



**‘HILIR’ MOBILE APPLICATION DEVELOPMENT FOR MONITORING
AND CONTROLLING ELECTRICITY USAGE BY UTILIZING
PZEM-004T SENSOR AND NODEMCU ESP8266 AS
MICROCONTROLLER USING FLUTTER**

UNDERGRADUATE THESIS

**Submitted as one of the requirements to obtain
Sarjana Komputer (S.Kom.)**

By:

PUTU SURYA NUGRAHA

001202000079

**FACULTY OF COMPUTING
INFORMATICS STUDY PROGRAM
CIKARANG
JUNE 2023**

Copyright by
Putu Surya Nugraha
2023

**'HiLir' Mobile Application Development for Monitoring and Controlling
Electricity Usage by Utilizing PZEM-004T Sensor and Nodemcu
ESP8266 As Microcontroller Using Flutter**

By

Putu Surya Nugraha
001202000079

Approved:



Ronny Juwono, S.Pd., M.T.
Thesis Advisor



Cutifa Safitri, Ph.D.
Program Head of Informatics



Rila Mandala, Ph.D.
Dean of Faculty of Computing

PANEL OF EXAMINER APPROVAL

The Panel of Examiners declare that the undergraduate thesis entitled
**'HiLir' Mobile Application Development for Monitoring and Controlling
Electricity Usage by Utilizing PZEM-004T Sensor and Nodemcu ESP8266
As Microcontroller Using Flutter**

that was submitted by Putu Surya Nugraha majoring in **Informatics** from the Faculty of
Computer Science was assessed and approved to have passed the Oral Examination on 7th June
2023.

Panel of Examiner



.....
Chair of Panel Examiner



.....
Examiner I

Statement of Originality

In my capacity as an active student of President University and as the author of the undergraduate thesis/final project/business plan (underline that applies) stated below:

Name : Putu Surya Nugraha
Student ID number : 001202000079
Study Program : Informatics
Faculty : Computing

I hereby declare that my undergraduate thesis/final project/business plan entitled **"HiLir' Mobile Application Development for Monitoring and Controlling Electricity Usage by Utilizing PZEM-004T Sensor and Nodemcu ESP8266 As Microcontroller Using Flutter"** is, to the best of my knowledge and belief, an original piece of work based on sound academic principles. If there is any plagiarism, including but not limited to Artificial Intelligence plagiarism, is detected in this undergraduate thesis/final project/business plan, I am willing to be personally responsible for the consequences of these acts of plagiarism, and accept the sanctions against these acts in accordance with the rules and policies of President University.

I also declare that this work, either in whole or in part, has not been submitted to another university to obtain a degree.

Cikarang, June 20th 2023



(Putu Surya Nugraha)

Scientific Publication Approval for Academic Interest

As a student of the President University, I, the undersigned:

Name : Putu Surya Nugraha
Student ID number : 001202000079
Study program : Informatics

for the purpose of development of science and technology, certify, and approve to give President University a non-exclusive royalty-free right upon my final report with the title:

'HiLir' Mobile Application Development for Monitoring and Controlling Electricity

Usage by Utilizing PZEM-004T Sensor and Nodemcu

ESP8266 As Microcontroller Using Flutter

.....
With this non-exclusive royalty-free right, President University is entitled to converse, to convert, to manage in a database, to maintain, and to publish my final report. There are to be done with the obligation from President University to mention my name as the copyright owner of my final report.

This statement I made in truth.

Cikarang, June 20th 2023



(Putu Surya Nugraha)

Advisor Approval for Journal/Institution's Repository

As an academic community member of the President's University, I, the undersigned:

Name : Ronny Juwono, S.Pd., M.T.

ID number : 20160700622

Study program : Information System

Faculty : Computing

declare that following thesis:

Title of thesis : 'HiLir' Mobile Application Development for Monitoring and Controlling Electricity Usage by Utilizing PZEM-004T sensor and Nodemcu ESP8266 as Microcontroller Using Flutter

Thesis author : Putu Surya Nugraha

Student ID number : 001202000079

will be published in **journal / institution's repository / proceeding / unpublished.**

Cikarang, June 20th 2022



Ronny Juwono, S.Pd., M.T.

Plagiarism Check Result

'HiLir' Mobile Application Development for Monitoring and Controlling Electricity Usage by Utilizing PZEM-004T Sensor and Nodemcu ESP8266 As Microcontroller Using Flutter - Final Revised

ORIGINALITY REPORT

14%	12%	4%	8%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

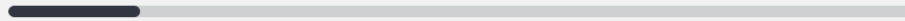
PRIMARY SOURCES

1	Submitted to President University Student Paper	2%
2	repository.president.ac.id Internet Source	1%
3	koinworks.com Internet Source	1%
4	www.moneysmart.id Internet Source	1%
5	eclickshop.blogspot.com Internet Source	1%
6	ejournal.polbeng.ac.id Internet Source	<1%
7	Submitted to Universiti Teknologi MARA Student Paper	<1%
8	repository.fe.unj.ac.id Internet Source	<1%

GPTZero Check Result

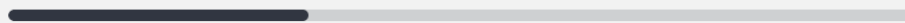
Stats

Average Perplexity Score: 145.692



A document's perplexity is a measurement of the randomness of the text

Burstiness Score: 331.736



A document's burstiness is a measurement of the variation in perplexity

Your sentence with the highest perplexity, "*Thesis Advisor Cutifa Safitri, Ph.D.*", has a perplexity of: 1719

Abstract

Technology is developing rapidly. Along with the development of this technology, people's activities in this millennial era are getting busier, so that in the midst of these activities, people often forget that the availability of electrical energy is very limited and the cost for electricity is also increasing, so that people's efforts to monitor electricity use in their homes are limited. The problem is how to develop a mobile application that can be used to monitoring electricity usage in real-time and control the electronic device on/off remotely. The writers gain references from analysing a similar application that already exist as the method. From analysing the business process of the projects shows that, this application has utilized an IoT device to support the real-time monitoring and control. Real-time monitoring is a feature that the writers develop to help user see the electricity usage of an electric device on real-time through menu on the home screen of the application. Through this real-time monitoring features, the user can determine what devices that should be turned on or off to save more on electricity usage cost.

Keyword: Technology, Internet of Things, Real-time, Electricity, Mobile.

Dedication

“I made this with the all of my heart and I am dedicating this project to my university as can be used as a reference to another better projects”

Acknowledgement

Praise the author goes to Almighty God, Ida Sang Hyang Widhi Wasa for His mercy and grace to be able to complete the report for final project assignment on time.

This final project report is submitted as a requirement to meet the graduation requirements of achieving the Bachelor of Science degree. In writing this report, the author received big help, guidance, and assistance from many people. Therefore, the author would say thank you to:

1. My family that always give me full engagement in encouraging me to write this report and blessing me for my success.
2. Mr Ronny Juwono, S.Pd., M.T. as my thesis/final project advisor that was helping me through the process and give an idea and feedback for my final project.
3. All of my friends: Tiara, Nabilah, Azzam, Ipink, Zee, that have given me a support and good vibes energy during the process.
4. Lovely Kim Nayoung (Lightsum), as an idol that always give me a motivation and encourage me to finish this final project report.

The authors recognize that this final report is far from perfect. Therefore, the author strives for perfection and expects constructive criticism and suggestions from readers. The authors hope that this final report of the project will benefit both the authors in particular and the general readership.

Cikarang, May 9th 2023

Author

Table of Contents

Dedication	i
Acknowledgement	ii
List of Tables	v
List of Images	vi
Chapter I	1
Introduction	1
1.1 Background.....	1
1.2 Problem Statement	2
1.3 Objective	2
1.4 Scope and Limitation	2
1.5 Methodology	2
Chapter II	4
Literature Review	4
2.1 Electricity.....	4
2.2 Internet of Things (IoT)	5
2.3 Arduino IDE.....	6
2.4 Nodemcu esp8266.....	6
2.5 PZEM-004T Sensor	7
2.6 Relay Module.....	7
2.7 Application.....	8
2.7.1 <i>Web Based Application</i>	8
2.7.2 <i>Mobile Based Application</i>	8
2.8 Flutter.....	8
2.9 Firebase.....	8
2.10 Related Works	9
Chapter III	11
System Analysis	11
3.1 System Overview	11
3.2 Hardware and Software Requirements	11
3.3 Functional Description.....	12
3.4 Use Case Diagram.....	12
3.5 Flowchart Diagram	13
3.5.1 <i>IoT Device Flowchart</i>	14

3.5.2 <i>Mobile Application Flowchart</i>	15
3.6 <i>Firestore Real-time Database</i>	15
3.7 <i>IoT Wiring Diagram</i>	16
Chapter IV	18
System Design	18
4.1 <i>User Interface Design</i>	18
4.2 <i>Physical Design</i>	20
Chapter V	22
System Implementation	22
5.1 <i>System Implementation</i>	22
5.2 <i>Coding Structure</i>	22
5.2.1 <i>Library and Plugins</i>	22
5.3 <i>Application Features</i>	25
5.3.1 <i>Real-time Electricity Monitoring and Control Device</i>	25
5.3.2 <i>Manual Electricity Cost Calculator</i>	38
Chapter VI	41
System Testing and Evaluation	41
6.1 <i>Software Environment</i>	41
6.2 <i>Testing Scenario</i>	41
6.2.1 <i>Real-time Electricity Monitoring and Control</i>	42
6.2.2 <i>Manual Electricity Calculator</i>	43
Chapter VII	45
Conclusion and Future Works	45
7.1 <i>Conclusion</i>	45
7.2 <i>Future Works</i>	45
References	47

List of Tables

Table 1 kWh meters category based on the environment [5].....	5
Table 2 Electricity cost based on type of kWh meters [5].	5
Table 3 Project features comparison	10
Table 4 HiLir App Functional Description	12
Table 5 Physical Design.....	21
Table 6 Testing Scenario	42

List of Images

Image 1 Nodemcu esp8266 scheme.....	6
Image 2 PZEM-004T Sensor	7
Image 3 Relay Module one channel.....	7
Image 4 Electricity monitoring using Blynk App	9
Image 5 IoT monitoring device using LCD	9
Image 6 HiLir Application Use Case Diagram	13
Image 7 IoT Device Flowchart	14
Image 8 Mobile Application Flowchart	15
Image 9 Firebase Real-time Database Interface	16
Image 10 IoT Device Wiring Diagram	16
Image 11 Home Page	19
Image 12 Electricity Monitoring Page	19
Image 13 Electricity Calculator Page	20
Image 14 Arduino Library	22
Image 15 Flutter Dependencies Plugins	23
Image 16 Additional Flutter Dev Dependencies Plugins	24
Image 17 Initialize the Firebase connection	26
Image 18 Using a dbRef Object as Firebase Database references.....	26
Image 19 Read Firebase Function.....	27
Image 20 Read the Switch Value Function	27
Image 21 Update Function.....	28
Image 22 Switch Status Check	29
Image 23 Init State Function.....	30
Image 24 Define the Access Point and Firebase Details.....	31
Image 25 Setup Access Point and Firebase Configuration	31
Image 26 Check Firebase Connection	32
Image 27 Read and Write Data to Firebase	32
Image 28 Read and Write Voltage Data	33
Image 29 Read and Write Current Data	34
Image 30 Read and Write Power Data	35
Image 31 Read and Write Energy and Cost Data (1).....	35

Image 32 Read and Write Energy and Cost Data (2).....	36
Image 33 Set Voltage and Current to 0	37
Image 34 Set Power and Energy to 0.....	38
Image 35 kWh Meters Option List	39
Image 36 Calculator Logic.....	40
Image 37 Displayed Data When Device is Off.....	43
Image 38 Displayed Data When Device is On	43
Image 39 Input Data on Calculator.....	44
Image 40 Displaying Pop-up Cost Data.....	44