A BASIC INTERNET MODEL

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Summary:
This project "A BASIC INTERNET MODEL" is focused on working of the networks. Here, we connect systems under a network to other systems using routers. Devices connect to routers of unique IP address through which the information stored in databases is exchanged among users. Further, the information is accessed using routing tables, and they help in choosing the shortest path from your router to the desired database and if the path is found successfully, the network provides you with the piece of information you want in the form of discrete data packets, otherwise, if the connection establishment fails, the program shows "Server not found" on the screen.

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1. Introduction

The Program of this Project uses various terms :-
1. Router:- A router is a networking device that forwards data packets between computer networks. Routers perform the traffic directing functions on the Internet.
2. Database:- A database is an organized collection of structured information, or data, typically stored electronically in a computer system.Here, in our project, we have created a short database so as to show it more efficiently.
3. Domain name Server(DNS):- The Domain Name System (DNS) is the hierarchical and distributed naming system used to identify computers reachable through the Internet or other Internet Protocol (IP) networks.
4. Routing Table:- A Routing Table, or Routing Information Base (RIB), is a data table stored in a router or a network host that lists the routes to particular network destinations, and in some cases, metrics (distances) associated with those routes. The routing table contains information about the topology of the network immediately around it.
5. Routing Protocol:- A routing protocol specifies how routers communicate with each other to distribute information that enables them to select routes between nodes on a computer network.

2. Internet: What is it and how it works:-

What is Internet:- The Internet is the global system of interconnected computer networks that uses the Internet protocol suite (TCP/IP) to communicate between networks and devices. It is a network of networks that consists of private, public, academic, business, and government networks of local to global scope, linked by a broad array of electronic, wireless, and optical networking technologies.

How it Works:- Firstly, you'll be required to connect your system or PC with any router or modem to establish a connection. This connection is the base of the connection.
When you open the browser and start typing something like "www.google.com", your system will push a query command to your ISP (Internet Service Provider) that is connected with other servers that store and process data.
Now, the web browser will start indexing the URL that you've entered and will fetch the details in numeric format (in their own language to identify the address (unique) that you're trying to reach.
Next is, now your browser will start sending the HTTP request where you're trying to reach and sends a copy of the website on the user's system. Note: The server will send data in the form of small packets (from the website to the browser)
Once all the data (of small packets) will be received at the user's end (PC/Laptop), the browser will start arranging all those small packets and later will form a collective file (here, the browser will gather all the small packets and rearrange

them just like a puzzle) and then you'll be able to see the contents of that website

3. Figures, Tables and Algorithms

Given below are the figures related to the project, the table containing the Complexity, and Algorithms used in the project.

3.1. Figures

Here, in the figures section, given below are three figures:-
Figure (1) describes how the router connections are made in our project.
Figure (2) shows the working of Dijkstra's Algorithm on a given graph, for which we have to find the distances between a node and the other vertices.

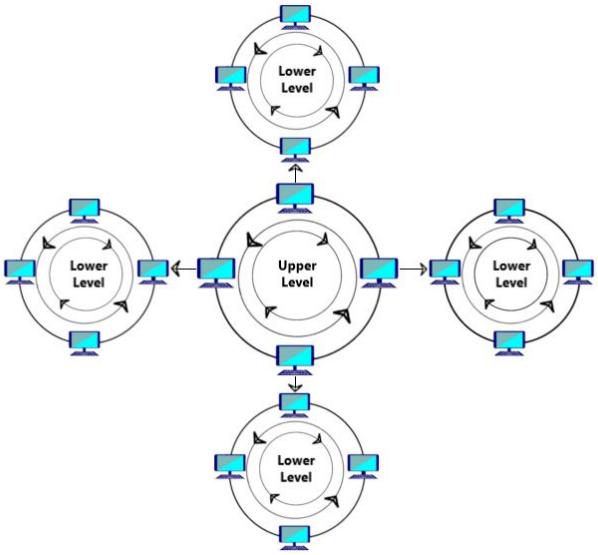
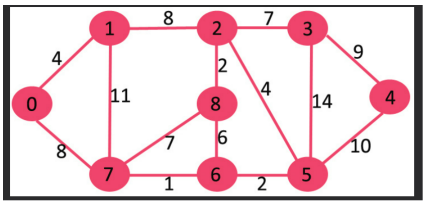
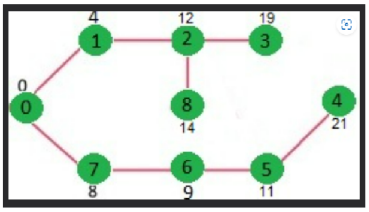


Figure 1: Figure Demonstrating the Network of routers.

Thanks to the `\subfloat` command, a single figure, such as Figure 1, can contain multiple sub-figures with their own caption and label, e.g. Figure 2a and Figure 2b.



(a) Distance from nodes initially



(b) Distance from nodes finally

Figure 2: Use of Dijkstra's Algorithm

3.2. Tables

The table given below contains the time complexity and the space complexity of dijkstra's algorithms.

Time Complexity and Order Complexity of Algorithms:

	Average TC	Worst Case TC	Space Complexity
Dijkstra	O(E*logV)	$O(V^2)$	O(V)

Table 1

Here, in the table, TC - Time Complexity, V - No. of vertices

3.3. Algorithms

Dijkstra's Algorithms:- The Dijkstra Algorithm is a graph search algorithm that solves the single-source shortest path problem for a graph with non-negative edge weights. The algorithm is named after its discoverer, Dutch computer scientist Edsger W. Dijkstra.Here, single-source means that only one source is given, and we have to find the shortest path from the source to all the nodes.

Algorithm 1 Dijkstra's Algorithm

```
1: function dijkstra(G, S)
2: for for − Each − vertex − V − in − G do
3:    distance[V] <- infinite
      previous[V] <- NULL
4:    if if − V! = S then
5:       Add V to priority queue Q
6:    end if
7:    distance[s] <- 0
8: end for
9: while while − Q − is − not − empty do
10:   U <- Extract MIN from Q
11:   for for − Each − unvisited − neighbour − V − of − U do
12:      tempDistance <-distance[U] +edgeweight(U, V)
13:      if temp − Distance < distance[v] then
14:         distance[v] <- temp-Distance
            previous[V] <- U
15:      end if
16:   end for
17: end while
18: return distance[], previous[]
```

4. Applications and Conclusions:-

In our project, we implemented A Basic Internet Model. Dijkstra algorithm has also been used and it has a wide range of applications in our day to day life, its major contribution is from internet. Some of them based on Dijkstra's Algorithm are listed below:-

1). Digital Mapping Services in Google Maps: Many times we have tried to find the distance in G-Maps, from one city to another, or from your location to the nearest desired location. There encounters the Shortest Path Algorithm, as there are various routes/paths connecting them but it has to show the minimum distance, so Dijkstra's Algorithm is used to find the minimum distance between two locations along the path.
2). Social Networking Applications: In many applications you might have seen the app suggests the list of friends that a particular user may know. How do you think many social media companies implement this feature efficiently, especially when the system has over a billion users. The standard Dijkstra algorithm can be applied using the shortest path between users measured through handshakes or connections among them. When the social networking graph is very small, it uses standard Dijkstra's algorithm along with some other features to find the shortest paths.
3). Telephone Network: As we know, in a telephone network, each line has a bandwidth, 'b'. The bandwidth of the transmission line is the highest frequency that line can support. Generally, if the frequency of the signal is higher in a certain line, the signal is reduced by that line. Bandwidth represents the amount of information that can be transmitted by the line.

4). IP routing to find Open shortest Path First: Open Shortest Path First (OSPF) is a link-state routing protocol that is used to find the best path between the source and the destination router using its own Shortest Path First. Dijkstra's algorithm is widely used in the routing protocols required by the routers to update their forwarding table. The algorithm provides the shortest cost path from the source router to other routers in the network.
5). Flight Agenda: For example, If a person needs software for making an agenda of flights for customers. The agent has access to a database with all airports and flights. Besides the flight number, origin airport, and destination, the flights have departure and arrival time.

Conclusions:- Through this project, we have explored a wide range of routing algorithms, we have gained remarkable knowledge about the DNS, connection of routers, routing tables, and transfer of data. We also have used Graphs so as to bring crash handling to our project, that how it would find a path and move along a network if one path of going to the routers is crashed. And after hours of interesting research, we finally concluded with the successful development and implementation of our project.

5. Bibliography and citations

1). https://en.wikipedia.org/wiki/Routing$_table$
2).$https://en.wikipedia.org/wiki/Routing_protocol$
3).$https://www.geeksforgeeks.org/applications-of-dijkstras-shortest-path-algorithm/$
4).$https://www.geeksforgeeks.org/open-shortest-path-first-ospf-protocol-states/$

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