ASTEN | 3rd ICES

International conference of educational sciences

Borderless Education as a Challenge in the 5.0 Society

Bandung, November 7, 2019

BOOKLET

FACULTY OF EDUCATION
UNIVERSITAS PENDIDIKAN INDONESIA

and life in various aspects, such as health, finance, mobility, infrastructure, etc." Japanese Prime Minister Shinzo Abe explained his vision of Society 5.0 and according to him, 5.0 society will be linked to data to increase growth in the future. Education and health services, from elementary to tertiary levels, will reach villages in remote areas.

The digital era should be responded wisely so that all the determinants related can be utilized as optimally as possible for the life of mankind. In this regard, teachers college (LPTK) must be able to answer the problem of how to prepare prospective teachers to have readiness of knowledge, skills, attitudes and behaviors that are in accordance with the characteristics of students in the digital era.

THEME

For the continuity of results achieved on the 1st- 2nd ICES 2017-2018, the theme of the 3rd ICES 2019 conference is set to be:

Education No boundaries as a Challenge in the Society 5.0

The theme was chosen to address the challenges and roles that should be carried out by teachers college in answering the challenges of education in the era of society 5.0.

SUB THEME

1. Philosophy and policy of teacher education
2. Curriculum, teaching and learning approaches
3. Learner's characteritics in digital era
4. Teaching and learning
5. Guidance and counseling
6. Leaning model development
7. Learning media development
8. Measurement in education
9. Global citizenship education
10. Vocational education
11. Teacher education qualification framework
12. Management, supervision and assessment
13. Lifelong learning for all
14. Diversity in education
15. Equality of educational opportunity
16. Vocational and entrepreneurship education
17. Evidence based teacher education
18. Education in the industry 4.0 era
19. Developing Educational Competencies (Teachers) for Education in the Industry 4.0 Era.
20. Models of Students' Development in the Industry 4.0 Era
21. Characteristics of Millennial Generation and Challenges of Educational Institutions in the Industry 4.0 Era

Keynote Speaker

1. **Prof. Dr. Ismunandar**
   Direktur Jenderal Ditjen Pembelajaran dan Kemahasiswaan
2. **Dr Marek Grummt**
   Martin-Luther-Universität Halle-Wittenberg
3. **Dr. Rudi Susilana, M.Si.**
   Universitas Pendidikan Indonesia
4. **Dr Mary Ellis**
   Nanyang Technological University

THE 3rd INTERNATIONAL CONFERENCE OF EDUCATIONAL SCIENCES
THE ASSOCIATION OF SOUTHEAST ASIAN TEACHER EDUCATION NETWORK (ASTEN)
7 NOVEMBER 2019 GEDUNG FIP B Lt. 10 UNIVERSITAS PENDIDIKAN INDONESIA BANDUNG

No	Time	Event
1	07.30 – 08.30	Registration
2	08.30 – 09.00	Opening Ceremony (FIP B Lt.10) 1. Indonesian National Anthem – Indonesia Raya Dr. Phil. Leli Kurniawati, S.Pd., M.Mus 2. Welcome Speech Dr. Riche Cynthia Johan, M.Si. 3. Opening Speech Prof. Dr. H. R. Asep Kadarohman, M.Si. Rektor Universitas Pendidikan Indonesia 4. Rampak Sekar FIP
3	09.00 – 09.40	Plenary Session 1 (FIP B Lt.10) **Prof. Dr. Ismunandar** Direktur Jenderal Ditjen Pembelajaran dan Kemahasiswaan
	09.40 – 10.20	**Dr Marek Grummt** Martin-Luther-Universität Halle-Wittenberg
	10.20 – 11.00	**Dr. Rudi Susilana, M.Si.** Universitas Pendidikan Indonesia
	11.00 – 11.40	**Dr. Mary Ellis** Nanyang Technological University.
4	11.40 – 12.10	Discussion
5	12.10 – 13.00	Lunch (Gd. FIP B Lt. 10)
6	13.00 – 15.40	Class Parallel (Gd. FIP B Lt 8 & Lt 9) 160 Presenter 1 Room for 16 Presenter : 10 Rooms 1 Presenter : 10 minutes Present the paper Total :16 Presenters x 10 minutes = 160 minutes/ Rooms

Class Parallel 4

Moderator : Effy Mulyasari, M.Pd.Notulen :R

Notulen : Bella Dharma Fitri

Location : FIP Lt. 9

No	Fullname	Sex	Institution	Title
1	Helaluddin Helaluddin, Hengki Wijaya, Muhammad Guntur, Zulfah, Sahrul Syawal	M	Islamic State University of Sultan Maulana Hasanuddin Banten	The Digital Immigrants Versus Digital Natives: A Systematic Literature Review of Ideal Teacher in Disruptive Era
2	Sri Lestari, Tjutju Yuniarsih, Nanang Fatah, Eeng Ahman	F	Universitas Islam Syekh Yusuf	CONSUMER BEHAVIOR BASED ON LIFESTYLE AND ECONOMIC LITERACY
3	Wildansyah Lubis, Gaffar Hafiz Sagala	M	Fakultas Ilmu Pendidikan, Universitas Negeri Medan	The Practice of Instructional Leadership in North Sumatera
4	Triana Lestari, Dra. Nenden Ineu Herawati, M.Pd., Endah Permatasari, Putri Ramadhani Ariningsum	F	UPI	Developmentally Appropriate Digital Practice (DADP): Integration of ICT with game-based self-care learning in early childhood education
5	Sasha Raj Lawrence, Roberto de Roock	F	National Institute of Education	Leveraging funds of knowledge and 21st century competencies to improve marginalised learnersâ€™ academic learning
6	Ari Danuwijaya	M	University of Adelaide	Investigating factors influencing English achievement in Indonesian secondary school context
7	Laksmi Dewi	F	Indonesia University of Education	FLIPPED SMART CLASSROOM DEVELOPMENT TO IMPROVE STUDENTâ€™S LEARNING INDEPENDENT
8	Budi Susetyo	M	APPKHI	DEVELOPMENT TEST MEASURE OF BASIC SCHOOL COGNITIVE ABILITY
9	Hendri Hendri	M	Faculty Engineering Universitas Negeri Padang	BRUSH LESS DIRECT CURRENT MOTOR CONTROL SYSTEM USING ARDUINO UNO R3 MICROCONTROLLER
10	Yusi Riksa Yustiana	M	PPB FIP UPI	UNDERSTANDING OF CONSELOR PROFESSION BASED ON THE EXPERIENCE OF LECTURER ASSIGNMENTS AT SCHOOL
11	MAMAN ABDURAHMAN SAEPULRAHMAN	M	DEPARTEMEN PKH FIP UPI	READING COMPREHENSION SKILLS THROUGH CHILDREN'S LANGUAGE APPROACHES WITH INTELLECTUAL DISABILITIES
12	Tjutju Soendari	F	APKHI	ADAPTATION OF MATHEMATICS LEARNING PROGRAMS FOR STUDENTS WITH MATHEMATICAL DIFFICULTIES IN ELEMENTARY SCHOOL
13	Laksmi Dewi, Wachyu Sundayana, Yulia Rahmawati	F	Indonesia University of Education	Identifying Character Building Values in Teachersâ€™ Lesson Plans at Senior High School
14	Nandi Warnandi	M	APPKhi	IMPLEMENTATION OF GAMIFICATION STRATEGY TO IMPROVE CHILDREN LEARNING MOTIVATION WITH EMOTIONALOBSTACLES AND BEHAVIOR
15	Doni Tri Putra Yanto, Erita Astrid, Rahmat Hidayat	M	Universitas Negeri Padang	The Achievement of Four Student Competencies in The Domestic Electrical Installations using A Project-Based Learning Model
16	Lucy Fernandez, A/P Mary Anne Heng, A/P Christine Lee	F	National Institute of Education, Singapore	What helps or hinders learning? Exploring student voice on teaching and learning.

Brushless Direct Current Motor Control System Using Arduino UNO R3 Microcontroller

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Abstract. *This article is aimed to: (1) Make a control device on the DC BRUSHLESS motor, (2) Make adjustments to the 3-phase inverter using the Arduino microcontroller and make the software and hardware. BLDC Motor (Brush Less Direct Current Motor) is a type of synchronous motor that is powered by DC voltage through an inverter or switching power supply that produces AC electricity to the drive of each motor phase through a closed loop controller, and the magnetic field produced by the stator and magnetic field the rotor rotates on the same frequency. This final task proposes to design an electronic control device using a DC BRUSHLESS motor as a load to be regulated. In this final assignment the writer uses the Arduino Uno R3 microcontroller as the main control center, sensor hall effect as detecting the position of the rotor, 6 Mosfets as an inverter to convert the DC voltage to AC output voltage, and 1 potentiometer as a regulator of the duty cycle of the PWM signal. Based on the results of testing in this final project testing using a brushless dc motor load with different voltages, namely between 0V to 48 DC voltage. The results obtained from the experiment show the difference in motor rotation speed that by increasing the value of the duty cycle, it will add the motor speed and increase the inverter output voltage and increase the inverter current.*

Keywords: *Brushless DC Motor, Arduino Uno R3, 3 Phase Inverter, Hall Effect Sensor*

1 Introduction

1.1 A Subsection Sample

BLDC Motor (BrushLess Direct Current Motor) is a type of synchronous motor powered by DC voltage through an inverter or switching power supply that generates AC current to drive each phase of the motor through a closed loop controller, and the magnetic field produced by the stator and the magnetic field produced by rotating rotors at the same frequency.

The tool used in electrical commutation instead of brushes is a 3-phase inverter. This inverter is used as speed control of the Brushless DC motor itself by adjusting dutycycle or switching time. The six-step method is the method used in controlling the Brushless DC motor in this study. This method is easy to implement and has a simple algorithm. The waveforms produced from this method are square or trapezoidal waves. To regulate the motor so that the motor is able to work with constant torque and speed, appropriate timing changes in commutation are needed in controlling the Brushless DC motor with the six-step method. Therefore, the Brushless DC motor has installed three hall sensors that function to determine the timing of computational changes in controlling the Brushless DC motor.

As the name implies, the Brushless DC motor does not use a brush on the commutator. Brushless DC motors electrically commute. Changing the direction of the current is done by controlling the switch on the inverter. Most Brushless DC motors use 3 phase windings with a Y (star) topology. Motors with this topology are driven by energizing two phases at the same time. One motor rotation consists of six stages of current flow. By conducting an electric current from terminal A to terminal B, the motor will go to a certain position and stand at that position. When the current flowing phase is changed from terminal C to A, the motor will rotate 60 degrees electrically.

The essence of DC BRUSHLESS motor commutation is knowing the position of the rotor and then energizing the phase so that it produces torque as the motor drive. In this study the position of the rotor is known with three hall-effect sensors mounted on the stator. When the magnet on the rotor passes through the hall-effect sensor, the sensor will issue a signal in the form of logic high or low. Knowing these three hall-effect sensor combinations can determine the exact commutation sequence.

Changes in load on the synchronous motor not In this final project the control system will be designed using the Arduino Uno module. Implementation of the tool uses 48 VDC main power source by using a 3-phase inverter as a brushless DC motor controller, and there is a digital control in the form of a minimum Arduino system that functions as a signal reading from the hall effect sensor that functions to detect changes in the magnetic field that occur in the Brushless DC motor when the motor spinning. The 3 hall effect sensors used are located sequentially on a Brushless DC motor, and have a distance between one hall effect sensor and the other sensors around 60 degrees electrically. The results of the signal reading by the hall effect sensor will be processed in a minimum Arduino microcontroller system which will then determine the response to these changes in the form of a switching signal on the 3 phase inverter.

The Brushless DC motor testing was conducted at the Electrical Energy Conversion Laboratory of the Electrical Engineering Department FT-UNP with the following research limitations: Use of the Arduino Uno Microcontroller which functions as a data processor obtained from the sensor and as a PWM switching source for regulating the Brushless DC Motor Speed, the Motor used is a DC Brushless DC motor type with 350 Watt power and 48 VDC voltage, Components used for drivers or 3-phase inverters are Mosfet IRFP250, the method used to drive the motor is the Six Step method which is based on the position of the hall sensor contained in the motor and refer to the Brushless DC motor control table.

2. Configuration And Operation Of Brushless Direct Current Motor Control System Using Arduino UNO R3 Microcontroller

This research was conducted by testing and taking data in the Electrical Energy Conversion Laboratory of the Electrical Engineering Department, Faculty of Engineering, State University of Padang. The flow of research conducted is as follows:

(1) Testing on a microcontroller (2) Testing of 3 phase inverters with a Brushless DC motor load, and measuring the speed of a Brushless DC motor.

Figure 1. Implementation of a Brushless DC Motor Testing

3. Controller Configuration

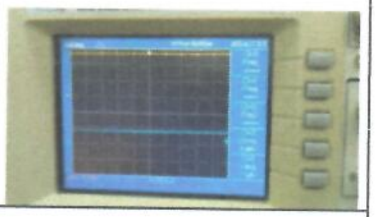
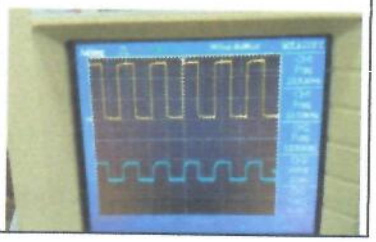
This research was conducted to analyze the effect of changes in the value of duty cycle and frequency on the voltage and rotational speed of a Brushless DC motor.

1.Testing the Gate Drive Series

Gate drive testing is carried out to find out whether the gate drive can gage the limits of the IRFP 250 mosfet. The PWM used for igniting the inverter circuit is generated from the Arduino UNO microcontroller with a frequency of 23.53 KHz. The following are the results of the gate drive test.

The gate drive circuit testing uses a 5 volt input voltage from a microcontroller with changing duty cycle and different output voltage results. Based on the tests that have been done, the higher the duty cycle, the higher the value of the output voltage. Changes in the value of the duty cycle will also affect the output waveform on oscilloscop.

Table 1. Testing Results of Zero Load Synchronous Motors

No	Pot		*Dutycycle* (Mikrokontroler)	*Dutycycle* (*Gate Drive*)	Picture
	Vin	Vout	%	%	
1	5 V		100	100	
2	5 V		50	50	

2. 3-phase Inverter Testing with No Load BLDC

Two levels of he BLDC motor testing by providing duty cycle values that change with a frequency of 20 KHz and 30 KHz, will affect the phase voltage and will change the speed of the motor according to the table and graph below.

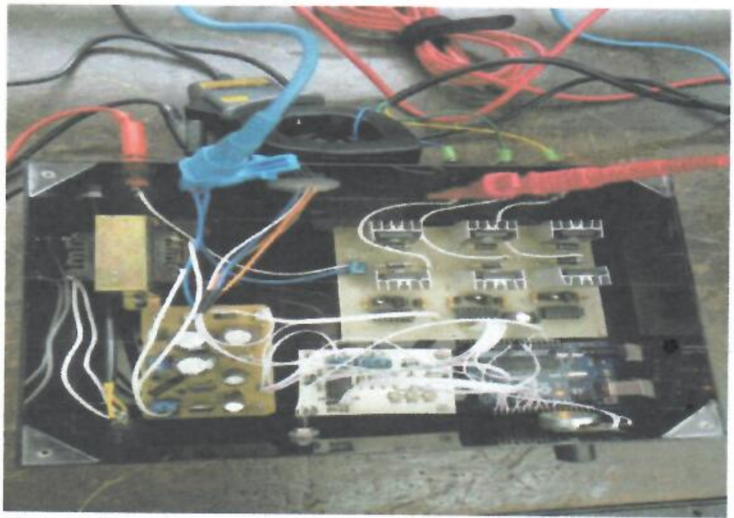


Figure 2. Measurement of the line output voltage of the inverter to neutral

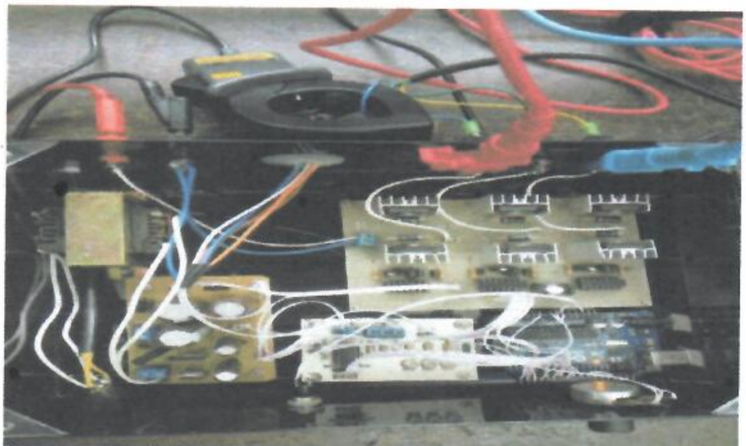


Figure 3. Line to line output voltage measurement

Figure 4. Measurement of motor rpm speed with a tachometer

4. Experimen

4.1 Measurement of 3 phase inverters at a frequency of 20 khz

Table 2. Frequencies of 20 khz with a duty cycle of 50%

Vin	Iin	Iout	V L-N	V A-B	V A-C	V B-C	Rpm
10	0.20	0.28	1.8	3.2	3.2	3.2	45.65
20	0.19	0.34	3.9	6.4	6.4	6.4	94.24
30	0.22	0.36	5.9	10.7	10.7	10.7	140.85
40	0.24	0.37	8	14.6	14.6	14.6	192.26
50	0.28	0.41	10.5	19.2	19.2	19.2	248.20

Table 3. Frequencies of 20 khz with 100% duty cycle

Vin	Iin	Iout	V L-N	V A-B	V A-C	V B-C	Rpm
10	0.33	0.31	3.6	6.4	6.4	6.4	90.66
20	0.35	0.38	7	13.1	13.1	13.1	177.59
30	0.44	0.45	11	20.2	20.2	20.2	266.75
40	0.50	0.46	14.6	26.6	26.6	26.6	355.94
50	0.54	0.52	18	32.7	32.7	32.7	435.71

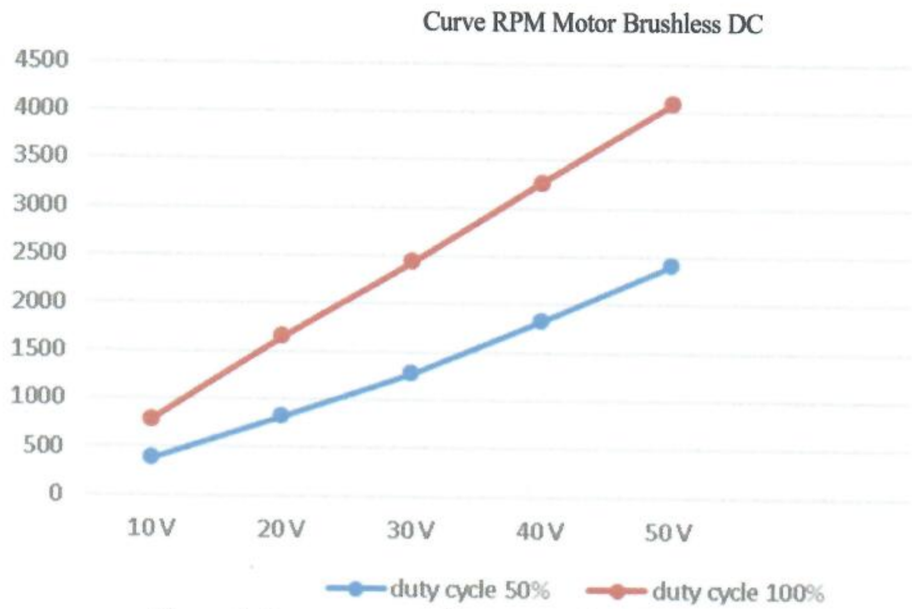


Figure 5. Rpm curve at a frequency of 20 KHz

4.2 Measurement of 3 Phase Inverter at a Frequency of 30 Khz

Table 4. Frequency of 30 khz with 50% duty cycle

Vin	Iin	Iout	V L-N	V A-B	V A-C	V B-C	Rpm
10	0.16	0.28	1.8	3.7	3.7	3.7	42.09
20	0.20	0.34	3.9	6.9	6.9	6.9	89.72
30	0.23	0.40	5.4	12	12	12	143.52
40	0.24	0.51	7.8	14.4	14.4	14.4	188.56
50	0.26	0.45	9.8	17.8	17.8	17.8	237.11

Table 5. Frequency of 30 khz with 100% duty cycle

Vin	Iin	Iout	V L-N	V A-B	V A-C	V B-C	Rpm
10	0.35	0.32	3.6	6.5	6.5	6.5	42.09
20	0.36	0.36	7.2	13.1	13.1	13.1	173.14
30	0.43	0.42	11	20	20	20	264.71
40	0.50	0.52	14.3	26	26	26	348.87
50	0.55	0.57	18	32.7	32.7	32.7	436.27

5. Conclusions

Previously, the design and manufacture of tools and the speed control tool for the Brushless DC motor have been carried out. So in this chapter it can be concluded that in determining the phase must be in accordance with the hall effect sensor and must be sequential so that the commutation process of the motor can run. Increasing the value of the duty cycle will increase the speed of the motor and increase the output voltage of the inverter and enlarge the inverter current and the increasing switching frequency will increase the speed of the Brushless DC motor.

Suggestion

The research that has been done only discusses the effect of changes in frequency and duty cycle on a Brushless DC motor so that it can still be continued and developed to analyze other effects. In addition, as scientific development in the repertoire of developing professional scientific insights.

After testing and discussing this tool, the authors suggest that in addition to using the hall sensor as a rotor position detector it might be possible to also use a back-emf motor circuit because by using the hall sensor when the motor speed is too high the hall sensor is often unreadable.

The author also recommends using a current sensor and a voltage sensor on a brushless dc motor so that the voltage can be protected from overcurrent or short-circuit which can damage the motor.

References

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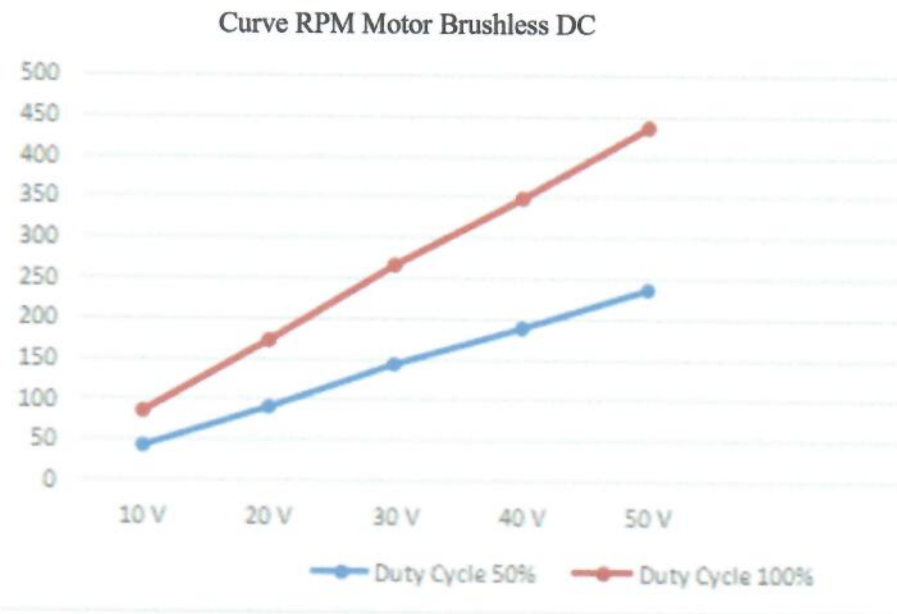

Figure 6. Rpm curve at a frequency of 30 KHz

From the test data, it can be described the value of the duty cycle affects the value of the output voltage and speed of the Brushless DC motor

If the duty cycle value is increased, the rotor rotation will be faster, this is because the coupling angle will be greater along with the synchronous motor induction torque will also increase. This increase in induction coupling will accelerate the rotation of the rotor and the motor rotates again at synchronous speed.

The biggest advantage of a Brushless DC motor is that a Brushless DC motor is more efficient at converting electricity to mechanical power than brushed motors. Because it is powered by a DC power source that is converted to AC electricity through an integrated inverter or switching power supply, which generates AC electrical signals to drive motors, additional sensors and electronics control the inverter output amplitude and wave and frequency, can reduce noise, last long in use , Due to the absence of a brush, brushless motor, reduces losses due to friction.