

Effect of Video Encoding Scheme of Battery Consumption of Mobile Device

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Abstract— Battery acts like a soul for mobile phones. It provides energy to the mobile phones. As long as the device is on, it will keep consuming the battery energy. Nevertheless, battery of mobile devices has limited power. In addition, the diversity of applications that are used reduce the battery lifetime. One of the application provided is a video player which mostly use for online streaming. However, the battery usage is difference while streaming a video. The codec used for video streaming affects the battery consumption. Therefore, the objective of this paper is to measure the battery consumption of mobile devices based on the type of video codec used. An empirical study was conducted by using a smartphone that supported by Samsung Galaxy Tab 2. The codec type such as WMV, MP4 and DIVX are among the codec, which be evaluated in this paper. In the end, the impact of several video codecs to the battery consumption are revealed. The outcome of this study assist the user to determine the best video codec for future use.

Index Terms— Battery, Video Codec

I. INTRODUCTION

Communication technologies today grow in tandem with the development of our generation. Along with that, have their own smartphones become almost necessity for everyone. Due to the trend, various applications for the smartphones are provide by the developer. The applications developed are to provide services to the users. But, what happen is, from the usage of variety applications make the battery life-cycle reduced faster.

Battery act like a soul for our mobile phones. It provides energy to mobile phones. The developers of phones attempt to develop mobile phones that use minimizes and more efficiently the power of battery so that it can be gives longer service to user. There are four type of rechargeable battery that commonly used in mobile phones. They are Lithium Polymer, Lithium Ion, Nickel Cadmium, and Nickel Metal Hydride.

However, the diversity of applications that are used to reduce the battery life time. One of the application provided are video player. For mobile devices, the different video players encode the video with different type of video codec. Video encoding is the process of converting original video files from one format to another while video decoding is the process of converting the compressed video file into the format to be viewable on the devices. The process is because of different devices and browsers support different video formats. This process can also be called as video conversion.

In this paper, video encoding scheme effect towards battery consumption is discovered and which video codec is suitable for mobile devices for video encoding. The proposed approach is to measure the battery consumption of mobile devices. The result is assessed by the performance of the mobile battery. In the end of this research, it is recommended that the best video codec that compatible for mobile devices are to view video with the least used of battery energy. This is because the type of video codec used to encode video affect the battery consumption of mobile devices.

In addition, this research focuses on watching video encoding by media player on mobile devices. For the experiment, android smartphone; Galaxy Tab 2, 7.0 model GT-P3100 with non-removable Li-ion 4000 mAh battery is used. The encoding video is tested on every video codec that compatible to this model such as MP4, H.264, H.263, Divx, Xvid, and WmV player.

The objectives achieve if the problems solved. First objective is to assess the battery consumption when watching the video in storage and stream video from server. The assessment is based on how much the battery reduced after watch the video. Second objective is to analyse the battery consumption based on type of video codec and format file. There is video codec with the same video format file but the usage of battery still different. The last objective is to know which video codec is the most suitable to be implemented, as several research and testing is done by viewing video playback.

As an output, the expected results fulfils the objective requirement as the recommendation of using H.264 video codec to save battery consumption and it is the advanced video compression standard. Other than that, in the end of this study .avi video format file is proposed to encode the video. Then, the reading of battery performance can be read based on percentage.

In the next section, the related work to this project is be discussed. Then, the methodology of the project is be elaborated. Next, the project design and implementation is explained. Finally, the conclusion is discussed in the end of this paper.

II. RELATED WORK

From previous research, an Analysis of Power Consumption in a Smartphone [1], measures the overall system power of a modern mobile device that is the Openmoko Neo Freerunner mobile phones. In fact, the exact breakdown of power consumptions is measured as the main hardware parts of devices. In his paper, the power required for playing a video file in storage. The power breakdown for the video playback, it showed that CPU used the most power when playing video. The measurements aggregate that power used excluding backlight is 453.5 mW.

From previous research about the battery, accurate online power estimation and automatic battery behaviour based power model generation for smartphones [2]. They show that the variation between power models for different type of model phones. A power model generation technique uses the knowledge of battery behaviour. The power characterization technique does not require external power measurement equipment. They explained the power model generation by using properties of Lithium-ion battery. They stated that the most popular batteries for portable embedded system are Lithium-ion battery. It was due to their high energy-to-weight ratios, long service lifetimes, and low self-discharge currents.

The voltage of battery is change when it discharges so it allows the reduction of energy. In this research, they explain how the changes occur. Lithium ions (Li+) carry current in the battery while discharge. The ions move from negatives electrodes, through the non-aqueous electrolyte and separator diagram. In a while, all the current in battery has loss the energy.

H.264 is a video codec method and format for video compression. It is the process of converting the video signal into a format that use less capacity when stored or transmitted. H.264 is the standard video compression that had been recommending by two international standard bodies, the ITU-T (International Telecommunication Union) and ISO/IEC (International Organisation for Standardisation / International Electro Technical Commission). It defines a format for compressed video and method for decode the syntax to produce a displayable video sequence. The H.264 Advanced Video Compression Standard book, [3].

In mobile phones, there are four basic commonly types of rechargeable battery that we used. They are Lithium Polymer (Li-Poly), Lithium Ion (Li-Ion), Nickel Cadmium (NiCd), and Nickel Metal Hydride (NiMH). These batteries have their own advantage and disadvantage.

For cell phone batteries Li-Poly is the newest and most advanced technology. This type use Ultra-lightweight energy, which do not effect from memory effect and deliver more battery capacity than NiMH of the same size [4]. It also no need a cell casing makes it thinner and lighter battery. The Li-ion battery is the currently and most popular battery. Although Li-ion battery is expensive, it is a bit lighter than NiMH battery, and also has a longer lifetime. However, it

may damage by extensive overcharging. [5] Then NiCd battery, it is the cheapest phone batteries. It helps to bring down the cost of mobile phones.

Video coding is the process of compressing and decompressing video signal. Compression consists of two pair of system, a compressor or encoder and a decompressed or decoder. The encoder converts the original video data into a compressed form, and the decoder converts the compressed form to the viewable form. The encoder and decoder are often called as a CODEC (enCOder/DECoder). [6].

Since this project is testing on Samsung Galaxy tab, there are a video codec that compatible with that type. There are MP4, H.264, Divx, Xvid, and WmV player. These all video codec is used so that the differences between them can be compared, as which one is the most suitable to be used. Some of them are using old standard and also have the most advanced standard for video compression.

However, this rechargeable battery suffers from memory effect, it must be completely charge 100% before recharging or else damage can occur. Then NiMH battery, this type is made from non-toxic material and environmentally friendly. It also delivers a higher capacity related to its size and weight. To maximize its performances, it is advised to completely discharge the battery.

QoE is needed in this paper to value the quality of video that have been compressed. QoE is referring to quality of user experience with the services. Users directly value the quality of services and give their opinion based on their experience [7]. In this study, experiment has been conducted on 10 persons as users to test and play the video that already compressed with different type of video codec. The five stars method is used and understand how users most preferable on each type of video. From the result collected, researchers could assume which video users most preferred.

III. METHODOLOGY

The methodology that used to implement in this paper is Top-Down Network Design as in Figure 1. This methodology was selected because, it relies on the new requirements from users. Top-Down Network Design approach guidance for selecting appropriate methods, techniques and tools based on the specifics requirements for the project. It is a design technique that starts with the highest level of an idea and works its way down to the lowest level of detail. Steps involved in this methodology are analyse requirements, develop logical design, develop physical design, test the design, implement and test the design and last monitor and optimize the network performance. These steps move consecutively according to steps planned for each phase.

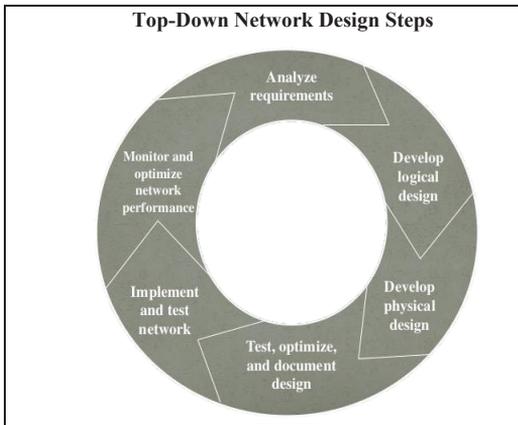


Fig. 1: Top-Down Network design

A. Analyse Requirements

The first step in this model is the project purpose, objectives and scope must be defined clearly including as well as the requirement of hardware and software. In other words, problems who users faced need to be identified and what users required according to this project. From this point, data is collected and requirements from users is gathered. Besides, data and requirements gathered from previous research also implemented. Information that gathered is analysed to fulfil project requirements.

Firstly, the purpose of this project is to study the effect of video encoding scheme on battery consumption of mobile devices. Users having a problem when watching a video, the battery life time is decreased rapidly. This is happening because different type of video codec compressed the original video and many brand of mobile were installed with different video codec that are compatible to their operating system. Therefore, different video codec affects the usage of battery power consumption.

The next step is to analyse the existing or previous research that related to this project. From others research, we gathered the detailed data or new information about the project, in order to compare the result of this project and provide additional information to others. From this point, users' knowledge about their device is increased and distinguish the suitable video codec for their devices.

Lastly, the performance of battery consumption need to be characterized when viewing video using media player. During this step, the result of battery consumption with different type of video codec is monitored and compared, which focused on the most video codec that used large amount of battery of mobile devices.

B. Develop Logical Design

The second phase is to develop Logical design, since this project uses server to streaming the video, there was a network design that has been developed and understand the

flow of the video is transmitted. Figure 2 shows a logical design of a network consists of a server, mobile phone and the access point. Each of them are interconnected and networked together. The network design is assumed the network performances not changes even the network is expanded into double or triple, and the troubleshooting process operated in smooth condition.

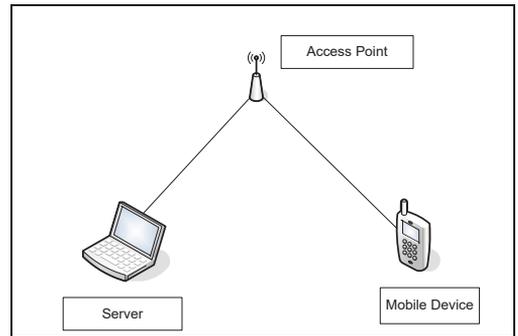


Fig. 2: Logical Design

C. Develop Physical Design

After completing the logical design, next is the physical design as illustrated in Figure 3. This design shows proper network that has been used. All the information such as IP address is stated. It also includes the device, location and cable installation. In this step, the devices technologies are decided in completing the design that has been decided. This network design was fully used wireless network.

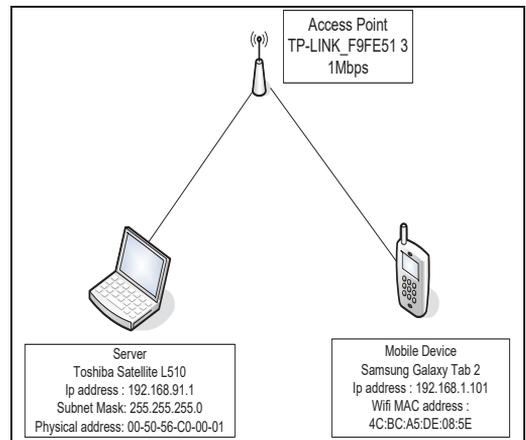


Fig. 3: Physical Design

This network also needs to maintain its performance so that the process of streaming is not affected. If this error occur, it may affect the performance of battery usage when playing the video.

D. Test, Optimize, and Document Design

The next phase is Test, optimize and document the design. In this phase, all the result meets the objectives and project goals are taken in the considerations. The testing is vital after the result show to the users that one of the video codec that supported by devices, use a least amount of battery consumption. From that users acknowledge about the effect of video encoding scheme on their mobile devices.

This phase is done by playing the video using media player on the device. The server streaming the video that already compressed with different type of video codec, and then users view the streaming video on their mobile and monitor the battery usage. Since there are six types of video codec that Samsung Tab supports, server streaming the video six times with different type of video compressed.

From this step, the usage of battery for each of the video codec that played is monitored. Besides, the battery is fully charge before view the different video. So, from this, we measure how much the battery power decreased.

E. Implement and Test Network

After all of the data that has been gathered, the next phase of implementation must be started. This phase, users installed video player that support all video codec type and play the video playback on their devices that already streamed by servers. Servers stream the video that already compressed through wireless network. Before that, users fully charge their mobile so that we can easily measure how much the usage of battery has been used by the mobile to watch the compressed video.

F. Monitor and Optimize Network Performance

Lastly, once all of the phases have been done, video streaming is executed and important to ensure that the network performance is good and no error occur during the streaming. This is because, if there are error occurred, this may affect the usage of battery. Besides, all of the streaming video is compressed with different type of video codec since, the main objective is to identify which video codec is the most suitable to be used.

IV. DESIGN AND PROJECT REQUIREMENT

In the network architecture, the logical and physical design is explained more detailed including the device information and device connection. In this section, the physical design is focused. Physical design is more detail than logical design. It explains all information that devices use such as type of device, IP address and MAC address. The physical design or hardware layout include all the physical connectivity of server and android in the network. It also includes the device, location and cable installation. This network used wireless access point to connect with each device and to transmit the data over the network.

Wireless local area network WLAN connects two or more devices over a short distance. It provides the connection through an access point for internet access. The use of spread-spectrum or OFDM technologies may allow users to move around within a local coverage area, and yet still maintain the connection in a network [8].

In this network, client streams the video from the server's database using wireless connection. Wireless access point function is to allow the wireless devices like a laptop and mobile phones to access into local area network. Its support Wi-Fi wireless communication standards

A. Video Codec Design

There are many available format of uncompressed video into the encoder out of encoder. Video codec is to compress the original video or source video into a compressed format. These formats actually make the video more available into many type of video player that use a less capacity or space compare to original video.

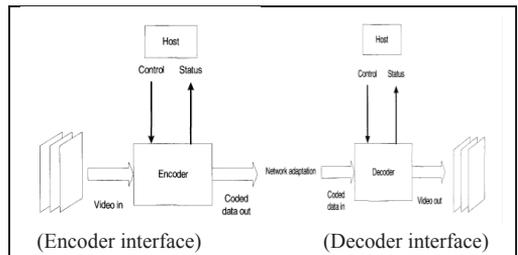


Fig. 4: Video Codec design

The Figure 4 illustrates the video codec design for both interfaces. It shows the main interfaces to a video encoder and video decoder. Encoder input the frames of uncompressed video then output the compressed bit stream. After that, the decoder inputs the compressed bit stream and control the parameters and then output the frames of uncompressed video send to a display unit [6].

B. Project Requirement

Project requirement is based on the project needs to be completed. It is the most important step in the process of completing the project. The project requirements must be well define in ensuring it works as planned, develop and implement the project. The project is considered success as all the requirements need has been met.

The project requirement needs software and hardware requirements. For software requirement, different types of video codec has been applied according to the type of mobile device supports. Thus, video codec software is needed that compresses the original video into different video with different format. There are MP4, H.264, DivX, Xvid, WMV

player. These all video codec have own their standard on video compression.

MP4 or MPEG-4 is a digital multimedia format that have been used commonly to stored video and audio data. It also allows streaming over the internet. MPEG-4 Part 14 or in formal standard is ISO/IEC 14496-14:2003 is a standard specified as a part of MPEG-4 [9]. Besides that, there also DivX codec that is able to compress a long video into small sizes while the visual quality is maintained while Xvid is a video codec that follow MPEG-4 standard that compressed video data in order to facilitate and speed up online video data exchange. Then, H.264 and H.263 video codec is used for this study. Both are same but H.264 is improved from H.263 codec, which is an advanced video coding for video compression and is currently one of most commonly used format.

TABLE I
SPECIFICATION OF SAMSUNG GALAXY TAB 2

Components	Specifications
OS	Android OS, v4.0.3 (Ice Cream Sandwich), upgradable to v4.1.1 (Jelly Bean)
CPU	Dual-core 1 GHz
Memory	Card slot : microSD, up to 32 GB Internal : 8/16/32 GB storage, 1 GB RAM
WLAN	Wi-Fi 802.11 a/b/g/n, DLNA, Wi-Fi Direct, dual-band, Wi-Fi hotspot
Video Codec	MP4/H.264/DivX/Xvid/WMV player
Audio Codec	MP3/WAV/eAAC+/WMA/AC3/Flac player
Battery	Non-removable Li-Ion 4000 mAh battery Stand-by : Up to 1190 h (2G) / Up to 1080 h (3G) Talk Time : Up to 40 h (2G) / Up to 20 h (3G)

Besides, VLC media player is used for server and VLC Direct Pro for android. VLC media player is open-source media player that can streaming media server. It supports many audio and video compression methods and file formats. It enables to stream over a network. Meanwhile, VLC Direct Pro acts as wireless streaming bridge from computer to the tablet. Then, the tablet is used as a remote control for watching movies over the internet.

In addition, Battery Monitor Widget application is used since this application is the most complete tool to manage the battery usage. It shows historical data (% , mA, mW, mV and temperature), calculates estimated run-times and battery aging, helps calibrate battery, and improves the battery runtime. The data given in the graph form easy to measure the battery consumption when playing the video.

Then, for hardware requirement, Samsung Galaxy Tab2 (7.0), model GT-P3100 one of the newest technologies in mobile world is used. This device with 4.0.4 android version is chosen because its specification that supports variance of application that also has a lot of capacity. Table 1 shows the device specifications.

On the other hand, Toshiba Satellite L510 that uses 32-bit operating system and has 1GB installed RAM is also being used. This laptop use Window 7 platform and processor

Pentium® Dual-Core CPU. It acts as a server that stored the video that client android streamed. In this server, VLC media player is installed to connect with the android.

Besides, wireless access point is required in a centre as a receiver and transmitter over data transmission in network, since the video is streamed over the network access point that acts as bridge between servers and android that allows both to communicate and connected. TP LINK wireless router with 1mbps is used in this settings.

V. IMPLEMENTATION AND TESTING

There are two testing about the video codec are carried out. Firstly, user plays the compressed video in the storage of mobile devices and secondly, the user streaming the compressed video through wireless from server's storage.

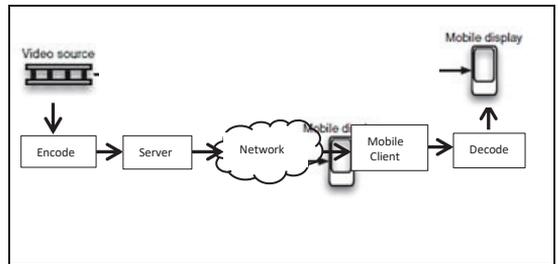


Fig. 5: Video coding scenario

Figure 5 shows the scenario of video coding. It is an internet video streaming. Video is coded and stored in a server. Then, the coded video is transmitted or stream over the internet and when client displays the video, it decoded.

A. Implementation of video on android storage

For the first experiment, it just the usual testing by playing the video on media player. The battery consumption is measured hundred per cent on the video playback. The others elements like wireless not affect the battery consumption as shown in Figure 6.

1. Convert the original video into a format that android support. In this case, the video is converting into MP4, H.264, DivX, Xvid, WMV player format.
2. All the video have been converted using MyFFVideoConverter software. This software can convert all type of format that you want.
3. First click the importing video button to import the original video
4. After that, choose the format type that you want to convert the original video into.
5. Then, click the Convert button and wait until the converting process is done.



Fig. 6: MyFFVideoConverter interface

6. After all the converting process done for each type, transfer the video into android.
7. Make sure the android's battery is fully charge before viewing the video.
8. Repeat step 7 by viewing different type of video format in android media player.
9. Then, measure the battery consumption for each type of video format.

B. Implementation of video streaming on android

Next for second experiment, user streams the video using VLC Direct Pro through wireless network. In this testing, the wireless affect the battery consumption. So, from both experiment we measured the exactly battery consumption on playback the compressed video.

1. Install VLC 2.0.2 on the server. Make sure that 2.0.2 version is installed otherwise; it crashes when streaming to android.
2. ConFig. VLC to allow remote connection once the installation done.
3. Since the server use Window 7, download the script that makes the configuration automatically. Then, run it as administrator as in Figure 7.

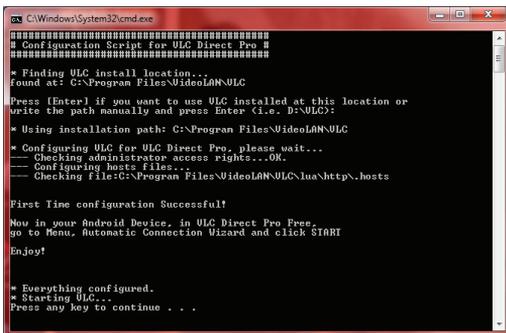


Fig. 7: Remote configuration of VLC

4. After that, enable the VLC web interface by click the View on menu tab.
5. Install VLC Direct Pro in the android. This application allows users to stream video from server.
6. After installation is done, open The VLC Direct in the device.
7. Go to Menu, and then click Automatic Connection Wizard.
8. Click Start button then VLC starts scanning the network and search server in network.
9. VLC Direct shows the folder that available in server once the connection is success.
10. At the same time, VLC in server also show the connection is success. As in Figure 8.

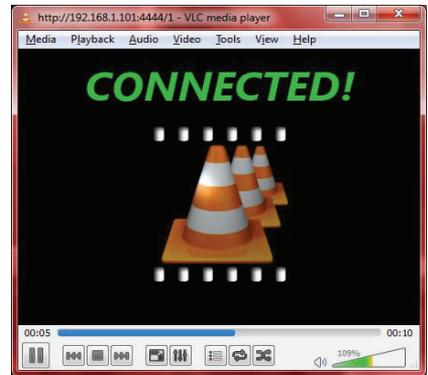


Fig. 8: VLC media player in server

11. Then, user can choose the video file that provided.

C. Test Plan

The test plan provide guidelines to do the testing process, so that it is more easy and systematic. Under test plan, it include test environment and test schedule. Test environment is the environment where the testing is executed, in software and hardware, while test schedule is the duration or time cycle of the testing running.

There are two testing in this paper to measure the battery consumption on video encoding. Firstly, the testing of usage of battery on viewing video in the storage, and secondly, testing of usage of battery on viewing streaming video. Both testing is to measure the battery consumption of video encoding.

D. Test Environment

First testing is user play the video that already encode with different video codec that save in their mobile. Before that, the battery of mobile is fully charged. After done watching the video encoding with 28 minutes duration, the battery consumption is measured based on how much it has reduced. In this testing, the battery power only used to play

the video. We off the Wi-Fi, GPS, or Bluetooth since they are not use the battery power.

Second testing is, users stream the video from server on the same network. The same video is used that encode with different video codec. Same with first testing, the battery must be fully charged before users stream the video. After 28 minutes, the battery consumption is measured based on how much its power reduced. 802.11 standard Wi-Fi technologies with 4mbps speed to connect server and android is implemented.

E. Test Schedule

Test schedule is the test duration and cycle time of testing process. Before each testing is carried out, different type of video codec need to make sure while the battery is fully charge and it is not connected with power supply when testing process occurred. The testing time is only 28 minutes and 35 seconds. It was the video duration. After the video end, the usage of battery on playing the video is recorded. From different video types, different amount of battery usage is collected.

F. Testing

In the testing phase, firstly, user play with the video in the storage. The videos are already encoded with different type of video codec. Then, the result is compared from collection based on battery consumption, which is type of video codec and type of video file format. The video quality also is compared with each other, so from the differences researcher able to identifies which one of video codec is better in viewing the video on mobile devices. The original video size is 0.99GB.

server. Then, the result is compared based on data collection of battery consumption, type of video codec and type of video file format as in Figure 9.

VI. RESULT AND ANALYSIS

The Table 2 shows the result of all testing that has been done on each video codec. Each of them gives different value. From the table, H.264 video codec use battery about 7% and battery remaining is 93% with the quality of video is very good. Although, the file size is bit large than MP4, the video quality is much better for user to view video. Users prefer this video codec to watch the video since the usage of battery consumption, H.264 is a suitable video codec.

TABLE II
COMPARISON BETWEEN THE VIDEO CODEC

Type of Video Codec	File format	Battery Balance	Battery used	File Size
WMV	.wmv	94%	6%	139MB
H.264	.mp4	93%	7%	191MB
MP4	.mpeg4	93%	7%	184MB
Xvid	.avi	93%	7%	192MB
Divx	.avi	92%	8%	192MB

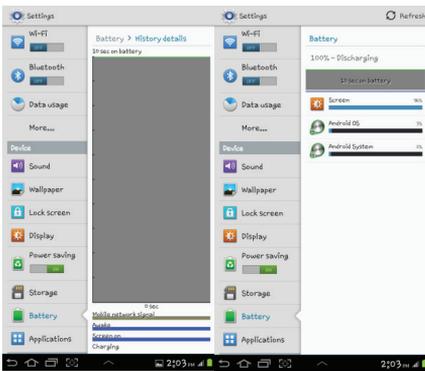


Fig. 9: The battery is fully charge

Secondly, user streaming video on android from server. The connectivity and the services availability are checked to ensure the system is working. So that, when playing the video, there is no connection error occur. The videos that encode with different video codec is stored in one place in the



Fig. 10: Battery usage from Battery Monitor Widget

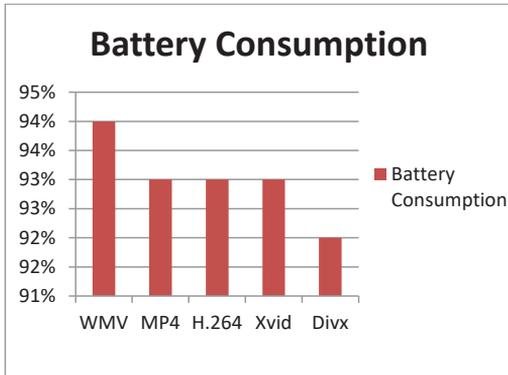


Fig. 11: Battery Consumption for different Video Codec

Both Fig. 10 and 11 show the usage of battery consumption for different video codec. This video had been tested by users that play the video in the mobile phone. In Figure 10, it shows that line graph where battery had been charge and used. Green colour is when the battery is charge while red colour when battery is been used. The battery had been charge for five times for five type of video codec. For second Fig., it shows the amount of battery consumption of all five type of video codec.

For video quality, it based on QoE. 10 persons of users are asked to play the video and choose which video quality they prefer. Out of five stars, users give the stars of marks for each video. Table 3 shows that H.264 has the highest value. Out of 10 persons, nine of them prefer H.264 video codec that show the best quality of video. While, WMV is the lowest rate which 8 user rate is only 1. Table 3 shows that user of mobile phones are prefer for quality of H.264 video codec to watch the video.

TABLE 3
VIDEO QUALITY FOR FIRST TESTING

Type of video codec	QoE Rate				
	1	2	3	4	5
H.264	0	0	0	1	9
MP4	0	0	2	5	3
Xvid	0	1	2	6	1
Divx	0	1	1	8	0
WMV	8	2	0	0	0

Meanwhile, Table 4 shows the overall result that collected from testing the video that streaming from server. The table 4 includes the type of video codec, type of file format, battery balance, battery used and size of file. From the table 4, it shows that Divx use the highest amount of battery power to play the video, while WMV use the least amount. Besides that, H.264, MP4 and Xvid use same amount of battery power although their file size is different. Even that, H.264 is the video codec that suitable and most preferred by our users that use proper amount of battery with common file size.

TABLE 4
COMPARISON BETWEEN THE VIDEO CODEC

Type of Video Codec	File format	Battery Balance	Battery used	File Size
WMV	.wmv	93%	7%	139MB
H.264	.mp4	92%	8%	191MB
MP4	.mpeg4	92%	8%	184MB
Xvid	.avi	92%	8%	192MB
Divx	.avi	91%	9%	192MB

Both Figure 12 and 13 show the usage of battery consumption for different video codec. This video had been tested by users that stream the video from server. In Figure 12, it shows that line graph where battery had been charge and used. Green colour is when the battery is charge while red colour when battery is been used. The battery had been charge for five times for five type of video codec. For Figure 13, it shows the amount of battery consumption of all five type of video codec.

For video quality, it based on QoE. 10 persons as users play the video and ask them about which video quality they prefer. Table 4 shows that H.264 has the highest value. Out of 10 persons, eight of them prefer H.264 video codec that show the best quality of video. While, WMV is the lowest rate which 9 user rate is only 1. From the table, we know that user of mobile phones prefer quality of H.264 video codec to watch the video.



Fig. 12: Battery usage from Battery Monitor Widget

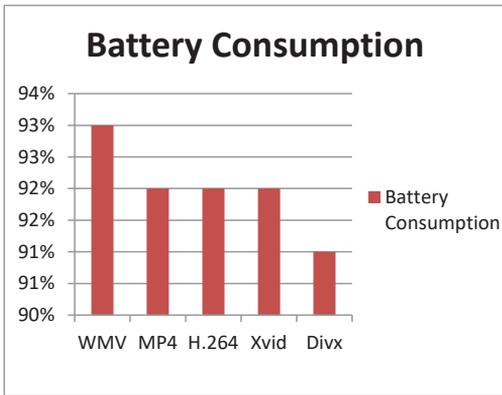


Fig. 13: Battery Consumption for different Video Codec

In addition, the survey based on QoE show that users prefer H.264 video codec. This is because even that video codec not use the least amount of battery amongst them, it gives the best quality of video, and it not use large amount of battery usage. So, this helps users to save their battery power.

TABLE 5
VIDEO QUALITY FOR FIRST TESTING

Type of video codec	QoE Rate				
	1	2	3	4	5
H.264	0	0	1	1	8
MP4	0	0	2	5	3
Xvid	0	2	2	6	0
Divx	0	1	1	8	0
WMV	9	1	0	0	0

VII. RECOMMENDATION

In future planning, this study will be tested in different network since the same network has been tested. Thus, user in different network can also choose to stream any video that server allow. The function is same like YouTube, the largest video- sharing website, where users can share, view uploads and downloads video from various website.

Besides that, a different type of mobile phones will be used since, in current research, only test by using one mobile device, which it may has a possibility when using different mobile phones give different results compared to just using one mobile phone.

VIII. CONCLUSION

As a conclusion, the research is about the effect of video encoding scheme of battery consumption of mobile devices.

First objective is to assess the battery consumption when watching the video in storage and stream video from server. The assessment is based on how much the battery decreased after watching the video. From the result collected show that wmv use least amount of battery compared to others, but it

gives a bad quality of video. Therefore, user did not preferred wmv video codec.

Second objective is to analyse the battery consumption based on type of video codec and format file. There are video codec with the same video format file but the usage of battery still different. Even Divx and Xvid have same file format and file size, however, the battery consumption of these two video codecs are different. Divx uses more battery than Xvid.

The third objective is to know which video codec is better to be implemented. After all the research and testing done, users understand and used a suitable video codec when playback the video. In the end, from data collected and survey from users done, researcher suggest to users to use H.264 video codec. This video codec use consistent amount of battery even it provides the good quality of video. This video codec converts original video into compression form into common size of video.

In the end, H.264 video codec is proposed, which is the best and most advanced video compression that suitable for any mobile phones. This video compression standard takes less capacity when storage or transmission and provide good quality video to users to streaming using mobile phones.

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