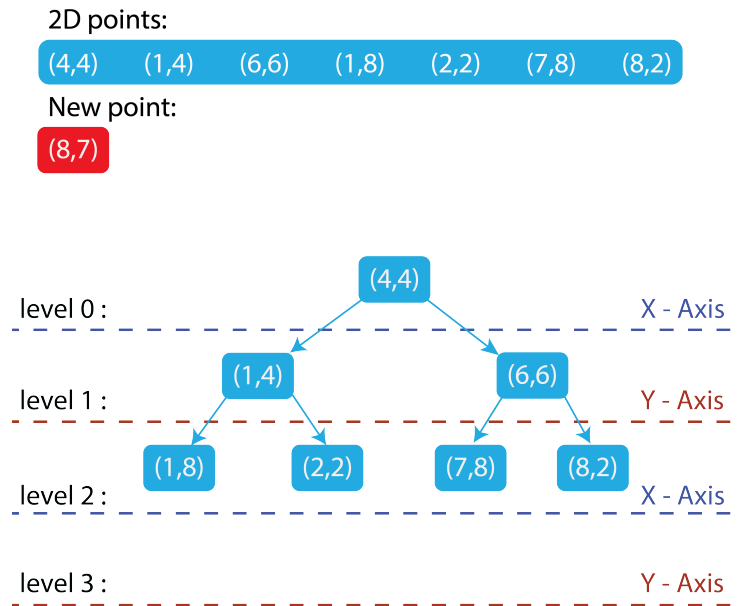


Proposal - KD Trees for Finding the Nearest Neighbor

What is a KD Tree?

A KD Tree (k-dimensional tree) is a binary search tree used for organizing and searching points in a k-dimensional space. One of its application is performing nearest neighbor searches in k dimensions.

Here is an example of a KD tree:



How it works

Given N points with dimension K , the tree is organized by cycling through the axes of the dimensions at each level.

Using the example above:

For a set of 7 points in 2 dimensions, the tree functions like a regular binary tree but alternates the axis used for comparison at each level.

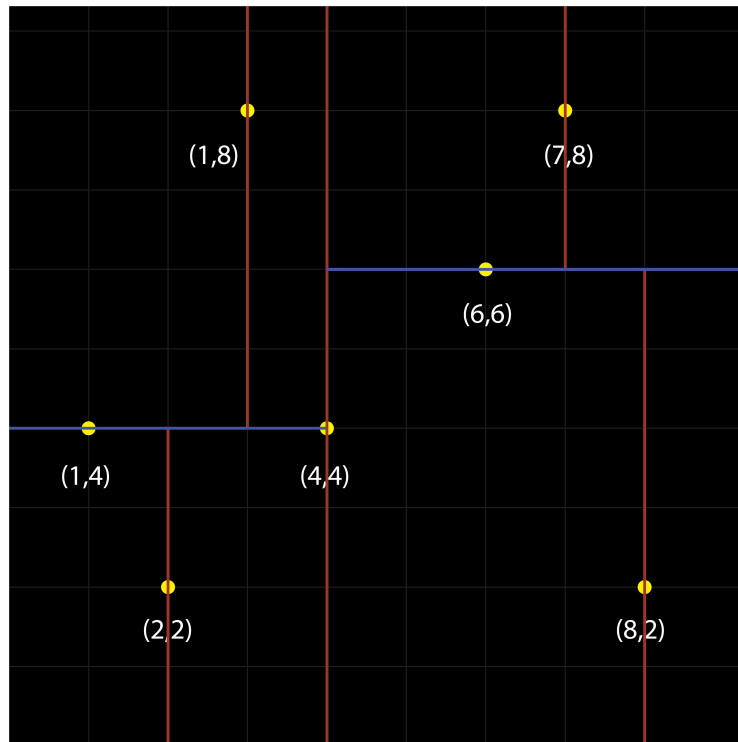
- First the first point will be the root node
- From here the next point will be are organized using one dimension at a time, with the axis determined by the level of the tree (Level mod K)

For new point (8,7): *Left if Smaller And Right if Greater or equal*

Node → Right → Right → Right

Becoming a new leaf node

This is way we can quadrant points like so:



Create a $O(\log n)$ search at best for nearest neighbor.

Application of KD Tree

Create a solution to semi-automate the Circuit runs between strobe ckt to create an optimal loss of voltage with the use of K-D Tree as the algorithm.

Problem

Given a set of **STROBES** (devices used in fire alarm systems to visually notify occupants in the case of a fire) with **X, Y, Z** coordinates.

We need to find the most optimal circuit run that will have the lowest voltage drop by connecting the closest strobe in a series.

Then, use that circuit in a CAD drawing to create a technical drawing that can be followed in the field.

Key Points

1. **Starting location** - The initial node point, which is the location of the fire alarm panel.
2. **Circuit run** - The circuit will follow from the Panel (FACP/NAC) to the closest strobe (device).
3. Continue to the next closest device until all devices have been addressed to complete the circuit run.
4. *Future implementation* - Circuit runs will alternate "A/B" to comply with NFPA code requirements.

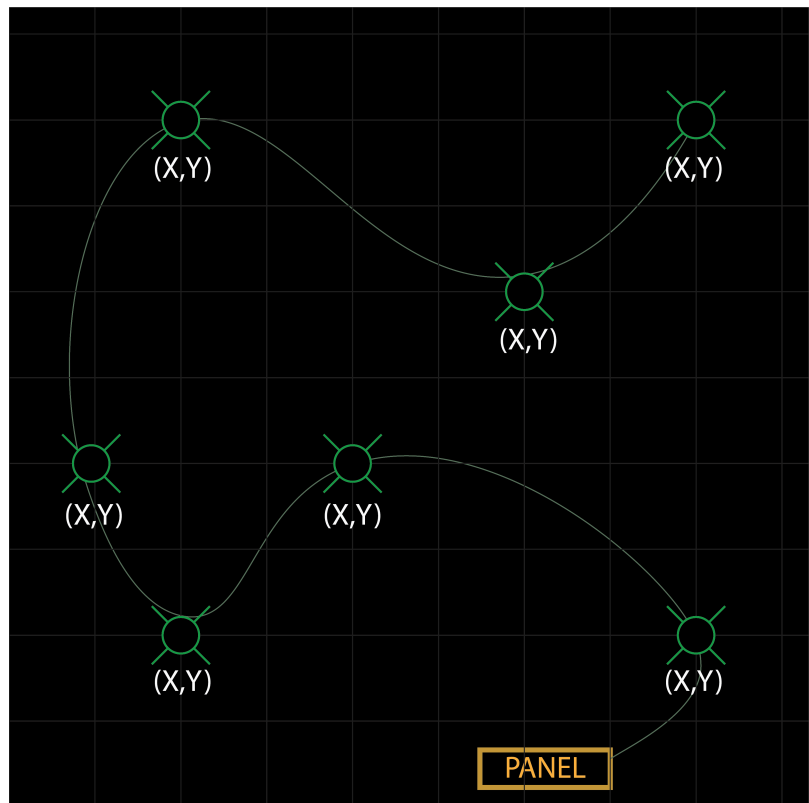


Diagram of Strobe -green-, Panel and circuit