

Code Generation with Vision Language Models for Robot Arms Application

Tran Quang Minh, Luu Trong Hieu, Nguyen Cong Khanh,
Nguyen Quang Trung

Department of Artificial Intelligence
FPT University - VietDynamic JSC

Internship Presentation - Fall 2025

Table of Contents

- 1 Introduction
- 2 Related Work
- 3 Methodology
- 4 Results
- 5 Discussion
- 6 Conclusion

Table of Contents

- 1 Introduction
- 2 Related Work
- 3 Methodology
- 4 Results
- 5 Discussion
- 6 Conclusion

Motivation

- The rapid advancement of **AI and machine learning** has led to development of vision language models (VLMs)
- VLMs show remarkable capabilities in **natural language processing tasks**, including code generation
- **Automated code generation** has significant implications for software development in robotics
- Opportunity to explore VLMs for **robot arm applications** at VietDynamic JSC

Project Objectives

Primary Objective

Explore the capabilities of **vision language models (VLMs)** in generating code for robot arm applications

Secondary Objectives

- Automate the coding process for robotics
- Improve efficiency and reduce development time
- Integrate visual understanding with code generation
- Validate generated code in simulation environments

Internship Details

Duration: September 2025 - December 2025

Location: VietDynamic JSC, Ho Chi Minh City

Team Members:

- Tran Quang Minh
- Luu Trong Hieu
- Nguyen Cong Khanh
- Nguyen Quang Trung

GitHub Repository: <https://github.com/Minhtrna/Code-gen-for-robot-arm-OJT-FALL-2025-FPT>

Table of Contents

- 1 Introduction
- 2 Related Work
- 3 Methodology
- 4 Results
- 5 Discussion
- 6 Conclusion

State of the Art

Key Research Areas

- **RoboCodeX** [1]: LLMs for robotic task code generation
- **Robotic Programmer** [2]: Video-instructed policy code generation
- **MobileVLM** [3]: Multimodal vision-language models

Research Gap

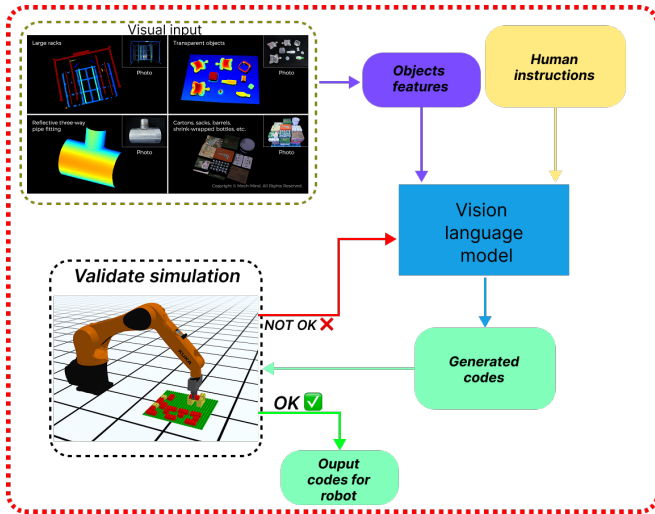
Integration of **3D visual sensors** with VLMs for industrial robot arm applications remains underexplored

⇒ **Our work addresses this gap by combining Mech-EYE 3D cameras with VLMs.**

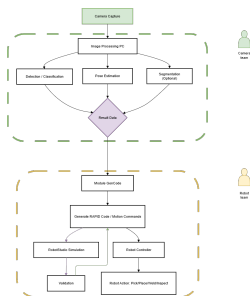
Table of Contents

- 1 Introduction
- 2 Related Work
- 3 Methodology**
- 4 Results
- 5 Discussion
- 6 Conclusion

System Overview



Pipeline Components



- **Mech-EYE 3D Camera:** Captures high-resolution images and 3D point clouds
- **Vision Language Models:** Process visual data and generate robot code
- **ROS2 + Gazebo:** Simulation environment for code validation
- **Integration:** Seamless pipeline from perception to execution

Technical Stack

Hardware Components

- **Mech-EYE 3D Industrial Camera** - High-precision visual sensing
- Robot arm simulation platform

Software Framework

- **ROS2** - Robot Operating System for communication
- **Gazebo** - Physics simulation environment
- **Vision Language Models** - MobileVLM, RoboCodeX variants

Table of Contents

- 1 Introduction
- 2 Related Work
- 3 Methodology
- 4 Results**
- 5 Discussion
- 6 Conclusion

Current Progress

GitHub Repository: <https://github.com/Minhtrna/Code-gen-for-robot-arm-OJT-FALL-2025-FPT>

Key Achievements:

- Successfully integrated Mech-EYE 3D camera with ROS2
- Developed VLM-based code generation pipeline
- Created simulation environment for validation
- Established end-to-end workflow

3D Point Cloud Visualization

Gazebo Simulation

Figure: Mech-EYE camera output

Figure: Robot arm simulation

Technical Contributions

Data Collection Pipeline

- Automated capture of 3D visual data
- Integration with robot workspace mapping
- Real-time processing capabilities

Code Generation Framework

- VLM adaptation for robotics domain
- Context-aware code generation
- Safety constraint integration

Table of Contents

- 1 Introduction
- 2 Related Work
- 3 Methodology
- 4 Results
- 5 Discussion**
- 6 Conclusion

Challenges and Limitations

- **Model Accuracy:** VLMs require fine-tuning for robotics-specific tasks
- **Real-time Performance:** Balancing accuracy with processing speed
- **Safety Constraints:** Ensuring generated code follows safety protocols
- **Hardware Integration:** Synchronizing 3D vision with motion planning

⇒ **Future work will focus on addressing these technical challenges.**

Impact and Applications

Industrial Applications

- Automated assembly line programming
- Pick-and-place operation optimization
- Quality control integration

Research Contributions

- Novel integration of 3D vision with VLMs
- Open-source framework for community use
- Validation methodology for generated code

Table of Contents

- 1 Introduction
- 2 Related Work
- 3 Methodology
- 4 Results
- 5 Discussion
- 6 Conclusion**

Key Takeaways

Technical Achievements

Successfully demonstrated VLM-based code generation for robot arms with 3D visual input

Learning Outcomes

- Deep understanding of vision-language model integration
- Practical experience with ROS2 and Gazebo simulation
- Industry collaboration skills at VietDynamic JSC

Future Directions

Real-world deployment and performance optimization

Acknowledgments

Special Thanks

- VietDynamic JSC for providing this valuable learning opportunity
- FPT University for academic support and guidance
- Internship supervisors and mentors
- Team members for collaborative effort

Contact:

- quantran102005@gmail.com
- Luutronghieu0709@gmail.com
- congkhanhtruongthi@gmail.com
- trungnqse183108@fpt.edu.vn

Thank You!

Questions & Discussion

References I

- [1] Yao Mu et al. “Robocodex: Multimodal code generation for robotic behavior synthesis”. In: *arXiv preprint arXiv:2402.16117* (2024).
- [2] Senwei Xie et al. “Robotic programmer: Video instructed policy code generation for robotic manipulation”. In: *arXiv preprint arXiv:2501.04268* (2025).
- [3] Xiangxiang Chu et al. “Mobilevlm: A fast, strong and open vision language assistant for mobile devices”. In: *arXiv preprint arXiv:2312.16886* (2023).