ROBUST GAMELAN BONANG HAMMER ACTUATOR

LAM SOON TENG

MAY 2008

"I hereby declared that I have read through this report and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Electrical Engineering (Power Electronic and Drive)"

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Date : 23 April 2008

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Fakulti Kejuruteraan Elektrik
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"I hereby declared that this report is a result of my own work except for the excerpts that have been cited clearly in the reference."

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ABSTRACT

Robust Gamelan Bonang Hammer Actuator is a project to create an actuator that can play gamelan automatically controlled by a computer. Microcontroller, AT89S52, will be used as controller. This project is divided into three sections which are constructing microcontroller and driver circuit, writing a software and mechanical hammer design. Overall, goal for this project is to construct actuator control circuit and hammer mechanism to knock gamelan bonang according to music notes.

ABSTRAK

Projek *Robust Gamelan Bonang Hammer Actuator* ialah suatu projek untuk mencipta satu penggerak yang boleh memainkan gamelan secara automatik yang dikawal oleh sebuah komputer. Mikropengawal, AT89S52, akan digunakan sebagai penguasa. Projek ini adalah terbahagi kepada tiga seksyen iaitu membina litar mikropengawal dan litar pemacu, menulis satu perisian dan mereka bentuk satu tukul mekanikal. Pada keseluruhannya, matlamat projek ini adalah untuk membina litar kawalan penggerak dan mekanisme tukul untuk memukul gamelan bonang menurut nod-nod muzik.

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CHAPTER 1

INTRODUCTION

1.1 Overview

Machine is a mechanical or electric instrument that uses to send or change energy to do or help people in work implementation. Normally development a machine needs an input as directive to send energy and transformed it into an output.

Machine has been changing human condition towards developed. Main difference between machine and people is sourcing of energy and operation. Machine is more efficient. Machine term refers to those mechanical do the job. Usually these tools display its working style with change an authority figure to form another.

The main purpose of created machine is to facilitate works which does. It can save energy and time of people. To now considerable time machine has been renewed more sophisticated follow the march of time. Since machine can make people life be better, therefore there is an attempt to design an automated gamelan playing system.

Gamelan is a way of linking individuals in social groups. Gamelan music is performed as a group effort, and so there is no place for an individual showoff. Traditionally, gamelan is only played at certain occasions such as ritual ceremonies, special community celebrations, shadow puppet shows, and for the royal family. Gamelan is also used to accompany dances in court, temple, and village rituals. Besides providing music for social functional ceremonies, gamelan also provides a

livelihood for many professional musicians, and for specialized craftsmen who manufacture gamelan.

Today, although gamelan music is still used for ritual ceremonies and the royal family, it is also performed as concert music at social and cultural gatherings to welcome guests and audiences. Gamelan is also used to accompany many kinds of both traditional and modern dances, drama, theatrical and puppetry.

Gamelan playing machine is machine that can replace human that would play gamelan. This machine is designed is to facilitate more music way played. Gamelan will be played without use manpower. Since lately, majority young generation do not have interested with this traditional music instrument. So that gamelan will not outdate from time, machine is designed by using technology sophisticated follow the march of time.

An automated gamelan playing system is needed to design for this project. This machine is utilizing hardware as solenoid and microcontroller. This playing machine is created by combination in among the hardware with microcontroller. Microcontroller is functioned to control all task has been programmed. This gamelan playing system can control by computer. Player can key in the notes which needed into computer. Once computer receive the signal from consumer, the gamelan playing system will played. In this project, C language is used to write the program.

1.2 Introduction of Gamelan

Gamelan is an indigenous Indonesian orchestra composed largely of pitched percussion instruments. These appear in the form of knobbed gongs, some of which are suspended and some laid out horizontally on rope supports and keyed metallophones, mounted on trough or tubular resonators. Additional instruments are often included such as various types of drums, bamboo flutes, bowed and plucked string instruments, drums as well as solo and choral singing.

Although similar ensembles are found in other parts of Southeast Asia, gamelan (used here as a collective noun) are primarily found on the islands of Java,

Madura, Bali, Lombok and Borneo, in the country of Indonesia. There are many regional gamelan types found on the islands of Java and Bali, each with its own idiosyncratic instrumentation, tuning and repertoire. It has been said that indeed, every gamelan has its own unique tuning and sonic personality. [1]

1.3 Project Objectives

Generally, the main objectives of this project are as below:

1. To design hammer knocking mechanism for gamelan bonang.
2. To design a controller that receives input from computer with parallel communication.
3. To design a driver circuit to ensure the actuator function properly as require function controller.
4. Write a program in C language for microcontroller to activate actuator.

1.4 Scope of Project

Project Robust Gamelan Bonang Hammer Actuator is a project to design an automated playing system which held by computer. This project aims to facilitate the way of play gamelan without player. Program shall be programmed into system microcontroller.

Microcontroller is an integrated circuit which it uses for receives and supply signal. In other words, it functions as processor centering on control hardware. After receiving any signal from the consumer, microcontroller which was programmed will direct bashful to respond knocking to gamelan bonang.

This project is divided into three sections which are constructing microcontroller and driver circuit, writing a software and mechanical hammer design. The most important of this project is to design mechanical hammer which able to play bonang according to the note with a good sound.

1.5 Problem Statement

Gamelan is one of the musical instruments played by society Melayu immemorial. Gamelan really was music that originated from Jawa, Indonesian. Gamelan also is one of a music produce from the merger several musical instrument as kendang, kenong, gong, bonang and several other musical instrument. Currently, this gamelan is less popular because gamelan is traditional society music Melayu and it almost unknown by society currently. Apart from that, gamelan also is one of music have been drifting swallow time result rapid development. Gamelan is under game played currently. Therefore, no those innovations was done to maintain this game. This game did not even experience development and development process by modern. This is may be caused by this music has no rank among society today, then it difficult to be developed. Apart from that, this gamelan just will be played in council which involves traditional music.

Since this gamelan is not developed by modern, then it still stays in old notch. Nowadays, there is still no existing gamelan playing system that can include and display node to music gamelan. This situation shows that society still play this musical instrument by manually with train players to be playing this gamelan. Although this musical instrument no as great as musical instrument modern as piano, guitar or drum, this gamelan device could be developed also while it still maintain rhythm or tempo and ordinary music played. This development process is to facilitate more device gamelan this played but consumer must know how to use this system.

CHAPTER 2

LITERATURE REVIEW

2.1 Gamelan Playing Machine (Software) [11]

This project is purposely to create a program by using C language with Turbo C compiler. This software is able to play the music device (called gamelan) operates with microcontroller. This software is used as key function to setting up the music node and tempos. This software is connected to microcontroller circuit by using serial port. Input data transferred to microcontroller and the microcontroller made movement on the gamelan playing device. For this project 8051 microcontroller processor is used for the microcontroller. The Turbo C compiler is used for consumer to key in data with variable node and tempo to make the gamelan music device play variable sound.

How did this paper contribute to the project?

- Gives more knowledge about the microcontroller
- Gives an idea about how to compile C language

2.2 Gamelan Playing Machine (Hardware) [9] & [10]

This project basically refers to the condition of creating one algorithm that can play gamelan automatically controlled from the personal computer. This function come in handy where it does not need any player in playing the instrument but directly controlled by computer. Microcontroller used in this project is MC 8051. This microcontroller is the centre controller for all movement of the gamelan playing machine.

Main section of this project is the hardware implementation for holder structure. The hardware for the gamelan knocking system indeed needs to be flexible and able to process input from program creation section.

How did this paper contribute to the project?

- Gives more knowledge in hardware implementation
- Gives an idea in designing the gamelan knocking system

2.3 History of Gamelan in Malaysia

According to [11], gamelan is either tradition art music Malay since long centuries ago. This gamelan is palace dance period which is said beginning from *Kesultanan Riau-Lingga* introduced when reign of Sultan Abdul Rahman II. At beginning gamelan played in the temple or pretended in Jawa worship for god's ceremony. At that time, each player are required carry one musical instrument only because it staggering.

Gamelan began to be brought access to Tanah Melayu by the Sultan Pahang, Sultan Ahmad, after listening music by himself which played when child marriage ceremony of *Raja Kepulauan Riau-Johor* , Raja Ali Haji, in *Pulau Penyengat*. Majesty interest for this kind of music resulted majesty bring back one set of gamelan equipment to Pahang. This music develops further to Terengganu when Tengku Meriam (son of

Sultan Ahmad) marries with the child sultan of Terengganu, Sultan Zainal Abidin II. Music gamelan also is being played during the royal marriage. Sultan Zainal Abidin II interested with gamelan and has brought this instrumental of gamelan to Terengganu after death of Sultan Ahmad.

Sultan Zainal Abidin II and Tengku Ampuan Meriam had coached the children who among 8 to 10 years old to be playing this music equipment and dance. Tengku Ampuan Meriam was much help in development of this music gamelan with diversify music that the present to suit with favorite sultan. Tengku Ampuan Meriam also gets coaching and art upbringing gamelan from her mother, Che Subaidah. At time of Sultan Zainal Abidin II, gamelan only is being played at the palace to celebrate plenty official and welcome certain celebrations. This gamelan dance only can dance by girl and accompanied by instrumentals as gambang, saron, bonang, kenong and gong.

Gamelan reputed has more than 39 type dances that part of it is created personally by Tengku Ampuan Meriam which complies with flag stories. Each movement gamelan dance pulled by dancer has purpose and its distinctive story. For example *Tarian Taman Sari* tell Queen of Sultan Daha merry-making with plenty handmaiden and her baby-sitter. While *Tarian Ketam Renjang* also pulled by dancer follow crab gesture. Other dance is like *Timang Burung*, *Lantai Lima* and *Ayak-ayak*

2.4 Instruments of Gamelan

The instruments used in gamelan are included: saron (a metallophone),peking, gambang (a xylophone), keromong or bonang (sets of small kettle gongs), kenong (larger kettle gongs), gong, gendang or drums and gender. Figure 2.1 to Figure 2.8 show the instruments of gamelan.

Figure 2.1 Gambang, [1]

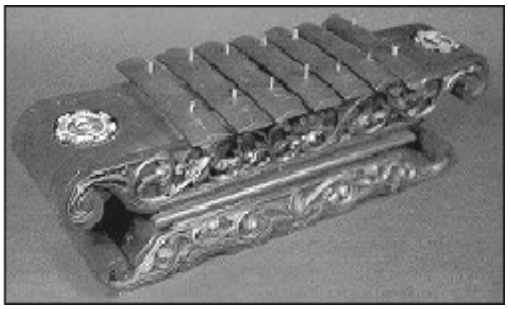

Figure 2.2 Saron, [1]

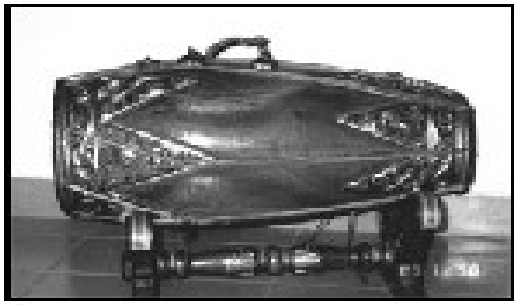

Figure 2.3 Gendang, [1]

Figure 2.4 Bonang, [2]

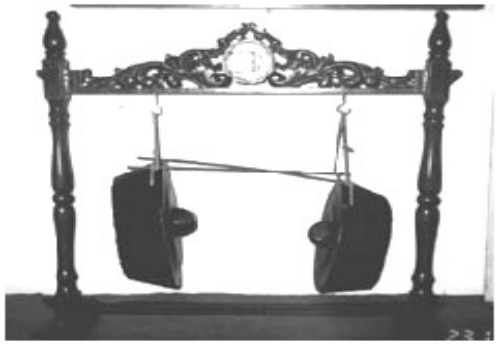

Figure 2.5 Gong, [1]

Figure 2.6 Kenong, [2]

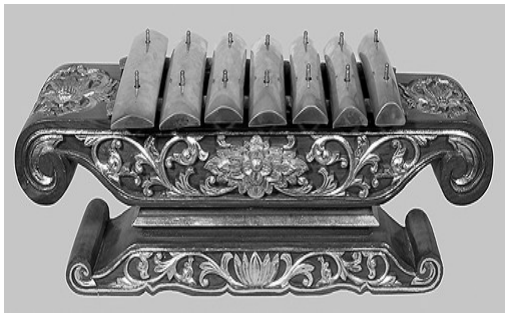

Figure 2.7 Peking, [2]

Figure 2.8 Gender, [1]

2.5 Introduction to Parallel Port Communication

Parallel port is a port contains a set of signal lines that the CPU sends or receives data with other components. Normally this kind of port used to communicate via modem, printer, keyboard, mouse etc. In signaling, open signals are "1" and close signals are "0" so it is like binary system. A Standard Parallel Port sends 8 bits and receives 5 bits at a time. The serial port RS-232 sends and receive 1 bit at a time.

The Parallel Port is the easiest way to control devices outside the PC, like LEDs, lights and even home appliances. In fact the idea behind parallel port is really simple. It is an 8-bit parallel interface, so there are eight bits available. Simple put, since each data bit can be set as either “0” (“turned off”) or “1” (“turned on”), user can directly turn on or off up to eight devices.

On the PC the parallel port uses a 25-pin connector (called DB-25, 25-pin D-sub or 25-pin D-shell) as shown in Figure 2.9. The Parallel Port actually has 32 pins.

- 8 - Data Pins (shown in yellow)
- 8 - Control Pins (shown in red)
- 8 - Status Pins (shown in blue)
- 8 - Ground Pins (shown in green)

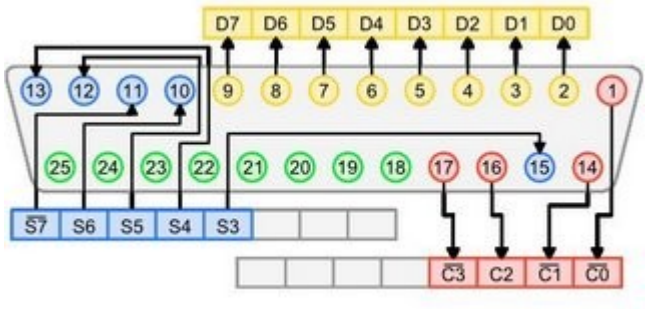

Figure 2.9 Parallel Port, [5]

But only 25 pins were required to run a printer through it, so rest of the pins (not shown in above picture) were not made available outside the mother board.

- 8 - Data Pins
- 4 - Control Pins
- 5 - Status Pins
- 8 - Ground Pins

Data pins are used to send 8-bits of data. Pins 2 to 9 are data pins or 8-bit data bus (D0 – D7). This data bus carries 8-bit data at any instant of time as shown in Figure 2.10.

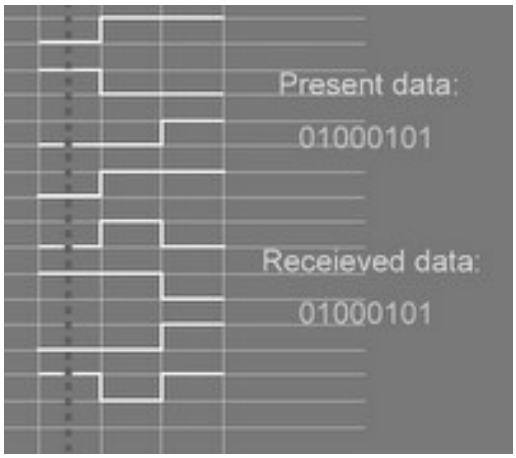

Figure 2.10 Data Bus Carries 8-bits Data, [5]

The type of data it carries is in digital form, i.e. either 0 or 1.

- '0' means OFF or 0 volts.
- '1' means ON or 5 volts.

For example, if pin 2 is carrying '0', then it will give 0 volts at output. And if it is carrying '1', then it will give 5 volts at its output. Similarly user will get output as 0 volts or 5 volts from other data pins. User has to send '0' or '1' to each pin (D0-D7) simultaneously. Each Data Pin has been assigned a bit value as shown in Table 2.1.

Pin #	Label	Bit Value
2	D0	$2^0 = 1$
3	D1	$2^1 = 2$
4	D2	$2^2 = 4$
5	D3	$2^3 = 8$
6	D4	$2^4 = 16$
7	D5	$2^5 = 32$
8	D6	$2^6 = 64$
9	D7	$2^7 = 128$

Table 2.1 Bit Value of Data Pin, [5]

D7 is the most significant bit and D0 is the least significant bit. This means, if user send any data say '16' , then '1' will be sent to D4 and '0' to rest of the pins. Similarly '255' will send '1' to each pin. [5]

2.6 Microcontroller

Microcontroller is a highly integrated chip that contains all the components comprising a controller. Typically this includes a CPU, RAM, some form of ROM, I/O ports, and timers. Unlike a general-purpose computer, which also includes all of these components, a microcontroller is designed for a very specific task -- to control a particular system. As a result, the parts can be simplified and reduced, which cuts down on production costs.

Microcontrollers are sometimes called *embedded microcontrollers,* which just mean that they are part of an embedded system which is one part of a larger device or system as shown in Figure 2.11.

A microcontroller (or MCU) is a computer-on-a-chip. It is a type of microprocessor emphasizing self-sufficiency and cost-effectiveness, in contrast to a general-purpose microprocessor (the kind used in a PC). In addition to all arithmetic and logic elements of a general purpose microprocessor, the microcontroller usually also integrates additional elements such as read-only and read-write memory, and

input/output interfaces. Microcontrollers are frequently used in automatically controlled products and devices, such as automobile engine control systems, office machines, appliances, power tools, and toys. By reducing the size, cost, and power consumption compared to a design using a separate microprocessor, memory, and input/output devices, microcontrollers make it economical to electronically control many more processes. [18]

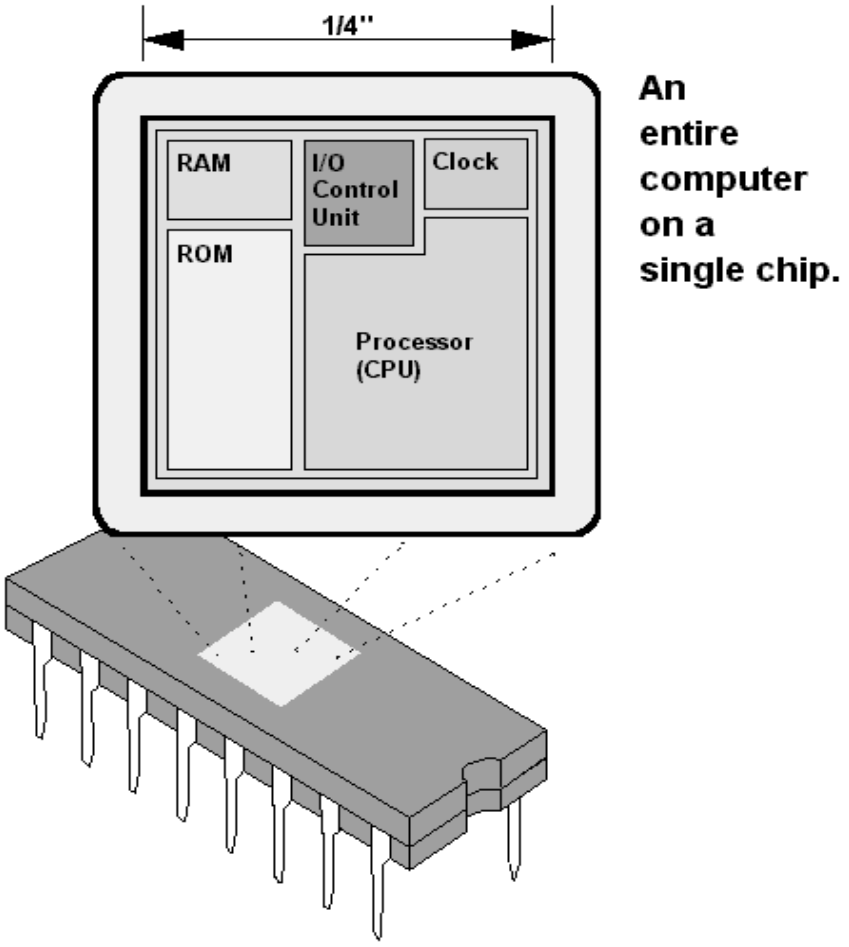

Figure 2.11 Elements in Microcontroller, [18]