



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

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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 susah 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 menggunakan 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.

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TABLE OF CONTENTS

	PAGE
TABLE OF CONTENTS	x
LIST OF TABLES	xiv
LIST OF FIGURES	xv
LIST OF SYMBOLS	xvii
LIST OF ABBREVIATIONS	xviii
LIST OF PUBLICATIONS	xix
CHAPTER 1 INTRODUCTION	1
1.1 Introduction	1
1.2 Background	1
1.3 Problem Statement	3
1.4 Objectives	5
1.5 Scope of Work	5
1.6 Project Significance	6
CHAPTER 2 LITERATURE REVIEW	7
2.1 Introduction	7
2.2 Analysing the Methods Used to Determine the Moisture Content	9
2.2.1 Oven-Dry Method	9

2.2.2	Electrical Conductivity Method	11
2.2.3	Wireless Network Sensors (WSNs)	12
2.2.4	Moisture Sensing using Bluetooth	15
2.2.5	Saturated Aqueous Solutions Methods	17
2.2.6	Microwave Sensing using Dielectric Properties	19
2.2.7	Moisture Soft Sensor	21
2.2.8	Capacitance Sensing System	22
2.3	Effects of Moisture Content	23
2.3.1	Effect of Feedstock Moisture Content on Biomass Boiler Operation	23
2.3.2	Combustion of High Moisture Content Material	24
2.3.3	Effect of Feedstock Moisture Content to Thermal Performance	25
2.3.4	Effect of Feedstock Moisture Content to Biomass Boilers in Pulp and Paper Mills	26
2.3.5	Effect of Feedstock Moisture Content and Pyrolysis Temperature on the Structure	26
2.3.6	Effects of the Biomass Moisture Content and Pelleting Temperature on the Pressure-Induced Agglomeration Process	27
2.4	Application of Monitoring System	28
2.4.1	Monitoring System for Floatover Installation	28
2.4.1.1	X-Band Wave Radar and Vertical Measuring Range Finder (VMRF)	28
2.4.2	Monitoring System for Photovoltaic (PV) Based Power Generation	29
2.4.2.1	Linux Real Time Application Interface (RTAI)	30

2.4.2.2	ZigBee Radio Technology	31
2.3.2.3	National Instruments (NI)	32
CHAPTER 3	METHODOLOGY	33
3.1	Introduction	33
3.2	Project Deveopment	33
3.3	Parameter	36
3.4	Hardware	38
3.4.1	Arduino Uno	38
3.4.2	Wi-Fi Module	39
3.4.3	Moisture Sensor	40
3.4.4	Voltage Regulator	40
3.5	Coding and Simulation	41
3.5.1	Arduino Programming Software	41
3.5.2	Proteus Design Suite	42
3.5.3	Fritzing	43
3.5.4	Blynk App	44
3.6	Experiment Setup	45
3.7	Testing and Experiment in Laboratory	49

CHAPTER 4	RESULT AND DISCUSSION	50
4.1	Introduction	50
4.2	Measuring and Displaying the Moisture Reading	50
4.3	Data from Field Study	53
4.3.1	Moisture Reading Taken in Room Temperature (Normal Humidity)	54
4.3.2	Moisture Reading Taken in Rainy Weather (High Humidity)	56
4.3.3	Moisture Reading Taken in Hot Weather (Low Humidity)	58
4.3.4	Comparing the Data of All Conditions	60
4.4	Calculation from the Oven-Dry Process	61
4.5	Discussion of Result	65
CHAPTER 5	CONCLUSION	67
5.1	Introduction	67
5.2	Achievement of Research Objectives	67
5.3	Problem Faced during Research	68
5.4	Suggestion for Future Work	68
REFERENCES	69	

LIST OF TABLES

TABLE	TITLE	PAGE
Table 4-1:	Average Moisture Reading over Time in Room Temperature	54
Table 4-2:	Average Moisture Sensor in Rainy Days vs Time Table	56
Table 4-3:	Average Moisture Sensor in Hot Weather vs Time Table	58
Table 4-4:	Table of Condition, Sum of All Reading and Average	60

LIST OF FIGURES

FIGURE	TITLE	PAGE
Figure 2-1:	The Classical Tree WSNs	13
Figure 2-2:	Line-of-Sight Link between Two Nodes	14
Figure 2-3:	Link Diagram between Two Nodes with Obstacles	14
Figure 2-4:	WSNs Field Test	15
Figure 2-5:	Real System Model of Signal Damping Measurement	16
Figure 2-6:	Measuring Construction Minimal Distance	17
Figure 2-7:	Measuring Construction Maximum Distance	17
Figure 2-8:	Schematic Diagram of the Capacitance-To-Voltage Transducer Circuit	23
Figure 2-9:	Sketch of Wave Monitoring with X-Band Wave Radar and VMRF	28
Figure 2-10:	Diagram of LXRT	31
Figure 3-1:	Flowchart of Project Development	34
Figure 3-2:	Arduino Uno	38
Figure 3-3:	ESP8266 Wi-Fi Module	39
Figure 3-4:	Moisture Sensor	40
Figure 3-5:	Schematic Diagram of LM3940	40

Figure 3-6:	Arduino Programming Software	41
Figure 3-7:	Proteus	42
Figure 3-8:	Fritzing Software	43
Figure 1-9:	Blynk Application	44
Figure 3-10:	The Flow of the Data	45
Figure 1-11:	The Sketch of the Prototype	46
Figure 1-112:	Placement of the Sensors	47
Figure 1-13:	Block Diagram of the Project	48
Figure 3-14:	The Coding Flowchart of Monitoring System Application	49
Figure 4-12:	Measuring the Moisture Content	51
Figure 4-13:	Screenshot from the Blynk Application	52
Figure 4-14:	Average Moisture Reading in Room Temperature vs Time Graph	55
Figure 4-15:	Average Moisture Reading in Rainy Days vs Time Graph	57
Figure 4-16:	Average Moisture Reading in Hot Weather vs Time Graph	59
Figure 4-17:	Average of All Reading vs Condition Graph	60
Figure 4-18:	Preparing Sample for Drying Process	62
Figure 4-19:	Drying Process in Chemistry Lab	63
Figure 4-20:	Weighing the Sample after the Drying Process	64

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.