

Student Projects

The following student projects are documented in the HIVE Annual Report 2025–2026. These can be listed under Ongoing and Completed project categories.

Products Developed (2025–2026)

1. Vending Machine

TRL Level	TRL Level 4
Innovation	Smart tea/coffee vending with IoT & payment integration
Technology Stack	Microcontroller, Servo Motors, Sensors, Software
Objective	Design, fabricate and test Tea/Coffee Vending Machine
Methodology	Design Fabrication workflow → Testing
Status	Completed – TRL 4

2. Solar Still

TRL Level	TRL Level 4
Innovation	Sound wave agitation (square wave, 110 Hz) to enhance evaporation in solar desalination; novel acoustic approach replacing costly materials/design changes
Technology Stack	Speaker (K20 Sonic), Signal Generator (SM5060-2), CRO, Amplifier (IC 4440), Taguchi L9 array, ANOVA & Regression analysis
Objective	Optimize single-basin solar still performance using sound agitation by finding the optimum sound intensity, wave type, and water depth
Methodology	Taguchi L9 orthogonal array → 9 experimental runs → S/N ratio + ANOVA + Regression analysis → Comparison of MSS vs CSS
Status	Completed – TRL 4

3. AR Assembly (AI Quality Checker for Valve Components)

TRL Level	TRL Level 2
Innovation	Instance-Level Metrology using polygon-based edge measurement; Non-Contact QC eliminating manual caliper errors; Edge-Ready Design for low-power industrial controllers
Technology Stack	AI: YOLOv8/v11 Segmentation (Ultralytics); Python 3.12; CVAT (Annotation), OpenCV (Vision), SciPy (Geometry), Pandas (Logging); 3D Printed FDM Prototypes; Meta Quest 3

Objective	Automate identification and dimensional verification of five critical valve components; create a digital-first Quality Control (QC) pipeline for Industry 4.0
Methodology	Dataset → Annotation → Training → Calibration → Deployment
Status	Ongoing – TRL 2

4. Metal Vista

TRL Level	TRL Level 4
Innovation	Multi-modal AI + thermal imaging for scrap classification; Explainable AI (LIME, SHAP, Grad-CAM) for transparent decisions; Industrial-grade accuracy at 1/4 the cost
Technology Stack	DenseNet121, VGG-16, YOLO, LIBS/XRF Spectroscopy, Thermal Imaging, LIME, SHAP, Grad-CAM
Objective	Build a cost-effective AI classification system (>95% accuracy) with thermal preprocessing and explainable outputs
Methodology	Metal scraps → Conveyor belt → Thermal enhancement → Camera capture → AI models → XAI explanation → Metal classification & sorting
Status	Completed – TRL 4

5. AI Quality Checker

TRL Level	TRL Level 8 – Deployed in industrial use
Innovation	AI-driven automated quality inspection combining computer vision, OCR, defect detection, and hybrid AI classification with real-time decision-making in production environments
Technology Stack	Python, PyTorch, YOLO, CNN + Hybrid AI Model, OCR (CRNN), OpenCV, Tkinter UI, SQLite Database, GPU Acceleration
Objective	Design and deploy an intelligent AI-based quality inspection system to detect defects, classify product quality (OK/NOT OK), and automate manufacturing inspection
Methodology	Image Capture → Part Segmentation (YOLO) → OCR Label Detection → Defect Detection → Metadata Extraction → Hybrid AI Classification → Database Logging → Visualization
Status	Completed – TRL 8 (Industry Deployed)

6. Resume Analyzer

TRL Level	TRL Level 6 – Working web-based prototype
Innovation	Explainable AI-based resume screening with ATS compatibility, role-fit analysis, bias-aware design, and actionable feedback

Technology Stack	Frontend (HTML, CSS, JavaScript), Backend (Flask APIs), NLP Transformer-based AI Model, OCR & Resume Parsing (PDF/DOCX), Cloud Deployment
Objective	Design a transparent, fair, and explainable AI system for resume screening to improve hiring efficiency and candidate feedback
Methodology	Resume Upload → Text Extraction → AI Analysis (NLP Model) → Explainability Generation → Feedback Output → Human Review
Status	Completed – TRL 6

7. BluePrintBot

TRL Level	TRL Level 4 – Lab prototype validated with real industry drawings
Innovation	Automated Engineering Drawing Interpreter: AI system that extracts dimensions, GD&T symbols, and projection views from scanned or legacy 2D drawings
Technology Stack	AI Models: YOLO, EdgeNet, Florence-2; Logic: OCR + RAG reasoning engine; Platform: Python, Flask, SQLite
Objective	Reduce manual effort: eliminate manual dependency in reading engineering drawings, reducing interpretation time from 20–30 minutes to under 45 seconds
Methodology	Data Annotation → Model Fusion → Industry Validation
Status	Completed – TRL 4

8. Panel2Wire

TRL Level	TRL Level 5 – End-to-end pipeline tested; producing AutoCAD-native DXF output
Innovation	Automated SLD-to-3LD Converter: World's first AI system that reads any Single Line Diagram image and automatically generates a production-ready Three Line Diagram
Technology Stack	AI Models: YOLOv11n, OpenCV (Contour + Hough); Logic: NetworkX topology graph + Rule-based 3LD engine; Platform: Python, PyTorch 2.5, CUDA 12.1, ezdxs, AWS
Objective	Eliminate manual drafting: remove human dependency in SLD-to-3LD conversion, reducing per-diagram time from 4–8 hours to under 60 seconds with zero transcription errors
Methodology	Smart Detection → Topology Graph → 3LD Conversion → DXF Generation
Status	Completed – TRL 5