LAMPIRAN

Lampiran 1 Daftar Riwayat Hidup

DAFTAR RIWAYAT HIDUP

A. Biodata Mahasiswa

Nama Lengkap	: Nendi Sunendar
NIM	: 14240027
Program Studi	: Informatika
Fakultas	: Teknologi Informasi
Jenjang	: Strata Dua (S2)
Peminatan	: Artificial Intelligence dan Blockchain
Tempat Tinggal	: Bogor, Indonesia
Email	: sunendarnendi@gmail.com
Nomor Telepon	: +62 811-9821-873

B. Riwayat Pendidikan Formal dan Non-Formal

1. Universitas Nusa Mandiri, Program Studi Informatika (S2), 2024–2026.
2. Universitas Krisnadwipayana, Program Studi Teknik Informatika, 2019–2024.
3. STM Negeri Sukabumi, Elektronika Komunikasi, 1993–1996.
4. Pelatihan Xamarin, IPDL, 2018.
5. Pelatihan Microsoft Visual Studio/C#, 2017.
6. Data Science untuk Pengembangan dan Penerapan Artificial Intelligence (AI), Inixindo Jogja, 2024.

C. Riwayat Pengalaman Organisasi / Pekerjaan

1. IT Programmer dan Data Analyst, Godrej Distribution Indonesia, Bogor, 2013–sekarang.
2. Kepala Bagian MIS, PT Citra Mandiri Metalindo Abadi, 2010–2013.
3. MIS/IT Manager, PT Hargas Industries Indonesia, 2008–2010.
4. IT Supervisor, PT Solana Akusara, 2006–2007.
5. IT Programmer, PT Kanzen Motor Indonesia, 2005–2007.
6. IT Programmer, PT Solaiti Indonesia, 2000–2005.



Jakarta, 11 Agustus 2024



(Nendi Sunendar)

Lampiran 2. Surat Keterangan Riset

SURAT KETERANGAN RISET

Kemenkes
RS Persahabatan

Kementerian
Direktorat Jenderal Kesehatan
RSUP Persahabatan Jakarta
Jl. Persahabatan Raya No. 1 Jak-Tim 13230
(021) 4891708
www.rspersahabatan.co.id

Nomor : DP.04.03/D.XIX.2/6631/2026 24 Juni 2026
Hal : Izin Penelitian

Yth, Wakil Rektor II Bidang Non Akademik
Universitas Nusa Mandiri
Jl. Jatiwaringin Raya No.2
di Jakarta Timur

Sehubungan dengan surat dari Wakil Rektor II Bidang Non Akademik No. 022/5.01/UNM/WR2/V/2026 tanggal 08 Mei 2026 perihal Permohonan Izin Penelitian dan surat keterangan lolos uji etik dari Komite Etik Penelitian Kesehatan RSUP Persahabatan No. 0205/KEPK-RSUPP/06/2026 tanggal 22 Juni 2026, bersama ini disampaikan hal–hal sebagai berikut:

1. Pada prinsipnya dapat disetujui usul penelitian yang akan dilakukan di RSUP Persahabatan atas :
   Nama Peneliti : Nendi Sunendar
   Judul Penelitian : **"Rancang Bangun Model Protoipe Berbasis *Artificial Intelligence* dan *Blockchain* untuk Otomatisasi *Purchase Order* Obat pada Layanan Kesehatan Mitra BPJS"**
   Pendamping : Farizal Ginanjar, S.Kom
2. Penelitian tersebut wajib dilaksanakan sesuai dengan prosedur yang berlaku di RSUP Persahabatan dengan ketentuan sebagai berikut:
   a. Peneliti bersedia menandatangani surat pernyataan penelitian yang antara lain wajib mencantumkan pembimbing lapangan (SDM RSUP Persahabatan) pada saat publikasi.
   b. Membayar biaya administrasi penelitian sesuai SK Direktur Utama RSUP Persahabatan No. HK.02.03/D.XX/5767.1/2025 tanggal 5 Mei 2025 tentang tarif penelitian sebesar Rp. 2.100.000,- (Dua Juta Seratus Ribu Rupiah), terdiri dari:
      1) Biaya administrasi Uji Etik Sebesar Rp. 500.000,- dibayarkan melalui transfer ke Bank Mandiri dengan No rekening **006-00-0497-5342** a.n. RPL 182 BLU RSUPP U OPS PN MDRI
      2) Biaya Penelitian sebesar Rp. 1.600.000,- dibayarkan melalui transfer ke Bank Mandiri dengan No. Virtual Account **8891420510000365**
3. Izin Penelitian akan diterbitkan dan diserahkan kepada peneliti setelah syarat sesuai tercantum pada point angka 2 diatas terpenuhi.
4. Teknis pelaksanaan penelitian dan penyelesaian administrasi dapat menghubungi *Clinical Research Unit* RSUP Persahabatan atau narahubung Sdri. Mila Fitriaty, S.KM., M.Epid dan Wati Melasari, S.M di nomor telepon (021) 4891708 Ext. 651.

Demikian disampaikan, atas perhatian dan kerjasamanya kami ucapkan terima kasih.

Direktur Sumber Daya Manusia, Pendidikan, dan Penelitian Rumah Sakit Umum Pusat Persahabatan Jakarta,

Emmy Amalia, SKM, MPH

Kementerian Kesehatan tidak menerima suap dan/atau gratifikasi dalam bentuk apapun. Jika terdapat potensi suap atau gratifikasi silahkan laporkan melalui HALO KEMENKES 1500567 dan https://wbs.kemenkes.go.id. Untuk verivikasi keaslian tanda tangan elektronik, silahkan unggah dokumen pada laman https://tte.kominfo.go.id/verifyPDF

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Lampiran 3. Bukti Hasil Pengecekan Plagiarisme Laporan Tesis

Tesis Nendi Sunendar 14240027-1.pdf

ORIGINALITY REPORT

11%	9%	4%	8%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to Universitas Raharja Student Paper	3%
2	repository.nusamandiri.ac.id Internet Source	2%
3	Submitted to Universitas Bina Sarana Informatika Student Paper	1%
4	Submitted to Universitas Pamulang Student Paper	<1%
5	Submitted to Universitas Sangga Buana YPKP Student Paper	<1%
6	Arief Priyono, Hasby Firmansyah, Wahyu Asriyani, Rizki Prasetyo Tulodo. "Analisis Pengaruh Parameter Support Vector Machine Terhadap Akurasi Prediksi Harga Saham", Jurnal Pengabdian Masyarakat dan Riset Pendidikan, 2025 Publication	<1%
7	Submitted to Sekolah Teknik Elektro & Informatika Student Paper	<1%
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11	Submitted to UM Surabaya Student Paper	<1%
12	Submitted to UPN Veteran Yogyakarta Student Paper	<1%
13	Budi Antoro, Nurhayati Nurhayati, Andika Prayoga, Zafnia Febby, Clara Chyntia Haris Putri Lubis. "Perbandingan Kinerja Jaringan Saraf Tiruan dan Seasonal Naïve Dalam Peramalan Konsumsi Listrik Bulanan Rumah Tangga: Studi Walk-Forward Validation", Bisnis Net Jurnal Ekonomi dan Bisnis, 2026 Publication	<1%

Lampiran 4. Bukti Hasil Pengecekan Plagiarisme Artikel Ilmiah

Jurnal AI



42011-85725-4 AI-based benchmarking framework for heterogeneous hospital pharmaceutical demand forecasting.pdf

ORIGINALITY REPORT

13%	12%	8%	8%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	iaescore.com Internet Source	2%
2	Submitted to learndirect Student Paper	2%
3	Submitted to University of Wollongong Student Paper	1%
4	mdpi-res.com Internet Source	1%
5	madoc.bib.uni-mannheim.de Internet Source	<1%
6	journal.50sea.com Internet Source	<1%
7	staff.najah.edu Internet Source	<1%
8	arxiv.org Internet Source	<1%
9	Yuan Shi, Jiaqi Ding, Ting Qu, Binghong Xie. "Beverage manufacturing demand forecasting system driven by multi-stage machine learning model pool", Applied Soft Computing, 2026 Publication	<1%
10	Rashid, Mamunur. "From Data Synthesis to Station Siting: A Learning-Based Framework to Accelerate EV Adoption.", Tennessee Technological University Publication	<1%
11	Submitted to Universitas Esa Unggul Student Paper	<1%
12	ijeecs.iaescore.com Internet Source	<1%
13	Andreas Sarantopoulos, Zoe Dorothea Pana, Andreas Larentzakis, Sophia Kondylis et al. "Chat GPT Against Medical Students: A Comparative Analysis of	<1%

Jurnal Blockchain

PAPER021060_A Blockchain-Based Smart Contract System for Pharmaceutical Procurement with Demand Forecasting.pdf

ORIGINALITY REPORT

11%	7%	9%	4%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Taras Kyryliuk, Mykhailo Palahuta, Oleksii Dovhaniuk, Vitaly Deibuk. "FPGA Implementation of a Fault-tolerant Encryptor Based on Reconfigurable Fredkin Gates", International Journal of Information Technology and Computer Science, 2026 Publication	2%
2	Submitted to Caucasus University Student Paper	1%
3	Jay Daniel, Ashutosh Samadhiya, Jose Arturo Garza-Reyes. "Blockchain Technology - Transforming Businesses and Shaping the Future", CRC Press, 2024 Publication	1%
4	www.mdpi.com Internet Source	<1%
5	Nayankumar M. Mali, Narendrasinh C. Chauhan. "Advances in Malware Detection using Machine Learning and Deep Learning: A Comprehensive Comparative Analysis", International Journal of Computer Network and Information Security, 2026 Publication	<1%
6	www.ijsrcseit.com Internet Source	<1%
7	Behnaz Behara, Mehdi Delrobaei, Nima Afraz. "Trusted Blockchain-Based Clinical Decision and Medication Management System for Movement Disorders", IEEE Access, 2025 Publication	<1%
8	blog.dblk.uk Internet Source	<1%
9	Rahma Haouas Zahwanie, Lilia Cheniti-Belcadhi, Saoussen Layouni, Ghada El Khayat. "An Ontology Driven Machine Learning Framework for Early Prediction in Children with Cerebral Palsy", International Journal of Information Technology and Computer Science, 2026 Publication	<1%
10	globalsciences.uz Internet Source	<1%

Lampiran 5. Bukti Publikasi dan Proses Publikasi Artikel Ilmiah

5.1. Artikel IJECE (Published)

AI-Based Benchmarking Framework for Heterogeneous Hospital Pharmaceutical Demand Forecasting

International Journal of Electrical and Computer Engineering (IJECE)

Status: Published

Link : https://ijece.iaescore.com/index.php/IJECE/article/view/42011

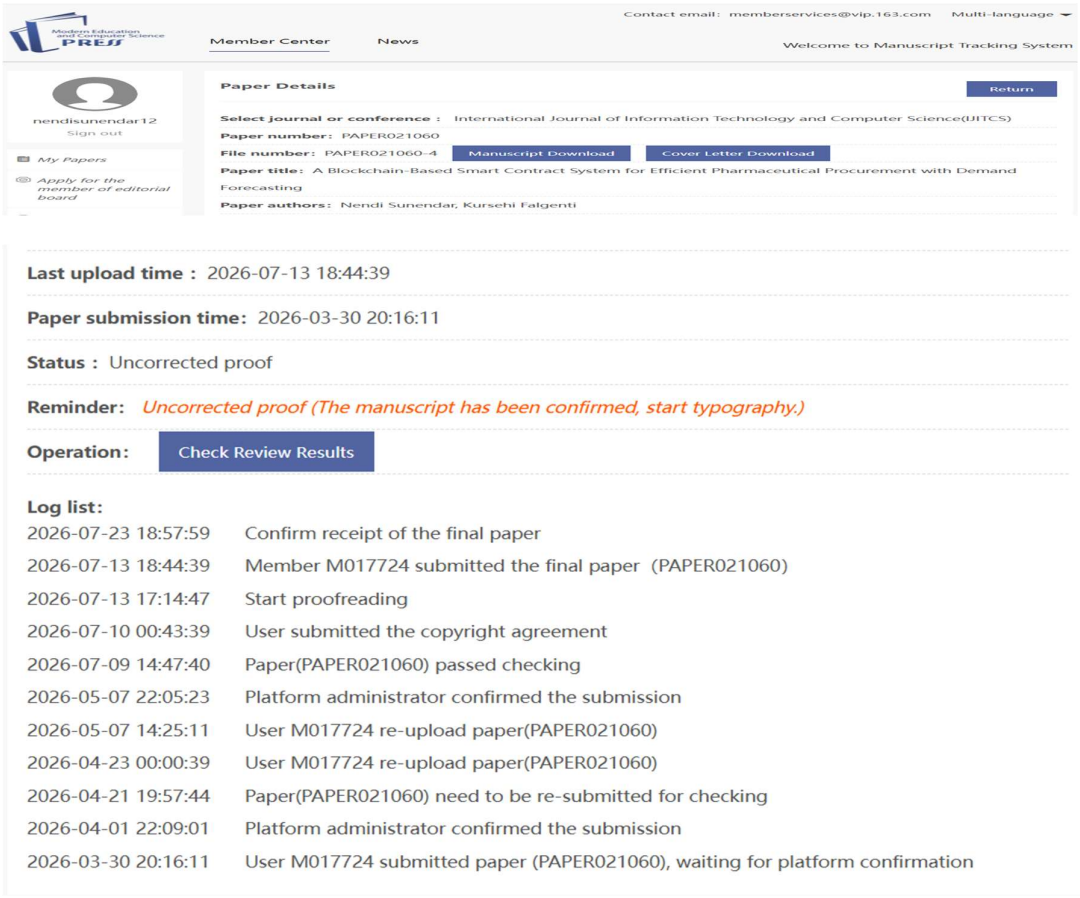
DOI: http://doi.org/10.11591/ijece.v16i5.pp2847-2857



5.2. Artikel 2 (Production)

A Blockchain-Based Smart Contract System for Efficient Pharmaceutical Procurement with Demand Forecasting

Status: Proofreading / Production



Lampiran 6. Daftar Jurnal yang Pernah Dipublikasikan Penulis

“COMPARISON OF ARIMA, LSTM, AND GRU MODELS FOR FORECASTING SALES OF HIT AEROSOL PRODUCTS”. 2025. Jurnal Pilar Nusa Mandiri 21 (2): 153-59. https://doi.org/10.33480/pilar.v21i2.6412.

“COMPARATIVE PERFORMANCE OF TRANSFORMER AND LSTM MODELS FOR INDONESIAN INFORMATION RETRIEVAL WITH INDOBERT”. 2025. Jurnal Pilar Nusa Mandiri 21 (2): 228-33. https://doi.org/10.33480/pilar.v21i2.6920.

Sunendar, Nendi. 2025. “Perancangan Business Intelligence Dashboard Sales Performance”. Innotech: Jurnal Ilmu Komputer, Sistem Informasi Dan Teknologi Informasi 2 (2):121-36. https://ejournal.cyber-univ.ac.id/index.php/innotech/article/view/86.

Nendi Sunendar, Harjono P. Putro, and Rizki Hesananda. 2025. “Prediksi Penjualan Aerosol Menggunakan Algoritma ARIMA, LSTM Dan GRU”. INSOLOGI: Jurnal Sains Dan Teknologi 4 (1):113-26. https://doi.org/10.55123/insologi.v4i1.4868.

UNIVERSITAS
NUSA MANDIRI

Lampiran 7. 10tps-run1

Caliper report

Summary of performance metrics

Name	Succ	Fail	Send Rate (TPS)	Max Latency (s)	Min Latency (s)	Avg Latency (s)	Throughput (TPS)
CreatePO-10TPS-Run1	200	0	10.1	0.58	0.02	0.07	10.1

Benchmark round: CreatePO-10TPS-Run1

Submit 200 CreatePO transactions at a target rate of 10 TPS

```
rateControl:
  type: fixed-rate
  opts:
    tps: 10
```

Performance metrics for CreatePO-10TPS-Run1

Name	Succ	Fail	Send Rate (TPS)	Max Latency (s)	Min Latency (s)	Avg Latency (s)	Throughput (TPS)
CreatePO-10TPS-Run1	200	0	10.1	0.58	0.02	0.07	10.1

Resource utilization for CreatePO-10TPS-Run1

Test Environment

benchmark config

```
name: smartfarmasi-table3-10tps-run1
description: >-
  Hyperledger Caliper pharmaceutical procurement benchmark at 10 TPS,
  experimental run 1
workers:
  type: local
  number: 2
rounds:
  - label: CreatePO-10TPS-Run1
    txNumber: 200
    rateControl:
      type: fixed-rate
      opts:
        tps: 10
    workload:
      module: workload/createPO.js
      arguments:
        runId: 10tps-run1
        targetTps: 10
        submittedTx: 200
    description: Submit 200 CreatePO transactions at a target rate of 10 TPS
```

SUT

```
not provided
```

Lampiran 8. 10tps-run2

Caliper report

Summary of performance metrics

Name	Succ	Fail	Send Rate (TPS)	Max Latency (s)	Min Latency (s)	Avg Latency (s)	Throughput (TPS)
CreatePO-10TPS-Run2	200	0	10.1	0.21	0.02	0.04	10.1

Benchmark round: CreatePO-10TPS-Run2

Submit 200 CreatePO transactions at a target rate of 10 TPS

```
rateControl:
  type: fixed-rate
  opts:
    tps: 10
```

Performance metrics for CreatePO-10TPS-Run2

Name	Succ	Fail	Send Rate (TPS)	Max Latency (s)	Min Latency (s)	Avg Latency (s)	Throughput (TPS)
CreatePO-10TPS-Run2	200	0	10.1	0.21	0.02	0.04	10.1

Resource utilization for CreatePO-10TPS-Run2

Test Environment

benchmark config

```
name: smartfarmasi-table3-10tps-run2
description: >-
  Hyperledger Caliper pharmaceutical procurement benchmark at 10 TPS,
  experimental run 2
workers:
  type: local
  number: 2
rounds:
  - label: CreatePO-10TPS-Run2
    txNumber: 200
    rateControl:
      type: fixed-rate
      opts:
        tps: 10
    workload:
      module: workload/createPO.js
      arguments:
        runId: 10tps-run2
        targetTps: 10
        submittedTx: 200
    description: Submit 200 CreatePO transactions at a target rate of 10 TPS
```

SUT

Lampiran 9. 50tps-run1

Caliper report

Summary of performance metrics

Name	Succ	Fail	Send Rate (TPS)	Max Latency (s)	Min Latency (s)	Avg Latency (s)	Throughput (TPS)
CreatePO-50TPS-Run1	500	0	50.2	0.10	0.02	0.03	50.1

Benchmark round: CreatePO-50TPS-Run1

Submit 500 CreatePO transactions at a target rate of 50 TPS

```
rateControl:
  type: fixed-rate
  opts:
    tps: 50
```

Performance metrics for CreatePO-50TPS-Run1

Name	Succ	Fail	Send Rate (TPS)	Max Latency (s)	Min Latency (s)	Avg Latency (s)	Throughput (TPS)
CreatePO-50TPS-Run1	500	0	50.2	0.10	0.02	0.03	50.1

Resource utilization for CreatePO-50TPS-Run1

Test Environment

benchmark config

```
name: smartfarmasi-table3-50tps-run1
description: >-
  Hyperledger Caliper pharmaceutical procurement benchmark at 50 TPS,
  experimental run 1
workers:
  type: local
  number: 2
rounds:
  - label: CreatePO-50TPS-Run1
    txNumber: 500
    rateControl:
      type: fixed-rate
      opts:
        tps: 50
    workload:
      module: workload/createPO.js
      arguments:
        runId: 50tps-run1
        targetTps: 50
        submittedTx: 500
    description: Submit 500 CreatePO transactions at a target rate of 50 TPS
```

SUT

```
not provided
```

Lampiran 10. 50tps-run2

Caliper report

Summary of performance metrics

Name	Succ	Fail	Send Rate (TPS)	Max Latency (s)	Min Latency (s)	Avg Latency (s)	Throughput (TPS)
CreatePO-50TPS-Run2	500	0	50.2	0.55	0.02	0.05	50.1

Benchmark round: CreatePO-50TPS-Run2

Submit 500 CreatePO transactions at a target rate of 50 TPS

```
rateControl:
  type: fixed-rate
  opts:
    tps: 50
```

Performance metrics for CreatePO-50TPS-Run2

Name	Succ	Fail	Send Rate (TPS)	Max Latency (s)	Min Latency (s)	Avg Latency (s)	Throughput (TPS)
CreatePO-50TPS-Run2	500	0	50.2	0.55	0.02	0.05	50.1

Resource utilization for CreatePO-50TPS-Run2

Test Environment

benchmark config

```
name: smartfarmasi-table3-50tps-run2
description: >-
  Hyperledger Caliper pharmaceutical procurement benchmark at 50 TPS,
  experimental run 2
workers:
  type: local
  number: 2
rounds:
  - label: CreatePO-50TPS-Run2
    txNumber: 500
    rateControl:
      type: fixed-rate
      opts:
        tps: 50
    workload:
      module: workload/createPO.js
      arguments:
        runId: 50tps-run2
        targetTps: 50
        submittedTx: 500
    description: Submit 500 CreatePO transactions at a target rate of 50 TPS
```

SUT

```
not provided
```

Lampiran 11. 100tps-run1

Caliper report

Summary of performance metrics

Name	Succ	Fail	Send Rate (TPS)	Max Latency (s)	Min Latency (s)	Avg Latency (s)	Throughput (TPS)
CreatePO-100TPS-Run1	1000	0	100.3	0.10	0.01	0.03	100.0

Benchmark round: CreatePO-100TPS-Run1

Submit 1000 CreatePO transactions at a target rate of 100 TPS

```
rateControl:
  type: fixed-rate
  opts:
    tps: 100
```

Performance metrics for CreatePO-100TPS-Run1

Name	Succ	Fail	Send Rate (TPS)	Max Latency (s)	Min Latency (s)	Avg Latency (s)	Throughput (TPS)
CreatePO-100TPS-Run1	1000	0	100.3	0.10	0.01	0.03	100.0

Resource utilization for CreatePO-100TPS-Run1

Test Environment

benchmark config

```
name: smartfarmasi-table3-100tps-run1
description: >-
  Hyperledger Caliper pharmaceutical procurement benchmark at 100 TPS,
  experimental run 1
workers:
  type: local
  number: 2
rounds:
  - label: CreatePO-100TPS-Run1
    txNumber: 1000
    rateControl:
      type: fixed-rate
      opts:
        tps: 100
    workload:
      module: workload/createPO.js
      arguments:
        runId: 100tps-run1
        targetTps: 100
        submittedTx: 1000
    description: Submit 1000 CreatePO transactions at a target rate of 100 TPS
```

SUT

```
not provided
```

Lampiran 12. 100tps-run2

Caliper report

Summary of performance metrics

Name	Succ	Fail	Send Rate (TPS)	Max Latency (s)	Min Latency (s)	Avg Latency (s)	Throughput (TPS)
CreatePO-100TPS-Run2	1000	0	100.2	0.15	0.01	0.03	100.0

Benchmark round: CreatePO-100TPS-Run2

Submit 1000 CreatePO transactions at a target rate of 100 TPS

```
rateControl:
  type: fixed-rate
  opts:
    tps: 100
```

Performance metrics for CreatePO-100TPS-Run2

Name	Succ	Fail	Send Rate (TPS)	Max Latency (s)	Min Latency (s)	Avg Latency (s)	Throughput (TPS)
CreatePO-100TPS-Run2	1000	0	100.2	0.15	0.01	0.03	100.0

Resource utilization for CreatePO-100TPS-Run2

Test Environment

benchmark config

```
name: smartfarmasi-table3-100tps-run2
description: >-
  Hyperledger Caliper pharmaceutical procurement benchmark at 100 TPS,
  experimental run 2
workers:
  type: local
  number: 2
rounds:
  - label: CreatePO-100TPS-Run2
    txNumber: 1000
    rateControl:
      type: fixed-rate
      opts:
        tps: 100
    workload:
      module: workload/createPO.js
      arguments:
        runId: 100tps-run2
        targetTps: 100
        submittedTx: 1000
    description: Submit 1000 CreatePO transactions at a target rate of 100 TPS
```

SUT

```
not provided
```

Lampiran 13. 150tps-run1

Caliper report

Summary of performance metrics

Name	Succ	Fail	Send Rate (TPS)	Max Latency (s)	Min Latency (s)	Avg Latency (s)	Throughput (TPS)
CreatePO-150TPS-Run1	1500	0	150.3	0.48	0.02	0.09	149.8

Benchmark round: CreatePO-150TPS-Run1

Submit 1500 CreatePO transactions at a target rate of 150 TPS

```
rateControl:
  type: fixed-rate
  opts:
    tps: 150
```

Performance metrics for CreatePO-150TPS-Run1

Name	Succ	Fail	Send Rate (TPS)	Max Latency (s)	Min Latency (s)	Avg Latency (s)	Throughput (TPS)
CreatePO-150TPS-Run1	1500	0	150.3	0.48	0.02	0.09	149.8

Resource utilization for CreatePO-150TPS-Run1

Test Environment

benchmark config

```
name: smartfarmasi-table3-150tps-run1
description: >-
  Hyperledger Caliper pharmaceutical procurement benchmark at 150 TPS,
  experimental run 1
workers:
  type: local
  number: 2
rounds:
  - label: CreatePO-150TPS-Run1
    txNumber: 1500
    rateControl:
      type: fixed-rate
      opts:
        tps: 150
    workload:
      module: workload/createPO.js
      arguments:
        runId: 150tps-run1
        targetTps: 150
        submittedTx: 1500
    description: Submit 1500 CreatePO transactions at a target rate of 150 TPS
```

SUT

```
not provided
```

Lampiran 14. 150tps-run2

Caliper report

Summary of performance metrics

Name	Succ	Fail	Send Rate (TPS)	Max Latency (s)	Min Latency (s)	Avg Latency (s)	Throughput (TPS)
CreatePO-150TPS-Run2	1500	0	150.3	0.36	0.01	0.05	149.9

Benchmark round: CreatePO-150TPS-Run2

Submit 1500 CreatePO transactions at a target rate of 150 TPS

```
rateControl:
  type: fixed-rate
  opts:
    tps: 150
```

Performance metrics for CreatePO-150TPS-Run2

Name	Succ	Fail	Send Rate (TPS)	Max Latency (s)	Min Latency (s)	Avg Latency (s)	Throughput (TPS)
CreatePO-150TPS-Run2	1500	0	150.3	0.36	0.01	0.05	149.9

Resource utilization for CreatePO-150TPS-Run2

Test Environment

benchmark config

```
name: smartfarmasi-table3-150tps-run2
description: >-
  Hyperledger Caliper pharmaceutical procurement benchmark at 150 TPS,
  experimental run 2
workers:
  type: local
  number: 2
rounds:
  - label: CreatePO-150TPS-Run2
    txNumber: 1500
    rateControl:
      type: fixed-rate
      opts:
        tps: 150
    workload:
      module: workload/createPO.js
      arguments:
        runId: 150tps-run2
        targetTps: 150
        submittedTx: 1500
    description: Submit 1500 CreatePO transactions at a target rate of 150 TPS
```

SUT

```
not provided
```

Lampiran 15. Source Code Tahap sumber dan pengambilan data

Modul yang digunakan:

src/ingestion/endpoint_source.py
https://github.com/nsunendar/repository_tesis_nendi/blob/main/src/ingestion/endpoint_source.py

src/ingestion/prima_penggunaan.py
https://github.com/nsunendar/repository_tesis_nendi/blob/main/src/ingestion/prima_penggunaan.py

scripts/00a_sync_penggunaan_api.py
https://github.com/nsunendar/repository_tesis_nendi/blob/main/scripts/00a_sync_penggunaan_api.py

Prosesnya:
- Python mengakses endpoint sumber data rumah sakit.
- Respons endpoint dibaca berdasarkan periode tertentu.
- Field sumber dipetakan menjadi struktur internal.
- Data mentah dimasukkan ke tabel staging MySQL.
- Data mentah tetap dipertahankan agar proses dapat diaudit ulang.

Field utama dari sumber:
kode → drug_code
qty → qty_used
t → period_date

Tabel staging:
prima_penggunaan_dump

Perintah menjalankan:

```
python -u -m scripts.00a_sync_penggunaan_api \
  --start 2020-01 \
  --end 2026-07 \
  --mode replace
```

Lampiran 16. General preprocessing

Modul yang digunakan:

src/preprocessing/general.py

https://github.com/nsunendar/repository_tesis_nendi/blob/main/src/preprocessing/general.py

scripts/01_general_preprocessing.py
https://github.com/nsunendar/repository_tesis_nendi/blob/main/scripts/01_general_preprocessing.py

Perintah:

python -u -m scripts.01_general_preprocessing

Ringkasan kualitas disimpan pada:

preprocessing_quality_summary

Lampiran 17. Analisis stasioneritas

Modul yang digunakan:

scripts/02c_stationarity_analysis.py
https://github.com/nsunendar/repository_tesis_nendi/blob/main/scripts/02c_stationarity_analysis.py

Perintah:

python -u -m scripts.02c_stationarity_analysis

Proses ini membaca data dari:

preprocessed_daily_usage

Lampiran 18. Seleksi obat untuk pemodelan

Modul yang digunakan:
src/inventory/drug_selection.py
https://github.com/nsunendar/repository_tesis_nendi/blob/main/src/inventory/drug_selection.py

src/models/drug_sampling.py
https://github.com/nsunendar/repository_tesis_nendi/blob/main/src/models/drug_sampling.py

scripts/02_auto_drug_selection.py
https://github.com/nsunendar/repository_tesis_nendi/blob/main/scripts/02_auto_drug_selection.py

Perintah:

```
python -u -m scripts.02_auto_drug_selection
```

Kriteria seleksi meliputi:

status obat aktif,
panjang histori mencukupi,
jumlah observasi memadai,
frekuensi penggunaan mencukupi,
kualitas deret waktu dapat diproses,
kecocokan dengan master obat.

Setiap kode obat memperoleh status seperti:

ACTIVE
INACTIVE
ADEQUATE
INSUFFICIENT_HISTORY
SELECTED
NOT_SELECTED

Lampiran 19. Preprocessing khusus model Seasonal Naive

File utama:

src/preprocessing/model_specific.py
https://github.com/nsunendar/repository_tesis_nendi/blob/main/src/preprocessing/model_specific.py

scripts/03_preprocess_models.py
https://github.com/nsunendar/repository_tesis_nendi/blob/main/scripts/03_preprocess_models.py

Perintah:

```
python -u -m scripts.03_preprocess_models
```

Lampiran 20. Preprocessing khusus model SARIMA

https://github.com/nsunendar/repository_tesis_nendi/blob/main/scripts/train_sarima.py

Lampiran 21. Preprocessing khusus model LightGBM

https://github.com/nsunendar/repository_tesis_nendi/blob/main/scripts/train_lightgbm.py

Lampiran 22. Preprocessing khusus model LSTM

https://github.com/nsunendar/repository_tesis_nendi/blob/main/scripts/train_lstm.py

Lampiran 23. Rolling time-series cross-validation

File:

src/models/cross_validation.py
https://github.com/nsunendar/repository_tesis_nendi/blob/main/src/models/cross_validation.py

src/models/training_common.py
https://github.com/nsunendar/repository_tesis_nendi/blob/main/src/models/training_common.py

Lampiran 24. Training empat model

Dalam draft tesis, model utama yang dibandingkan adalah:

1. Seasonal Naive;
2. SARIMA;
3. LightGBM;
4. LSTM.

Implementasi file:

src/models/seasonal_naive_training.py
https://github.com/nsunendar/repository_tesis_nendi/blob/main/src/models/seasonal_naive_training.py

scripts/04_1train_seasonal_naive.py
https://github.com/nsunendar/repository_tesis_nendi/blob/main/scripts/04_1train_seasonal_naive.py

src/models/sarima_training.py
https://github.com/nsunendar/repository_tesis_nendi/blob/main/src/models/sarima_training.py

scripts/04_2train_sarima.py
https://github.com/nsunendar/repository_tesis_nendi/blob/main/scripts/04_2train_sarima.py

src/models/lightgbm_training.py
https://github.com/nsunendar/repository_tesis_nendi/blob/main/src/models/lightgbm_training.py

scripts/04_3train_lightgbm.py
https://github.com/nsunendar/repository_tesis_nendi/blob/main/scripts/04_3train_lightgbm.py

src/models/lstm_training.py
https://github.com/nsunendar/repository_tesis_nendi/blob/main/src/models/lstm_training.py

scripts/04_4train_lstm.py
https://github.com/nsunendar/repository_tesis_nendi/blob/main/scripts/04_4train_lstm.py

Atau dijalankan berurutan melalui:

python -u -m scripts.run_train_models_sequential

https://github.com/nsunendar/repository_tesis_nendi/blob/main/scripts/run_train_models_sequential.py

Lampiran 25. Evaluasi MAE, RMSE, dan MAPE

src/utils/metrics.py
https://github.com/nsunendar/repository_tesis_nendi/blob/main/src/utils/metrics.py

src/models/train_evaluate.py
https://github.com/nsunendar/repository_tesis_nendi/blob/main/src/models/train_evaluate.py

Tabel MySQL:
ablation_results
model_cv_results

Lampiran 26. Studi ablasi

src/models/unified_training.py
https://github.com/nsunendar/repository_tesis_nendi/blob/main/src/models/unified_training.py

src/models/feature_search_models.py
https://github.com/nsunendar/repository_tesis_nendi/blob/main/src/models/feature_search_models.py

scripts/04_0unified_train_ablation_predict.py
https://github.com/nsunendar/repository_tesis_nendi/blob/main/scripts/04_0unified_train_ablation_predict.py

scripts/run_parameter_ablation.py
https://github.com/nsunendar/repository_tesis_nendi/blob/main/scripts/run_parameter_ablation.py

Lampiran 27. Pemilihan model terbaik per obat

src/models/model_selection.py
https://github.com/nsunendar/repository_tesis_nendi/blob/main/src/models/model_selection.py

scripts/04a_select_best_features_four_models.py
https://github.com/nsunendar/repository_tesis_nendi/blob/main/scripts/04a_select_best_features_four_models.py

Lampiran 28. Forecasting 7, 21, dan 30 hari

src/forecasting/horizon.py
https://github.com/nsunendar/repository_tesis_nendi/blob/main/src/forecasting/horizon.py

src/forecasting/operational.py
https://github.com/nsunendar/repository_tesis_nendi/blob/main/src/forecasting/operational.py

scripts/05_rebuild_best_per_drug_forecasts.py
https://github.com/nsunendar/repository_tesis_nendi/blob/main/scripts/05_rebuild_best_per_drug_forecasts.py

Tabel hasil harian:
forecasting_daily_results

Lampiran 29. Integrasi ABC–VEN

src/inventory/drugs_fornas_source.py
https://github.com/nsunendar/repository_tesis_nendi/blob/main/src/inventory/drugs_fornas_source.py

src/inventory/abc_ven_rop.py
https://github.com/nsunendar/repository_tesis_nendi/blob/main/src/inventory/abc_ven_rop.py

scripts/05_inventory_abc_ven_rop_po.py
https://github.com/nsunendar/repository_tesis_nendi/blob/main/scripts/05_rebuild_best_per_drug_forecasts.py

Lampiran 30. Safety stock dan reorder point

src/inventory/abc_ven_rop.py
https://github.com/nsunendar/repository_tesis_nendi/blob/main/src/inventory/abc_ven_rop.py

Data yang digunakan:
- forecast kebutuhan
- current stock
- lead time rata-rata
- lead time maksimum
- rata-rata penggunaan
- penggunaan maksimum
- prioritas ABC–VEN

Lampiran 31. Penyimpanan hasil inventory ke MySQL

python -u -m scripts.05_inventory_abc_ven_rop_po
https://github.com/nsunendar/repository_tesis_nendi/blob/main/scripts/05_inventory_abc_ven_rop_po.py

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