# MY APPROACH -

We have used the normal BFS Approach to traverse through the Binary Tree.
Since the maximum number of nodes in the Binary Tree is 16, a given level can have a max of 8 nodes.
Hence, we have used 8 Memory units to store the address of child nodes.

Memory Units :-

A Single Memory Unit Contains an 8-bit Register(Combination of 2 "74179" ICs) connected to an 8-bit Buffer ("74HC241" IC).
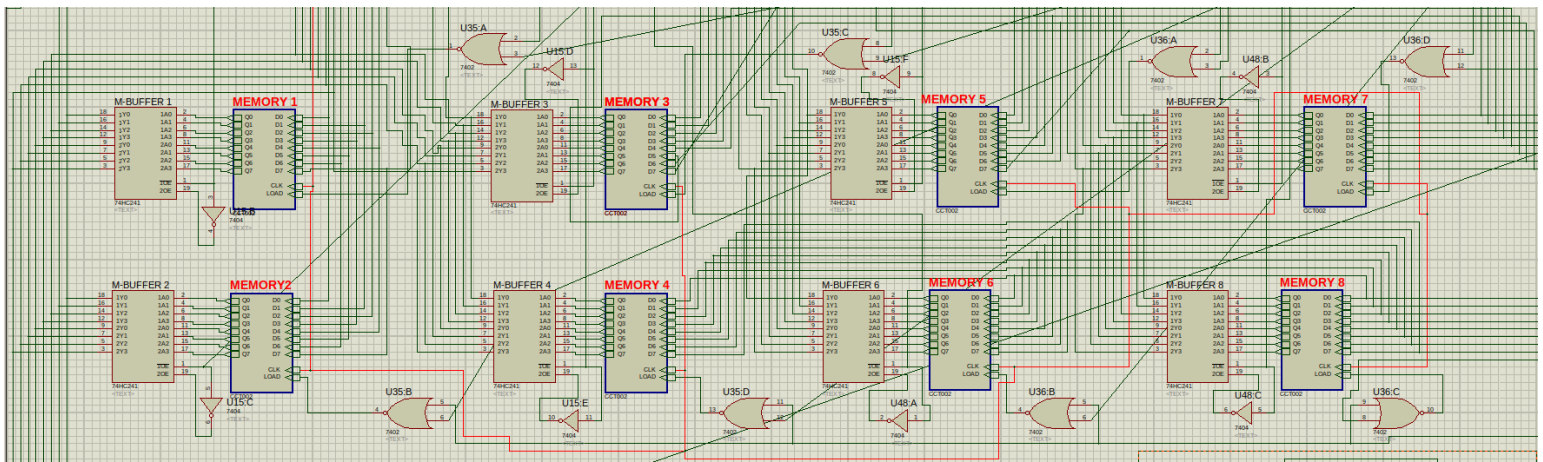
The Loads of these 8-bit Registers of each Memory Unit are connected to "Decoder 1"("74HC151" IC) whose input is connected to a counter which is triggered whenever an address of a child node is read by the ROM(given that: address is not equal to 255).
Once the value at the address stored in a given register is read, it can be used to store another address if all the other registers are full.

The enables of 8-bit Buffers connected to these Registers in each Memory Unit are connected to "Decoder 2"("74HC151" IC) whose input is connected to a counter which is triggered when the addresses of both the child nodes are read by the ROM.

The addresses of child nodes are stored in such an order that all the child nodes at a single level are read at first then the system proceeds to another level.

Tree Traversal :-

The tree traversal starts from address 0.

The value at the given node is first read then the addresses of the left and right childs of the node is read by adding 1 and 2 to the node address respectively.

After the first node (at address 0), the next node addresses are extracted from the memory units using Decoder 2.
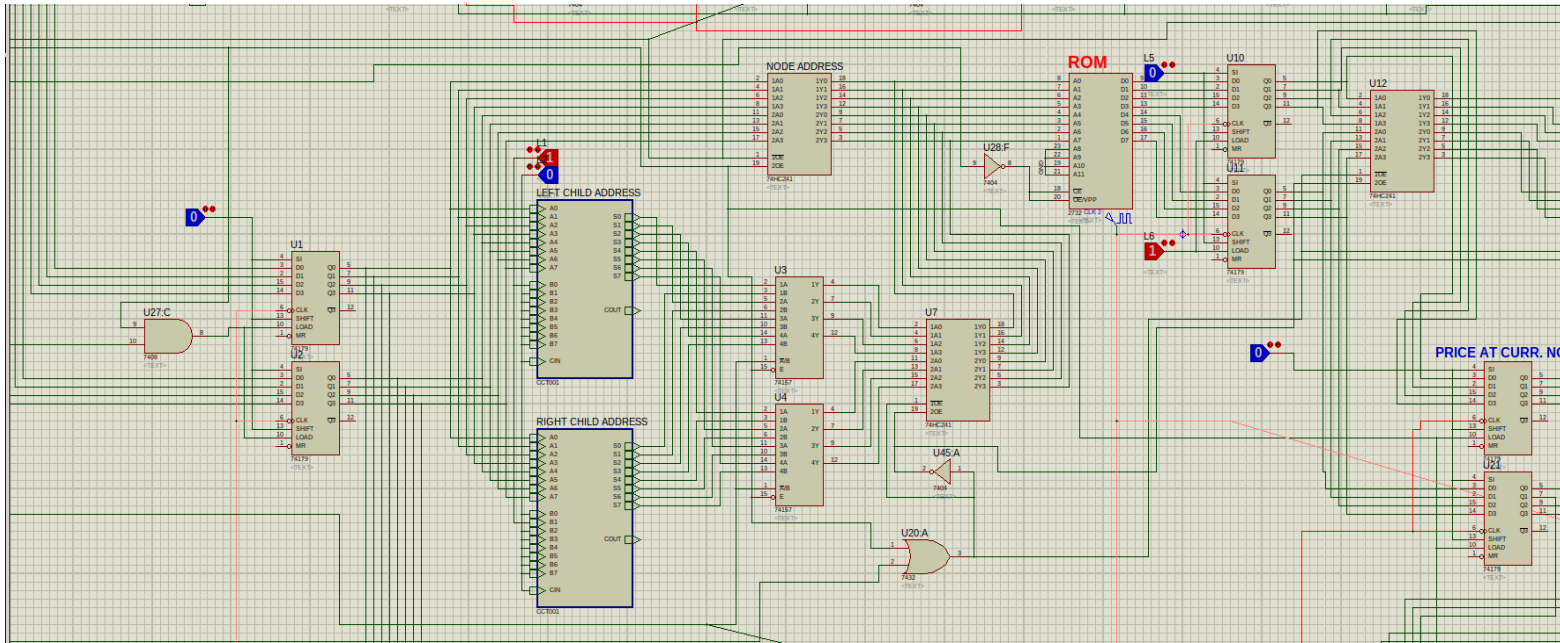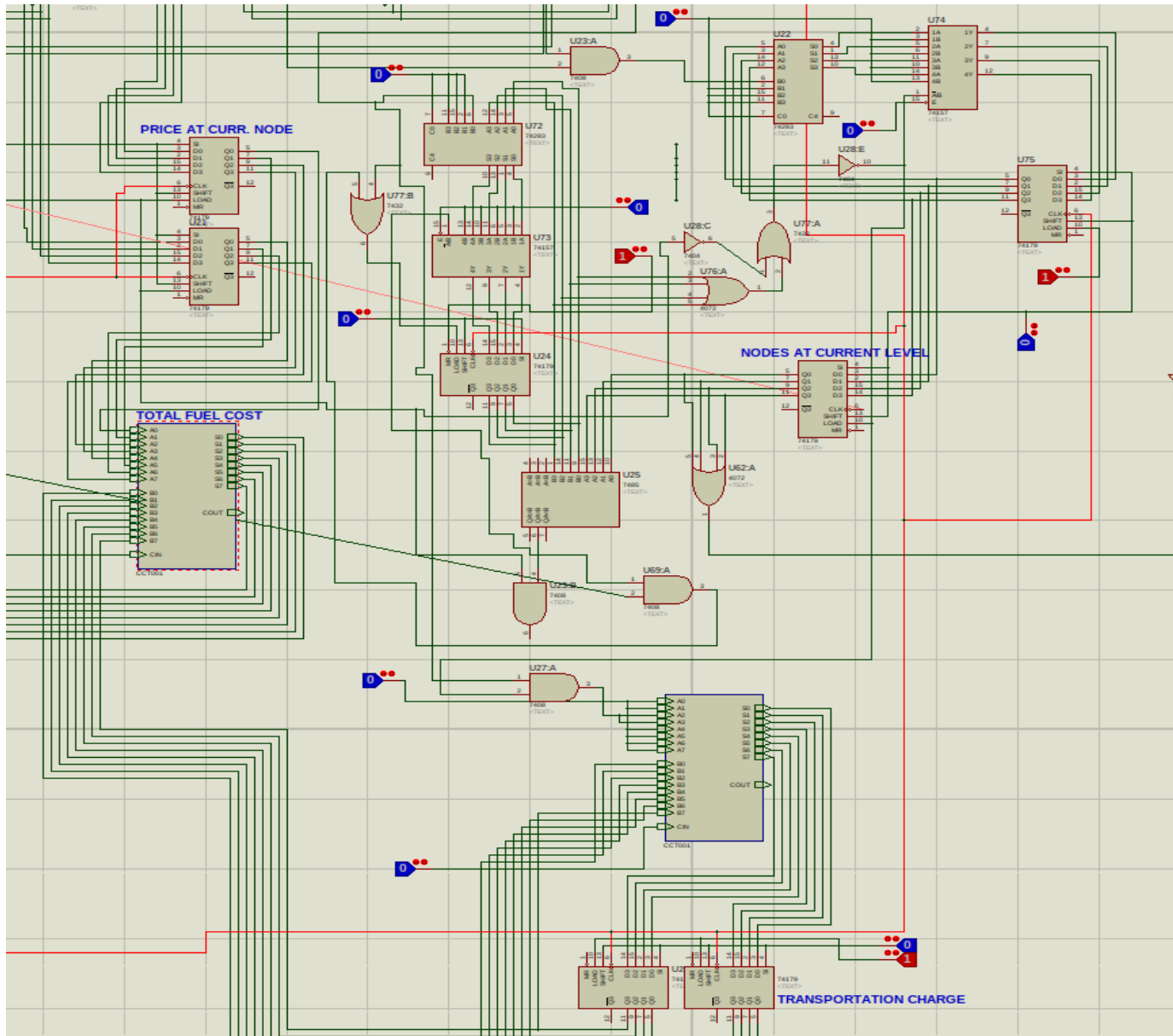

Calculating the fuel cost :-

The value at each node i.e. the fuel price at each node is stored in a separate 8-bit Register which is added to the Transportation Cost of that node.

The transportation cost depends on the distance of a node from the root node (i.e. the level of the node). The transportation cost increases by a value of "12" at each level. So, whenever a new level of the tree is being read the transportation cost is increased by a value of "12".

The number of nodes that are going to appear in the next level are stored in a 4-bit register by checking the valid addresses while storing in the memory units.
Now during traversal in a given level the number of visited nodes are compared by the total number of nodes in a level using a 4-bit Comparator ("7485" IC) and as the number of visited nodes equals the total number of nodes in a level the next level of the tree begins and the Transportation Cost is updated.
The total fuel cost is calculated by adding the fuel price at a node and the transportation cost of that node.

Calculating the minimum cost :-

The minimum cost is stored in an 8-bit register which is updated whenever the total cost at a node is less than the value stored in the minimum cost register.
The address of the node with minimum cost is also stored in an 8-bit register which is also updated simultaneously.

LEAST COST NODE

MINIMUM FUEL COST