A PROJECT REPORT

ON

"SHORTEST PATH FINDING VISUALIZER"

Submitted in the Partial Fulfilment of the Requirement for the Award of

**BACHELOR'S DEGREE IN
COMPUTER ENGINEERING**

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CERTIFICATE

This is certify that the project entitled

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is a bonafide student of this institute and the work has been carried out by him/her under the supervision of **Prof. Prachi Nilekar** and it is approved for the partial fulfillment of the requirement of Savitribai Phule Pune University, for the award of the degree of Fourth year Bachelor of Engineering (Computer Engineering).

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ABSTRACT

Visualization is an efficient way to learn concepts faster than traditional methods. Modern technology enables the creation of e-learning tools, which also greatly contribute to the improvement of computer science education. The goal of this project is to create the Pathfinding Visualizer, a web-based e-learning tool that can be used to visualize the Shortest Path algorithm. Conceptual applications of the project are illustrated through implementations of algorithms such as Dijkstra's and DFS. This project aims to perform all these tasks with some knowledge of HTML, CSS, JavaScript, and the React framework. Since the final product is a web application, users can easily see and learn how the algorithm works. The ease of use of the project provides users with simple operating instructions. First results using the application promise benefits of this herelearning tool for students with a good understanding of the shortest path algorithm.

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Chapter 1

Introduction

1.1   Overview

Currently, e-learning is being promoted very strongly among from different fields. Modern technologies enable the development of visualization tools for topics such as various graph theory algorithms and their descriptions. The implementation of such e-learning tools is one of the most important prerequisites for the successful use of any e-learning system. Learning by visualization has been shown to help improve learning ability. Gives more autonomy to an individual's learning process. By providing a visual representation of what the destination node algorithms look like, applications aim to make them easier to understand.

A good algorithm visualization tool will bring the algorithm to life by showing the traversal of nodes through the and animating transitions from one node to another. One of the broader applications of graph theory is the determination of shortest paths in many practical applications such as maps, road networks, and robot navigation. Dijkstra's algorithm is used to demonstrate how the tool works. This is because it also works for weighted graphs. So, it takes longer to run than BFS.

This algorithm guarantees the shortest possible path. Moreover, using online learning methods instead of face-to face lectures has the power to reinforce learning in terms of improving student performance, increasing student satisfaction, and increasing student learning flexibility.

1.2   Motivation

Now a days e-learning is spreading widely. And students are grabbing the concept to fast. So, we decided to contribute to e-learning. As we are aware of algorithms, we find it difficult to learn. And most of the students don't understand and leave it without completing it. we have also gone through these stages of leaning algorithms and found it difficult.

Visualization is the best way to learn any difficult thing as per studies it is found that most part of can be grabbed from visualization The motivation behind this project is to investigate how operations on data structures are performed. Enable students to learn various algorithms through animation. Gain a clear knowledge of various data structures and operations on them. Makes learning data structures more interesting. The main goal of this project is to implement various sorting algorithms, prime number and binary search game systems. - Investigate and visualize the best and worst cases for each algorithm rule implemented.

1.3   Problem Statement

In recent years, we have seen huge growth in computer science education. There are many difficult topics in computer science , that are very complex to learn and in particular algorithms like shortest path algorithms, these are often hard and complex to understand. Modern technologies has proven to be a boon for learning process. Visual aids have been recognised as means to amplify learning capabilities of an individual. Visualisation makes understanding the explanation of a particular topic surprisingly easy. We seek to build such an e-learning tool ,using which one can learn path finding algorithms through visualisation of every step of working of algorithm. Features of the tool:

- Easy to use

- Ensure visualization better by adding animation

- Ability to add obstacles in the path

1.4   Scope of Project

- A recent study made by the World Economic Forum showed that after the United States, India has the largest number of online course enrollments with

more than 2,00,000 students. Reputed universities offer top-notch certified on-line courses, bringing world-class professors and instructors to impart learning to the students.

- Now a days every student is moving towards E-learning. As it make study easier.And in that studies found that visualization makes you understand any complicated thing earlier.

1.5   Methodology

1.Select an algorithm.

2. Add maze or bomb to the path.

3. Add a start node.

4. Add A destination node.

5. Start the algorithm.

6. It shows you the shortest path to the destination node.

Chapter 2

Literature Survey

2.1 Path Finding Visualizer Application for Shortest Path Algorithm

Author:Nikhil Yadav,Karishma Dhameja ,Prakhar Chaubey e-Learning is one of the best outcome brought forward by transformation of the internet. It has made users capable of gathering education and knowledge along with it fruitfully from different resources out there and effectively utilize it to learn and rapidly obtain up to date information. Different problems require different solution and similarly different types of e-learning include blending and informal learning, network-based learning. Both asynchronous and synchronous methodology of e-Learning are equally important. e-Learning is a modern solution to train and help workforce in acquiring required knowledge and skills which are needed to turn change into an advantage and create more opportunities. As a result, many corporations have realized that e-Learning can be used to help keep their employees stay updated with new advances and add new skills to keep providing better solutions and that synchronous tools should be used hand in hand with asynchronous environments to allow for 24*7 available learning model. e-Learning has been proven to be very effective in current situation of covid. e-Learning has made it possible to provide education anytime, anywhere. e-Learning can successfully replace Campus-based Classrooms and help in improving Student Performance

2.2 ALGORITHM VISUALIZER

Authors:Roshni Gurubaxani,Virat Kumar
Every software engineer should have a good understanding of DSA to develop efficient software. Visualizers have a good history of providing effective understanding to the users. Many algorithm visualizers have been developed over the years.

In 2008, paper "AlCoLab: Architecture of Algorithm Visualization System" concerns the style of script supported algorithm visualization systems for educational purposes, focusing on the support and the improvement that those systems provide in the process of teaching of an conceptual subject such as algorithms. In 2019, paper "Towards Developing an Effective Algorithm Visualization Tool for Online Learning" reports a work-in-progress research project at Athabasca University on developing an effective algorithm visualization tool for online learning.

2.3   Node Path Visualizer Using Shortest Path Algorithms

Authors:Deep Singh, Brahmbind Singh,Harleen Kaur
An important field of mathematical theory is that the mathematical study of the structure of abstract relationships between objects by means that of graphs (networks). though work of those constructions will be strictly theoretical, they'll be wont to model try wise relationships in several globe systems. one amongst most generally exploitation applications is determination of shortest ways in several sensible applications as: maps; automaton navigation; texture mapping; typesetting in TeX; urban traffic planning; optimum pipelining of VLSI chips; subroutines in advanced algorithms; telemarketer operator scheduling; routing of telecommunications messages; approximating piecewise linear functions; network routing protocols (OSPF, BGP, RIP); exploiting arbitrage opportunities in currency exchange; optimum truck routing through given hold up pattern.

2.4   ALGORITHM VISUALIZER

Authors:Barnini Goswami,Antriksh Gupta
Literature Review is needed to require the matter into concerns that can't be cleared within the past researches. several researchers attempt to interpret numerous quite conclusions and to boost those past results literature review is required. this literature serves several varied fascinating options, that forms the important background for the study and conducted a thought.

2.5   Comparison table for Literature Survey

Sr.No	Title	Year of Publication	Description
1	Path Finding Visualizer Application for Shortest Path Algorithm,	2021	One of the widely used application of graph theory is determination of shortest path in many practical application like maps,road networks and robot navigation.
2	ALGORITHM VISUALIZER	2021	Usually, in any explicit field of engineering, there is a customized way of visualization of data - graphs and trees are drawn as circles connected by line segments, number sequences could be visualized as collections of vertical bars, there are standard ways of drawing matrices, vectors, real functions, etc.
3	Node Path Visualizer Using Shortest Path Algorithms	2022	This field of analysis is predicated heavily on Dijkstra's rule for locating the shortest path on a weighted graph.
4	ALGORITHM VISUALIZER	2015	we are well aware of the fact that the more we do things ourselves and engage the more we tend to learn about a particular topic.

Chapter 3

Software Requirement Specification

3.1   Introduction

This software requirement specification (SRS) report expresses complete description about proposed System. This document includes all the functions and specifications with their explanations to solve related problems.

3.1.1   Problem Definition

To Convert Speech into Text and generate the Summary of that text. In some of the organisations they require a Summary report for a specific meeting, so out model helps to achieve the same.Text summarization extracts the utmost important information from a source which is a text and provides the ad- equate summary of the same.Text mining is a field that attempts to bring together meaningful information from natural language text.Automatic Text categorization and summarization is the process of assigning pre-defined class labels to incoming, unclas- sified documents.

3.1.2   User Classes and Characteristics

- Basic knowledge of using computers is adequate to use this application.

- Knowledge of how to use a mouse or keyboard and internet browser is necessary.

- The user interface will be friendly enough to guide the user.

3.1.3   Assumptions and Dependencies

- Assumptions:

    1. The product must have an interface which is simple enough to understand.

2. All the software such as React JS environment and VS code should be pre-installed and working.

- Dependencies:

  1. All necessary software's are available for implementing and use of the system.

  2. The proposed system would be designed, developed and implemented based on the software requirements specifications document.

  3. End users should have basic knowledge of computer and we also assure that the users will be given software training documentation and reference material.

3.2 Functional Requirement

3.2.1 System Feature (Functional Requirement)

Functional requirement describes features, functioning, and usage of a product/system or software from the perspective of the product and its user. Functional requirements are also called as functional specifications were synonym for specification is design. Provide User friendly Interface and Interactive as per standards.

3.3 Non-Functional Requirement

3.3.1 Performance Requirements

- High Speed :- System should process requested task in parallel for various action to give quick response. Then system must wait for process completion.

- Accuracy :- System should correctly execute process, display the result accurately. System output should be in user required format.

3.3.2 Availability Requirements:

- Application should be available 24 hours in order to provide access to user withoutany server down / fail.

3.3.3 Security Requirements

- Administrator will have full access to Application to resolve any issues.

- Normal user can use the application without any time requirements.

3.3.4 Software Quality Attributes

1. Runtime System Qualities: Runtime System Qualities can be measured as the system executes.

2. Functionality: The ability of the system to do the work for which it was intended.

3. Performance:The response time, utilization, and throughput behavior of the system. Not to be confused with human performance or system delivery time.

4. Security:A measure of systems ability to resist unauthorized attempts at usage or behavior modification, while still providing service to legitimate users.

5. Availability: (Reliability quality attributes falls under this category) the measure of time that the system is up and running correctly; the length of time between failures and the length of time needed to resume operation after a failure.

6. Usability: The ease of use and of training the end users of the system. Sub qualities: learn ability, efficiency, affect, helpfulness, control.

7. Interoperability: The ability of two or more systems to cooperate at runtime.

3.4 Security Requirement

In the past, security concerns were basically around network infrastructure layers. Currently, due to the growing use of networks and the Internet concept dominance, such as cloud computing, Software as a Service (SaaS), serious vulnerabilities are being discovered by attackers in the application layer. Therefore, the concept of application security layer emerged as an essential task in the development process. According to Federal Information Processing Standard (FIPS) (The National Institute of Standards and Technology (NIST), 2010) there are three security core principles that guide the information security area:

- Confidentiality: preserve the access control and disclosure restrictions on information. Guarantee that no one will be break the rules of personal privacy and proprietary information;

- Integrity: avoid the improper (unauthorized) information modification or destruction. Here is included ensure the non-repudiation and information authenticity;

- Availability: the information must be available to access and use all the time and with reliable access. Certainly, it just must be true for those who have right of access.

3.5 System Requirement

Chapter 4

System Design

4.1 System Architecture:

We see a significant gap between theory and practical understanding of algorithms. This is also true for shortest path algorithms and in particular for Dijkstra Algorithm. The main goal of the e-learning tool is to use it for studying known graph algorithms. Starting with the Dijkstra, other shortest path algorithms will also be implemented gradually. The main idea of the system is to provide an integrated educational environment to facilitate the learning process in efficient way. The Pathfinding Visualizer tool involves three steps: 1. Selecting Algorithm 2. Placing Nodes 3. Visualizing
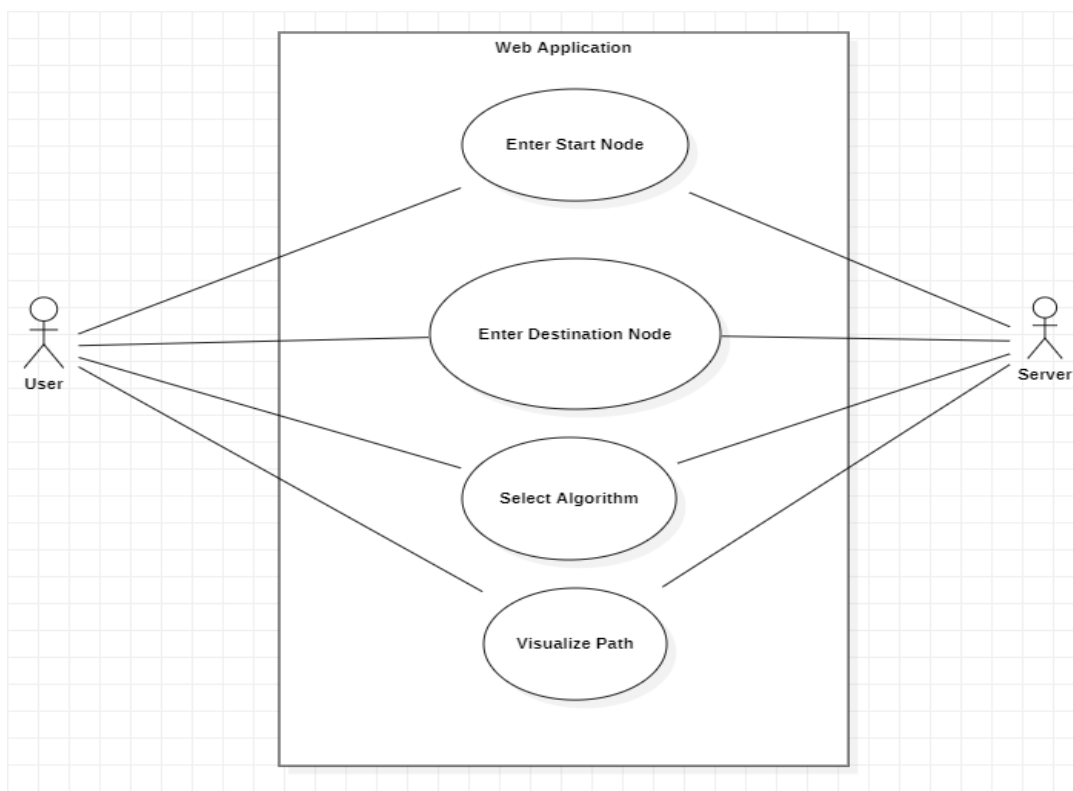

Figure 4.1: System Architecture
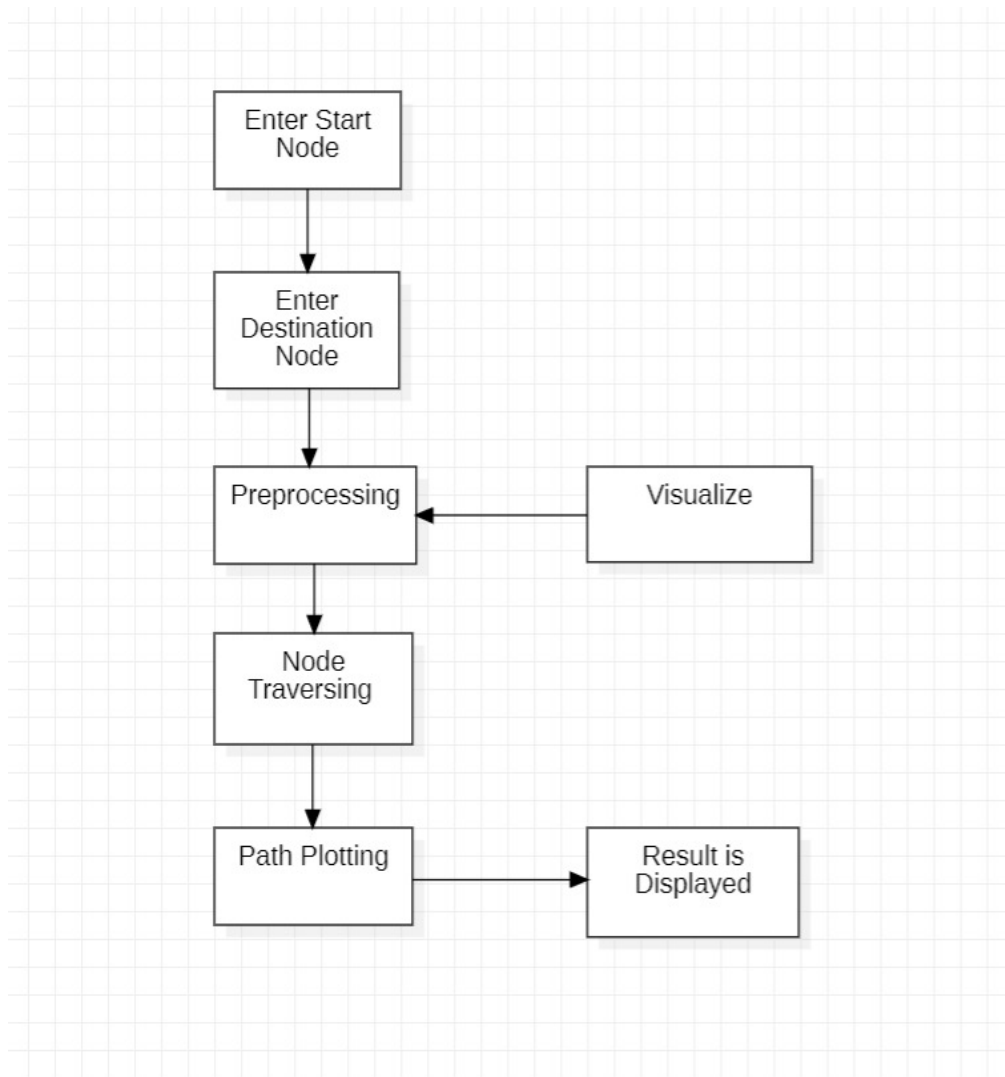
4.2   Flow diagram

Figure 4.2: Flow Diagram

4.3   Entity-Relationship diagram

ER Diagram stands for Entity Relationship Diagram, also known as ERD is a diagram that displays the relationship of entity sets stored in a database. In other words, ER diagrams help to explain the logical structure of databases. ER diagrams are created based on three basic concepts: entities,attributes and relationships.
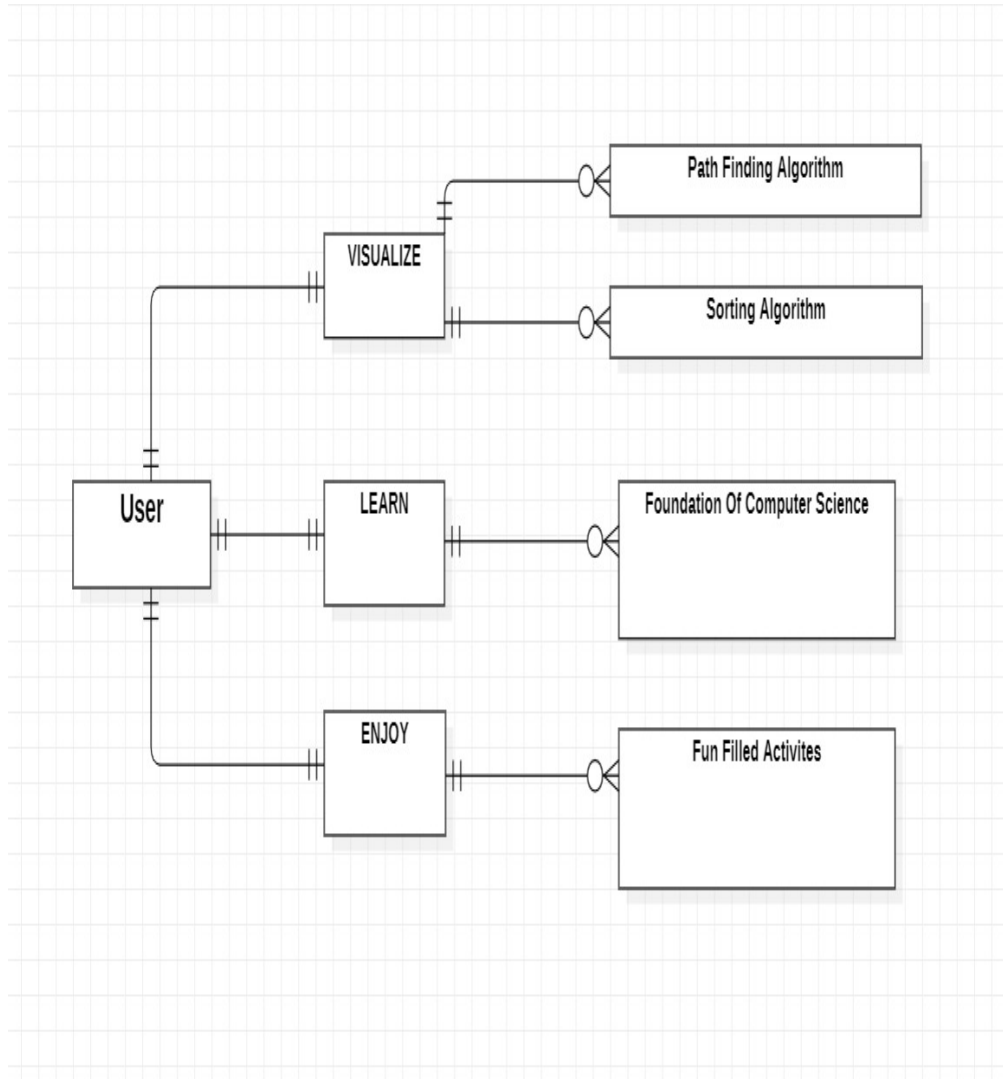
Figure 4.3: Entity Relationship Diagram

4.4 UML diagrams

4.4.1 Use case Diagram

Use case diagram is used to represent the actual users present in the system. Actors are nothing but users. Use case diagram represent the actual processes that the actors supposed to do.It shows the functionalities that the actors should implement.
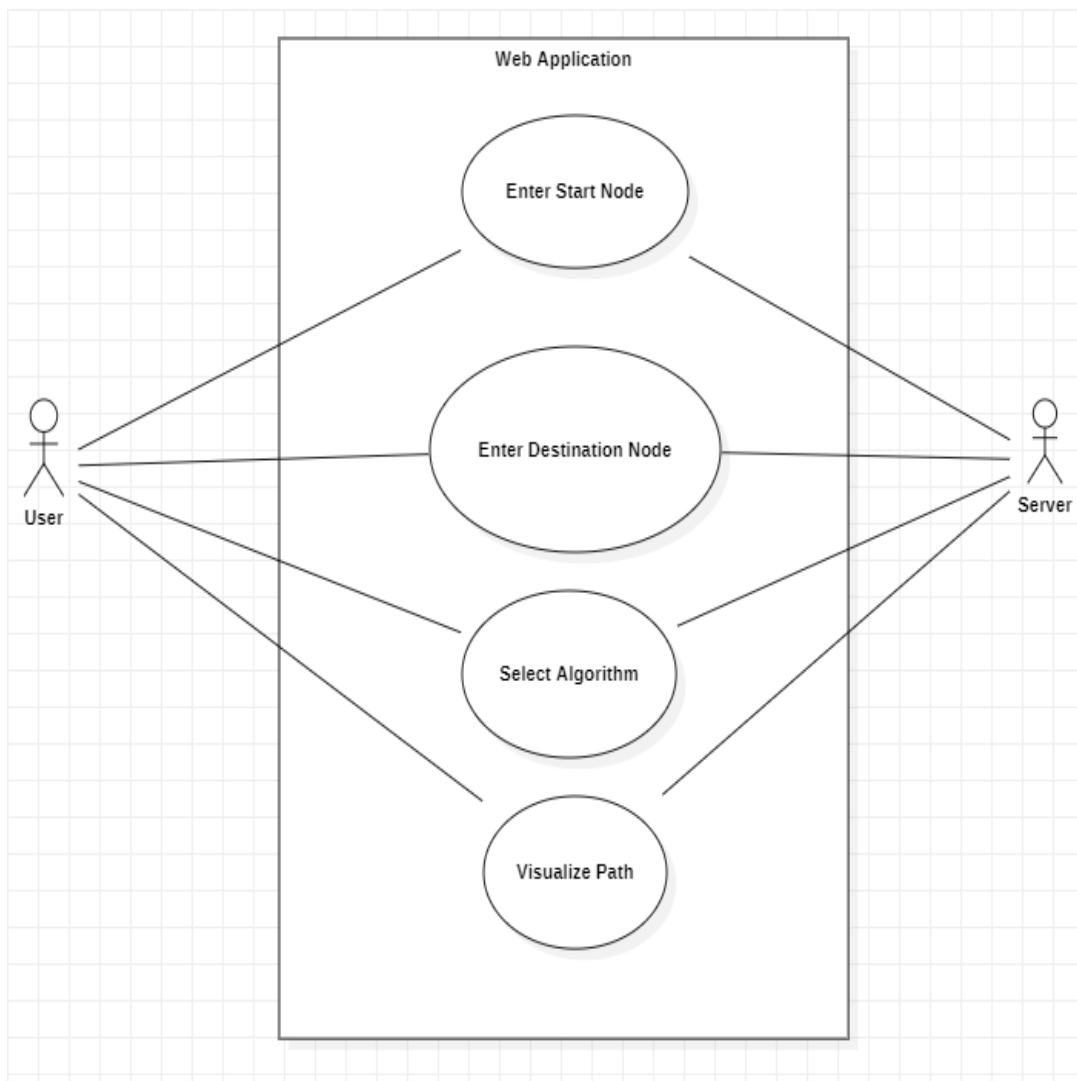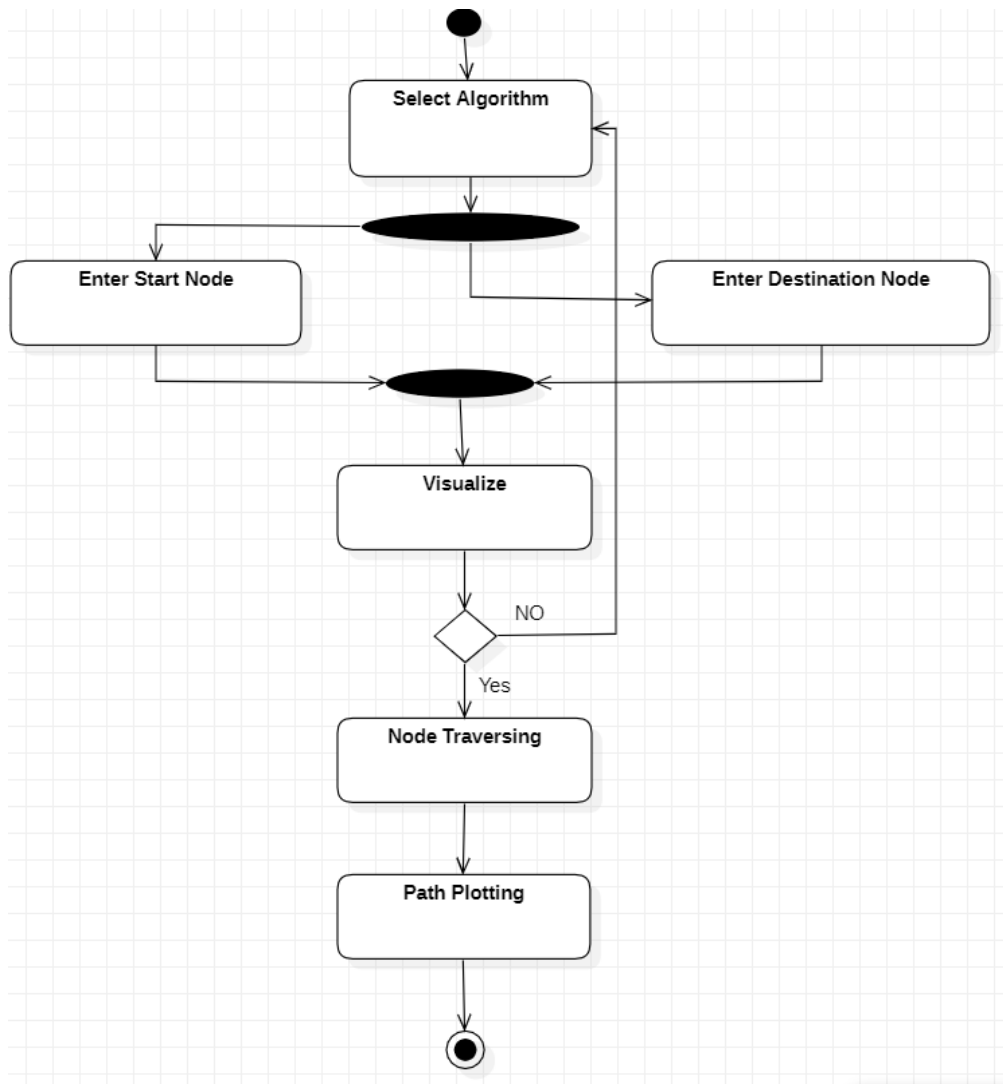

Figure 4.4: Use Case Diagram

4.4.2 Class Diagram

Class diagram is a static diagram. It represents the static view of an application. Class diagram is not only used for visualizing, describing, and documenting different aspects of a system but also for constructing executable code of the software application.

Figure 4.5: Class Diagram

4.4.3 Activity diagram

Activity diagram is another important behavioral diagram in UML diagram to describe dynamic aspects of the system. Activity diagram is essentially an advanced version of flow chart that modeling the flow from one activity to another activity.

Figure 4.6: Activity Diagram

Chapter 5

Conclusion and Future Scope

5.1 Conclusion

e-Learning is the latest solution for delivering education and knowledge. A variety of tools have been developed to implement this method of learning and to get people to recognize and accept its importance. Both synchronous and asynchronous learning methods are equally important. 's e-learning tools meet the needs of 's novices and experts alike, and its consistency also proves his 's effectiveness in traditional methods. The web application helped visualize how the pathfinding algorithm works and made it easy to understand. Further development of this tool may involve visualization of more complex algorithms and their implementation on real maps.

5.2 Future Scope

In order to gain technical knowledge,further we fix minor annoyances to improve learner algorithm understanding skills.

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