Muhammad Haekal Muhyidin Al-Araby

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Research Interest

Operating Systems and ***Storage System***, with a focus on fast and efficient ***cache management*** to enhance ***performance*** in large-scale systems.

Education

Sepuluh Nopember Institute Of Technology (***its.ac.id***) Aug 2022 – Jan 2026
B.Eng. in Computer Engineering (Expected)

- GPA: **3.71/4.0**
- Major GPA: **3.8/4.0**

Publications

Demystifying and Improving Lazy Promotion in Cache Eviction [Experiment, Analysis & Benchmark] 2025
*Submitted to **VLDB 2026** - Manuscripts available upon request*

Qinghan Chen, **Muhammad Haekal Muhyidin Al-Araby**, Ziyue Qiu, Zhuofan Chen, Rashmi Vinayak, Juncheng Yang

Research Experience

International Research Collaboration on Cache System utilizing Flash Storage July 2025 - Present
Undergraduate Researcher

- Collaborated with ***Prof. Juncheng Yang*** from ***Harvard University*** researching on how to integrate ***machine learning*** into ***Flash Cache*** admission, to reduce unnecessary ***write*** without sacrificing ***miss ratio***.
- Designed and implemented ***Hierarchical Cache Simulator*** to simulate ***Cache Management System*** utilizing ***DRAM*** and ***Flash Device***.
- Experimented on commonly used algorithms such as: ***CLOCK, LRU, and FIFO***. We discovered that ***CLOCK*** would always outperform ***LRU*** and ***FIFO*** while having ***sequential*** operation and low ***writes***.

International Research Collaboration on the Novel Concept of Lazy Promotion in Cache Eviction Algorithm March 2025 - October 2025
Undergraduate Researcher

- Collaborated with ***Prof. Juncheng Yang*** from ***Harvard University*** to improve ***miss ratio*** and ***efficiency*** in cache utilizing the novel concept of ***Lazy Promotion***.
- Developed experiment and processing pipeline on ***6300+ traces*** from ***Twitter, TencentPhoto, TencentBlock, CloudPhysics, WikiMedia, Alibaba***, and proprietary traces.
- Implemented the concept of ***Lazy Promotion*** into advanced algorithms such as ***ARC*** and ***2Q***. Improved ***miss ratio*** by ***1%*** and reduced ***promotion*** by ***80%***
- Discovered ***Delayed-CLOCK*** which outperforms both ***LRU*** and ***CLOCK***. Reduced ***miss ratio*** by ***20%*** and ***promotion*** by ***90%*** compared to ***LRU***.
- Packaged the experiments conducted into ***fully reproducible*** artifact.

UChicago-Indonesia SYstem and AI Research Training Jan 2025 – Jun 2025
Research Trainee

- ***Top 50*** students from Indonesia are selected for this program.
- Covered ***20+*** papers and reproduced key experiments from ***OSDI, SOSP, FAST*** conferences.
- Instructor: ***Prof. Haryadi Gunawi*** from University of Chicago.

Work Experience

Computer Engineering Department & Faculty of Medics, Sepuluh Nopember Institute of Technology Sept 2024 – Jan 2025
Backend Software Engineer

- Designed, implemented, and deployed a system for efficiently storing images of ***cancer cells***. Increased the ***performance*** of medical practitioner by ***25%***

Computer Engineering Department, Sepuluh Nopember Institute of Technology July 2024 – Jan 2025
Backend Software Engineer

- Our app used by ***Directorate General of Digital Infrastructure(DGDI)*** under ***Indonesian Ministry of Communication and Digital Affair***.
- Designed and implemented system for efficiently finding ***anomalies*** in ***DGDI's*** database, reduced it to ***0***.

Computer Engineering Department, Sepuluh Nopember Institute of Technology Aug 2023 – Jan 2025
Teaching Assistant

- ***Computer Security*** : Graded midterm and final exam of ***70+*** students.
- ***Digital Circuit*** : Oversaw practicum and assisted ***30+*** students.
- ***Basic Programming*** : Oversaw practicum and assisted ***30+*** students.

Projects

Interpreted Programming Language *(source)*

- Implemented core programming language feature such as ***variable, arithmetic, function, and class.***
- Designed and implemented ***custom IDE*** with working syntax highlighting and interactive shell.

Tetromino - Tetromania Castle *(source)*

- Implemented the ***game mechanic and 2D collision detection*** from scratch using C++.

ESP32 PingPong Game *(source)*

- Ping-Pong Game written in C++ for ESP32 and dot-matrix display.
- Implemented the ***dot-matrix display rendering*** and a ***buzzer-based music player*** for the game.

Image sharing platform - Lorem Ipsum *(source)*

- Developed web application for sharing random image using Go and HTMX. Includes ***authentication*** and ***light-weight image loader*** algorithm.

Technical Skill

Languages: C/C++, Python, Javascript, Go, C#, Shell, Lua

Framework: Tensorflow, Keras, React, Echo

Database: PostgreSQL, MongoDB

Tools: Linux, Neovim, Git, GitHub, Docker, libCacheSim, distComp

Misc: Cloudlab, AWS EC2, AWS S3, Arduino, PlatformIO, ESP32

References

Juncheng Yang *juncheng@g.harvard.edu*
Assistant Professor of Computer Science, Harvard University

Haryadi S. Gunawi *haryadi@cs.uchicago.edu*
Professor of Computer Science, University of Chicago

Reza Fuad Rachmadi *fuad@its.ac.id*
Associate Professor of Computer Engineering, Sepuluh Nopember Institute of Technology