UNDERGRADUATE THESIS

PREDICTION OF COMMERCIAL CHICKEN EGG PRICES IN SIDOARJO REGENCY USING GATED RECURRENT UNIT (GRU)-TPE

MOHAMMAD ZAKI MUSHODDAQ
NPM 19081010017

THESIS ADVISORS
Andreas Nugroho Sihananto, S.Kom., M.Kom.
Ardhon Rakhmadi, S.Tr.T., M.Kom.

MINISTRY OF HIGHER EDUCATION, SCIENCE, AND TECHNOLOGY
UNIVERSITAS PEMBANGUNAN NASIONAL VETERAN JAWA TIMUR
FACULTY OF COMPUTER SCIENCE
INFORMATICS STUDY PROGRAM
SURABAYA
2026

APPROVAL SHEET

PREDICTION OF COMMERCIAL CHICKEN EGG PRICES IN SIDOARJO REGENCY USING GATED RECURRENT UNIT (GRU)-TPE

By :
MOHAMMAD ZAKI MUSHODDAQ
NPM. 19081010017

Has been defended before, and accepted by, the Board of Assessors of the Thesis Examination of the Informatics Study Program, Faculty of Computer Science, Universitas Pembangunan Nasional Veteran Jawa Timur, on June 17, 2026

Approved,

Andreas Nugroho S., S.Kom., M.Kom. **NIP. 19900412 202406 1 003**	.....	**(Advisor I)**
Ardhon Rakhmadi, S.Tr.T., M.Kom. **NIP. 19910805 202406 1 002**	.....	**(Advisor II)**
Dr. Ir. Mohammad Idhom, SP., S.Kom., MT **NIP. 19830310 202121 1 006**	.....	**(Head Assessor)**
Dr. Firza Prima Aditiawan, S.Kom, M.T.I, M.C.F, M.O.S **NIP. 19860523 202121 1 003**	.....	**(Assessor I)**

Acknowledge by,

Dean of the Faculty of Computer Science

Prof. Dr. Ir. Novirina Hendrasarie, MT.
NIP. 19681126 199403 2 001

APPROVAL SHEET

PREDICTION OF COMMERCIAL CHICKEN EGG PRICES IN SIDOARJO REGENCY USING GATED RECURRENT UNIT (GRU)-TPE

By :
MOHAMMAD ZAKI MUSHODDAQ
NPM. 19081010017

Approved to proceed to the Thesis Examination

Approved by,

Coordinator of Informatics Study Program
Faculty of Computer Science

Dr. Intan Yuniar Purbasari, S.Kom. MSc.

NIP. 19800602 202521 2 029

STATEMENT OF ORIGINALITY

I am the undersigned :

Student Name	:	Mohammad Zaki Mushoddaq
NPM	:	19081010017
Degree Program	:	Bachelor (S1)
Study Program	:	Informatics
Faculty	:	Faculty of Computer Science

Hereby declares that this undergraduate thesis contains no part of any other scientific work that has been submitted to obtain an academic degree at any higher education institution. Furthermore, it does not contain any work or opinions previously written or published by others, except for those which are explicitly cited in this thesis and listed completely in bibliography.

And I declare that this scientific document is free from elements of plagiarism. If in the future indications of plagiarism are found in this Thesis, I am willing to accept sanctions in accordance with the applicable laws and regulations.

Thus, I made this statement without any coercion from anyone and to be used as it should.

Surabaya, June 17, 2026
Declarant,

MOHAMMAD ZAKI MUSHODDAQ
NPM. 19081010017

ABSTRACT

Student Name / NPM	:	Mohammad Zaki Mushoddaq / 19081010017
Thesis Title :		Prediction Commercial Chicken Egg Prices in Sidoarjo Regency Using Gated Recurrent Unit (GRU)-TPE
Advisor	:	1. Andreas Nugroho Sihananto, S.Kom., M.Kom 2. Ardhon Rakhmadi, S.Tr.T., M.Kom.

Commercial chicken eggs are a strategic food commodity with highly volatile prices, reaching up to 82% difference between the lowest and highest values based on daily SIMPONI Ternak data from Sidoarjo Regency for the 2020–2025 period. This price instability significantly affects farmers, traders, and regional food security, underscoring the need for an accurate prediction system accessible to non-technical users. This study aimed to evaluate the performance of a Gated Recurrent Unit (GRU) model optimized with the Tree-structured Parzen Estimator (TPE) via Optuna, assess the contribution of calendar-based exogenous features to prediction accuracy, and deploy the best model as a Streamlit-based web application. A quantitative experimental approach was employed with three input scenarios: univariate (price only), bivariate (price + is_holiday), and trivariate (price + is_holiday + dtoh_norm). A total of 2,192 daily observations were chronologically split at a 70:15:15 ratio, with each scenario independently optimized over 100 trials. The GRU-TPE-Tri model achieved the best performance on the test data, with a MAPE of 0.6064%, MAE of Rp164.80, and RMSE of Rp359.16, outperforming the unoptimized LSTM baseline by 16.35% in MAPE. Adding the dtoh_norm feature reduced the MAE by 28.03% compared to the bivariate scenario, demonstrating that a quantitative representation of temporal distance to holidays is more informative than a binary signal alone. The best model was successfully deployed as a functional web application prototype without programming expertise. Subsequent research may add other exogenous variables, perform multi-step prediction, or use hybrid methods.

Keywords: Gated Recurrent Unit (GRU), Tree-structured Parzen Estimator, Commercial chicken egg price prediction, calendar exogenous features, Streamlit

ACKNOWLEDGEMENTS

Praise be to Allah SWT for all His graces, guidance, and gifts to the author so that the thesis proposal with the title **" PREDICTION OF COMMERCIAL CHICKEN EGG PRICES IN SIDOARJO REGENCY USING GATED RECURRENT UNIT (GRU)-TPE"** can be completed properly.

During the preparation of the thesis proposal, the author also received a lot of assistance from various parties. For this the author would like to thank the:

1. Mr. Prof. Dr. Ir. Akhmad Fauzi, MMT. as the rector of the National Development University “Veteran” East Java.
2. Mrs. Prof. Dr. Ir. Novirina Hendrasarie, M.T. as the Dean of the Faculty of Computer Science, National Development University "Veteran" East Java.
3. Ms. Dr. Intan Yuniar Purbasari, S.Kom., MSc. as the Coordinator of Informatics Study Program, Faculty of Computer Science, National Development University of East Java.
4. Andreas Nugroho Sihananto, S.Kom., M.Kom., and Ardhon Rakhmadi, S.Tr.T., M.Kom., as Thesis Advisors, for their guidance, direction, motivation, and valuable advice throughout the research and writing process.
5. Dr. Ir. Mohammad Idhom, SP., S.Kom., MT., and Dr. Firza Prima Aditiawan, S.Kom, M.T.I, M.C.F, M.O.S., as Examiners, for providing meaningful feedback, suggestions, and evaluations to improve this thesis.
6. All lecturers and educational staff in the Informatics Study Program who have imparted knowledge to the author during the lecture period so that the author has the necessary skills to complete this undergraduate thesis.
7. The author’s beloved parents, for their endless prayers, support, and assistance, both morally and financially, throughout the educational journey and the completion of this thesis.
8. All those who cannot be named individually but who have helped and supported the author in completing this thesis.
9. Lastly, the author would like to appreciate himself for the perseverance and effort in overcoming various challenges throughout the process of completing this thesis.

The author realizes that in the preparation of the following thesis there are many shortcomings. For this reason, constructive criticism and suggestions from all parties are highly expected for the perfection of writing the following thesis. Finally, with all the limitations that the author has, hopefully the following report can be useful for all parties in general and the author in particular.

Surabaya, June 17th 2026

Author

LIST OF CONTENTS

LIST OF FIGURES

LIST OF TABLES