A WiMAX Solution For Real-Time Video Surveillance in Public Transport

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Abstract

Video surveillance is a highly useful tool to the public transport authorities, which is now widely used as a measure to ensure passenger safety and security. While video surveillance application in static environments like airports, shopping malls, train stations has been a huge success, real-time video surveillance in moving public transport experiences serious technological challenges mainly due to low data rates at vehicular speeds offered by existing communication technologies. Success of live video surveillance in public transport depends on future communication technologies. WiMAX has emerged as an exciting technology with promises to offer high throughput, a key requirement for video surveillance in public transport. WiMAX, however, offers limited throughput at high vehicular speeds mainly because of multipath fading that causes high bit error rate at the receiver. In this paper, we propose a forward error control (FEC) scheme for WiMAX that proactively and dynamically adjusts the size of extra parity bits of error correcting codes for real-time applications like video surveillance based on the estimated bit error probability at various vehicular speeds. We further propose a model to improve the utility gain of a live video surveillance system in public transport that uses WiMAX technology. Simulation results confirm that the proposed scheme significantly improves the throughput and utility of the video surveillance system in public transport.

Keywords

Vehicular speeds, video surveillance, utility, bit error rate, throughput.

1. Introduction

Video surveillance in public transport has attracted increasing attention in recent years as a measure to ensure the safety and security of passengers against events like terrorist attacks, vandalism, anti-social conducts, brawl and harassment on public transport [1-5]. A public transport video surveillance system is also useful in determining the circumstances that lead to a hazardous event (e.g., fire or accident) and, capture and increase the effectiveness of measures used during a contingency period. It can also be used to assist the operation of police, security and other emergency personnel. Real-time video surveillance has already been widely deployed in many public places like airports, shopping malls, train and bus stations. Video surveillance systems on moving public transport however, are still offline (i.e., recorded and then analyzed at a later time). A centrally monitored real-time video surveillance system in moving vehicles encounters serious technological challenges mainly due to the limited throughput offered by the existing communication technologies at high vehicular speeds. In a centrally monitored video surveillance system (Fig. 1), real-time video data from multiple video cameras mounted on a mobile transport needs to be transmitted to base stations (BS) that are connected to a high speed wide area network (WAN). BSs then forward the video data to a central control room where the security experts monitor and interpret the video contents.

DOI : 10.5121/ijcnc.2011.3202

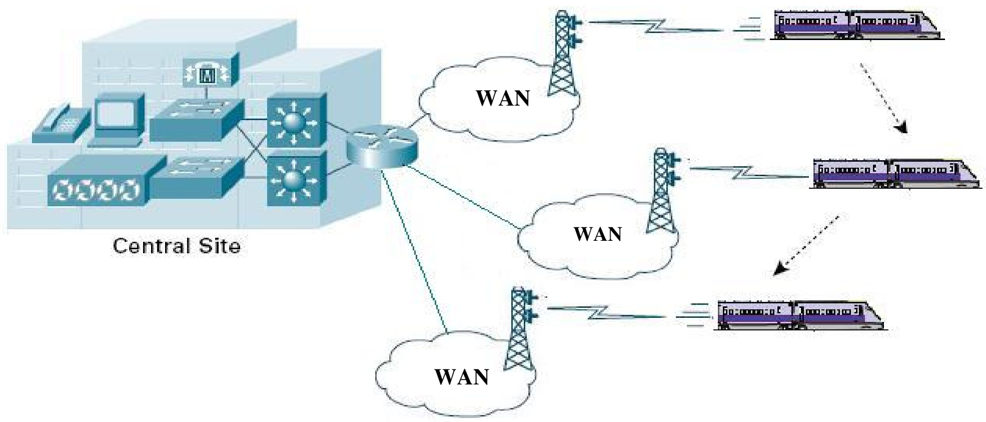

Figure 1: Framework for a centrally monitored video surveillance system on public train.

For a centrally monitored video surveillance system in a moving public transport, wireless communication is the most suitable technology that has so far been dictated by the IEEE 802.11 standards. Almost all mobile video cameras (e.g., videocomm RT mobile systems [6]) available in the market place adhere to the IEEE 802.11 [7-9] standard, a standard that promises to deliver a data rate up to 64 Mbps. This throughput however, is suitable only for a near ideal communication environment where the nodes are fixed or nomadic at best. Throughput starts to decrease exponentially with the increase in speed and mobility of nodes [10]. Another disadvantage with the IEEE 802.11 is that it does not offer any guarantee on quality of service (i.e., throughput, delay jitter) and hence, is not suitable for video data transmission. Other video surveillance technologies reported in the literature, are either for static environment [11-13] (e.g., intelligent analysis of CCTV coverage at train stations/airports) or for very low mobility environment [14] (e.g., robot vision in underground mining). To the best our knowledge, there is no suitable technology that can be readily used to facilitate video transmission from a vehicle moving at high vehicular speeds. Future of live video surveillance in public transport therefore, heavily depends on future communication technologies that will deliver high throughput at vehicular speeds.

Recently, the IEEE 802.16 [15-18] has emerged as an exciting wireless technology with a promise of long range coverage, better mobility support, higher throughput and guaranteed quality of service for traffic like video data. The IEEE 802.16, also known as WiMAX, is designed to support high scalability, rapid deployment and high speed data rate. WiMAX, however, has yet to prove its effectiveness when the wireless mobile stations are not fixed and free to move at vehicular speeds. Recent studies suggest that while WiMAX has the potential to deliver a data rate up to 75 Mbps for fixed wireless communications, it fails drastically for mobile wireless communication, often offering a data rate less than 1 Mbps when the mobile nodes travel at high speeds. In wireless communication, many objects in the environment, surrounding the transmitter and the receiver, act as reflectors of the original radio signal, which create multiple paths that the original signal can traverse, causing the receiver to experience the overlapping of multiple copies of the transmitted signal, each traversing a different path and having differences in attenuation, delay and phase shift. Such overlapping of signals causes interference, either amplifying or attenuating the signal power received at the receiver, known as the *fading problem*. Multipath fading is the main reason for low throughput at high speed, especially when the carrier frequency is in the lower range [19].

For wireless channels that carry real-time video data at high vehicular speeds, reactive error recovery schemes like the transmission control protocol (TCP) that attempt to address the corrupted data by requesting packets for retransmission, have limited, if not detrimental, impacts on the effective data rate and jitter because the system can not afford the extra overheads caused by the reactive protocols when the usable data rate is already very low. Error control mechanisms like forward error control (FEC) are particularly suitable for high speed wireless communication as they do not require retransmissions of packets. In FEC, extra parity bits are added to a packet to recover the corrupted symbols in a packet. The optimal number of extra parity bits is highly critical as unnecessary parity bits limit the actual data transmission while insufficient parity bits result in unrecoverable corrupted packets. Improvement in throughput at high vehicular speeds has significant implication for many practical applications including live video surveillance in public transport where real-time video data from multiple video sources mounted in a mobile transport is transmitted to wireless base stations. The 802.11 is not suitable for such applications as it does not provide the quality of service (QoS) required for video data. WiMAX has the mechanism to offer guaranteed QoS required for video data as long as overall throughput does not fall below a certain level. Therefore, it is important to maintain high throughput even at high vehicular speeds.

Researchers have been working to improve the FEC based error control mechanism for long. The key research interest remains how to make the FEC code size dynamic/adaptive [20-24] instead of using fixed FEC code under all communication environments. Almost all of the existing FEC schemes depend one way or another on feedback information mainly in the form of packet loss rate at the receiver end. This is rather a reactive approach to adjust the FEC code size and efficiency of reactive FEC schemes is constrained by how good the feedback information represents the current environment. In a truly mobile environment, the communication environment changes very quickly as the nodes move at high vehicular speeds (e.g., an electric train is accelerating from a platform to reach its top speed) and the feedback information does not always represent the current communication environment. Moreover, at high vehicular speeds, the usable transmission rate becomes significantly low and overheads in the form of feedback information tend to create detrimental impacts on effective data rate. Also, as the channel becomes noisier at high vehicular speeds, it is a common scenario that the feedback information is lost on its way to the sender. The effectiveness of reactive FEC schemes is therefore limited in wireless mobile communications. In this paper, we propose a new FEC scheme to proactively compute the FEC code size in WiMAX communication. We use a type of error correction code called the Reed-Solomon (RS) code [29]. We also propose a model to improve the utility gain of a video surveillance system in public transport that uses WiMAX and the proposed FEC code. To the best knowledge of the author, there is no other work in literature that proactively computes the FEC code size at various speeds of end nodes in WiMAX communication and addresses the utility issues of a live video surveillance system.

2. THROUGHPUT AT VEHICULAR SPEEDS IN THE 802.16E AND PROPOSED SCHEME

The proposed scheme has three integral parts: (i) first we show how to estimate the bit error probability at various vehicular speeds in WiMAX, (ii) we then show how to use this information to adjust the RS code size in a proactive fashion for real-time applications like video surveillance and (iii) finally how to improve the overall utility of the surveillance system by putting camera(s) offline when the resources are estimated to be insufficient to support all the streaming videos.

2.1 Estimation of Bit Error Rate in WiMAX

For a WiMAX communication channel that is characterized by the parameters: N be the number of OFDM sub carriers, f_m be is the Doppler frequency where $f_m = f_c(v/c)$, v be the speed of mobile nodes, c be the speed of light, f_c be the carrier frequency, T_s be the duration of each M-ary QAM symbol, E_s be the average symbol energy, E_b be the average energy per bit, N_o be the noise energy, γ_b be the received bit-energy-to-noise ratio, $\overline{\gamma_b}$ be the average received bit-energy-to-noise ratio, γ_s be the received symbol-energy-to-noise ratio, $\overline{\gamma_s}$ be the average received symbol-energy-to-noise ratio, $P_b(\gamma_b)$ be the probability of received bit error, P_P be the packet error probability. Following the Rayleigh fading model [25, 26], we can express the probability density function of received symbol energy to noise ratio as

$$p_{\gamma_s}(x) = \frac{1}{\overline{\gamma_s}} e^{-x/\overline{\gamma_s}}, x \geq 0 \tag{1}$$

and the average symbol error probability for a such channel can be expressed as

$$P_M = \int_0^\infty P_M(x)\, p_{y_s}(x)\; dx \tag{2}$$

where the average received symbol-energy-to-noise-ratio is given by

$$\overline{\gamma_s} = \frac{1}{1 - \frac{1}{N^2}\left[N + 2\sum_{i=1}^{N-1}(N-i)J_0(2\pi f_m T_s i)\right] + \frac{NT_s}{E_s / N_0}} \tag{3}$$

From Eq. (3), we can express $\overline{\gamma_b}$ as

$$\overline{\gamma_b} = \frac{1/\log_2 M}{1 - \frac{1}{N^2}\left[N + 2\sum_{i=1}^{N-1}(N-i)J_0(2\pi f_m T_s i)\right] + \frac{NT_s}{\log_2 M}\left(\frac{1}{E_b / N_0}\right)} \tag{4}$$

For a fixed channel with unchanged values of N, NT_s, relatively constant E_b / N_0 over time and a known modulation scheme, the main source of error for a mobile terminal is the velocity v that has direct impact on f_m, which in turn influences received symbol/bit energy to noise ratio. According to the equation, higher will be the velocity, lower will be the received symbol/bit energy to noise ratio. For OFDMA air interface, the main source of bit error is the inter-carrier interference instead of interference between the OFDMA users. Additive white Gaussian noise (AWGN) [26] is often used to successfully approximate the OFDMA inter-carrier interference. Taking AWGN into consideration, we can derive the bit error probability as

$$P_b = Q\left(\sqrt{2\gamma_b}\right) \tag{5}$$

where bit error probability P_b and symbol error probability P_M of OFDM are related to each other in the form of

$$P_b \approx P_M / \log_2 M \tag{6}$$

For M=2 or M=4, the average bit error probability at a vehicular speed v is available as:

$$\begin{aligned} P_b(v) &= \int_0^\infty P_b(x)\, p_{\gamma_b(v)}(x)\, dx \\ &= \frac{1}{2}\left[1 - \sqrt{\frac{\overline{\gamma_b}(v)}{1 + \overline{\gamma_b}(v)}}\right] \end{aligned} \tag{7}$$

Bit error probability for higher order of M can also be obtained from:

$$P_b(v) \approx \frac{\int_0^{\infty} P_M(x)\, p_{\gamma_M(v)}(x)\, dx}{\log_2 M} \tag{8}$$

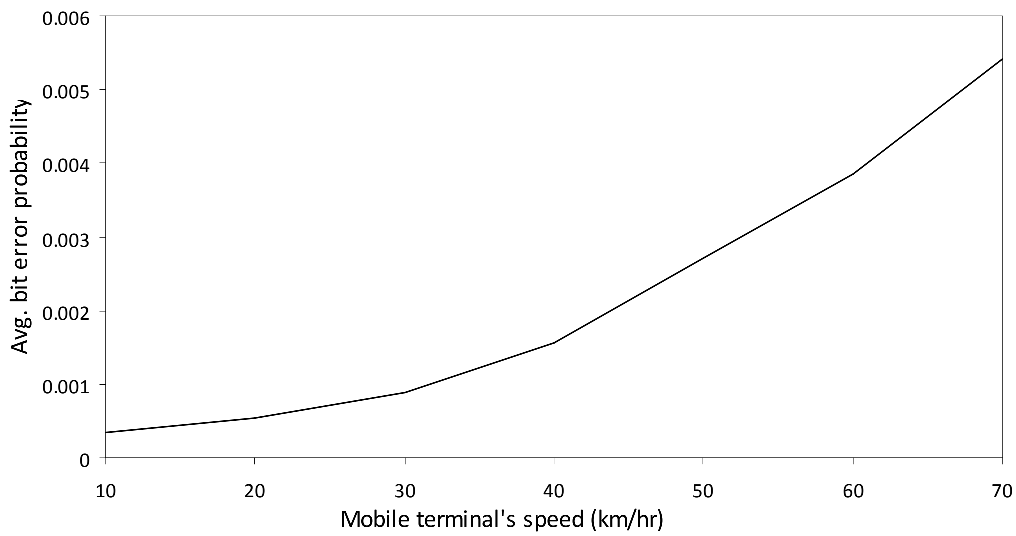

Figure 2: Average bit error probability at various mobile terminal's speed.

The error rate becomes excessively high for higher order of M (> 4) and therefore, is not recommended for most practical applications. It is also evident that bit error probability remains almost the same for PSK and QAM for M up to 4. For a scenario where carrier frequency f_c is 2.6 Ghz, bandwidth is 12 MHz, number of sub carriers N equals 2048, symbol period equals 149.33s, modulation scheme is QPSK and E_b/N_0 equals 5 dB, the above expressions lead to a relationship between the average bit error probability and mobile terminal's speed that can be depicted as shown in Figure 2 [27]. The Figure demonstrates that higher the mobile terminals' speed, higher is the average bit error probability. At higher bit error probability, for real-time applications like video surveillance, reactive error control mechanism (i.e., reactive adjustment of FEC size or retransmission of corrupted packets) is inefficient mainly because of throughput and jitter considerations. In the following, we propose a proactive error control mechanism for real-time applications.

2.2 Proactive FEC Code Size for Real-time Applications

Now, for an m bits symbol, the relationship between average bit error probability and average symbol error probability at a speed v can be expressed as:

$$S_P(v) = 1 - \left(1 - P_b(v)\right)^m \tag{9}$$

For a packet comprising K data symbols, the number of estimated corrupted symbol F can be computed as:

$$F = K \times S_p(\text{v}) \tag{10}$$

For a RS code that can correct up to half of the number of its parity symbols, the number of required parity symbols (C = code size) can be given as:

$$C(v) = 2K \times S_p(v) \quad (11)$$

Now, for the proposed proactive scheme, the average bit error probability is an estimated value and subject to some errors in real time. Our observation suggests that if the actual symbol error at the receiver end is greater than the estimated number, even by a single symbol, the whole packet is identified as corrupted at the receiver end, and overall efficiency declines. To address this issue, we propose to upgrade Equ. (11) as:

$$C_r(v) = \alpha\left(2K \times S_p(v) + \varepsilon\right) \quad (12)$$

where, α (≥ 1) is the strength parameter of the RS code and ε represents the number of guard symbols, required to be added to address the estimation error in real-time. To conservatively address the variation of corrupted symbol numbers, we set ε equal to 1. Our future work will continue to optimize α. The network provider can tune the strength parameter α for different levels of error recovery capability, depending on the types of applications. For real-time application, the strength should be higher and for offline applications, the strength can be set as low.

The overall algorithm for the proposed method to proactively compute the number the required parity symbols for RS code can be given as:

Procedure ***compute_FEC_code_size*** (v, K)

Begin

$P_b(v)$ = Find estimated average bit error probability at mobile terminals' speed v from the relationship

as depicted in Figure 2 obtained from Eq. (7).

$C_r(v)$ = Compute FEC code size using Eq. (12).

return C_r

End ***compute_FEC_code_size*** (v,K).

When the mobile terminal is the transmitter of data (e.g., video uploading from a public train for video surveillance application) and the base stations are the receiver, the speed information is readily available (from the speedometer of the train) for estimating the error rate using expression (7) and compute the code size accordingly. When the mobile nodes are the receiver (e.g., experts giving video/voice assisted instructions to a driver in a contingency period), the proposed scheme can be readily applied for many systems (e.g., automated public train system like PTA, Western Australia where trains including their directions and speeds are controlled from a central control room) where the speed information at different locations is deterministic and the transmitter can use this knowledge while using the procedure *Compute_FEC_code_size*. For mobile receivers that are entirely dynamic in nature (e.g., cars), the proposed system relies on message exchanging mechanism used in WiMAX. In WiMAX, the transmitter and the receiver exchange messages at regular intervals to maintain the connection and QoS, and the proposed scheme needs to gather the speed information from these messages.

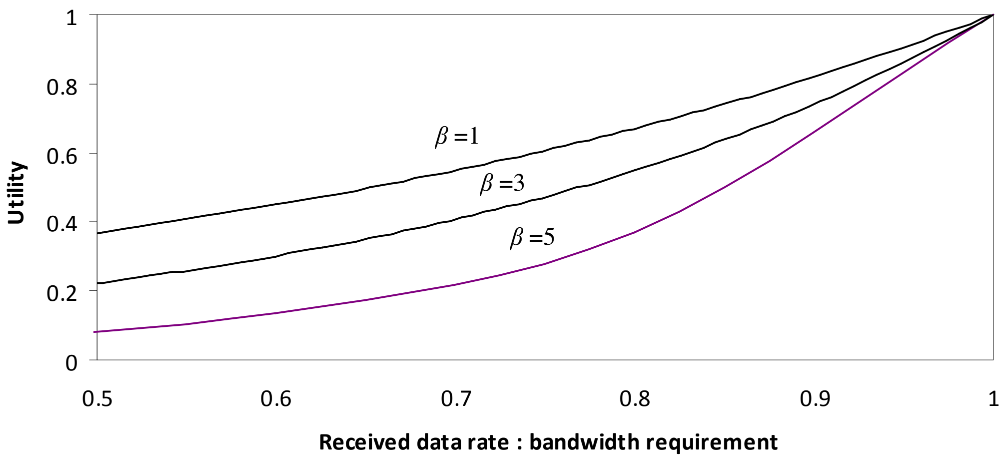

Figure 3: Utility of streaming video at various received data rate.

2.3 Utility for Real-Time Video Surveillance Application in Public Transport

As shown in Figure 1, live video data needs to be uploaded at high vehicular speed for a real-time video surveillance application in public trains. The main challenge here is to achieve sufficient throughput to support multiple video streaming from different cameras installed in the train. WiMAX MAC has the scheduler to maintain QoS of video streams as long as the throughput remains sufficient. One of the key requirements for video surveillance application is that the received video data rate must not fall below a certain limit where the security experts/ automated software can not reliably interpret the information contents of the surveillance environment because of the poor video quality. As such, the utility for a streaming video decreases dramatically if the transmission rate is not maintained above a certain limit. In consultation with the commonwealth security experts, we propose a utility function [28] for CCTV camera in public train as:

$$U_i(d_i) = \begin{cases} e^{\beta_i\left(\frac{d_i}{D_i}-1\right)} & \text{if } d_i \geq b_i \\ \mu & \text{if } d_i < b_i \end{cases} \quad (13)$$

Here, U_i stands for the utility of streaming video from i-th camera, d_i is the current rate of received video sent from i-th camera source, b_i is the minimum acceptable video data rate, D_i is the desired transmission rate (bandwidth demand), μ is the insignificant utility for poor video quality ($\mu = 0$ in Fig. 3), and β_i is used to select the priority of the i-th camera based on its location. The utility model is depicted in Figure 3 and it is evident that utility of streaming video decreases with decreasing received data rate and the utility becomes insignificant beyond a certain transmission rate (50% of the bandwidth demand in this case). In cases where the average received video data rate falls below the acceptable level, we propose to stop live feeding from one or more cameras and store the data from the offline camera(s) into the storage device installed at the train that can be uploaded once the available throughput permits. This will allow to stop flooding the channel and thereby pushing the video quality to degrade below the acceptable level for video data from all the cameras.

A data packet has overhead in the form of a header (h) and RS code (C_r), which will increase with higher bit error rate and vice versa. The overhead per data bit can be expressed as:

$$q(v)=\left(h+C_r(v)\right)/K \tag{14}$$

If q per bit can be estimated at various vehicular speeds at the mobile node, this can assist to estimate the effective data transmission rate W^* (W^*= W - qW where W is the maximum data rate in bps supported by the channel). Based on the estimated effective data transmission rate, a decision can be made at the transmitter end whether the available bandwidth will be able to support all the streaming videos at acceptable video quality. If b_i stands for the minimum bandwidth demand for streaming video from i-th camera, then the overall minimum bandwidth demand B_{min} is given by

$$B_{\min} = \sum_{i=1}^{j} b_i \tag{15}$$

and if $W^* < B_{\min}$ then the mobile node needs to stop live feeding from one or more cameras until $W^* \geq B_{\min}$ is satisfied.

The overall algorithm of the proposed solution can be summarized as:

Procedure ***live_feeding_status_check*** (v, K)

Begin

C_r = *compute_FEC_code_size* (v, K)

q = (h+C_r) / K

W^*= W – qW

$$B_{\min} = \sum_{i=1}^{j} b_i$$

While ($W^* < B_{\min}$)

{

Stop live feeding from camera i where camera i has the lowest utility return U_i per unit bandwidth

and store the data offline.

$B_{\min} = B_{\min} - b_i$

}

End ***live_feeding_status_check*** (v, K).

3. SIMULATION RESULTS

The simulation is conducted in Network Simulator (NS) 2 for a centralized real-time video surveillance system in a train as shown in Fig. 1. The train is equipped with 3 video cameras (one at front, one at rear and one at the middle); each of them sending video data at a rate of 512 Kbps to the base stations. The video data are then sent through a wired optical communication network to a central control room where the security experts interpret/monitor the video contents and take actions accordingly. The maximum data rate capacity of the wireless channel

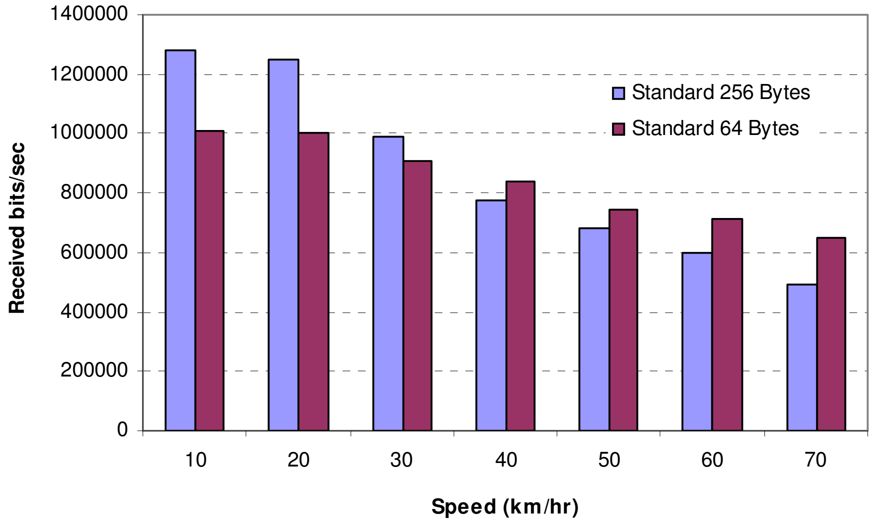

Figure 4: Throughput in bits per second at various vehicular speeds.

is 2 Mbps and carrier frequency was 2.6 GHz, number of sub carriers is 2048 and the modulation style is QPSK. For the simulation scenario, the train moves from a stop and gradually increases its speed, reaching a speed of 40 km/hr at 20 sec and a top speed of 70km/hr at around 60 sec time. The train continues to cruise at that speed before the train starts to slow down at 110 sec. The train continues to slow down and finally stops at the next railway station at 180 sec. Simulation results presented in this section are for RS strength parameter $\alpha = 6$, a value that shows the most consistent throughput for video transmission. We have monitored the overall throughput and jitter of received packets for different data packet sizes as the train moves at various speeds. Data packet size is known to have reasonable impacts on overall throughput as higher data packet size has higher packet corruption rate at high vehicular speeds, but higher efficiency at lower speed because of lower overheads mainly in the form of header bits and RS code size.

Figure 4 shows the received throughput at various vehicular speeds. While packets with larger data size (256 bytes) offer lower overheads and hence carries extra data bits at low vehicular speeds, packet corruption rate increases sharply at high vehicular speeds for larger packets because the probability of containing corrupted bit(s) is higher in a large packet compared to a small packet. Smaller data packets perform efficiently compared to larger packets at high vehicular speeds. However, extra overheads limit the performance of smaller packets at low vehicular speeds. Figure 5a shows the comparison of received bit rate at the receiver end in the proposed, original (i.e., without FEC) and reactive FEC (RFEC) scheme (i.e., FEC scheme where feedback information is required, e.g., [24]). In reactive FEC scheme, average packet loss rate, calculated in every 5 sec interval, is sent to the sender and the FEC code size is adjusted accordingly. As evident in Figure 5a, the RFEC scheme improves the data rate compared to the original scheme. The improvement, however, is not consistent and follows a zigzag pattern. This is because, in RFEC, packet corruption rate starts to decrease sharply as the code size is adjusted based on the past packet corruption rate information. Feedback information about the new low packet corruption rate then leads to a lower code size causing higher packet loss rate in the next interval(s). Our observation suggests that as the time interval between feedback information is reduced, the data rate at the receiver end becomes more unstable (i.e., higher degree of zigzag pattern). If the interval is increased, the zigzag pattern becomes less prominent,

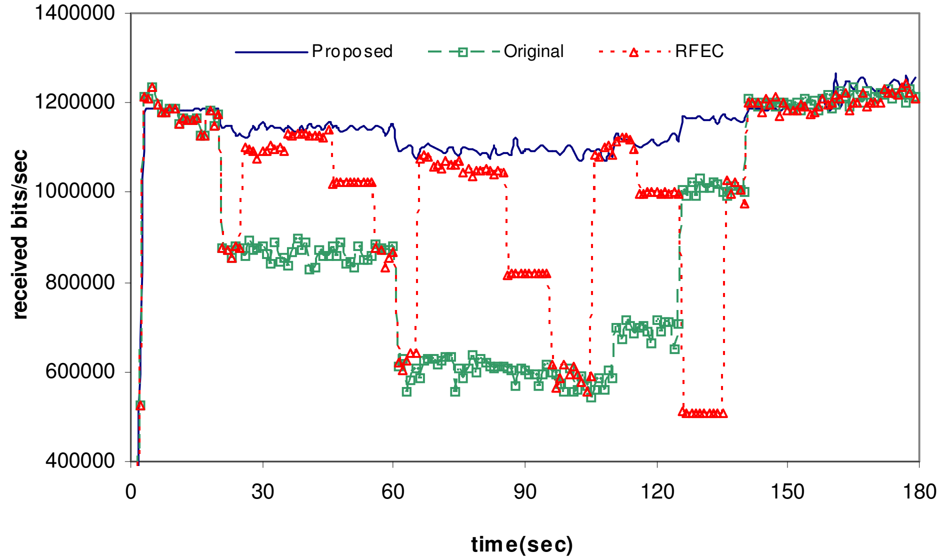

Figure 5a: Comparison of received bits in the proposed, original and RFEC schemes for 128 bytes data packet.

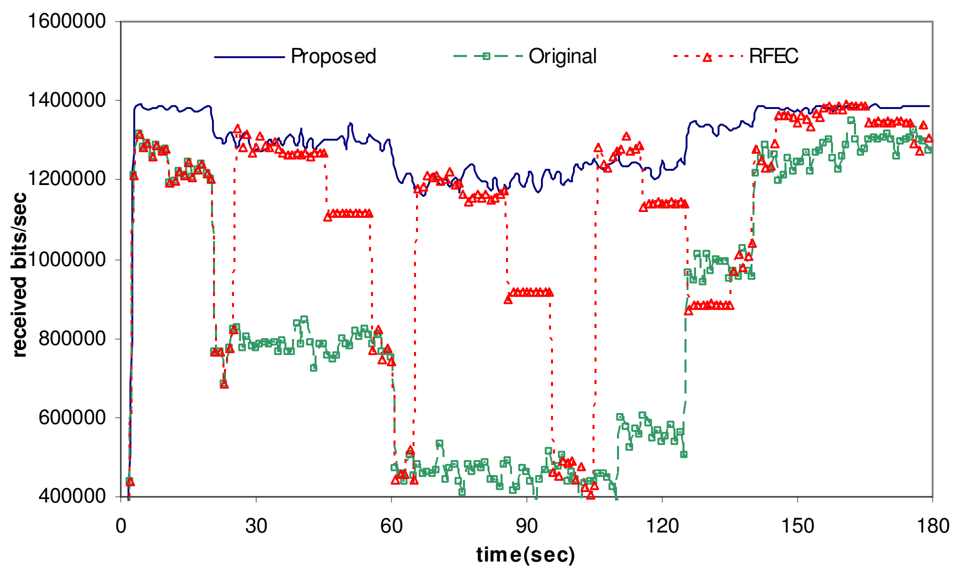

Figure 5b: Comparison of received bits in the proposed, original and RFEC schemes for 256 bytes data packet.

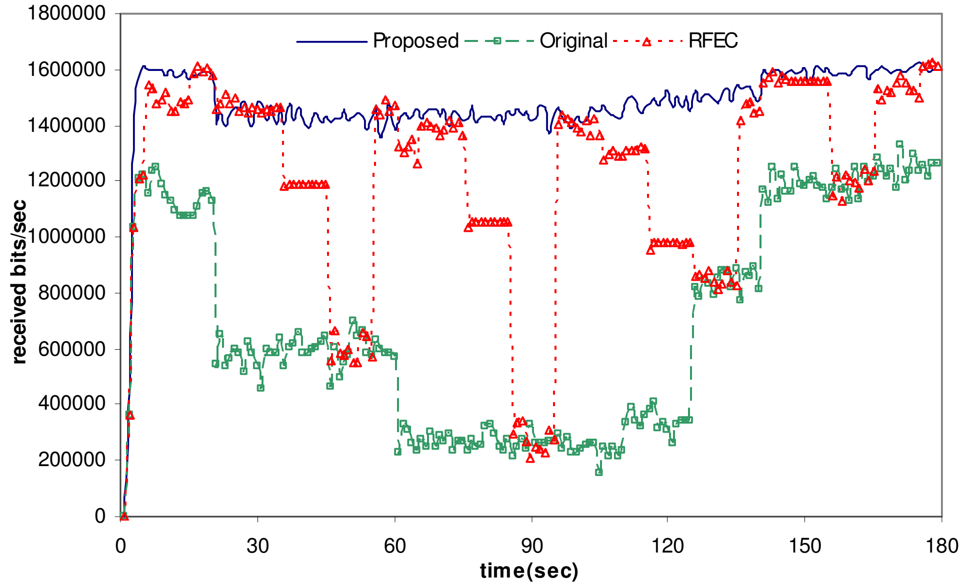

Figure 5c: Comparison of received bits in the proposed, original and RFEC schemes for 512 bytes data packet.

but the peak data rate at the receiver end decreases because the feedback information does not represent the packet loss information at current or near past speeds. The proposed scheme addresses this problem quite effectively as it estimates the bit error rate at the receiver end at current speed and computes the code size accordingly. As evident in the figure, the proposed scheme achieves consistently outperforms the other schemes by a margin up to 600Kbps. Figure 5b shows the received data rate for 256 bytes data packet. While the data rate improves for higher packet size at lower vehicular speeds, throughput drops at high speeds in the original scheme. This is because larger packets have lower overhead, which contributes to higher effective throughput when the bit error rate at the receiver end remains in the lower range. As the bit error rate increases with higher vehicular speed, larger packets have higher corruption probability and useable data rate decreases. The proposed scheme, however, consistently outperforms the existing schemes even at higher vehicular speeds because it estimates the higher bit error rate at higher speed and adapts the FEC code size accordingly. Figure 5c shows the received data rate for 512 bytes packet size and the proposed scheme shows consistent improvement over other schemes.

Table I: Throughput efficiency in mobile WiMAX communication.

Schemes/ Data Size	128 bytes	256 bytes	512 bytes
Proposed	56%	64%	74%
RFEC	51%	55%	61%
Original	45%	42%	35%

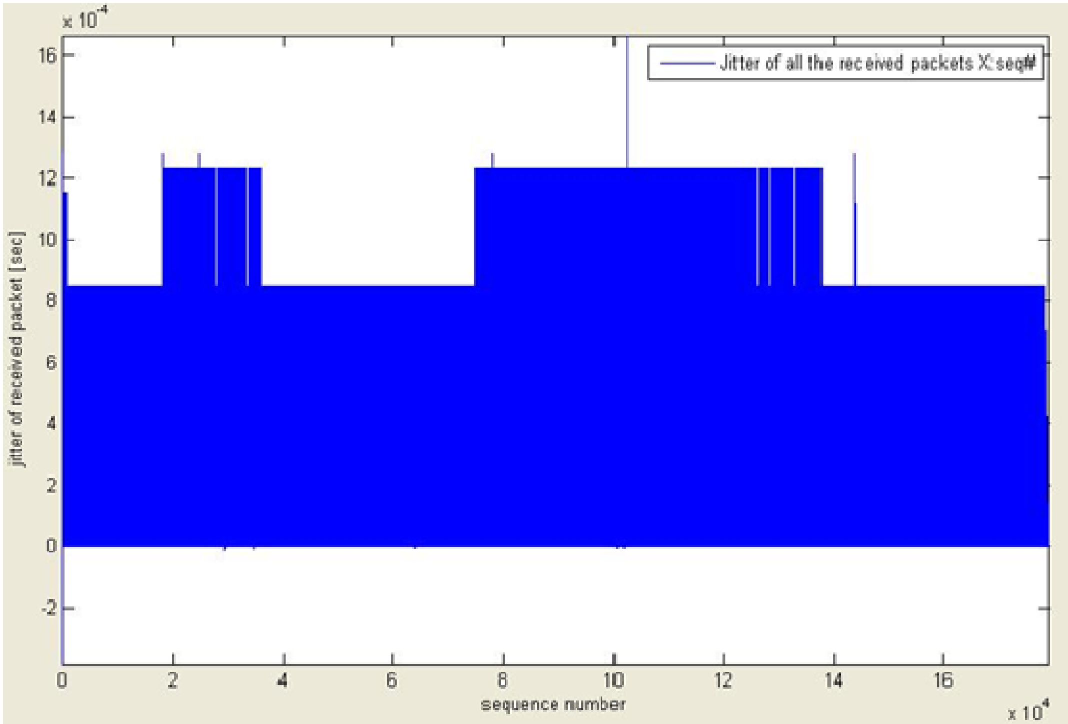

Figure 6a: Jitter of received packets (sec) in the proposed scheme.

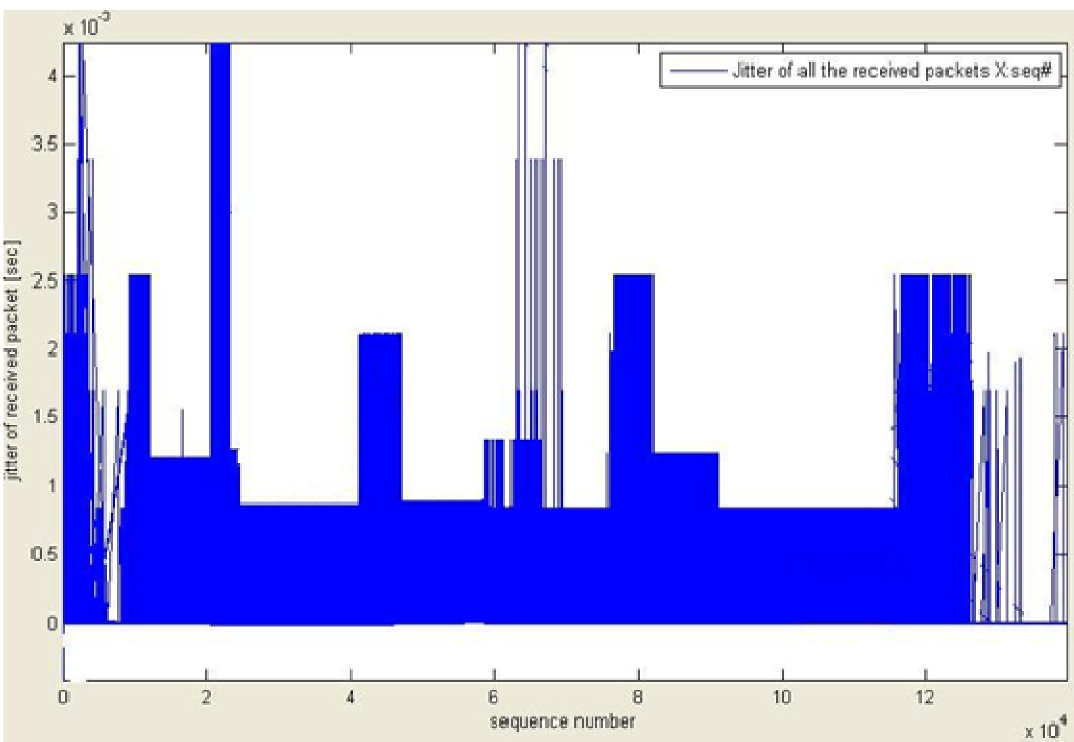

Figure 6b: Jitter of received packets (sec) in the RFEC scheme.

Table I summarises the overall throughput efficiency (i.e., ratio of received load to the offered load) in different schemes. It is clearly evident that the proposed scheme maintains the highest level of efficiency for various maximum packet sizes. We also monitored the delay jitter in different schemes. Delay jitter for most of the packets in the proposed scheme remains within 12×10^{-4} sec range whereas delay jitter in the RFEC scheme varies significantly often reaching up to 25×10^{-4} sec. This is because, in RFEC scheme, higher numbers of packets are received as corrupted at the receiver end as the FEC code is not adjusted proactively taking the bit error rate at changing vehicular speeds into consideration.

Figures 6a and 6b show the delay jitter of received packets in the proposed and RFEC scheme for 256 bytes packet size. Delay jitter for most of the packets in the proposed scheme remains within 12×10^{-4} range whereas delay jitter in the RFEC scheme varies significantly often reaching up to 25×10^{-4}sec. This is because in RFEC scheme higher numbers of packets are received as corrupted at the receiver end as the FEC code is not adjusted proactively taking the bit error rate at changing vehicular speeds into consideration.

We also conducted the simulation to monitor the average utility per camera of the video surveillance system in a public train. The utility for video transmission rate below half of the bandwidth demand is considered to be insignificant (0.05 in this case). The proposed *live_feeding_status_check* algorithm estimates the effective transmission rate at the transmitter end at various vehicular speeds and makes a decision whether to put one or multiple camera(s) offline. Utility for each offline camera is assumed to be 0.2 and all cameras are assumed to have the same priority (β=1). The result, as reported in Figure 7, is the actual utility (i.e., measured against actual received data rate) measured at the receiver end. As evident in the Figure, while the proposed solutions yield better utility compared to other schemes, the difference is not huge in terms of average utility per camera at low vehicular speeds (< 30 km/hr). However, when the speed increases, the proposed solutions achieve significantly higher utility gain compared to other schemes. Two issues contribute to this significant difference: i) the proposed solutions

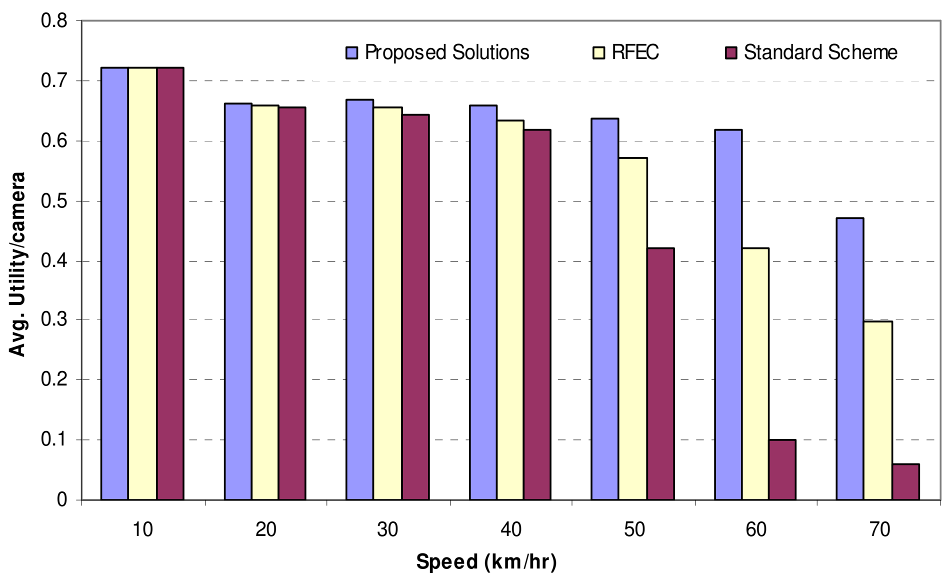

Figure 7: Average utility per camera in the proposed, RFEC and standard schemes.

offer better received video data rate even at high vehicular speeds, thanks to the *compute_FEC_code_size*, yielding better utility for each camera, ii) the *live_feeding_status_check* algorithm assists the WiMAX MAC to make a decision whether to put a camera offline based on the estimated video transmission rate.

4. CONCLUSION

Low throughput at vehicular speeds offered by existing wireless communication technologies is a key challenge towards deployment of real-time video surveillance system in public transport. Even 4G technology like WiMAX fails to deliver sufficient throughput at high vehicular speeds for successful deployment of video surveillance in moving transport. Multipath problem at high vehicular speeds is the key reason for this low throughput. In this paper, we proposed a proactive FEC scheme for WiMAX communications that takes the bit error rate caused by multipath fading at various vehicular speeds into account and proactively computes the FEC code size, which ultimately reduces the number of corrupted packets at the receiver end and improves the overall data transmission rate. We further proposed a utility based decision making algorithm for WiMAX MAC that decides when to put camera(s) offline and how many of them are required to be put offline. We simulated the proposed and other FEC schemes for a centralized video surveillance system in a public train. The results confirmed the suitability of the proposed scheme and established that the proposed scheme achieves consistently higher throughput, improved jitter and higher utility compared to other standard schemes both at low and high vehicular speeds.

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