GRID BASED NAVIGATION

Grid based navigation:-

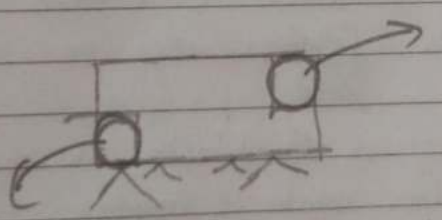
Grid based navigation is very useful in robot's UAV autonomous driving and also for path planning (inorder to known the current position of vechile and goal point (destination).

In grid based navigation the surrounding are represented in computer memory using block of square.

* In block of square are Black then it says that we have obtacle which is at that position
* The free space are represented by ~~free Block~~ which color.

How to Collect the data from surrounding

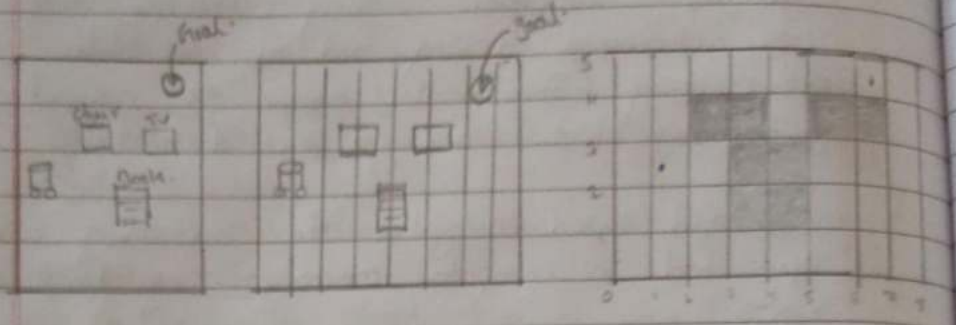
We will use sensor for our robot in such way that It should cover both front part & Back part of robot surrounding. So for getting both front & Back part we will place sensor (or) laser at opposite direction as



an assumption diagram (or) Simple way to illustrate where to place lidar's to get over information about surrounding.

By using these data we will create a grid on our computer memory as for ~~path~~ path planning

How the surrounding is represented in Computer memory



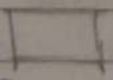
Goal point

The above grid are also called as occupancy Grid. where their are usually useful for representing obstacle & and surrounding of a robot's lidar.

* Here we can observe that if an obstacle is partially occupy the Grid cell then it will be represented as fully occupied because In the occupancy grid we will use the probability algorithms like naive bays algorithm to known the probability of obtacle.

If probability of obtacle is 1 then grid cell will be black (filled).

If probability of obtacle is 0 then grid cell will be white (Empty)



If Probability of obtacle is greather than 0.5 then it will be consider as that grid cell is having obstacle where robot will not move through that cell.

If probability of obtacle is less than 0.5

then we consider it as Positially placed obstacle It is represented using a grey color where robot will move through that with an Extract features

Right now we got data of surrounding, Now we need to make path planning for moving robo (or) UAV to a Particular position

How to respect represent our goal in grid cell:-

To do this we need to specific the position of goal through code as a predefined (or)

How to represent our goal Position:-

By using sensor (or) lidar (or) other devices that will emits the light ray from them and we will a recieve that recieve the light ray and estimate the distance and position of goal (coordinates of goal).

This a way to get the goal position if the light ray are visible to reciever sensor.

By using Gps (longitude & latitude points) if we define the position where to go then it will automatical get the position value as (Goal)

Now we need to navigate:- from initial position to goal point

for navigation, we need path planning. we have path, how to plane for path what which the robot (or) UAV should consider.

To answer this we will use the algorithm like A*, Dijkstra's Algorithm etc.

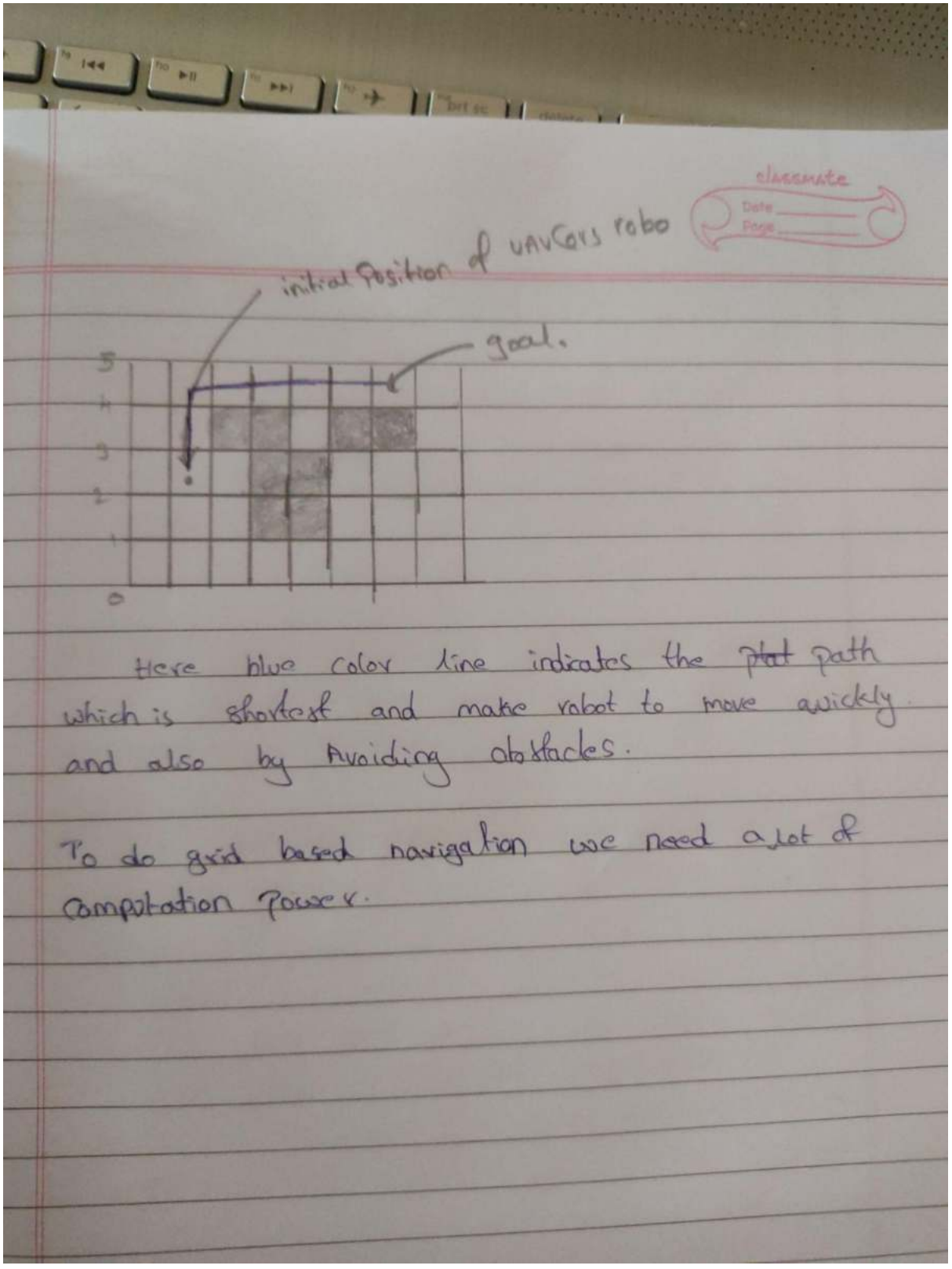
The best algorithm for deriving the shortest path in UAV navigation is often influenced by factor such as environment, mission requirement & computational resources, are widely used algorithm is Dijkstra's algorithm.

Algorithm steps

* Nodes could be waypoints, obstacles, and other significant location
* Assign a tentative distance values to every node Set the initial node's distance to 0 & all other to infinity.
* we will Examine neighbor's node from current node & calculate distance
* and we will update distance if the newly calculated distance is shorter.
* once node is explored then it is marked as visited and it will not be visited again (or) checked.
* This will continue until destination node is marked as visited (or) all node are Explored.
* we will use Back tracking from goal node to starting node to select shortest path.

Navigation:-

After determining ~~Path Planning~~ path planning we will navigate to particular goal. by ~~defo~~ defining the speed of UAV (or) Robo and moving it that direction according to Coordinates values and also by avoiding collision with obstacles.



Here blue color line indicates the ~~plot~~ path which is shortest and make robot to move quickly and also by Avoiding obstacles.

To do grid based navigation we need a lot of computation power.

SIR FOR PATH PLANNING I HAVE WRITTEN A CODE AND EXECUTED

TO MAKE CHOICE OF BEST SHORTEST PATH IN GRID STARTING NODE TO GOAL NODE

HERE IS O/P OF THE GRID BASED NAVIGATION USING A* ALGO AND DIJKSTRA ALGO

ABOVE SCREENSHOT IS AN O/P KNOWING HOW MANY STATE DOES IT EXPLORED FROM INITIAL STATE TO GOAL STATE USING DIJSTRA_ALGO

OUTPUT PNG FOR THE PATH THAT WE SHOULD CONSIDER

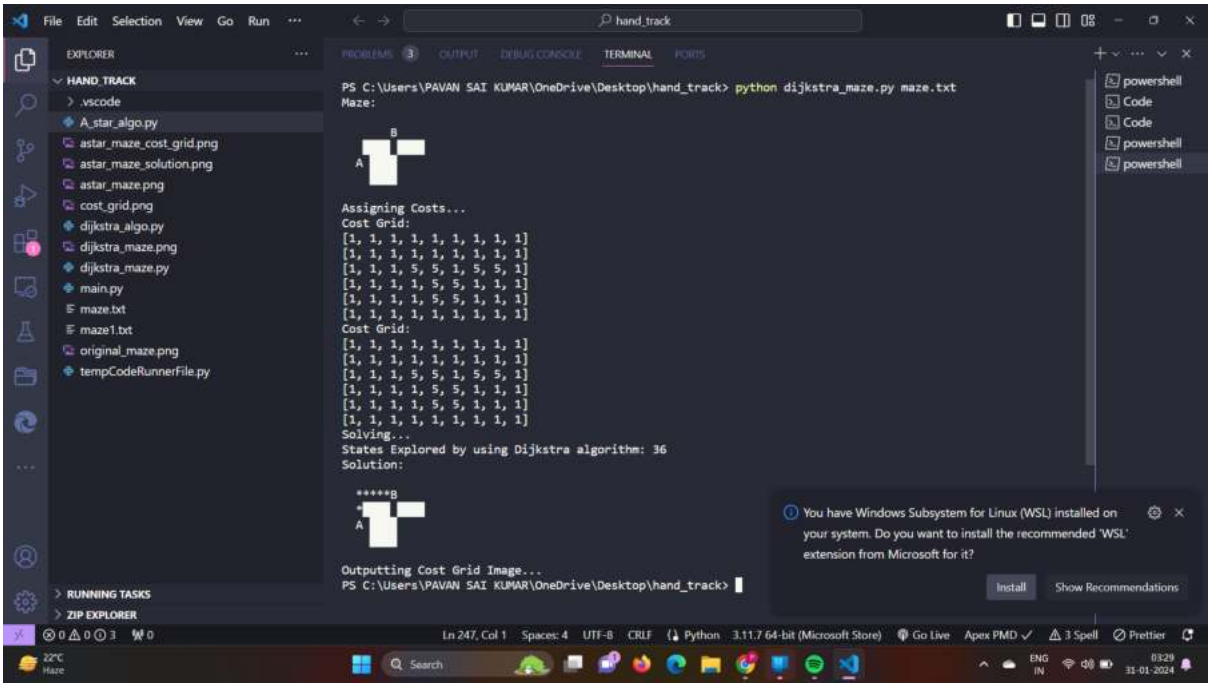
THINK RED CELL REPRESENT STATING POINT

GREEN COLOR REPRESENT ENDING POINT

BLACK REPRESENT OBSTACLES

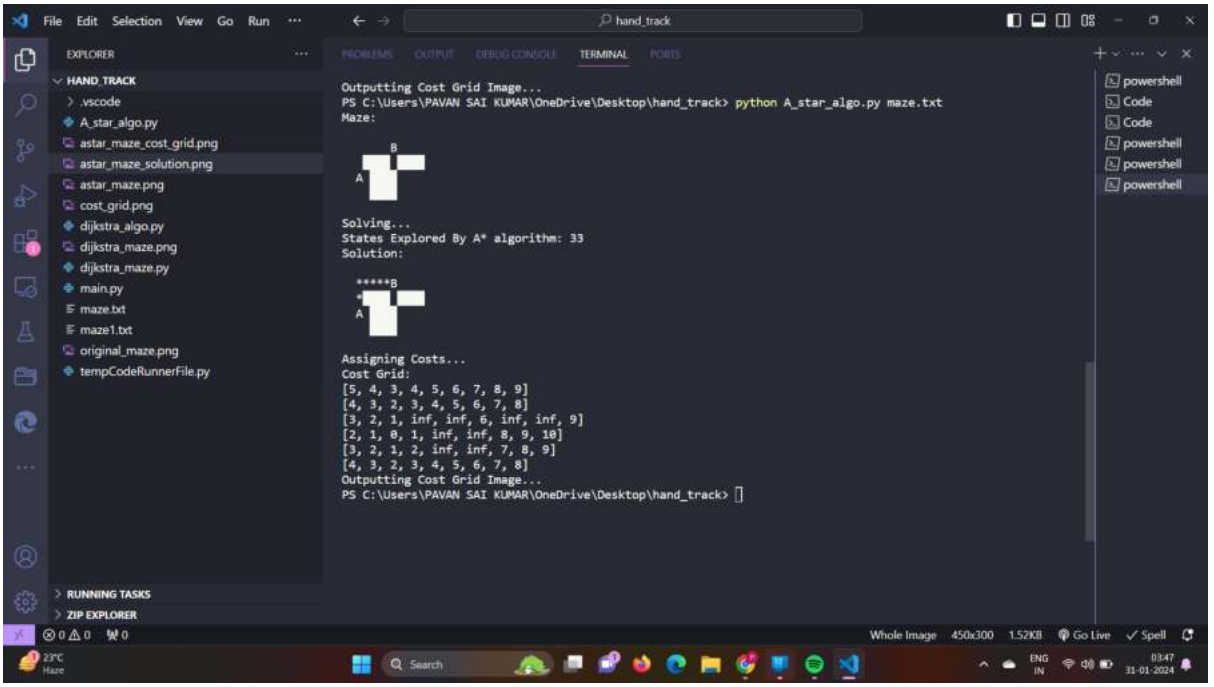
LIGHT RED COLOR REPRESENT EXPLORED CELL

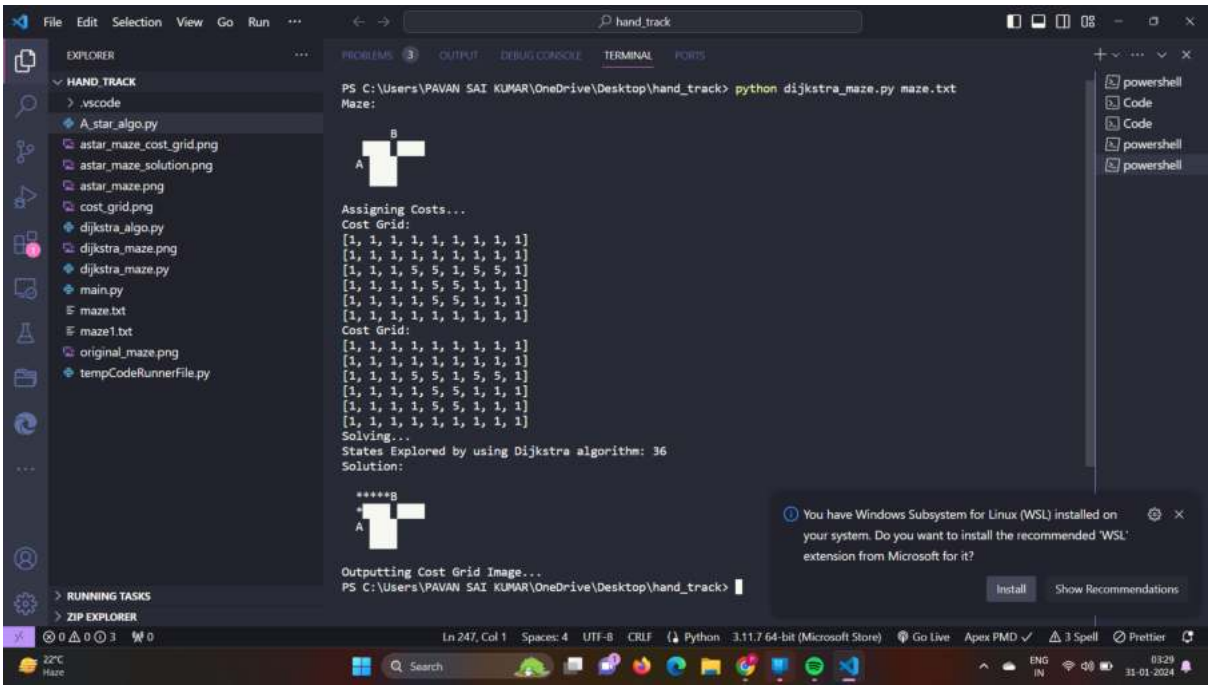
WHITE REPRESENT UN EXPLORED CELL



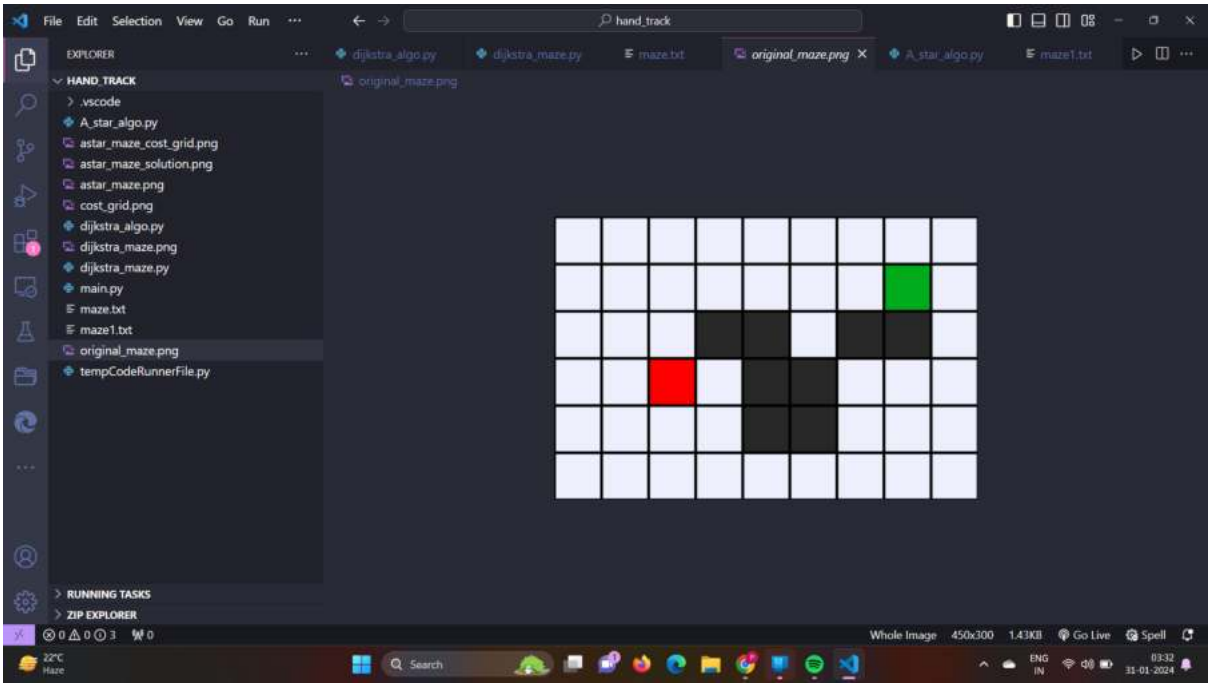
THESE IS THE PROCESS PROGRAM TO GET THE OUTPUT

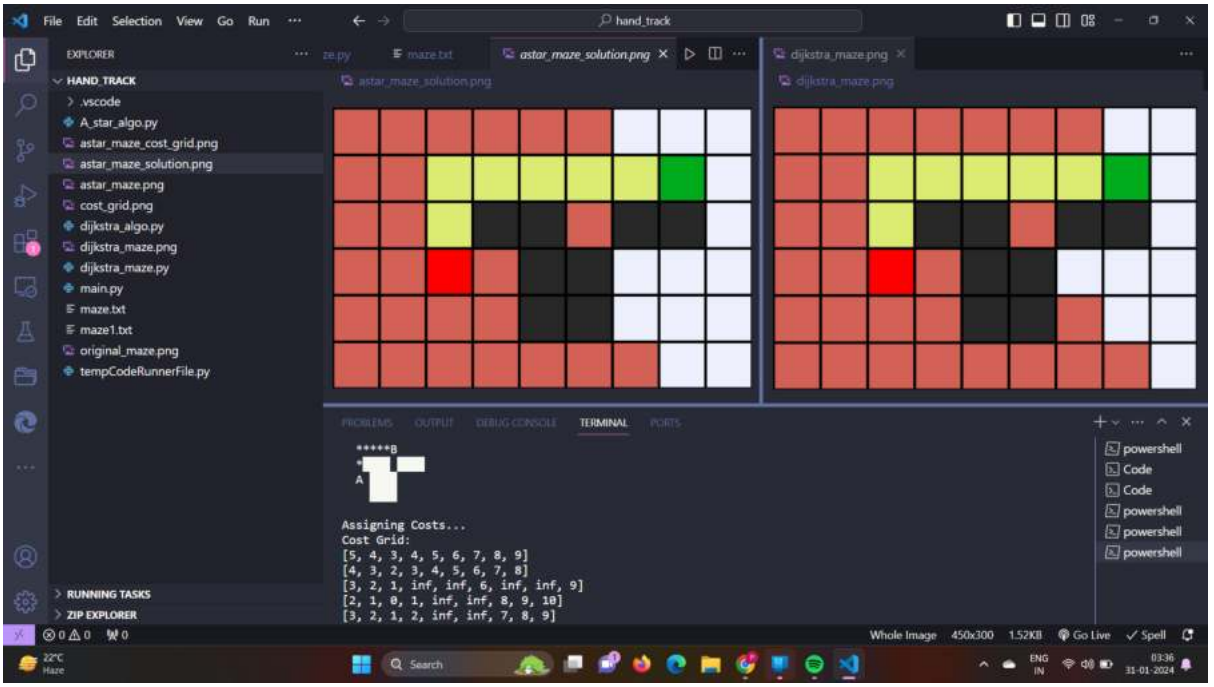
NOW I HAVE DONE SAME PATH PLANNING USING A* ALGO





ORIGINAL REPRESENTATION OF GRID AND STARTING NODE AND GOAL NODE AND OBTACLES





BOTH HAS ALGORITHMS HAVE THEIR OWN ADVANTAGE

BUT ON OUR REQUIREMENT WE ALGO’S

SIR I HAVE DONE THIS PATH PLANNING FOR UNDERSTANDING PURPOSE ONLY

I TRIED MY LEVEL TO REPRESENT THEM VISUALLY