

LiteMP4Repair: Corrupted MP4 Repair Tool Using Header Substitution

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Abstract: In digital forensic, recovery of deleted and damaged video file plays an important role in searching for evidences. However, failure to repair the corrupted MP4 file may lead to delayed the searching process. In this project, a corrupted MP4 repair tool has been developed. This tool is called LiteMP4Repair. Development of this tool is using Object-Oriented System Development methodology. The tool is written using C#. This project creates an alternative way for repair corrupted MP4 file which is focusing on corrupted file header. LiteMP4Repair tool focus on repairing corrupted MP4 file using header substitution. This tool use substitution method by using 10 random headers within 32bytes. For the result of testing the playable or repairing corrupted MP4 file, there 10 corrupted MP4 from difference timeline has been test. Finally, an alternative tool called LiteMP4Repair has been successfully developed.

Keywords: MP4 file, Substitution method, repair corrupter MP4 file

1. Introduction

The growth of digital camera, CCTV and security camera, which is used to capture image and record video events was along with smart device. The demand for this device is increase by time was shows that most people is using the smart device such as smart phone [1]. Besides that, these devices are used by criminal to record illegitimate activities such as robbery, murder and threads. The data or information from these devices can be used to identify the criminal to being justice. In criminal investigation, the recorded video data often provides important evidence for a case.

To solve this issue, the video data restoration and video carving has been actively studied [2]. Studies on the file carving have targeted the restoration of different file types like pdf, zip, and image files but there are small number of methods on carving of the file type like video. The existing contributions in this field are based on manual comparison of video container structure and content, which is time demanding and error-pron [3]. File carving is the process of reassembling computer file from fragments in the absence of the file system metadata [4]. File carving is one of powerful method that taking advantage of the video file structure.

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The actual file content can be found by using conventional file restoration technique, but the file cannot be restored if the file link is lost for example is lost part of header link file. For MP4 file, it known as that it has a large volume and it was likely corrupted although the meta information a remain in the file header. The existing technique based on restoration technique such as Frame-based recovery, Bi-fragment gap carving (BGC) and Smart carving technique. These techniques are not efficient when the target video file was fragmented though it can introduce the method of providing a signature of the file system.

For this study, the propose tool are focusing only for corrupted of header MP4 file. In this study, a simple corrupted MP4 repair tool has been proposed, in which corrupted header in MP4 file repair by using 10 multiple header substitution that may able to repair and been display. This application can only repair out one file at one time. 10 multiple header substitution that been used has its own characteristic and category to been choose. The corrupted header MP4 file that be repair size file must less than 30MB. This study is to test the functional of repair MP4 header by change the corrupted header with another structure of header MP4 file. To complete the propose tool, the study for MP4 header structure is important to may have a higher functionality for LiteMP4repair tool.

The remaining of the paper is organized as follows. Section 2 review all work related to the MP4 repair method. Section 3 presents the Object-Oriented System Development methodology used to perform application develop tasks. Section 4 presents the result and discussion, Section 5 present the results, and finally, Section 6 concludes the work and highlights a direction for future research.

2. Related Work

2.1 MP4 Overview

A file that use.mp4 file extension was an MPEG-4 video file format. MPEG-4 stands for “Moving Pictures Expert Group 4,” which is a standard for audio and video coding compression[5]. MPEG-4 is commonly shortened to “MP4.” MP4 files can be read by computer applications such as QuickTime and VLC. This type of file is one of the common video file formats used for downloading and streaming videos. MP4 files were created by the ISO/IEC14496-12:2001 standard by the ISO/IEC and Motion Picture Experts Group (MPEG) [6].

Since 1999, the MPEG-4 standard has been undergone some involvement which make MPEG-4 has 3 part, which is Part1,2, and 3. this part were the initial standard that outlined the file format to contain audio and video data. These 3 parts was been identify in ISO/IEC 14496-1, ISO/IEC 14496-2 and ISO/IEC 14490-3 [7].

Moreover, standard for MP4 file format been used today was made in 2003 which is MPEG-4 Part 14. MPEG-4 was introduced in ISO/IEC 14496-14, there have been many further amendments to MPEG-4 file structure. Besides that, Advanced Video Coding (AVC) was introduced in MPEG-4 Part 10 defined in ISO/IEC 14496-10 in 2003. In 2004, MPEG -4 Part 15 defined in ISO/IEC 14496-15. In this part, it introduced the storage format for encoded data.

Table 1: Comparison with MPEG-1, -2, and -4

Parameter	MPEG-1	MPEG-2	MPEG-4
Standard	1992	1994	1998
Picture structure	Frame	Top/bot.field, frame	Top/bot. field, frame
Picture type	I-,P-,B-,D-picture	I-,P-,B- picture	I-,P-,B- rect/arb
Motion compression of block size	16 x 16	16 x 16 (16 x 18 field)	16 x 16, 8 x 8
Transmission rate	Up to 1.5Mbps	2-15Mbps	64kbps-150Mbps

Table 1 shows the difference MPEG-1,2 and 4. The standardized for 3 type of MPEG is different, which is MPEG-1 standardized out in 1992 for MPEG-2 is in 1994 and for MPEG-4 is in 1998. Besides that, the picture structure for MPEG-2 and 3 is frame and Top/bot.field but only MPEG-1 do not have Top/bot.field.

For picture type MPEG-1 use I, P, B, and D, MPEG-2 use I, P, and B-picture, and MPEG-4 use I, P, B-rect/arb. Next, motion compression of block size for MPEG-1 was 16 x16, MPEG-2 was 16 x 16 (16 x 18) and MPEG-4 was 16 x 16 and 8 x 8. The transmission rate for MPEG-1 is up to 1.5Mbps, MPEG-2 is 2 to 15 Mbps and for MPEG-4is from 64kbps to 150 Mbps.

In order to do this project, it is important to understand the MP4 container-based nature of the file itself. MP4 file is made of a few separated units or individual data structure shown in figure 1. The first version of MPEG-4 which is MPEG-4 Part 1 it called as atoms [8]. The second version that nowadays use for MP4 which is MPEG-4 Part 14 called as boxes. Both versions are identified via unique 4-byte sequences.

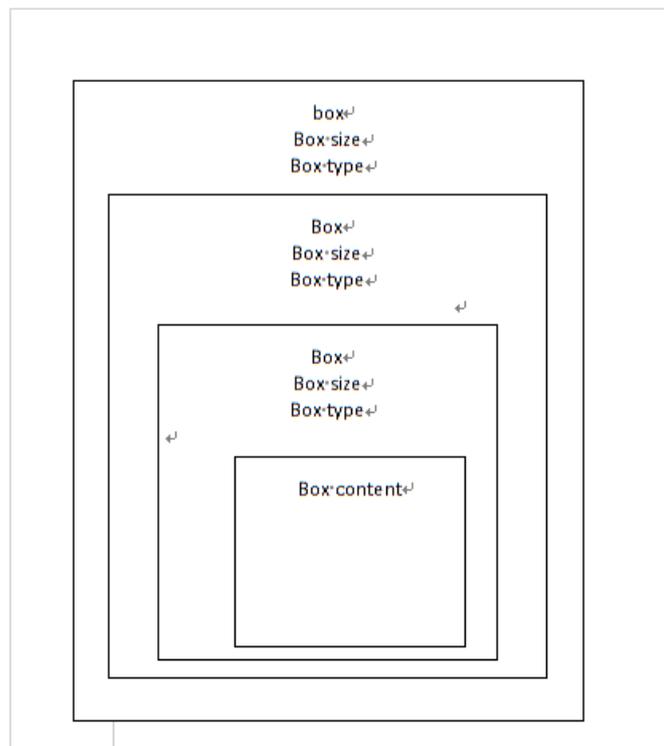


Figure 1: MPEG-4 Box Structure[9]

For each box, it begins with an unsigned 32-bit or 64-bit integer, but most of the box use the 32-bit integer. On purpose of parsing the MPEG-4 boxes all byte size value will described in hexadecimal value using prefix '0x', where 0x00=0 bytes, 0x10=16 bytes, 0x20=32 bytes, etc.

MPEG-4 has three main type of boxes, namely file type ("ftyp") box, the movie ("moov") box and movie data ("mdat") box. The beginning of the file that provides information about the content of the file is file type ("ftyp") box. For the movie ("moov") is contains information about the media within the file and for movie data ("mdat") box is provide the raw data for video and audio within the file. Figure 2 shows the main structure of MP4 video file in hex-viewer.

Offset	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
00000000	00	00	00	18	66	74	79	70	6D	70	34	32	00	00	00	00	ftypmp42
00000010	69	73	6F	6D	6D	70	34	32	00	00	0D	A8	6D	6F	6F	76	isommp42 moov
00062E20	01	14	6A	6C	6D	64	61	74	21	10	05	20	A4	1B	FF	C0	mdat
00062E30	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	
00062E40	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	
00062E50	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	

Figure 2: MP4 structure in hex-viewer [10]

The example file for the file type (“ftyp”) box in figure 3, the first four bytes represent the size of the box highlight with red colour. The next four bytes define as the type of the box in figure 3 highlight with green colour. The ISO specification requires this box to exist as early as possible in the file. In each file, it only must have one (“ftyp”) box and not more to follow ISO specification [11].

Offset	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
00000000	00	00	00	18	66	74	79	70	6D	70	34	32	00	00	00	00	ftypmp42
00000010	69	73	6F	6D	6D	70	34	32	00	00	0D	A8	6D	6F	6F	76	isommp42 moov
00000020	00	00	00	6C	6D	76	68	64	00	00	00	00	D1	AA	82	A0	lvhd
00000030	D1	AA	82	A0	00	00	03	E8	00	00	13	AB	00	01	00	00	

Figure 3: Ftyp structure in 1-8 bytes

Offset	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
00000000	00	00	00	18	66	74	79	70	6D	70	34	32	00	00	00	00	ftypmp42
00000010	69	73	6F	6D	6D	70	34	32	00	00	0D	A8	6D	6F	6F	76	isommp42 moov
00000020	00	00	00	6C	6D	76	68	64	00	00	00	00	D1	AA	82	A0	lvhd
00000030	D1	AA	82	A0	00	00	03	E8	00	00	13	AB	00	01	00	00	

Figure 4: Mdat structure in hex-viewer

Figure 4 shows that the next four bytes is define as the movie (“moov”) box. The first four in red represent the size of the box which is 0x0D 0xA8 bytes. The next four in green represent the type of the box, which is 0x6D, 0x6F, 0x6F, 0x67.

2.2 Study of Existing Systems

Recovery application has been wisely developed by many companies as they see the potential of recovery data. PhotoRec software and Restore media software are the two examples of the existing tool.

PhotoRec is an open-source digital forensic tool. This tool is designed to restore lost or corrupted file such as document, audio, video, picture from the disk image. This tool use signature matching of file to retrieves deleted file and also this tool do not consider the storage media file system metadata [12]. The technique that use in this tool is text-based data recovery techniques [13]. So, each block needs to be check against the signature databases. It can carve lost files from digital camera storage media of, USB flash drives, hard disks, and CD-ROMs. Moreover, it restores most common photo formats, audio files, document formats, such as Microsoft Office, PDF, HTML, and archive or compressed formats. However, it does not attempt to write to the damaged media from where carving is being performed [14].

Restore Media repairing technology us build on searching for all existing file fragment as well as on repairing based on available information. It can repair a video from camera, android smartphones,

drone and other device with internal and removable media storage device [15]. He/she software analyzes the downloaded file for program errors and then fixes them by substituting lost during the process of conversion /compression bits of information.

Frame-Based Recovery of Corrupted Video Files Using Video Codec Specifications is one of technique that been used for corrupted video repair. The advantages for this technique are it repair the corrupted video file by taking advantage in video code. The method makes a video file converted into video frames where every frame that been an important part of the video [16]. It is applied to MP4 and H.264 video coding structure. Besides that, it also applied to dual common video coding standard, which is been using as automobile black boxes and mobile devices. This technique does not have ability to extract data by their own rather take help from additional tool [17]. For the additional tool, there have their own limitation like the playable video frames and decoding header information.

For this research, experiments are carried out between LiteMP4repair, Restore Media and PhotoRec because both are widely used open source for carving or repair. Secondly, both tools are also capable of doing video repair. Table 2 shows a summary of file recover or repair reviewed in this study.

Table 2 :Comparison with Existing System

Feature	PhotoRec	Restore Media	Frame-based recovery
MP4 Carving	√	√	x
Corrupted MP4 Repair	√	√	√
Substitution header technique	x	x	x

2.3 Important of MPEG-4

MP4 is video format that it be referred to as MPEG-4 Part 14 or MPEG-4 AVC. MPEG stands for Motion Pictures Expert Group and AVC refers to Advanced Video Coding. The MP4 is a lightweight of multimedia container format that permits storing of audio, video, subtitles and still images in a single file [18]. Additionally, it also contains more complex contents, such as user interactivity, 2D, 3D graphics, animation and menus

The MP4 works similarly to MP3 but the most fundamental difference between them is the type of data they store. MP3 files can only be used for audio, whereas MP4 files can store audio, video, still images, subtitles and text. In technical term, MP4 is a “digital multimedia container” format while MP3 is an “audio coding: format. However, both try to compress files and obtain high quality output files. MP3 is a revolution in music and audio world meanwhile MP4 has revolution in the way people usage and share videos. The important of MPEG-4 is make MP4 may overcome MP3.

In future, MP3 only support audio information, but MP4 support video, audio and other information in multimedia. Secondly, it compresses multimedia information in such a way that it retains high quality in a remarkable slight file size. Thirdly, it is a good format for sending files through the web, with a remarkable speed and outstanding quality. Besides that, it is getting more popular because many applications are now supporting the MP4 format.as in iTunes, iPods and Play Station Potable. And lastly, it is more convenient for the user to convert each DVD into MP4 to appreciate your movies anywhere on your portable device.

3. Methodology and System Analysis

System methodology that is used to follow in developing the LiteMP4Repair tool using header substitution. The methodology is a series of systematic produce to conduct problem-solving during the project. It gives the guideline for the developers to reach their goals to react to the object for the project.

To reach the objective of the project, there needs a plan or guideline to follow such as the scope of the project, the cost, and the time management for the time provided in an earlier stage.

3.1 System Requirement Analysis

In the analysis phase, the important thing that needs to be take note is the user requirement and the existing system. This user requirement and existing system were analyzed and made the comparison. The outcome for the analysis phase is literature review. In order to develop a working application, the requirements are user requirements, functional requirements, non-functional requirements and system requirement which are shown in Table 3, Table 4, Table 5 and Table 6.

Table 3: User requirements

No	User requirement
1	User should be able to upload file to the software tool
2	User should be able view the uploaded file from the software
3	User should be able to choose the file in database that be save
4	User should be able to start repair the uploaded file
5	User should be able to view the file has been repair
6	User should be able to download file from the software tool

Table 4: Functional requirements

No	Data	Functionality
1	User Registration	The system should be able to register for a new account in the application
2	User Login	The system should allow user to log into the application
3	Insert Corrupted MP4 File	The system should be able to let user to upload MP4 file
4	Repair Corrupted MP4 File	The system should be able to repair the selected video
5	View Playable MP4 File	The system should allow user view the file that has been repair
6	Save Playable MP4 File	The system should allow user to save the MP4 file that been repair
7	User Log Out	The system should allow user to logout from the application

Table 5: Non-functional requirements

No	Data	Functionality
1	Usability	The application tool should be easy to use
2	Operational	<ul style="list-style-type: none"> • The application tool should be able to display repair file • The application tool should be user-friendly • The application tool available to Window 10
3	Performance	The interaction between user and application should not exceed 5 minutes

Table 6: System Requirements

No	Data	Requirement
1	Operation System	Microsoft Windows 10
2	Hardware	<ul style="list-style-type: none"> • Processor: Intel® Core™ i5-6200U CPU @2.30GHz • Memory (RAM): 4.0GB • Hard Disk (HDD): Minimum 2GB
3	Software	<ul style="list-style-type: none"> • Xampp Control Panel v3.2 • Microsoft Visual Studio 2019

3.2 Unified Modelling Language Specification

Unified Modelling Language (UML) is a visual modelling language designed to be used for the system analysis, design and implementation. UML uses graphic notation to create software system visual model [19]. There are three type of UML diagram presented in this project, use case diagram, and sequence diagram. A use-case diagram is used to describe the requirement of a system.

In a use-case diagram there are two important aspects which are the actor and the use case. The actor represents as the external entity that interacts with the system while use-case are represent list of action that defines interaction between actor and the system. Figure 5 shows the Use-case diagram for LiteMP4Repair tool.

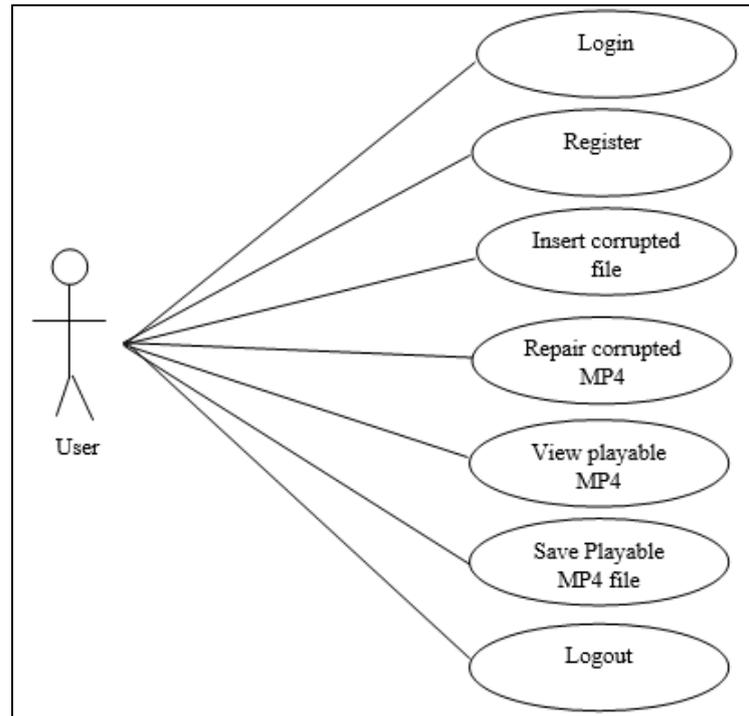


Figure 5: Use-Case Diagram for LiteMP4Repair tool

The end user can log into the system with his/she username and password after creating their account in the proposed application. After successfully logging in, the user can insert the corrupted MP4 file, and repair corrupted MP4 file. Moreover, the user can view the MP4 file and safe the playable MP4 file to the laptop. For the last use case user has logout from the LiteMP4Repair tool.

The sequence diagram display interaction between object arrangement in time sequences. The dynamics behaviour between the user and the application object is been described. It also visualized the data flow of the action is carried out through functionalities of the application. Figure 6 shows the sequence diagram of user registration and user login.

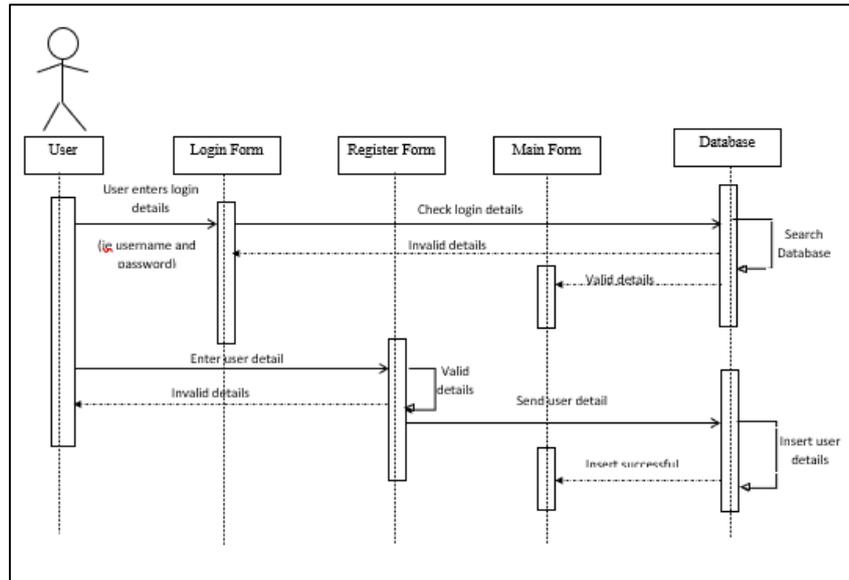


Figure 6: Sequence diagram for Login and Register

As shown in Figure 6, in order to register an account, the user needs to provide a unique username, and password. Once verified, the information will be saved inside the database and the user will be redirected to the main page. If the user already has an account, he/she need to login before log into the application. The username and password provided by the user is checked if they match. After successful login, the user will be redirected to the main page otherwise an error message will be shown.

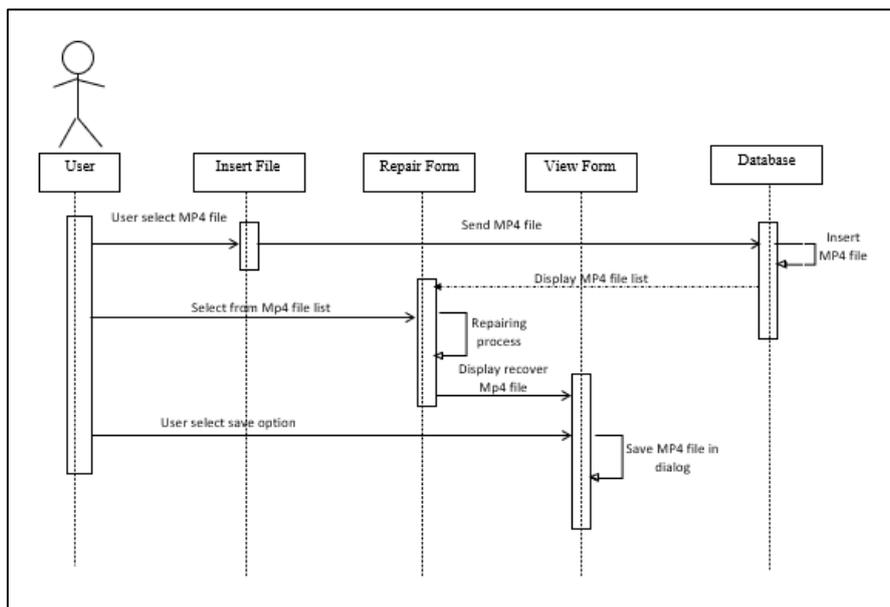


Figure 7 :Sequence Diagram of LiteMP4Repair tool

In Figure 7, the sequence of chatting process is shown. The user can choose from his/her computer to select corrupted MP4 file. After selected file, it will save in database. If the user wishes to repair the corrupted file, he/she can select file in database. After file finish repair, user can save the file back to he/she computer.

3.3 System Design

After all the user’s requirements were successfully analyze, the project will proceed in design phase. In this phase, both interface and database had been designed in order to help visualize the system before

proceed with the coding the system. For the design of the application, flowchart is used as a tool to describe the flow of the LiteMP4Repair application. The end user will carry the step of process by follow the flowchart. The flowchart of the proposed application is shown in Figure 8.

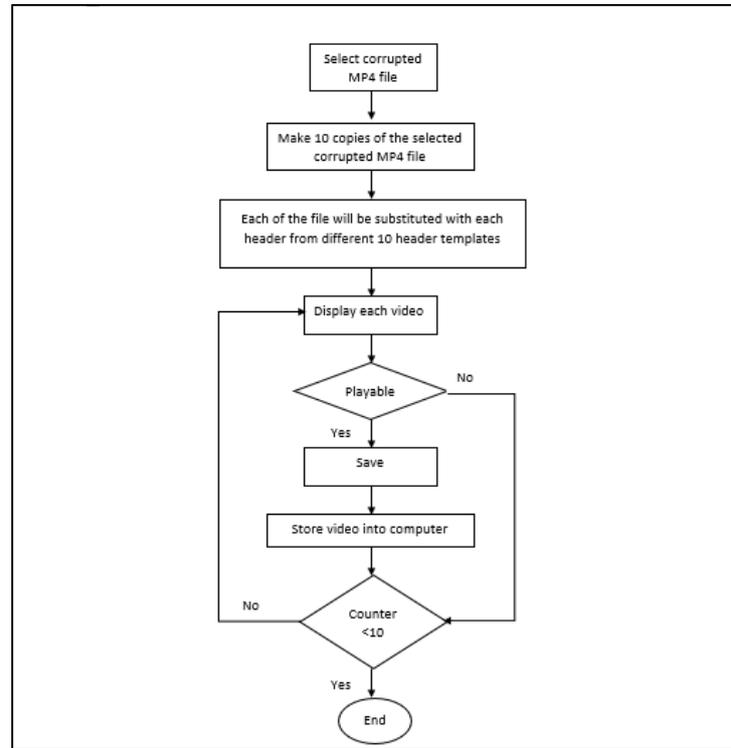


Figure 8: Flowchart of LiteMP4Repair tool application

The process starts with a login module where the user is required to provide the correct username and password associated to his/her account. After a successful login, the user will be able to perform the functions provided in the application. The user can choose whether to add corrupted MP4 file and repair the corrupted file. Other than that, the user can also view and save the file that have been repair. Lastly, the user can also choose to be logged out of the application.

4. Results and Discussion

This section the implement and testing that was conducted for LiteMP4Repair tool.

4.1 Implementation

Implementation process starts from the interface design and database. The two aspects of the application are very important in ensuring the tools runs smoothly. The coding for the application was done using C sharp programming language and the IDE is Microsoft Visual Studio 2019. On the other hand, phpMyAdmin was used as the database for the application. The app is connected to phpMyAdmin Database with adding dependencies and implementation to Microsoft Visual Studio 2019.

To start using the application, a user needs to create an account by registering to login to the application. After entering registration detail, username and password must be provided to login the tool. A message will display if the username or password invalid, and the field is empty. The user then can proceed to add new corrupted MP4 file.

Basically, there are 10 type of header that has been use and for each header has different characteristic. Table 7 will show each characteristic for 10 header that been choose.

Table 7: Characteristic of 10 Header Mp4

No	Hex Code Header	ASCII(HEX)	Characteristic
1	00 00 00 18 66 74 79 70 6d 70 34 32 00 00 00 00 6d 70 34 32 69 73 6f 6d 00 00 00 18 62 65 61 6d	....ftypmp42.... mp42isom....bea m	Source: Tiktok Duration: 1 minute Size file: <30MB
2	00 00 00 18 66 74 79 70 6d 70 34 32 00 00 00 00 69 73 6f 6d 6d 70 34 32 00 01 25 42 6d 6f 6f 76	....ftypmp42.... isommp42..%Bmo ov	Source: Youtube Duration: 1 minute Size file: <30MB
3	00 00 00 20 66 74 79 70 69 73 6f 6d 00 00 02 00 69 73 6f 6d 69 73 6f 32 61 76 63 31 6d 70 34 31	... ftypisom.... isomiso2avclmp41	Source: Edit (Capcut) Duration: 1 minute Size file: <30MB
4	00 00 00 18 66 74 79 70 6d 70 34 32 00 00 00 00 69 73 6f 6d 6d 70 34 32 00 00 66 ae 6d 6f 6f 76	....ftypmp42.... isommp4....f®mo ov	Source: Phone Camera Duration: 1 minute Size file: <30MB
5	00 00 00 18 66 74 79 70 6d 70 34 32 00 00 00 00 69 73 6f 6d 6d 70 34 32 00 01 08 93 6d 6f 6f 76	... ftypmp42.... isommp42...“moo v	Source: Facebook Duration: 1 minute Size file: <30MB
6	00 00 00 18 66 74 79 70 6d 70 34 32 00 00 00 00 69 73 6f 6d 6d 70 34 32 00 01 0a 08 6d 6f 6f 76	... ftypmp42.... isommp42....moo v	Source: Youtube Duration: 5 minutes Size file: >30MB
7	00 00 00 20 66 74 79 70 69 73 6f 6d 00 00 02 00 69 73 6f 6d 69 73 6f 32 61 76 63 31 6d 70 34 31	... ftypisom.... isomiso2avclmp41	Source: Edit (Capcut) Duration: 5 minutes Size file: >30MB
8	00 00 00 18 66 74 79 70 6d 70 34 32 00 00 00 00 69 73 6f 6d 6d 70 34 32 00 01 33 e8 6d 6f 6f 76	....ftypmp42.... isommp4....3èmo ov	Source: Phone Camera Duration: 5 minutes Size file: >30MB
9	00 00 00 18 66 74 79 70 6d 70 34 32 00 00 00 00 69 73 6f 6d 6d 70 34 32 00 01 07 57 6d 6f 6f 76	... ftypmp42.... isommp42...Wmo ov	Source: Facebook Duration: 5 minutes Size file: >30MB
10	00 00 00 1c 66 74 79 70 6d 70 34 32 00 00 00 00 6d 70 34 32 6d 70 34 31 69 73 6f 34 00 00 cf dd	....ftypmp42.... mp42mp4liso4..ÏÝ	Source: Twitter Duration: 5 minutes Size file: >30MB

4.2 Testing

Once the application has been developed, a testing phase is commenced to examine the functionality of the application. Testing was conducted to identify any sorts of error that comes arise when using the LiteMP4Repair tool. Another purpose of testing is to find out whether the application able to achieve their objective and scope specified. Table 8 shows the summary of the functional testing results.

Table 8: Test Case Result for Register Form

No.	Test Case	Expected Result	Result
1	Users register with weak password which does not meet the strong password criteria.	Shows error invalid password.	Success
2	Users enter existed username	Error message shown	Success
3	Users leave fields empty	Shows error message.	Success
4	Users fill all the fields correctly and click register button.	Users can proceed creating account	Success
5	Application display register page	Displays username, password and confirm password	Success

Table 9: Test Case Result for Login Form

No.	Test Case	Expected Result	Result
1	Application display login page	Displays username, and password	Success
2	Users leave the fields empty	Shows invalid username or password error	Success
3	Users enter the invalid username	Shows error message	Success

Table 10 :Test Case Result for Main Form

No.	Test Case	Expected Result	Result
1	Click on Repair New Video	Open to Repair form module	Success
2	Click on View Fixed Videos	Open to View form module	Success

Table 11: Test Case Result for Repair Form

No.	Test Case	Expected Result	Result
1	Click on Open File button	Open file dialog	Success
2	Click on Repair button	Send the selected file to database	Success
3	Click on Arrow back	Open to Main form module	Success
4	Click on Log out.	Signed out of application.	Success

Table 12: Test Case Result for View List Form

No.	Test Case	Expected Result	Result
1	Click on Choose button	Selected file be repair and go to video form module.	Success
2	Click on Delete button	Delete the selected file from the database	Success
3	Click on Arrow back	Open to Main form module	Success
4	Click on Log out.	Signed out of application.	Success

Table 13:Test Case Result for View List Form

No.	Test Case	Expected Result	Result
1	Click on Video 1 button	Selected file will be display	Success
2	Click on Video 2 button	Selected file will be display	Success
3	Click on Video 3 button	Selected file will be display	Success
4	Click on Video 4 button	Selected file will be display	Success
5	Click on Video 5 button	Selected file will be display	Success
6	Click on Video 6 button	Selected file will be display	Success
7	Click on Video 7 button	Selected file will be display	Success
8	Click on Video 8 button	Selected file will be display	Success
9	Click on Video 9 button	Selected file will be display	Success
10	Click on Video 10 button	Selected file will be display	Success
11	Click on Stop button	Stop the video that display	Success
12	Click on Arrow	Open to Main form module	Success
13	Click on Save button	Selected file will be saved in dialog.	Success
14	Click on Log out.	Signed out of application.	Success

For the result of testing the playable or repairing corrupted MP4 file, there 10 corrupted MP4 from same resource and size file has been test. However, 10 corrupted MP4 file that been test have different timeline or duration. This test to see whether selected 10 header can repair corrupted header which from different source, size file and timeline based on table 7.

Table 14: Testing Result of Corrupted MP4 File

Corrupted MP4 file	Duration	Header
1	2 min	Header 2,6 and 9
2	4 min	Header 2,6 and 9 (no sound)
3	6 min	Header 2,6 and 9 (no sound)
4	8 min	Header 6 and 9 (no sound)
5	10 min	Header 2,6 and 9
6	12 min	Header 2,6 and 9
7	14 min	Header 2,6 and 9 (no sound)
8	16 min	Header 2,6 and 9
9	18 min	-
10	20 min	-

Table 14 shows the result of testing, which is most of the corrupted MP4 file can be repair using header 2, 6 and 9. Source of header 2 and header 6 is YouTube and header 9 source from Facebook. Figure 9 shows the success percentage of repairing corrupted MP4 file. There are 12% are successfully repair, 11% are intermeddle which mean the corrupted MP4 file can display but it has no sound, and 77% are fail.

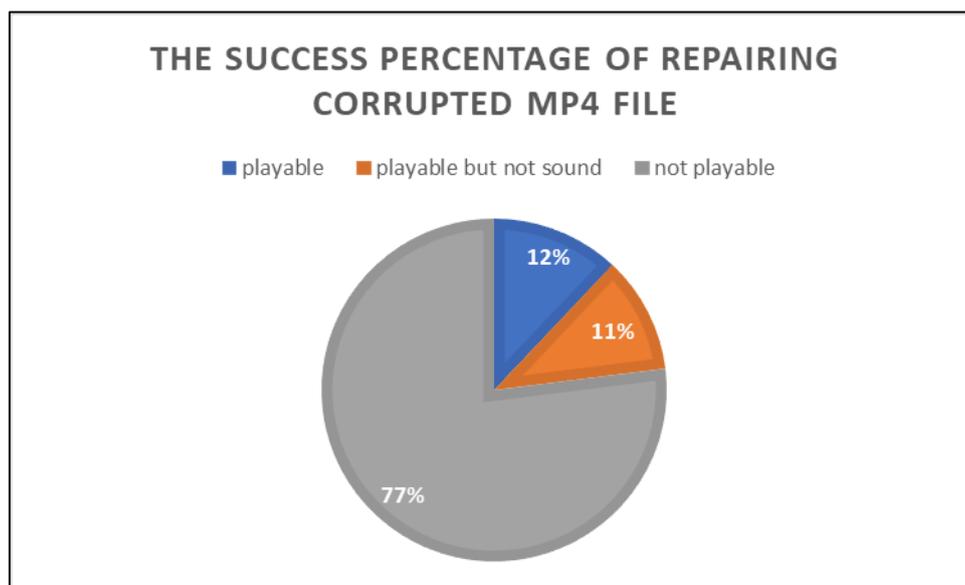


Figure 9: Pie chart of success percentage of repairing MP4 file

Based on the test results, comparisons were made to headers 2, 6 and 9. Overall, the header structure of all three is the same, but it has slightly difference in movie box (moov) size. As in literature review, there 2 boxes in MP4 file structure which is file type (ftyp) box and movie (moov) box. Table 15 shows the comparison on header 2, 6, and 9 which is the four bytes in yellow represent the size of the box.

Table 15: Comparison on header 2, 6, and 9

No	Header	ASCII(HEX)
1	Header 2	....ftypmp42....isommp42..%Bmoov
2	Header 6	... ftypmp42....isommp42....moov
3	Header 9	... ftypmp42....isommp42...Wmoov

5. Conclusion

Three objectives of this LiteMP4Repair tool have been set as the indicators of the application development as follows:

- To propose simple corrupted MP4 repair tool using multiple header substitution.
- To develop LiteMP4Repair tool.
- To test the functionality of the application.

All the three objectives of LiteMP4Repair tool are achieved. The developed application is to try to applied MP4 file repair using multiple random header substitution technique. This method is to see whether the corrupted MP4 header can be repair by substitute header with random header.

There are several limitations that can be found on the application. Firstly, this application can only support Microsoft window 7 above as a platform. The size of corrupted MP4 file that can be repair using this application is 30MB. The interface is less attractive. Lastly, the percentage of success repair the MP4 file are lower.

There are some improvements that can be implemented to enhance the limitation stated. This application is suggested to be able to support other operating systems such as iOS and Android platform. Besides that, user can repair MP4 file that have file size more than 30MB and design an interface that will attract more user. Other than that, make the percentage of success repair the MP4 file are higher should also be considered.

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