# Section A-Problem Context – what is the situation?

In the present world, Information System and calculations plays a very vital role in every place. Every real world problem can be linked as an entity and the corresponding relationships can be defined in between.

Beacon is responsible to solve the complexity of the problems and system of any logistics company. Its solves the mindjolting and tedious tasks automatically using its advanced algorithms and data flow design .Some of the complex problems like TSP (travelling salesman problem ) CLP (container loading problem ) can’t be solved manually or any other way .Beacon keeps everything organised ,updated ,smart and accessible .

#### Description of the problem area: -

* To enter data of the goods to be transported and organizing the relationships between data is a complex and time-taking tasks. Every goods from nail to big industry parts are needed to be logged into the system with its specifications and related data .What are the materials going to transfer in which container and vehicle.
* The information related to the goods, transported like basic price of goods, charge of transportation,value,size,weight,owner,destination, insurance papers etc. This data are needed to be arranged in the normalized manner to solve the data redundancy and availability.
* Deployment of system in the cloud platform like Google app engine forreliability, security and performance from third party infrastructure .Automatic scalability matter when there are increasing number of users and data.
* Efficient algorithm for solving the TSP with the facility to import map or create a weighted graph . To solve the problem with the advanced genetic algorithm is also a tedious and brainy task that includes various constraints like time, amount of goods, traffic etc.
* Second most important algorithm need to generate to solve CLP of ships. To generate whole new algorithms is the research part in the project .Also the system is responsible to generate 2D/3D graphs to show the efficient container loading .This features include a high level of challenge and skills.
* Implementing the unique ID generation for the transport and the goods is also a challenge, these Ids can be used to track and update the status. Also small mobile app can be used for the customer of the company to manage their goods.
* Features like language support and import of data through excel sheets, interactive reports are also the problem areas which are not clear.

Setting an example - Kumar Saheb is a famous business man fromIndia. His company exports various things like natural resource (coal, iron ores, etc), agriculture product,couriers, vehicles and everything from ships and trucks. He needs to cut the expenses from the TSP and CLP problem in the system .Company can saves thousands of dollars if theyhave efficient algorithms for the best loading and supplying .And also they need the interactive system to deal with the various constraints ,data and reports of every transportations.

## Rationale behind the system: Why do we need this project?

As obvious from the problem context presented above the situation warrants such a system that helps reducing the complexity , solve the TSP , CLP problem that is impossible to solve in any manual way or by supercomputers . In TSP and CLP the problem grows exponentially fast in every turn that makes its unsolvable when the inputs of data is high. When the destination in TSP is more than 20 or in CLP .It’s very tough to create the optimal solution for the system.

Beacon will solve the problem as its inputs the data in the validated manner with all possible constraints and then it’s creates an automatic loading graph and then travelling graph .This task are done in minutes which is impossible to do as manual or computationally. It is increases the efficiency of the system. Plus Beacon also generates the interactive and customgraphs,bill and other documents. Other stuff is the customer of the company is also benefited with the unique Id plan.

Setting an example: A company like DHL is known for exports/imports business and they need the system to plan, organize and track the goods. Beacon is perfect in this situation .It’s also has small mobile app for users to track the products.

### Benefits of the system

The system implemented could bring about significant tangible and intangible benefits. Given below is a list of tangible and intangible benefits expected from the system:

#### Tangible Benefits

***Reduced Complexity of Problem***- This system generates the optimal solution that seems impossible to solve manually or technically .TSP and CLP problems are being solved with the most efficient problem solution being designed and implemented by developer.

***Graphical view of route and container loading*** – The system will generate 2D/3D view of the containers to show the best loading graph in CLP and the best route graph in TSP. Its gets easier to load container using graph and route map makes the route clear.

***Organised Data and accessibility*** – The Data of every container is very much organised and validated during entry and can be used to plan a consignment. Also every goods/material will gets easily to track as per the unique id provided .The status can be made available for the customer in the current time.

***Interactive Planning and work division***- The planning tools are provided for the system to plan and manage the consignment. The works are divided for every consignment as per the organizational structure of enterprise.

***Cost Benefits*** - Cost being “the most” important factor for any organization, it’s always beneficial to adopt cost-cutting or cost-saving measures. With Beacon, cost benefits come in following ways-

Most efficient route will be produced, results in precious fuel saving hence cost cutting.Best Container loading plan optimizes the overall loading with the ships and also maxims the number of container .Hence this reduces the administration and managerial overhead results into cost benefits

Effects of ERP in cost benefits are lowering the cost of products and services purchased, paper and postage cost reductions, inventory reduction,faster product / service look-up and ordering saving time and money and automated ordering and payment, lowering payment processing and paper costs.

***Time Benefits***- WithBeacon, the time of container loading reduced efficiently as everything will be decided by the system will be pre-planned. Report generation and task assignments are easier to discuss and also proper planning and scheduling make the most out of work in minimum time. Trucks and ships save time by going through the shortest path provided results in more resource availability. **For Example:**More the trucks reduce the time of travelling; more the loading of trucks will be possible. Also the container loading takes the minimum time in ships.

#### Intangible Benefits

***Increased Employee /Enterprise productivity*** – With employee being aware about the task and work division among the organisation results into employee task productivity.**For Example** – The Work load is very much reduced by the algorithms of TSP /CLP and also the planning tool makes the productivity easier .The Consignment planner can easily arrange every box and goods.

***Increased work flexibility and easier to understand and operate –*** The work load assigned are easier to plan and manage and keep track of the work progress .Also the ERP makes easier to understand the problem statement and to organise and plan the things based on different constraints.**For example -** Desirable production and better planning can be targeted as the vision of the project.

***Increased customer satisfaction -*** All organizations churn out some services whose final consumer is the customer .With Beacon promising to deliver so much for improving the productivity and uptimes for the businesses they are surely going deliver more better results for their end customers thereby promoting customer satisfaction and customer loyalty thereby increasing business for the organizations. **For Example:**An android based mobile application or functions can be declared to make use of the status of the goods and can be share to a third party tool.

### Description of Problem Area

As depicted by the previous section above the problems are pretty clear. Here is a complete list of problems which have been produced:

* **Complexity of the problem solving approach in TSP** –To conclude the best path or the shortest path for travelling is very complex for enterprise.
* **Complexity in create 2D/3D view of the containers with proper algorithm** – Packers people can’t solve this solution manually.
* **Extra cost incurred -** The bad design and wrong route map increases the cost of the consignment as more resources are being used for less goods transportation.
* **Very Large no of supply –** It is complex to plan, organize and track each materials.
* **Low Employee Productivity-** Due to improper tools, the employee productivity was low.

### Target Audience

This system is being developed primarily for:

**Shipping Companies/SMEs /Courier Company** - Organization who manages a large supply or export/import packages to move on.

**Skilled People targeted** – Package planner, Package Loader, Insurance People, Manager, Accounts. The system also targets different worker of same enterprise according to work divided.

**General/Typical Users -**Any person who wants to control their data can use the system.

**Research peoples and Students** – The advance algorithm and problem solving techniques can be used in academics and research.

## NATURE OF CHALLENGE

The development of Beacon calls for numerous challenges to be faced by the developer which includes learning curve of new concepts, learning new development tools, mastering already known tools, domain analysis, new programming languages etc.

### NEW CONCEPTS, THEORIES AND TECHNOLOGIES TO BE LEARNT

**Genetic Algorithm and Optimization approach –** The advanced genetic algorithm and simulated annealing approach need to be derive to solve the complex problem of TSP and integral optimization algorithm will be used to solve the CLP problem.

**Implementation of Algorithm and complexity –**The implementation of algorithm using data structure, derive mathematical expression and actually implement it is tedious task. It’s require a learning curve to generate a whole new optimize algorithm considering space and time complexity.

**2D or 3D graph –**To generate 3D graphs for the container requires knowledge of multimedia and it should be depends on the variable of algorithm generated to solve CLP or marine loading .

**Cloud Architecture** / **Multiplatform -**  Since the application may be deployed on cloud to be used by different users or targeted to a single company .It require knowledge of SaaS (software as a service). Windows, Unix and Mac needs to be familiar to the developer to make the system that works on all the Operating System .

**Interactive Graphs -** Interactive graph and technique will be required in order to effectively show the planning and working of the system.

### PROGRRAMING LANGUAGE SKILLS

*C# - To implement TSP and CLP*

*Android Technology –*Small mobile application can be used to keep track of the goods, this requires the knowledge of Android.

### DEVELOPMENT TOOLS TO BE LEARNT

*Microsoft Studio 10 and development framework 4.0*

*Oracle Database 10g*

*Eclipse .*

# Section B – Brief description of project objectives.

**PROJECT GOAL-**  The primary aim of Beacon is to provide the Container Loading in Marine and the efficient path detection for the transport .Planning , organising ,directing and tracking of the goods is also required .

**PROJECT OBJECTIVES**-

1. To learn advanced programming techniques, software engineering principles, project management concepts, advanced algorithms and integration of varied technologies.
2. Learn about domain area, i.e. Genetic algorithms.
3. To implement the knowledge gained in Objective 1 to develop such a system which leads to goal mentioned above.
4. To make efforts to ensure that the system being developed will fulfil all the tangible and intangible benefits mentioned in the previous section.

The Proposed system intends to allow engineers to manage their container loading provided with the unique id of every container .The system manages all the data using an integral optimum methods to organise them as the weight remain same and the overall container loading doesn’t affect the balance of the ship or anything .In second stage it provides the route map of the ship. All the input data are verified and validated with unique Id . Custom report generation and automatic billing, insurancepapers ,consignment ,language support , data entry through excel and other are some small features . Also the small mobile app use the functions to track the status of the goods material that can be used by third party tools .The important feature of the system is the graph generation of the container loading in 2D/3D.

The modules for the proposed system have been listed below:

***Software Module :*** This module will be installed on desktop machine of the organization .Different software are divided mainly for data entry , container loading and route map and report generators. Automatic Synchronization is the feature.

***Web Module :*** This module also contains all the functionalities which is hosted in some domain and accessible 24/7.Also , one can import the data and graphs from the desktop. Data will be synchronised automatically.

***Mobile Module****:* This will be the small application used from android mobile that is used to track the status of the goods materials .The function can be used to distribute information to 3rd party customer .For example: Shipping company is providing courier of some courier company , then this function automatically send updates to courier company .

## Functionalities to be implemented

CORE FUNCTIONALITIES

|  |  |
| --- | --- |
| Functionality | Description |
| Data entry and Unique ID | The information about each goods and container need to be logged in the system with unique identification. |
| Algorithms for CLP | Integral Optimal Algorithms for CLP that provides the maximum container loading and ship balance. |
| 2D graph for CLP | 2D graph for the CLP used for reference during loading |
| Algorithms for TSP | Genetic Algorithm, simulated annealing or Ant Colony Optimization (ACO )to determine the shortest and the best path for transportation. |
| Interactive Reports | Interactive and Customizable Reports of loading , bill ,insurance and other reports |

ENHANCED FUNCTIONALITIES

|  |  |
| --- | --- |
| Functionality | Description |
| Language Support | Different Major Language Support for the system. |
| XML Data Entry | Data entry through excel sheet. |
| Interactive Document Production | Automatic and downloadable Insurance , Bill , Transport Agenda and other report generation |
| Mobile Module and Status | Function and application for mobile technology can be used by 3rd party or customers. |

SPECIAL FUNCTIONALITIES

|  |  |
| --- | --- |
| Functionality | Description |
| 3D view of container loading | Total 3D view of the loading structure of ship and containers |
| Cloud based software | Cloud based, multiuser software deployed on some application engines. |
| Route import // or Google Map integration | Google map integration in the system for best route determination. |

DELIVERABLES OF THE PROJECT

The following is a list of minimum deliverables expected to be fulfilled:

1. SRS
2. Documentation
3. Set-up Files
4. User Manual

LIMITING THE PROJECT SCOPE

The developer intends to develop the system with the above mentioned features and functionalities taking the time constraint into account.

* The System does-not include any automatic entry technique like RFID.
* The system uses the maps as weighted graphs not the real map.
* No GPS support is provided with the system.
* Storage Management are not discussed in details. Backup, restore, and other integration generally happen in any Organisation.
* Simulation is not provided that define the actual route of travelling in video form.

# Section C-Brief description of the resources needed by the proposal

LIST OF USERS FOR USER REQUIREMENTS

The System includes data entry, planning, organising, loading and routing .For each steps there need are going to primary users who are of concern. But more specifically the following list of people with role depending on the organization they are employed by need to be interviewed at various stage and by various means in order to produce a reliable set of requirements. The list may include:

1. Manager
2. Planner
3. Data entry staffs
4. Package Loading engineer
5. Route map staff
6. Accounts and bill staffs
7. Higher Management like General manager
8. Typical Users.
9. System Admin

The following data gathering methods would help in extracting the needed information from the above users:

1. *Research:* Research is going to be the primary fact-finding method to be utilized by the developer mainly for algorithms. Research areas are going to range from the online web to journals, magazines, e-books and white papers. Journals of IEEE are accessed for ant colony optimization ACO, TSP, CLP and genetic algorithms.
2. *Interview:* Developer is planning interviews sessions with the peoples involved in different logistics business, analysts, students and technical peoples of various organizations in order to seek knowledge about problems with current software and procedures.
3. *Questionnaires:* Appropriate questionnaires specifically targeted need to be developed in order to generate a consensus over the exact look and feel of the final system.
4. *Ethnography:* The developer plans to himself experience firsthand about the working ,functioning ,techniques and approaches involved in the solving criteria of two problems and proposed solutions,
5. *Studying Documentation:* The developer will be engrossing himself with white papers and documentation of some existing genetic algorithm approaches and tools which may become a good source of information for system related queries.

HARDWARE RESOURCES

The following is the list of the hardware resources required for developing and running the system:

*For developing the system*

1. *CPU:*2.0 GHz Pentium IV or above,
2. *Memory:*RAM 4GB
3. *Disk Space:*15 GB space(at least)
4. *Monitor:*Any Standard Monitor
5. *Peripherals:*Mouse, Keyboard

*For running the system*

1. *Same system*
2. *Cloud Application Engines*
3. *Web Server and Database Server*
4. *Java compatible mobile device.*

SOFTWARE RESOURCES

The following is a tentative list of software resources that the developer seeks to utilize:

1. *Operating System :*Windows® 7
2. *Server:*Apache Tomcat 5.5
3. *Software Development Tools:* NetBeans IDE 6.8
4. *Project Management Tools* : Microsoft Project, Visio2007
5. *Case Tools:* Smart Draw, Visual Paradigm6.0
6. *Graphic Design Tools:*Adobe Photoshop CS4
7. *Web Browser:*Internet Explorer(8.0+), Opera (11.0+), Mozilla Firefox(3.5+), Google Chrome(5.0+)
8. *Presentation Tools:* MS Word 2007, MS PowerPoint 2007

# Section D- Academic research being carried out and techniques being learnt

RESEARCH PLAN

There are varied areas in which research has to be accomplished in order to derive some deductions during the development of the proposed system. This system is going to involve all three kinds of research namely, Primary, Secondary and Academic research. Following areas have been shortlisted which needs to researched:

1. Key Concepts Genetic Algorithms and Greedy approach
2. Concepts of Implementation of Graph theory with data structure
3. Fundamentals of Socket programming
4. Database concepts
5. Vb.net /ASP.net Programming Languages
6. Android Technology
7. Maya for 3D graphics
8. Software Methodology and Software Engineering
9. Human Computer Interaction Principles

Algorithmic and Genetic Algorithms

*Books:*

* + 1. Clifford Stein,Thomas H. Cormen,Charles E. Leiserson,Ronald L. Rivest ,2010,Introduction to Algorithms ; Massachusetts USA: PHI Learning.
    2. David E. Goldberg ,1989, Genetic Algorithms in search, Optimization & Machine Learning, 1/e; USA ; Pearson Education

Database and Data structure

*Books:*

* + 1. Kevin Loeny,2004 , Oracle Database 10G The Complete Reference ; New York: McGraw-Hill

Software Methodology and Software Engineering

*Books:*

* + 1. Daniel MB(ed) 2008, Software Engineering for Modern Methodologies and Technologies, IGI Global, USA
    2. Shari LawerencePfleeger (2002). Software Engineering; 2nd Ed; New Jersy: Pearson Education.
    3. Jeffry L Whittem, Lonnie Bentley (2005). System Analysis and Design; London: McGraw-Hill.

*PDF- ebooks:*

* + - 1. <http://www.sdprocess.com/pdf/S1-Kruchten2004Toronto.pdf>
      2. <http://www.relativitycorp.com/projectmanagement/article1.html>
      3. <http://www.buzzle.com/articles/waterfall-model-advantages-and-disadvantages.html>

White Paper and Journals

1. A Guide to the Project Management Body of Knowledge (PMBOK ® Guide) By Project Management Institute.
2. Approximation Algorithms for Deadline-TSP and VehicleRouting with Time-Windows by Nikhil Bansal.
3. Hybrid binary ant colony algorithm for container loading problem by Yuan Junliang

*White papers on:*

* Genetic Algorithms.
* Travelling Salesman Problem.
* Container Loading Problem.
* General Whitepapers.

# Section E- Brief description of the development plan for the proposed project.

A development plan is necessary for accomplishment of every software development project. The development plan works as map providing a set of guidelines that help us capture milestones and achieve deadlines. To begin with a software methodology has to be selected. A software development methodology refers to the framework that is used to structure, plan, and control the process of developing an information system. The sole purpose of software development methodologies is to improve the management and control of the system development process, structuring and simplifying the process, and standardizing the development process and product by specifying activities to be done and techniques to be used.

SPECIFICATION AND REASON FOR SOFTWARE METHODOLOGY

The success of the proposed system relies to a large extent on the fact that whether the software methodology selected for its development was suitable enough or not? Whether it was compatible or not? A wrong selection can bring a downfall to even the best of ideas. Whereas on the other hand a correct methodology can lead to success by providing a framework in which the development process thrives and is efficiently managed. With so much at stake, the developer had to carefully analyse, decide upon a suitable methodology. The developer started the selection process with a target of selecting such a methodology that meets specific scope, time, resources, goals, quality and the needs and expectations of its target users (administrator, typical user, students & managers) and organization according to the information obtained from primary research. A wrong selection of methodology could have serious outcomes like delay in the completion of the project, errors in the software created and sometimes even total failure of the project. Hence, a lot of research had to be done before a methodology was finalized.

During the research the developer discovered that some methodologies address certain issue well, but have weaknesses in other aspects. In order to clarify things, a comparative study was made on the most common development methodologies. After the analysis was made the developer came up with the following deductions:

Waterfall Model: The waterfall provides an orderly sequence of development steps and helps ensure the adequacy of documentation and design reviews to ensure the quality, reliability, and maintainability of the developed software.

Critical principles of a waterfall methodology:

1. Work is done in stages,
2. Content reviews are conducted between stages, and
3. Reviews represent quality gates and decision points for continuing.

Rapid Application Development:Key objective is for fast development and delivery of a high quality system at a relatively low investment cost. Uses iterative prototyping, active user involvement, computerized development tools like GUI builders, Computer Aided Software Engineering (CASE) tools, Database Management Systems (DBMS), fourth-generation programming languages, code generators, and object-oriented techniques;

Prototyping: Prototyping is not a standalone, complete development methodology, but rather an approach to handle selected portions of a larger, more traditional development methodology. It Attempts to reduce inherent project risk by breaking a project into smaller segments and providing more user involvement throughout the process, which increases the likelihood of user acceptance of the final implementation.

Spiral: Focus is on risk assessment and on minimizing project risk by breaking a project into smaller segments and providing more ease-of-change during the development process, as well as providing the opportunity to evaluate risks and weigh consideration of project continuation throughout the life cycle.

Incremental Model:This approach involves breaking the application into small components which are then implemented and delivered in sequence.

JUSTIFICATION

After some deliberation and discussion the developer settled upon using Waterfall Model for the development of this system. The most tempting factor for selection of Waterfall model is the freezing of requirements. With the submission of Project Specification Form (PSF) the developer has fixed the requirements and there will no looking back. Always one activity is performed at a time.Verification at each stage ensures early detection of errors/misunderstanding. It is easy to track development. The phase wise division in case of waterfall matches with the distribution of our FYP modules. In the initial phase only research and design needs to be done as is the case with our FYP modules. Implementation will be started only after completion of designing phase that is our next semester FYP subject. Project is released to the supervisor near the end of the software life cycle or semester.

Another important reason to choose waterfall model is that it is document driven; documentation is produced at every stage. Waterfall model is a well-organized process model which will lead to a concrete, more secured and reliable software.

Not much risks are involved in this project, which is concurrent to the fact that waterfall model too does not involve much risk assessment. Spiral model, Prototyping model and Incremental model are chosen specifically when user requirements are not clear and risk is involved. As parameters are already defined in this application it is not advisable to go for other software development methodology.

DEVELOPMENT PLAN

Here is the specification of tasks to be performed during various stages of the project, with possible duration for the outlined tasks:

Start Date: August, 2012

Duration : 36 Weeks

End Date: April, 2013

1. Project Definition

Estimated Duration: 1 weeks

Tasks:

* Submission of Abstract Draft Proposal.

1. Project Planning and Research

Estimated Duration: 3 weeks

Tasks:

* + Project Proposal Form
  + Work Breakdown Structure and Time Estimation
  + Prepare Schedule
  + Gantt Chart

1. Requirement Analysis

Estimated Duration: 12 weeks

Tasks:

* + Identify Project Specifications
    - Project Background
    - Resources Required
    - Goals and Objectives
    - Determine System Functionalities
    - Identify Scope of Research
  + Project Specification Form
  + Data Gathering through Academic and Primary Research
    - Algorithms and Techniques
    - Human Computer Interaction
    - User Requirements
  + Analysis
    - User Modelling and Profiling
    - System Analysis
    - Domain Analysis
    - Risk analysis

1. System Design

Estimated Duration: 5 weeks

Tasks:

* + Navigational Design
  + Abstract Interface Design
  + Architectural Design

1. Production and Implementation

Estimated Duration: 7 Weeks

Tasks:

* + Code generation
  + Module Integration

1. Testing and Evaluation

Estimated Duration: 7 weeks

Tasks:

* + Test Plans
  + Unit Testing
  + Integration Testing
  + System Testing
  + Critical Evaluation
  + Release for Beta Testing
  + Making Necessary Changes

1. Project Ending

Estimated Duration: 3 weeks

Tasks:

* + Final Submission
  + Presentation and Demonstration

ON-GOING ACTIVITIES

* Schedule and Risk Management
* Resource Management
* Quality Management

THE HARDEST TASK AND ITS DESCRIPTION

Here is a list of tasks that the developer thinks are going to be hardest during the development process.

*Research:* As the system involves integration of many different technologies, to provide solutions for varied problems, thorough study and findings should be made so as to adequately and properly address all problems.

*Deriving the best Algorithms for CLP : Using genetic algorithm technique ,deriving the pseudo code for the CLP considering various constraints is the toughest task according to the developer.On later stage implementing it on 3D graphs makes it more challenging .*

*Achieving Usability:* Even if project is developed correctly but if users do not accept the system, the project will be branded a failure. Therefore care will have to be taken to ensure acceptable levels of usability.

*Project Management:* Managing the project so that it is successfully completed within budget, schedule and fulfilling all the core functionalities is definitely one of the hardest tasks because there are always reasons which can lead to budget over-runs or schedule delays.

*Achieving Professional Standards:*Usually student projects are not able to achieve those professional standards seen in industry projects. Therefore it becomes one of the hardest tasks for the developer to try and maintain industry like professional standards.

# Section F- Brief description of the evaluation and test plan for the proposed project

TESTING METHODS AND TECHNIQUES TO BE USED

Testing is the process of exercising software with the intent of finding and correcting errors. The objective of the testing is to uncover different classes of errors and to do so with a minimum amount of time and effort. In order to provide highly acceptable and error free system, the system should have to face the testing procedure and evaluation of each and every module and functionality.

Testing is the process of executing a program with the intent of finding errors. Once the system is developed, testing will be performed according to test plan. The result of the testing is used for enhancement and correction of the system in the next iteration. The developer plans to use the following methods and techniques to perform testing mechanisms:

*Unit testing:* In unit testing each module or unit is tested. Unit testing will be done as soon as the code of a particular logic is done, to ensure that the logic works as per required. Unit testing is done during the implementation stage of the system. The project developer itself will be going to perform the unit testing.

*Tester:*Developer

*Black Box Testing*: After performing unit testing, developer will try achieving functional and non-functional requirements of the system. Therefore developer has decided to perform the black-box testing. Black Box testing also known as functional testing as it tests the functionality of an application as opposed to its internal structures or workings.

*White Box Testing*: On the next level, after performing black-box testing white box testing will be required for testing the certain modules. Actually white box testing is developer level testing which can only be done by the developer itself.

*Tester*: Developer

*Integration Testing:* Integration testing will be done to check integration of various modules of the system. The goal here is to see if modules can be integrated properly, the emphasis being on testing interfaces between modules. Integration testing can raise the problems related to the interfaces among program components before trouble occurs in final program execution.

*Tester:*Developer

*System Testing:* The testing will next proceed towards system testing where the software will be subjected to compatibility, security and performance testing. System Testing be conducted on the complete, integrated system in order to evaluate the system's compliance with its specified requirements.

*Tester:*Developer

*Alpha Testing:* After the completion of system testing alpha testing is done, where the functional requirements are evaluated to know whether the system is acceptable by a potential end-user. It is also called user-acceptance testing. It is done just before the public release of the system. It is done on the developer’s side.

*Tester:* Anyone on the Developer’s side

TEST PLAN

The test plan for the proposed system is as follows. The developer is going to be the primary tester for this application. Any external user if involved would be mentioned in the documentation at later stages.

Test unit specification: Container Loading

* Feature to be tested: The system should be able to generate the efficient plan and place for every container which is optimizing as a whole. Time and Space complexity need to considered.
* Approach for the testing: Black Box Testing
* Schedule: 3 day
* Pass/Fail criteria: Pass if “successful optimal graph generation” displayed otherwise fail.

Test unit specification: Best Route generation

* Feature to be tested: System should be able to generate the best efficient path .
* Approach for the testing: Black Box Testing
* Schedule: 3 days
* Pass/Fail criteria: Successful best route generation as a graph as a 2D model

Test unit specification: Unique ID and Status tracking

* Feature to be tested: Status and constraints are changed accordingly with unique ID.
* Approach for the testing: Black Box Testing
* Schedule: 1 days
* Pass/Fail criteria: successful status tracking through mobile application

Test unit specification: Full Application

* Feature to be tested: All modules are integrated and perform seamlessly.
* Approach for the testing: System and Integration Testing
* Schedule: 5 days
* Pass/Fail criteria: If all functionalities achieved.

SUCCESS CRITERIA OF THE SYSTEM

*Presentation Layer*: The layer of the application that provides the GUI.

*Success Criteria*

*Features to be tested*: HCIU Factors, HCIU Principles.

*Methods & Techniques*: Unit Testing, Integration Testing, Compatibility Testing

*Testers Involved*: Developer, End Users

*Business Layer:* It is the layer which processes the business models such as user authentication.

*Success Criteria*

*Features to be tested:* Correct Authentication, Validated entry,optimal output for CLP and TSP.

*Methods & Techniques:* Unit, Integration Testing, Boundary Value Analysis , Algorithms testing.

*Testers involved:* Developers, End Users

*Data Layer:* This layer houses the data used by the application or that is collected from the end user.

*Success Criteria*

*Features to be tested:* Data Redundancy, Integrity, Encryption, reliability.

*Methods & Techniques:* Unit, Integration Testing, Performance Testing

*Testers involved:* Developer