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Routing of Data From Raspberry PI to A Remote Router Connected in a Network through Shortest Path Algorithm

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Abstract
The proposed security system captures information and transmits it via a remote router to local router and then to client's laptop. To route the video data the Raspberry Pi is sending the data to remote router with the help of shortest path algorithm the local router is able to receive it. So to route the data we have two types of routing (1) Static and (2) Dynamic. Static routing manually sets up the optimal paths between the source and the destination computers. On the other hand, the dynamic routing uses dynamic protocols to update the routing table and to find the optimal path between the source and the destination computers. Since we are having multiple router connected in the network present therefore we are using Dynamic Routing with Shortest Path algorithm. We have two types of data to be send to client (1) Encrypted video data (2) Signal for checking whether motion is detected or not. After receiving the signal of motion detection, the client will decrypt the encrypted data to see the video data received through routing and hence the Smart Surveillance Monitoring System is achieved.

Keywords
Dijkstra's Algorithm, Dynamic Routing, Networks, Raspberry PI, Shortest Path Algorithm

I. Introducion

A. Motivation
Observing or analysing a particular site for safety and business purposes is known as video surveillance. Security and crime control concerns are the motivating factors for the use of routing in smart surveillance system. Video surveillance cameras are used in shopping centres, public places, banking institutions, companies and ATM machines. Nowadays, researches experience continuous growth in network surveillance. The reason being is the instability incidents that are happening all around the world. Therefore, there is a need of a smart surveillance system for intelligent monitoring that captures data in real time, transmits, processes and understands the information related to those monitored. The video data can be used as a forensic tool for after-crime inspection. Hence, these systems ensure high level of security at public places which is usually an extremely complex challenge. As video cameras are available at good price in the market, hence video surveillance systems have become more popular. Video surveillance systems have wide range of applications like traffic monitoring [1] and human activity understanding [2].

B. Literature Review
Fast development in the technology has increased the risk of intrusion. Using security cameras allows a person to monitor his property. The majority of organization and administrations are making use of such security cameras with the intention to save their business as well as property from terrorists and illegal entry. Nowadays, the security cameras have become much more advanced, reasonable, smaller and straight forward. A number of video surveillance systems have been proposed for different purposes. Drew Ostheimer (Drew Ostheimeret al., 2006) proposed an automated and distributed real-time video surveillance system which can be used for the detection of objects and events in a wide range of applications. The system captures video from multiple sources which is then processed and streamed over the internet for viewing and analysis. The proposed system is flexible as the components of the system can be interconnected in several manners. The experimental results of the system show that it can handle multiple video data running on standard computers and yielding fluid video. A number of interconnected clients can view the multiple video feeds simultaneously. Alberto Amato (Alberto Amatoet al., 2005) proposed a semantic event detection system based on a neural classifier that screens continuous video streams and detect relevant events for video surveillance.

C. Objective
To transfer the video data from remote router to client's local router present in a network where intruder's router are also present to obtain the data .Thus we are using shortest path algorithm so that only client's router which is nearer to the remote router will be able to receive the data avoiding the leaking of data and thus providing security.

II. Existing Techniques
Although smart monitor surveillance system is already developed, but none of the system has included routing. Which can be very dangerous for leaking of data if any intruder try to hack the system. So in this system routing is considered as a main purpose for providing security in terms of data transferring.

III. Design and Analysis of System

A. Proposed System
The proposed system consist of USB camera, Raspberry pi, routers present in network and client's laptop. As soon as the motion is detected the USB camera will start and the captured video will send to the client's laptop through router present in the network. Now the question arises how to select the client's router?

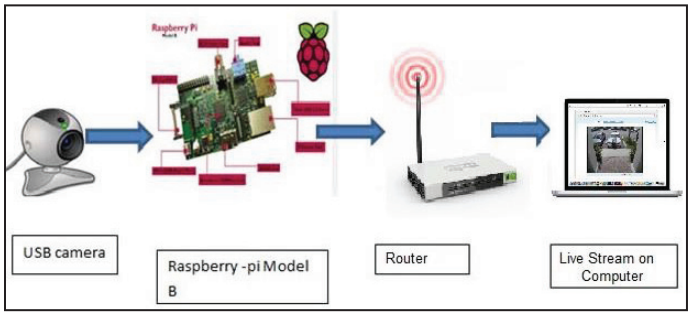

Fig. 1: Proposed System

The answer to the above question can be obtained with the help of the shortest path algorithm. The remote router will see the

optimal path as in the network it is having multiple router and since the client's router will be directly connected to the remote router and indirectly also. Using TRACEPATH command we can see how much time is required to reach the client's router and the minimum time path will get selected and the video data will be transferred on it.

B. Implementation

Steps:-

- Make a router as a primary router which will send the video data captured to the client's router.
- Connect two router one is the intruder's router which will be having the ip one greater than the primary router and it should be LAN to LAN connection, makes it DHCP off and second is the client' router which is having ip two greater than the primary router and it will be LAN to WAN connection, makes it DHCP also off .(We are doing this just to get the routers in network)
- Now there are two way of transferring data one is direct and second is indirect.
- Type the command tracepath <client's laptop ip>
- Select the minimum time path and data is transfer using that path.

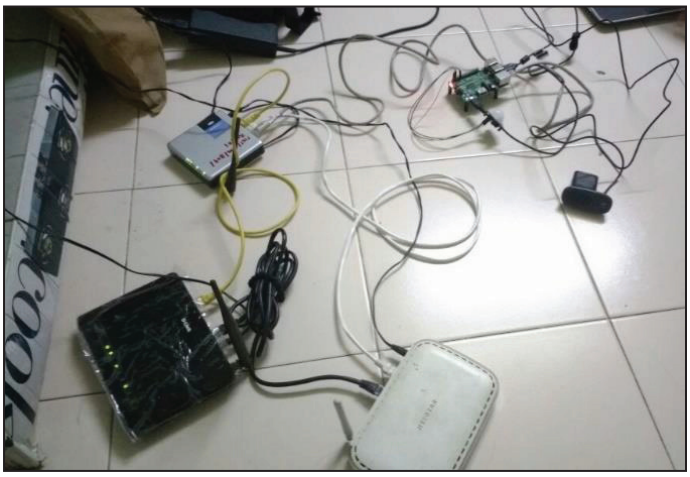

Fig. 2: Actual Implementation (3 Routers Connected in a Network)

IV. Related Mathematics

Let S be the set of system such that
$S = \{x, y, start, end, F_{main}, DD, NDD, Su, Fa|\phi_s\}$

x :- Input
Packets of video data which is to be send

y :- Output
= Data is received at client' laptop

start :- start state
=Create Vertex Set Q

end :- end state
= Shortest path is obtained from remote router to client's local router

F_{main} :- Main Function
Finding Shortest path from source to destination
Let Graph G represent the network
G=(E,V)
Where E=Links=(V_i,V_j) and V=Nodes
To go from V_i to V_j by Dijkstra's algorithm
$D(V_i,V_j)=\min(\Sigma_E)$
Where D=minimum distance between V_i and V_j

DD:- Deterministic data
1. Data is routed
2. Data send to client's router

NDD:- Non-Deterministic data
1. Connection Lost
2. Data send to intruder's router

Su:- Success case
1. Shortest path is obtained
2. Video data is send
3. Video data is received

Fa:-Failure case
1. Shortest path is not obtained
2. Video data is not send
3. Video data not received

V. Observation on Implementation Results

This section talks about the implementation that was undertaken by the researchers to demonstrate the transfer of video data from source router to client's router.

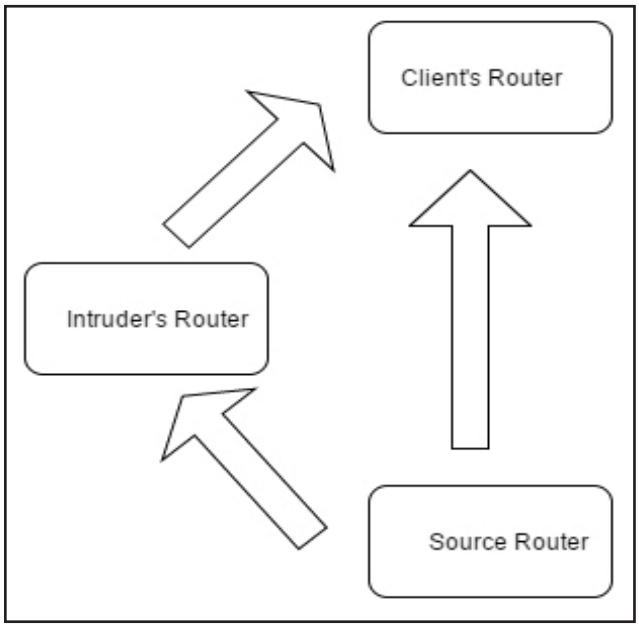

Fig. 3: Network Formed

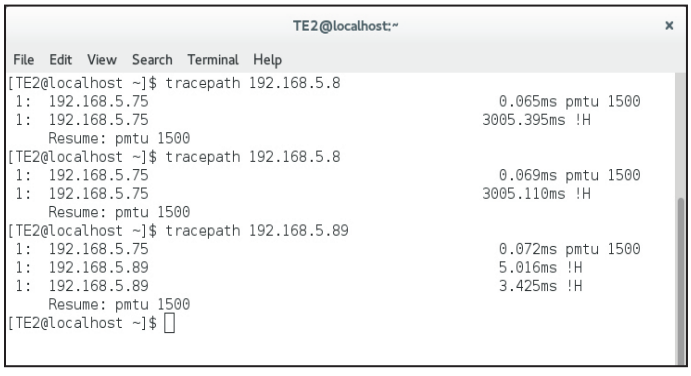

Fig. 4: Snapshot of Tracepath Command

In the above snapshot tracepath command is giving us the time required to reach an IP with more than one route path. After getting the minimum time our router on the basis of different parameters apply shortest path algorithm and send the data from source router to client's router.

VI. Conclusion and Future Enhancement

Raspberry Pi opens up a whole new chapter when it comes to technology today. Not simply because of its size but because of its capabilities. The fact that it is so portable allows it to be used for anything. Even though it is Linux based and many individuals are not familiar with terminal commands, the online community for Pi is growing.

Smart surveillance systems significantly contribute to situation awareness. Such systems transform video surveillance from data acquisition tool to information and intelligence acquisition systems. Real-time video analysis provides smart surveillance systems with the ability to react in real-time. Our system senses the intrusion and sends notifications to authorized persons so that action can be taken in response to the intrusion.

VII. Future Enhancements

Routing of data can be done on a very large scale area. In this implementation we are just creating a small network, but in future the network can be large enough for bigger purpose use of this idea.

The voice alarm circuit can be added to this system which indicates that the room is full and the persons cannot enter. The devices such as TV, Washing machine, can also be controlled.

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