolving world which goes to explain that the prerequisites and requirements advance through the joint effort between groups or teams. It evolves around adaptive planning, self-association and minimum delivery time (fast delivery). Agile methodology is adaptable, quick, and has continuity in the improvement of the quality utilizing instruments like Scrum and eXtreme programming as examples (Stackify, 2017).

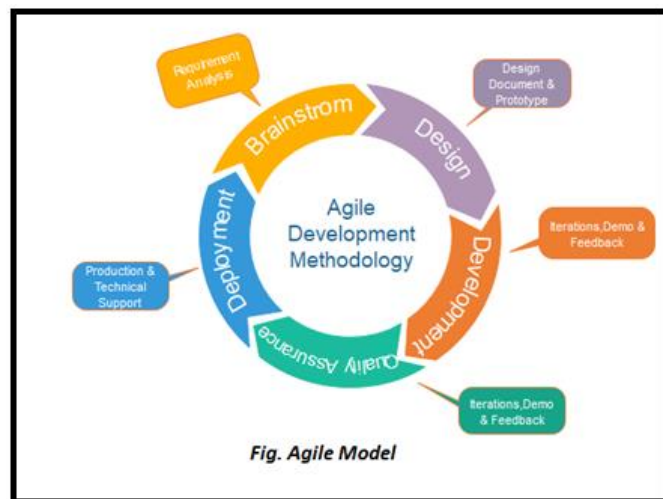


Fig 1: Agile Model

HOW TO MAKE THE PROJECT MORE AGILE

Iterative planning

Adopting an iterative approach when it comes to planning makes the project more Agile and makes the project more flexible. As opposed to making far reaching diagrams that show the flow from beginning to end of the project, planning happens consistently, through a series of on-going investigations and adaptations. This allows the course of the project to change as developers gain a greater understanding of the project at hand and the change in the user feedback received and requirements. **Waiters on Wheels** is a rapidly growing business; therefore, the project should be organized in a way that it can cater for the customer feedback received as it may vary from one customer to another. The team can drop procedures and tasks that are not yielding results and focus on the tasks that are accelerating the development of the system. (Patner, 2019)

Team Structure and Roles

To make sure that the system needed by **Waiters on Wheels** is delivered as proficiently as could be expected, use of a small core team size (range of three to six) is recommended. This recommendation thus increases the speed and focus on the project. Unlike other approaches whereby the project manager oversees quite several tasks such as balancing the budget of the project, the project scope, project reporting and adaptation to change. The Agile approach divides the tasks and responsibilities among the product owner, scrum master and the team. The Product owner's sole responsibility is to ensure that the project at hand delivers the best conceivable product to the end user (adheres to the requirements) and that the user of the system is the focus throughout the undertaking (Patner, 2019). The Scrum master ensures that the team is aware of the tasks with high priority and guides the team accordingly. Tasks that are causing a lag in the project are eliminated. The team's responsibility is to handle all the tasks assigned to them, reporting their progress and quality control. (ThinkingPortfolio, 2019)

Iterative Delivery

Similarly, to planning, Agile's approach to dealing with delivery is additionally iterative and puts more attention on the completion of individual responsibilities and tasks before delivering for reviews. For instance, adopting of the Scrum approach may be feasible. Using the Scrum approach, work is finished in plainly, short and contained stages known as 'sprints'. After two weeks, the working features are delivered and shown to the manager for example towards the end of each

sprint. This accelerates reviews and feedbacks, aligns the project to the requirements, incorporate any additions or subtractions and gives a hold and control on the budget. (Patner, 2019)

Estimation and Prioritization

The project at hand may be a very big one, with many defined requirements and many drafted solutions, separating the prerequisites and requirements of the new system into clear and short requirements will make it a lot simpler to evaluate the effort needed to finish every unit of work.

Once the separation and breaking down of requirements has been done, prioritization of the tasks that need high priority according to the requirements is to be done. After prioritization as highlighted by the agile iterative process, it is important to review the prioritized tasks frequently as the project is being undertaken. This reviewing is very important because it shows you the backlog of the tasks that are always up to the schedule. This gives you confidence in the project as you are assured that the high priority tasks are being worked on consistently. The reviewing also gives you an opportunity to adjust the backlog of tasks based on feedback or reviews given. (Patner, 2019)

Retrospectives and Demonstrations

Demonstrations happen towards the finish of each sprint and includes both the project team and the company personnel that are not directly associated with the day to day running of the project but requested the system at hand. All things considered, demonstrations offer the opportunity to get feedback and responses that would be able to be utilized as a project check point, on progress and if the project adheres and meets their requirements.

Retrospectives additionally occur following the fulfillment of each sprint, but rather than putting focus on the project deliverables rather permits the project team to take a look at their performance so as to identify what is functioning very well alongside the areas that may be in need of more effort and improvement. (Patner, 2019)

2.2. AGILE PRINCIPLES

CUSTOMER SATISFACTION

System is created to meet requirements defined by the end users which in this case is Waiters on Wheels and ensure that the customer is satisfied. Throughout development of the project, it is best to shorten the time between gathering of the requirements and client input by planning less change at a given time. This gives you a greater chance direct the system development in a satisfactory direction for the end-user. (Swanberg, 2019)

A customer is happier when they get a working system frequently, as opposed to waiting on a long time before a release of a working system. (Eby, 2016) Iterative delivery assures customer satisfaction through the regular delivery of a working system. Agile makes the project flexible and adaptive. The developers must be receptive to changes in the requirements throughout the development process. For the creation of a system for Waiters on Wheels, it is ideal to shorten the time between creation and implementation of the request received. (Eby, 2016)

TEAMWORK

The developers must work closely and daily with the management to ensure the successful delivery of a working system. Throughout the development of the system, the management may steer the developers in the right direction by pin pointing areas of the requirements that require priority and attention for example the system must be able to calculate and print a deposit slip for the total receipts. Better decisions are made when the management and developers of the system work well together. Face to face communication and interactions are the most effective and efficient mode of communication and it is more successful when the team is co-located. This shortens the time taken between a question is asked and when an answer is received. (Swanberg, 2019)

FAST DEVELOPMENT

In the Agile methodology, the work is broken down into short manageable tasks known as sprints. This ensures better productivity and maintains a constant pace throughout development. The process of breaking down the project work into sprints ensures that the team members stay motivated as they may be a burnout from working on the project for an extended period. (Landau, 2017)

HIGH PRODUCT QUALITY

Team members who are motivated and skilled who have the power to make decisions concerning the project, discuss frequently with the other team members and offer their thoughts and ideas to ensure a good and quality product is delivered. (Eby, 2016)

Simplicity is very essential because it cuts out the unnecessary tasks which may have been included in the project. The time between comprehension and completion should be shortened to ensure the completion of the crucial tasks. It is also great to follow up on all team members and the time they both spend dwelling on the assigned tasks. (Landau, 2017)

Attention should be paid to the technical aspects of the project and the design must enhance agility. When the right skills and a good design are employed the pace of the team is maintained which constantly improves the product and encourages change. (Eby, 2016) As a developer it would be taxing and time consuming when you must backtrack and fix errors, it is better to ensure that each iteration is improving. Scrum tools can be used to increase the speed of task completion without stripping the final product of the quality. (Hasan, 2017)

STRATEGIES IN IMPLEMENTING AGILE PRINCIPLES

Set vision with a strategy meeting

Towards the start of another new Agile project, the team must characterize the company need or vision the task is tending to. Basically, the team must answer why they are doing what they are setting out to do. The best ways to state the vision is to use the Elevator's Pitch:

1. For: this refers to the target customer who is the user of the system
2. Who: the reasons for the implementation of the new system?
3. That: the benefits of the new system to the company
4. Product: this is the final statement of primary differentiation

The strategy meeting should occur before any project begins or once a year to ensure that the requirements of the projects are still valid, with periodic updates. (MacKay, 2018)

Design the system roadmap

When the strategy has been approved by the team members and the project manager, the system owner translates the vision into the product roadmap. This is defined as the high-level view of the system requirements with a set timeframe for the development of each. In this stipulated time frame identification, prioritization and set a rough estimation on how long each task will take. The

goal-oriented product roadmap is highly recommended and pays close attention to the goals, objectives and eliminating any technical debt. The goal-oriented roadmap outlines the idea of what needs to be done clearly, when and how success will be measured. The system roadmap is created by the product owner but may also include any input from Waiters on **Wheels** and should be in place before the planning of sprints is made. (MacKay, 2018)

Get amped with a release plan

At this stage, the system owner makes a high-level timetable for the release of a working system. Agile project has multiple releases and prioritization of the features of the system that need to be released first is important. The project managers, team members and members from Waiters on Wheels should be present. The release plan should be constructed at the beginning of any new release and reviewed at every quarter on a minimum. (MacKay, 2018)

Planning of sprints

The project manager and the development team plan the sprints which are small cycles of the development of the tasks to be undertaken. Sprints last between one to four weeks and this length should be maintained throughout the project. At the start of every sprint cycle, a backlog of tasks to be completed to obtain a working system is developed by the project manager and the team. (MacKay, 2018)

Daily standups

All through the sprints progression, the project manager needs to ensure that there are no distractions arising and hindering finishing of the completion of the new system on time. To asset this, daily meeting known as Standups are held. Three things are discussed in the meeting which are:

1. What was completed yesterday?
2. What is the task at hand on present day?
3. Are there any hinderances stopping progress? (MacKay, 2018)

Review

If everything has gone as arranged, before the finish of every sprint cycle the team ought to have a working system. At this point, reviewing of the progress made so far is done and demonstrations are made to the team and the key stakeholders of Waiters on Wheels. The initial plan set at the beginning of the cycle is reviewed to ensure that all requirements are met. If there are any

abnormalities, the project manager may ask for reasons to the abnormality and everyone present at the meeting has the chance to chip in their thoughts on the progress made so far.

Discuss next point of focus in the next sprint retrospective

The subsequent stage after each progression is set and this decision is made during the sprint retrospective. When a sprint has been completed, this serves as a great opportunity to decide on what happens next. Take time to discuss the previous sprints, how they went and how the next one could be improved. The team members all must be present for the decisions to be made. A working system should be available now which can be sent to Waiter on Wheels for reviewing and to start the planning of the new features and fixes. (MacKay, 2018)

2.3. METHODOLOGIES: COMPARE & CONTRAST

Waterfall Model

The Waterfall method is a linear model that uses the sequential approach to the system development. This means that one can only move to the next phase only if the preceding phases are completed and perfected hence the term waterfall. The Waterfall model is highly structured and rigid and can be used for almost all types of projects. (Rouse, 2019)

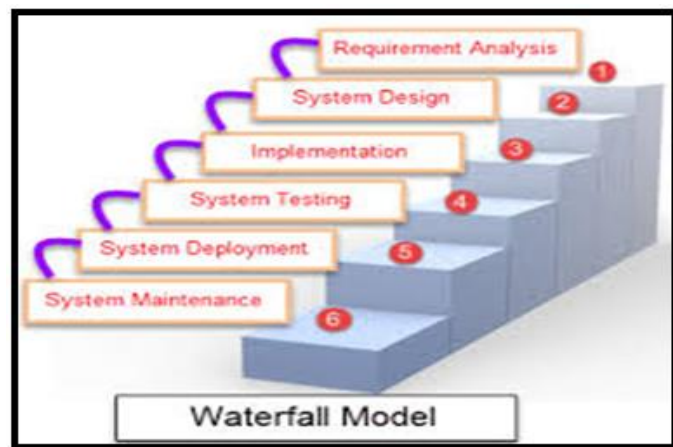


Fig 2: Waterfall Model

Rapid Application Development

Rapid Application Development is a system development method that does not commit a lot of time or resources to the planning process. Instead RAD dedicates the time and resources to a method of prototyping for the introduction of the product. A prototype is a product version that imitates the original product and performs the same functionalities of the original product.

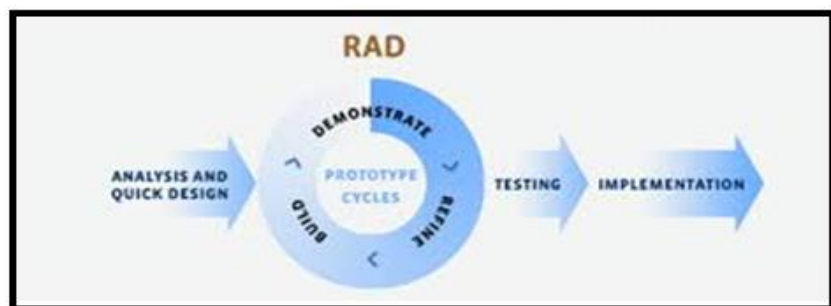


Fig 3: RAD model

Incremental Methodology

Incremental model is system development methodology which breaks down the requirements of a system into different independent modules of the system development cycle. The incremental development is done in phases which start from the analysis, design, implementation, testing and maintenance. This model brings together the elements of the waterfall model with the iterative philosophy of prototyping. (Ghahrai, 2018)

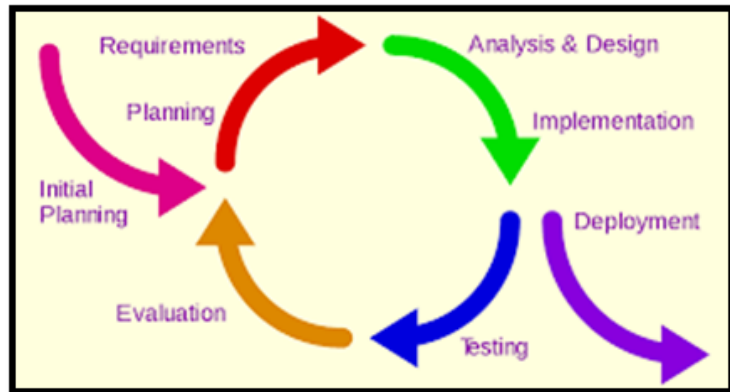


Fig 4: Incremental model

Spiral Methodology

Spiral methodology is a system development methodology that places much emphasis on risk analysis. (EconomicTimes, 2019) The spiral model is a combination of the waterfall model and the iterative model. Each stage of the spiral model starts with the designing of the product to be made and ends with the customer or user reviewing the progress made. (Guru99, 2019)

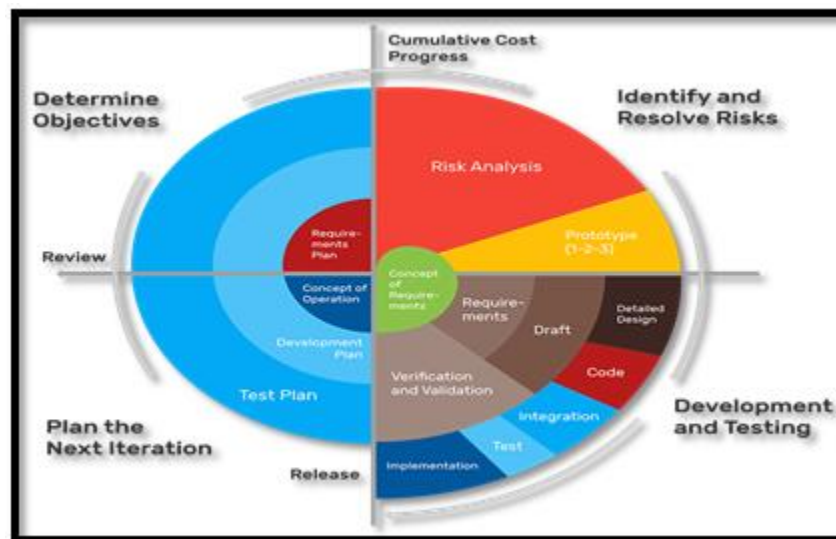


Fig 5: Spiral Methodology

The above-mentioned methodologies all show similarities and differences in their features and phases. The table below shows the differences and similarities between them. (Guru99, 2019)

	Waterfall Methodology	Rapid Application Development	Incremental Methodology	Spiral Methodology
FEATURES				
Planning	Planning is done in the earlier stage	No planning is done in the earlier stage	Planning is done in the earlier stage	Planning is done in the earlier stage
Large Projects	It is not appropriate for large projects	It is not appropriate for large projects	It is not appropriate for large projects	It is appropriate for large projects
Documentation	Detailed documentation is necessary	Documentation is limited and is not detailed	Not much detailed documentation	Detailed documentation
Cost	Low cost	Low cost	Low cost	Expensive
Flexibility to change	Difficult to adapt and change	Can be easily changed and adapted	Can be easily changed and adapted	Can be easily changed and adapted
User Involvement	Users are only involved at the beginning	Users are only involved at the beginning	User involvement is intermediate	There is high user involvement
Duration of development	Stretches over an extended period (long)	Short development time	Stretches over a very long time	Stretches over an extended period (long)
Framework Type	linear	linear	Linear and iterative	Linear and iterative
Testing	Testing is done after the coding phase	Testing is done after the coding phase	Testing is done after every iteration	Testing is done at the end of the

				engineering phase
Availability of a working system	End of the life cycle	End of the life cycle	End of each and every iteration	End of each and every iteration
Customer control over developer	Very low	High control	High control	High control
Requirements	Requirements are gathered at the beginning	Uses a time boxed release for requirements	Requirements are gathered at the beginning	Requirements are gathered at the beginning
Risk	High amount of risk	Low amount of risk	Low amount of risk	Medium to high risk
Reusability	Up to a certain extent	Yes	Up to a certain extent	Up to a certain extent
Previous stage/ phase	Returning to the previous phase is not possible.	Returning to the previous phase is possible.	Returning to the previous phase is possible.	Returning to the previous phase is possible.

3. SYSTEM ANALYSIS

3.1.DATA COMPILATION

After gathering the data from the work area and field research the raw data must be compiled so that the analysis that has to be performed can be done without difficulty, the data can be broken up into respective parts and sections. This can be accomplished in the following manner

- Keeping revisiting and concentrating on a definitive objective of the research and modelling all the procedures accordingly.
- Dividing the actual objectives into sections and accentuating on divided sections independently by involving analytical techniques.
- Orchestrating the inquiries made by the customers in the survey appropriately so that the analysis can be done efficiently.

- The survey may contain comparative responses with different competitors. For this situation the responses can be orchestrated accordingly by analyzing the responses and computing the weighted average of the response and comparing the average with benchmark figures. This aids the business to determine which division or administration should be utilized.

Data analysis and compilation additionally incorporates a data cleaning strategy before further analysis is performed. This cleaning is essentially validating the data for any error or insignificant information. This is exceptionally important before the analysis takes place as it can aid the business to fetch desirable results. This procedure likewise incorporates determining the missing values and inputting the most appropriate values in place. It is also critical to maintain the quality of the analysis and compilation for which the perfect key is to utilize reliable measurement techniques. Data sampling is additionally one progressively recognized way to decrease the probability of repetitive data elements. It includes making subsets of data as per a particular variable value and managing them as a whole. More the data is relevant, the more accurate the results are.

A business must characterize all the objectives in accordance to the market requirement. The results from the compilation and analysis of information are significant for the business and it highlights its success factors. The result of the procedure also portrays the pattern of the business by determining weak and strong points and how they stand in the market. Hence, every organization ought to have a sorted out and refined method for compiling the data.

3.2 DATA ANALYSIS

Data is most helpful in the event that you can accomplish something with it, however how would you analyze it? Organizations like Amazon and Google are experts at analyzing data. Furthermore, they utilize the resulting knowledge to gain a competitive advantage.

The ability to analyze data provides unique opportunities for your organization as well. However, analyzing data can also be challenging. Changing algorithms and technology, even for fundamental data analysis, which may cause issues.

The principal question the organization should ask themselves before plunging themselves into a huge data analysis is, what issue they would say they are attempting to settle? There is indeed a

lot of data when you start analyzing for an organization, but the critical focus should be on data that can provide the organization with a valuable insight.

Alternately, if the organization is not sure of the business problem they are trying to solve, maybe the focus can be shifted on to areas that need improvement. Even an analytic-driven strategy, directed at the correct territory, can furnish helpful outcomes with data. With regards to analysis, consider a range of possible kinds, which are briefly outline in the table below.

Analysis Type	Description
Basic analytics for insight	Slicing and dicing of data, reporting, simple visualizations, basic monitoring.
Advanced analytics for insight	More complex analysis such as predictive modeling and other pattern-matching techniques.
Operationalized analytics	Analytics become part of the business process.
Monetized analytics	Analytics are utilized to directly drive revenue.

Table by (Judith Hurwitz, 2013).

How Waiters on Wheels can use Analytics

In the age of UberEats, Muchery, Amazon Restaurants and other food delivery services, how can Waiters on Wheels remain on the top of their game and competitive? The key to success in the next generation of food delivery service is data. A world of chances and potential outcomes open up when you assemble, analyze and actualize customer data.

Improve Menu

Influence data on customer orders, reviews, social media posts, etc. To assemble feedback on menu that's offered by the different restaurant chains that are in partnership with Waiters on Wheels. This will aid the various restaurants to refine the ingredients and flavors so that they can suit the customers preferences.

Create more deals by offering advancements on popular items while eliminating those that aren't requested regularly to boost sales and increase operational productivity.

Reduce Delivery Time

Waiters on Wheels will lose customers if you make them wait too long for their orders, which arrive cold and soggy because they've been in transit for too long.

Use data such as food preparation time, delivery location, GPS, and real-time traffic updates to help dispatch drivers, locate the most productive course, and decrease average wait time.

Furthermore, influence big data and predictive analytics to evaluate how many drivers Waiters on Wheels will require on a specific day to ensure you have the appropriate amount of man power to handle the deliveries.

Customize Customer Recommendations

Offer customized recommendations dependent on a customer's habits and preferences using data from his or her profile. You can likewise compare a customer's habits and preferences from different customers to recommend menu items that they may also like.

Make it simple for clients to reorder their preferred dishes and offer ideas that are timely and seasonal.

Predict Demand

Analyze browsing history and customer orders to predict demand, for example, volume and popular menu items at specific day and time. Utilize predictive analytics to evaluate how many numbers of customers will order a specific dish, when and from where.

You'll be able to better forecast customer demand, oversee inventory levels and cut delivery time to expand customer loyalty.

3.3 PRESENTING DATA

Presentation of data refers to the organization of data into tables, graphs or charts so that logical and statistical conclusions can be derived from the collected measurements. Data can be presented in many ways but the (2 methods) Tabular and Graphical will be convenient to understand and aid in representing huge data.

Table

Tables are helpful to feature exact numerical values; proportions or trends are better illustrated with charts or graphics. Tables summarize a lot of related information clearly and allow

comparison to be made among groups of variables. Generally, well-built tables should naturally be logical with four principle parts: title, columns and rows.

Titles

Keep it brief and relate clearly to the substance of the table. Words in the title represent and summarize variables utilized in the columns and rows as opposed to repeating the columns and rows titles.

Columns and Rows

Columns are vertically listed data, and rows are horizontally listed data. Comparative data should be exhibited in segments. Often these are dependent factors and allow clearer comparison among groups.

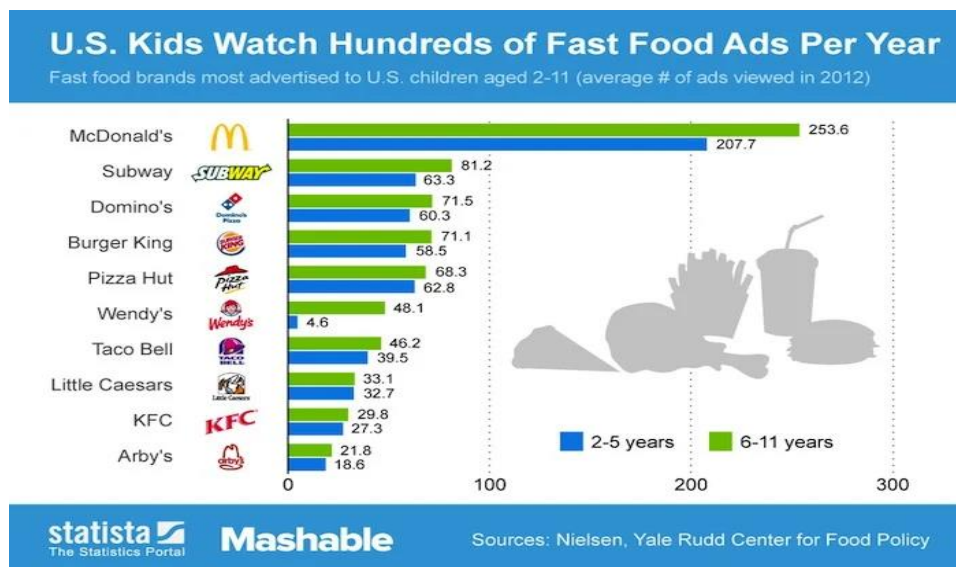
Results		Messages		
	ItemId	ItemName	UnitsSold	CompanyID
1	1	Large Pizza	5	2
2	2	Garlic Knots	6	3
3	3	Large Pizza	3	3
4	4	Medium Pizza	8	4
5	5	Breadsticks	7	1
6	6	Medium Pizza	11	1
7	7	Small Pizza	9	6
8	8	Small Pizza	6	7

Graphics

Graphics are especially useful for demonstrating a pattern in the data that would not be apparent in tables. It gives visual emphasis and avoids lengthy text description. However, presenting numerical data in the form of graphs will lose subtleties of its exact qualities which tables can provide. The creators need to choose the best arrangement of getting the intended message across. A well-constructed graphic should have a title, figure legend and footnotes along with the figure. Titles ought to contain words that depict the information compactly. Define symbols and lines used in legends clearly.

Some general guides to graphic presentation are:

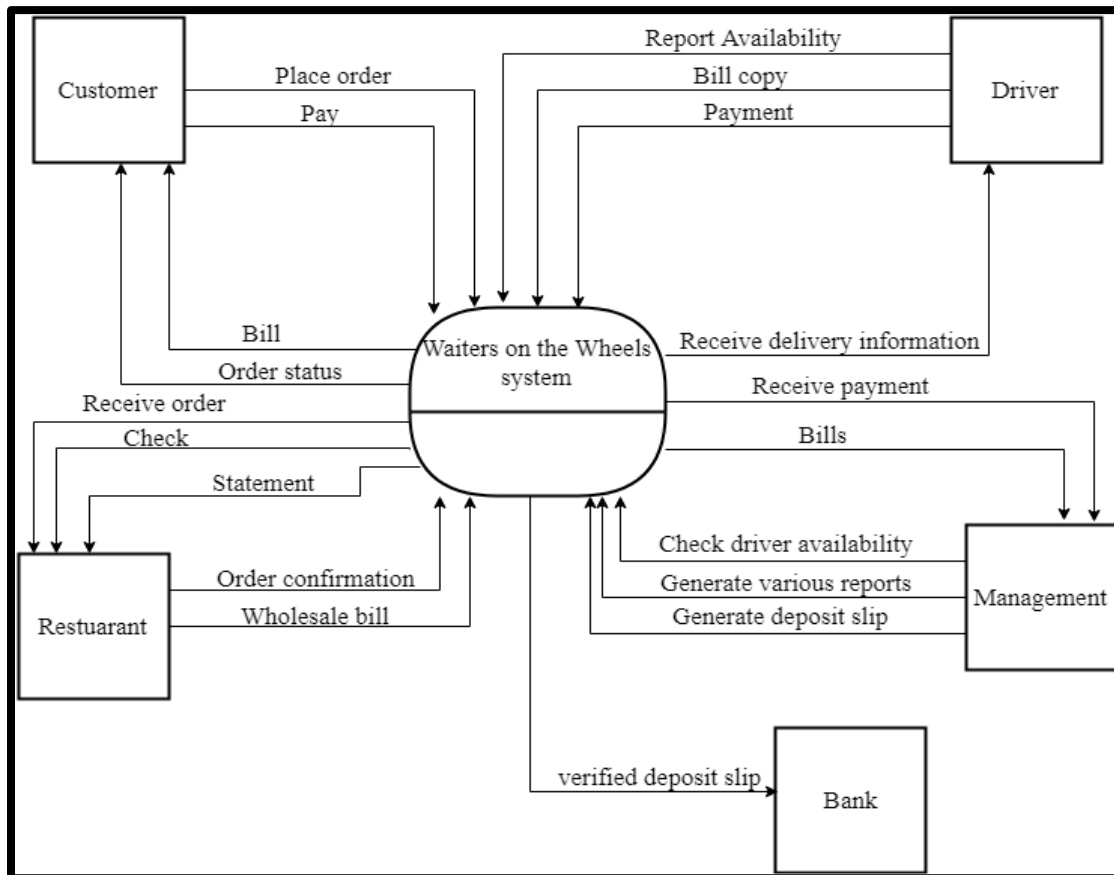
- Bar charts, either horizontal or column bars, are utilized to show clear cut information. Strictly speaking, bar charts with continuous data should be drawn as histograms or line graphs. Usually, data exhibited in bar graphs are better shown in tables except if there are significant patterns or trends that need to be emphasized.
- Avoid 3-D diagrams and outlines. Three dimensional illustrations are impressive in slide shows and can easily catch the attention of the audience. In data presenting however, they are not effective because it is difficult to read the precise values on the Y axis (the height of the bars) accurately.



4. SYSTEM DESIGN

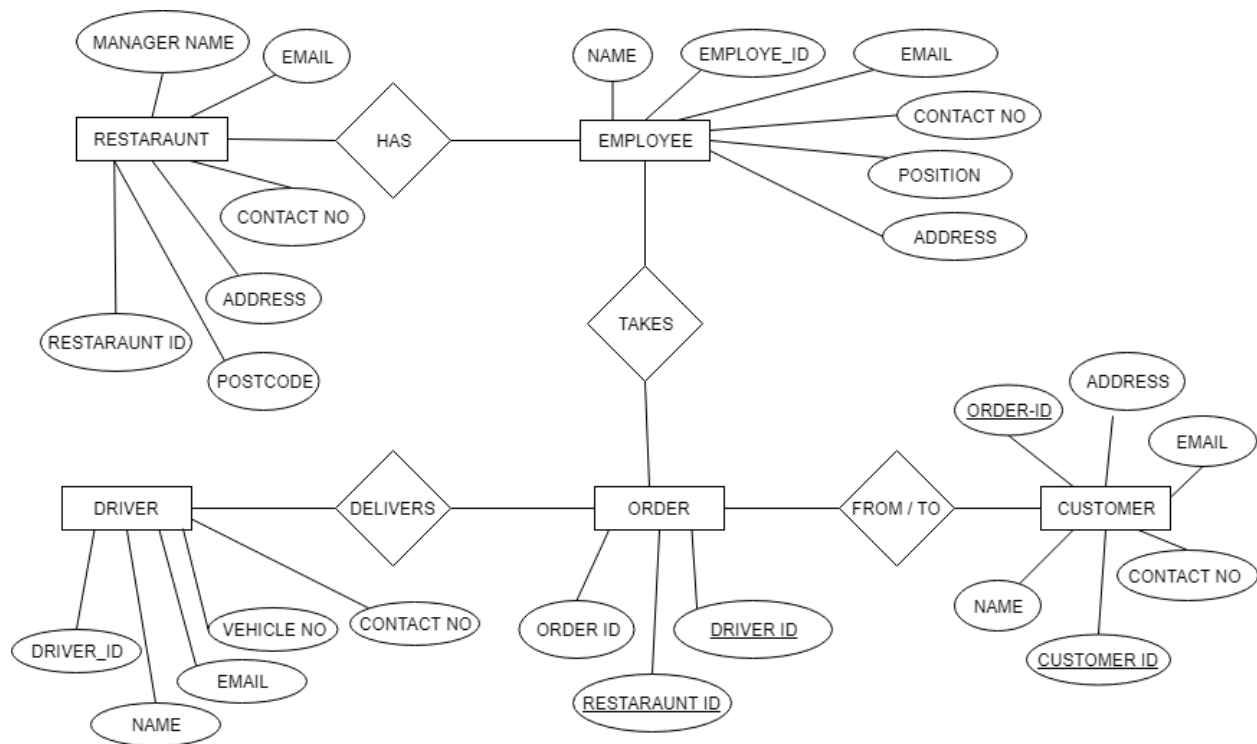
4.1.CONTEXT FREE DIAGRAM (CFD)

A context data flow diagram (DFD), also known as a level 0 DFD, gives a broad overview of an information system and the way it interacts with external entities.



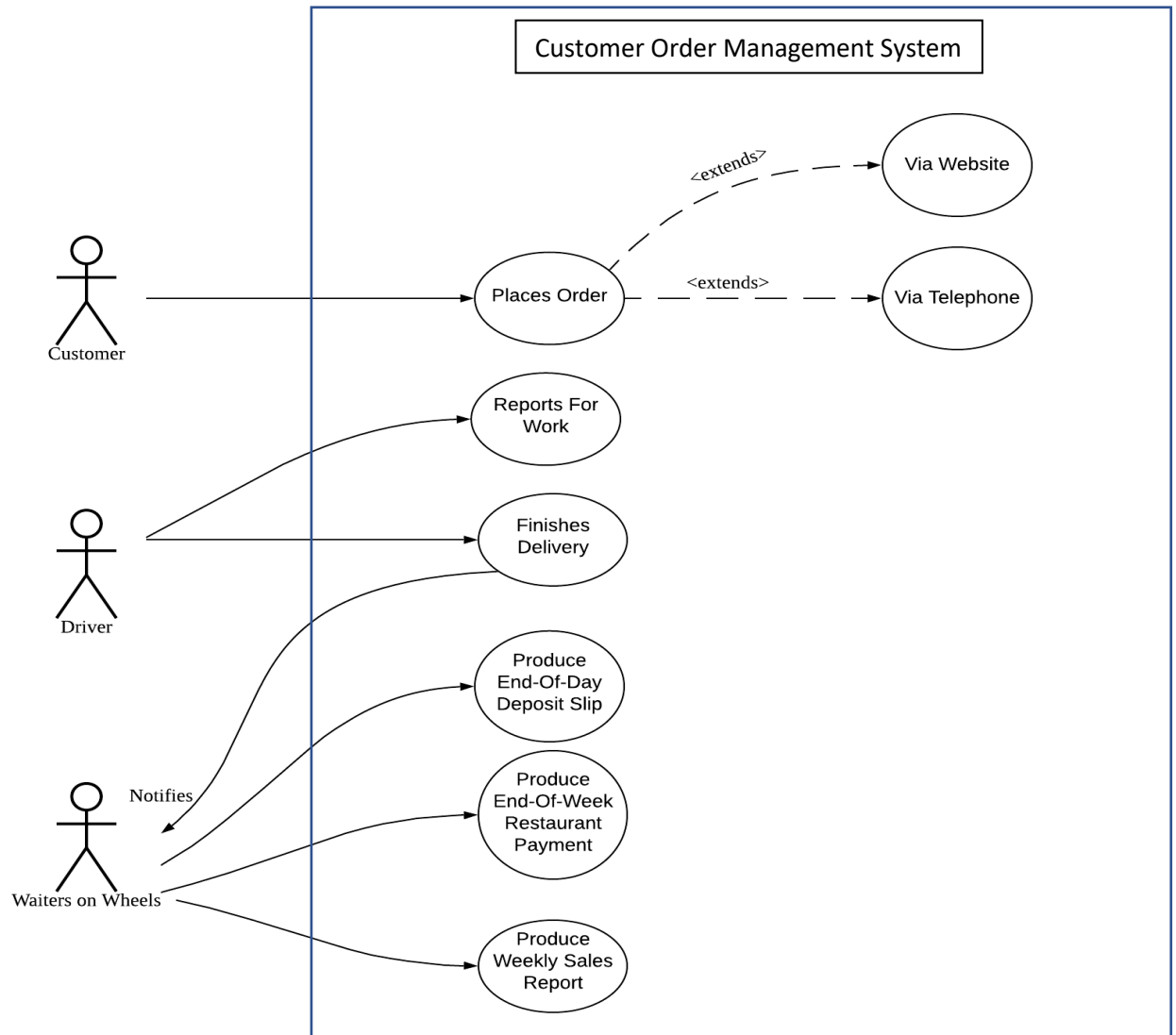
4.2.DATA FLOW DIAGRAM (DFD)

The Data Flow Diagram also known as the DFD graphically represents the capabilities, processes which manipulate, store and capture data between the system and the system environment and the system components. In simple terms a Data Flow Diagram is used to outline the flow of data in a system graphically using entities, data flows, data stores and processes. (VisualParadigm, 2019)



4.4. USE CASE DIAGRAM

A use case diagram is a realistic portrayal of the communications among the components of a framework. A use case is a technique utilized in framework investigation to recognize, explain, and arrange framework necessities. In this specific situation, the expression "framework" alludes to something being created or worked, for example, a mail-request item deals and administration Web website. Use case outlines are utilized in UML (Unified Modeling Language), a standard documentation for the displaying of true articles and frameworks.



5. IMPLEMENTATION & DEPLOYMENT

5.1. CONSTRUCTION

SYSTEM CONSTRUCTION

For the new system to be effective, efficient and ensuring it contributing to the profit of the company. It needs to be built using tools and software that are most suitable.

MySQL, this is an open source relational database system that allows records to be stored and sorted accordingly. The benefit of using MySQL is, it makes it easier to keep track and sort records which in turn helps to make future calculations and validating easier compared to doing it on paper which occupies a lot of time and affects the environment.

NetBeans is a programming platform that supports Java programming language. Java is one of the languages that supports object-oriented programming. Java supports a modular structure for programs which makes it easier to maintain and make changes to part of a system if any issue arises without a need to make large scale changes. Objects written can be reused which enables faster development of the system. Also, java simplifies the designing of the GUI of an application which saves time that is spent by developers on the system.

HTML stands for Hypertext Markup Language it is used to design the front end of the website for instance web applications and web pages together with JavaScript and Style sheet, HTML is the core structure of and webpage.

jQuery is JavaScript framework that simplifies the work on designing the user interface of the website rather than writing lines of code in JavaScript, implementing jQuery will save time on the overall website design and it will also allow flexibility in terms of design. A prototype can be built to show the client and get their approval while in coding it would consume time and if the clients don't like the design coding would have to start all over again.

Amazon web services (AWS) provides cloud storage services. Cloud storage is a way of storing data into virtual machines as oppose to physical hard disks or papers. Using cloud storage services will allow the company to go green by eliminating papers-based records stored as back up. Cloud storage eliminates the use of cabinetry which in turn allows to manage the office space better, functional and make it look pleasant. Lastly is also eliminates the risk of records getting destroyed to due natural disasters or corruption of physical storage devices. Furthermore, Amazon web

services provides a platform to launch a website online which will be used by the customers to view menus and make order.

A CPU with core I5, RAM of 3GB and HDD of 500GB machine required to install the software developed by the programmers.

A 15-inch monitor will be required for the purpose of displaying various information easily to the user.

An ergonomic mouse will be required to navigate through the software user interface and to select any option and prevent nerve damage to the user.

An ergonomic keyboard will be required to change prices and menu list also to add other information on the website as well as the desktop application.

5.2. TESTING

System testing is a process that involves verifying and validating all the possible scenarios of a system to ensure all the technical and business requirements are met that are set by the clients.

Dynamic Testing

Dynamic testing is considered as validation of the system where you work with the system providing real inputs and comparing the end results to see if it matches the expected results. Otherwise speaking, working with the system with the goal of discovering mistakes. The main purpose of dynamic testing is to ensure that the software works appropriately and is stable after installation without and critical faults (Guru99, 2019).

Dynamic testing is divided into several layers namely Unit, Integration, System and Acceptance testing. Below are the most recommended tests that should be performed for the software that is being designed for waiters on wheels.

Unit Testing:

Unit testing is considered as the fundamental testing because individual components of the system are tested. The aim of unit testing is to make sure that each system unit performs as expected. This test is performed using white box method which is the person testing the system knows it inside and out and he or she writes a sample data that will be used on each unit. Unit testing allows the

modification of the system to be effective as each tiny detail is tested and if any error is found, the focus will be on that unit as opposed to considering the whole system (Guru99, 2019). It is important for the website and the desktop application that is being developed to go through unit testing to eliminate errors from the programs.

Integration Testing:

Integration testing is a testing method that is done by combining the individual units that interlink together and are tested as a group. The whole purpose of this test is to see if the communication between the individual units of the system runs smoothly as it is supposed to. There are several types of integration testing, but big bang is most efficient and time saving as several units of the system are combined and tested at one go. It is important to do system testing for the system we are designing as it will be used every day so we must ensure that all the components run smoothly (Guru99, 2019). Integration testing is usually conducted by a group of specialized testers.

System Testing:

System testing is done once the system is completely designed and fully functioning. The aim of this test is to evaluate the overall behavior of a completely integrated and fully functioning system meets the clients specified requirements as well as the user-end and functional requirements. It also gives a base line on the quality of the system developed (Guru99, 2019). Most of the time this test is performed by independent testers where black box method is implemented since the independent testers do not know how the internals of the system function.

Usability Testing:

Usability testing is focused on the user perspective of the system it checks if the user can navigate through the system with ease. This test is recommended to be conducted as it gives feedback on how the customers feel when they will be using the website to place order, if they are satisfied with the functionality and the ease of navigation and the same goes for the employees of waiter on wheels with the desktop application if they can navigate through it in ease.

5.3. SYSTEM DEPLOYMENT

System deployment

Once the testing of the system is done and an ok is given by the testing team, a plan is devised on how the new system will be executed by following several procedures.

1. Determining deployment options emphasizes on where the final system will be

delivered.

2. Packaging the system focuses on what and how every component will be delivered to the users.
3. Deployment schedule should be plan accordingly so that the stake holders can attend.
4. System change over strategies aims on how the old system will be replaced with the new.
5. Post deployment test or on-site testing.
6. Provided necessary training if required.

Change over strategies are divided into four type

- Direct cutover – in this strategy the old system is completely replaced by the new one at one go. It best works in a situation where system failure is not critical.

Advantages	Disadvantages
It is cheaper compare to the other strategy.	If any problems occur the changeover cannot be reverted.
It saves time as there is less workload.	The sudden change in the system may cause a confusion among the users.
	There is a high chance of failure and loss data.

- Parallel changeover – this type of strategy the new system runs alongside the old system for a given period. This strategy is preferred over all as it has the lowest risk.

Advantages	Disadvantages
If the system fails it can be reverted to the old system in case of a failure.	The cost to implement this strategy is higher as both systems needs to be maintained.
Can be used for all type of scenarios.	Extra workload as must work with both systems.

- Pilot changeover – in this strategy a smaller scale of the system is deployed alongside the old one for testing purpose before launching the complete system. The small-scale program is usually referred to as beta program.

Advantages	Disadvantages
It is cost effective compare to parallel change over.	The total changeover process can be very time consuming.

- Phased changeover – this strategy falls between direct and parallel as the old system is replaced by the new system in stages.

Advantages	Disadvantages
This strategy allows the users to adapt to the new system gradually.	This strategy cannot be implemented on a system cannot be broken down into separate parts.
In case of failure of a phase, it does not affect the whole system as it is isolated.	It is the most expensive and time consuming out of all the strategies.

The most suitable system changeover strategy for waiters on wheels would be parallel changeover strategy as it is a company that must attend to its clients daily. It is also the safest option in terms of data integrity in case of any critical failure they can revert to the old system and still run the business.

PART B: INDIVIDUAL COMPONENT

6. SELECTION OF METHODOLOGY

6.1. MUHAMMAD SARMAD AIDRUS TP050751

6.1.1 WATERFALL METHODOLOGY

Waterfall methodology was first introduced by Dr. Winston W. Royce in a paper published in 1970. The waterfall model is a software development process. It is a breakdown of project activities into linear sequential phases, where each phase depends on the deliverables of the previous one and corresponds to a specialization of tasks. In software development, it tends to be among the less iterative and flexible approaches as progress flows in largely in one direction, downwards like a waterfall. (Powell, 2016)

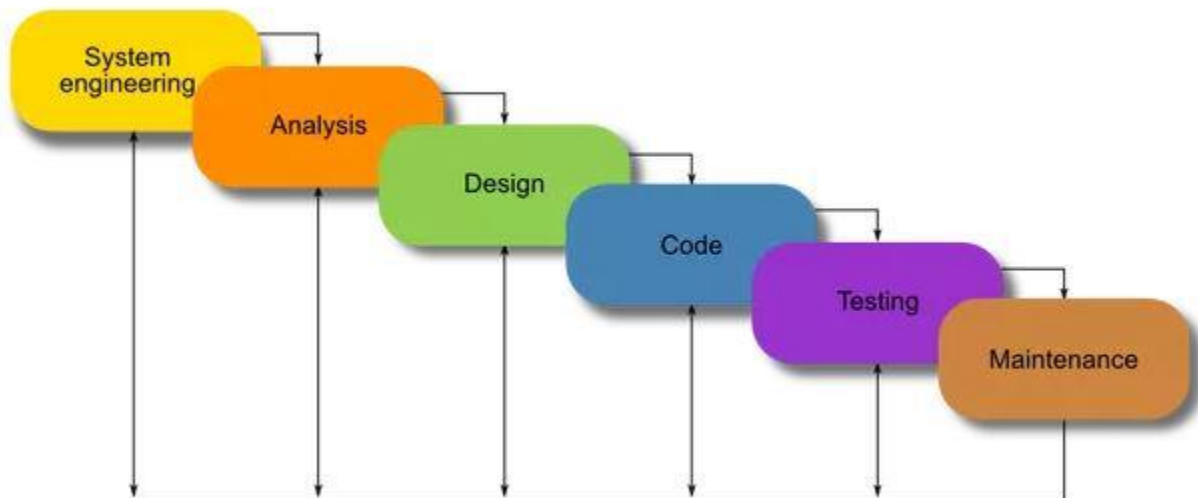


Fig: Waterfall Methodology

The Waterfall model is highly structured and rigid and can be used for almost all types of projects. (Rouse, 2019). The popularity of the waterfall model has been waned over the years in favor of agile methodologies. The logical nature of the sequential process used in waterfall method cannot be denied and it is widely used in the industry.

6.1.2 SIX STAGES OF WATERFALL METHOD

Implementing a waterfall method in a new software project is a straightforward process. The whole process is divided into sequential stages, and it is imperative to complete each

phase successfully in order to move onto the next one. According to the International Software Testing Qualifications Board, the Waterfall Model consists of 6 phases:

1. Requirements Analysis

In this phase all requirements of the project are analyzed and documented within the specification document and a feasibility study is carried out to check if these requirements are valid or not. In this phase it is important to consider the limitations and constraints that might affect the development process too. After careful analysis of the requirements a requirement understanding document (RUD) is created. This document also known as the requirement specification document specifies what the application must do but not how it should do it.

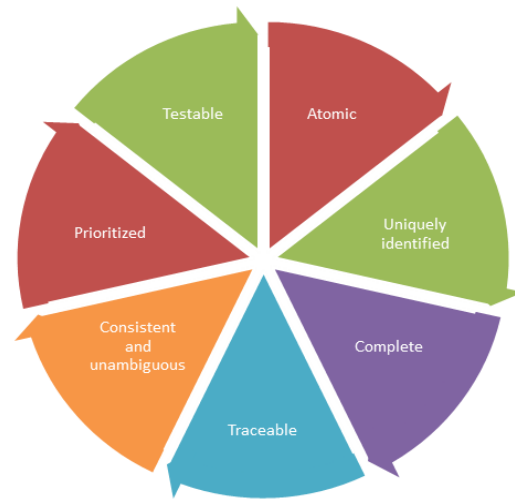


Fig: Requirements Analysis

2. System Design

In this phase the design of the system is made which is to be developed. It includes the hardware, system requirements such as data layers, programming languages that would be used to develop it, the network infrastructure and the user interface. This phase is usually used to define the overall architecture of the system. This phase is further divided into low level and high-level design phase. After careful analysis of the company's requirements this model will implement this phase in order to define a more detailed look at the design of the system that has to be developed.

3. Implementation

This phase involves the implementation of the requirements by writing the source code. The physical design specifications are turned into a working code. The system is developed in small programs called as units which are then integrated to work as a full system. Before integration each unit is tested through unit testing. The company has different modules including the customer side and the waiters who will deliver, so each module is implemented separately and then integrated after careful testing.

4. Testing

The testing phase comes after the complete implementation. The source code is then transferred to the testing team. The team checks the system for all possible defects and problems by running test cases either manually or through automation. The clients are also involved in this phase so they can give complete feedback about the system and to ensure if all the requirements are met. Quality assurance is ensured after fixing all the bugs and errors that are detected in this phase. After the implementation and during the testing phase this system is given to the company to test whether it takes complete orders of the customers and if customers have complete access to their order.

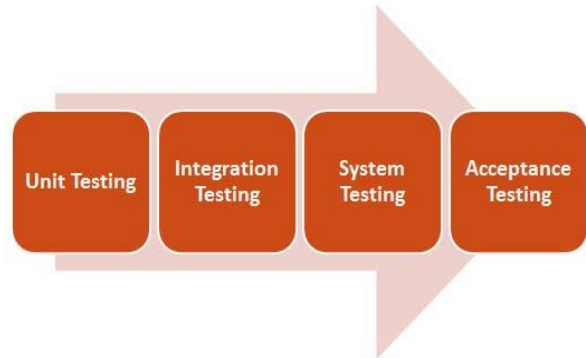


Fig: Testing

5. Deployment

This phase comes after the testing phase and when the system is ready to be deployed into a live environment. Once it is deployed it is available to the end users and its performance can be tested. This phase also involves the training of the end users to tell them about the system. When this system is deployed into the Waiter's on Wheel's server. They can easily access the drivers and the customers while on the other hand the application is also installed in the customers mobile phones. In this environment the quality and performance of the system can be tested thoroughly as well.

6. Maintenance

This phase comes after the deployment phase and usually consists of providing support and maintenance to the Waiter's on Wheel's and making sure that the system runs smoothly. If the client or the end users come across defects or bugs, fixing them is the main purpose of this phase. The company might face issues through feedback by the users which are then resolved in this phase.

COMPARISON

Waterfall methodology is well suited for large projects that require rigid and deadlines that are met within the cascading waters represented by the methodology. The waterfall methodology requires

detailed documentation of the stages employed in the development of the project from the design through to the testing and implementation of the system. This allows Waiters on wheels to hand over the system documentation to any other developer in the case of a malfunction that needs to be traced. Waterfall is inherent linear in structure and well suited in this project as the project is date focused. The methodology is clear and simple as the development stages can be understood by everyone so it is easy to give the project a time line which will ensure that a working system is delivered to Waiters on wheels in time. (Morse, 2016). Progress of the system development can be measured easily as the full scope of the work is already known in advance.

6.2. SHARON WUTETE TP050904

NAME:	SHARON RUVIMBO WUTETE
TP:	TP050904
METHODOLOGY:	SPIRAL METHODOLOGY

Spiral Methodology

Spiral model is a combination of the waterfall model and the iterative model. Each stage in the spiral model starts with the design goal and stops with the customer surveying the advancements. The Spiral model was first mentioned in a 1986 paper by Barry Boehm. (Guru99, 2019)

The Spiral model is one of the significant System Development Life Cycle models, which offers help for Risk Handling. In its diagrammatic portrayal, it would appear like a spiral with many loops. The precise number of loops in the spiral is obscure and can vary from project to project. Each loop is referred to as a phase of the system development process. The number (exact number) of stages required to develop the product can be changed by the project manager depending on the project risks. The radius of the spiral represents the expenses(cost) of the project until a specific point, and the angular dimension represents the advancements made so far in the present stage. (Pal, 2019)

6.2.1. PHASES OF THE SPIRAL METHOD

The Spiral Model consists of four main system development life cycle phases. Throughout the development phase, the whole development process continuously passes through these four phases. Each iteration in the model is known as a Spiral.

1. PLANNING PHASE

This is where the project begins. The team gathers the objectives of the system and the requirements from the company, Waiters on Wheels. The team can gather requirements from Waiter on Wheels using a couple of gathering techniques. The first one would be an interview which a face to face meeting between two people is, the interviewer who the person is leading the interview and the interviewee who the person is answering the questions in the interview. The project manager schedules a meeting with the company manager or several users (external or internal users.) The project manager confirms the venue and time over a convenient communication professional platform. During the interview, the interviewer who in this case will be the project manager may ask clarity on answers received if unclear and question to gain an overview of the current system. This gathering technique provides accurate information and the

information received provides a great overview of the existing system that is in use at Waiters on wheels. Another gathering technique that can be employed by the team, to obtain requirements of the system would be observation. A member of the team is sent to the company Waiters on Wheels to spend a day or two monitoring how work is undertaken in the company and the current existing system. The team member assigned observes how Waiter on Wheels handles the orders received, the delivery and the receipts. The team member assigned for observation may be able to pick out disadvantages that come about from use of the old system and therefore draft the requirements.

In the resulting spirals, all the requirements are created based on the customer's feedback. Thus, permanent communication between the customer and the project manager is vital to the project.

After the requirements of the system are generated, they are elaborated and analyzed by the team members. Alternative solutions are then brought forward by the team members for the development of a successful system. (Pal, 2019) The deliverable in this phase is the System Requirements Specifications.

2. RISK ANALYSIS

This is the most important development stage in the Spiral model. After the team members have proposed their solutions, all the possible solutions are evaluated, and the best solution is selected. After the best solution is selected, the risks linked with selected solution are found. A risk in this case is a potential condition or occasion that prevents the development team from progressing in the development of the project. The risks vary from trivial risks to fatal risks. The primary task of the development team is to identify all the potential threats and risks and organize them as per significance. After the prioritization of the tasks, the development team comes up with strategies that can assist in the elimination and overcoming of the risks identified. These strategies are referred to as the risk mitigation strategies. (Gurendo, 2015)

A risk mitigation is defined as the taking of an initiative to overcome or reduce potential risks or adverse effects. There are four different strategies that can be employed by the development team to mitigate risks which are: avoidance, acceptance, reduction and transference. (Schenkelberg, 2019) The deliverable in this phase is a document outlining all the risks and mitigation strategies.

The best strategy is chosen and finalized, and the risk is resolved using the best strategy from the risk mitigation strategy. At the end of this phase, a prototype is produced. If a risk is identified in the prototype produced, alternate solutions are put into place. (Gurendo, 2015)

3. ENGINEERING PHASE

In this phase, the development team develops the system along with further testing. During the first spiral, when the general requirements are unclear, a document known as a Proof of Concept (POF) is made to obtain the customer's feedback. In the subsequent spirals, the working version of the system which is known as a build is created and sent to the customer to obtain new, more informative and detailed feedback. Such a methodology permits accomplishment of higher clarity on the system requirements. (Gurendo, 2015) After the final build is made, testing is carried out at the end of the phase. The testing carried out by the development team can be system testing, unit testing or integration testing. Deliverables in this phase are the coding, test summary report and defect report.

4. EVALUATION PHASE

After a testing has been carried out and a test summary report has been created, the next phase is Evaluation. In the Evaluation phase, Waiters on Wheels and the customers assess the new system to date and give their feedback and appraisal of the system before the project progresses to the next spiral. (Pal, 2019)

In this phase, identification and observation of risks is also done. This includes schedule slippage and cost overrun. Schedule slippage is an indicator that measures the time a project is lagging as compared to the baseline set (Guru99, 2019). In the event of a slippage, the development team may work overtime and assign the productive resources to the most critical tasks.

Cost overrun is the increase in the original cost of the project budget. If the project manager identifies a cost overrun, an action plan can be created for the development team or cut out tasks which are unnecessary to the development of the system and give priority.

At the end of the evaluation phase, planning of the next spiral is conducted.

The Spiral methodology is an iterative method, after the first prototype is made the second prototype is created and undergoes the four phases.

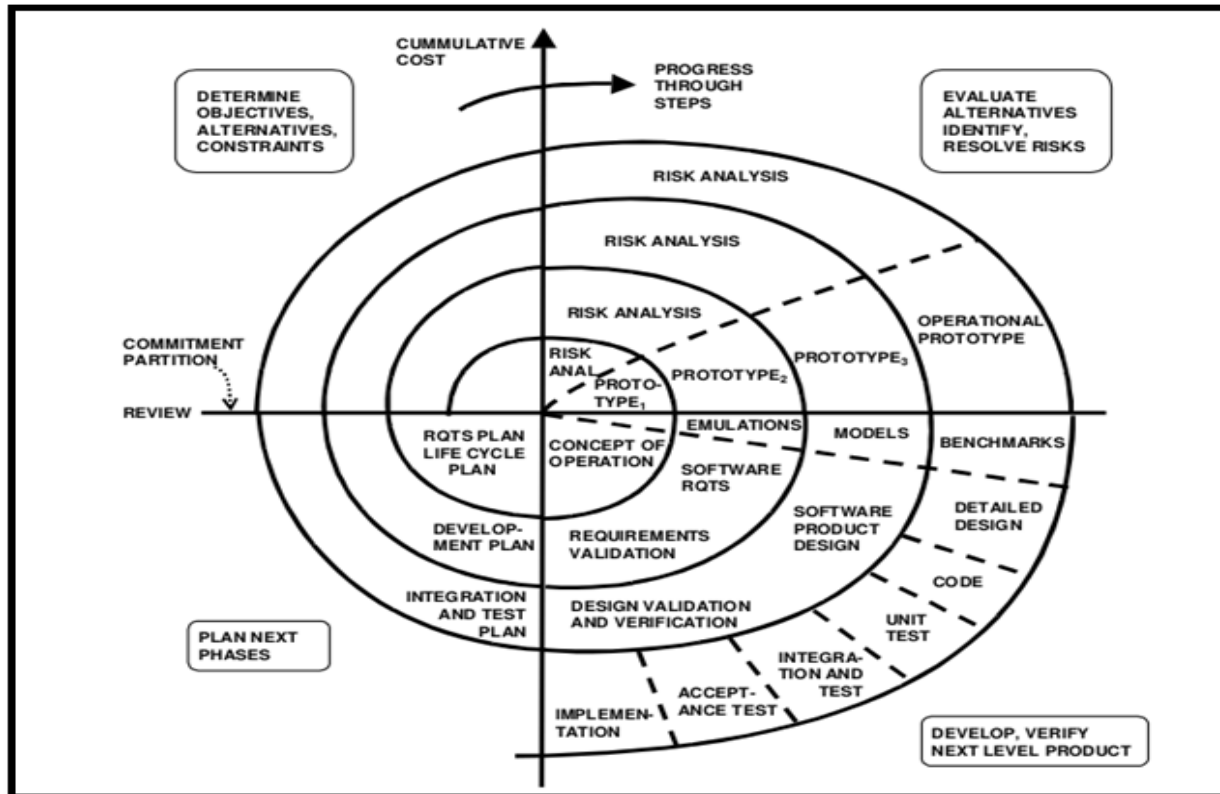


Fig 6: Spiral Method explained

Comparison

Waiters on Wheels is a growing company which means that the project to be completed would be large and complex to a certain extent. Spiral methodology is well suited for the development and testing of large complex projects. The Spiral methodology is cost effective and provides better risk management as it incorporates risk analysis as a phase in the development cycle. This helps remove and avoid any potential risk. It allows for modification and changes that may occur in the middle of the development throughout the project documentation. The project is not developer centered and input from the user is very much significant to the progress, therefore spiral methodology permits customer feedback and input for a developed code. (Christina, 2019) Due to the use of prototypes in this methodology which are all close to the final system, the customer gets the opportunity to review the system early in the development and provides useful feedback and input.

There are many methodologies available and can be applied to the project but there are no one size fits all methodologies. The choice is highly influenced by the needs of the customer and if the project at hand is extremely large, The Spiral methodology is well suited for application.

6.3. SYED MEHDI AHMED ABIDI TP050431

NAME:	SYED MEHDI AHMED ABIDI
TP:	TP050431
METHODOLOGY:	INCREMENTAL METHODOLOGY

Incremental Methodology is a procedure of software development where requirements are divided into numerous independent modules of the software development cycle. In this model, every module experiences the requirements, design, implementation and testing the phases. Each resulting release of the module adds an additional function to the previous release. The process continues until the complete framework is accomplished.

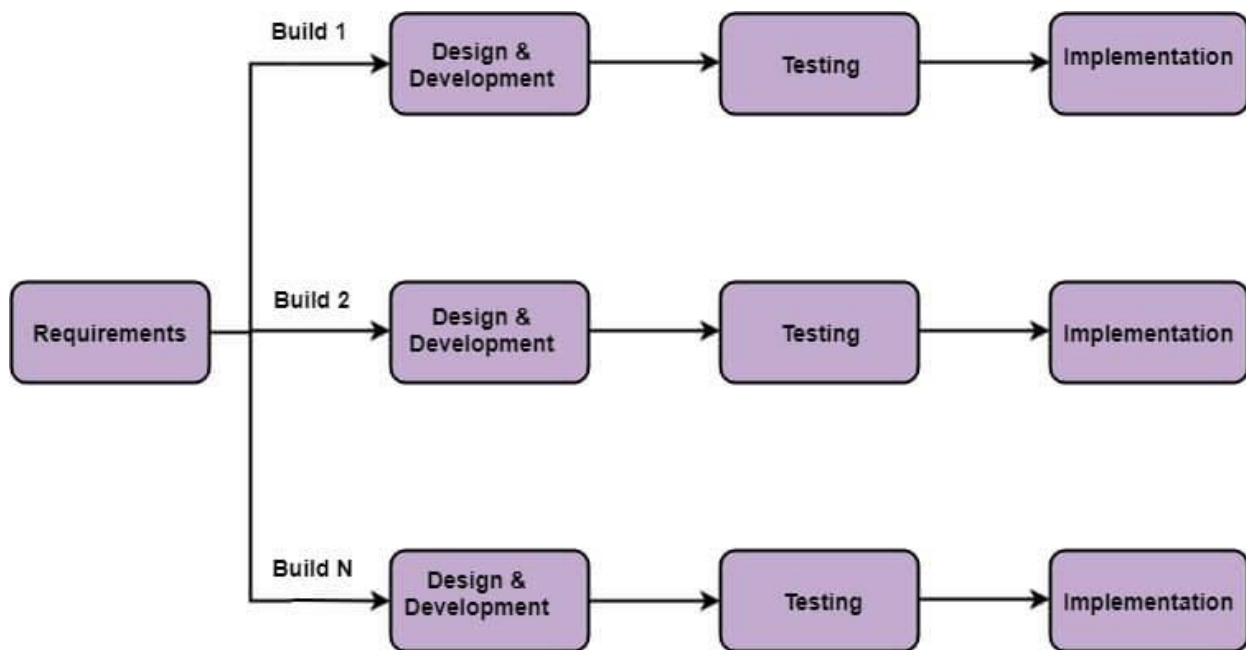


Fig: Incremental Model

There are four main Phases of the Incremental Methodology and they are the following:

Requirement Analysis:

In the primary phase of the gradual model, the product analysis expertise identifies the requirements, and the system functional requirements are understood by the requirement analysis team. To build up the product under the incremental methodology, this phase plays out a significant job.

Design and Development

In this phase of the incremental model, the design of the system functionality and the advancement technique are finished with success. When the software develops new practicality, the incremental model uses style and improvement stage.

Testing

In the incremental methodology, the testing phase checks the performance of the currently existing functions and all the additional functionalities that are added. There are various methods that are utilized to test the behaviors of all the functions.

Implementation

Implementations phase empowers the coding phase of the development system. It includes the final coding design that was structured and designed in the designing phase. After completion of the phase, the working product is enhanced and upgraded up its final functionality.

6.4. MUSTAFA SAIFUDDIN SHAMSHUDDIN TP050422

NAME:	MUSTAFA SAIFUDDIN SHAMSHUDDIN
TP:	TP050422
METHODOLOGY:	RAPID APPLICATION DEVELOPMENT

Rapid application development (RAD) methodology is adapted from waterfall methodology. Its focus is to develop an application in a short duration of period. RAD tends to follow iterative process and does not emphasize on the planning stage but rather focuses on prototyping. RAD methodology usually has a small team made up of domain experts, developers, customer representatives and IT resources working on their respectful prototype progressively. In RAD methodology the important modules are designed in parallel as prototypes and are incorporated to make the complete system for a quicker product conveyance. Considering there no any pre-plan devised changes can easily be implemented into the developing system. The most important point to implement this methodology is that the prototypes design should be reusable.

RAD model can be applied when:

- The system can be divided into small components.
- There is enough budget for using automated code generating tools.
- There are enough experts available.
- Changes are applied throughout the development stage.
- The deadline is between 3-4 months.

RAD methodology is divided into five main phases:

1. Business Modeling.
2. Data Modelling.
3. Process Modelling
4. Application Generation
5. Testing and Turnover

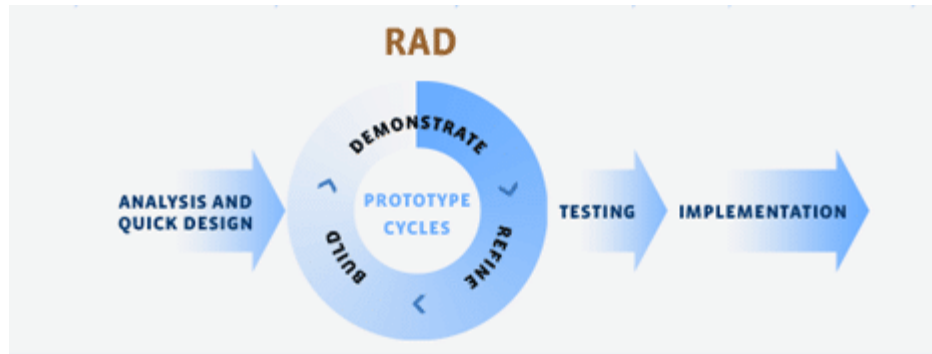


Fig 7: RAD Method explained

Business Modelling

This is where the project is initialized. The project manager allocates few of the team members to gather information on the company in this case it is Waiter on Wheels. The team members can obtain information by conducting a quick survey to the customers and finding out what are the problems they are facing as well as conduct interview of the staff to get the in sight of the current system.

Data Modelling

At this phase, every bit of information that was acquired during the Business modelling phase is analyzed. Once analyzed the information is grouped that can benefit the developers. The value of each grouped information is cautiously evaluated and given a precise description. Relationship between the functionality and its related group as defined in the business modelling phase is established in this phase

Process Modelling

In this phase the groups of information collected are transformed into the essential usable information. During this process optimizations and changes can be applied, and the grouped data can be further interpreted. Any descriptions for removing, adding, or changing the data objects are also designed in this phase.

Application Generation

This phase focuses on coding all the information that was gathered, analyzed and processed. Once the coding is completed the system is used to develop a prototype. The Data models designed are converted into genuine prototypes which will be tested out in the next phase.

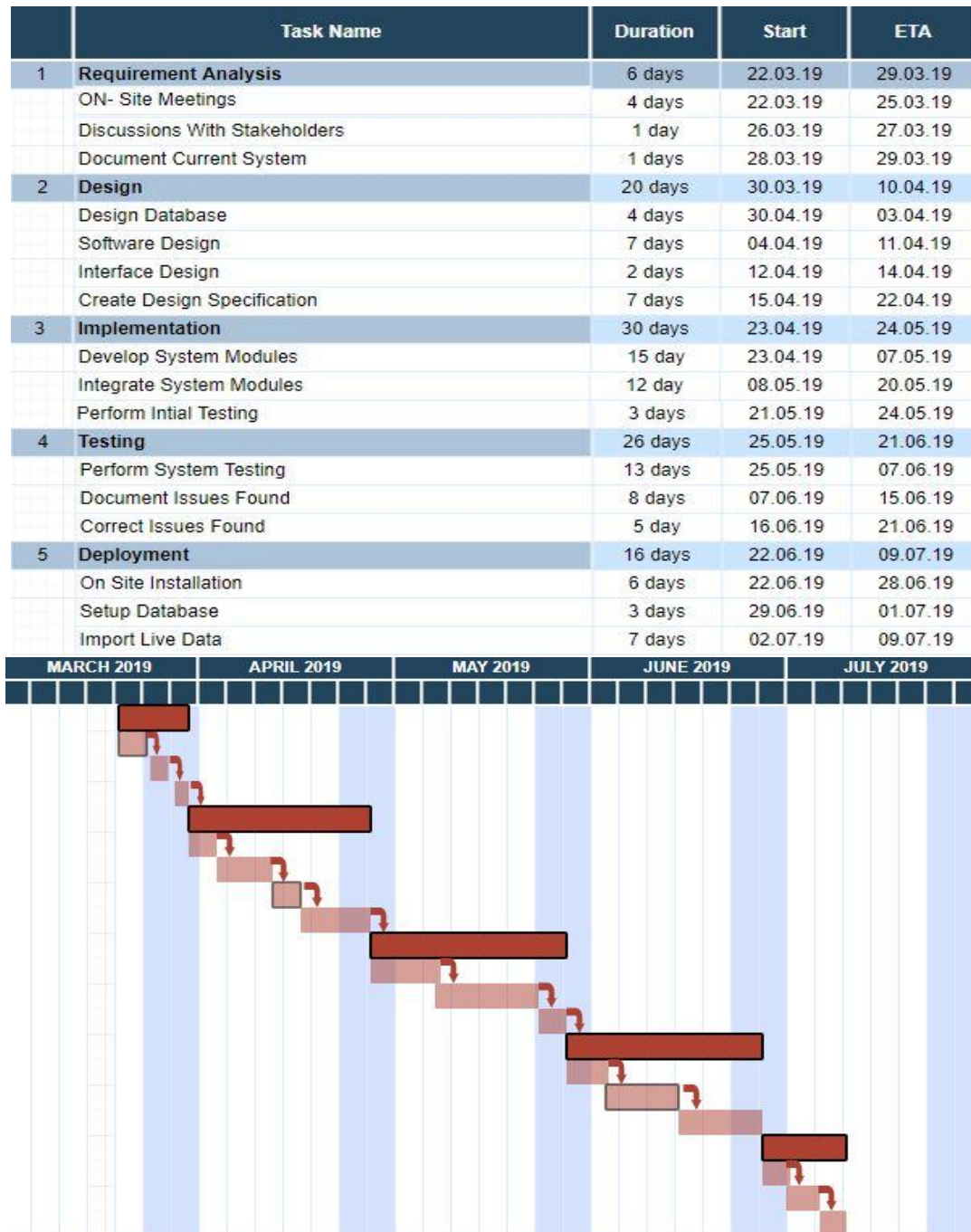
Testing and Turnover

This is the last phase of RAD methodology it focuses on reducing the overall testing time of the prototypes designed. Each prototype is evaluated separately to detect and adjust the components quickly to produce the most effective product.

As a conclusion for waiters on the wheels RAD methodology is the best option as they require the new system as soon as possible since their business is expanding on a daily basis. If another method is used it will be time consuming as proper planning has to be done. Furthermore, since the system is not a large-scale system RAD can easily be applied to design by breaking it down into small parts and each team can focus on one part making the most effective system. Lastly, the clients (waiters on wheels) can interact with the developers and give feedback on the prototypes and guide the developers on how they want to personalize the system.

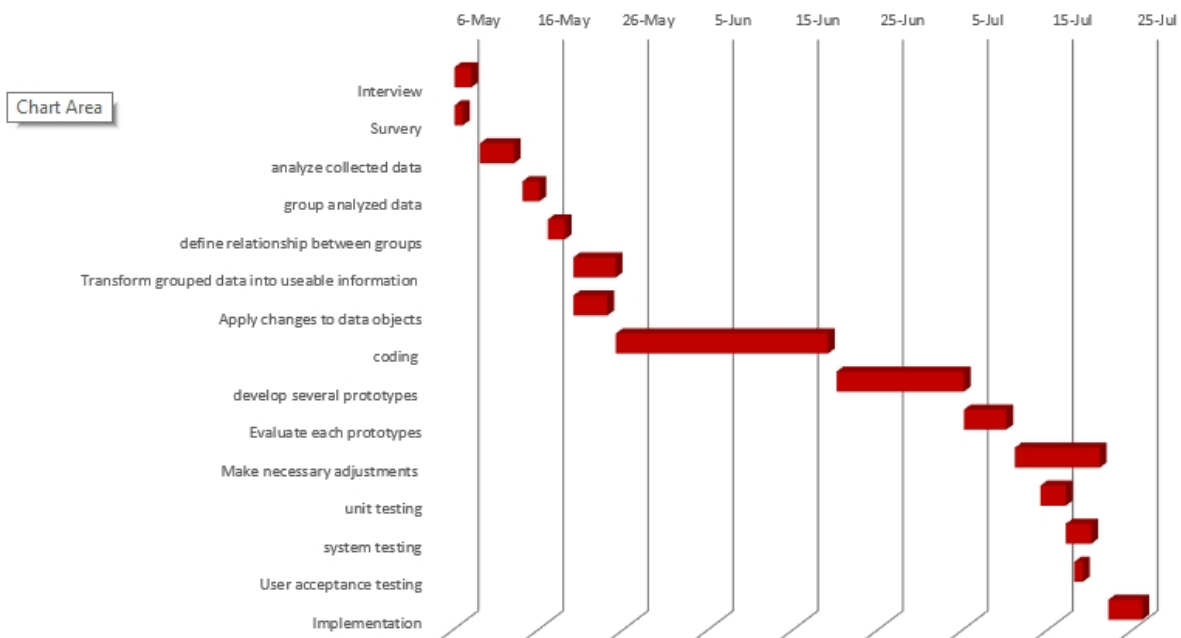
7. PROJECT SCHEDULING

7.1. MUHAMMAD SARMAID AIDRUS TP050751



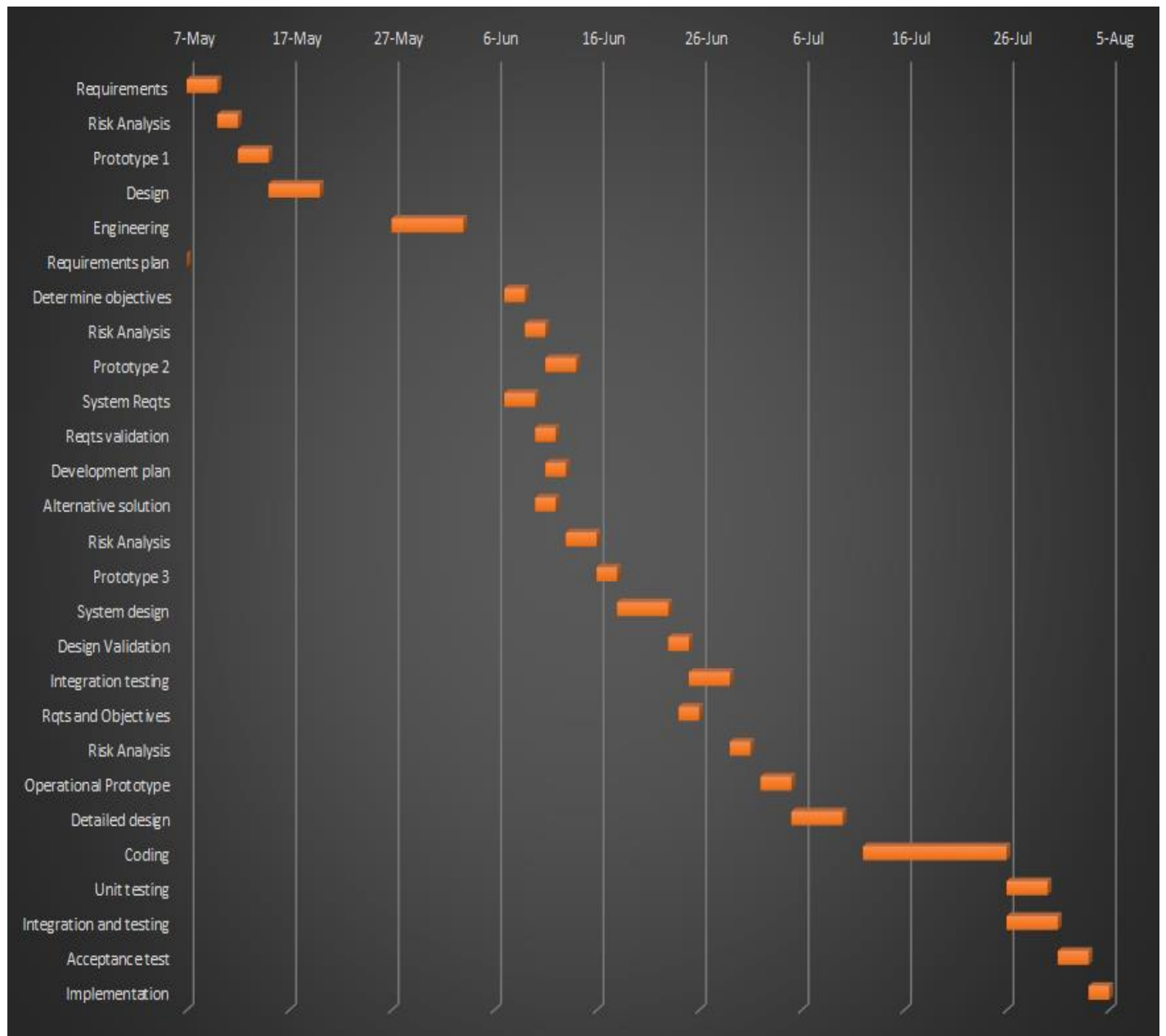
7.2. MUSTAFA SAIFUDDIN SHAMSHUDDIN TP050422

Activity	Duration	Start Date
Interview	2	6-May
Survey	1	6-May
analyze collected data	4	9-May
group analyzed data	2	14-May
define relationship between groups	2	17-May
Transform grouped data into useable information	5	20-May
Apply changes to data objects	4	20-May
coding	25	25-May
develop several prototypes	15	20-Jun
Evaluate each prototypes	5	5-Jul
Make necessary adjustments	10	11-Jul
unit testing	3	14-Jul
system testing	3	17-Jul
User acceptance testing	1	18-Jul
Implementation	4	22-Jul



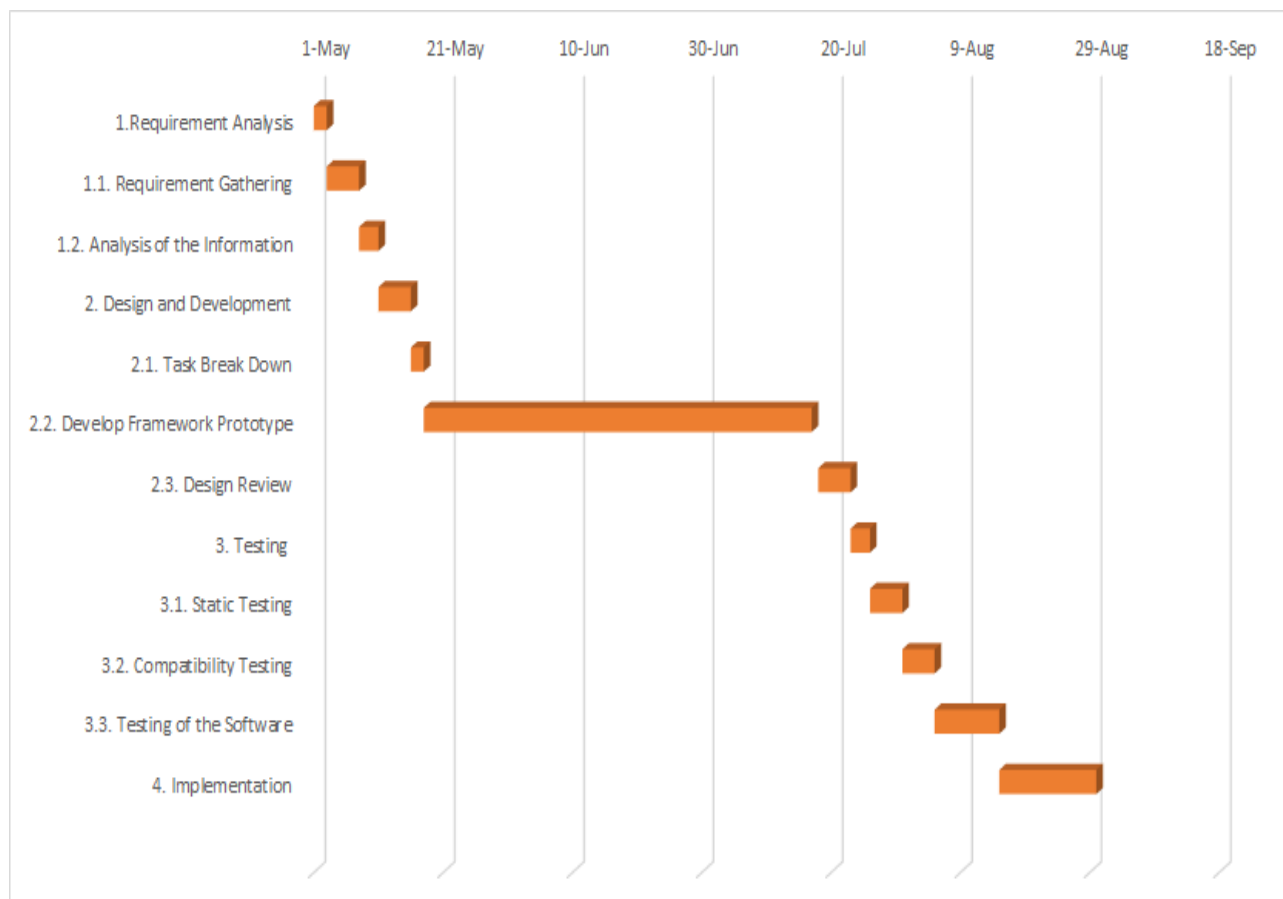
7.3 SHARON WUTETE TP050904

Activity	Duration	Start Date
Requirements	3	7-May
Risk Analysis	2	10-May
Prototype 1	3	12-May
Design	5	5/15/2019
Engineering	7	5/27/2019
Requirements plan	2	5/5/2019
Determine objectives	2	7-Jun
Risk Analysis	2	9-Jun
Prototype 2	3	11-Jun
System Reqts	3	7-Jun
Reqts validation	2	10-Jun
Development plan	2	11-Jun
Alternative solution	2	10-Jun
Risk Analysis	3	13-Jun
Prototype 3	2	16-Jun
System design	5	18-Jun
Design Validation	2	23-Jun
Integration testing	4	25-Jun
Rqts and Objectives	2	24-Jun
Risk Analysis	2	29-Jun
Operational Prototype	3	2-Jul
Detailed design	5	5-Jul
Coding	14	12-Jul
Unit testing	4	26-Jul
Integration and testing	5	26-Jul
Acceptance test	3	31-Jul
Implementation	2	3-Aug



7.4 SYED MEHDI AHMED ABIDI TP050431

Task	Start Date	Days to Complete
1.Requirement Analysis	1-May	2
1.1. Requirement Gathering	3-May	5
1.2. Analysis of the Information	8-May	3
2. Design and Development	11-May	5
2.1. Task Break Down	16-May	2
2.2. Develop Framework Prototype	18-May	60
2.3. Design Review	18-Jul	5
3. Testing	23-Jul	3
3.1. Static Testing	26-Jul	5
3.2. Compatibility Testing	31-Jul	5
3.3. Testing of the Software	5-Aug	10
4. Implementation	15-Aug	15



8 APPENDIX

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