Designing Fan Speed Regulation Software Using Backpropagation Method

[1] Satria Yudha Prayogi, [2]Sony Bahagia Sinaga
[1]Universitas Islam Sumatera Utara, Jl. Sisingamarangaraja, Medan, Indonesia
[2]STMIK Mulia Darma, Jl. Adam Malik No. 28, Rantauprapat, Indonesia

ARTICLE INFO	ABSTRACT
Keywords: Fan, Speed Regulator, Backpropagation, Simulation	Fans have the main function of air conditioning, room fresheners, and dryers which are usually equipped with heating components. In addition, fans are also used in vacuum cleaners and various decorative elements in the room, which play a role in keeping the air temperature within the specified limits. Advances in the field of computer programming provide many benefits, especially in terms of ease and efficiency in the use of devices connected to computers. With control through a computer, the device can be operated more optimally and responsively according to the needs of the user.
Email: Satria.yp@ft.uisu.ac.id	

INTRODUCTION

The development of fans is increasingly diverse, both in terms of size, placement position, and function. Fan sizes vary, from mini fans that can be held by hand and use batteries as an energy source, to larger-sized fans. The fan speed can be controlled through various mechanisms, such as manual players, towing ropes, or remote controls. In general, the rotation of a fan propeller is divided into two types, namely "centrifugal", where the airflow moves in the direction of the fan shaft, and "axial", where the air flows parallel to the fan shaft. Advances in the field of computer programming bring many benefits, especially in increasing the ease and efficiency of operating devices connected to computers. With computer-based control, the device can be optimized and controlled faster according to the needs of its users. Before a system or device can be run through a computer, the first step is to simulate the system in a computer program.

The quality of SPA services and to get attributes that are priorities in improving the quality of SPA services at PT. Royal Amadeus. SPA is present because of the interest in SPA services so that it can increase the company's turnover which is as active as it can be rapidly.

The system proposed by the author is Android. By using two hardware devices, namely Android and laptop. Android is an operating system released by Google Inc. under the coordination of the Open Handset Alliance, which is Open Source. Apart from being an operating system, Android consists of middleware and several key applications by providing a Software Development Kit (SDK) as tools and an Application Programming Interface (API) to create or develop Android-based applications using the Java programming language.

With the existence of the Android application, SPA room booking using the User Centered Design (UCD) method is one of the approach methods with the concept of the essence of the learning algorithm with the Backpropagation method lies in its ability to adjust the weight value in response to errors that occur. To calculate errors, the learning process requires an output pattern as a target to be compared to the output of the network. The difference between the two results in an error or error value. Therefore, Backpropagation Artificial Neural Network is a network with a guided learning process. Once the error is calculated, the network propagates the child from the error to the hidden layer through a weighted connection that has not yet been updated. Each neuron in the hidden layer then sums up the weights of the errors that have been propagated back to determine its contribution to the output errors. Once each neuron in the hidden layer and the output layer knows the magnitude of the error, they will adjust their weights to minimize the error.

In the learning process, convergence will be achieved faster if momentum is added to the weight renewal formula. To use momentum, the weights (weight updates) of one or more previous learning patterns

must be stored. For example, the simplest form of Backpropagation with momentum, a new weight for the learning step (t + 1) is based on the weights on the learning steps (t) and (t–1). The mathematical formulation for Backpropagation with momentum is :

$$w_{jk}(t+1) = w_{jk}(t) + \alpha\delta_k z_j + \mu[w_{jk}(t) - w_{jk}(t-1)] \quad \Delta w_{jk}(t+1) = \alpha\delta_k z_j + \mu\Delta w_{jk}(t)$$

$$v_{ij}(t+1) = v_{ij}(t) + \alpha\delta_j x_i + \mu[v_{ij}(t) - v_{ij}(t-1)] \quad \Delta v_{ij}(t+1) = \alpha\delta_j z_i + \mu\Delta v_{ij}(t)$$

where the momentum parameter μ is limited to a range of 0 to 1.

METHOD

This study uses experimental and simulation methods to design and implement fan speed regulation software based on Artificial Neural Network (JST) with Backpropagation algorithm**.** The research process includes several main stages, namely data collection, system design, algorithm implementation, and system testing and evaluation. The data used in this study consists of:

   a. Room temperature data obtained from temperature sensors (e.g. DHT11 or DS18B20).
   b. Fan speed data based on room temperature to be used as output target.
   c. Training and test data used in the learning process of artificial neural networks.

Testing is carried out to ensure the accuracy and effectiveness of the system in regulating the fan speed based on temperature changes. The evaluation is carried out by:

   a. It uses Mean Squared Error (MSE) to measure the error between the network output and the target.
   b. Measures the response time of the system in adjusting the fan speed to temperature changes.
   c. Compare the simulation results with real conditions to see the success rate of the system.

The research methodology used in designing this fan speed regulation software is:
1.   Research Flow Chart
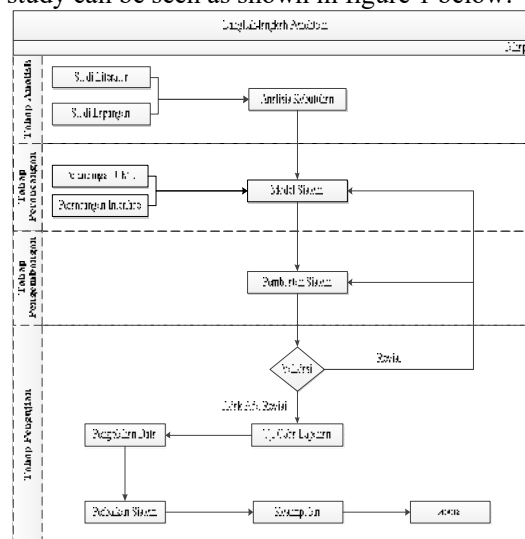   The flow chart of this study can be seen as shown in figure 1 below:

Figure 1. Research flow chart

Information:
Analysis Stage
   At this stage, a needs analysis process is carried out for the system that will be designed and built so that it can be understood by what kind of software is needed by the user based on literature studies and field studies. At this stage, the software and hardware requirements of the system to be designed are also analyzed. The specification of software and hardware requirements at this stage needs to be documented. A

Software Requirements Specification must include a description with its environment. The specification of the needs of the system to be built is as follows:

The required hardware specifications are:
1) *Laptop/PC*
2) *Ram 4GB*
3) *Hardisk 500 GB*
4) *Lolipop 5.0*
5) *Dual Core*
6) *RAM 1G (Android)*

The required Software specifications are
1. Windows 8.1 operating system
1) Web Server XAMPP-PHP-MySQL
2) *Android Studio*
3) Procesor Core I3

The needs analysis stage consists of:
Literature Study Collecting sources that can be used as literature study material from scientific journal journals, and the results of the research then identify the problem, problem formulation, purpose and benefits of the research by observing this research.The design stage is the modeling stage of the system to be built. System Modeling is a form of simplification of a very complex element and component to facilitate the understanding of the information needed. This planning stage consists of:
a. UML Design
At this stage, the mapping of the system model to be built using the UML model is carried out. After designing the model of the system to be built, the interface design of the system to be built is carried out.
b. Interface Design
At this stage, the interface design process is carried out , namely by designing the appearance of the system to be built, be it the display of the input page, the process page and the output page so that it can provide convenience at the stage of building this SPA room booking system.
c. Development Stage
At this development stage, the process of creating a system is carried out, namely by implementing the results of the system design in the previous stage. The system is built using the Android Studio programming language, PHP and MySQL data processing engine.

Testing Stage (Validation)
Validation is a process to show how much the program's accuracy value is against the conditions when it is actually used. This process runs scenarios based on data and environments that represent the real world using an experiment engine. At this stage, there will be several improvements, both in terms of system design and system development until the appropriate system is obtained and the reports produced are in accordance with the needs or need to be improved.

RESULTS AND DISCUSSION

In regular circular motion particles move at great speed, constant, but the direction of acceleration is not constant. The particle will move accelerated at the moment t of the particle at P and at the moment $t + \Delta t$ at P'. The speed in P' is v' which is equal to v but only different The length of the track traveled in Δt is the PP' arc equal to $v \Delta t$. Δ CPP' is the same as ΔPP'. If the approach of the PP bow rope is made is equal to the length of the PP bow, then,

$$\Delta v \cdot v \Delta t$$
$$V \cdot r$$

$$\Delta t \ . \ v2$$
$$\Delta t \ . \ r$$

For $\Delta t \rightarrow 0$ the exact price is obtained

$$a = \lim_{\Delta t \rightarrow 0} \Delta v / \Delta t = v2/r$$

which is the magnitude of the speed experienced by the particles. While the direction is the same as the direction Δv, which is towards the center of curvature. Because it is going to the center, this acceleration is called centripetal acceleration When understanding circular motion will find the angle formed by the radial vector that connects the two different positions of the object in the circular trajectory.
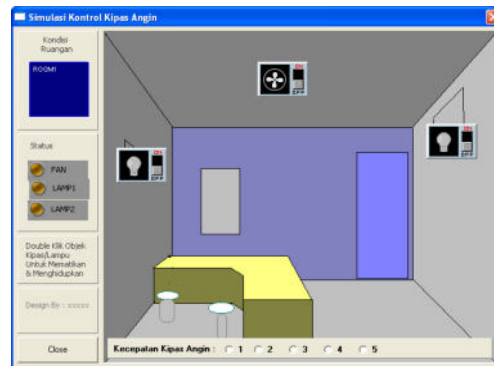

Figure 1. Room Form Display
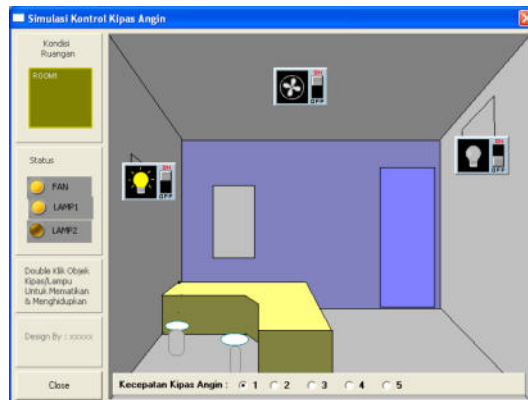

Figure 2. Light On Form Display

Figure 3. Display of the Walking Fan Room Form

The following image is an image of the Fan Control. And to control the existing equipment in this simulation, it is necessary to turn a fan on and off or regulate every fan speed.

Figure 4. Fan Speed Setting

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