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Performance Analysis of Reduced Handoff Interruption Time and Energy Utilization in Cognitive Radio Networks by Unmanned Area Vehicle

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Abstract :The WiMAX (Worldwide Interoperability Microwave Access) is important in communication systems. Mobility is also important in WiMax to achieve high speed in data exchange over the medium. During the exchange of data handoff may be occurred.This paper is focused on handoff in WiMAX and MS (Mobile Station). The Handover Management Algorithm is used to avoid handoff in addition to improve the handover interruption time and to decrease the signaling transaction during the handover procedure we used Global Position System (GPS) to perform handoff faster. GPS has been introduced in this paper to find the position of the MS and BS then the MS will automatically choose BS by routing. We developed a new algorithm to improve the handoff interruption by introducing Time Division Multiple Access (TDMA).The MS finds its position using GPS and find the distance to the SBS (Source Base Station) and nearby BSs. In the next step,MS selects the target BS based on distance. Moreover we combine Handover Management Algorithm (HMA) with Cognitive radio networks (CRNs) for which are the way out for the trouble of underutilizing the license spectrum for which there are more needs in the final pair of decades. The congestion of the wireless spectrum has triggered a stringent contest for panic network resources.

Keywords - WiMAX, TDMA, Handoff, GPS, UAV, CRN, HMA

I. INTRODUCTION

The concept between Hard Handoff and Soft Handoff are explained. In soft handoff the MS is connected to two BS of various types, soft handovers like FBSS (fast base station switching) and in hard handoff the connection is established for serving BS which is interrupted while the new base station gets into connection by Handoff Prioritization

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In general Frequency ranges 2-11 GHz for NLOS (Non-Line of Sight) and 10-66 GHz for LOS (Line Of Sight).In NOS transmission, the range extension is 8 km with speed up to 70 Mbps and in LOS transmission, the range is about 50 km.

WiMAX range can be extended in wireless access up to 8000 square km of coverage. A WiMAX tower to tower connection are made using of microwave link called backhaul[5].

In NLOS, a small antenna on your computer is connected to tower, a fixed dish antenna points straight at the WiMAX tower from a apex [2] But in our algorithm distance is determined by MS using GPS. The departure is less than 2 meters In the next section HMA algorithm will be introduced. Since so many users shares the same channel there is a chance of occurring handoff delay so to avoid that we introduce TDMA in this method the users transmit information in every succession, one by one transmission / reception, everyone can use its own time slot[3]. In general WiMAX tower, covers up to 8,000 square km by a single tower. The distance between two towers can be 30 to 50 km. The HMA algorithm used in Femtocell which is a small cellular base station a low-power wireless AP (access point) designed for use in low level environment[4]. All MSs and BSs have a position. The MS position will be determined by GPS. The distance between MS and BSs are actually determined by MSs. The position of the MS can be determined in a period of time less than 60 ms, When the position of MS and all BSs are determined. Shadow fading will be occurred when there are physical obstacles (e.g. hills , towers , and buildings) between the BS and MS , which affects the received signal strength. Multipath fading occurs when two or more transmission paths exist between the BS and MS. According to the IEEE 802.16e standard, BS requests the report within 10 seconds by sending REP-REQ (report-request) message to all MSs and receives their responses by REP-RSP (report-response) or ACK (acknowledgement) message. In addition HMA and CRN are combined together by means of introducing UAVs to the system, UAVs or drone base stations (DBS) will help us to have signaling range to the place where no signal occurs.

II. RELATED WORKS

A. Handover Delay

The total time for the completion of handoff is based on the mobility of the mobile user. Moreover the handover process should be in a fast manner[1].

B. GPS system

The MN (Mobile Node) with GPS generates an AP (Access Point) map while it travels within a network. When MN enters into another network, it will download its GPS map from server. The MN gets the latitudes and longitudes by Basic Service Set ID (BSSID), AP's Service Set ID(SSID) and IPV6 are configured. By these AP and GPS map, we can locate the MN's position in a network and whether a MN moves or not. Finally GPS is used to calculate the distance.

C. Cloverleaf receiver design

The antenna is designed in such a way that it emits maximum radiation, The field gain of the receiver should match with signaling strength of DBS, neglecting losses also the receiver is incorporated with both the horizontal and vertical polarization, the receiver is chosen to have zero losses also there is a possibility of having signal ranges in all possible mode for that Quadrature phase Shift Keying (QPSK) modulation is enabled in this paper.

D. Skew planar antenna

D.1 DBS design based on structure includes

- Weight
- Flying mode
- Avionics method (UAV Command Control Communications)
- Integrated Network which includes ground station connectivity

D.2 DBS design based on power

- Transmission power of the MBS (Mobile Base Station)
- Transmission power of the DBS
- Time slot duration
- Path loss between drone and earth station
- Noise power level
- Mobility services center
- Multi-hop communication
- UAVs are occupying areas with high traffic where there may be a congestion

D.3 UAVs design must have

- Better antenna design as transceiver
- Coordination with MBS

UAV can be a multi-copter which includes battery, GPS module, Receiver, Auto Pilot so the design must be incorporated with those things

III. PROPOSED METHOD

We propose HMA method, distance dependent fading, or path loss, occurs when the received signal becomes weaker due to increasing distance between MS and BS and to reduce scanning delay 96 % of handover delay.We use umbrella concept to cover all small BS in a biggest BTS (Base Transceiver Systems). UAVs also used for covering uncovered area or during emergency UAVs are used as flying drone base stations. In this paper we propose drone base station (DBS) or UAV to cover uncovered area which is shown in figure 6.

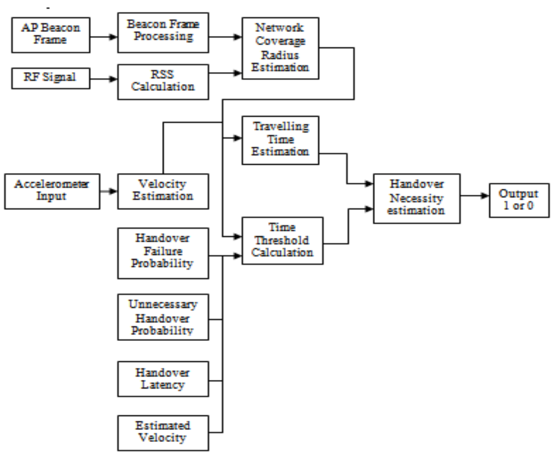

Fig. 1. Handover Estimation

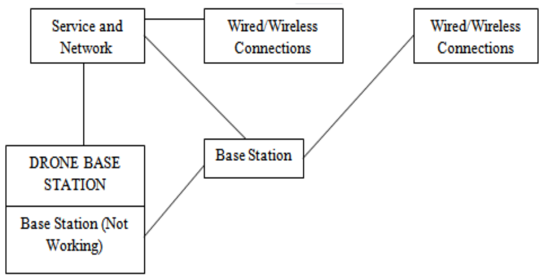

Fig. 2. Drone BS engages BS which is not working

In this paper we focus on DBS design for emergency coverage to a large area struck during festival and by natural disaster. The design of DBS which involves

- DBS Mother board
- DBS Base
- DBS Frame
- DBS Propeller
- FPV Antenna

FPV Antennas are most favorable antennas especially meant for Drone BS, it supports both for linear and circular polarization. FPV antennas are tuned to specific frequencies 5.8 GHz for video

- Cloverleaf antenna as receiver
- Skew planar antenna as video transmitter.

A. Hypothetical consideration

Parameters involved in multimedia transmission are as follows:

- Processing time due to multimedia traffic, the processing time for process completion varies.
- Bandwidth utilization Bandwidth utilization is linked to the transmission of data.As the transmission essentials are complex, the bandwidth utilization increases, and this outcome in increase in processing time.

IV. SYSTEM REQUIREMENTS

Table- I: System Configuration

Operating system	Windows 7 &Windows 8
CPU (Central Processing Unit)	i3 Processor, Core 2 Duo
Memory	4 GB RAM
Network	TCP/IPv4

For the entire software controlled operations we choose windows 7 as operating system, by giving additional well equipped processor i3 the speed of all operations can be increased, the 4GB RAM is more than enough for this DBS enabled system.

V. RESULTS

For simulating the scenario we used the QualNet4.5.We choose the environment that contains 8 BS and every BS has one subnet. In this scenario, handover is performed in BS1, BS2, BS3 and BS4. All BS are connected to one switching center. Handover is performed just in the first access level. We didn't consider handovers between ASN's. One MS moves and connects to four BSs that are in the path. Some MSs are connected to the BSs but just MS5 has movement during the simulating handover. Figure 6 shows the signaling path of DBS and figure 7 tells us how to operate UAV.Fig 3 shows Bit Error Rate (BER) analysis, Fig 4. Shows MS-BS Selection by distance, Fig 5. Shows Handover Vs Outage probability when the users travelling from one place to another. From fig 8 we observes how drone working in air medium through wireless connectivity.

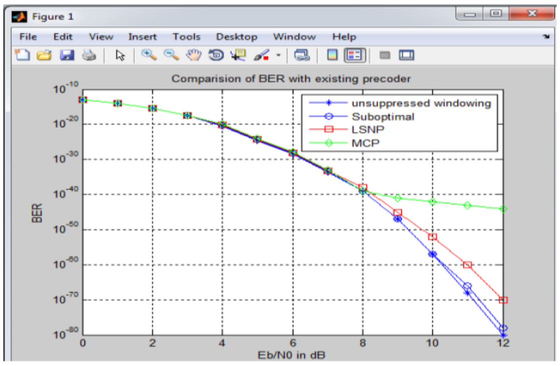

Fig. 3. BER Analysis

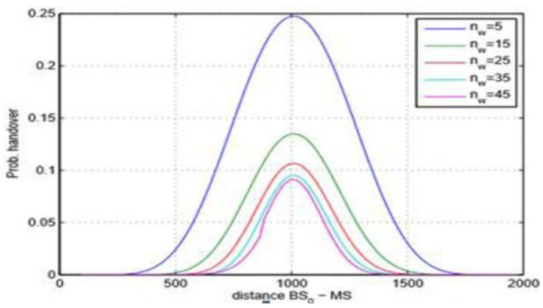

Fig. 4. MS-BS Selection by distance

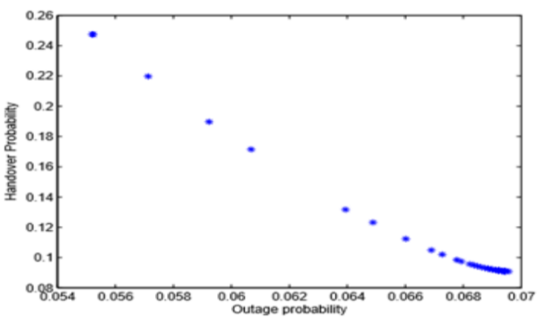

Fig. 5. Handover Vs Outage

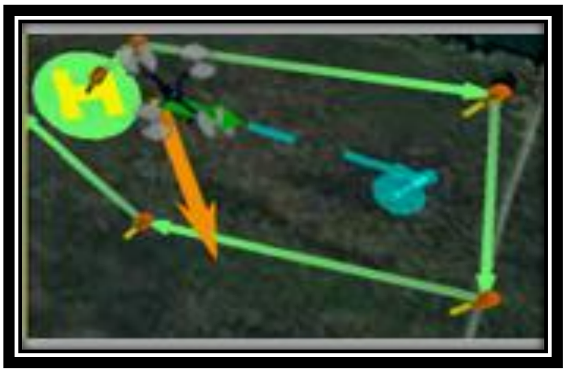

Fig 6.Drone signaling path

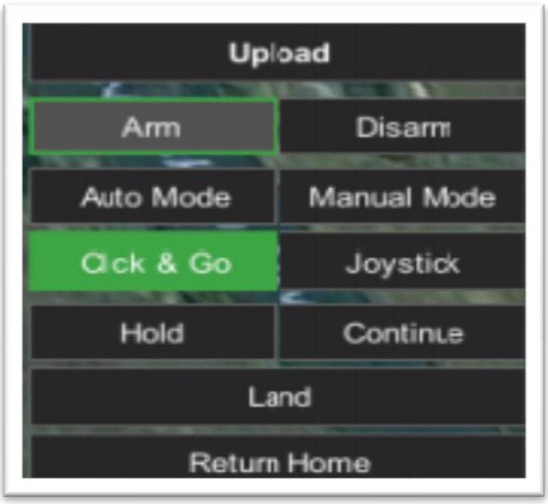

Fig 7. Screenshot Monitoring UAV Control

Fig. 8 . Multi-copter connected with various parts and UAV base station – Wireless Connectivity

Table- II:. Throughput, Jitter, Average delay

Speed (mps)	10	50	100	150	200	250
Server Throughput (bps)	3175	1000	690	575	550	800
Average Jitter(s)	0.011	0.01	0.01	0.01	0.021	0.061
Average end to end delay (s)	0.029	0.03	0.03	0.04	0.04	0.11

VI. CONCLUSION

The HMA for cognitive radio networks have been proposed. In this paper we calculated server throughput, Average jitter and Average end to end delay calculation is simulated by QualNet4.5 and by using UAV signaling path is identified by Universal Ground Control software (UGCS) and the corresponding signaling transaction is given by DBS to the place where we have no signaling during emergency period. Finally handover probability , MS-BS selection, BER analysis also have been calculated. we proposed to intend drone base stations (DBS) stir relentlessly and update their stirring directions mobility algorithm, the continues movement of DBS may reduce distance between BS and users further which also probably gives LOS (Line of Sight) connection. The frames of information about signaling level of BS is continuously sending to ES (Earth Station) via OFDM (Orthogonal Frequency Division Multiplexing) procedure in the midst of AM(Adaptive Modulation) and coding is used to attain erratic data rates 62 kbps to 744 kbps and to afford a multipath resistant solution.

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