Department of Computer Science & Engineering

Course Title : Artificial Intelligence and Expert Systems Lab

Course Code : CSE 404

Lab Report : 02

Submission Date : 11.04.25

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Problem Title:

Finding the Optimal Path from Mogbazar Mor Noyatola to UAP Using A* Search Algorithm

Problem Description:

The objective of this problem is to determine the optimal path from Azimpur Bus Stand(home) to UAP(University of Asia Pacific) using the A* search algorithm.

A Search Algorithm*

f(n) = g(n) + h(n)

Where:
f(n) = Evaluation function
g(n) = Actual cost from the start node to the current node
h(n) = Heuristic estimated cost from the current node to the goal node

Tools and Languages Used:

- Programming Language: Python
- Tools: Colab Notebook

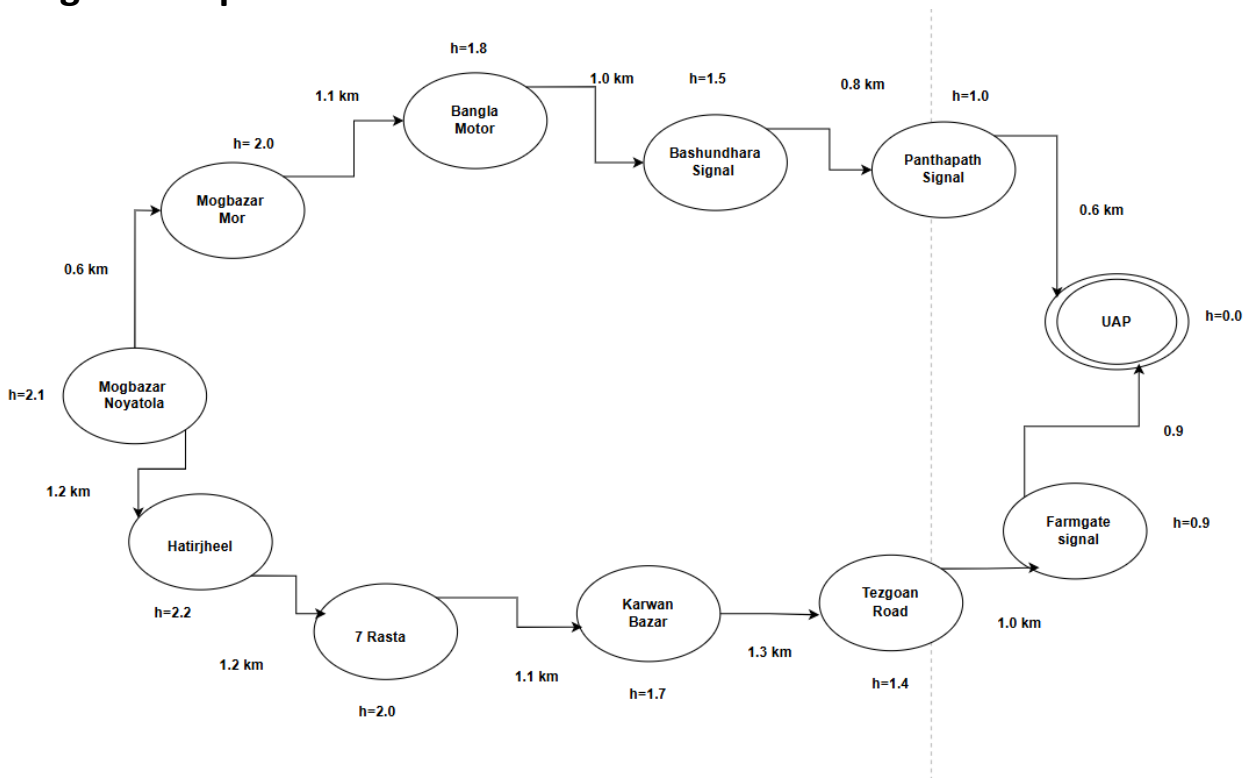
Diagram:

Designed Graph:

- Edge labels represent g(n) values (actual distances in km from Google Maps)
- Node labels include h(n) values (heuristic cost using Manhattan Distance)

Diagram:

Designed Graph



Here,

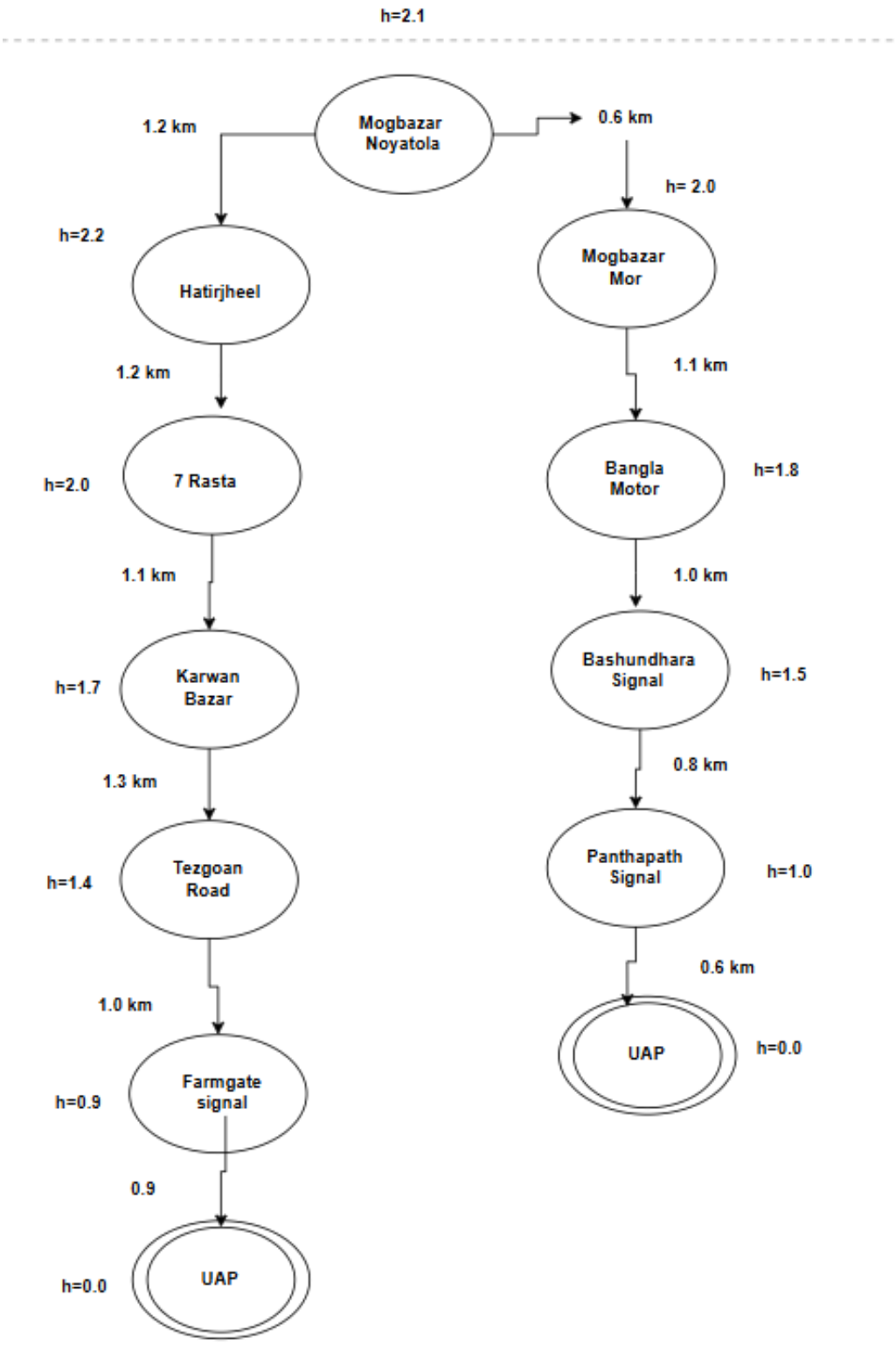
Start Node : Mogbazar Noyatola (Home)

Goal Node : UAP(University of Asia Pacific)

g(n) : Calculated in Kilo meter(km) from Google Maps

h(n) : Calculated from Google Maps(Longitude,Latitude),using Manhattan Distance(Longitude - Latitude).

Designed Search Tree



Sample Input/Output:

```
import heapq

# Graph representation with distances (g(n))
graph = {
    "Mogbazar Mor Noyatola": {"Mogbazar Mor": 0.6, "Hatirjheel": 1.2},
    "Mogbazar Mor": {"Banglamotor": 1.1},
    "Banglamotor": {"Bashundhara Signal": 1.0},
    "Bashundhara Signal": {"Panthapath Signal": 0.8},
    "Panthapath Signal": {"UAP": 0.6},
    "Hatirjheel": {"7 Rasta": 1.2},
    "7 Rasta": {"Karwan Bazar Signal": 1.1},
    "Karwan Bazar Signal": {"Tejgaon Road": 1.3},
    "Tejgaon Road": {"Farmgate Signal": 1.0},
    "Farmgate Signal": {"UAP": 0.9},
    "UAP": {}
}

# Heuristic values (h(n))
heuristic = {
    "Mogbazar Mor Noyatola": 2.1,
    "Mogbazar Mor": 2.0,
    "Banglamotor": 1.8,
    "Bashundhara Signal": 1.5,
    "Panthapath Signal": 1.0,
    "Hatirjheel": 2.2,
    "7 Rasta": 2.0,
    "Karwan Bazar Signal": 1.7,
    "Tejgaon Road": 1.4,
    "Farmgate Signal": 0.9,
    "UAP": 0
}
```

```python
# A* Algorithm

def astar(graph, heuristic, start, goal):
    open_set = []
    heapq.heappush(open_set, (0 + heuristic[start], 0, start, []))
    visited = set()

    while open_set:
        f, cost, current, path = heapq.heappop(open_set)

        if current in visited:
            continue
        visited.add(current)

        path = path + [current]

        if current == goal:
            return path, cost

        for neighbor, g in graph[current].items():
            if neighbor not in visited:
                new_cost = cost + g
                priority = new_cost + heuristic[neighbor]
                heapq.heappush(open_set, (priority, new_cost, neighbor, path))

    return None, float("inf")

# Execute the search
start_node = "Mogbazar Mor Noyatola"
goal_node = "UAP"
path, cost = astar(graph, heuristic, start_node, goal_node)

# Output
if path:
    print("Optimal Path:", " -> ".join(path))
    print("Total Cost (km):", cost)
else:
    print("No valid path found.")
```

Output:

Optimal Path: Mogbazar Mor Noyatola -> Mogbazar Mor -> Banglamotor -> Bashundhara Signal -> Panthapath Signal -> UAP
Total Cost (km): 4.1

Conclusion:

By implementing the A* search algorithm, we successfully determined the most optimal path from Mogbazar Mor Noyatola to UAP while minimizing travel distance. The algorithm efficiently balances actual travel cost (g(n)) and estimated distance (h(n)), ensuring the shortest possible route.