UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF AN INTELLIGENT TRAINER BOARD FOR ARDUINO COMPONENTS

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electronic Engineering Technology (Telecommunication) with Honours.

by

ARFAH HAFIEZA BINTI MOHD HARUN

B071610303

940912-08-5714

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ARFAH HAFIEZA BINTI MOHD HARUN

Alamat Tetap:

No. 294, Jln. Masyarakat,

Kg. Tengku Hussein Baru,

30020, Ipoh, Perak.

Tarikh:

Disahkan oleh penyelia:

.....

AMAR FAIZ BIN ZAINAL ABIDIN

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I hereby, declared this report entitled Development of an Intelligent Trainer Board for Arduino Components is the results of my own research except as cited in references.

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Author : ARFAH HAFIEZA BINTI MOHD HARUN

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APPROVAL

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

Signature: …….

Supervisor: AMAR FAIZ BIN ZAINAL ABIDIN

Signature: …….

Co-supervisor: RAHAINI BINTI MOHD SAID

ABSTRAK

Arduino adalah platform prototaip elektronik yang pesat di mana ia merupakan sumber terbuka. Segala perisian dan perkakasan dapat dilaksanakan dan fleksibel untuk diubah dan dilanjutkan. Masa kini, kit Arduino perlu disambungkan ke papan pemasangan elektronik berasingan dan disambungkan dengan komponen yang berkaitan; input dan output, untuk mengkonfigurasi projek berasaskan Arduino. Kerumitan ini boleh menimbulkan kesilapan dan pengekodan yang salah.

Papan Pelatih Komponen Arduino dibangunkan untuk pengguna yang berminat untuk meneroka dan memperluaskan pengetahuan mereka kepada idea pembinaan litar mengenai pengaturcaraan berasaskan Arduino. Projek ini dibina menggunakan MIT Apps Inventor dan dihubungkan melalui Bluetooth ke telefon pintar Android. Setelah disambungkan, soalan akan dipaparkan dan pengguna perlu melakukan sambungan litar berdasarkannya. Komponen ini akan mensimulasikan pengekodan Arduino yang diprogramkan ssetelah sambungan dibuat.

Satu tinjauan dijalankan ke arah pensyarah dan pelajar di Fakulti Teknologi di Universiti Teknikal Malaysia Melaka (UTeM) untuk menyiasat kebolehpercayaan papan latihan ini untuk pengguna.

ABSTRACT

Arduino is a rapid electronic prototyping platform in which it is an open source where software and hardware is practicable and flexible to be extended and edited. Concurrently, the Arduino kit must be connected to a separate breadboard which contains all related components; of input and outputs, to configure an Arduino-based project. The hassle of worrying of misconnections and wrong coding could be too much in one time.

Arduino Component Trainer Board is developed for user who keen on exploring and expand their knowledge to the idea of circuit construction regarding Arduino-based programming. An application is build using MIT Application Inventor and to be connected via Bluetooth to an Android smartphone. Once connected, questions will be displayed and user to do the circuit connection based on it. The component will simulate Arduino coding programmed as the connection is made.

A survey is conducted towards lecturers and students in Faculty of Technology of Universiti Teknikal Malaysia Melaka (UTeM) to investigate the reliability of the trainer board for users.

DEDICATION

This report is finished on time with all the supports and loves received from my dear families and best friends. Not to forget, supervisors who has nothing but genuine guide all year-round throughout PSM 1 and PSM 2.

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LIST OF SYMBOLS

SYMBOL	EXPLANATION
&	and
Ω	Ohm
±	Plus-minus
^{o}	Degree (unit of angle)
^{o}C	Celcius (unit of temperature)
s	Seconds
cm	Centimeters
RM	Malaysia Ringgit
%	Percentage

LIST OF ABBREVIATIONS

ABBREVIATION	EXPLANATION
USB	Universal Serial Bus
PC	Personal Computer
RAM	Random-access Memory
MCU	Microcontroller Unit
CPU	Central Processing Unit
IEEE	Institute of Electrical and Electronics Engineers
ACC	Assorted Component Checker
NPN	Negative-Positive-Negative
PNP	Positive-Negative-Positive
MOSFET	Metal Oxide Semiconductor Field Effect Transistor
BJT	Bipolar Junction Transistor
FET	Field Effect Transistor
MOOC	Massive Open Online Course
IT	Information Technology
TV	Television
R & D	Research and Development
DC	Direct-Current
DAC	Digital-to-Analog Converter
ADC	Analog-to-Digital Converter
PCB	Printed circuit board
CAD	Computer-Aided Design
AVR	Automatic Voltage Regulation
PIR	Passive Infrared Sensor
FYP	Final Year Project
PSM	Projek Sarjana Muda

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

The aim of this chapter is in creating the framework and introducing the brief idea of the project. It focused on the overview of the project, detailing the objectives, briefly discuss the problem statement, scope and provide the outcome of the project. Therefore, the structure of the whole project can be precisely visualized.

1.2 BACKGROUND STUDY

An Arduino-based system course has become one of many crucial courses in today engineering field. Arduino is an open-source electronics platform used for constructing and programming of electronics. To pursue an Arduino-based project, it needed an Arduino board where all boards are entirely open-source, allowing users to build them separately and finally adapt them to their exact needs. As time and technology evolve, there are many kinds of Arduino boards invented such as Arduino Uno (R3), LilyPad Arduino, Red Board, Arduino Mega (R3) and Arduino Leonardo. Arduino boards are an easy and low-cost board that allows users to build the boards separately and adapt them to their own engineering project and different applications.

Arduino can be counterfeit as a little computer that can program to do things and interacts with the world through all kind of electronic components such as electronic sensors, lights, and motors. Basically, it makes electronic projects accessible to everyone and users can be as creative as they can and make all their ideas a reality. Many programmers use the Arduino because it makes things easier as it is the simpler version of C++ and the already made Arduino microcontroller are easy to program, erase and reprogrammed at any given time which made them very convenient.

Among many benefits of using Arduino is that the software of Arduino is well-suited and flexible with all kinds of operating systems such as in Linux, Windows and Macintosh, etc. Furthermore, an Arduino is very easy to use; even for beginners now that there are a lot of Arduino's source code available and accessible online. There are many and growing support from people and organizations out there that embrace Arduino, therefore whenever difficulties arise, there is always a pre-coded project and something new to learn online. Users just needs to connect the Arduino board to the computer via USB and communicate using a standard serial protocol, runs in standalone mode and an interface connected to Personal Computers (PC).

However, even an easy-to-use Arduino has its own weaknesses. One of them is it hides the software complexity to make things easier for the user. All these limitations may trouble the users later as it causes the user to lack an understanding of how certain things work. An equally important weakness of Arduino is the complexity of accessing the library. It is not very efficient in certain parts, may waste RAM and CPU cycles and controls a lot of peripherals of the MCU. Above all, an Arduino board is a device that is very sensitive and delicate, so it must be handled carefully.

1.3 PROBLEM STATEMENT

To develop skills in Arduino programming, one must know how to build a basic circuit connection with components competent to Arduino. A basic Arduino kit sold in store is completed with all necessities to build a circuit, however, there is not one kit that have an integrated component attached on a board. This causes some difficulties for user in building a circuit connection based on an Arduino program.

There are so many starter kits sold in the market for individual who have interest in exploring Arduino. The price is very affordable, at the price of less than RM100. In this case, the Arduino starter kit sold in the market that provided with basic circuit building, have a price that may be way cheaper than this trainer board. However, the trainer board benefits can win over as it is component integrated rather than individually.

To configure an Arduino-based project, the user must firstly construct a hardware circuit which contains respective and needed components based on the program configured, then only the Arduino is programmed and connected to the board. Some components may be found having faulty from the retail shop of the components bought. For this reason, the trainer board may firstly check the functionality of the components before proceeding using it to any electronic projects.

1.4 OBJECTIVES

The main objectives of this project are:

1. To build a trainer with all-in-one Arduino components with an aim to saves more time in building the hardware of the project.

2. To design an affordable and low cost, portable and integrated trainer kit to be used anyone who keen to learn how an Arduino works. The trainer kit of size 25.7cm x 20.5cm x 10cm with a cost of less than RM200 can be used effortlessly by many who is devoted to brush up their knowledge in Arduino.

3. To evaluate the performance of the intelligence trainer board in relation to electronic components that are tested using it.

1.5 SCOPE OF WORKS

Scopes are recorded to guarantee the venture will be inside its expected limit. The scopes will be functional to guarantee those projects are heading in the right course with attain the objective. Considering in designing the trainer board, not all electronic components will be available, though the most basic and relevance components will be possible to operate. Hence, the Arduino-based project must take regard in the type of components available on the trainer board only before proceeding to design the project.