AutoCODE

Automated Code Generation for Variants Using Legacy Code

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MOTIVATION & GOALS

As industrial robotics shifts toward **modularity and faster product cycles**, manually programming robot assembly tasks becomes increasingly **repetitive and time-consuming**. Translating **CAD models and Bills of Materials (BoMs)** into **executable robot code** is still a major bottleneck, especially when handling **multiple product variants**. This project investigates whether **Large Language Models (LLMs)** can help **automate this translation process**, reducing manual effort and enabling quicker adaptation to new designs. We focus on how well LLMs can **generalize across variants**, and whether their outputs are **reliable enough** for real robotic workflows. Our goal is to evaluate LLMs' ability to generate usable robot code, adapt to design changes, and support **variant-rich assembly lines.**

Project FactBox

Project Name AutoCODE
Project ID FFG 926965
Duration 6 Months

Area 2
Area Orchestration

Project Lead
DI Dr. Ouijdane Guiza

APPROACH

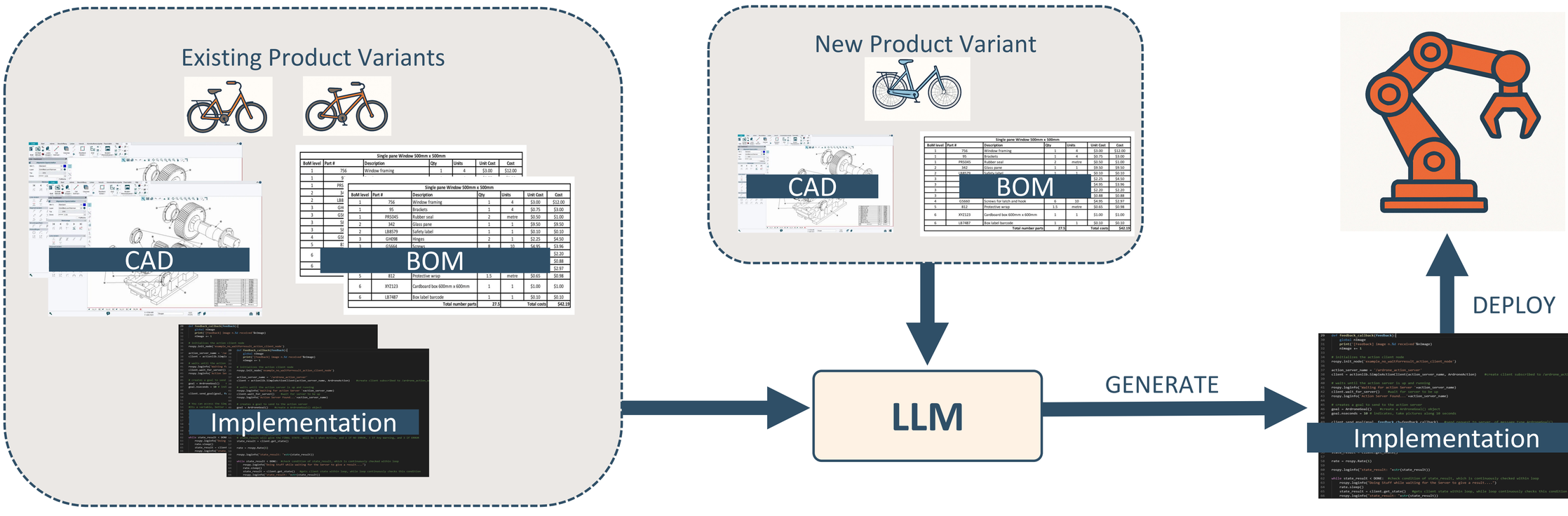
- The input to the model consists of product variants, each with a **CAD model (.STEP)**, **BoM (.CSV)**, and corresponding **implementation** for robot execution.
- The LLM is then prompted to generate code for a **new variant**, using only its **CAD and BoM**, plus the previous full examples.
- This simulates a few-shot generalization task, repeated across multiple product families to test robustness.
- We evaluate outputs based on **syntactic correctness**, **task success**, and **variant consistency**, and also test the LLM's ability to **generate code for novel product designs**.

CONTRIBUTION

Scientific contribution
- Proposes an empirical study testing LLMs on robot assembly code generalization across product variants
- Proposes a variant-to-variant code generation benchmark using CAD, BoM, and robot code
- Validated on real hardware using pyniryo and Niryo NED
- Provides early insight into how design structure affects LLM-driven robotics performance

Economic contribution
- Reduces manual coding workload in variant-rich product assembly
- Enables faster prototyping of new robotic tasks without expert programming
- Lowers technical barrier for deploying CAD-to-code pipelines

SYSTEM FRAMEWORK



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