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Faculty of Electrical and Electronic Engineering Technology

SMART ABACUS EDUCATIONAL APPS EMBEDDED WITH ABACUS HARDWARE AS PRIMARY STUDENTS EDUCATIONAL KIT

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

NUR HIDAYATUL FARAHI BINTI ABDULLAH

Bachelor of Electronics Engineering Technology (Telecommunications) with Honours

2021

SMART ABACUS EDUCATIONAL APPS EMBEDDED WITH ABACUS HARDWARE AS PRIMARY STUDENTS EDUCATIONAL KIT

NUR HIDAYATUL FARAHI BINTI ABDULLAH

A project report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Electronics Engineering Technology (Telecommunications) with Honours

Faculty of Electrical and Electronic Engineering Technology

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Tajuk Projek : SMART ABACUS EDUCATIONAL APPS EMBEDDED WITH ABACUS HARDWARE AS PRIMARY STUDENTS EDUCATIONAL KIT

Sesi Pengajian : 2021

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DECLARATION

I declare that this project report entitled “Smart Abacus Educational Apps Embedded With Abacus Hardware As Primary Students Educational Kit” is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : Farahi

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Date : 10 / 01 / 2022

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APPROVAL

I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Electronics Engineering Technology (Telecommunications) with Honours.

Signature : 

Supervisor Name : ELIYANA BINTI RUSLAN

Date : 11 / 01 / 2022

DEDICATION

I acknowledge my sincere dedication, honors and gratitude to both of my parents for their love, encouragement, supports, and sacrifices throughout whole of my life. Without their sacrifices and encouragement, I cannot possibly reach this stage. Special gratitude also dedicated to my parents which always support and advise me in whatever I do in my life. Special thanks to all of lecturers especially my supervisor Madam Eliyana Binti Ruslan and my co-supervisor Madam Dayanasari Binti Abdul Hadi, who had taught and guided me throughout my studies and during this Bachelor Final Project 1 and 2 progress. I would like to thank all my friends who always been with me throughout this challenging semester and help me during movement control order (MCO). I hope all of their supports and encourage will help me make this project a success.

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ABSTRACT

Abacus is a traditional mathematical tool for calculation that are already exist for a long time, which is widely used in China, Japan and Russia. With the development of technology, the educational of abacus has been improved from time to time. From traditional methods to the utilization of PC application like courseware and website, and also in mobile application such as smartphones and tablets. The abacus calculation tool is a must learn for all first level of elementary school students in Malaysia. Nonetheless, abacus learning is very boring, because it includes repetitive exercises and endless exercises. In addition, Malaysia's abacus education still uses traditional methods, which needed students to remember calculation methods. Using Arduino Mega to develop smart abacus is to combine the functionality of abacus with electronic equipment to provide better visualization of abacus operation. The main focus of this technology is to help elementary school students verify basic arithmetic operations. In order to save time for learning abacus, smart abacus was introduced. The main goal of the project is to make smart abacus easy to learn and use. The concept of the planned device is to combine the traditional abacus with the mobile application. The smart abacus can perform task by displaying values consistent with the beads on LCD display. The hardware utilized in the development of smart abacus is 4+1 bead type Japanese abacus (Soroban), Arduino Mega microcontroller and 4-way infrared (IR) sensor. The open source Arduino software (IDE) is employed to program the microprocessor in C language. From observation, it is obvious that the smart abacus can operate with success to perform mathematical operations.

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ABSTRAK

Abakus adalah alat tradisional matematik untuk pengiraan, digunakan secara meluas di China, Jepun dan Rusia yang telah wujud untuk satu jangka masa yang lama. Dengan kemajuan teknologi, pendidikan sempoa bertambah baik dari semasa ke semasa. Dari kaedah tradisional hingga penggunaan aplikasi pc seperti perisian dan laman web, dan juga dalam aplikasi mudah alih seperti telefon pintar dan tablet. Alat pengiraan sempoa mesti dipelajari untuk semua pelajar sekolah rendah tahap satu di Malaysia. Namun, pembelajaran sempoa sangat membosankan, kerana merangkumi latihan berulang dan latihan tanpa henti. Di samping itu, pendidikan sempoa di Malaysia masih menggunakan kaedah tradisional, yang memerlukan pelajar mengingati kaedah pengiraan. Menggunakan Arduino Mega *untuk mengembangkan* Smart Abacus *adalah menggabungkan penggunaan abakus dengan peralatan elektronik untuk memberikan visualisasi operasi sempoa yang lebih baik. Fokus utama teknologi ini adalah untuk membantu pelajar sekolah rendah mengesahkan operasi aritmetik asas. Untuk menjimatkan masa untuk belajar sempoa,* Smart Abacus *diperkenalkan. Matlamat utama projek ini adalah menjadikan* Smart Abacus *mudah dipelajari dan digunakan. Konsep peranti yang dirancang adalah untuk menggabungkan sempoa tradisional dengan aplikasi mudah alih.* Smart Abacus *dapat melakukan tugas dengan menampilkan nilai yang selaras dengan manik pada layar* LCD. *Perkakasan yang digunakan dalam pengembangan* Smart Abacus *ialah sempoa Jepun jenis 4 + 1 (Soroban), mikrokontroler* Arduino Mega *dan* 4-way IR sensor. *Perisian* Arduino *sumber terbuka* (IDE) *digunakan untuk memprogram mikropemproses dalam bahasa C. Dari pemerhatian, jelas bahawa* Smart Abacus *dapat beroperasi dengan berjaya untuk melakukan operasi matematik.*

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LIST OF SYMBOLS

µ	-	Micro

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LIST OF ABBREVIATIONS

V	-	Voltage
℃	-	Celcius

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CHAPTER 1

INTRODUCTION

This chapter consist the background of the project, problem statement, the objectives by doing this project and scope of the project. It will give out the main reason of doing this project and the idea how this project will be creating.

1.1 Background

An abacus is a calculating instrument using beads slide along a series of wires or poles set in the frame to represents decimal places. May be Babylonian Origin is the ancestor of today's modern digital technology calculator. Start with the bargains of the Middle Ages throughout Europe and the Arab world, it is replaced by arithmetic operations based on Indian Arabic numerals. It used in Europe after the 18th century and is still in use today Middle East, China and Japan (Merriam Webster.com). The abacus is called the first external assist in calculating mathematics or computing equipment. This is interestingly, the first use of beads is mathematics. The abacus was first used in 2400 BC by Babylonian Origin. In the first century in China and India, record that the abacus with beads has been used. This is estimated that the abacus was once in Rome or Greece around 300 BC (Boyer & Merzbach, 2011).

There are many different types of abacus used. These various abacus different names from different countries. Three main types of abacus are the abacus of Japan, China and Russia. The Japanese abacus is also called Soroban, and Soroban it is further divided into two types, 5 + 1 beads on each rod as shown in Figure 1.1 and 4 + 1 beads type as

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shown in Figure 1.2. The Chinese abacus is called Suanpan and the Russian abacus is called Stschoty, these are shown in Figure 1.3 and Figure 1.4 respectively (Lutjens, 2012).They are divided into two layers, and the beads on the upper layer are called "heaven" beads, the lower layer is called "earth" beads (Frank & Barner, 2011). These two kind of Soroban as shown in Figure 1.1 and Figure 1.2, Suapan and Stschoty have different numbers of beads Figure 1.3 and Figure 1.4.

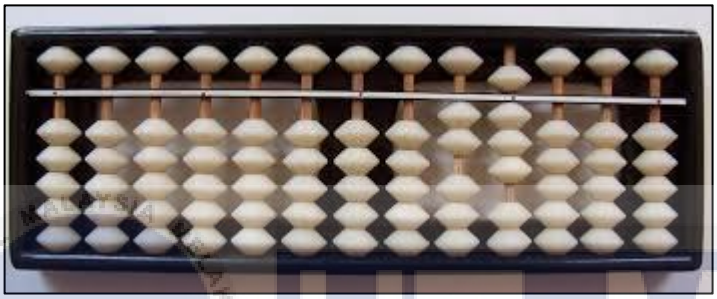

Figure 1.1 Soroban (5 + 1) beads

Figure 1.2 Soroban (4 + 1) beads

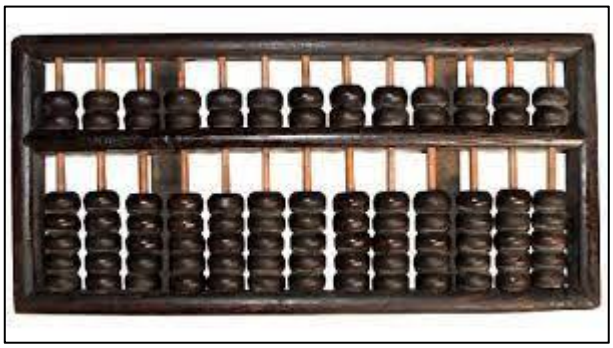

Figure 1.3 Suanpan Abacus (Chinese Abacus)

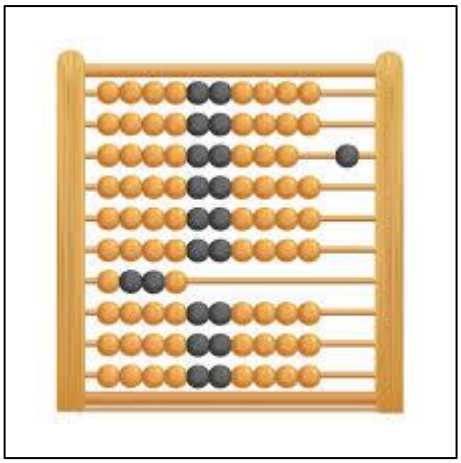

Figure 1.4 Stschoty Abacus (Russian Abacus)

In 1994, the abacus was first introduced in Malaysian education. (Mustama, 2010). The type of abacus used in the early days was 5 + 2, namely Suanpan as shown in Figure 1.3. Malaysia calls this abacus "Sempoa" in malay language. However, as time passed, people found that the 5 + 2 type abacus cannot be used as a calculation tool. So in 1996, the Ministry of Education agreed to change the abacus to the 4+1 type, as shown in Figure 1.2. At the same time, mental arithmetic has also been introduced Ministry of Education. (Mustama, 2010). Although the training for abacus teachers is was carried out, but from 1996 to 2010, abacus education not officially implement in school. In 2004, the Ministry of Education issued an official notice point out that elementary students must receive abacus education. (Mustama, 2010).

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In order to save time on the learning abacus, it is recommended to use the smart abacus as a learning tool, as an introduction how to use the abacus as a mathematical tool, which can be used by elementary school students. After connecting, it will display the value of the bead and the answer to the mathematical operation in the application. The smart abacus is expected to solve problems and enable students to learn the basic

mathematics operations of the abacus without missing the physical experience of using actual instruments.

1.2 Problem Statement

Starting in 2004, Malaysia's primary school students began to receive abacus education (Mustama, 2010). However, it is difficult for some children to learn abacus. This is mainly due to problems such as the difficulty and boredom of the abacus. The abacus consists of repetitive exercises and endless exercises, making it boring. It is said that learning the abacus is boring because it involves a lot of calculations, which requires students to persevere, and patients to practice every day. The reason why students are required to practice continuously is that if students stop using their brains for calculations, their brain functions will begin to slowly decline. (Agilemaths, 2010).

The worst part is, on the other hand, the abacus allows users to calculate mathematical operations themselves. The abacus education in Malaysia still uses the traditional method, requiring students to remember the calculation method. The traditional method is not an effective way for learning abacus because it relies on the lack of cognitive interaction (Gee, 2014). Since students need to remember the calculation method, they prefer to use a calculator instead of abacus. They don't understand how to find the answers for the mathematical operations. The statement merely implies that recitation is not the most effective method of learning, but a comprehensive understanding of information at all cognitive levels is more important in learning.

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There are many uses of abacus today as a game or educational application. The current game abacus for children in the Play Store only contains addition and subtraction, while the abacus in the curriculum includes addition, subtraction, multiplication and division (Mustama, 2010). After the project is completed, a smart abacus covering the entire agenda will be developed to fill the niche market in the market.

1.3 Project Objective

The main aim of this project is to develop the real or hardware abacus embedded with the infrared sensors and make it simple and interactive cause it target for the primary students. Specifically, the objectives are as follows:

a) To identify the learning of abacus for the primary students to make smart abacus easy to learn and use.

b) To assist the primary students in improving a fundamental mathematics tool.

c) To develop a versatile educational smart abacus device that uses the Arduino framework.

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1.4 Scope of Project

The scope of this project is primarily to make an elective path for the kids to learn abacus through the application without missing the actual experience of utilizing the genuine abacus. The venture learns about the primary school understudies in approving a fundamental mathematics operations.

Then, the project is to build up a application utilizing the Android Studio. The application prerequisites depend on the learning styles of essential understudies. Target students for this undertaking are:

- Primary school students age 7 to 12 years of age
- Beginners and students of abacus

Undertaking likewise comprises of the best educational program that can be received by the application to allow the understudies to learn abacus quicker in a great manner. It includes expansion, deduction, augmentation and division up to three digits numbers.

In smart abacus, the sensor is set to be active low because it will possibly identifies the beads when the beads are tallied. The situation of the sensors should be corresponding to where the beads stop while the beads are checked up or counted up. In this venture, two microcontrollers were utilized. The capacity of the first microcontroller is to deal with information from sensors and activity fastens and afterward the outcome will be shipped off the second microcontroller. The second microcontroller then will show the outcome through LCD and application utilizing wireless remote module. Thus, this project is where the real or hardware abacus will embed with the abacus apps. This is an educational kit that can be used to primary students as introduction on how to use an abacus as a mathematics tool and it's more to introduction to abacus functionality.

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CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Literature review is the review on the past discussion, journal and research paper regarding to Smart Abacus. To ensure the successful of this project, this chapter will be used as a reference in the future to in order to encounter problem during project implementation.

2.2 Research, Ideology and Concept Previous Project

2.2.1 Electronic Abacus (e - Abacus) using FPGA Altera DE2 Board

Based on the [1], this paper proposes a method to verify the mathematical operations performed by the abacus without losing physical experience using actual instruments. In addition, by demonstrating the integration of traditional abacus with sensors and microcontrollers and integrating the abacus with electronic equipment, abacus operations can be better visualized. The structure created in this way allows integration to produce flexible applications, and allows the abacus to be operated individually or with the help of microcontroller calculations. Therefore, the ability to display numbers based on the position of the abacus bead and the result obtained by performing arithmetic operations on the LCD screen are the salient features of the invention. Finally, the electronic abacus it