

Streaming Performance Analysis of Virtual Objects in Augmented Reality Cloud Based on X86 and ARM Processor Types

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ABSTRACT

Augmented Reality is a technology that makes it possible to create 3D objects in the real world with the help of a camera on a gadget. In its development, Augmented Reality technology began to be developed and combined with cloud computing technology. With the existence of Cloud computing technology Augmented reality can work more efficiently because all 3D objects can be stored on the Cloud. With the development of this technology, the author feels the need to conduct an analysis to determine the right processor in making the Augmented Reality Cloud application, because there is no research that is used as a reference in developing hardware and software used for Augmented Reality Cloud. Result of this experiment can be concluded CISC architecture processors have faster time in detecting markers compared to RISC architecture processors, because CISC processor speeds are faster than RISC processors.

Keywords: Augmented reality, Cloud, CISC, Processor, RISC.

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1. Main text

Today the development of the computer world has made a lot of progress. The application of computers at this time almost becomes a necessity in every activity carried out by humans, almost in every activity we will not be separated from the computer. Image processing is one example of the development of the computational world which is now starting to be applied one of its applications, namely Augmented Reality technology. [1] Augmented Reality is an experience that brings out a form in the real world that is enhanced by computer-generated content that is intertwined with specific locations or activities, many uses of Augmented Reality ranging from being applied to education, health, and others. Along with the development of Augmented Reality technology and the many applications that utilize Augmented Reality technology, it shows great enthusiasm among users. From time to time the development of Augmented Reality has had many developments so that Augmented Reality began to be combined with many other technologies, one of which is Augmented Reality combined with Cloud technology.

With this Cloud technology makes it easy to store objects that will be displayed on Augmented Reality, making it easier for users to experience this Augmented Reality technology even with very small memory capacity gadgets. With the combination of Augmented Reality Cloud, it raises new problems, which are difficult for developers to develop applications based on X86 processors or ARM-based processors because there is no reference for what processor is good to use in implementing

Augmented Reality Cloud. In this paper I will discuss the processor whether it is optimal to be used for devices that use Augmented Reality Cloud technology

2. STATE OF THE ART

[1] Augmented reality is an experience in which a form emerges in the real world that is enhanced by computer generated content that is intertwined with specific locations or activities. [4] Augmented Reality is a technology that combines the virtual world with the real world so that it can bring an image of virtual objects to the real world with an Augmented Reality Environment. While the Augmented Reality Environment can be a computer, smartphone, or all computer-based equipment.

The framework for the Augmented Reality process can be described as follows.

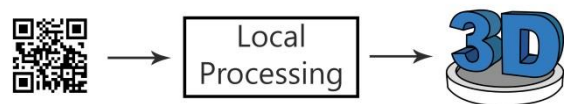


Figure 1. System Scheme

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In figure 1, the process of Augmented Reality is explained so that detection of markers is needed to be able to bring up Augmented Reality objects.

2.1. Cloud

Cloud computing is internet-based computing which means storing and accessing data, programs, and other computing devices via the internet.

Characteristics [5] cloud computing Users access data, applications, or other services with the help of a browser. The infrastructure provided by third parties is accessed using the internet. It doesn't have to require high level IT skills. Reliable services can be obtained by using several sites. Maintenance is easier because it doesn't need to be installed on each user's computer. Payments based on facilities used Performance can be monitored. Security can be as good or better than traditional systems.

Mobile Cloud is a cloud implementation that is implemented on mobile devices [6] mobile cloud also allows users to use all cloud resources on mobile devices.

2.2. Processor X86 and ARM

Broadly speaking, many processors on the market are types of X86 and ARM for X86-based processors using CISC (Complex Instruction Set Computing) instructions, while ARM-based processors use RISC (Reduce Instruction Set Computing) instructions. [7] CISC has characteristics. Has a very large and complex set of instructions.

- 1) Instructions generally take more than 1 clock cycle for execution.
- 2) The instructions have different sizes.
- 3) Complex addressing methods.
- 4) Works very well in simple compilers.

While RISC has the following characteristics:

- 1) Simple old instructions
- 2) The instruction is executed at 1 clock cycle
- 3) Format fixed instructions / fix
- 4) Experience instruction uses a fixed mechanism (load and store).
- 5) Need complexity before entering into the compiler.

2.3. Augmented Reality Cloud

Augmented Reality Cloud has the same process in the process of reading markers to bring up 3D objects but in Augmented Reality Cloud 3D objects are stored on the Cloud so that it can streamline memory on local devices. [2] The process of Augmented reality Cloud starts with capturing the marker using the camera on the device, then the data that has been processed on the local process is sent to the cloud. In the processed cloud data the local process is matched to the database, the corresponding results will be sent back to the device and bring up 3d objects. Below is a working chart for Augmented Reality Cloud.

3. SYSTEM SCHEME

The research design this time I tried to design an Augmented Reality Cloud application made from Unity software. This application was made into two versions, the version that runs on x86 and ARM processors. Once created, these two versions will be measured by how fast these two applications are in displaying 3d objects stored in the cloud. Following is the form of system design that will be made.

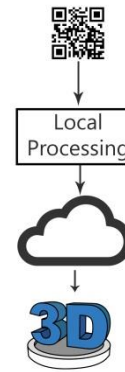


Figure 2. Augmented Reality Process.

In this study researchers used X86-based CPUs with Pentium III specifications with 700 MHz clock speed with 512 MB RAM then for ARM-based CPUs researchers used the Raspberry Pi with the same clock speed of 700 MHz and 512 RAM with Android Kitkat 4.4 operating system. In running Augmented Reality Cloud applications using Unity software. In measuring the 3d object streaming that will be displayed on both devices, measurements are made based on the time needed to bring up 1 whole object. This Augmented Reality object will consist of the first 3 types of objects that are static 3d objects, dynamic 3d objects or motion animations, and the last are multimedia objects.

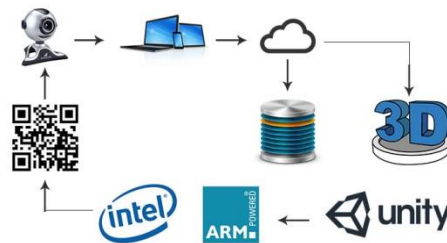


Figure 3. System Experiment Design

The following will be shown the assessment table for streaming object measurements.

Value	Time
Fast	< 5 second
Normal	= 5 second
Slow	> 5 second

In table below we will display experiment result that conduct with 2 computer architecture, one using x86 processor and second using arm processor. Experiment result displayed below. it can be concluded that

x86 processors have very fast detection speed when detecting markers compared to arm processors because there is a difference between the two architectures where x86 is a CISC architecture processor even though the CISC architecture program has properties requiring several cycles to run a program line but the CISC architecture has a very fast processing speed so that even though it is done in several cycles there is no significant delay. On ARM processors that have RISC architecture seen in the graph, it takes a long time to detect a marker because RISC architecture requires 1 cycle to run a program line, but the constraints of RISC architecture processors when the research took place have no processor that has a clock speed which quickly affects the results of the experiment.

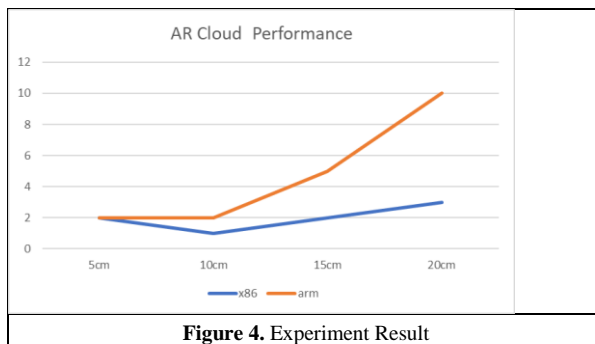


Figure 4. Experiment Result

But according to researchers if the RISC processor has a higher speed and the number of cores in the processor added does not rule out the possibility that RISC will be faster in detecting markers than CISC architecture processors.

4. Conclusion

The conclusions in this study can be described as follows:

- CISC architecture processors have fast marker detection speeds compared to RISC architecture processors for AR Cloud technology.

- Judging from the characteristics of the RISC processor, it can be concluded that RISC processors can be faster in detecting markers on AR Cloud technology with the condition that the number of cores and clock speed is fast so that program line execution can be done quickly thereby reducing process delay.

REFERENCES

- [1] Yuen Yin, Yaouyuneong Gallayane and Johnson Erik, "Augmented Reality: An Overview and Five Directions for AR in Education," Journal of Educational Technology Development and Exchange, October 2011.
- [2] Huang Bai-Ruei, Lin Chang-Hong and Lee Cia-Han, "Mobile Augmented Reality Based on Cloud Computing," IEEE Trans. Anti-Counterfeiting, Security and Identification (ASID), August 2012.
- [3] Camba Jorge, Contero Manuel and Herranz Gustavo Salvador, "Desktop vs. Mobile: A Comparative Study of Augmented Reality Systems for Engineering Visualizations in Education," IEEE Trans. Frontiers in Education Conference (FIE), October 2014.
- [4] Editya Arda Surya, "Pengembangan Media Pembelajaran Dengan Menggunakan Teknologi Augmented Reality Untuk Meningkatkan Prestasi Belajar Pada Mata Pelajaran Teknik Dasar Elektronika Pada Smk Negeri 1 Sidoarjo," Unesa Journal, October 2014.
- [5] J.Yashpalsinh, and M. Kirit, "Cloud Computing - Concepts, Architecture and Challenges," 2012 International Conference on Computing, Electronics and Electrical Technologies [ICCEET], pp. 877-880, March 2012.
- [6] Chen Ming, Ling Chen and Zhang Wenjun, "Analysis of Augmented Reality Application based on cloud Computing," 2012 International Conference on Image and Signal Processing, October 2012.
- [7] Blem Emily, Menon Jaikrishnan and Sangkaralingam Karthikeyan, "A Detailed Analysis of Contemporary ARM and X86 Architectures," IEEE Intl. Symposium on High Performance Computer Architecture (HPCA 2013), October 2013.