**SENSOR PLACEMENT IN WATER DISTRIBUTION NETWORKS**

**Motivation For Centrality**

To assess the importance of a node depending on its ability to capture the most difference in the values of flow or pressure measured at that node in case of a failure in the network. A failure can be defined as leak or pipe bursts.

As we identify the path to the failure node by analysing the most affected neighbor nodes...we look at betweenness centrality specifically for our problem.

Betweenness centrality of a node v is the sum of the fraction of all-pairs shortest paths that pass through v:

c_B(v) =\sum_{s,t \in V} \frac{\sigma(s, t|v)}{\sigma(s, t)}

where V is the set of nodes, \sigma(s, t) is the number of shortest (s, t)-paths, and \sigma(s, t|v) is the number of those paths passing through some node v other than s, t. If s = t, \sigma(s, t) = 1, and if v \in {s, t}, \sigma(s, t|v) = 0.

**Method used to obtain centrality**

**Pseudo Code:**

**Input:** G is Graph(vertices(neighbors),edges(source,target))

Edgeweight=0

For all nodes in G:

Get greediest path from source to the node based on value of flow or pressure in that point during leak in that node.

Increase the weight of all the edges in the path

For each pair of nodes in G:

For each node v in G:

Get number of shortest paths between them

Get the number of shortest paths between them that pass thro v

Get ratio

Ratio is summed across all pairs

Sum is the betweenness centrality of v.

**Output:** Betweenness Centrality of each node v

**Description:**

Nodes are given betweenness centrality based on how much they are affected for each and every node leak in the network and the modes affected most are given as output.

This can give a possible rankings of nodes when considered for placement of sensors

**Analysis**

Visualisation - Distance vs Centrality Graph