An Effective and Reliable Handover Mechanism in Mobile Area Network

Sumit Sharma¹, Dr. Balkishan²

¹M. Tech. Student, DCSA MDU Rohtak (India)
²Asstt. Professor, DCSA MDU Rohtak (India)

Abstract
Mobile Area Network is the indoor sensor network in which the network is defined with tiny smart sensors. Such kind of network having the challenge is the mobility of smart sensor nodes over the network. Each sensor node is controlled by relative base station or the coordinator. But if the sensor node moves outside the range of coordinator in such to perform the reliable communication the control of that sensor node handover to some other coordinator, this process is called handoff process. In this work, a parametric handoff process has been defined under the physical characteristics analysis as well as under throughput and response time based analysis. Presented work is implemented in NS2 environment. The obtained results show that the presented work has reduced the error rate upto an extent.

Keywords: Handoff, MANET, WiMax, Horizontal Handover, Throughput.

1. Introduction
A wireless sensor network (WSN) consists of large numbers of sensor nodes, which are consistent through wireless links to perform distributed sensing task. These sensor nodes collect data from the network and report to the sink. The sink node is one of the very critical elements of the wireless sensor networks (WSN). In the future the sensor networks will be widely use with the help of promising sensing and wireless technologies. These technologies can be deployed in civil or military applications. Sensor network are often used in application where it is difficult to setup wired network for example, monitoring in wild life, military surveillance and tracking objects.

As battery powered sensor nodes have limited life time of energy so these methods have to be energy efficient. In the sensor networks there are also some work mutually considers multi-hop network transmission and sink movement in the data collection. The meeting approach has been broadly studied in which sensor nodes sends the data to some selected meeting point for temporary storage until the sink came and collect the data. Then data are forwarded to the closest node of the sink. Then sink picks up the hidden data when it passes by. Wang et al. showed that compelling the mobile transmits in the neighborhood of the sink can increase the network life time. Xing et al. projected two algorithms for planning the data collection of the sink in which sink move along the network routing tree. So location privacy of the sink is very necessary in the sensor networks.

Many attackers can capture the passing through node and they can read the destination address of packets and can find out the location of the sink. Some attackers may predict the location of the sink by the network traffic. When sensor nodes sends the data to the sink then attackers may notice the traffic at sink ad may predict the location of the sink. To address these problems we proposed a scheme of data collection at random time. Some attackers may trace the sink by predicting its movement. In random data collection scheme which protect location privacy of the sink there is a thing where attackers can attack on the data, which is time, in random data collection scheme sink collect the data at specific time. So attackers can attack on the sink node by continuously sitting at same node.

Handoff process basically defines the continuous communication between the mobile sensor and the coordinator even if the node moves outside the coordinator range. In such case, the control of the
sensor node shifted to some other coordinator. In this paper, the work is defined to perform an effective handover process under different parameters. The decision parameters taken here are the throughput analysis under the physical characteristic analysis of the coordinators. The work is about to reduce the error rate and to improve the network throughput and network delay.

2. Review of Literature

Ejaz Ahmed et. al. performed a work, “Handover Optimization for Real-Time Application in Mobile WiMAX / IEEE 802.16e”. In Presented scheme minimum number of Base Stations will be scanned and MS should scan only those BSs which can fulfill the bandwidth requirement of MS. Priority should be given to real time flows in handover. Farhat Anwar et. al., presented the performance analysis of Ad hoc Routing Protocols in mobile WiMAX environment. They study and compare the performance of four ad hoc routing protocols (AODV, DSR, OLSR and ZRP) for Mobile WiMAX environment under the assumption that each of the subscriber station has routing capabilities within its own network. From our simulation, we found that ZRP and AODV protocols outperform DSR and OLSR. A performance comparison of four different ad hoc routing protocols (AODV, DSR, OLSR and ZRP) was performed here using different mobility scenarios. Simulation had been conducted in Mobile WiMAX environment. From the result of our studies, it can be said that, on an average ZRP and AODV perform better than DSR and OLSR. In case of DSR, it has less routing overhead, but average end to end delay is higher. However in case of OLSR, it has higher routing overhead, but average end to end delay is less. Haidarali K. Ansari performed a work, “Efficient Handover among WiMAX and WiFi”. In this paper, Author propose the fast handover techniques between WiMAX and WiFi networks to speed up handover process. A link layer fast handover approach is proposed to realize fast link layer connectivity. An IP layer fast handover mechanism is proposed to achieve the high speed IP layer connectivity. Harjit Kaur et al. have performed a work, “Improved switching technique in soft handovers for wiMAX network”. They have developed a base station selection procedure that will optimize the soft handover such that there is no data loss; handover decision is taken quickly and thus improving overall handover performance. It will compare the quality of service with hard handover and soft handover. They have analyzed the proposed technique with an existing scheme for soft handover in wiMAX with simulation results. Thruput, End to End delay and Packet delivery fraction are main parameters to determine quality of service. These parameters are also analyzed and compared with simulation results. Jianlin Guo performed a work, “Location Aware Fast Handover Between WiMax and WiFi Networks”. This paper proposes a location aware fast handover technique for vertical handover between WiMAX and WiFi networks. The proposed technique aims to reduce the total handover latency and can be applied to realize seamless handover between WiMAX and WiFi networks. J. Ho Park et. al explained the design of a mobile WiMAX system for military applications and its performance in fading channels. In this paper, they proposed a new mobile WiMAX scheme that provides the DL to UL ratio (DUR) to be 9:33 by modify the frame structure. Fading channels for the modified mobile WiMAX system are presented. They evaluate the bit error rate (BER) performance and compare the throughput at the different DUR. We have presented DUR to be 9:33. In military applications, MS can transmit much bigger data. So the frame structure of UL can need to be bigger. They analyzed the military applications of OFDM in mobile WiMAX system. In the DL, the complex signal processing for overcoming fading channels should be done by the MS. The MS may be not suitable for this signal processing because the MS has the limited hardware. But in the UL, the complex signal processing by the BS is more convenient to handle fading channels. Kheya Banerjee performed a work, “An Efficient Handover Scheme for PMIPv6 in IEEE 802.16/WiMAX Network. The proposed scheme reduces handover latency by eliminating the need of a Policy Server (PS) and by pre-registration of the mobile node for a new access point. Furthermore, a comprehensive analysis has been done by NS-2 (Network Simulator-2) for evaluating the delay of Presented proposed handover scheme and that of general PMIPv6. M. Grine performed a work, “Performance Optimization of WiMAX Mobile Networks with a Predictive Handover Process”. In this paper Author use the linear regression model to build a predictable hard handover algorithm that predict the Received Signal Strength Indicator (RSSI) value and adveritze the MS to
trigger the scanning procedure and the handover process operations reducing so the total handover latency and packets loss rate.

3. Problem Formulation

The presented work is about to achieve the effective and stable handover in an indoor MANET area network. The work is performed for WiMax protocol so that the effective throughput can be obtained over the network during the handover process. In this work, the smart sensors are been defined as the network nodes and the coordinators are defined as the controller nodes over the network. As the node moves outside the sensing range of its coordinator, the coordinate reselection is required. This process includes the Handover decision, initialization, synchronization etc. In this work, the main stress has been defined for the decision parameters. We have defined a multi parameters based analysis approach to perform the handover over the network.

4. Research Methodology

When we work with a large Wireless MANET network with n number of clusters and the nodes over the network having the mobility in itself. A a node move from one cluster area to other, In some case it is possible that more then one cluster head claim the control on that node. In such case which CH will be selected to take the control of communication for that network. The node selection must be reliable, secure and efficient. The proposed approach is the work in the same direction such that a secure handover will be performed. A secure and efficient handover will result the efficient transmission over the network. The parameters considered here are the capacity of Coordinator node, Idle capacity of node and the throughput analysis. The capacity is the basic physical characteristics used to perform the analysis based on the frequency range etc.

A. Coordinator Capacity Estimation: To perform the effective handover process, the foremost task is to estimate the capacity of all sensor coordinators that are in range. The range estimation is based on the frequency specification of the coordinator along with overhead symbols. The type of multiplexing used by the coordinator, the type of signals and the frame structure used by the coordinator defines the physical characteristics. These characteristics collectively used to perform the frequency based analysis over the nodes. To perform the estimation of capacity analysis the signal analysis is basically defined in this work. The signal analysis here defined based on the number of symbol frames transmitted over the particular interval.

B. Idle Capacity Analysis: The next work of this communication analysis is the estimation of idle capacity when no communication is performed over the network. In such case the message analysis is been performed. To calculate idle capacity each BS can estimate its maximum effective capacity on a real-time basis. Through statistics a BS is also aware of the current data traffic throughput. Therefore, each BS could obtain the effective idle capacity as:

\[ C_i = C_{\text{effective}} - C_{\text{throughput}} \]

C. Target Cell Decision: In our decision algorithm the decision factor for each candidate coordinates depends on both factors: idle capacity and signal strength. We have combined the two factors into a weighted target cell decision function. The parameters taken here are the throughput analysis on the response time analysis. The neighbor coordinator with higher throughput and minimum response time will be selected as the next communicating coordinator.

D. Algorithm: The steps to perform the handoff process are given as under:

1. Define a network with N number of nodes and M number of coordinators.
2. Define the initial parameters such communication range, sensing range, communication rate for the coordinator nodes
3. Perform the random selection of node that will move outside its current coordinator. As it will be outside the sensing range, the handover will be performed.
4. for i=1 to Length(Neigbours(Coordinators))
   For j=1 to Number of Nodes
\{ 
\text{Distance}(i)= \text{Distance}(\text{Node}(i),\text{Coordinator}(i)) \\
\text{Throughput}(i)=\text{ThroughputOn}(\text{Cluster}(i)) \\
\text{Responsetime}(i)=\text{ResponsetimeOn}(\text{Cluster}(i)) 
\}

5. Find the cluster head with maximum throughput and minimum response time and set it as the current coordinator

6. Return \text{CurrentCoordinator}

5. Results

The presented work is implemented in NS2 environment under the defined scenario. The scenario parameters are given in table 1.

\begin{table}[h]
\centering
\begin{tabular}{|l|c|}
\hline
\textbf{Parameter} & \textbf{Value} \\
\hline
\text{Modulation Scheme} & 1/2 BPSK \\
\hline
\text{No of Clusters} & 5 \\
\hline
\text{No of Sensor Nodes} & 50 \\
\hline
\text{Simulation duration} & 10 s \\
\hline
\text{Requested data rate} & 50 kbps \\
\hline
\text{Coordinator Coverage} & 10 m \\
\hline
\text{MS Speed} & 5 m/min \\
\hline
\end{tabular}
\caption{Scenario Parameters}
\end{table}

The result analysis of presented work is shown in figure 2 and figure 3.

As we can in figure 2 Number of packets transferred in proposed work is higher as compare to the existing work. It means the proposed approach transmit the higher number of packets.

As we can see, in the existing work, the loss rate is higher but in proposed work packet loss is not there. It means the existing approach gives the higher data loss.

6. Conclusion

The paper introduced an optimized handover scheme for Mobile Area Network. The work defined is under different parametric estimation. These parameters includes the physical properties analysis as well as the communication analysis. The proposed work shows that the proposed work has improved the network throughput and reduced the packet loss over the network.

References


