Seamless Handover of Video Streamingin 4G Wireless Network

Dr. S. M. Koli
Prof. (E&TC Department)
Dr. D. Y. Patil School of Engineering
Charoli, Lohegaon, Pune
sanjaykoli@yahoo.com

Anand B. Raut
Student, Master of Engineering
Dr. D. Y.Patil School of Engineering
Charoli, Lohegaon, Pune
rautanand11@gmail.com

Abstract—This paper presents QoS aware seamless vertical handover system for video streaming over wireless network. When the user is moving, the signal strength varies which may resultin buffering of the video. Various modulation techniques are used for continuous streaming of video and to resolve this issue. OFDM technique is used for multi carrier transmission with modulation formats such as BPSK and 16QAM.The system modulator switches between the two modulation schemes depending upon the Signal to Noise Ratio (SNR).In order to achieve continuous streaming of video the video is compressed at the time of handover. Experimental results shows that the performance of the system is better.

Keywords—*QoS Handover; Video Streaming; OFDM; Wireless Networks; Signal to Noise Ratio*

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I. INTRODUCTION

Streaming video is a content sent in compressed form over the Internet and displayed for the viewer in real time. With streaming video or streaming media, a Web user need nothave to wait to download a file to play it. Instead, the media is sent in a continuous stream of data and is played as it arrives. While accessing video streams the 3G/4G wireless networks user has to wait for large buffering delays and still it suffers from lots of interruptions due to the variation in the bandwidth and link fluctuations that are caused by user mobility and multipath fading[1].

- Basic Handover Scheme

Handover is the process of switching from its current mobile node to a new mobile node for a new connection as shown in fig.1. Decision of switching is initiated because user is moving away from old node and its signal strength becomes low because of interference,noise and other impairments in the signal path [2].

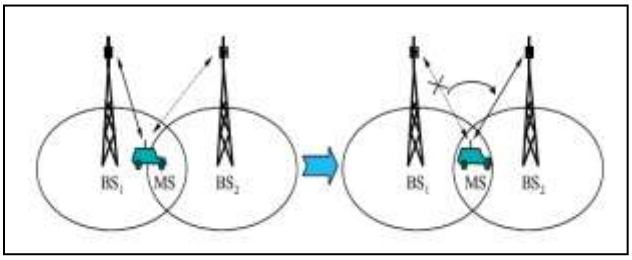

Fig.1Basic Handover Scheme

Handover is classified into two categories which are soft handover and hard handover. Hard handover is further divided into two types-Interdomain handover and Intra domain handover. Soft handover is again divided into two types-multiway soft handover and softer handover.The proposed system focus is on soft handover.

This paper is organized as follows: Section II gives the block diagram of the proposed system, flow of system and details of the methodology used. Software used, Hardware components and its implementation are discussed in Section III. Section IV describes results of the proposed system. Finally, conclusion is given in Section V.

II. PROPOSED WORK

A. *Architecture of the proposed video streaming*

Architecture of the proposed system is shown in fig 2. Input video stream is a raw video sequence. Video encoder converts raw uncompressed digital video to analog video.The Signal to Noise Ratio (SNR) is estimated. Based on SNR modulation is performed using one of the modulation techniques such as BPSK and QPSK. Modulated signal is transmitted over wireless channel. At the receiver end, demodulation will be performed on transmitted signal. Channel quality feedback is provided to the transmitter section. Video decoder performs reverse operation of the video encoder and it converts analog video to digital.

B. *Proposed Scheme*

In the proposed system, video compression takes place depending upon the signal strength. To avoid buffering and delay in the video sequence the system performs video compression,then,comesthe scenario whenthe vehicle moves from one node to another. Based on the distance, the signal is transmitted through BPSK or 16QAM modulation technique.

Proposed system consists of three stages
1. Video Compression
2. Scenario Handover
3.Adaptive Modulation

1. Video Compression

In the video compression process, as shown in fig.3 video frames are resize.Frames resize into half of its original size by dividing rows and columns of video frame by two.

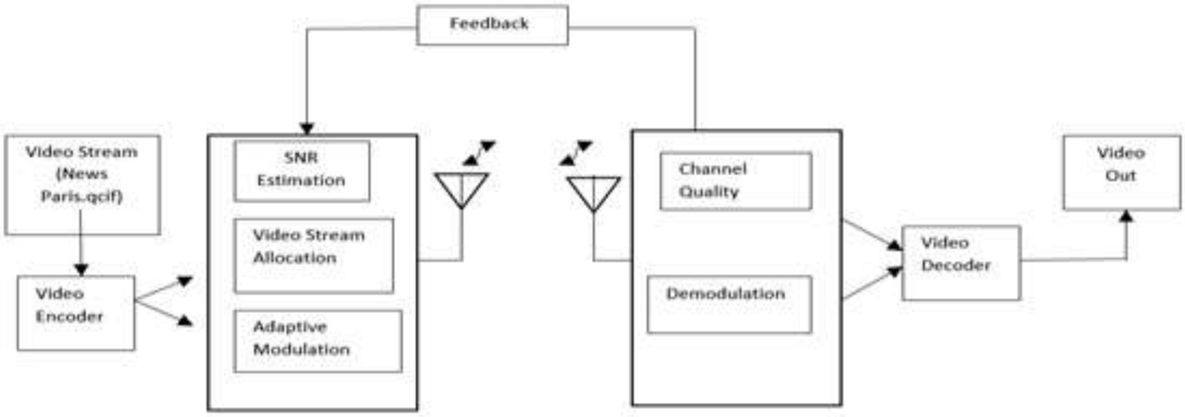

Fig.2 Architecture of proposed video streaming system

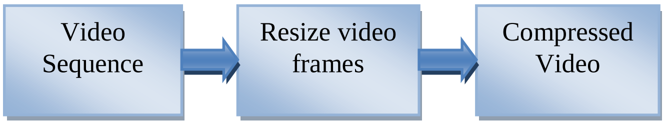

Fig.3 Video Compression Process

2. Scenario

Scenario means different movements of the vehicle within the node area or outside the area of the node [3].When the vehicle is moving away from the area covered by on Node 1 and entering into the area which is covered by another Node2.Then handover is needed to transfer the connection of the vehicle from the current node to the other node before the vehicle moves out of the range of the first node, to avoid delay in playing the video sequence.

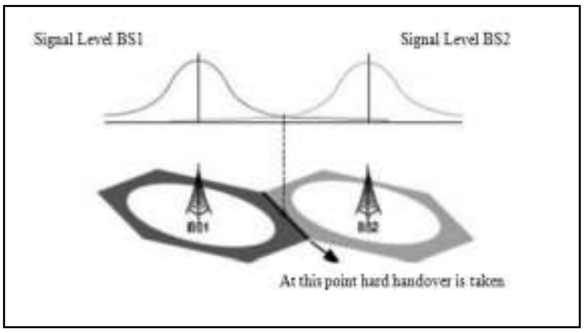

Fig.4 Handover and signal strength variation

3. Adaptive Modulation

Adaptive modulation is a technique for maximizing data throughput of subcarriers which are allocated to the users.Adaptive modulation involves measurement of the SNR of each subcarrier in the transmission, and then selection ofthe required modulation scheme depending upon the data rate of the transmission.OFDM uses a fixed modulation scheme over all the subcarriers [4].Combination of adaptive modulation with OFDM is proposed in the system. Functions of OFDM transmitters are divided in two parts- channel coding and modulation.In adaptive OFDM transmission, all subcarriers in asymbol are split into adjacent subcarrierblocks. The same modulation is used for all subcarriers in the same block. The choice of the modulations to be used by the transmitter for the next OFDM symbol is determined by estimating channel quality of the receiver based on the current OFDM symbol. Instantaneous SNR of the subcarriers is measured at the receiver end [5].

The first step in OFDM modulation is subcarrier modulation. One or more bits obtained from the channel coding step are assigned to each subcarrier. Then thesubcarrier is modulated using a simple technique such as phase shift keying (PSK) or quadrature amplitude modulation (QAM). The number of bits used for each subcarrier depends on the modulation technique being used [5].

Generally, adaptive modulation uses following modulation techniques for modulating and demodulating the signal:

(1) Binary Phase Shift Keying (BPSK)
(2) Quadrature Phase Shift Keying (QPSK)
(3) 16Quadrature Amplitude Modulation (16-QAM)
(4) 64Quadrature Amplitude Modulation (64-QAM)

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Adaption Procedure is shown in fig 5 [6].

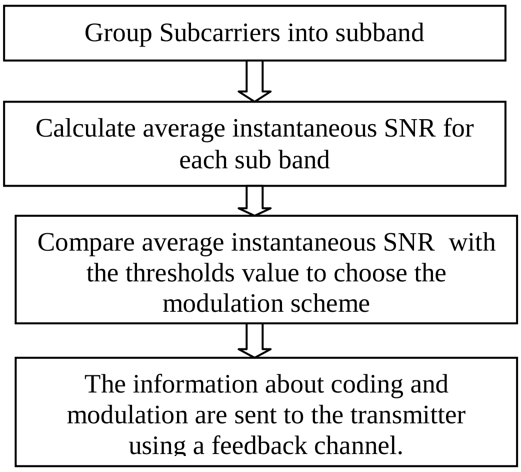

Fig.5 Adaption Procedure

III. System Implementation

A. System Flow

The steps given below show the implementation flow of the system.In this system, firstly the video datais read; thencompression is performed.Based upon SNR, modulation is done and the video signal is transmitted.

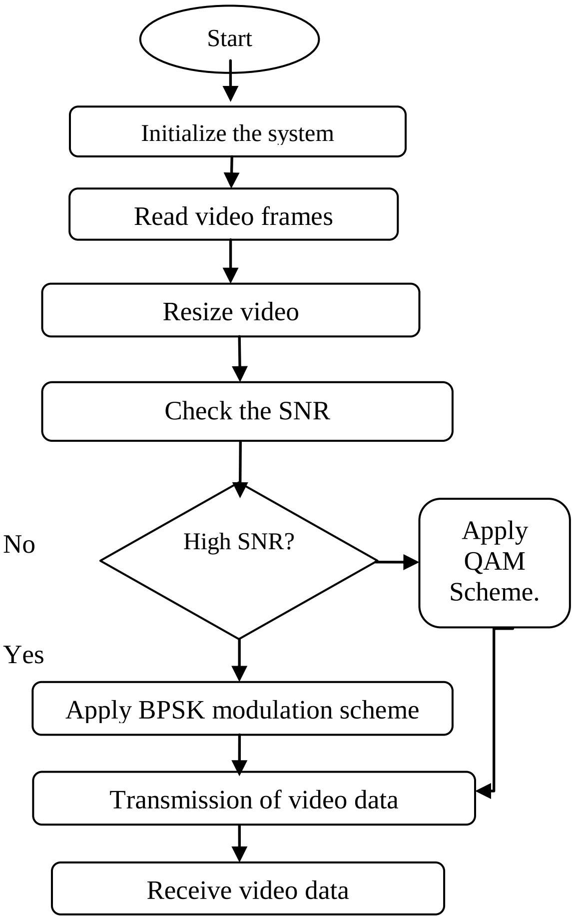

Fig.6. Proposed System Flow

IV. Results

The proposed system is simulated using MATLAB. Fig.7 shows handover scenario. The vehicle is travelling from one cell to another. As the vehicle moves away from the antenna signal strength lowers, noise gets increased as shown in fig.8.

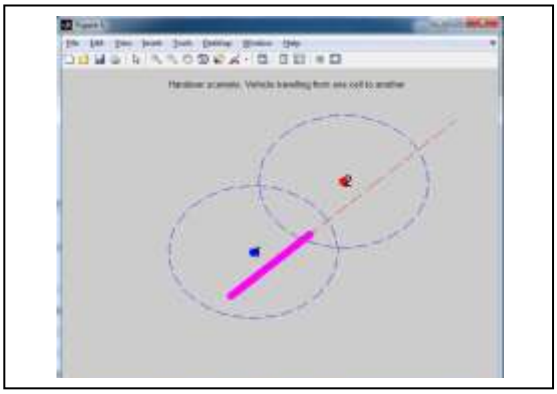

Fig.7 Handover Scenario

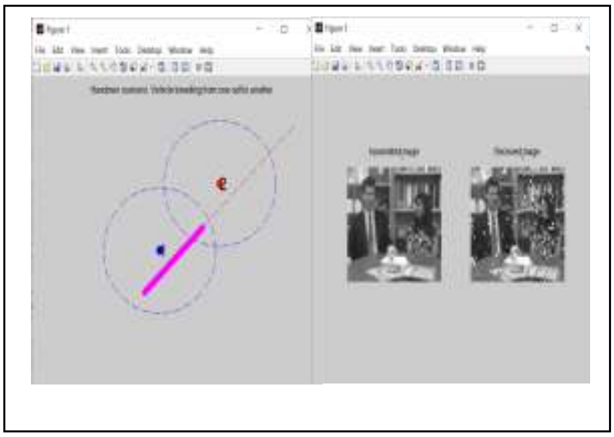

Fig.8 Results of noise addition

Handover is executed when the signal strength is lowering. Transmission of video is done seamlessly by soft handover.Transmission network 4G/LTE gives better performance as compared to WiMAX, Wi-Fi. Adaptive modulation is used for video transmission.Fig.9 and fig.10 show the results of transmitted and received video with and without adaptive modulation. Comparison of fig. 9 and fig.10 shows that the performance of video transmission with adaptive modulation is better than transmission without adaptive modulation.

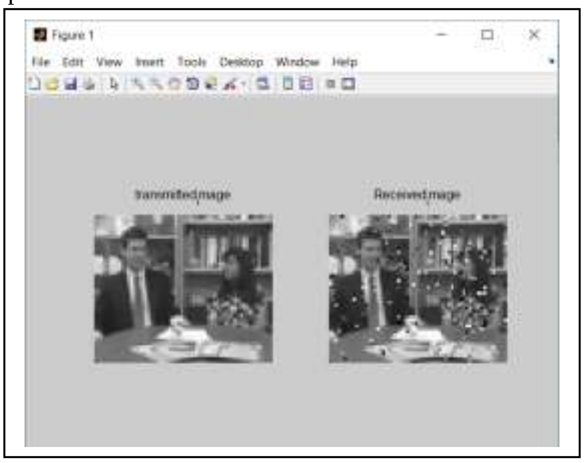

Fig.9 Results without adaptive modulation

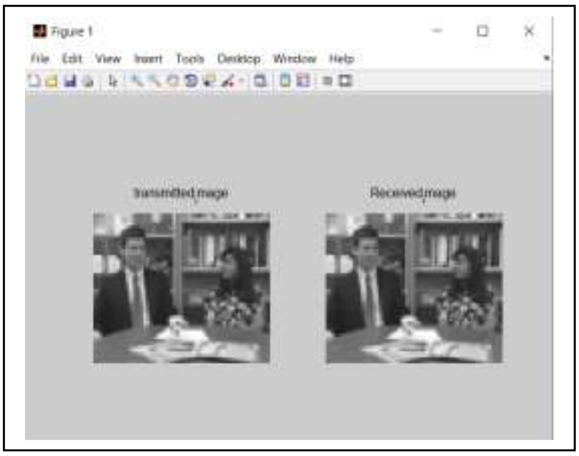

Fig.10Results with adaptive modulation

In terms of performance, there is animprovement in quality of video gained by adaptive modulation. SNR is better than the system without adaptive modulation, it gives 35% more quality in terms of SNR.

Fig. 11 shows the received video frame when the handover is not executed. Also the graph of the delay, jitter and the graph the distance of vehicle from both cell is shown. The vehicle is moving, the distance from the antenna of cell 1 is increased, the signal strength is lowering therefore quality of video is degraded. The graph of the delay shows that the delay increased as vehicle move away from the cell 1 antenna, the vehicle mobile user still connected to the cell 1, handover is not executed therefore delay increases as distance increase from antenna of cell 1. Also the jitter increased. In the distance graph blue line shows the distance from the cell 1 and red line presents the distance from the cell2.

The received video frame when the handover is executed is shown in the fig. 12. Also the graph ofthe delay, jitter and thedistance of vehicle from cell is shown. The vehicle is moving, the distance from the antenna of cell 1 is increased, the signal strength is lowering therefore quality of video is degraded. At the specific point where the distance of vehicle from cell1 antenna is more than the distance from the cell 2 antenna, the signal strength of the cell 2 is more than the cell 1. Handover is executed and the moving object is connected to the cell 2 antenna. The SNR increased and quality of video is better. The graph of delay shows that delay increased when the vehicle is moving away from the antenna of the cell 1, but when the handover takes place delay is lowered.

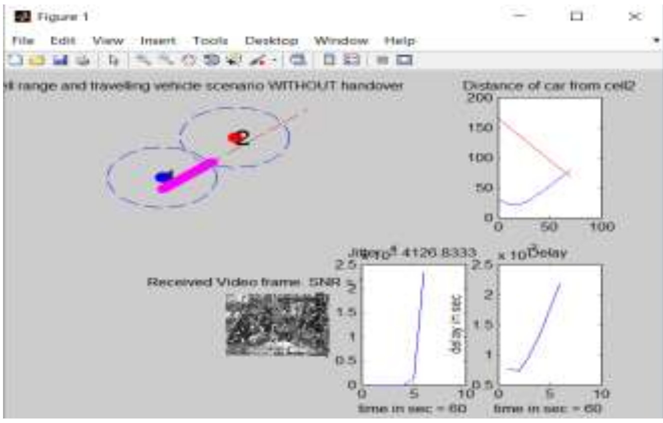

Fig11Received Video, Delay and Jitter Graph when Handover not executed

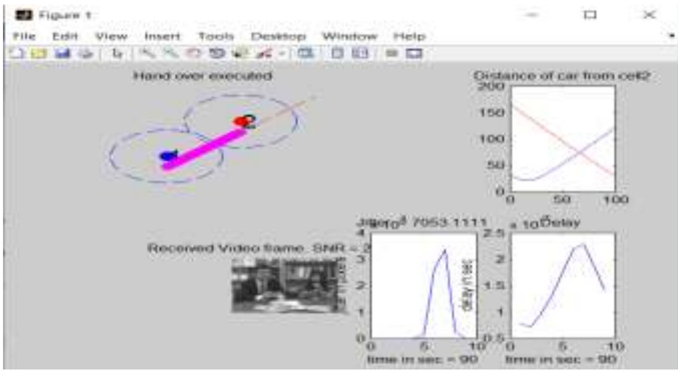

Fig.12Received Video, Delay and Jitter Graph when Handover executed

TABLE 1: SNR values for handover and without handover execution

Distance from cell1 (m)	SNR (without handover) dB	SNR (with handover) dB
60	12	12
80	3.04	3.04
100	1	8
120	0.5	18.5

The moving mobile user when moves away from the connected base antenna the signal strength is reduced, therefore SNR changes. The table shows the values of SNR related to distance from cell antenna when the handover is executed and when the handover is not executed. It shows that when moving mobile user is at distance 60m and 80m from cell 1 antenna the SNR values are remains same in case of with and without handover. But when the distance increases to 100m and 120m SNR decreases in case of without handover and increased in case of with handover.It gives 60% to 70% better SNR when handover is takes place.

V. CONCLUSION

In this paper OFDM based QoS handover system has been implemented for video streaming. As a result when moving from one node to another, signal strength changes and affects the value of SNR.The user can experience seamless video streaming Depending upon SNR, modulation scheme is employed and handover takes place.

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