

DEVELOPMENT OF OPEN LOOP SENSING SYSTEM (OLSS)
HYDRAULIC PRESSURE MONITORING SYSTEM TO PREVENT
OVERPRESSURE IN HYDRAULIC PUMP OF PC1250-8

By

KRISNA DWI NURCAHYO
22452064

MASTER'S DEGREE
in
MECHANICAL ENGINEERING – ENGINEERING MANAGEMENT
FACULTY OF ENGINEERING AND INFORMATION TECHNOLOGY



SWISS GERMAN UNIVERSITY
The Prominence Tower
Jalan Jalur Sutera Barat No. 15, Alam Sutera
Tangerang, Banten 15143 – Indonesia

Revision after the Thesis Defense on February 3, 2026

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.



Krisna Dwi Nurcahyo

Student

17 February 2026

Date

Approved by:



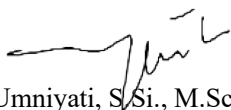
Dr. Ir. Maulahikmah Galinium, S.Kom., M.Sc.

Thesis Advisor



17 February 2026

Date

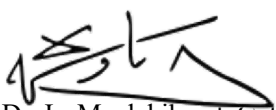


Dr. Yunita Umniyati, S.Si., M.Sc

Thesis Co-Advisor

17 February 2026

Date



Dr. Ir. Maulahikmah Galinium, S.Kom., M.Sc.

Dean

17 February 2026

Date

ABSTRACT

**DEVELOPMENT OF OPEN LOOP SENSING SYSTEM (OLSS)
HYDRAULIC PRESSURE MONITORING SYSTEM TO PREVENT
OVERPRESSURE IN HYDRAULIC PUMP OF PC1250-8**

By

Krisna Dwi Nurcahyo

Dr. Ir. Maulahikmah Galinium, S.Kom., M.Sc., Advisor

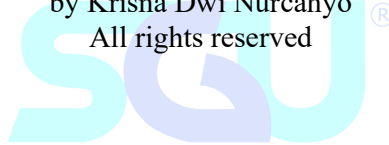
Dr. Yunita Umniyati, S.Si., M.Sc., Co-Advisor

SWISS GERMAN UNIVERSITY

Problems with the Komatsu PC1250-8 hydraulic system in mining areas are primarily caused by operational factors, including blasting and non-blasting material, and the lack of a real-time temperature and pressure monitoring system. This study designed a web-based pressure and temperature monitoring system for the *Open Loop Sensing System (OLSS)* hydraulic system using temperature and pressure sensors with delta analysis as its main feature. The Define–Measure–Analyze–Improve–Control (DMAIC) method was used, starting with identifying root causes through focus group discussions (FGDs), interviews, and field observations. The results were then analyzed using fishbone diagrams and Failure Mode and Effects Analysis (FMEA). The implementation results demonstrated more real-time pressure and temperature monitoring processes, Digi OLSS Web monitoring real time, reducing inspection downtime and associated downtime. The implementation of this system has been proven to improve inspection and maintenance efficiency, reduce the risk of excessive pressure and temperature changes in hydraulic pump maintenance, unscheduled hydraulic system breakdowns decreased from 38 cases to 3 cases and support the reliability and productivity of heavy equipment under demanding mining conditions.

Keywords: Pressure and Temperature, Hydraulic Pump, Digi OLSS Web, FMEA, DMAIC

© Copyright 2026
by Krisna Dwi Nurcahyo[®]
All rights reserved



DEDICATION

I dedicate this thesis to my beloved Parents, Wife, Children, Friends, Lecturers, and Beloved Company of PT. Kalimantan Prima Persada, has supported my studies to date.



ACKNOWLEDGEMENTS

All praise and gratitude I offer to Allah Subhanahu Wa Ta'ala for all His abundant grace, guidance, and strength, enabling me to successfully complete this thesis. Without His will, the preparation and completion of this scientific work would not have been possible.

With the utmost respect and love, I express my deepest gratitude to my beloved wife and children, who have been a source of encouragement, patience, and motivation throughout this study. I also express my deepest gratitude to my parents for their constant prayers, moral support, and affection that have always accompanied my every step.

I also express my deepest appreciation and gratitude to my primary advisor, Dr. Ir. Maulahikmah Galinium, S.Kom., M.Sc., for her guidance, direction, and constructive evaluation throughout the preparation of this thesis. I also extend my sincere thanks to my co-advisor, Dr. Yunita Umniyati, S.Si., M.Sc., who has provided significant contributions through her valuable academic input. Furthermore, I would like to convey my gratitude to all SGU academic and administrative staff who have provided continuous support and assistance during my study period and the completion of this thesis.

May all the good deeds you have received be rewarded with value in the sight of Allah Subhanahu Wa Ta'ala. Finally, I realize that this thesis is far from perfect, and I am open to any form of input for future improvements.

TABLE OF CONTENTS

STATEMENT BY THE AUTHOR.....	2
ABSTRACT.....	3
DEDICATION	5
ACKNOWLEDGEMENTS	6
TABLE OF CONTENTS.....	7
LIST OF FIGURES	9
LIST OF TABLES	10
CHAPTER 1 - INTRODUCTION	11
1.1 Background.....	11
1.2 Research Problem	15
1.3 Research Objective	16
1.4 Research Questions	16
1.5 Hypothesis	16
1.6 Significance of Study	17
1.7 Research Scope.....	18
1.8 Research Limitations	19
CHAPTER 2 - LITERATURE REVIEW.....	20
2.1 Theoretical Perspectives: Hydraulic Pump.....	20
2.2 Charge Pump	22
2.3 TVC Valve.....	22
2.4 CO Valve	23
2.5 NC Valve	24
2.6 Servo Piston.....	24
2.7 Basic Concepts of IoT(web) with Arduino	25
2.8 Arduino Based Sensor & Data Logger Architecture	25
2.8.1 Arduino-Based Diesel Generator Monitoring System	26
2.8.2 Data Analysis Method with Arduino in IoT Systems	26
2.9 IoT Based Predictive Maintenance Concept	27
2.10 Challenges and Obstacles to Arduino-Based IoT Implementation.....	29
2.11 Previous Studies.....	29
CHAPTER 3 - RESEARCH METHODS	32
3.1 Research Framework	32
3.2 Define	33
3.3 Measure	34

3.4	Analyze	34
3.4.1	Pareto Problem Hydraulic System of PC1250-8	35
3.4.2	Field Data Collection	36
3.4.3	Failure Mode and Effects Analysis	37
3.4.4	Architecture Diagram	41
3.4.5	Use Case Diagram	42
CHAPTER 4 - RESULTS AND DISCUSSIONS		43
4.1	Improve	43
4.1.1	Fitur display monitoring pressure OLSS the hydraulic pump	43
4.1.2	Design interface web monitoring	44
4.1.3	Personal user only	45
4.1.4	Alert notification	46
4.2	Trial and error	48
4.3	Control	49
4.3.1	Pareto Problem	49
4.3.2	FGD, Interview, and Observation	50
4.3.3	FMEA	52
4.3.4	Comparison of OLSS Pressure Measurement Methods	54
4.3.5	User Acceptance test	55
4.3.6	User Experience Questionnaire	56
CHAPTER 5 - CONCLUSIONS AND RECOMMENDATIONS		58
5.1	Conclusions	58
5.2	Recommendations	58
REFERENCES		60
CURRICULUM VITAE		63

LIST OF FIGURES

Figure 1.1 Location of PT.XYZ.....	11
Figure 1.2 Excavator of PC1250-8 Komatsu.....	12
Figure 1.3 Hydraulic Pump Components.....	13
Figure 1.4 Power Train of Excavator PC1250-8.....	14
Figure 2.1 Component of Hydraulic Pump.....	20
Figure 2.2 Charge Pump	22
Figure 2.3 TVC Pump.....	23
Figure 2.4 CO Valve Operations	23
Figure 2.5 NC Valve	24
Figure 2.6 Servo Piston.....	24
Figure 2.7 Schematic Representation of the Setup to Monitor Exhaust Gases Emitted by a Diesel Generator.....	27
Figure 2.8 Bathtub Curve.....	28
Figure 3.1 Research Flowchart	32
Figure 3.2 SIPOC	33
Figure 3.3 Pareto of Hydraulic System Frequency May-July 2025.....	35
Figure 3.4 Architecture Diagram	41
Figure 3.5 Digi OLSS Concept.....	41
Figure 3.6 Use Case Diagram	42
Figure 4.1 Fitur display monitoring.....	43
Figure 4.2 Web system implementation	44
Figure 4.3 Display interface web monitoring	44
Figure 4.4 Design user Log-in	45
Figure 4.5 Member registration	45
Figure 4.6 Design interface	46
Figure 4.7 Coding program.....	47
Figure 4.8 Coding system and flowchart	47
Figure 4.9 Trial message.....	48
Figure 4.10 Proses trial and error.....	48
Figure 4.11 Performance of PC1250-8 Oct-Dec 2025.....	49
Figure 4.12 FGD Minutes of Meeting	50
Figure 4.13 Relation Diagram.....	51
Figure 4.14 Comparison of OLSS Pressure	54
Figure 4.15 Before after project Digi OLSS Web monitoring.....	54
Figure 4.16 Result of User Acceptance Test.....	55
Figure 4.17 Score of implementations OLSS Digi Web monitoring system.....	57

LIST OF TABLES

Table 2.1 Komatsu PC1250-8 Hydraulic Pump Specification	21
Table 2.2 Previous Studies.....	30
Table 3.1 Summary of FGD Participants, Data Contribution, and Validation Method	37
Table 3.2 Severity Rating Scale.....	38
Table 3.3 Occurrence Rating Scale.....	39
Table 3.4 Detection Rating Scale.....	39
Table 4.1 Trial and error implementation	49
Table 4.2 Result of Failure Mode Effect Analysis.....	53
Table 4.3 Result scala UEQ	56

