Implementation of Doodle Jump Game Based on Accelerometer Sensor and Kalman Filter

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Abstract— **The doodle jump game is a video game with a jumping game model assisted by accelerometer sensor technology. Placing the accelerometer sensor in the doodle jump game is a very appropriate solution to determine the accuracy of the values on the sensor. The accelerometer sensor can be measured in real time, however applying a small force to the sensor can result in interference with measurement accuracy. Therefore, creating the measurement results you need using filters can help reduce noise. The method used to use this filter is the Kalman Filter algorithm. The use of the Kalman Filter method can provide a stable level of accuracy in the movements of the main characters in the game and the accelerometer sensor so that it can become a precise algorithm. This research has successfully influenced the accuracy of the accelerometer sensor, as an example of using the performance of the accelerometer sensor and the application of Kalman filter has an accuracy difference of 20.70% for the right tilt detection results and 33.25% for the left tilt detection results. This indicates that the application of the Kalman filter to the Doodle Jump game can have a significant effect.**

Keywords— Doodle Jump, Accelerometer, Noise, Kalman Filter, Accuration.

I. INTRODUCTION

As technology begins to improve, so does the need for distance estimation; the development of this technology can optimize the performance of applications or systems. However, sensor readings can affect the accuracy of measurement results [1, 2, 3]. For example, accelerometer readings can reduce accuracy and are only useful in certain applications. It is therefore important to select the correct optimization technique to provide accurate and useful value. The use of filters in the sensor will reduce the occurrence and increase the accuracy of the data [4, 5, 6].

Over the years there have been several technological developments including force plates, motion capture systems and accelerometers [7, 8]. These technologies have been used to assess vertical jump performance characteristics such as jump height, peak concentric force and impulse [9, 10]. However, they are not suitable for field evaluation due to their low power, high cost and the need for specialized computer equipment for data collection and analysis [11, 12].

Doodle Jump was created by Igor and Marko Pusenjak and published by the American studio Lima Sky. At the time of its launch, the Doodle Jump game was experiencing a surge, with more than 25,000 copies of the game being sold every day for a period of 4 months, and the game was released on various platforms [13, 14, 15]. Doodle Jump is a video game with a jumping game model using accelerometer technology. The placement of accelerometer sensors in the game is a very appropriate solution to know the accuracy of the value on the sensor [7, 8]. The sensor can be measured in real time with a small force applied, causing interference in the measurement. To obtain reliable measurement results, it is therefore necessary to use filters to reduce the noise [16, 17].

The Kalman filter can be used as a parameter estimation system with the aim of minimizing the error and noise in the estimation and, under certain conditions, minimizing the covariance error. Kalman filters have many applications in science and technology, such as tracking and monitoring vehicles, especially aircraft and spacecraft. It has evolved from optimal vehicle estimation to automation, positioning, target tracking, communications and signal processing, digital image processing, speech signal processing, earthquake prediction and many other fields. Therefore, the filter can be used as one of the tools that have general information, control and process automation [18].

From the above statement it may require some effective, flexible and concrete solutions in its implementation, with this development of the doodle jump game can have a positive impact on these problems, especially the Kalman filter method that can minimize the game error by providing accurate values to correct the game error [19, 20]. The accelerometer sensor technology and the Kalman filter method in the Doodle Jump game can help to minimize errors and stabilize the character at the start of the game, making it a material for evaluating and analyzing problems that will be able to provide solutions to users [21, 22].

Fajar Irvansyah, Setiawansyah and Muhaqiqin, in his research entitled 'ANDROID-BASED HAIR SURGE SERVICE BOOKING APPLICATION' the development of the Android system has a very significant technological development so that it cannot be separated from the role of AOSP (Android Open-Source Project) which has the authority to develop the Android operating system and is directly managed by Google [23].

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Android developer, in his research entitled 'Platform Architecture' Doodle Jump has a game with a type 2 game of jumping or moving places with the aim of getting as many points as possible. In the Doodle Jump game, the character itself has a role or character that almost resembles a cartoon alien and is given small clouds on the game screen that act as background or wallpaper in the game [24].

R. I. Alfian, A. Ma'Arif and S. Sunardi, in a study entitled "Noise reduction in the accelerometer and gyroscope sensor with the Kalman filter algorithm" The Kalman filter process consists of two stages, namely the "predict" stage, which uses estimates from the previous time to predict current events, and the "update" stage, which is used to correct the first stage prediction and provide a more accurate time estimate. This algorithm aims to control systems that are susceptible to noise disturbances with the aim of reducing errors and monitoring time under predetermined conditions [25].

Based on the background, the problem formulation in this final project can be summarized as follows: how to implement an accelerometer sensor in the Doodle Jump game, how to stabilize the movement of the main character in the game, and what is the accuracy of the Kalman filter in enhancing the gameplay experience of Doodle Jump.

The objectives of this study aim to address the formulated problems as follows: to analyze the motion stability of the main character in the Doodle Jump game, to stabilize the character's movement within the game, and to determine the accuracy level of the Kalman filter in improving the gameplay experience.

The topics and limitations of this research are as follows: this study will focus on analyzing the motion stability of the main character in the Doodle Jump game, with the analysis being conducted by the author. Additionally, the research will concentrate on the analysis process using the Kalman filter method.

II. RESEARCH METHOD

A. Flowchart System

The system that has been built uses a flowchart to assist researchers in their research, as described in Fig 1.

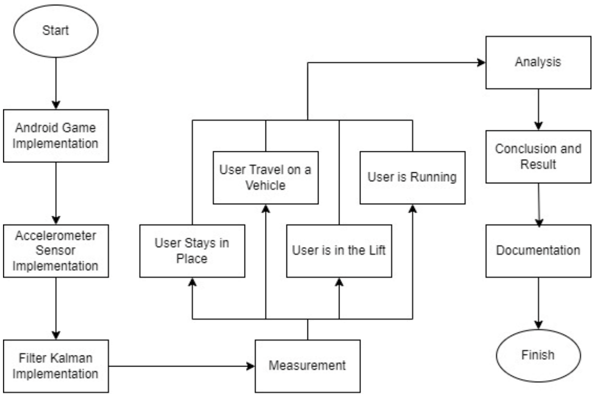

Fig. 1. Flowchart Diagram

Based on Fig 1, it can be concluded that the flow of game development by researchers starts from game implementation using Android Java language, accelerometer sensor implementation, Kalman filter implementation, measurement, to case studies conducted daily by researchers on the application of doodle jump games. The implementation carried out by the researchers can produce accurate data as a comparison of accuracy with previous algorithms, therefore accuracy comparison is the final part of the research.

1) Implementation of the game on Android

The game observed in the research is a doodle jump game based on the Java programming language and supported by the Android Studio IDE software.

2) Accelerometer Sensor Implementation

The sensor is inbuilt by Android in the previous system found in the Doodle Jump game that has been made. The accelerometer sensor functions as providing movement to the game character. In addition, the movement of the game character will produce an output value that can be known and analysed by researchers who focus on the level of accuracy of the game character.

3) Filter Kalman Implementation

The mathematical calculation of the Kalman filter will be implemented in the Doodle Jump game by integrating it using the Java programming language. The output generated by the accelerometer sensor is used as input for the calculation of the Kalman filter method.

4) Measurement

It consists of five parameters that are used as measurements in the Doodle Jump game. In addition, there is an accelerometer sensor to provide movement to the appropriate character as directed by the user so that it will produce a user input value.

5) Case Study

The main case study as a variable control in the measurement of parameters consisting of four, namely:

- *Neutral/no interference, the user will stay in place without moving while operating the game.*
- *Interference from the acceleration of the environment around the user, the user will ride in a vehicle as a passenger while operating the game.*
- *Gravity interference, the user will be in a lift while using the game.*
- *User acceleration interference, the user will be walking while using the game.*

6) Analysis

This analysis presents the test results and the comparison with and without the Kalman filter implementation in the game.

7) Conclusion and Result

Conclusions can be drawn from the results of the analyses carried out.

8) Documentation

Report the results of the research carried out by the researcher to analyze the results of the entire case study, so that it can be used as a reference material to solve the solution to the

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game previously made and know the implementation.

B. Research Diagram Illustration

System research on Doodle Jump games, which can be interpreted in the following block diagram.

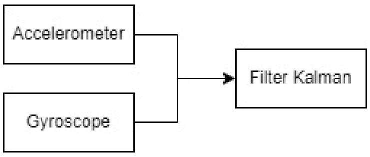

Fig. 2. Doodle Jump Diagram

Fig 2 shows a smartphone with an accelerometer sensor to control the character in the game Doodle Jump. In addition, the sensor can be played by tilting it to the right and left or called a gyroscope. In addition, the use of Kalman filter is because of comparison numbers from the accelerometer sensor so that it can be analyzed in the analysis based on the test results.

C. Use case Diagram

The diagram below provides an overview of the program flow as interpreted by the researchers.

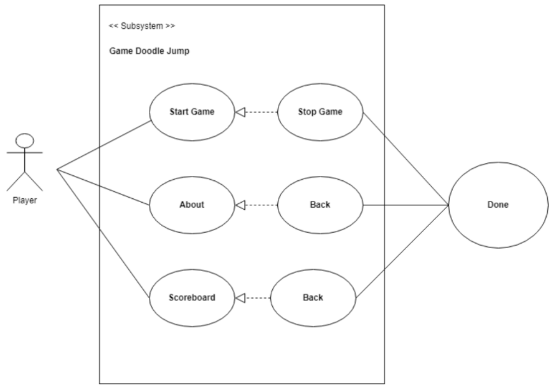

Fig. 3. Use case Diagram

Fig 3 illustrates the interaction between players (actors) and various features in the game. A detailed explanation of the figure follows.

- *Player: The player is the main actor interacting with the system. The player can choose different options available in the game.*
- *Start game: The player can start the game by selecting the 'Start Game' option.*
- *Stop Game: Once the game has started, the player can stop the game by selecting 'Stop Game'.*
- *About: The player can select the 'About' option to get more information about the game.*
- *Scoreboard: Players can view the highest score by selecting the 'Scoreboard' option.*
- *Back: From the 'About' and 'Scoreboard' menus, players can return to the main menu by selecting the 'Back' option.*
- *Done: All player activity, whether starting the game, viewing About the Game or viewing the Scoreboard, ends at a point called 'Done'.*

III. RESULT AND DISCUSSION

A. Research Diagram Illustration

1) Accelerometer Sensor Result

a) User Stays in Place

The user stays in place while operating the game and requires 10 trials to generate a number as a reference for comparing accuracy without using the Kalman filter. The detection results in the table below are the tilt results obtained from the user remaining in place under seated conditions. As shown in table 1.

TABLE I. TESTING WHEN THE USER IS STATIONARY USING THE ACCELEROMETER SENSOR

Test Scenario	Tilt	Detection Result	Tilt	Detection Result
Test 1	Right	39,89	Left	-31,09
Test 2	Right	45,42	Left	-42,95
Test 3	Right	42,51	Left	-39,22
Test 4	Right	30,19	Left	-43,05
Test 5	Right	30,35	Left	-44,15
Test 6	Right	39,50	Left	-38,52
Test 7	Right	30,97	Left	-36,06
Test 8	Right	41,39	Left	-41,74
Test 9	Right	32,08	Left	-43,36
Test 10	Right	31,44	Left	-39,22

b) User Travel on Vehicle

The user rides on a motorized vehicle as a passenger during operation and requires up to 10 tests to produce figures as a reference for comparing accuracy without using the Kalman filter. The detection results in this table below are the slope results obtained from the user riding on a motorized vehicle at a speed of 40km/h. As shown in the following table. As shown in the following table 2.

TABLE II. TESTING WHEN THE USER IS RIDING IN A VEHICLE USING THE ACCELEROMETER SENSOR

Test Scenario	Tilt	Detection Result	Tilt	Detection Result
Test 1	Right	58,10	Left	-56,65
Test 2	Right	62,42	Left	-53,81
Test 3	Right	57,55	Left	-52,96
Test 4	Right	57,37	Left	-58,51
Test 5	Right	64,16	Left	-50,10
Test 6	Right	60,40	Left	-60,50
Test 7	Right	52,94	Left	-61,29
Test 8	Right	51,95	Left	-50,54
Test 9	Right	49,96	Left	-61,58
Test 10	Right	56,38	Left	-56,66

c) User is in the lift

The user is in the lift while playing the game and needs 10 tests to produce numbers as a reference for comparing accuracy without using the Kalman filter. The detection results in this table below are the tilt results obtained from the user in the lift. As shown in the following table 3.

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TABLE III. TESTING WHEN THE USER IS IN THE LIFT USING THE ACCELEROMETER SENSOR

Test Scenario	Tilt	Detection Result	Tilt	Detection Result
Test 1	Right	30,97	Left	-36,22
Test 2	Right	41,95	Left	-34,95
Test 3	Right	42,30	Left	-40,28
Test 4	Right	45,67	Left	-50,10
Test 5	Right	33,22	Left	-43,86
Test 6	Right	39,27	Left	-30,21
Test 7	Right	45,20	Left	-44,23
Test 8	Right	30,03	Left	-38,34
Test 9	Right	30,23	Left	-41,01
Test 10	Right	30,24	Left	-43,25

d) User is Running

The user walks while the game is running and needs 10 trials to produce numbers as a reference for comparing accuracy without using the Kalman filter. The detection results in this table below are the tilt results obtained from the running user. As shown in the following table 4.

TABLE IV. TESTING WHEN THE USER IS RUNNING USING THE ACCELEROMETER SENSOR

Test Scenario	Tilt	Detection Result	Tilt	Detection Result
Test 1	Right	87,31	Left	-89,49
Test 2	Right	70,01	Left	-70,56
Test 3	Right	74,30	Left	-76,50
Test 4	Right	73,56	Left	-89,88
Test 5	Right	71,70	Left	-86,94
Test 6	Right	89,10	Left	-78,90
Test 7	Right	73,56	Left	-80,56
Test 8	Right	80,20	Left	-89,85
Test 9	Right	83,95	Left	-74,67
Test 10	Right	89,77	Left	-75,26

2) Filter Kalman Testing

a) User Stays in Place

The user remains in place while operating the game and requires 10 trials to produce numbers as a reference for comparing accuracy using the Kalman filter. The detection results in the table below are the tilt results obtained from the user remaining in place under seated conditions. As shown in table 5.

TABLE V. TESTING WHEN THE USER IS STATIONARY USING A KALMAN FILTER

Test Scenario	Tilt	Detection Result	Tilt	Detection Result
Test 1	Right	30,84	Left	-26,81
Test 2	Right	27,50	Left	-24,13
Test 3	Right	24,81	Left	-28,85
Test 4	Right	30,01	Left	-22,39
Test 5	Right	29,21	Left	-27,43
Test 6	Right	30,40	Left	-27,75
Test 7	Right	31,02	Left	-27,25
Test 8	Right	31,09	Left	-25,50
Test 9	Right	22,75	Left	-26,31
Test 10	Right	24,61	Left	-26,77

b) User Travel on Vehicle

The user rides on a motorized vehicle as a passenger during operation and requires 10 tests to produce figures as a reference for comparing accuracy using the Kalman filter. The detection results in this table below are the tilt results obtained from the user riding on a motorized vehicle at a speed of 40km/h. As shown in the following table. As shown in table 6.

TABLE VI. TESTING WHEN THE USER IS RIDING IN A VEHICLE USING A KALMAN FILTER

Test Scenario	Tilt	Detection Result	Tilt	Detection Result
Test 1	Right	27,40	Left	-34,83
Test 2	Right	28,52	Left	-29,85
Test 3	Right	30,45	Left	-31,30
Test 4	Right	33,18	Left	-39,45
Test 5	Right	28,44	Left	-36,98
Test 6	Right	32,92	Left	-20,42
Test 7	Right	28,31	Left	-28,05
Test 8	Right	33,45	Left	-34,78
Test 9	Right	37,40	Left	-32,93
Test 10	Right	35,76	Left	-33,62

c) User is in the lift

The user is in the lift while playing the game and needs 10 tests to produce numbers as a reference for the accuracy comparison using the Kalman filter. The detection results in this table below are the tilt results obtained from the user in the lift. As shown in table 7.

TABLE VII. TESTING WHEN THE USER IS IN THE LIFT USING A KALMAN FILTER

Test Scenario	Tilt	Detection Result	Tilt	Detection Result
Test 1	Right	35,96	Left	-30,40
Test 2	Right	38,94	Left	-45,58
Test 3	Right	37,38	Left	-47,69
Test 4	Right	35,86	Left	-48,57
Test 5	Right	36,84	Left	-44,75
Test 6	Right	38,15	Left	-45,81
Test 7	Right	35,60	Left	-47,30
Test 8	Right	37,55	Left	-43,13
Test 9	Right	34,25	Left	-48,30
Test 10	Right	34,39	Left	-44,61

d) User is Running

The user runs while playing the game and needs 10 tests to produce numbers as a reference for the accuracy comparison using the Kalman filter. The detection results in this table below are the slope results obtained from the running user. As shown in table 8.

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TABLE VIII. TESTING WHEN THE USER IS RUNNING USING A KALMAN FILTER

Test Scenario	Tilt	Detection Result	Tilt	Detection Result
Test 1	Right	34,15	Left	-39,53
Test 2	Right	40,72	Left	-38,52
Test 3	Right	37,00	Left	-19,25
Test 4	Right	32,53	Left	-42,30
Test 5	Right	30,83	Left	-39,68
Test 6	Right	29,81	Left	-38,49
Test 7	Right	32,79	Left	-22,94
Test 8	Right	24,83	Left	-38,03
Test 9	Right	34,43	Left	-39,76
Test 10	Right	34,06	Left	-43,67

B. Discussion

In the accelerometer sensor and Kalman filter method, it can be seen the difference in the value of the accuracy results obtained by researchers, as described as follows.

- *The use of the performance of the accelerometer sensor and the application of Kalman filter in the condition of the user staying in place has an accuracy difference of 20.70% for the right tilt detection results and 33.25% for the left tilt detection results.*
- *Using the performance of the accelerometer sensor and applying the Kalman filter in the condition of the user riding on a motorized vehicle has an accuracy difference of 14.29% for the right tilt detection results and 24.47% for the left tilt detection results.*
- *Using the performance of the accelerometer sensor and applying the Kalman filter in the state of the user in the lift has an accuracy difference of 5.27% for the right tilt detection results and 5.83% for the left tilt detection results.*
- *The use of accelerometer sensor performance and the application of Kalman filter in the walking user condition has an accuracy difference of 46.23% for right tilt detection results and 48.89% for left tilt detection results.*

C. Doodle Game Simulation

Then, for the Doodle Game simulation built in this study, it can be seen in the following fig 4

Fig. 4. Doodle Game Simulation

IV. CONCLUSION

This research has solved the problem of the accuracy of the accelerometer sensor data by implementing it into the Kalman filter method. This research has obtained information on accuracy problems based on initial testing of the accelerometer sensor. In making the table can obtain information on accuracy data that has been compared by researchers, the information compared is accelerometer sensor data and Kalman filter. This research has successfully influenced the accuracy of the accelerometer sensor, as an example of using the performance of the accelerometer sensor and the application of Kalman filter has an accuracy difference of 20.70% for the right tilt detection results and 33.25% for the left tilt detection results. This indicates that the application of the Kalman filter to the Doodle Jump game can have a significant effect.

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REFERENCES

[1] Ben, Lonnqvist., Zhengqing, Wu., Michael, H., Herzog. (2023). 1. Latent Noise Segmentation: How Neural Noise Leads to the Emergence of Segmentation and Grouping. arXiv.org, doi: 10.48550/arxiv.2309.16515

[2] Ahmet, Kağan, Kaya. (2023). 2. Noise-Robust Diffusion Based Semantic Segmentation. doi: 10.1109/siu59756.2023.10223870

[3] Noisy image segmentation model combining PDE and improved variational level set method. Academic Journal of Mathematical Sciences, doi: 10.25236/ajms.2022.030106

[4] Yan, Fang., Feng, Zhu., Bowen, Cheng., Luoqi, Liu., Yao, Zhao., Yunchao, Wei. (2023). 4. Locating Noise is Halfway Denoising for Semi-Supervised Segmentation. doi: 10.1109/iccv51070.2023.01523

[5] Eden, Grad., Moshe, Kimhi., Lion, Halika., Chaim, Baskin. (2024). 5. Benchmarking Label Noise in Instance Segmentation: Spatial Noise Matters. doi: 10.48550/arxiv.2406.10891

[6] A. Abadleh, B. M. Al-Mahadeen, R. M. AlNaimat, and O. Lasassmeh, "Noise segmentation for step detection and distance estimation using smartphone sensor data," Wireless Networks, vol. 27, no. 4, pp. 2337–2346, May 2021, doi: 10.1007/s11276-021-02588-0.

[7] Damjana, Cabarkapa., Dimitrije, Cabarkapa., Nicolas, M., Philipp., Andrew, C., Fry. (2023). 1. Impact of the Anatomical Accelerometer Placement on Vertical Jump Performance Characteristics. Sports, doi: 10.3390/sports11040092

[8] Dimitrije, Cabarkapa., Andrew, C., Fry., Matthew, J., Hermes. (2021). 2. Accuracy of an Experimental Accelerometer for Assessing Countermovement Vertical Jump Height. doi: 10.18060/24831

[9] Dennis, Moschina., Tobias, Röddiger., Michael, Beigl. (2023). 3. Vertical Jump Test Using an Earable Accelerometer. doi: 10.1145/3594739.3610669

[10] M.A., Choukou., Guillaume, Laffaye., Redha, Taiar. (2014). 4. Reliability and validity of an accelerometric system for assessing vertical jumping performance. Biology of Sport, doi: 10.5604/20831862.1086733

[11] Giacomo, Villa., Serena, Cerfoglio., M., Galli., Veronica, Cimolin. (2024). 5. Impact of IMU Placement on Vertical Jump Height Estimation: A Comparative Analysis in Countermovement Jumps. The Star, doi: 10.1109/star62027.2024.10635965

[12] D. V. Cabarkapa, D. Cabarkapa, N. M. Philipp, and A. C. Fry, "Impact of the Anatomical Accelerometer Placement on Vertical Jump Performance Characteristics," Sports, vol. 11, no. 4, Apr. 2023, doi: 10.3390/sports11040092.

[13] Anita, Teli., Sheetal, Harkuni., Deepti, M., Kadeangadi., Madhumati, J, Patil. (2023). 2. An assessment of the effectiveness and perception of the

p-ISSN 2301-7988, e-ISSN 2581-0588
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doodle – Video reinforced teaching method. BLDE university journal of health sciences, doi: 10.4103/bjhs.bjhs_207_22
[14] Jaimie, Carlson., Jason, Friedman., Christopher, Kim., Cynthia, Sung. (2020). 3. REBOund: Untethered Origami Jumping Robot with Controllable Jump Height. doi: 10.1109/ICRA40945.2020.9196534
[15] Dyaneshwar, Bavakar., Ramesh, Shahabade., Vishal, Vilas, Shinde., Bhargav, Vivek, Modak., Manas, Narendra, Telavane., Shantanu, Parameswara. (2024). 5. A Proposed Approach for AI Doodle Generation with a Hybrid Intelligent Agent. International Journal For Multidisciplinary Research, doi: 10.36948/ijfmr.2024.v06i02.17871
[16] Amulya Raveendra Katti; Anamay Sarkar; Pranav Mallikarjuna Swamy; Riya Kothari; Shenoy Pratik Gurudat, “Reinforcement Learning and Adversarial Attacks on Player Model with Doodle Jump.”
[17] S. M. Irsyad, A. Basuki, and B. S. B. Dewantara, “Rancang Bangun AirMouse Menggunakan Sarung Tangan Bersensor Berbasis ESP32,” Jurnal Rekayasa Elektrika, vol. 18, no. 3, Sep. 2022, doi: 10.17529/jre.v18i3.25816.
[18] M. Khodarahmi and V. Maihami, “A Review on Kalman Filter Models,” Archives of Computational Methods in Engineering, vol. 30, no. 1. Springer Science and Business Media B.V., pp. 727–747, Jan. 01, 2023. doi: 10.1007/s11831-022-09815-7.
[19] Manuel, Baltieri., Takuya, Isomura. (2021). 3. Kalman filters as the steady-state solution of gradient descent on variational free energy. arXiv: Neurons and Cognition,
[20] Alejandro, Juárez-Lora., Luis, M., García-Sebastián., V., Ponce., E., Rubio-Espino., Herón, Molina-Lozano., Juan, Humberto, Sossa, Azuela. (2022). 2. Implementation of Kalman Filtering with Spiking Neural Networks. Sensors, doi: 10.3390/s22228845
[21] Thomas, James. (2019). 5. The Kalman Filter. doi: 10.1007/978-3-030-31934-2_5
[22] Lyakhov, P., Kalita, D., Bergerman, M. (2022). Hardware Implementation of the Kalman Filter for Video Signal Processing. In: Tchernykh, A., Alikhanov, A., Babenko, M., Samoylenko, I. (eds) Mathematics and its Applications in New Computer Systems. MANCS 2021. Lecture Notes in Networks and Systems, vol 424. Springer, Cham. https://doi.org/10.1007/978-3-030-97020-8_12
[23] Fajar Irvansyah; Setiawansyah; Muhaqiqin, “APLIKASI PEMESANAN JASA CUKUR RAMBUT BERBASIS ANDROID,” Bandarlampung, 1, 2020.
[24] Developer Android, “Arsitektur Platform,” developer.android.com.
[25] R. I. Alfian, A. Ma’Arif, and S. Sunardi, “Noise reduction in the accelerometer and gyroscope sensor with the Kalman filter algorithm,” Journal of Robotics and Control (JRC), vol. 2, no. 3, pp. 180–189, May 2021, doi: 10.18196/jrc.2375

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