

2D Animation Video of IoT-Based Agricultural Monitoring Using Onion Skinning Technique

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ABSTRACT

Learning is support from educators to help students acquire knowledge, skills and habits, as well as carry out the process of forming attitudes and beliefs. In other words, learning is a process that helps students learn well. Learning has the same meaning as teaching, but has a different meaning. In education, educators teach students to study and master the content of the material in order to achieve certain goals (cognitive aspects), changes in students' attitudes (emotional aspects) and skills (psychological aspects) can also affect students. After the outbreak of COVID19 in Indonesia, the learning process between educators and students was changed through e-learning. The application of e-learning makes the practicum process less effective, especially the practical learning of IoT (Internet of Things). Often, students struggle to understand what materials to use and what materials to design first when it comes to IoT tools. For this reason, we need a learning media that can help students understand the function and design of IoT tools. The purpose of making teaching aids in the form of animated videos is so that students can understand what materials are used and also pre-engineering IoT devices. The method used in designing this learning animation video is MDLC which consists of three stages, namely pre-production, production, and post-production. The results of this study are that a learning animation video has been successfully made about IoT tools.

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INTRODUCTION

At present, the implementation of national policies in the field of online learning makes practical learning of IoT devices difficult. Nevertheless, research on the Internet of Things must continue at the right time [1]. The Internet of Things (IoT) is a tool for increasing resilience by extending the benefits of internet connectivity by connecting equipment, machines and other physical objects with networked sensors and actuators to collect data and control their own performance [2]. This allows the machine to work independently with newly received information. At first it was a machine made only to lift people, and was operated manually, but gradually it worked automatically. This release implements Internet of Things (IoT) ideas [3]. This allows remote control of any machine using an IP address identifier that uses the internet as a means of communication [4]. Internet of Things (IoT) is the idea of using the internet as a hub, enabling all objects in the real world to communicate with each other as part of an integrated system. For example, a roadside video surveillance system is connected to the Internet and installed in a control room, which is several tens of kilometers away [5]. Basically Internet of Things (IoT) devices consist of sensors that function as data collection tools, communication tools, and information analysis tools. During this pandemic, the use of technology to teach Internet of Things (IoT) tools can also be applied, one of which is the use of video media [6].

The use of video material can stimulate students' knowledge, train logical and analytical thinking, be more effective and creative, hone students' imaginations and be fun. According to the Big Indonesian Dictionary, video is a live recording or TV show that is broadcast on a TV [7]. That is, images are images that move with sound. Video is an electronic media that combines audio and visual technology to create dynamic and interesting shows [8]. As time goes by, video material develops very rapidly, one of which is that videos can be played through online viewing. One example is through the online media owned by large company Google, namely YouTube [9]. YouTube makes it easy for people around the world to connect to the Internet and play a variety of video content. The ease of accessing videos also has a very positive impact on the world of education because educators can visualize the applied curriculum [10]. The benefit of live video is that it can attract students' attention and interest by placing elements of motion, sound, color, and light in the video to facilitate their learning. In its development, learning videos continue to progress, one of which is animated videos which are in great demand by many groups because they can create and motivate students to understand learning material [4][11].

The use of technology for online learning is an alternative to addressing the educational challenges of COVID-19, one of which is animated videos. Animation is a means of information and entertainment [12]. The animation has a variety of imaginative expressions and plots that are more interesting and memorable. Animation actually comes from the Latin Anima which means life, soul, spirit [13]. The characters used to create animations are people, animals and other real objects, and can be represented in 2D and 3D images [14]. Animated characters can be interpreted as images that appear to contain creatures, with a series of images that change regularly and appear sequentially, giving the viewer the illusion of the images being displayed. Objects in animation are colors, text, object shapes, and special effects [15]. Several steps are used to move a moving object to make it look more realistic, one of which is by using the Onion Skinning technique [5].

Onion Skinning Technology is a 2D computer graphics technique that creates cartoons by editing clips so that multiple frames can be seen in one view [16]. In this case, the animator can create or modify images based on previous drawings. Onion skinning is a technique that has its roots in the early 1920s when Disney animators

made each frame of animation a different transparent sheet or gel [17]. These early animators came up with the idea of peeling onions to ensure that these individual gels were properly aligned to create smooth animations. The process begins with the first frame of the animation where the animator outlines the animated characters and no color is added to them [18]. The second gel is smeared on top of the first gel. In the second gel, the animator redraws the animation, but moves the character slightly into position needed for frame 2 of the animation sequence [19]. The advantage of this process is that you can see where the previous animation was drawn through the transparent gel. This process is repeated by adding more gel on top of each other. Each gel is an animation frame [20]. Hold the gel over the lamp to see all the positions of the anime characters in one view.

The purpose of this research is to make IoT learning animation videos as an alternative learning system for educators, and to make it easier for students to understand the design of IoT tools in online learning.

METHOD

In this study, data was collected through books and modules on animated video-based subject matter. In addition to books and modules, the required data is also obtained from other sources such as magazines and the internet to support project preparation and design.

At the stage of taking the questionnaire, it was carried out as a search for information data regarding the Animation Video for Learning IoT Tools. To calculate the required number of samples in the questionnaire using the Slovin formula.

Information :

n = Sample size of the number of respondents

N = Population Size

e = Percentage of accuracy of sampling errors that can still be tolerated

In the Slovin formula there are the following provisions:

The value of $e = 0.1$ (10%) for a large population

The value of $e = 0.2$ (20%) for a small population

So the sample range that can be taken from the Slovin technique is between 10-20% of the study population.

The total population in this study was 80 students from Amikom University, Purwokerto. So that the percentage of allowance used is 20% and the results are rounded to achieve suitability. Adjusted by researchers to 30 respondents to sample data from users. This method was chosen because it is more structured and the steps for making animated videos are more sustainable & easier to understand. The stages are as follows:

The Pre-Production stage is the stage that must be done in the Pre-Production stage as follows:

- a) Identification
Identify the hardware and software needed to create the animation.
- b) Orientation
This is the stage where familiarity with the field and scope of project activities takes place in order to prepare and create digital multimedia videos and synchronize needs and interests.
- c) Data collection
The stage of data collection or documentation on all matters relating to the compilation and production of digital multimedia videos.

d) Shooting

Steps of taking photos as photos or videos for display or visual display to help digital multimedia video creators and creators.

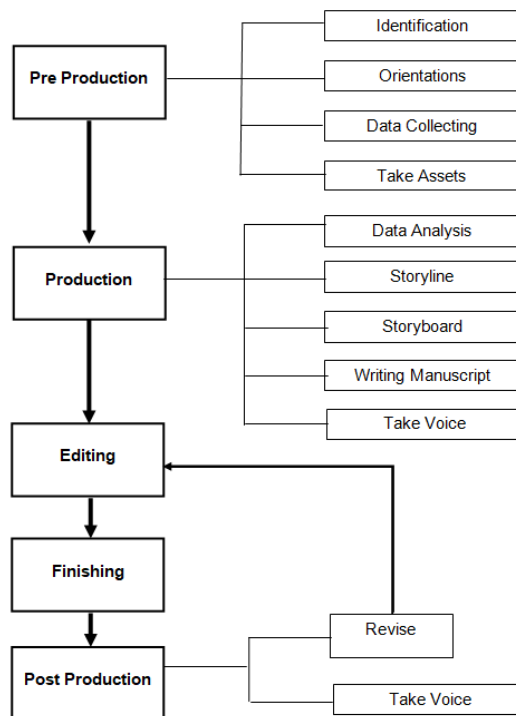


Figure 1, Processing Phase

Production Stage there are several steps that must be done. The following are the stages in the production process:

- a) Data analysis
The needs analysis stage of the collected data to process it in a way that suits the data needs to support the preparation and production of digital multimedia videos.
- b) Storyline
Film Storyline Creation Stage and initial multimedia design phase for the preparation and production of digital multimedia videos.
- c) Storyboards
This stage is a guideline, starting from the production process to the editing process, so that the process is easier and the results are appropriate. This stage plays a major role in the process of making audio, video, animation.
- d) Script Writing (Scripting)
Stages of designing and realizing narrative scenarios for voice overs to prepare and produce digital multimedia videos.
- e) Voting
The sound capture stage is to meet the needs of audio or broadcasters to provide visual information (video or photograph).
- f) Music Illustrate
Steps in creating and composing music that are useful for giving nuance to digital multimedia video broadcasts.

- g) Editing
The step of cutting and combining disparate data and materials into a digital multimedia video package.
- h) Finishing
The steps are to compile the edited results in mp4 format and then upload them to online media.

RESULT & DISCUSSION

Identifying hardware and software requirements needed in making animated videos.

Table 1, Software Support

Software	Description
<i>Windows 11 64bit</i>	Operating system
<i>Adobe Animate Pro CC 2017</i>	Animation Software
<i>Adobe Premiere CC 2017</i>	Video Editing Software
<i>Adobe Audition CC 2017</i>	Sound Editing Software
<i>Adobe Illustrator CC 2017</i>	Vector Software
<i>Adobe After Effects CC 2017</i>	Effect Video Software
<i>Adobe Photoshop CC 2017</i>	Image management software
<i>Blender 3.0</i>	3D Software

Tabel 2, IoT Data

Sensor	Description
Anemometer/Sensor Kecepatan Angin	3D
Barometer	BM280
Kelembaban Tanah	YL39
Curah Hujan	Tipping Bucket 3D
Suhu & Kelembaban Udara	DHT11
Modul Wifi	ESP8266
Arduino Mega	2560
Modul RTC	DS3231
LCD	27x2

After capturing the sensor image, a video is taken with the Camera to complete the IoT design and learning video tutorial. At the video shooting stage, taken from several angles, namely high angle, eye level, medium close up, long shoot. Taking pictures on making IoT learning animation videos, sketched using a pencil and then made into two dimensions using Adobe Illustrator.

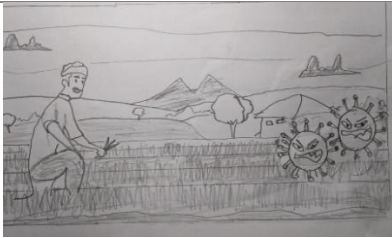
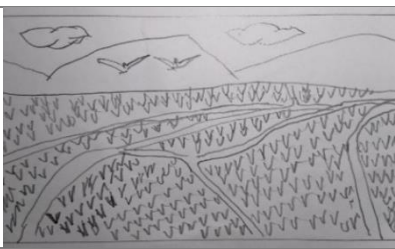




Figure 2, Design asset with Illustrator.

Storyboard is a sequential depiction of an animated film that follows the plot of the animated film. Below is the IoT learning animation video storyboard:

Table 3, Storyboard of animation concept.

1		00.13 – 00.16	Displays a map of Research coordinates.
2		00.20 – 00.30	Showing a farmer who is coming from the Corona Monster.
3		00.30 – 00.33	Shows hands holding rice and paddy.
4		00.33 – 01.18	Showing impressions of rice fields by explaining the research project.

The sound capture stage is also known as dubbing which is a process for the announcer's needs. To provide information about visual effects (video or photo), Sound uses Adobe Audition to create this animation.

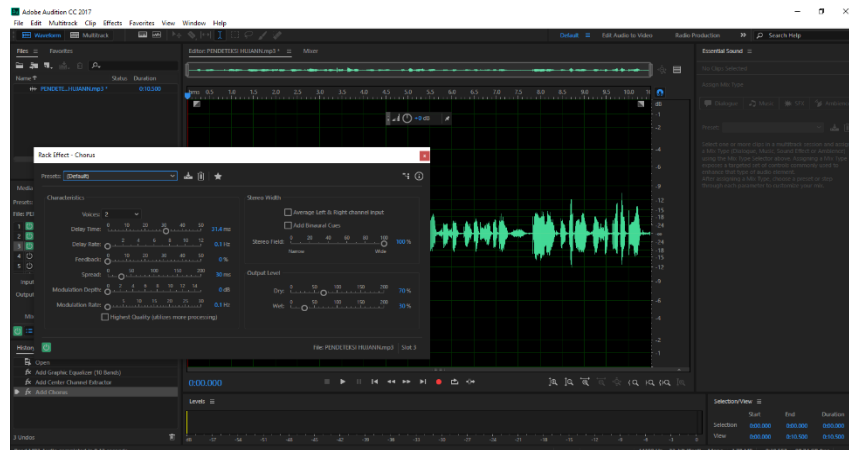


Figure 3, Editing dubbing in audition

The next stage is to use Adobe Animate cc 2017 to create a 2-dimensional animation, then export it to mkv or mp4 format. This process uses the Onion Skinning technique, namely a 2D computer graphics technique that creates cartoons by editing clips so that several frames can be seen in one view. An example of using the onion skinning technique can be seen in the image below.

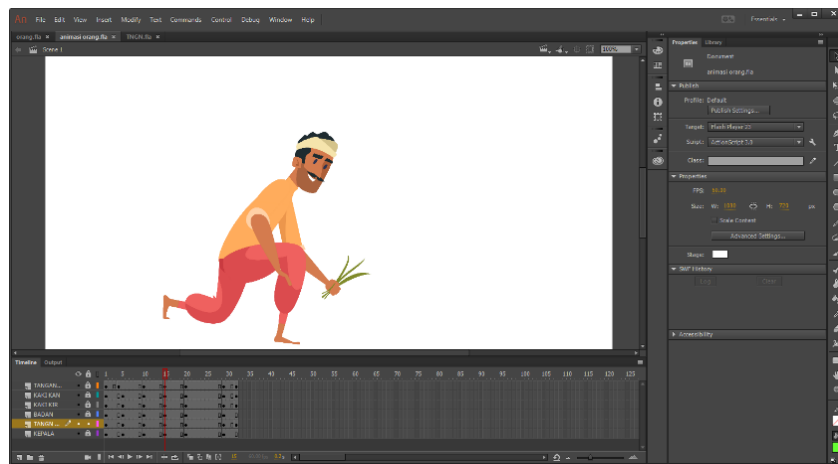


Figure 4, Adobe Animate CC 2017 software animation editing and the use of the onion skinning technique

Alpha testing of animated videos as learning media The introduction of IoT-based agricultural tools during the COVID19 pandemic was carried out by researchers as creators of animated videos. Testing is carried out by matching the original concept of the animation or storyboard with the resulting animation production, whether it is in accordance with the results applied or not, the following conclusions will be obtained:

Table 4, Testing parameter with Alpha.

Scene	Object	Expected results	Results
1	Opening logo, ministry of education and culture and lpdp logo.	Displaying the logo of Amikom Purwokerto University, the logo of the Ministry of Education and Culture, Lpdp.	Appropriate / Not suitable
2	Map of Research places	Displays a map of Research coordinates.	Appropriate / Not suitable
3	A farmer who is visited by the Monster Corona.	Showing a farmer who is coming from the Corona Monster.	Appropriate / Not suitable
4	Hand View	Shows hands holding rice and paddy.	Appropriate / Not suitable
5	Paddy field footage	Showing impressions of rice fields by explaining the research project.	Appropriate / Not suitable
6	Agricultural IoT tools	Displays photos and videos of sensors with explanations of sensor functions.	Appropriate / Not suitable
7	Tool design	Displays videos of designing IoT tools and explanations	Appropriate / Not suitable
8	Arduino schematic	Show arduino schematic.	Appropriate / Not suitable
9	Tool Coding	Shows coding and explanation of the program used.	Appropriate / Not suitable
10	Coding results	Shows impressions of the results of the IoT tool design.	Appropriate / Not suitable
11	3d Tool case	Displays 3D animation where IoT tools.	Appropriate / Not suitable

The number of respondents is 30 people. With the number of questions to respondents as many as 10 questions. In testing the Beta Test the author gave questions to 30 User respondents who were still active in lectures.

After calculating the next index formula is to create criteria using intervals, the formula used is as follows:

INTERVAL FORMULA $I = 100 / \text{total score or weight then } I = 100 / 5 = 20$ (calculation of the interval from the lowest 0% to the highest 100%)

Then it can be seen that the Likert scale interval used in this study is as follows,

It can be said that the interval 0 – 19.99% is very bad category, 20-39.99% is not good category, 40 – 59.99% is neutral category, 60 – 79.99% is good category, and 80 – 100% is very good category. .

The final result of beta testing the questionnaire that has been calculated based on sample data, for that animated video as a learning medium The introduction of IoT-based agricultural tools during the COVID19 pandemic has an average of:

Index formula as follows:

$$\text{Average} = (R1 + R2 + R3 + R4 + R5 + R6 + R7 + R8 + R9 + R10) / 10 = (82\% + 85.3\% + 76.6\% + 76.6\% + 70.6\% + 76.6\% + 78.6\% + 80\% + 76\% + 76.6\%) / 10 = 778.9 / 10 = 77.89\%$$

Then the results obtained from 30 respondents reached an average index formula of 77.89% and entered the (Good) category.

CONCLUTIONS

Making Learning Animation Videos The design of IoT tools aims to provide alternative learning systems for educators and also to help students understand the design of IoT tools in online learning. Then the results of alpha and beta tests on the Animation Video Learning Design of IoT tools have gone well. Whereas after testing using a questionnaire to 30 respondents, an average index formula of 77.89% was produced in the Good category, which means "Video Animation Using Onion Skinning Techniques as Learning Media Introducing IoT-Based Agricultural Tools During the Covid-19 Pandemic" was as expected and feasible as an alternative learning media during a pandemic.

Some of the suggestions given for the development of animated videos for this learning video media are 1) This learning media only discusses learning the design of IoT tools, hopefully in the future we can develop learning videos for other materials. 2) This learning media can be more interesting if the animated characters and footage used are developed further.

Acknowledgement

In completing this thesis the author realizes that many parties have provided assistance, input, advice, and support. The writer thinks that this thesis is the best work that the writer can present. But the author realizes that it is possible that there are deficiencies in it. Therefore, constructive criticism and suggestions are highly expected. Finally, I hope this paper can be useful for writers in particular and for readers in general.

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