Rain conditions affect the transmission of Streaming video data on Aeromodelling

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Rain conditions affect the transmission of Streaming video data on Aeromodelling

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ABSTRACT

Streaming is the process of sending data continuously that can be broadcast over the internet. FPV (First-person view) is a method used to control radio control vehicles from the pilot. Analysis of live video streaming service on FPV aeromodelling with standard configurations to determine the maximum results for live video streaming service on FPV aeromodelling. Distance measurements and environmental conditions are also necessary to determine the performance of live video streaming. Then, the performed on a Quality of Service (QoS) analysis, including measurement of delay, jitter, and throughput using Wireshark. From the tests that have been carried out, the comparison of the best value between the measurement of data delay with a value of 0.0085 m/s, for a jitter of 20.294 m/s and a throughput of 0.009 m/s is obtained, all of which are in accordance with the standards recommended by ITU-T. So that, the overall QoS obtained gives sufficient results.

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1. INTRODUCTION

Radio Control (RC) Aeromodelling is a form of aeromodelling activity which was originally raised as part of military activities but then attracted a lot of interest from the general public, giving rise to a new form of hobby. Aeromodelling itself consists of several types, including Free-Flying Aeromodelling, Control Line Aeromodelling, and RC Aeromodelling [1].

First-Person View (FPV) is a method used to control a radio-controlled vehicle from the pilot's point of view. FPV is an Unmanned Aerial System (UAS). It is equipped with a small video camera and transmitter to wirelessly downlink the video signal in real-time to a monitor or virtual reality glasses. The speed in data traffic on the video is also important because the video is realtime and is still peer to peer [2].

The application of video through computer networks is a form of multimedia implementation and new applications that are currently being developed in the computer program. By utilizing this application, users can get easy access to multimedia videos anywhere and anytime by connecting to a computer network, both wired and wireless [3]. Thus, the application of video streaming becomes a new solution in delivery of network-based like shipping and receiving data multimedia. One way to access fast video streaming is that there are 2 methods used, namely the HTTP Streaming and True Streaming methods [4].

Weather, time and distance between the transmitter and the receiver affect data transfer and affect quality of data transmission process [4]. For users themselves, most frequent obstacles are long load times, supporting plugins used, and slow data access. Many users complain because they feel uncomfortable with long time when it takes to access video streaming [5].

Rain attenuation is considered as dominant disturbance. Rain attenuation of satellite signals becomes especially severe at frequencies higher than 10 GHz. It is therefore absolutely necessary to correctly identify and predict overall impact of each significant rain-reducing factor on the Quality of Service (QoS), the characteristics of location, and transmission or propagation along a particular path between satellite and terminal. In the research conducted by Kamal Harb, it showed that is on weather prediction methods to maintain QoS on wireless and satellite networks [5].

In this research, the weather has a great impact on wireless networks, because this FPV aeromodelling system uses wireless technology, so evaluation and testing of the FPV system will be carried out with live streaming media using FPV aeromodelling. By the evaluation, it will provide data from several experiments to determine performance which is the best of FPV live streaming of weather situations. Then from the results of this study, an overview will be obtained to propose mechanism of the streaming process in aeromodelling which is expected to be developed from different technologies. This study focuses on QoS live streaming to determine the quality and speed of FPV aeromodelling streaming in different weather.

2. LITERATUR REVIEW

A. Weather Effects

Rain and snow can have a distorting effect on Ku and Ka band signals resulting in excessive digital transmission errors. This loss of signal attenuation is commonly called fade rain. Fading rain impacts the Quality of Service in wireless and satellite networks [4].

B. Wireless LAN Network (WLAN)

Wireless LAN is a wireless network that uses radio frequencies for communication between computer devices and eventually access points which are the basis of two-way radio transceivers that typically work in the 2.4GHz (802.11b, 802.11g) or 5GHz (802.11a) bandwidth. Most devices are Wi-Fi qualified, IEEE 802.11b or IEEE 802.11g accommodation and offer several levels of security such as WEP and WPA[6]. Wireless network is a group of computers that are connected to each other so that a computer network is formed using air/wave media as the data traffic path [6].

C. Digital Transmission

High data rates in the transmission process mean that large amounts of data can be sent in one unit of time. Therefore, the higher the data rate, the greater the amount of data that can be sent in one unit of time. While the speed of signal transmission is expected to be low because it is related to the bandwidth of the signal. The lower the baud rate, the smaller the amount of bandwidth needed to transmit signals [7].

D. FPV (First-person view)

FPV (First-person view) is a method used to control radio-controlled vehicles from the pilot's point of view. FPV is an Unmanned Aerial System (UAS) equipped with a small video camera and transmitter to wirelessly downlink video signals in real-time to a monitor or virtual reality goggles. The speed in data traffic on the video is also important because the video is realtime and is still peer to peer [2].

E. Streaming Video

The high bandwidth of wireless technology supports streaming media not only in wireless environments, but also in user mobility. On the other hand, QoS support on the Internet promises a more predictable channel for streaming media applications that can make low-bandwidth and low-latency streaming reach IP. Video streaming will continue to be an attractive area for exploration, development, and deployment in the future[8].

F. Quality of Service

Quality of Service (QoS) is the ability of a network to provide good service by providing bandwidth, overcoming jitter and delay. QoS parameters are latency, jitter, packet loss, throughput, MOS[8]. QoS is largely determined by the quality of the network used. There are several factors that can reduce the QoS value, such as: Attenuation, Distortion, and Noise [6].

G. Real time

Streaming media is a technology that enables the distribution of audio, video and multimedia data in real time via the internet. One of the categories of streaming media is video streaming. Video streaming is the delivery of digital media in the form of video, voice and data so that they can be received continuously. Real Time Streaming Protocol (RTSP) is a protocol that exists at the application level which functions to control sending data in real time[9].

H. Wireshark

Wireshark is a tool intended for analyzing network data packets. Wireshark is also called a network packet analyzer whose function is to capture network packets and try to display all the packet information in as much detail as possible[10].

I. ITU Recommendation Standard G.114

ITU-T is part of ITU, which is a specialized agency of the United Nations. Its standards have more formal international weight than most of the standards development organizations that issue technical specifications. In table 1, table 2 and table 3, we can see the ITU G.114 recommendation table used to standardize streaming video access [11].

a. Standard Delay Table

Table 1. Standard delay tabel

	Category	Delay
Packet length(bit) / *Link bandwidth (bps)*	Good	0-150 m/s
	Medium	150-400 m/s
	Poor	>400 m/s

Source ITU G.114 [11]

b. Standard Jitter Tabel

Table 2 Standard jitter tabel

	Category	Jitter
$\sum$ *Variantion delay* / $\sum$ *Packet received*	Good	0-20 m/s
	Medium	20-50 m/s
	Poor	>50 m/s

Source ITU G.114 [11]

c. Standard Througput Table

Table 3 Standard throughput table

	Category	Throughput
$\sum$ *Sent data (bit)* / *Time data delivery (s)*	Excellent	100 %
	Good	75 %
	Medium	50 %
	Poor	< 25 %

Source ITU G.114 [11]

3. RESEARCH METHOD (10 PT)

This research was conducted in five steps as shown in Figure 1, namely literature study, system planning, system implementation, system analysis, and conclusion.

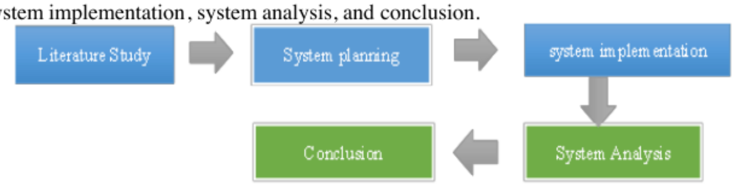

Figure 1. Research Flow

The research methods that were carried out include:

A. Literature Study

The first step was to find literature related to the research topic. The literature used relates to streaming, streaming methods, and the FPV System. The literature is in the form of books, journals, and articles on the internet.

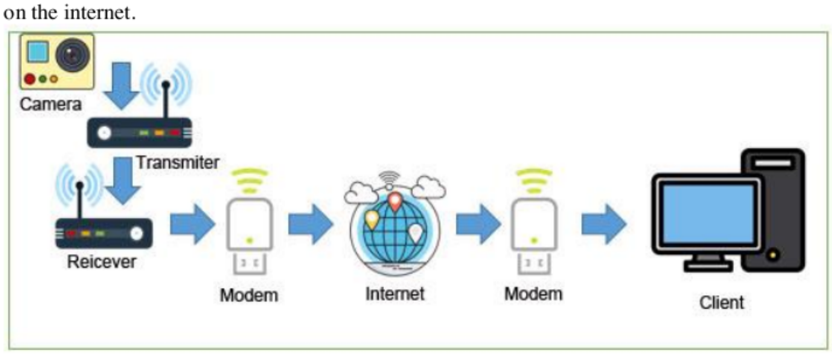

Figure 2. System Design

B. System Design

At this stage was preparing FPV aeromodelling in the form of a camera, transmitter, receiver, modem, and video monitor.

C. FPV Implementation Scenario

In this scenario, FPV quality testing was carried out by streaming aeromodelling videos using an HD camera. This test was carried out at the specified distance, time and weather, namely clear nights with a temperature of 23 °C with 100% humidity, with rainy weather at night with a temperature of 22 °C with 100% humidity, because the humidity of water particles had a distorting effect which was resulting in excessive digital transmission errors. Signal loss and attenuation were often referred to as a rain fade. Rain Fade affected the quality of service on wireless and satellite networks [4]. The server sent the video stream to the client. Then QoS data was taken as delay, jitter, and throughput 30 times with 5 meters of distance and 30 seconds of retrieval time of distance. It was in the position of Wireshark client application to record ongoing video streaming activity.

4. RESULTS AND ANALYSIS

Experimental data was taken using 30 data, data test was taken for each activity with different conditions, namely on clear nights and rainy nights, so that the data was obtained as shown in table 4

Table 4 Testing Data

Testing Number	Nigth			Raining Night		
	Delay	Jitter	Throughput	Delay	Jitter	Throughput
1	0,008696	30,019	0,835	0,12211588	28,453	0,034
2	0,007294	30,009	1	0,126277533	28,665	0,036
3	0,008129	31,393	0,906	0,151904306	31,748	0,033
4	0,007304	29,296	1,023	0,018763951	29,253	0,38
5	0,007458	28,758	0,983	0,152802469	37,131	0,033
6	0,009341	27,818	0,781	0,170416185	29,482	0,028
7	0,007996	29,361	0,914	0,163437838	30,236	0,032
8	0,007372	30,358	1,013	0,160617021	30,196	0,033
9	0,009348	30,185	0,781	0,155148148	29,323	0,033
10	0,007524	30,073	0,98	0,048676609	31,007	0,138
11	0,007307	30,345	1,609	0,157492147	30,081	0,033
12	0,008337	29,728	0,802	0,150139303	30,178	0,033
13	0,007198	28,477	1,641	0,170977143	29,921	0,031
14	0,007225	30,143	1,623	0,03091446	30,358	0,228
15	0,008238	30,934	0,891	0,017601041	40,588	0,406
16	0,00641	29,292	1,169	0,017058364	32,735	0,418
17	0,006839	31,61	1,091	0,014891794	37,021	0,488
18	0,006719	28,329	1,093	0,013779133	30,507	0,529
19	0,006815	29,093	1,099	0,013360485	30,836	0,545
20	0,006747	31,596	1,099	0,013674575	30,549	0,53
21	0,010746	29,25	0,677	0,015534149	30,478	0,468
22	0,009023	28,945	0,813	0,042758916	29,974	0,158
23	0,006669	29,349	1,121	0,174864706	29,727	0,027
24	0,006762	29,401	1,107	0,018736284	30,053	0,394
25	0,006765	29,514	1,107	0,020798325	29,804	0,327
26	0,006575	29,464	1,145	0,146660099	29,772	0,033
27	0,006124	29,243	1,227	0,143509615	29,85	0,033
28	0,006246	29,05	1,19	0,152270408	29,845	0,032
29	0,007272	29,007	1,024	0,138665138	30,229	0,033
30	0,00639	29,708	1,16	0,149005	29,801	0,033
Averrage	**0,00749**	**29,65827**	**1,0635**	**0,09576**	**30,9267**	**0,8239**

In this FPV (First-person view) test, several different weather scenarios were carried out. From this scenario, the performance was analyzed using Wireshark software. This software captured all data that passes through and then analyzed it by calculating delay, military, packet loss and throughput.

4.1. Testing Data

A. Data Delay Testing

Based on Figure 3 on clear night conditions with 100% humidity, it can be seen that the delay value changes each time, where changes from the 1st experiment to the 30th experiment occur. The highest delay occured on clear night conditions with a delay value of 0.010746 m/s, for the lowest delay value of 0,006124 m/s. Meanwhile, the highest delay occurred during night rain of 0.1749 m/s and the lowest delay was 0.01336 m/s. The delay value from the implementation results is still within the tolerance value limit according to the ITU-T G.114 recommendation, namely the delay must be < 150 m/s for video streaming services [11]

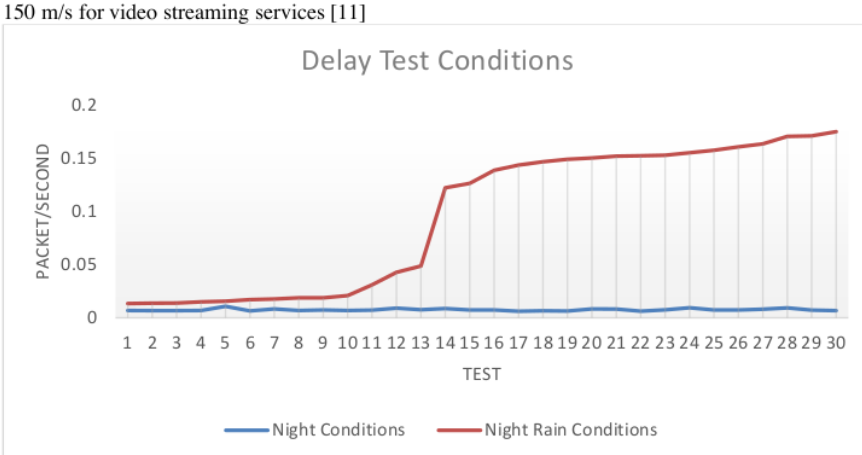

Figure 3. Chart delay testing

B. Data Jitter Testing

Based on Figure 4 in the rainy day and night situation with 100% humidity, it can be seen that the jitter value changes each time, where the changes start from the 1st experiment to the 30th experiment. The highest jitter occurred during clear night conditions with a jitter value of 31,61 m/s, for the lowest jitter value of 27.818 m/s which occurred during clear night conditions. The average for the highest jitter occurs in rain night of 40,588 m/s and rain night of 28,453 m/s for lowest jitter rain night condition. The magnitude of this jitter value is still the appropriate tolerance limit value recommended by ITU-T G.114, which is good jitter <30 m/s for video streaming services.

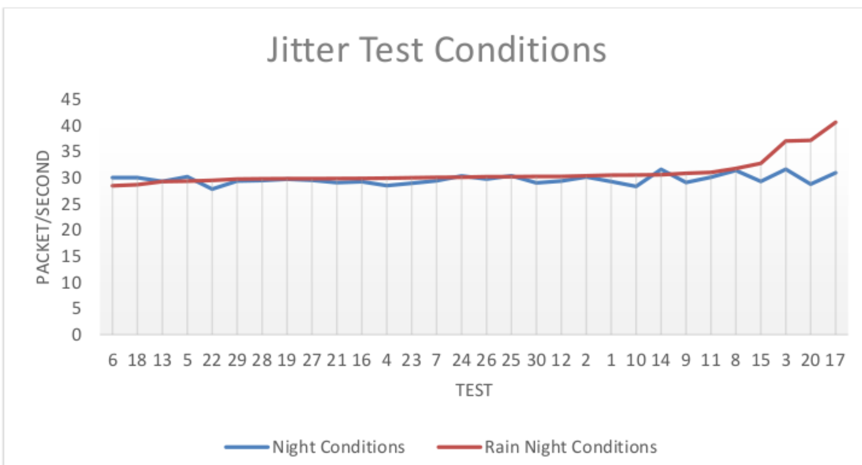

Figure 4. Chart jitter testing

C. Data Throughput Testing

Based on Figure 5 in the rain night and clear night situation with 100% humidity, it can be seen that the throughput value of each time changes, where changes start from the 1st experiment to the 30th experiment. The highest throughput occurs in the clear night conditions with a throughput value of 1,641 m/s, for the lowest throughput value of 0.667 m/s occurs in the clear night conditions. The average for the highest throughput occurs in the rain night of 0.545 m/s and night rain of 0.027 m/s.

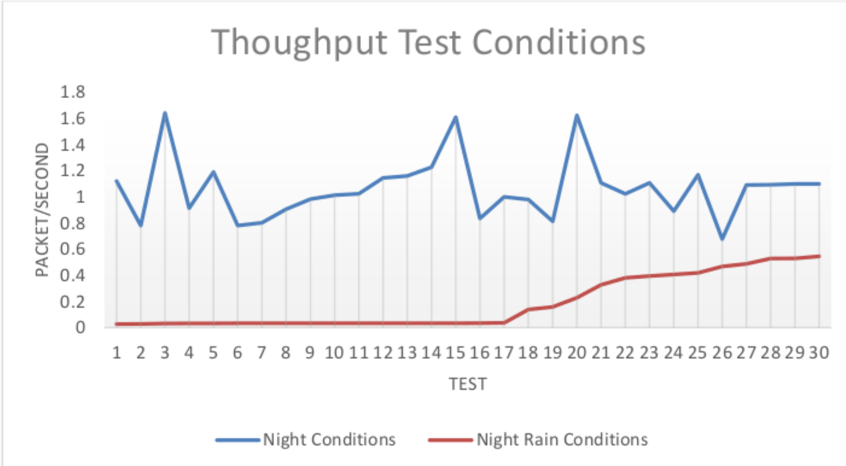

Figure 5. Chart throughput testing

4.2. Analysis and Results

A. Delay Result

Based on Figure 6, it can be seen from the existing graph, the delay results occur in clear night conditions with a delay value of 0. 00749 m/s which is smaller than raining night conditions with a delay value of 0. 09576 m/s. The results of the delay obtained a difference in value of 0.08827 m/s.

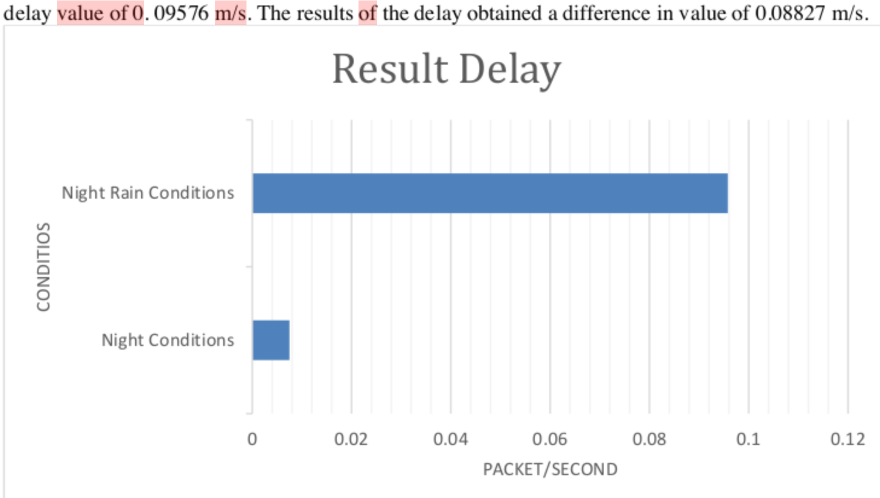

Figure 6. Delay result

B. Jitter Result

Based on Figure 7, it can be seen from the results that jitter occurs during night rain with a delay of 30.9267 m/s which is greater than afternoon rain with a jitter of 29.6583 m/s. Jitter results obtained difference in value of 0.7152 m/s.

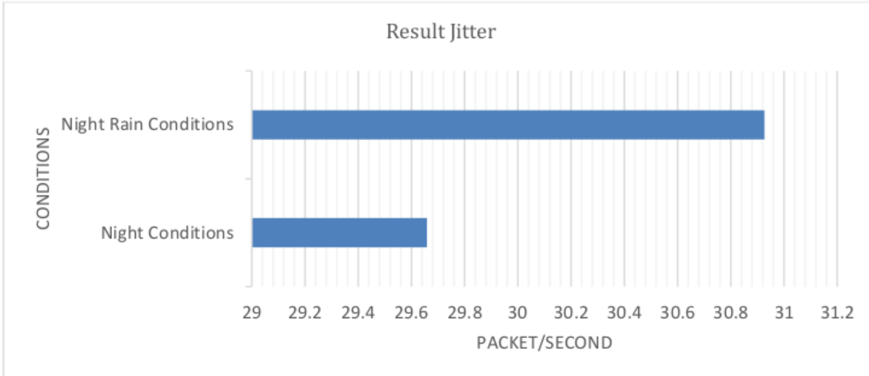

Figure 7. Jitter result

C. Throughput Result

Based on Figure 8, it can be seen from the results that the throughput occurs during night rain is 0.3567 packets which is smaller than afternoon rain with a throughput of 0.3964 packets/s. Throughput results obtained difference in value -0.3188 packets/s.

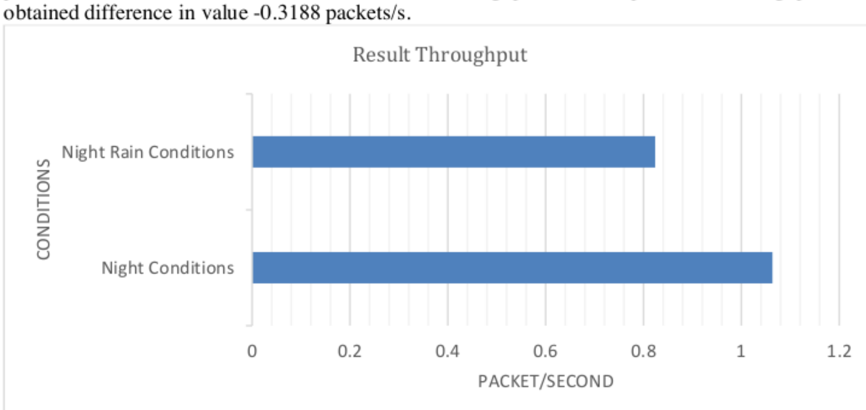

Figure 8. Throughput result

5. CONCLUSION

The influence of weather conditions when it is sunny and when it rains on sending data on the PFV system is indeed very influential. In streaming FPV testing during daytime conditions with 100% humidity and a temperature of 23 °C, 0.03% is better than rainy day conditions with humidity 100% and a temperature of 22 °C which can be seen from the delay value that occurs. But the delay value can still be tolerated for the ITU-T G.114 standard because the delay occurs <150 m/s. FPV quality testing carried out during rainy weather at night for an average throughput value of 0.8239 packets was higher than during rainy weather during clear night, which is the difference in throughput values of 1,06347 packets which occurred at 0.2396 packets. Thus, it can be concluded that the greater the throughput value, the lower the delay value.

REFERENCES

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