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Designing of Robot Gamelan Music using ATmega 16 Microcontroller

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ABSTRACT

This paper presents a robot concept which is the robot can play the instrumental Gamelan music. Gamelan is a percussive instrument. Instrumental Gamelan music keys are consist of 2 octaves in 15 tones. Robot Gamelan music is using proportional-derivative (PD) control system. PD control of the robot is by controlling DC gear motor position to desired Gamelan key position. Robot Gamelan music using ATmega 16 microcontroller as a controller. Feedback of PD control is using magnetic rotary encoder (MRE) sensor. PD control is using the constant. The constant functions of PD control are determining the pulse width modulation (PWM) toward the geared DC motor velocity in order to reposition a gamelan key position and pushing down the errors.

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1. INTRODUCTION

Robot Gamelan music was created for an innovation of robotic in art of Indonesia traditional musical instruments. Gamelan is an Indonesian cultural heritage instrument music that must be preserved. Musical gamelan instrument gradually would be abandoned by the young generation. It because there is a possibility no longer interesting of gamelan. Gamelan music is an Indonesian traditional music using a set of instruments called gamelan, this is a percussion instrument [1]. The name of gamelan is from the low Javanese word 'Gamel', which means a type of hammer, like a blacksmith's hammer. The name 'Gamelan' thus refers to the method of playing instruments. Generally, a method of playing Gamelan is by striking them, as they are almost entirely percussion [2]. This research is using gambang gangsa gamelan in the robot application.

Gambang gangsa gamelan is a gamelan with the keys made from bronze. The keys generally have 14 to 15 keys or two octaves [3]. Generally, gamelan is playing with 2 beaters in left and right hand. It is also can be playing with one beater as usually played by several amateur musicians [4]. On this paper, the robot gamelan music is using gambang gangsa gamelan with 15 keys and one beater. Robot gamelan music is using proportional-derivative (PD) control system by tuning the constantan proportional (K_P) and constantan derivative (K_d). There are two-way methods to tuning the constantan of PD. these are the trial and error method and the process response curve method [5]. The PD constantan tuning of robot gamelan music is only using a trial-error method. Robot gamelan music is using ATmega 16 microcontroller as a controller and magnetic rotary encoder sensor as a feedback to support in PD system.

2. RELATED WORK

This section will describe a comparison research a robotic technology which is related percussion instrument. Chang Geun Oh, and Jaeheung Park, with the kinetic xylophone. The kinetic xylophone is an interactive instrument, which plays music with motorized mallets by gestures from spectators. This instrument consists of fourteen metallic tubes, and reacts through embedded infra-red sensor with spectators. Those distance signals trigger the rotation of mallet attached to motors. Spectator can easily perform music with this installation by hand-waving gestures instead of grabbing mallets. Thus, this kinetic art work can also be performed by children, and persons with disabilities [6]. It is one of previous robot percussion research. The kinetic xylophone in the robot system are much needing motor for fourteen mallets and much using input-output (I/O) in the controllers.

On this paper will make difference robot percussion. It is robot gamelan music. Robot gamelan music does not need much motor in the robot system. Gamelan beater/mallet in the robot will be actuated by one servo motor. It will be carried by a trolley. The trolley will use a rail route system based on gamelan length size. The trolley function will shift to the left or to the right based on a desired gamelan key input in the robot. This is using one geared DC motor to actuating it.

3. COMPONENTS OF ROBOT GAMELAN MUSIC

3.1. Input of robot gamelan music

Input components of robot gamelan music are consist of matrix keypad 4×4, mechanical limit switch, and magnetic rotary sensor. The description and function of these as follows:

1. Matrix keypad 4×4 have 4 row and 4 column by keypad switch design. Row and column in matrix keypad 4×4 is crossing each others. Matrix keypad 4×4 working system is by scan row and column. Row and column scans of general matrix keypad are binary code form. It seems morse code [7]. Matrix keypad 4×4 function is to giving the input controller device. By the input from Matrix keypad 4×4, controller device can set the position gamelan key or call playing song mode.
2. Mechanical limit switch is the most basic and widely used device for sensing objects and their position. A mechanical limit switch contains a spring-activated snap mechanism to close or open a set of physical contact. An actuator is physically deflected to trigger the mechanism and operate the switch. Mechanical limit switch work best in robotics applications that permit physical contact between the switch actuator and the object to be sensed [8]. On this research, the mechanical limit switch function as a protector robot for the trolley of robot gamelan music to keep on the safe route.
3. Magnetic rotary encoder (MRE) are often used as sensors in motor control systems which employ digital controllers. Their functions as position and speed detector. MRE consist of two components: a magnetic drum and a magnetic sensor. Magnetic drum periphery are recorded some magnets, both north and south poles. Magnetic sensor has multiple magneto resistive (MR) elements on an insulating substrate, such as glass. The sensor faces the magnetic drum with a radial spacing ℓ, and the field of magnetic drum is linked to it. MR of magnetic rotary encoder (MRE) has equipped an amplifier integrated circuit in order to obtain output voltage in rectangular wave form. Rectangular waveform amount can be used as position and speed of motor detector [9]. This sensor will be used as feedback control to support PD control system in the robot gamelan music.

3.2. Controller device of robot gamelan music

Controller device of robot gamelan music is using ATmega 16. ATMega 16 is an 8-bit microcontroller. It is a low power microcontroller based on AVR enhanced reduced instruction set computing (RISC) architecture. It is a 40 pin microcontroller with 32 input output (I/O) pins divided into four 8-bit ports designated as port A, port B, port C, and port D [10].

3.3. Actuator of robot gamelan music

Actuator of robot gamelan music is using geared DC motor. Geared DC motor has planetary gear head. Planetary gear head is consisting of a sun gear, a ring gear, several planets, and a carrier. Any of the carrier, ring, and sun can be selected as input or output component, and the power are transmitted through multiple paths of the planet meshes. All of the make high motor torque [11]. Speed of geared DC gear motor can be set by using pulse width modulation (PWM).

3.4. Plant of robot gamelan music

Plant of robot gamelan music is trolley. The trolley position will be set by geared DC motor which was linked by timing belt. Trolley will be set to a desire gamelan key, we called it gamelan key set point position. Trolley carrier a single gamelan beater, gamelan beater will be actuated by servo motor. Servo

motor is a rotary actuator that allows for precise control of angular position. It has bidirectional spinning clockwise (CW) and counter clockwise (CW). Angular degree of servo motor is controlled by pulse width PWM [12].

4. CONCEPT AND DESIGN OF ROBOT GAMELAN MUSIC

4.1. Mechanical design of robot gamelan music

Robot gamelan music was designed with dimension volume 100cm × 30cm × 25cm in Figure 1. Mechanical design of robot Gamelan music is using trolley to carrying a gamelan beater. The trolley is balanced by cylinder shaft balancer rail. Gamelan beater was connected with lever of servo motor to sounding the gamelan key. The documentation of robot gamelan music shown in Figure 2.

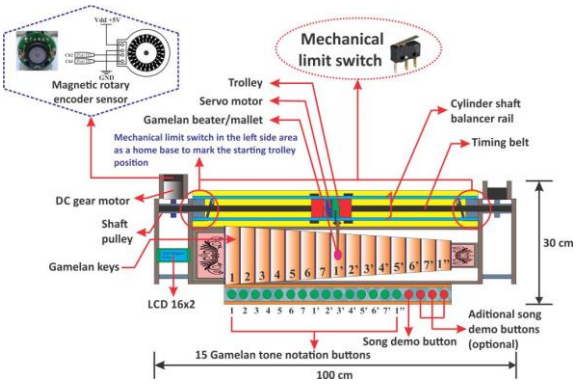


Figure 1. Mechanical design of robot gamelan music

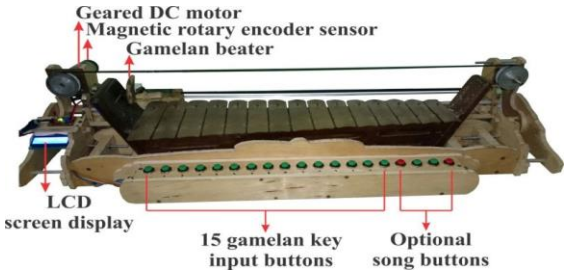


Figure 2. The documentation of robot gamelan music

4.2. Design of software

Figure 3 shows the flowchart process of robot gamelan music to positioning key (gamelan key). It is called by set point (SP) name. If geared DC motor are spinning and shifting the trolley of gamelan beater. It will obtain the present value (PV) of geared DC motor. Geared DC motor position was detected by MRE to recording in ATmega 16 microcontroller as a controller. If PV is the same with SP, Servo motor of gamelan beater will strike the key. But if it not, robot gamelan music will use MRE feedback sensor and use PD control system. The first procedure in PD control system must know how much the error values. Error (Err) value can be calculated by refer to (1).

$$error=SP-PV \quad (1)$$

On this robot gamelan music system will make an error tolerance in maximum and minimum as show in (2).

$$Err < 3 \text{ and } Err > -3 \quad (2)$$

The error (Err) tolerance function is allowing gamelan beater to strike a desired key. In (2), it is means that geared DC motor has been positioning the gamelan beater on the trolley, it because gamelan beater still in area of desire key. If the error not zero, and error not in (2) condition, either. The control system will use PD control. The general form of proportional derivative controllers (PDs) are given by (3-6):

$$PD = P + D \quad (3)$$

$$P = K_P \times e(t) \quad (4)$$

$$D = rate\ error \times K_d \quad (5)$$

$$rate\ error = error - past\ error \quad (6)$$

Proportional derivative (PD) controls are combination between proportional control and derivative control. They are simple structure and easy implementation of the controller [13]. Proportional (P) control function in (4) can fix the rise time in transient responses. P control was influenced by error changes value (e (t)). Derivative (D) control function in (5) can muffle output oscillation of geared DC motor. K_P for gaining P and K_d for gaining D. K_P and K_d obtained by trial and error method. Result of PD control is PWM value for controlling direction rotation and controlling speed geared DC motor. Positive PWM value indicate for clockwise (CW) rotation, and negative PWM value indicate for counter clockwise (CCW) rotation. PD control function for repositioning gear DC motor until reach error zero or error in (2) condition.

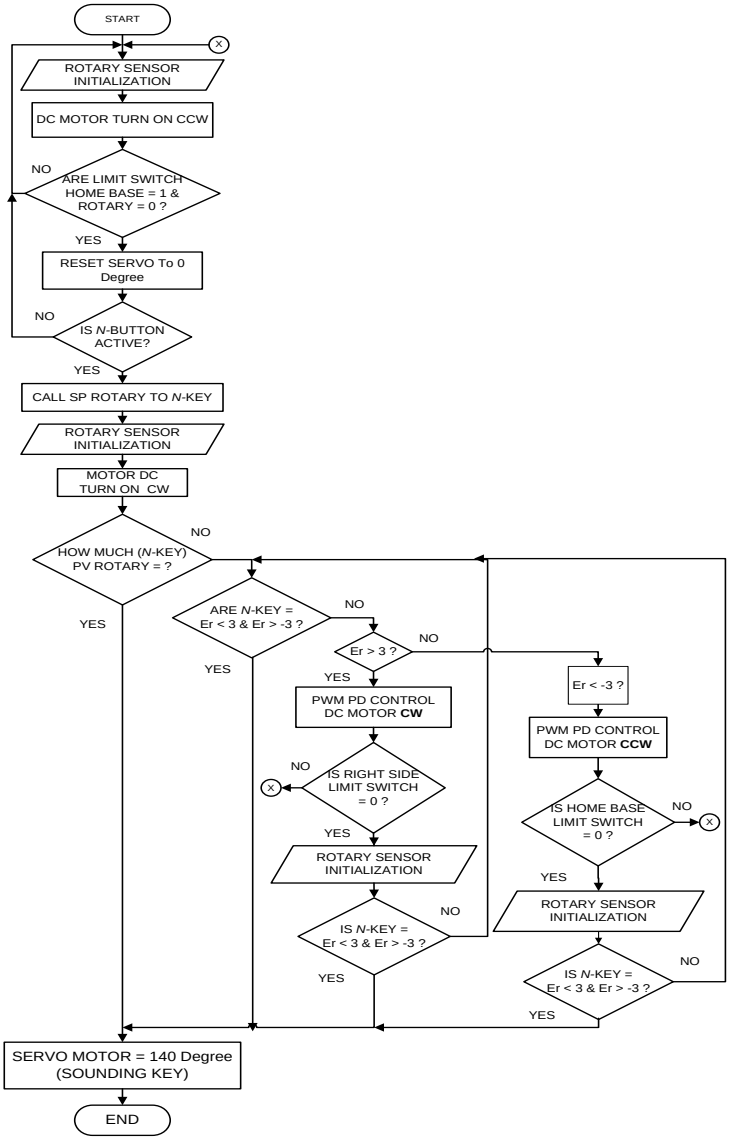


Figure 3. Flowchart design of robot gamelan music

4.3. Control system design of robot gamelan music

Robot gamelan music is using PD in close loop system. Diagram block of robot Gamelan music system control are consist of input, control device, actuator, and plant, as shown in Figure 4. Robot Gamelan music input are matrix keypad as button for gamelan key/song buttons, MRE sensor, and limit switch sensor. Robot gamelan music actuator is DC motor driver. Robot gamelan music plant is a trolley of gamelan beater carrier. Trolley of robot gamelan music are consist of DC gear motor and gamelan beater. DC gear motor is connected to trolley by using timing belt. Gamelan beater was actuated by one servo motor.

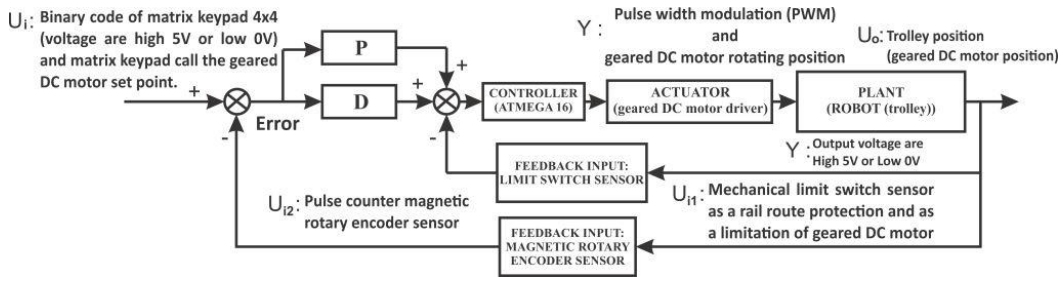


Figure 4. Diagram block of robot gamelan music

4.3. Electronic design of robot gamelan music

ATmega 16 microcontroller are using 4 unit ports as I/O data. Furthermore this electronic circuit concist of clock generator pulse and reset. I/O ports design as follows:

a. Port A0-A7 is used as keypad matrix 4×4 input and 16^{th} number button as a song demo.
b. Port D3 is connected to channel 2 (CH2), and port D2 is connected to channel 1 (CH1) of MRE sensor pins.
c. Port D7 is connected to the limit switch sensor on the right side of trolley route.
d. Port D6 is connected to the limit switch sensor on the left side as home base position of trolley.
e. Ports of B0-B5 are used as LCD 16×2 output display
f. Port D0 and port D1 are connected to DC motor driver.
g. Port C0 is connected to servo motor data pin

The schematic electronic I/O port design will show in Figure 5.

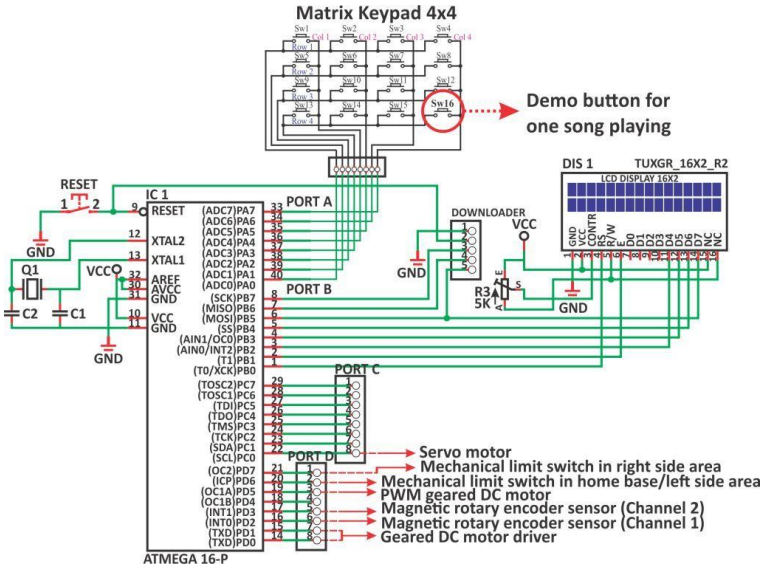


Figure 5. Electronic design of robot gamelan music

5. RESULTS AND DISCUSSIONS

Robot gamelan music tests are covering by marking gamelan key position of robot gamelan music, gamelan beater test, and robot gamelan music playing test. The control program was written in basic language and under BASCOM AVR software program.

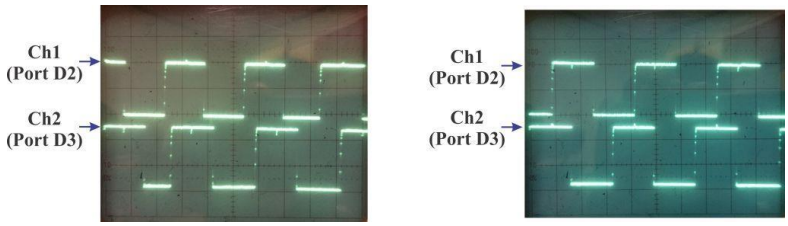
5.1. Marking position gamelan key

Gamelan key positions can be marked by using MRE sensor. MRE will record the geared DC motor, the reason is because geared motor will spin and shift the trolley of gamelan beater. So the gamelan beater will know the position of gamelan key. Marking position gamelan key data as show in Table 1.

Table 1. Gamelan Key Positions in MRE Test

Gamelan Key	MRE Sensor Value (pulse)
1	40
2	90
3	140
4	200
5	250
6	300
7	350
1'	400
2'	450
3'	500
4'	550
5'	600
6'	650
7'	700
1"	750

Table I shown the data of 15 gamelan keys that was recorded by MRE sensor. Gamelan keys record is started from home base position that was signaled by a limit switch home base sensor activation where is the location in the left side area of rail route. So the procedural of gamelan key marking is by rotating MRE sensor from the left side to the right side. It is until the 15^{th} gamelan key position was recorded. MRE sensors have channel 1 (Ch1) and channel 2 (Ch2) input data. Ch1 and Ch 2 have rectangular wave forms both of them, but in different start time. They will show in Figure 6. (a) and (b).



(a) (b)

Figure 6. (a) Output pulse of MRE sensor rotate to CW, (b) Output pulse of MRE sensor rotate to CCW

Figure 6. (a) show the rectangular wave position data in CW rotation and Figure 6. (b) show the CCW rotation of MRE sensor. One rectangular wave have 1,6 ms bandwidth and 5V input voltage. CW rotation of MRE sensor is showing that Ch1 was leading from Ch2 in output pulse. Bandwidth interval between Ch1 and Ch2 in CW rotation has obtained by 1,5 ms. CCW rotation of MRE sensor is showing that Ch1 was lagging from Ch2 in output pulse. Amount of MRE rectangular wave will be counted by ATmega 16 microcontroller. It will display the position of MRE sensor in liquid crystal display (LCD) as show in Figure 7. (a), (b), and (c).

(a) (b) (c)

Figure 7. (a) MRE sensor display at home base position; (b) MRE sensor display at first gamelan key position; (c) MRE sensor display at second gamelan key position

One rotation of MRE sensor has 38 rectangular wave pulses in Ch1 and Ch2. Figure 7 (a), (b), and (d) are showing the displays of MRE position data sensor from the gamelan key position on LCD. Notice that are R = number of MRE sensor pulse, and N = gamelan key position. The home base position is display with R = 0 pulse.

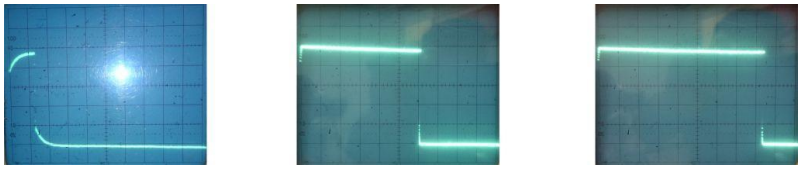
5.2. Gamelan beater test

Robot gamelan music use servo motor to actuate gamelan beater. Servo motor angle will set by giving differences PWM. There are three types from gamelan beater angle, they are $+0^o$ as start position, $+90^o$ as ready position, and $+140^o$as striking the gamelan key position. Servo motor data shown in Table 2.

Table 2. Servo motor test result actuate the gamelan beater

Servo Motor PWM Input (ms)	Position of Servo Motor Lever
0,24 ms	Position ($+0^0$)
1,20 ms	Position ($+90^0$)
1,68 ms	Position ($+140^0$)

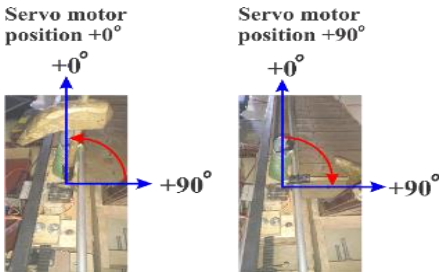
Table 2 show the PWM input for servo motor angle. PWM inputs data of servo motor have measured by the test result in the oscilloscope displays as shown in Figure 8 (a), (b), and (c). Figure 8 (a) show the input voltage in 4,9V and 0,24ms PWM bandwidth pulse for $+0^o$ position. Figure 8 (b) show the input voltage in 5V and 1,20ms PWM bandwidth pulse for $+90^o$ position. Figure 8 (c) show the input voltage in 5V and 1,68ms PWM bandwidth pulse for $+140^o$ position.



(a) (b) (c)

Figure 8. (a) PWM input of servo motor for $+0^o$; (b) PWM input of servo motor for $+90^o$; (c) PWM input of servo motor for $+140^o$

Documentation samples of positioning gamelan beater angle shown in Figure 9. (a), and (b)



(a) (b)

Figure 9. (a) Servo motor position at $+0^o$; (b) Servo motor positi at $+90^o$

5.3. Robot gamelan music playing test

Robot gamelan music is automatically playing a demo song by input at 16th button of matrix keypad 4×4. A button input in 16th is to calling a subprogram data by an arranged sequential gamelan key to make a song. The sequential gamelan keys are song lyric keys. The sequential gamelan keys will refer to MRE sensor. The sequential gamelan keys are programmed in the ATmega 16 microcontroller by using basic language. These will be positioning a geared DC motor and automatically shifting the trolley where the

gamelan beater was carried. A song that will be played by robot Gamelan music is Indonesia national song. The Indonesia national song title is Indonesia Raya. Part of Indonesia Raya lyric song shown in Figure 10.

Figure 10. Part of Indonesia Raya lyric song in the first row

Table 3. Test Result Data of Robot Gamelan Music

Lyric	Tone Notation	Gamelan Key	SP (Pulse)	PV1 (Pulse)	PV2 (Pulse)	Error	PWM Geared DC Motor	Rotation	PWM PD Control	Rotation	Servo motor Position (^{o})
In	3	3	140	139	-	1	200	CW	-	-	140
do	4	4	200	200	-	0	200	CW	-	-	140
ne	5	5	250	249	-	1	200	CW	-	-	140
sia	3'	10	500	495	499	5	200	CW	100	CW	140
ta	3'	10	500	499	-	1	200	-	-	-	140
nah	2'	9	450	450	-	0	200	CCW	-	-	140
a	2'	9	450	450	-	0	200	-	-	-	140
ir	1'	8	400	400	-	0	200	CCW	-	-	140
ku	5	5	250	249	-	1	200	CCW	-	-	140
ta	5	5	250	249	-	1	200	-	-	-	140
nah	5	5	250	249	-	1	200	-	-	-	140

Table 3 show the test result data of robot gamelan music was playing Indonesia Raya song in first row. First lyric row of "*Indonesia raya"* song is *"Indo nesia tanah air ku. Ta nah"*, by tone notation" 3=In, 4 = do, 5 = ne, 3' = sia, 3' = ta, 2' = nah, 2' = a, 1' = ir, 5 = ku, 5 = Ta, 5 = nah ". So step for geared DC motor directional rotation in the first row lyric, as follow:

a. The tone notation from 1^{th} to 3^{rd} (*"In"* lyric), DC gear motor turn on CW with the first present value (PV1) 3^{rd} tone notation = 139 from set point (SP) 3^{rd} tone notation = 140, Gamelan mallet is active.
b. The tone notation from 3^{rd} to 4^{th} (*"In do"* lyric), DC gear motor turn on CW with PV1 4^{th} tone notation = 200 and error = 0 from SP 4^{th} tone notation = 200, Gamelan mallet is active.
c. The tone notation from 4^{rd} to 5^{th} (*"do ne"* lyric), DC gear motor turn on CW with PV1 5^{th} tone notation = 249 and error = 1 from SP 5^{th} tone notation = 250, Gamelan mallet is active.
d. The tone notation from 5^{rd} to 3^{rd} (*"ne sia"* lyric), DC gear motor turn on CW with PV1 3^{rd} tone notation = 495 and error = 5 from SP 3^{rd} tone notation = 500, Gamelan mallet will not active. It becaused error (Err) bigger than the terms error tolerance. It is by Err < 3. Error is 5 point, then by using calculation formula of PWM PD control was obtained a positive PWM value, then it will instruct geared DC motor in CW directional rotation. After geared DC motor turn on CW directional rotation, the second present value (PV2) 3^{rd} tone notation were obtained by 499 pulse and error = 1. By the error = 1, it will qualify terms error tolerance Err = 1 < 3 and Err = 1 > -3. Finally Gamelan mallet will active.
e. The tone notation from 3^{rd} to 3^{rd} (*"In"* lyric). Geared DC motor will not rotate, it is because geared DC motor position still using 3^{rd} tone notation. PV1 3^{rd} tone notation = 499 and error = 1 from SP 3^{rd} tone notation = 500. Gamelan mallet will active.
f. The tone notation from 3' to 2' ("*Ta nah"* lyric), geared DC motor will turn on CCW with PV1 2' tone notation = 450 and error = 0 from SP 2' tone notation = 450, Gamelan mallet is active.
g. The tone notation from 2' to 2' ("*nah a"* lyric), geared DC motor will not rotate, it is be caused geared DC motor position still using 2' tone notation. PV1 2' tone notation = 450 and error = 0 from SP 2' tone notation = 450. Gamelan mallet will active.

h. The tone notation from 2' to 1' ("*a ir*" lyric), geared DC motor will turn on CCW with PV1 1' tone notation = 400 and error = 0 from SP 1' tone notation = 400, Gamelan mallet is active.
i. The tone notation from 1' to 5^{th} ("*ir ku*" lyric), DC gear motor will turn on CCW with PV1 5^{th} tone notation = 249 and error = 1 from SP 5^{th} tone notation = 250, Gamelan mallet is active.

The directional rotation steps processing of geared DC motor in the first row of Indonesia raya lyric song and tone notation will be showed on the screen display oscilloscope in Figure 11.

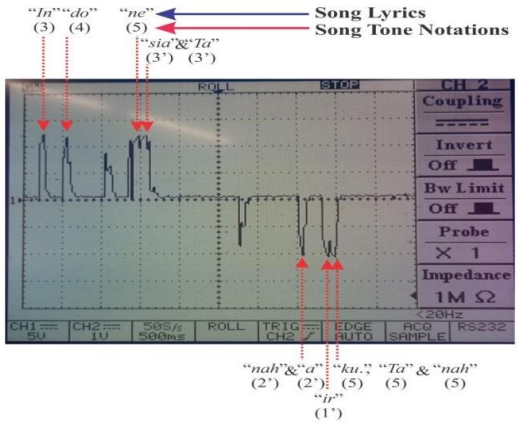


Figure 11. Voltage data response of geared DC motor position toward gamelan key position for "Indonesia Raya" in the first row song lyric.

6. CONCLUSION

The conclusions of robot gamelan music research as follow:

1. Matrix keypad 4×4 are used as manual button of 15 Gamelan tones and 16^{th} button as demo song button.
2. Limit switch sensor function as home base marker position and route protection of robot movement.
3. Position of magnetic rotary encoder rotation data was used as set point register for Gamelan key position.
4. Pulse data of magnetic rotary encoder sensor were used as feedback control while aiming to set point data.
5. Gamelan beater will be sounding a gamelan key by setting servo position in $+140^{o}$ and setting servo position in + 0^{o} as a normal position.
6. Robot Gamelan music is using PD feedback control to pushing down the error of geared DC motor position.
7. Robot Gamelan music is only playing slow rhythm songs.
8. Robot Gamelan music is only playing song with medium octave.
9. Long response interval of geared DC motor moving rotation, it caused the robot Gamelan music cannot play song quickly.
10. Robot Gamelan music can play "Indonesia Raya" song in the video documentation [14].

REFERENCES

[1] T.P Tomo, G. Enriquez, and S. Hashimoto. "Indonesian puppet theater robot with gamelan music emotion recognition", *in Robotics and Biomimetics Proceeding, 2015 IEEE International conference on*, December 2015, pp. 1177-1182.
[2] J. Hilder and J. Sutrisno (1992, June). Central Javanese Gamelon Handbook. Victoria University of Wellington.
[3] Sutton, R. Anderson.1975. The Javanese Gambang and Its Music. (M.A thesis) University of Hawaii.
[4] Brandts Buys, J.S., and A. Brandts Buys-van Zijp.1938. Javaansche gending's bij Land en bij Seelig. Djawa 18:182-225.
[5] D. Engin, and M. Engin, "Auto-tuning of PID parameters with programmable logic controller", in *Mechatronics and Automation Proceeding, 2013 IEEE International conference on*, August 2013, pp. 1469-1474.
[6] C. G. Oh, and J. Park, "The kinetic xylophone: an interactive musical instrument embedding motorized mallets", in *Robot and Human Interactive Communication (RO-MAN), 2013 IEEE International symposuium on*, August 2013, pp. 292-293.

[7] P. Nalajala, B. Godavarth, M.L. Raviteja, and D. Simhadri, "Morse code generator using microcontroller with alphanumeric keypad", in *Electrical, Electronic, and Optimization Technique (ICEEOT), 2016 IEEE International conference on*, March 2016, pp. 762-766.
[8] Shimon Y. Nof (1999, February). Handbook of industrial robotic 2nd edition. Jhon Wiley and Sons, Inc.
[9] K. Miyashita, T. Takahashi, and M. Yamanaka, "Features of a magnetic rotary encoder", *IEEE Trans. Mag.*, vol. 23, no. 5, pp. 2182-2184, Sept. 1987.
[10] B. Choudhury, T.S. Choudhury, A. Pramanik, W. Arif, and J. Mehedi, "Design and implementation of an SMS based home security system," in *Electrical, Computer and Communication Technologies (ICECCT), 2015 IEEE International Conference on*, March 2015, pp. 1-7.
[11] I.S. Jung, J.M. Seo, J.H. Kim, and S.H. Rhyu. "Development of slotless type brushless DC motors and planetary gear head for robot," in *Ubiquitous Robots and Ambient Intelligence (URAI), 2012 IEEE International Conference on*, Nov 2012, pp. 445-448.
[12] *Workshop KRI-KRCI 2007*, Institute of Technology Surabaya, Surabaya, 2007.
[13] S. Bencharef, and H. Boubertakh, "Optimal tuning of a PD control by bat algorithm to stabilize a quadrotor", in Modeling, Identification, and Control (ICMIC), 2016 *IEEE International Conference on*, November 2016, pp. 938-942.
[14] Handri Azhar. 2016. RoGal (Robot Gamelan) Main Lagu Indonesia Raya. http://www.youtube.com/watch?v=z-tQwy2bv3Q&t=5s. Access in August 5, 2016.

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