Stellantis: 2D Image Automation Systems

Team 11

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Mentors: Ralph Munguia

**PURDUE POLYTECHNIC**

Customer Background

Die casting, a process known for causing wear and tear on dies, results in frequent defects like solder, sinkholes, and inconsistent material in castings. The industry predominantly employs manual visual inspection to detect these flaws. This project aims to create an automated visual inspection system, with this team focusing on the mechanical and electrical design and build, while a graduate student will develop the AI software for automation.

Problem Statement

The project aims to boost the efficiency of identifying defects in engine blocks and transmission casings, aiming to decrease the number of defects missed, reduce scrap rates, ensure timely die replacement, and pinpoint the origins of common issues. Our scope encompasses the development of a specialized stand/mount for image capture that is compatible with Stellantis' current production lines, and thorough testing to assure the quality of both the stand and the imaging process. Following this, a graduate team will enhance the system with AI capabilities to detect these issues, building upon the foundations laid by Team 11.

Requirements Matrix

Design Requirement	Design Target
Part transportation for Engine block and Transmission case	Encloser efficently. For the transmission case a robot will pick and place and we must adapt our design to the robot. For the engine block the transportation of parts is done by hand with care.
Cameras for engine block and transmission case	Engine block will require images of all sides. Transmission case will require images of 3 sides
Computer selection engine block and transmission case	x86 64-bit CPU (Intel/AMD architecture). 4 GB RAM. 5 GB free disk space. Must have a hardened case and a minimum IP rating of 67.
Lens Requirements for engine block and transmission case	The engine block must have all sides and bore holes imaged there are going to be different distances. As for the transmission case three sides must have images taken and could be at different distances.
Placement of transmission case cell	The transmission cell must be in reach of the robots used to pick and place the case. We have the area that the robots can operate in.
Heat Resistance all components for engine block cell	DesigMust be able to function at apx. 200 Fn Target
Dust Resistance for all components	The system must be dust resistant due to the environment of the facility. The minimum IP rating needed is 67 but 69 is recommended.
Space for engine block vision system	There is limited space for the engine block, we have 56in x 34in x 36in
Height of the engine block cell	The engine block grabber has a maximum height of 5 ft.

Final Design – Detailed Description

Overall Functional Diagram

Engine Block

1 - Engine Block
2 - Enclosure
3 - Camera Arm

1 - Motor
2 - TurnTable
3 - Gear Assembly
4 - Electrical Hardware
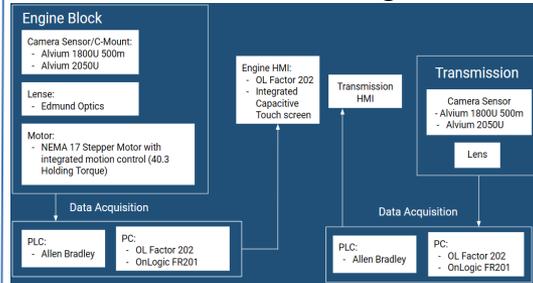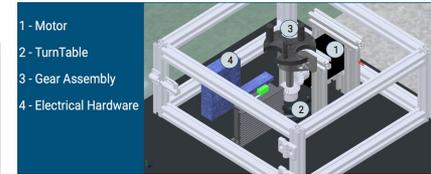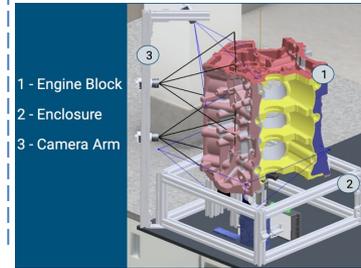
Schematic

Transmission Housing
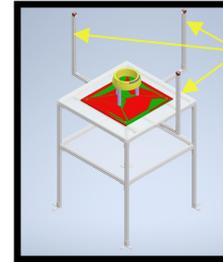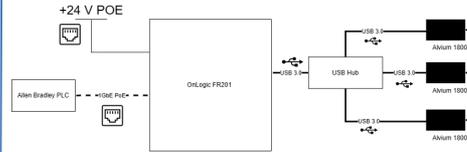
Camera placement

80/20 stand/cameras arms

Schematic

Final Design – Prototype Build

Cameras
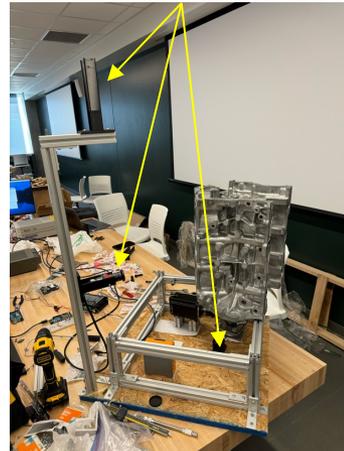
Engine Block Solution

Cameras

Transmission Block Solution
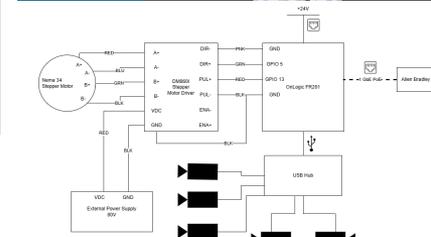
Image Output

Transmission Block

Transmission Block 8mm

Engine Block

Engine Block 8mm