

**DESIGN AND DEVELOPMENT BODY TEMPERATURE SENSOR  
FOR ATTENDANCE MACHINE AND SECURITY GATE**

By

Andreadie Wicaksono  
21952060

MASTER'S DEGREE  
in

MASTER OF MECHANICAL ENGINEERING  
FACULTY OF ENGINEERING AND INFORMATION TECHNOLOGY



**SWISS GERMAN UNIVERSITY**

SWISS GERMAN UNIVERSITY

The Prominence Tower  
Jl. Jalur Sutra Barat No.15, Alam Sutra  
Tangerang, Banten  
15143

Jan-2021

Revision after thesis defense on 27 January 2021

---

## STATEMENT BY THE AUTHOR

I hereby declare that this submission is my own work and to the best of my knowledge, it contains no material previously published or written by another person, nor material which to a substantial extent has been accepted for the award of any other degree or diploma at any educational institution, except where due acknowledgement is made in the thesis.

Andreadie Wicaksono

Student

Date:

Approved by:

Dr. Ir. Hanny J. Berchmans, MT.

Thesis Advisor

Date:

SWISS GERMAN UNIVERSITY

Dr. Henry Nasution, MT.

Thesis Co-Advisor

Date:

Dr. Maulahikmah Galinium, S.Kom, M.Sc\_

Dean

Date:

---

Andreadie Wicaksono

---

## ABSTRACT

### DESIGN AND DEVELOPMENT BODY TEMPERATURE SENSOR FOR ATTENDANCE MACHINE AND SECURITY GATE

By  
Andreadie Wicaksono  
Dr. Ir. Hanny J. Berchmans, MT.  
Dr. Henry Nasution, MT

SWISS GERMAN UNIVERSITY



In the face of the Covid-19 pandemic, health protocols have been implemented by checking body temperature, and limiting the number of people in the building. To support the implementation of the protocol for the new normal period, there are many activities that were not previously carried out but are now mandatory to prevent the spread of the Covid-19 virus. Measuring temperature and limiting the number of people in the building are new activities that must be done at this time. It is necessary to develop a tool that can help the process of checking body temperature, and the identification and restriction of anyone who will enter the building must meet the predetermined requirements. This tool can take temperature measurements on the face without physical touch and also identification and recording of faces to verify the attendance process. as a temperature measurement tool developed in the form of an infrared sensor D6T-44L made by Omron combined with the use of a camera and will be processed in a mini PC and can communicate with servers via the internet network.

*Keyword : Thermal Scanner, IR Scanner, Attendance Machine, Body Temperature*



---

## DEDICATION

I dedicate this research to Indonesia, especially to the world of education which is struggling to be able to provide lessons and prevent the spread of the deadly Covid-19 virus.



---

## ACKNOWLEDGEMENTS

Thanks to the people who have supported me until finally I was able to complete this education, especially for management and all my colleagues at Politeknik Manufaktur Astra. to the entire SGU University family, especially for classmates who always provide enthusiasm and support in solving all problems during classroom and online learning. Thanks to Mr. Hanny J. Berchmans as Advisor in this research and Mr. Henry Nasution as Co-Advisor for providing many inputs for improvement until this research can be completed. Thank you to my parents and family who have always supported and prayed for me while carrying out this education and research. I hope I can give pride to my big family



---

## TABLE OF CONTENT

STATEMENT BY THE AUTHOR.....	2
ABSTRACT.....	3
DEDICATION.....	5
ACKNOWLEDGEMENTS.....	6
TABLE OF CONTENT.....	7
LIST OF FIGURES.....	9
LIST OF TABLES.....	10
1.1. Background.....	11
1.2. Research Problems.....	13
1.3. Research Objectives.....	13
1.4. Significance of Study.....	14
1.5. Research Questions.....	14
1.6. Hypothesis.....	14
CHAPTER 2 – LITERATURE REVIEW.....	15
2.1 Theoretical Perspective.....	15
2.1.1 Artificial intelligence.....	15
2.1.2 Computer vision.....	<b>Error! Bookmark not defined.</b>
2.1.3 Face detection.....	17
2.1.4 Thermal infrared sensor.....	18
2.1.7 Attendance system.....	20
2.2 Previous study.....	21
CHAPTER 3 – RESEARCH METHODS.....	22
3.1. Research design.....	22
3.1.1 Selection measuring method.....	22
3.1.2 Design and build measurement device.....	24
3.1.3 Face tracking and capturing.....	26
3.1.4 Security gate and mechanical component.....	26
3.1.5 System integration.....	28
3.2 Scope of study.....	31
3.3 Equipment and material.....	32
3.4 Software.....	32
3.4.1 Arduino IDE.....	33
3.4.2 Visual studio.....	33
CHAPTER 4 – RESULT AND DISCUSSION.....	35
4.1 Result and Evaluation.....	35
4.1.2 Temperature measurement.....	35
4.1.2.1 Kalman filter.....	36
4.1.2.2 Face tracking.....	38
4.1.2.3 Temperature calibration.....	40
4.1.4 Recognize and identification.....	42
4.1.4 Data integration and communication.....	43
4.1.5 Graphic user interface.....	45

---

---

4.1.6 Audio and mechanical output .....	46
4.2 Discussion .....	48
CHAPTER 5- CONCLUSION AND RECOMMENDATION .....	50
5.1 Conclusion .....	50
5.2 Recommendation .....	50
GLOSSARY .....	51
REFERENCES .....	52
CURRICULUM VITAE .....	54



---

## LIST OF FIGURES

Figure 1. 1 Body temperature measurement .....	12
Figure 1. 2 Queuing at entrance gate .....	12
Figure 2. 1 Artificial intelligence function.....	15
Figure 2. 2 Input, process, output in computer vision .....	17
Figure 2. 3 Signalling chain of a system for contactless temperature measuring .....	19
Figure 3. 1 Flow of research method .....	22
Figure 3. 2 Omron D6T thermal sensor .....	23
Figure 3. 3 Field of view characteristic.....	24
Figure 3. 4Schematic diagram for sensor and micro controller.....	24
Figure 3. 5 Flowchart Of temperature measurement .....	25
Figure 3. 6 Schematic diagram of temperature measurement.....	26
Figure 3. 7 Output and actuator .....	27
Figure 3. 8 Design for access gate .....	28
Figure 3. 9 Flowchart of attendance application system.....	29
Figure 3. 10 Flowchart attendance monitoring system with body temperature measurement .....	30
Figure 3. 11 System integration .....	31
Figure 3. 12 Arduino IDE .....	33
Figure 3. 13 Visual studio code .....	33
Figure 3. 16 RFID Reader.....	43
Figure 4. 1 Thermal sensor installation.....	36
Figure 4. 2 Arduino program with kalman filter.....	37
Figure 4. 3 Graphic from kalman filter testing .....	38
Figure 4. 4 Visual studio code for face tracking .....	38
Figure 4. 5 Face tracking testing.....	39
Figure 4. 6 Visual studio code for face frame and temperature result.....	39
Figure 4. 7 Thermal scan area .....	40
Figure 4. 8 Calibration window .....	41
Figure 4. 9 Measurement test.....	41
Figure 4. 10 Graphic user interface.....	45
Figure 4. 11 Graphic user interface display on LCD .....	45
Figure 4. 12 Schema NodeMCU ESP 8266 .....	46
Figure 4. 13 Sound speak .....	46
Figure 4. 14 Trial process .....	48

---

## LIST OF TABLES

Table 2. 1 Typical structure of infrared sensor(Budzier & Gerlach, 2011) .....	18
Table 2. 2 Atmospheric windows(Budzier & Gerlach, 2011) .....	19
Table 2. 3 Previous study .....	21
Table 3. 1 Omron D6T Specification data .....	23
Table 3. 2 List of equipment and material .....	32
Table 4. 1 Calibration registration .....	42

