Camera (Webcam) Monitoring Application for Mobile Device Based on Android

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Abstract—Security system using camera for monitoring usually called CCTV are in common use lately. The goal is to do monitoring surroundings from another place directly and easily. But it spends a lot of money for applying the system, according to hardware also installation service. Furthermore, the system usually just doing offline monitoring at the local area. On the other hand, improvement of technologies for mobile devices are very rapid. Many people using it just like smartphone and tablet. Moreover, the availability of cheap internet connection make those devices become urgently to be owned, because the necessity of accurate information and communications are important to support their daily activities in advance of information technologies era. To reduce the problem, it is necessary to build mobile monitoring application which can accessed from another place where ever and whenever by using internet connections such Wi-Fi or even from mobile packet data. Mobile Monitoring application was built on client-server model. On the server side had a desktop application which it developed by Delphi programming language. The desktop application have features, there were such motion detector, record on motion and capture image. Meanwhile, mobile application was on the client side. This mobile application was developed by java programming language for android mobile device, which it did remote toward desktop application located inside webserver. Mobile application acts as a direct interface for user on monitoring situation using internet network connections. This research had more focused on discussing about Android Mobile Monitoring application and how it worked. This Android Mobile Monitoring application capable to do streaming video using RTSP protocol, recording video, record on motion capturing image, browsing image and video databases also showing alert notifications when motions were detected.

Keywords--Monitoring; Remote; Android; Mobile Device Apllication; Client-Server

I. INTRODUCTION

Security systems using cameras as monitors or commonly referred to as CCTV lately are increasingly used in buildings or on major city protocol roads. The aim is to monitor the surrounding situation of all criminal acts and road congestion so as to facilitate direct monitoring.

CCTV (Closed Circuit Television), which means using a closed signal, is a monitoring or monitoring system in an area using video cameras installed in certain places, arranged into a closed network and can be monitored from a control room.

However, to have a monitoring system, it is quite expensive to buy the hardware and installation services. In addition, monitoring can only be done locally or offline only in certain scope areas, for example in the scope of the office while monitoring can only be done from the security room.

On the other hand, the development of mobile device devices is increasingly progressing and is increasingly used such as smartphones and tablets. The ease with which to carry and the variety of applications available and affordable prices make this mobile device more attractive to the public at this time. Besides that, the existence of cheap and affordable internet connections makes this device more like a must-have item. In the era of advancing information technology, the need for fast and up-to-date information and communication is needed to support daily work activities.

Departing from the above problems, an idea emerged to create a camera monitoring application (webcam) for mobile devices that can be accessed online using an internet connection so that it will facilitate its use for remote monitoring.

This application will later be useful to see the state of the room or certain places and can be monitored directly using the Android mobile device. So, the situation around it can still be monitored by the monitoring application that has been installed on the Android smartphone as long as there is an adequate internet connection such as Wi-fi or cellular operator data package services.

The camera system (webcam) monitors the surrounding situation so that the object is obtained, then the object in the form of an image or video is directly transmitted through the internet to be accepted by the application installed on the Android mobile device. The monitoring using a camera (webcam) produces the output of images or videos that are not so optimal, such as CCTV cameras or video cameras. This is done to realize a monitoring system that is cheap, easy to use and mobile.

From the description above, the problem raised is how to develop software in the form of a webcam-based monitoring application for Android-based mobile devices. Android is an operating system for cellphones based on Linux. Initially Google Inc. buy Android Inc. who are newcomers who make software for cellphones / smartphones, then to develop Android, the Open Handset Alliance was formed, the consortium of 34 hardware, software, and telecommunications companies, including Google, HTC, Intel, Motorola, Qualcomm, T-Mobile and Nvidia[1]. While the purpose of this research is to develop a camera monitoring application (webcam) for Android-based mobile devices that are cheap, easy to use and are mobile by utilizing an internet connection using video streaming. The process of sending files takes place from a server to a client via an intranet or internet local network. Where the file sent is in the form of a time stamped package or commonly referred to as a stream media file[2].

II. PURPOSE

The purpose of this study is:

Build an Android-based camera (webcam) monitoring application that can be monitored through a mobile device using an internet connection such as Wi-Fi or mobile operator data plan services.

III. METHODOLOGY

System development methods carried out in this study include literature studies, identification of system requirements, data collection, system development requirements, and system development methods.

A. Literature Study

Literature studies are conducted to study theories related to and support research topics, so that the data to be collected is analyzed more accurately. The theories related to this research include Android, Java, UML (Unified Modeling Language), Streaming-Server Application, Client-Server Application, Webcam Monitoring, PHP, and Delphi.

B. Identification of System Requirements

The identification of system requirements in this study was carried out by identifying needs in a camera monitoring application (webcam) on an Android-based mobile device.

With this camera monitoring application, users will be assisted in monitoring or monitoring a place in real time and continuously. This application can do monitoring in real time, record (record), capture objects in a place that has been predetermined through an android mobile device by utilizing data communication services in the form of an internet connection.

In addition, this mobile application also has a motion detection feature, so users do not need to continuously monitor, just activate the motion detection feature and if a motion is detected, the system will provide feedback in the form of pop-up notifications. So that the user will always be vigilant and can take the next action needed.

Motion detectors can be created using the histogram benchmarking principle, calculating the difference in histogram values between before and after frames. The threshold value for tolerance of histogram differences is used, the histogram is the color distribution in the image usually divided into 4 values, namely red, green, blue and gray whose values represent the color of a pixel in the image. The histogram is plotted into a graph with the x axis being values from 0-255 and the y axis is the number of colors that appear in the image[3].

C. Data Collection

Data collection methods used in this study were conducted by studying existing literature by reading or retrieving information from papers, scientific journals, books and also utilizing the internet as a source of information, by looking at information provided by websites, discussion forums, mailing lists and so on.

From the literature study conducted, concepts will be found on how the monitoring system has been applied to earlier studies. In addition, from the literature study, we also find theories about monitoring techniques that can later be applied to the system that will be created later.

D. System Development Requirements

In its development, this application uses computer hardware and software specifications.

The hardware used in this study has the following specifications:

1) Processor: AMD A6-3420M APU with Radeon HD Graphics (4-CPU) 1.5 Ghz

2) Memory: DDR2 6 GB

3) VGA card: 962 MB

4) Hard disk: 350 GB

5) Web Camera: Havit f: 3,8 mm 10x digital zoom with LED

6) Smartphone: Android jelly Bean 4.1 Samsung Galaxy Note II GTN7100.

While the software used in this study include:

1) Operating system : Microsoft Windows 7 Ultimate

2) Editor: Eclipse Juno with ADT Version 8.0.1 and Emulator with screen HVGA 320x480 with Android version 4.1.2, Borland Delphi 7.0.

3) System Design: Visual Paradigm 10.0 dan Ms. Office Visio 2007

4) Web Server : Apache 2.2.21

5) DBMS : MySQL 5.5.16

6) Web Programming: PHP 5.2.8

7) Web Browser: Google Chrome 17.0.963.79.

E. System Development Methods

The system development method used in this study refers to the stages in the SDLC standard (System Development Life Cycle) using the waterfall model or Linear Sequential Model[4]. The waterfall model in Fig 1 approaches systematically and sequentially starting from the level of system requirements and then goes to the stages of analysis, design, coding, testing / verification, and maintenance.
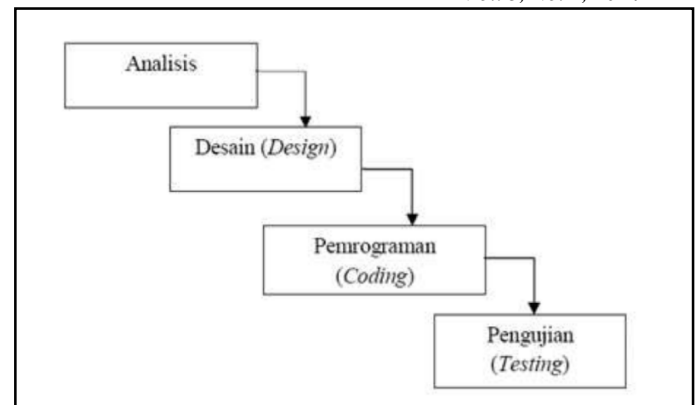

Figure 1. Waterfall Model

The explanation of the stages of the system development methodology is:

1) Requirements Analysis

This stage is intended to obtain a description of the use of a camera (webcam) as a substitute for CCTV for the purposes of a monitoring system. What method is appropriate to be applied in the motion detection process which is the core of this monitoring system process. In addition, it is also to analyze the conditions that might arise that can affect system performance in the process of motion detection as well as models of actions or warning systems provided by systems that are adapted to technological developments.

2) Design

This camera monitoring application (webcam) is built with a functional approach model. In this case, the system design starts with creating a system architecture to be built, then proceed with creating a UML (Unified Modeling Language) design and user interface design.

3) Programming

Programming is a process of implementation of system design and modeling. The design must be translated in a form that can be understood by the machine using a programming language. Programming is done using the Java language, PHP.

4) Testing

This method is used to find out whether the software is functioning correctly. At this stage testing uses black box testing which is a test of the fundamental aspects of the system without regard to the internal logic structure of the software. Black box testing is a method of designing test data based on software specifications. Test data is generated, executed on software and then the output of the software is checked whether it is as expected.

Black box testing tries to find errors in the category [5]:

1) Incorrect or missing functions
2) Interface error
3) Errors in data structures or external database access
4) Performance error
5) Initialization and termination errors.

Black box testing must be able to answer the following questions:

1) How functional validity is tested
2) What input class will make the test case better
3) Will the system be very sensitive to certain input values
4) How is the boundary of a data isolated
5) What is the data speed and volume of data what the system will tolerate
6) What is the influence of certain combinations of data on system operations

IV. RESULT AND DISCUSSION

A. Test Result

The results of this test involved twelve respondents consisting of two employers and several students from various public and private universities in Yogyakarta. Tests carried out on the functional, interface and access to the Android Mobile Monitoring application.

The list of application testers can be seen in Table I.

TABLE I. LIST OF TESTERS FOR ANDROID MOBILE MONITORING APPLICATIONS

No.	Tester's Name	Status
1	Muchammad Yusa	Student
2	Muhammad Zikri	Student
3	Alfarabi	Student
4	Taufik Fahrul Rajab	Student
5	Haidarullah	Student
6	Muhammad Irfan	Student
7	Ahmad Ramso Febrian	Student
8	Ayyadana Akbar	Student
9	Ezza Armas Hadi	Student
10	Amen Nasrullah	Student
11	Ramadhan Gatra	Employer
12	Aris Fadillah	Employer

1) Functional Testing on Mobile Applications

After distributing questionnaires for testing Android Mobile applications Monitoring, then the researcher calculates the

results of testing the mobile application. The calculation for functional testing on a mobile application can be seen in Table II.

TABLE II. FUNCTIONAL TESTING OF ANDROID MOBILE MONITORING APPLICATIONS

No.	Test Result Criteria	Yes	Not	Total
1	Applications can be easily installed and run on Android-based mobile devices properly	12	0	12
2	Applications can receive and display notifications properly and direct the user to the application's main window if clicked.	12	0	12
3	The application can open a new window and do video streaming properly.	10	2	12
4	The application can capture images by remote to the desktop application (server) followed by the appearance of "Image captured" pop-up text as the image has been captured properly.	12	0	12
5	The application can open a new window and display the listing image or image of the image capture process that has been done well before.	11	1	12
6	The application can do video recording by remote to the desktop application (server) followed by the appearance of the pop-up text "Recording" and the background button that lights up as a sign that the recording process is going well. Then the button text changes to "Record On"	12	0	12
7	The application can stop video recording by remote to the desktop application (server) followed by the appearance of the "Record off" pop-up text and the dead background button as a sign that the recording process has finished well. Then the text button returns to "Record Off".	12	0	12
8	The application can open a new window and display the video listing of the previous video recording results properly.	11	1	12
9	The application can perform a record on motion process by remote to the desktop application	12	0	12

		SS/Yes	No	Total
	(server) followed by the emergence of the "Recording motion" pop-up text and the background button that lights up as a sign that the recording process is running well. Then the text button changes to "Motion Record On"			
10	The application can stop the record on motion process by remote to the desktop application (server) followed by the appearance of the "Motion Record off" pop-up text and the dead background button as a sign that the recording process has finished well. Then the text button returns to "Motion Record Off".	12	0	12
11	The application can update image and video databases, both of which are the result of video recording and capture of previous images. And also the video image data is automatically stored in each of the database folders properly.	11	1	12
12	The application returns the user to the main menu if the activity on the selected menu is finished by clicking the back button.	11	1	12
	Total	138	6	144

2) Interface Testing and Accessing

After testing the functional Android Mobile Monitoring application, the next step is to test the interface and access to the Android application itself. The calculation is done with four character evaluations, namely SS (Strongly Agree), S (Agree), TS (Disagree), and STS (Strongly disagree). The calculation for interface testing and access can be seen in Table III.

TABLE III. INTERFACE TESTING AND ACCESSING THE ANDROID MOBILE APPLICATION

No.	Statement	SS	S	TS	STS	Total
1	The application display is convenient and easy to use for users	10	2	0	0	12
2	The menu on the application is functioning properly	7	5	0	0	12
3	Access data content fast enough	5	5	2	0	12
	Total	22	12	2	0	36

B. Discussion

Based on the table testing the functionality of the Android Mobile Monitoring application, the percentage of the functional test results of the application is obtained:

1. Answer Yes: (138/144) * 100% = 95,8 %.

2. Answer No: (6/144) * 100% = 4,2 %.

As for the percentage of the results of testing the interface and accessing the Mobile Monitoring application, the following data are obtained:

1. Strongly Agree (SS): (22/36) * 100% = 61,11%.

2. Agree (S): (12/36) * 100% = 33,33%.

3. Disagree (TS): (2/36) * 100% = 5,55%.

4. Strongly Disagree (STS): (0/36) * 100% = 0%.

From the percentage results above, we can draw the conclusion that most users state that the functional system is functioning properly. The functional test results state that 95.8% stated that the functional function was good and 4.2% stated that the functional function was not functioning properly. There are still some respondents who claim that the functional does not function properly, this is due to technical factors regarding internet services used. For example, the case was when the respondents tried the application using the campus Wi-Fi facilities, especially UIN Sunan Kalijaga. Some menu features such as video streaming, browsing images and videos do not work as they should. This is due to the policies of the relevant campus authorities who block ports related to video streaming content and other vital ports. In addition, the factor of bandwidth limitations also affects the failure of the video streaming feature.

Whereas from the results of testing the application based on testing the interface and accessing the Android Mobile Monitoring application, it was concluded that most users agreed with the mobile application that had been made. Data from the interface and access testing results show that 61.11% stated strongly agree, 33.33% said they agreed, 5.55% said they did not agree and 0% stated that they did not agree. As for some users who say they disagree, this is related to the lack of access to internet content which results in incorrect data. Internet network connections and bandwidth limitations are the main causes. And the author feels this is a common thing given the limited internet access and inadequate bandwidth and is evenly distributed in several regions in Yogyakarta.

Whereas in the case of video streaming, problems were found, namely streaming new videos appeared after 1-15 seconds. Then when the video streaming process is running it is found that there is a problem again, namely the video streaming process only runs about 1-2 minutes then after that the video streaming process stops. This is apparently caused

by the synchronization process that occurs between VLC as a streaming server and Android application as a client. In addition, it turns out there are still weaknesses, namely memory buffer management in the Android operating system in the process of streaming video using the RTSP protocol. So that users are forced to press the back button to return to the main menu, then start again from the streaming video menu if you want to stream the video.

Based on the discussion above, it can be concluded that the Android Mobile Monitoring application for this Android-based mobile device is quite feasible to use, but further and deeper improvements and improvements are needed in order to obtain maximum results.

V. CONCLUSION

Based on research conducted by the author regarding Android-based Camera Monitoring (webcam) Applications for Android-based mobile devices, conclusions can be taken as follows:

1) Making Mobile Monitoring Applications for Android-based mobile devices has been successfully carried out properly.

2) From the test results in the application, it can be concluded that the functions contained in the Android Mobile Monitoring application can run well and in accordance with what is expected, so that it is suitable for use by users or end users. Even if there are features that are running less than perfect, this is caused by inadequate internet connection media and unstable bandwidth. In addition, memory buffer management problems in the Android operating system are also an obstacle, this is what causes delay in the case of video streaming. As well as the video streaming process that can only last for approximately 1-2 minutes, after that the video streaming process will stop. The user is forced to return to the main menu and click again on the streaming video menu if you want to process the video streaming.

3) This Android Mobile Monitoring application can help users to monitor or monitor cameras (webcam) remotely.

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