Spread Reach – A Multipurpose Network Connectivity Model

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Summary

Reachability is important factor in any sort of activity happening in the real world. Specifically, in providing help to common people, it becomes the success of an activity that is measured using the amount of reach the activity achieves. People are connected in this world with physical interconnections. This interconnections occupy, a lot of space, matter and sometimes it is not feasible in few places. Thus reachability factor gets affected. Nowadays, we are moving towards wireless connectivity to enhance the reach and the effect is multifold. As it can be easily achieved in many places and ease of use for common people, we try to improve the reachability using wireless communication and use the achieved reach as a tool to provide basic connectivity.

Key words:
Networking, nodejs, javascript, helptool, roadways, hospitals, police, public

1. Introduction

To provide reachability to people at all points in the given area or locality an efficient way for intercommunication with Wi-Fi and hotspot. It is more like providing open networks that can be used for multiple purposes. Here, you can be connected to anyone from anywhere just a click away from your devices "without internet". It can be achieved using this model.

Wi-Fi is a technology for wireless local area networking with devices based on the IEEE 802.11 standards. Wi-Fi is a trademark of the Wi-Fi Alliance, which restricts the use of the term Wi-Fi Certified to products that successfully complete interoperability certification testing.

Devices that can use Wi-Fi technology include personal computers, video-game consoles, smart phones, digital cameras, tablet computers, digital audio players and modern printers. Wi-Fi compatible devices can connect to the Internet via a WLAN network and a wireless access point. Such an access point (or hotspot) has a range of about 20 meters (66 feet) indoors and a greater range outdoors. Hotspot coverage can be as small as a single room with walls that block radio waves, or as large as many square kilometers achieved by using multiple overlapping access points [1 & 2].

Wireless adapters allow devices to connect to a wireless network [3]. These adapters connect to devices using various external or internal interconnects such as PCI, miniPCI, USB, Express Card, Cardbus and PC Card.

A hotspot is a physical location where people may obtain Internet access, typically using Wi-Fi technology, via a wireless local area network (WLAN) using a router connected to an internet service provider [4 & 5].

2. Requirement Specifications

A. *Inputs identified*

   a. Input - accident: output – inform the nearest ambulance, hospital and police station.

   b. Input – chain snatch: output – inform the police vehicles in radius of 5 km about the issue.

   c. Input – traffic jam: output – inform the nearest police station and traffic police regarding the issue.

   d. Input – nearest amenity(hospital, medical shop multi complex): output – show the address of buildings

   e. Input – transport station: output – lists the nearest bus stops, rapid transits, metro stations, etc.

B. *Problem statements*

  I. Connection to the world: As there is no internet, we have to go for some other method to connect to the outside world.
Solution: Wi-Fi to hotspot data transfer. The mechanism to be used is explained earlier in the introduction part.

  II. Failure handling and path feasibility: If some nodes are damaged, it should not end the connection to other nodes. In case of movable nodes, their connection changes dynamically with location. Solution: Dynamic routing.

C. *Technological requirements*

   a) HTML
   b) CSS
   c) JavaScript
   d) Node.js
   e) XAMPP

HTML and CSS are used in the front end development of the application. JavaScript and local host are used for back end and for the database management of the application. The XAMPP control panel is used for the activation of

Apache server and MySQL, which are the basic requirements for working with a database.

Node.js is a runtime environment for JavaScript programs. It is the most suitable environment for networking applications and applications involving asynchronous calls.
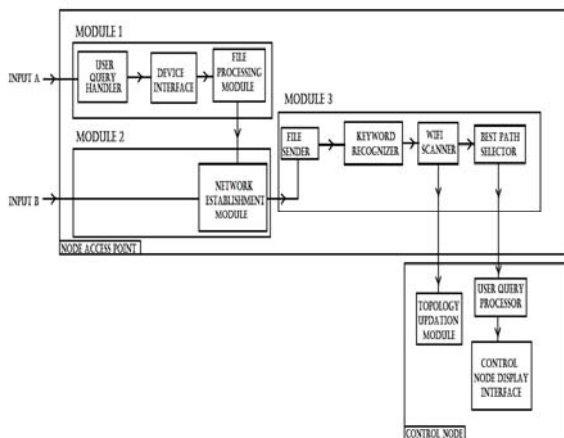
2. System Design

Fig. 1 The arrangement of modules for Spread Reach.

Detailed description of each of the modules presented in the system design in Fig 1, is elaborated below.

Node Access Point

Input a - request from user
Input b - connection request from a node access point
Module I.
- User query handler   - gets query from the user
- Device interface - displays the interface of the application for the user to access
- File processing module - converts the user request into a file along with a keyword

Module II.
- Network establishment - establishes connection between module several nodes in the network by getting their IP address and initiating Wi-Fi to hotspot connection

Module III.
- File sender - fetches the created file and sends it through the network of nodes to reach the specific control node
- Keyword recognizer - recognizes the keyword to route the information to the correct destination

- Wi-Fi scanner - scans the nearby nodes by means of Wi-Fi connection
- Best path selector - selects the best and shortest path to reach the destination

A modified hardware device similar to a router with required features is built. It has Wi-Fi, hotspot, minimal processing capacity, required memory and power supply. The working setup of Node Access Point is shown in Fig 2.

Example: streets at connectable distance to other devices.
- Input- Data from end user.
  Output- Packets of data with necessary serial numbers for control node identifications.
  Process- Processing the data into small packets and controlling data flow to other surrounding nodes.

- Input- Data as packets from surrounding nodes.
  Output- Redirection to control nodes
  Process- Checks the correctness of packet and redirects the packets in known direction of control nodes or floods the system.
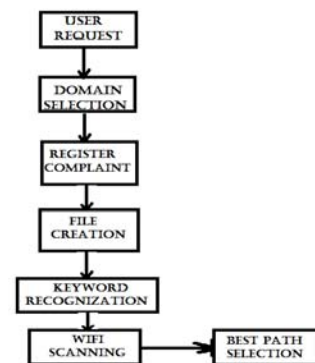

Fig. 2 The flow of commands in Node Access Point.

Control Node

- User query processor - gets the user query and decides the work to be done further based on the type of query received
- topology update - updates the topology of the network module whenever newer nodes are added or whenever current nodes fail
- control node display - displays all the information received from the user interface

This is similar to a computer or node access points with large storage and considerable memory. These are installed at major places which provides service for the people.

Example: hospitals, police stations etc.

- Input- The information as packets
  Output - The information in readable format
  Process - The process is extension of that of demodulator and provides with readable data.

End Users

The people who access the node access points give the initial inputs to the system. The system converts the information into packets and sends to appropriate designations according to the input. At the designated places, (control nodes) the users have to cater the required action by logging in a system. So both the end users play a vital role in this system. The system acts as a medium for connecting the end users. The working setup of Control Node is shown in Fig 3.
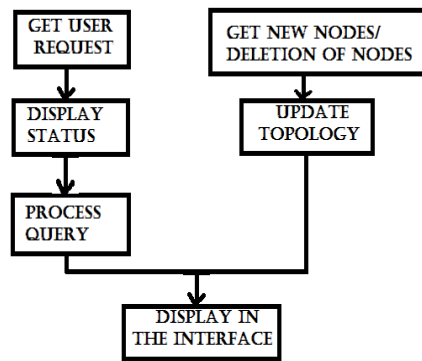

Fig. 3 The flow of commands in Control Node.

Algorithm:

Distance-Vector Routing algorithm
for each router y adjacent to x do
    for each other router w do
      if $Dx[w] > w(x, y) + Dy[w]$ then
        {It is faster to first go to y on the way to w.}
        Set $Dx[w] = w(x, y) + Dy[w]$
        Set $Cx[w] = y$
    end if
  end for
end for

Applications
- Help reach for incidents happening on transit
-

Example: When an accident happens and you have to reach for help. You can connect to this node access points and seek for Government set IP for accident help. This will take care of informing the nearest hospital, ambulance and police station.

- Hotel management automation:

Room service can be automated with node access points in every room and giving a local hosted IP for the users' need. They can login in any query and will be served right. Not just hotels, this idea can be extended to any sort of workplace environment.

- Access of internet to remote places:

This might be the ultimate future goal for this model. We don't have the enough knowledge and resources to work on this yet. Even if primitive algorithms can provide what is necessary, the speed and time and load on the node access points are huge to degrade the performance. Huge thought, knowledge and optimization in context with future hardware can make this possible.

4. Conclusion

The end result of the above software defined networking model varies depending upon the request given by the user as it is employed in different fields of day to day life. The purpose of the application is to provide reachability to people at a given locality without internet facility. The usage of this application can be helpful in places like hospitals, police departments and transport.

Appendix

XAMPP - Name of the tool that controls and manages the apache and mysql servers
HTML - Hypertext Markup Language, used to develop web pages
CSS - Cascading Style Sheets, used to add styles to web pages

Acknowledgment

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