

CS684 Project Final Report Team 15

Project Title: Optimal Path in Multi-Stage Graphs

Project Team number: 15

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1. Introduction

1.1 Problem statement

In our project, we find the optimal path between a source node and a destination node. Edges are links of white lines and nodes are where the edges intersect each other. The bot detects the number of outgoing edges from a given node and starts travelling on one of the unvisited edges. When it exhausts all the outgoing edges i.e. it reaches the destination, it backtracks to the immediate node which has unvisited outgoing edges. This is done till all the paths from the source to the destination are traversed and the distances measured. Hence we can find the optimal path from the source to destination in our multi-stage graph.

1.2 Requirements Specification

1. Core Algorithm Design

1.1 Graph Traversal

1.2 Edge Detection

1.3 Backtracking

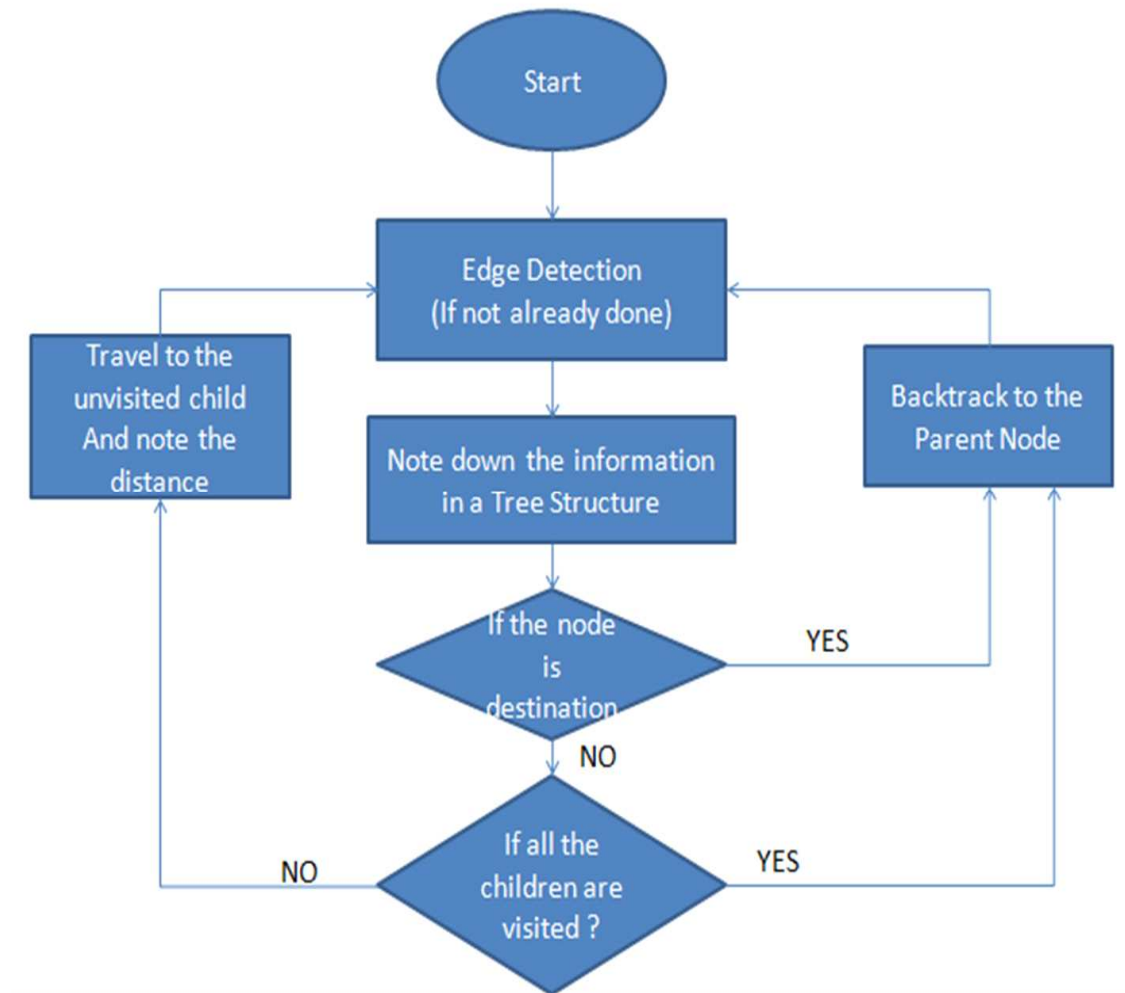
2. Implementation

2.1 Edge Detection

2.2 Graph Traversal

3. Computing Optimal path

1.3 System Design



1.4 Assumptions and limitations

Limitations: The algorithm only works on directed multi-stage graphs.

1.5 Setup and any extensions implemented on the robot

None

1.6 Additional hardware used

None

1.7 Project issues and workarounds

Here is a list of all the bugs we encountered and how we tried to get past them:

1. The sensors are not 100% accurate. For eg, the robot will not rotate with precise accuracy. So, we had to pad the values making the code specific to a robot so that the code would work.

2. Due to the size of the robot, inaccuracies are incurred in calculating the distance travelled by following the whiteline.

3. As the bot traverses, error incurred also increases. So we had to maintain an error variable which increases as the robot traverses the graph.

2. Present Status

2.1 A timeline based picture of project stating current status + requirements completed

Task	Completion Date
Core Algorithm Design	15 October
Build Whiteline Graph	15 October
Outgoing Edge Detection	25 October
Backtracking	25 October
Computing Optimal path	27 October

2.2 If there are any delays, why they occurred? How you have overcome issues?

There were some delays due to falling health of some group members (Arijit had Dengue so he had to go home). We had to spend whole nights in the lab to overcome these issues.

2.3 Critical steps in your projects: hardware, interfacing, algorithmic complexity, etc.

There is less complexity in hardware/interfacing as we haven't used any additional hardware. The Space complexity of the core graph traversal algorithm is an issue, for a large number of nodes, the space in the bot might get exhausted.

2.4 Individual roles and contributions

Core Algo Design : All team members.
Implementation: Gokul and Arjit
Documentaion: Vijay

2.5 How much time devoted to project so far - man-days

About 5-6 man days spent roughly.

3. Demonstration - Live demo + Video

3.1 Fill A4 sized sheet giving project details (title page of video to be taken in lab)

3.2 Show us a video of current status of project

4. Final Roadmap of Project

4.1 The roadmap to completion – with milestones + deliverables

Milestones:

1. The robot traverses the entire graph.
2. The robot detects edges and nodes correctly.
3. The robot backtracks correctly.
4. The robot computes and traverses the optimal path correctly.

4.2 State deadlines for each activity – Project completion, Documentation, code documentation etc.

See table in section 2.1

5. Innovation, Creativity and Reusability Index of your Project

5.1 Innovations in project

We have eliminated the need of a webcam by using only the whiteline sensors in the bot.

5.2 How you have enhanced reusability in project

In the project, the major tasks are divided into independent modules, which can be reused.

6. Help us in improving the process

6.1 What you think can be improved in terms of project activities

Deadlines should be more flexible.

6.2 Any comments on the current schedule of events

Could be better if deadlines were announced say a week before.

6.3 Are you satisfied with the way the course activities have gone – specially the project?

The course activities have gone fine. The staff at the Lab was very helpful.

6.4 Any other suggestions?

It would've been nice if the TA's were accesible to the students.

7. Bug Report

1. Sensors rarely gave 100% accurate reading.

-> Values padded to work only for a given bot.

2. Stack becomes too huge.

-> Maintained a finite tree.

8. Future Scope

(List of all possible project ideas based on your current project)

1. With proper modifications, the general range of graphs can be supported.

2. Other uninformed search techniques such as A* can be added.

9. Learnings

From this project we have come to know about the various stages in a project, the issues of communication, collaboration etc. between team members.