

LEGACY IT MODERNIZATION WITH AI

Several U.S. Federal Government agencies are modernizing their legacy, mission-critical systems. MITRE's Independent Research & Development Program is investigating the use of Large Language Models (LLMs) to accelerate IT modernization.

Legacy IT Modernization: An Ongoing Challenge

Government agencies need to transition their legacy IT into less expensive, more agile systems that provide more efficient service delivery. Legacy government systems may have decades of regulations and laws that must be retained in modernized systems for continuity of services and consistent processing that will hold up in a court of law in case of dispute. Because of these complexities, agencies are spending almost 80 percent of their IT budgets on operations and maintenance, doubling the ratio seen in the private sector ([Egan, 2022](#)). Modernizing complex government systems requires dedicated planning and sustained effort. However, eight of ten critical federal legacy systems in need of modernization lacked or had incomplete modernization plans ([GAO, 2023](#)).

The Federal Government has been working to modernize systems for decades, some of which are more than 60 years old (GAO, 2023; [Powner et al., 2024](#)). These agencies are exploring how new AI technology, such as LLMs, can accelerate and reduce the cost of modernization. LLM performance for the unique combination of [legacy IT languages](#) (e.g., Assembly Language Code, COBOL, VB6, MUMPS) and complex government systems remains unproven. To understand the best practices and mitigate risks with AI-assisted modernization, MITRE's IT Modernization (ITMOD) team is exploring LLM logic extraction and code generation from legacy systems to aid in modernization.

Legacy IT Modernization with AI

Federal government systems are large, complex, and must be assured to succeed due to the criticality in government operations. These systems have complexity and scale (e.g., millions of lines of code) unrivaled in training materials for today's commercially available LLMs. As such, legacy system complexity and logic extracted from legacy languages creates uncertainty and requires new methodologies for using LLMs that can only be tested on the legacy system and language.

The ITMOD Project

Beginning in 2024, the ITMOD team has been investigating the use of commercially available LLMs to achieve faster and less costly modernization of legacy systems. MITRE is exploring the creation and evaluation of LLM-generated products that synthesize the logic in legacy systems into formats such as code comments, UML diagrams, requirements documents, and summary descriptions [see Figure 1]. The logic products are called intermediate representations (IRs). MITRE is investing in ITMOD in partnership with government sponsors to demonstrate the utility of LLM-generated IRs in the modernization process.

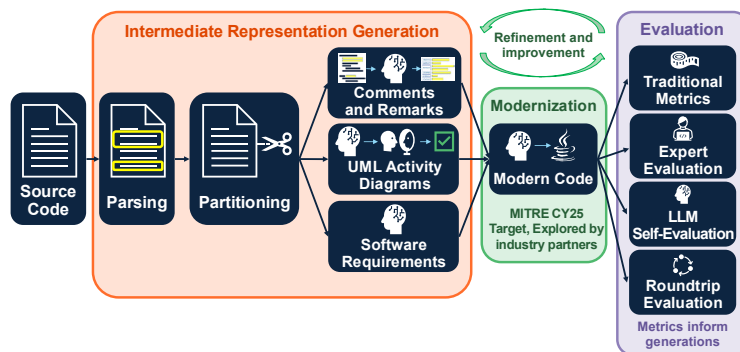


Figure 1. ITMOD Methodology and Workflow.

ITMOD Contributions

The ITMOD team has done extensive experimentation involving the generation and quantitative evaluation of IRs, discovering configurations and processes around LLMs that reliably generate intermediate representations at scale from legacy code [see Figure 2].

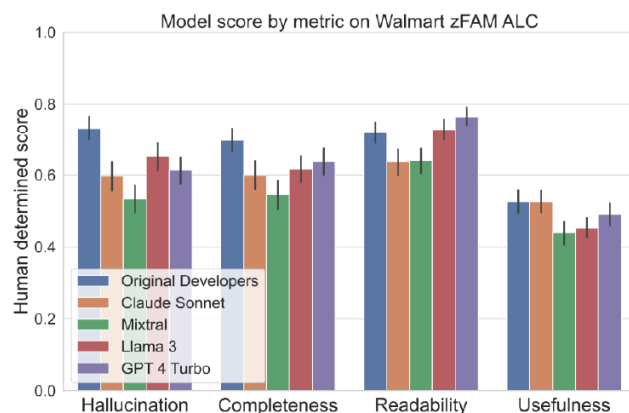


Figure 2. ITMOD measurements of LLM-extracted logic.

However, the evaluations show that current LLM performance measures do not match human subject-matter experts' perception of quality and are therefore not suitable for quality evaluation. ITMOD findings demonstrate that LLMs show promise to accelerate legacy code modernization but currently require appropriate human intervention and oversight. The ITMOD team recommends that LLMs be used in a highly supervised manner for legacy modernization efforts on mission-critical systems.

WHY? To understand the best practices and mitigate risks with AI-assisted modernization, MITRE's IT Modernization (ITMOD) team is exploring LLM logic extraction and code generation from legacy systems to aid in modernization.

HOW? MITRE is exploring the creation and evaluation of LLM-generated products that synthesize the logic in legacy systems into formats such as code comments, UML diagrams, requirements documents, and summary descriptions.

WHAT? ITMOD findings demonstrate that LLMs show promise to accelerate legacy code modernization but currently require appropriate human intervention and oversight.

References:

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