



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**DEVELOPMENT OF AUTOMATIC GAMELAN MECHANICAL
PLAYER USING ARDUINO MICROCONTROLLER AND
NDFEB MAGNET**

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electrical Engineering Technology (Industrial Automation and Robotics) With Honours.

by

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I hereby, declared this report entitled Development of Automatic Gamelan Mechanical Player Using Arduino Microcontroller and NdFeB Magnet is the results of my own research except as cited in references.

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APPROVAL

This report is submitted to the Faculty of Mechanical and Manufacturing Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Automotive) with Honours. The member of the supervisory is as follow:

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ABSTRAK

Pada masa kini, muzik Gamelan yang terkenal dengan melodi dan muzik sentimentalnya semakin pudar dan jarang didengari oleh generasi muda. Selain itu, instrumen Gamelan dan ahli muzik yang terlatih sukar ditemui di kalangan anak-anak muda. Oleh itu, Pemain Mekanikal Gamelan Automatik dengan menggunakan Arduino Mikrokontroler dan NdFeB Magnet dihasilkan. Projek ini adalah untuk merekabentuk, mengarang, merangsang dan menguji Pemain Mekanikal Gamelan Automatik untuk memainkan muzik Gamelan yang difokuskan pada Bonang, sebahagian daripada Gamelan. Pemain Mekanikal Gamelan Automatik akan dikawal oleh mikrokontroler Arduino. Data nod muzik Gamelan akan dibaca oleh Arduino IDE dan IDE Pemrosesan dan menukar kepada isyarat sebagai input untuk mikrokontroler Arduino. Selain itu, isyarat yang dijana oleh Arduino akan dihantar kepada Pemandu Gate untuk menghasilkan arus tinggi untuk IGBT dari arduino semasa yang rendah. IGBT akan digunakan sebagai kelajuan pensuisan pantas untuk membolehkan daya elektromagnet untuk mekanisme mengetuk dalam tindak balas pantas. Pemain Mekanikal Gamelan Awam ini akan mengetuk Gamelan Bonang dengan daya tinggi dan tindak balas yang cepat. Terdapat beberapa faktor yang mempengaruhi magnitud daya mengetuk yang dihasilkan, iaitu pembekalan, bilangan giliran gegelung solenoid, sifat magnet dan kecekapan fluks yang dihasilkan. Oleh itu, Pemain Mekanikal Gamelan Automatik ini akan menjalani beberapa eksperimen dan ujian untuk menyiasat keupayaan dan prestasi projek ini.

ABSTRACT

Nowadays, the Gamelan music that famous for its melody and sentimental music is getting faded and rarely heard by the youth generations. Furthermore, the Gamelan instruments and the well-trained musicians are hardly to find among the youngsters. Therefore, the Automatic Gamelan Mechanical Player using Arduino Microcontroller and NdFeB Magnet is developed. This project is to design, fabricate, stimulate and test the Automatic Gamelan Mechanical Player to play the Gamelan music that be focussed on Bonang, part of Gamelan. The Automatic Gamelan Mechanical Player will be controlled by the Arduino microcontroller. The Gamelan music node data will be read by the Arduino IDE and the Processing IDE and change to signal as the input for the Arduino microcontroller. Other than that, the signal generated by the Arduino will be transmitted to the Gate Driver to produces a high current for IGBT from the low current of Arduino. The IGBT will be used as its fast switching speed to enable the electromagnetic force for the knocking mechanism in the fast response. This Automatic Gamelan Mechanical Player will knock the Gamelan Bonang with a high force and fast response. There are several factors that affects the magnitude of the resultant knocking force, which is the supply, number of turn of solenoid coils, magnet properties and the efficiency of the resultant flux. Thus, this Automatic Gamelan Mechanical Player will undergo several experiments and tests to investigate the ability and performance of this project.

DEDICATION

This project I dedicate to my beloved family especially my parents who always been by my side. Their love and support give me some moral and motivate to achieve my dream in my life. I would to thank to them for their sacrifices and support me all the times.

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LIST OF SYMBOLS

NdFeB	-	Neodymium Iron Boron
IDE	-	Integrated Development Environment
FSR	-	Force Sensitive Resistors
IGBT	-	Insulated Gate Bipolar Transistor

CHAPTER 1

INTRODUCTION

1.1 Background

Gamelan is the traditional ensemble music of Java and Bali in Indonesia and has grown around the Southeast Asian country. Due to the modernization, the musicians prefer the modern musical instruments and make the Gamelan's name less known by the young generations. Thus, this project is to give an opportunity to make an Automatic Gamelan Mechanical Player by Using Microcontroller and NdFeB Magnet for raising the spirit of traditional music especially for Gamelan music.

1.2 Gamelan

Gamelan is the traditional music instrumental which has long been introduced in Indonesia in general. But, this Gamelan also popular and can be found in other Southeast-Asian such as Malaysia, Philippine, Thailand and others nearby countries. In history, the word of Gamelan is originated from the root word "Gamel" (Javanese), which mean to hit or to do and "Gambel" (Balinese) means to play musically. This root word is based on a musician that makes a sound by striking or playing the melodic instruments. Hence, Gamelan refers to the whole ensemble of percussive instruments that made of bronze, iron, wood or bamboo bar. Gamelan is the combination of multiple music instruments consist metallophones, xylophones, flutes and gongs. Basically, Gamelan is usually play for traditional performance or ritual and ceremonies. Wayang kulit player also usually

collaborates with the gamelan's musician as a soul and spirit for the wayang kulit performances.

The Malay Gamelan is believed to exist in Riau-Lingga Sultanate since the 17th century. Pahang and Terengganu also believed to be the early existence at Malay land. The dancers and musicians with the gamelan instruments are brought to play gamelan to give honour for royal wedding. The nation's earliest rhythms were nearly connected by correspondence and declarations. In the past, this gamelan music only played for royal family at the palace. But, for today, the gamelan is played for citizen for formal events such as wedding and ceremony.

However, the popularity of Malay gamelan has declined dramatically due to the presence of modern music genre. The youngsters nowadays are not interested anymore in traditional music and the techniques of modern musical instruments that are easier and more convenient compared to traditional one. Hence, Aaron Taylor Kuffner has implemented a project and introduced Gamelatron to the public as an innovation by combining the modern and traditional, between robotics and gamelan to continue the legacy. Gamelatron is the world's first completely automated Gamelan symphony fully without human help to play.

In this project, an automated Gamelan mechanical player will be implemented. The system is built up of an electromagnetic knocking mechanism and controlled by a microcontroller. To perform more better, the knocking mechanism and microcontroller that are paired with gate driver and power electronic switch (IGBT).



Figure 1.2.1: A Set of Gamelan

1.3 Problem Briefing

This project, automated Gamelan mechanical knocking mechanism is to design, stimulate, fabricated, and test the automated Gamelan to play the Gamelan. This system is use the electromagnetic function as knocking mechanism with the combining of permanent magnet (NdFeB) and the solenoid coil. The NdFeB permanent magnet will play as main role that produce the electromagnetic power that will be able to knock the Gamelan Bonang with high force and quick response. The number of loop of solenoid coil also can affect the strength of the electromagnetic field cause by the NdFeB permanent magnet.

This project uses the gate driver as the low-power input from the microcontroller and produce high-current that will be supplied to gate of power transistor (IGBT). Furthermore, this system is controlled by a microcontroller, Arduino as the main component that control the whole Gamelan knocking mechanism that act as interfaces between the software and hardware.

1.4 Problem Statement

Gamelan is traditional music that been popular in South East Asia. In Malaysia and Indonesia, Gamelan is commonly played for formal ceremonies and occasions. The combinations of gamelan and dance make gamelan has made gamelan a major and recognizable music in the past. Nowadays, the performer got less chance to perform the Gamelan music except only played for traditional music council and festival. Due to the lack of demand for gamelan performances, the name of gamelan became increasingly unrecognizable and unfamiliar. The uniqueness of the sound and melodies of gamelan are rarely heard due to the modern music that became more popular amongst the youngster nowadays. Other than that, well-trained musicians also hardly to find because of the toughness of gamelan's practices compare to other musical instruments that can be practices in short of time.

In the absence of an effort to make innovation or improvement to gamelan, it will become historical remains for the youngsters and its fascinated and delighted sound that only recognized by the older generation. Therefore, this project is created in hope to solve the problem with innovative combination between gamelan and robotics and maintain the unique sounds of gamelan.