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Expected Capacity Based Handoff` Scheme for Multimedia data

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Abstract: **Multimedia services such as VoIP using mobile stationsequipped with the IEEE 802.11 Wireless Local Area Network(WLAN) module in fast moving environments like Vehicle Adhoc Networks (VANETs) are being used constantly.To provide multimedia services handoff among access points is essential. But, the IEEE 802.11 handoff using hard-handoff may easily lose connection, and it wastes much time onrecognizing the connection severance and channel search time for re-connection. Such a wasted time can cause problems formultimedia data transmission. So, an expected capacity based handoff algorithm will give an idea to overcome the service disconnection problem. The simulation results show that the service disconnection problem is considerably reduced in expected capacity based handoff algorithm**.

Keywords: **Multimedia services, Wireless Local Area Network (WLAN), Vehicle Adhoc Networks (VANETs).**

I. INTRODUCTION

Vehicular ad hoc networks (VANETs) can provide scalable and cost-effective solutions for applications such as traffic safety, dynamic route planning, and context-aware advertisement using short-range wireless communication. Tofunction properly, these applications require efficient routing protocols. However, existing mobile ad hoc network routing and forwarding approaches have limited performance in VANETs. This study shows that routing protocols which account for VANET-specific characteristics in their designs, such as high density and constrained mobility can provide good performance for a large spectrum of applications.Wireless ad hoc networks (i.e., decentralized networks created on the fly by hosts located in proximity of one another) are no longer just a research concept. Due to their aptitude to require minimal effort to setup, ad hoc networks are suitable for a wide range of applications, including battlefields communications and disaster recovery operations. Researchers at the National Institute of Standards and Technology (NIST) demonstrated an ad hoc network prototype for first responders in building fires and mines collapse, Unmanned vehicles (aerial, terrestrial, and aquatic) with autonomic operation of a fewhours, already can be sent to regions where human presence is deemed dangerous, and they can form networks on the fly to report observations to command and control centres.

IEEE 802.11 based Wireless Local Area Network [WLAN] internet service support convenient network connection as well as high transmission speed, it supports wide-band wireless connection network. In addition, mobile devices, such as laptops, smart phones, and PDAs equipped with an IEEE 802.11- based WLAN module are spreading rapidly. Hence, users constantly want access the real-time multimedia services, such as multimedia video services, VoIP, and Internet services.In order to provide multimedia services while people are on the move, a mobile station needs multiple Access points and needs handoff between these APs.

IEEE 802.11 technology uses hard handoff method unlike Cellular network. The hard handoff connection to source is broken before the connection to target has been made. Therefore, the handoff method of IEEE 802.11 easily loses connections, which consumes time dropped by data transmission. This time is proportional to handoff latency; it approximates over 300ms in the OSI layer. This is longer than 150ms that users using Voice over Internet Protocol (VoIP) recognize a disconnection when they speak over a telephone. In order to support real-time multimedia services, it is important to decrease the gap of 150ms. Moreover, if a mobile station uses a real-time multimedia service that needs to transmit a tremendous amount of data, then it requires high bandwidth, but IEEE 802.11 only considers Received Signal Strength Information (RSSI) as a method of AP selection. The RSSI of AP that is selected by moving direction of the node may be weakened; therefore, the mobile station cannot get enough bandwidth, this causes frequent handoff problem. For this reason, we need an algorithm that reduces handoff latency for real-time multimedia services to select the best AP considering moving direction of mobile station. This work develops an algorithm that predicts handoff point of a mobile station using GPS information and proposed algorithm guarantees high transmission bandwidth considering not only RSSI, but also the moving speed and moving direction of mobile stations. The experimental results confirm that suggested algorithm achieves suitable handoff latency and bandwidth in real-time multimedia services.

II. EXPECTED CAPACITY BASED HANDOFF ALGORITHM

When a mobile station moves, the expected capacity-basedhandoff algorithm begins receiving the beacon frame that Apsadd their own location and state information to the last part ofbeacon frame. A mobile station produces an expected capacity that can beserviced during Ttime from the neighbour AP according to thelocation information received from its GPS and APinformation. Thus, an algorithm to handoff tothe AP with the highest expected capacity will be designed.

The handoff algorithm consists of the location informationcollection step, handoff prediction step and expected capacitycalculation step.

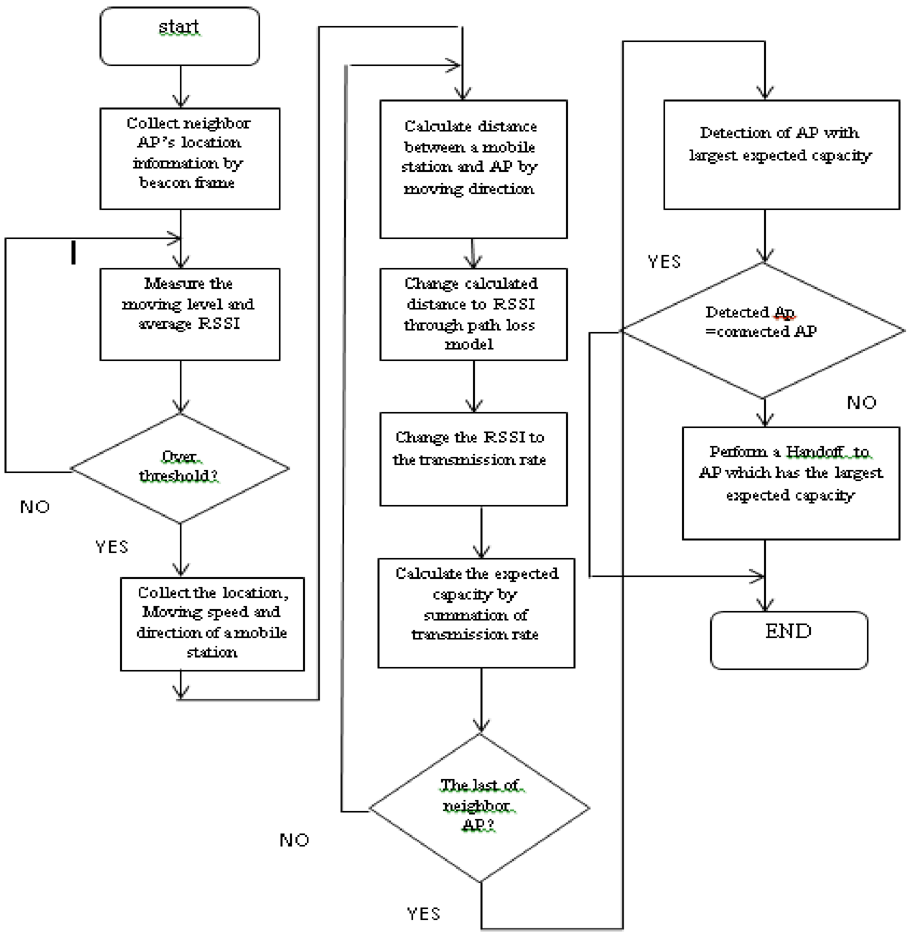

Fig 1: Flow chart of expected capacity-based handoff algorithm

I. The Location Information Collection Step:

The expected capacity based handoff algorithm calculates theexpected capacity that can be received during Ttime fromneighbour APs, while the mobile station handoffs to the AP that has the highest expected capacity.Therefore, the location information collection step must collect the mobile station location information and each AP'slocation information. The location data of mobile station is obtained by a GPS device that directly connects to a mobilestation.

II. The Handoff Prediction Step:

The previous location-based handoff only considersthe AP location, it maintains the connection with the nearby APeven if the signal strength of the currently connected AP isweak.Hence, in case of considering signal strength, a ping-pongphenomenon in AP's boundary area can easily occur.Therefore, in order to prevent the ping-pong phenomenon, theexpected capacity handoff algorithm predicts the handoff usingboth distance and signal strength between the connected AP asthreshold. That is, in order to prevent unnecessary handoffs, incase that the distance between the currently connected AP andmobile station is close and the signal strength is sufficient, themobile station maintains connection with the currentlyconnected AP.

III. Calculation Step:

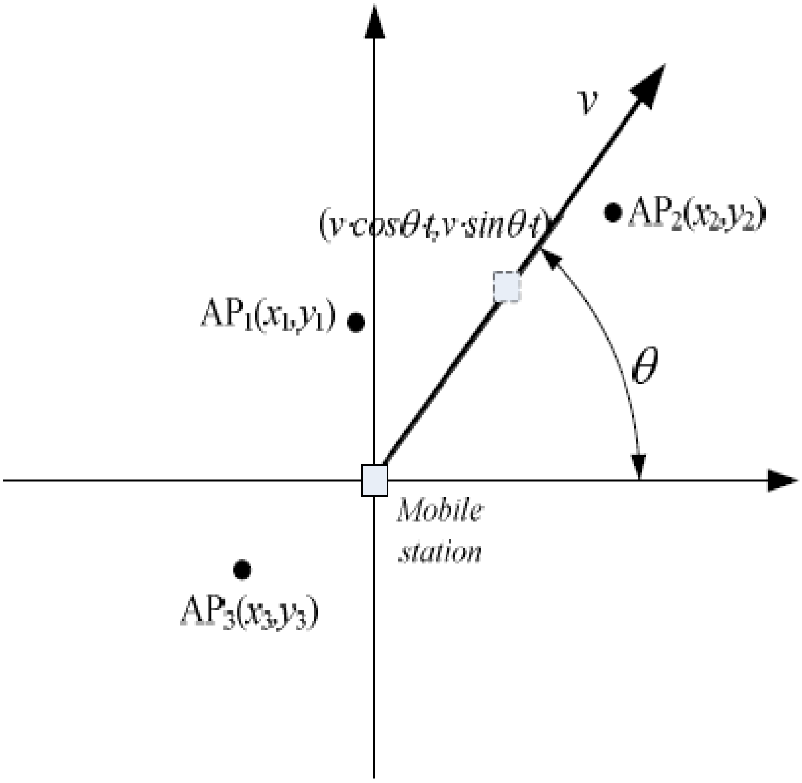

Fig 2: Graph used to calculate expected capacity

As above figure 2indicates, let us assume that we know the movingspeed of a mobile station, moving direction of mobile stationand location information (Xk, Yk) of candidate APks. The handoff algorithm that performs handoffs to APwith the highest Expected Capacity for T seconds will be designed.Assuming that a mobile station maintains moving speed andmoving direction of the current value, the expected distance(d(t)) between the mobile station and AP is as shown in equation-1.

d(t)=$\sqrt{v^2t^2 - 2v(x_k cos\theta + y_k sin\theta)t + x_k^2 + y_k^2}$

let$\omega_k = x_k cos\theta + y_k sin\theta$, $d_k = \sqrt{x_k^2 + y_k^2}$

d(t) =$\sqrt{v^2t^2 - 2\omega_k vt + d_k^2}$ - 1

d(t) has bigger value than 0, and in case Wkis a negativenumber, d(t) is monotone increasing in evaluation sectors [0,T]. Namely, a mobile station recedes from AP.In case of 0 <Wk<T a mobile station recedes afterapproaching AP. In case of Wk ≥ T, the mobile stationapproaches continuously in the evaluation sectors Because the mobile station moves, the distancebetween AP3 and the mobile station increases, the distancebetween AP2 and themobile station decreases, and the distancebetween AP1 and the mobile station increases after decreasing.

III. RESULTS AND DISCUSSIONS

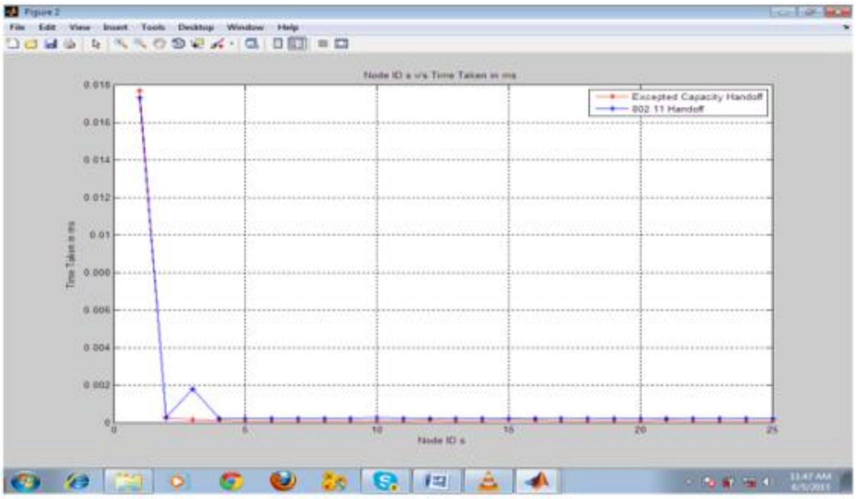

Fig 3: Time delay comparison

The time delay comparison of expectedcapacity based handoff algorithm is less compared to IEEE 802.11 hard handoff algorithm.

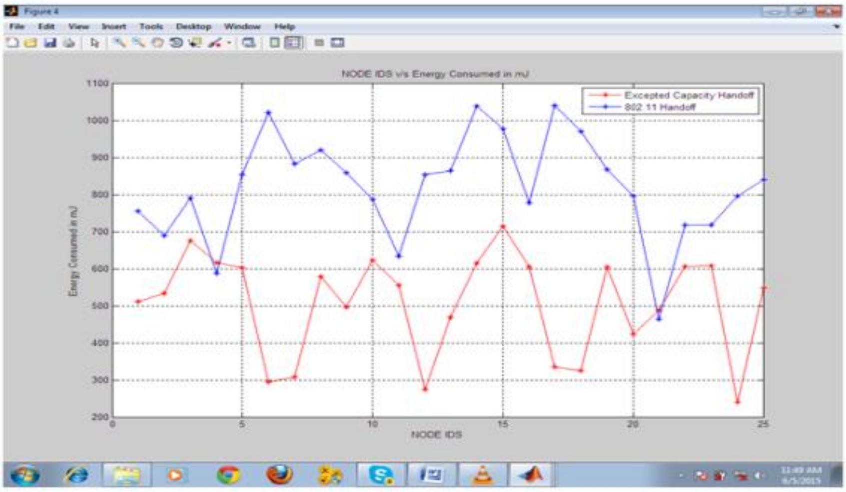

Fig 4: Comparison of energy consumption

The expected capacity based handoff algorithm will always consume less energy as compared to 802.11 handoff for all the 25 vehicles

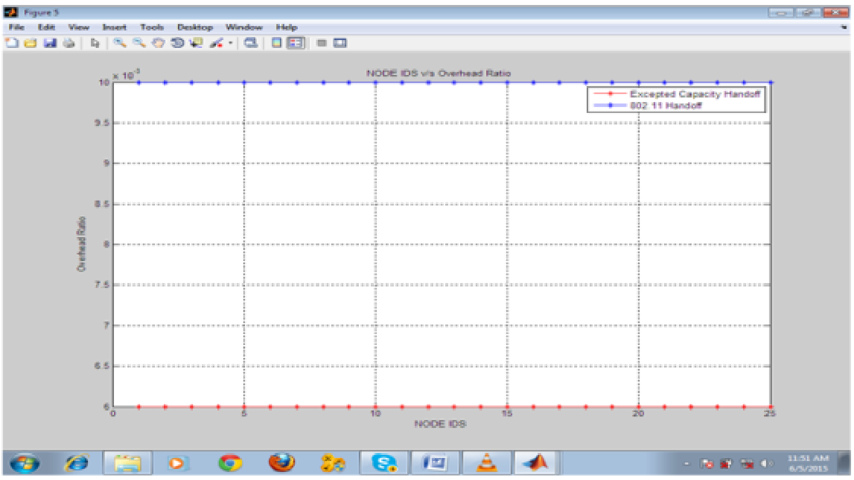

Fig 5: Comparison of overhead ratio

The overhead ratio of Expected Capacity Handoff is less as compared to 802.11 Handoff

Hence, the proposed expected capacity based handoff algorithm successfully overcomes the service disconnection problem found in IEEE 802.11 handoff algorithm.

IV. CONCLUSION

IEEE 802.11 Handoff and Expected Capacity Handoff are compared using the parameters namely time Delay, Number of Hops and Energy Consumption .The expected capacity handoff algorithm outperforms IEEE 802.11 when compared with all parameters and overcomes the service disconnection problem.

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