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Implementation Of Projector Screen Control With Android

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ABSTRACT

The use of Liquid Crystal Display (LCD) in daily activities is often hampered because it is still mandatory to use a laptop or computer as a feature to deliver presentations, therefore in this research an LCD projector control system was designed using a Smartphone, where the LCD Projector can be controlled using a smartphone, be it turning on, turning off, or as a source of information or video to be displayed on the LCD projector can use a smartphone only. This system uses Raspberry Pi as a link between the LCD projector and the smartphone, the screen display from the smartphone is to be sent to raspberry pi via the wifi network, which after that will be displayed on the LCD projector. And in tests that were tried to measure the strength of the WIFI signal against the distance, it was found that this system could run well with the maximum distance between the smartphone and the Raspberry Pi was 18 meters. As well as the ideal distance is 10 meters. As well as for testing quality of service(QoS) obtained the average Delay value resulting from measurements from various points is 359ms. As well as the average throughput value is 169. 3KBps.

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1. Introduction

In many activities every day, especially in the academic field, presentations using the Liquid Crystal Display (LCD) projector facility as a medium for delivering modules become a vital need for many people. Presentation is an activity where a person delivers inspiration to a group of people or an audience through the media output feature to show the presentation module of the input media feature in various fields of activity such as in the fields of learning, health and offices[1]. But in the process, it is still mandatory to use a laptop or computer as an intermediate equipment in delivering presentation modules. This situation is quite troublesome, where to use a laptop, it is necessary to bring a laptop that is quite large in size and also quite heavy. Therefore, the use of smartphones as presentation intermediary equipment facilities as a substitute for laptops wants to simplify the presentation process.

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But to use a smartphone as a presentation viewer equipment facility, a smartphone and LCD projector are needed that support it, and a connecting cable into the LCD projector which is still not often available in this day and age. Until then, in this research entitled" LCD Projector Control System" was raised a control system that uses Raspberry Pi as a link between the LCD projector and the smartphone, the screen display from the smartphone is to be sent to raspberry pi via the wifi network, which after that will be displayed on the LCD projector. After that, it was tried testing for WIFI signal strength against distance, and Testing Quality of Services (QoS) both from WIFI or bluetooth connections for audio.

In the first research, entitled" Prototype Switching Website-Based Wireless Projector with Virtual Network Computing (VNC) Server Using Raspberry Pi 3 " by Samsinar, Riza et al. learned about the use of raspberry pi as an intermediary medium so that presentations could be carried out wirelessly, but in the research, the presentation display equipment used was a Laptop / Pc[2], so that, in this research, it was developed so that presentations could be tried using smartphones android and also want to try research and testing overwriting the Quality of Services(QoS) of the system.

This research wants to use the Raspberry Pi 3. The Raspberry Pi is a small-dimensional Single Board Computer(SBC) feature the size of a credit card raised by a foundation called the Raspberry Pi Foundation in collaboration with Broadcom[3]. Raspberry Pi is equipped with all uses such as a complete pc, using an ARM SoC (System- onachip) that is packaged and integrated on top of the PCB. This feature uses an SD card for booting as well as long-term storage[4]. It is hoped that by using the Raspberry Pi 3, the presentation using the LCD projector no longer requires a Laptop / Pc.

2. Literature Review

2.1 Projector

AN LCD projector is a type of projector used to display video, images, or data from a computer on a screen or something with a flat surface such as a wall, etc. This type of projector is a more modern type and is a technology developed from the previous type with the same function, namely overhead projector (OHP) because in OHP the data is still in the form of writing on clear paper.

2.2 Android

Android is a Linux-based operating system with open source code and apache 2.0 licensed designed diversely for touchscreen mobile devices such as smartphones and tablet computers. Android was originally developed by Android, Inc., with financial support from Google, which later bought it in 2005. The operating system was officially released in 2007, along with the founding of the Open Handset Alliance, a consortium of hardware, software and telecommunications companies aimed at advancing the open standards of mobile devices. The first Android phone went on sale in October 2008.

2.3 Raspberry pi

Raspberry pi is a single-board computer (single-board circuit; SBC) which is the size of a credit card that can be used to run office programs, computer games, and as a media player to high-resolution video. Raspberry Pi was developed by a non-profit foundation, Rasberry Pi Foundation, which was led by a number of developers and computer experts from the University of Cambridge, England. [

3. System Design

In this study , the design of the system created can be seen as in Figure 1 as follows.

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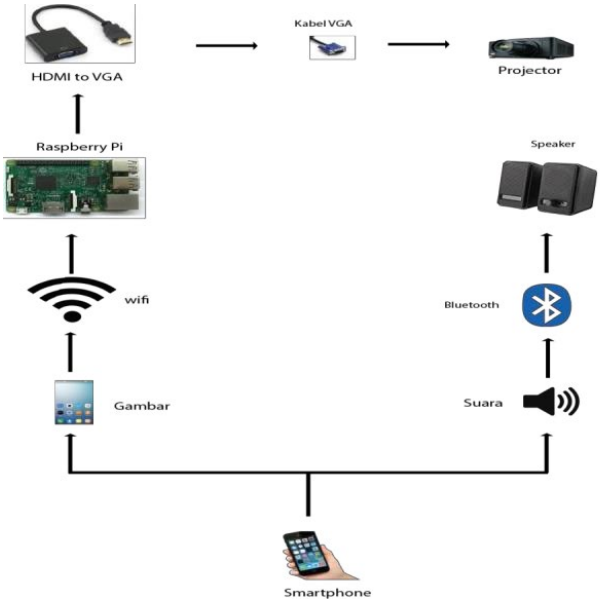

Figure 1. System Diagram Block

The smartphone is connected to the Raspberry Pi via the wifi network that is used to send photos / videos of the presentation to be displayed on the LCD projector, and the Raspberry Pi wants to be connected to the LCD Projector using a cable to send photos. Not only that, smartphones are also connected to speakers via bluetooth networks to send audio from the presentation.

The display of the presentation screen sent from the smartphone to the PROJECTOR LCD can be seen in Photo 2 below, where the projector screen is about to show the smartphone screen.

Figure 2. Projector screen display

Where to take advantage of the system, in this research an Android application was made to carry out a share screen from a smartphone and displayed on the LCD Projector.

As well as the hardware features used in this research can be seen in the following Table I.

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Table 1. Hardware List

No.	Hardware Name	Information
1	*Raspberry Pi* 3	- Processor :1.2GHz 64-bitQuad-core ARMv8 Cortex-A53- Ram :1GB LPDDR2 SDRAM- VideoOutput : HDMI- Onboard Network : 10/100Ethernet2.4GHz 802.11n Wi-Fi up to150Mbps *Bluetooth* 4.1 LE (BCM43438module)- Input Voltage: MicroUSBsocket 5V/2.4A- Size : 85 x 56 x 17mm
2	*Con* to V*ve* GA*rter* HDMI	Used to convertdata from HDMI *Port* to VGA *Port* mode.
3	VGA Cable	Used connecting *Raspberry Pi* to the projector.
4	LCD Projector	Used to displaydisplay from *a smartphone*.
5	*Smartphones*	Used as a devicewhich becomes the source of inputdata transmitted.
6	5V DC Adapter	Used for power from *RaspberryPi*.
7	*Bluetooth* Speaker	Used as anaudio device.

4. Results and Discussion

In this study, smartphones were used to test and analyze the control system of liquid crystal projectors. The tests and analyzes carried out are aimed at determining the quality of the manufactured system. The tests performed include a remote WIFI signal level strength test and a WIFI QoS test including delay, average delay, and throughput.

A. WiFi signal strength test against Distance

Because this wireless projector device uses a Wi-Fi network as its transmission medium, it performs signal level strength and distance measurements to determine the maximum power of the Wi-Fi beam for raspberry Pi devices.

Table II shows the results of observations of remote WiFi signal strength tests.

Table 2. SIGNAL STRENGTH TEST RESULTS

Distance(m)	Average Signal Strength		Connectivity	Image display caption on the projector
	Mw	*Dbm*		
2	0,04	-44	active	Show
4	0,01	-50	active	Show
6	0,002	-57	active	Show
8	0,0005	-63	active	Show

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10	0,00025	-66	active	Show
12	0,00012	-69	active	Show
14	0,00005	-73	active	Show
16	0,00003	-75	active	Show
18	0,00002	-77	active	Show
20	0,00001	-81	active	Not Performing

From the data in Table II above, signal strengths are obtained at various distances from 2 meters to 20 meters. At the shortest distance of 2 meters, the average signal strength is 0.4mW and -44dBm, even at this distance the screen looks good for the projector, the farther the screen, the lower the quality of the signal transmitted from the smartphone. Also, the maximum distance at which the presentation can be seen on the LCD projector is 18 meters, but at a distance of 20 meters, the presentation cannot be seen on the projector. The ideal signal for streaming image/video transmission is at least -67 dBm [5], achieved at a distance of 10 meters in this test.

B. QoS WiFi test for wireless projector devices

Quality of Service (QoS) is the level of service quality and consists of several parameters [6]. The smartphone allows the QoS test to determine the quality level of the LCD projector control system. The parameters tested in this study were latency, average latency, and throughput. This QoS test is intended to find out how good the WLAN connection quality of the system is. QoS can be measured by observing data packet traffic on Raspberry Pi Wi-Fi networks and smartphones. This QoS test uses a smartphone application, namely the tPacketCapture application. The data obtained from tPacketCapture is analyzed with the Wireshark application on your PC. This QoS test was carried out at three location points with distances of 5.9 meters, 5,923 meters and 8,273 meters, respectively. The placement of the points of the test location can be seen in Figure 3 below.

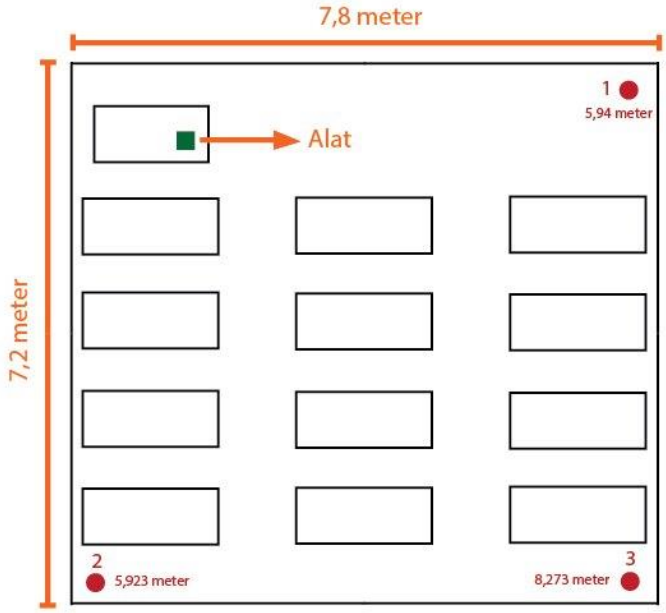

Figure 3. Test location points

And the results of this QoS test can be seen in the following Table III.

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Table 3. QOS WIFI TEST RESULTS

Point of locationtesting	Distance(m)	Delay(ms)	Average Delay(ms)	Throughput (KB/s)
1	5.94	0.29	229	124
2	5.92	0.39	472	143
3	8.27	0.44	378	241

Table III above shows the results of QoS testing for links using WIFI, observing the delay value, average delay and throughput at each test point. From the data above, we can see that latency increases as the distance between devices increases. However, the average latency and throughput values produced are slightly better in the third point. This may be because the device is blocked or unblocked during the measurement process and depends not only on the distance. It has been installed in the testing ground, but more research is needed to determine the effectiveness of the barrier. Throughput here is the speed or speed of data transfer between devices, measured in KB/s, and represents the total number of packets successfully transmitted in a given time interval [7]. Also, delay (latency) is the time it takes for data to travel the distance from the source to the destination. Latency can be affected by distance, physical media, congestion, or long processing times [8]. The latency/delay category table is shown in the table below.

Table 4. TIPHON DELAY CATEGORY

Latency Categories	Large Delay(ms)	Index
Very Good	< 150 ms	4
Good	150 to 300 ms	3
Keep	300 to 450 ms	2
Ugly	> 450ms	1

Table IV has a number of delay values based on Telecommunications and Internet Protocol Harmonization Over Network (TIPHON). General aspects of Quality of Service (QoS) [9]. From there, you can see if the latency values for the study survived well enough, averaging 359 ms (medium).

C. Bluetooth QoS Tester Bluetooth Speaker

This QoS test is intended to find out how good the system's Bluetooth connection is. QoS is measured by observing data packets passing through Bluetooth speakers and smartphone networks. This QoS test uses a smartphone application, namely the tPacketCapture application. The data obtained from tPacketCapture is analyzed with the Wireshark application on your PC. This QoS test was carried out at the same location as the QoS Wifi test at three points with distances of 5.9 meters, 5,923 meters, and 8,273 meters, respectively. The QoS test results for Bluetooth speakers are shown in Table IV below.

Table 5. QOS BLUETOOTH SPEAKER TEST RESULTS

Test location points	Distance (m)	Delay (ms)	Average Delay (ms)	Throughput (KB/s)

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1	5.94	0.495	10	42
2	5.923	0.286	11	38
3	8.273	0.594	19.4	22

From Table IV above, we can see that the farther the test distance, the delay value increases and the farther the test distance, the throughput value decreases. The average latency over the three test points was 13.7 ms. And the average throughput value was 3 KB/s. Here we can see that using a Bluetooth connection to transmit audio has better QoS than over a WiFi connection that transmits video.

5. Conclusion

Looking into the LCD projector control system by this smartphone, it uses a Raspberry Pi 3 mediator and uses a WIFI connection with the Raspberry Pi as a WLAN access point to display/display the smartphone screen display to the LCD projector. And the test results show that the system works well when the maximum distance between the smartphone and the raspberry pi is 18 meters. The ideal distance is less than 10 meters.

The average delay measured from different points is 359 ms. And the average throughput value is 169.3 KBps. Average WLAN latency at all measurement points is 359 ms and the average Bluetooth latency is 13.7 ms. If you run video and audio at the same time, the display will be out of sync with the audio because the two connections have different delay values.

References

[1] Y. E. Aritonang, J. Ester, and H. Manullang, "Peranan Kejaksaan dan Upaya Melakukan Pengelolaan Hasil Eksekusi Barang Bukti Tindak Pidana Korupsi (Studi di Kejaksaan Negeri Binjai)," *Nommensen Law Review*, vol. 1, no. 1, pp. 14–27, 2022, [Online]. Available: https://ejournal.uhn.ac.id/index.php/law_review

[2] J. B. Hasibuan, "Kedudukan Barang Bukti Dalam Perkara Pidana Ditinjau Berdasarkan Kitab Undang-Undang Hukum Acara Pidana," *Journal of Law (Jurnal Ilmu Hukum)*, vol. 6, no. 1, pp. 66–85, 2019, [Online]. Available: https://media.neliti.com/media/publications/

[3] O. A. Johar, F. Fahmi, and M. Yana, "Penyimpanan Barang Bukti Tindak Pidana Berdasarkan Peraturan Kepala Kepolisian Negara Republik Indonesia Nomor 08 Tahun 2014 Tentang Tata Cara Pengelolaan Barang Bukti di Polres Kuantan Singingi," in *Prosiding SENKIM: Seminar Nasional Karya Ilmiah Multidisiplin Vol. 1, No. 1*, 2022, pp. 124–133.

[4] R. R. Putra and T. W. Pribadi, "Perancangan Aplikasi Berbasis Komputer Untuk Proses Manajemen Mutu Pada Pembangunan Kapal Baru," *Jurnal Teknik ITS*, vol. 5, no. 2, pp. 129–135, 2016.

[5] S. T. Faulina, N. Lestari, and A. Anggraini, "Penerapan Metode Waterfall pada Aplikasi Pemesanan Soundsystem Dan Organ Tunggal Jefri," *Jurnal Informatika dan Komputer (JIK)*, vol. 12, no. 2, pp. 1–9, 2021, [Online]. Available: www.polinpdg.ac.id

[6] K. Kurniawati and M. Badrul, "Penerapan Metode Waterfall Untuk Perancangan Sistem Informasi Inventory Pada Toko Keramik Bintang Terang," *PROSISKO: Jurnal Pengembangan Riset dan Observasi Sistem Komputer*, vol. 8, no. 2, pp. 47–52, 2021.

[7] G. W. Sasmito, "Penerapan Metode Waterfall Pada Desain Sistem Informasi Geografis Industri Kabupaten Tegal," *Jurnal Informatika:Jurnal Pengembangan IT (JPIT)* , vol. 2, no. 1, pp. 6–12, 2017, [Online]. Available: http://www.tegalkab.go.id,

[8] I. Solikin, M. Sobri, and R. A. Saputra, "Sistem Informasi Pendataan Pengunjung Perpustakaan (Studi Kasus : SMKN 1 Palembang)," *JURNAL ILMIAH BETRIK : Besemah Teknologi Informasi dan Komputer*, vol. 09, no. 03, pp. 140–151, 2018.

ISSN 2962-4274

[9] R. A. Y. Manurung and A. D. Manuputty, "Perancangan Sistem Informasi Lembaga Kemahasiswaan Universitas Kristen Satya Wacana Salatiga," *JURNAL SITECH : Sistem Informasi dan Teknologi*, vol. 3, no. 1, pp. 9–20, 2020, [Online]. Available: http://www.jurnal.umk.ac.id/sitech

[10] A. Ardiyansyah and I. Iramayani, "Rancang Bangun Sistem Informasi Akuntansi Pendapatan Jasa Pada Rumah Susun Sederhana Sewa (Rusunawa) Harapan Jaya Pontianak," *Jurnal Teknik Informatika Kaputama (JTIK)*, vol. 5, no. 1, pp. 9–18, 2021.

[11] M. Tabrani, S. Suhardi, and H. Priyandaru, "Sistem Informasi Manajemen Berbasis Website Pada Unl Studio Dengan Menggunakan Framework Codeigniter," *JURNAL ILMIAH M-PROGRESS*, vol. 11, no. 1, pp. 13–21, 2021.

[12] V. Verawati and P. D. Liksha, "Aplikasi Akuntansi Pengolahan Data Jasa Service Pada PT. Budi Berlian Motor Lampung," *Jurnal Sistem Informasi Akuntansi (JUSINTA)*, vol. 1, no. 1, pp. 1–14, 2018.