UNIVERSITI TEKNIKAL MALAYSIA MELAKA

MOISTURE CONTENT MONITORING SYSTEM FOR BIOMASS FEED STOCK BY USING ANDROID SYSTEM

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

by

FATIN NADHIRAH BINTI MUSTAFA AZIZUL

B071510449

960715015512

FACULTY OF ELECTRICAL AND ELECTRONIC ENGINEERING

TECHNOLOGY

2018

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

Tajuk: MOISTURE CONTENT MONITORING SYSTEM FOR BIOMASS FEED STOCK BY USING ANDROID SYSTEM

Sesi Pengajian: 2019

Saya **FATIN NADHIRAH BINTI MUSTAFA AZIZUL** mengaku membenarkan Laporan PSM ini disimpan di Perpustakaan Universiti Teknikal Malaysia Melaka (UTeM) dengan syarat-syarat kegunaan seperti berikut:

1. Laporan PSM adalah hak milik Universiti Teknikal Malaysia Melaka dan penulis.
2. Perpustakaan Universiti Teknikal Malaysia Melaka dibenarkan membuat salinan untuk tujuan pengajian sahaja dengan izin penulis.
3. Perpustakaan dibenarkan membuat salinan laporan PSM ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. **Sila tandakan (X)

☐ SULIT* Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia sebagaimana yang termaktub dalam AKTA RAHSIA RASMI 1972.

☐ TERHAD* Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan.

☒ TIDAK TERHAD

Yang benar,

.....

FATIN NADHIRAH BINTI MUSTAFA AZIZUL

Alamat Tetap:

Lot 3273, Jalan Besar,

Kampung Sungai Lurus Darat,

Senggarang, 83200,

Batu Pahat, Johor.

Tarikh:

Disahkan oleh penyelia:

.....

ROSZIANA BINTI HASHIM

Cop Rasmi Penyelia

Tarikh:

*Jika Laporan PSM ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali sebab dan tempoh laporan PSM ini

DECLARATION

I hereby, declared this report entitled MOISTURE CONTENT MONITORING SYSTEM FOR BIOMASS FEED STOCK BY USING ANDROID SYSTEM is the results of my own research except as cited in references.

Signature: ……

Author : FATIN NADHIRAH BINTI MUSTAFA AZIZUL

Date:

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 Electronics Engineering Technology (Computer System) with Honours. The member of the supervisory is as follow:

Signature: …….

Supervisor : ROSZIANA BINTI HASHIM

Signature: …….

Co-supervisor: NORAIN BINTI IDRIS

ABSTRAK

Kandungan kelembapan di dalam sabut kelapa memainkan peranan penting kerana nilainya menentukan sama ada produk yang dihasilkan menggunakan sabut kelapa adalah produk yang bagus atau tidak terutamanya pada *biomass boiler operation*. Kandungan kelembapan berkemungkinan berbeza secara rawak di setiap bahagian sampel. Ini menjadi satu cabaran kepada industri kerana ianya sussah untuk menentukan kandungan kelembapan sampel adalah sekata di setiap bahagian sampel atau tidak, dan menentukan sama ada semua bahagian sampel berada di dalam anggaran nilai yang ditetapkan atau tidak. Projek ini secara dasarnya membantu untuk menentukan sama ada bacaan kelembapan di setiap bahagian sampel adalah sekata atau tidak dengan menggunakaan lima sensor. Kesemua nilai dan bacaan purata akan dipaparkan.

ABSTRACT

Moisture content in coconut coir is playing an important role as the value decides whether the product produces from the coconut coir is a good product or not especially in biomass boiler operations. The value of the moisture content might be randomly varied all over the sample. This gives challenge to the industry as it is hard to determine whether the moisture content of the sample is constant or not, and whether all parts of the sample is in the range of the fixed value or not. This project basically helps to determine whether the value of the moisture content all over the sample is constant by using five moisture sensors. All the value will be displayed as well as the average moisture content of the sample.

DEDICATION

To my beloved parents, family, lecturer and fellow friends.

ACKNOWLEDGEMENTS

First and foremost, all praise and gratitude to Allah S.W.T for giving me strength and will to finish this research project. I would like to thank my supervisor Puan Rosziana binti Hashim for encouraging and guiding me until the finishing line. Not to forget my co-supervisor Puan Norain binti Idris for the guidelines.

A big thank you to all of my lecturers and my friends for the guidance, tips, support and motivation since the very first day I started working on this project until it is finished.

Last but not least, a huge gratitude for my family especially my parents for keep supporting, motivating and bringing me up when I was down, and also help in financial matter.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS

cm	-	Centimetre
W_D	-	Dry Weight
W_W	-	Wet Weight
M_n	-	Moisture content of material n
°C	-	Degree Celcius
g	-	Gram

LIST OF ABBREVIATIONS

WSNs	Wireless Network Sensors
GPS	Global Positioning System
PWM	Pulse-Width Modulation
Wi-Fi	Wireless Fidelity

CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter will mainly discuss about the definition of the biomass and feedstock and types of feedstock. The elements of the feedstock is also stated in this chapter.

Besides, the problems which leads to the development of this project are also stated in this chapter and the objectives are made to overcome those problems. Scope of work of the project is also being discussed in this chapter.

1.2 Background

Biomass is the low value substance yields from forestry, agriculture and urban sources. Usually, the waste yielded cannot be used for many purposes and has high potential to be disposed. The streaming of biomass substance is always plenty. However, the biomass fuels are likely to be processed as a renewable energy. The main obstruction to the high consumption of the biomass substance is because of its low bulk energy density, its inclination to decay during storage, the physical property of a molecule

towards water or called as hydrophobicity and the requirement of high grinding energy. Numerous development has been made to overcome the drawbacks and to solve the problem regarding the biomass substance. One of the method is pre-treating and improving the biomass substances (Tag *et al.*, 2016).

According to Mohamed Abdul Ghani, Vogiatzis and Szmerekovsky (2018), biomass has the capacity to be developed as a sustainable energy systems and the energy systems is important to the society nowadays. The main problem with respect to the biomass is the residues is often burnt by the farmers usually after the feedstock is being harvested. The open burning can lead to air pollution. Thus a development is made using the biomass feedstock to overcome the problem.

Generally, the major elements of biomass on a dry basis are comparatively fixed. The elements are including 45-50% of carbon (C), 5-6% of hydrogen (H) and 40-44% of oxygen (O). Its moisture content, ash composition and ash content can be differed extensively based on the storage conditions and sources of the feedstock (Orang and Tran, 2015).

Aquatic weeds are also has been appointed as a biomass feedstock as it has high potential for bioenergy production. This is due to the increasing of oil prices and the reservation of existing fossil fuels has been used up. The reproduction rates of aquatic weeds is rather high. Besides, the cellulose and hemicellulose content of the weed is abundant and has a very slight content of lignin. It makes the aquatic weed is suitable in biofuel crop production (Kaur *et al.*, 2018).

Biomass residues such as leftover beverages and food, and agriculture residues can be used in butanol production. In this production, the type of feedstock is evaluated in a few factors. They are butanol yield, feedstock availability rate and the average composition of the feedstock. (Procentese *et al.*, 2017).

Besides the leftover food, fruit waste can also be referred as biomass feedstock. The fruit waste is claimed as volatile matter which contains aliphatic hydrocarbon, lignocellulose components and fatty acids which highly potential to be recovered as chemical feedstock via pyrolysis process (Lam *et al.*, 2016).

In addition to that, according to (Kou *et al.*, 2017), biomass feedstock for instance giant reed, silvergrass, switch grass, pennisetum and corn stalks are also able to be reproduced. Corn stalks are used widely in the production of bio-ethanol as well as xylitol. Meanwhile, giant reed is used to the production of biofuels.

Moisture content is a measureable factor which able to affect the value of energy contained in the sample. The current technique to determine the moisture content is oven-drying method (Fridh, Volpé and Eliasson, 2014).

1.3 Problem Statement

The measurement of moisture content has become a major problem in the production of new product using the biomass feedstock. The moisture content of the

biomass sample is said to be not distributed equally to all parts of the sample making the values to be vary even the reading of the moisture content has been taken a few times. This difference in moisture content reading resulting the measurement to be invalid as it can be claimed as inaccurate.

The previous project also shows the uneven results when it comes to taking the measurement of moisture content. This might due to the factors of surrounding temperature. The presence of temperature factor making the reading of the moisture content to be inaccurate too.

Besides, most of the moisture content monitoring system requires manual calculation to determine the value of moisture in the sample using a certain formula. Some of the formula is complicated and error might occur during the calculation. The error in manual calculation can make the reading of the moisture content is not precise. The correct calculations is important to determine the accurateness in approximating the data (Chesher, 2017). Park and Kim (2018) also emphasize that the fault in estimating works can occur due to factor of measurement error and the variedness between the observed values and the theoretical value.

In addition to that, there is no real-time monitoring system regarding the moisture content. The value of the moisture content cannot be automatically obtained and need to be measured from time to time as the content of moisture in the sample keep changing due to the factors of surrounding humidity and temperature.

On top of those problems, manpower is needed to monitor the moisture content of biomass feedstock sample and to do the manual calculation. The carelessness may lead to error in taking the measurement of the moisture content.

1.4 Objectives

With respect to the mentioned problem, the objectives of this project is

i. To develop project which produces accurate reading by means of monitoring system.
ii. To measuring moisture content using Arduino.
iii. To produce a project which reduces the manpower.

1.5 Scope of Work

The scope of this project is to develop a prototype of monitoring system which able to measure the moisture content accurately using the presence of a few sensors. The Arduino will display the average of the moisture content measured by the sensors and each sensor. Blynk apps is also used to develop an application which able to transmit the data from the Arduino to mobile phone as to monitor the reading of moisture of the biomass feedstock sample in real-time system.

1.6 Project Significance

Basically, this project can give impact on industrial field especially on biomass drying process of mass production. The measurement of the moisture content can be observed by using this project without needing the manpower to weigh the sample and calculate the moisture content manually. The consistency of the moisture content can also be obtained to ensure that the drying process of the sample is done uniformly.