

~55%
OF MANUAL KITTING TIME
 spent on bag-related steps

95%
BAG OPENER EFFECTIVENESS
 on 1" lip resealable bags

98.5%
STEP-TRACKING ACCURACY
 532 / 540 over 100-kit sample

100%
ERROR DETECTION
 40 / 40 errors caught

Introduction



FutureMakers is a nonprofit focused on inclusive workforce development—creating accessible, hands-on job opportunities for individuals of all abilities. Their manual kitting process is slow, inconsistent, and error-prone, especially when accessibility is required.

We deliver a low-cost, modular bagging-and-quality-control system that improves accuracy, reduces assembly time, and enhances usability—while preserving human oversight at every step.

System Requirements

- Reduce kitting time by $\geq 33\%$
- Achieve zero undercounts
- Accommodate operators with intellectual / physical disabilities
- Maintainable and adaptable for ≥ 5 years
- Maintain human control over assembly
- Minimize operator training and cognitive load

SUBSYSTEM 01

Computer Vision Quality Control

Led by **JONAS LARSON** · **JONATHAN PENG**

A camera-based vision system verifies kit assembly in real time. Unique bin markers identify required components, hand detection tracks operator interactions, and the “done” zone triggers immediate visual and auditory feedback.

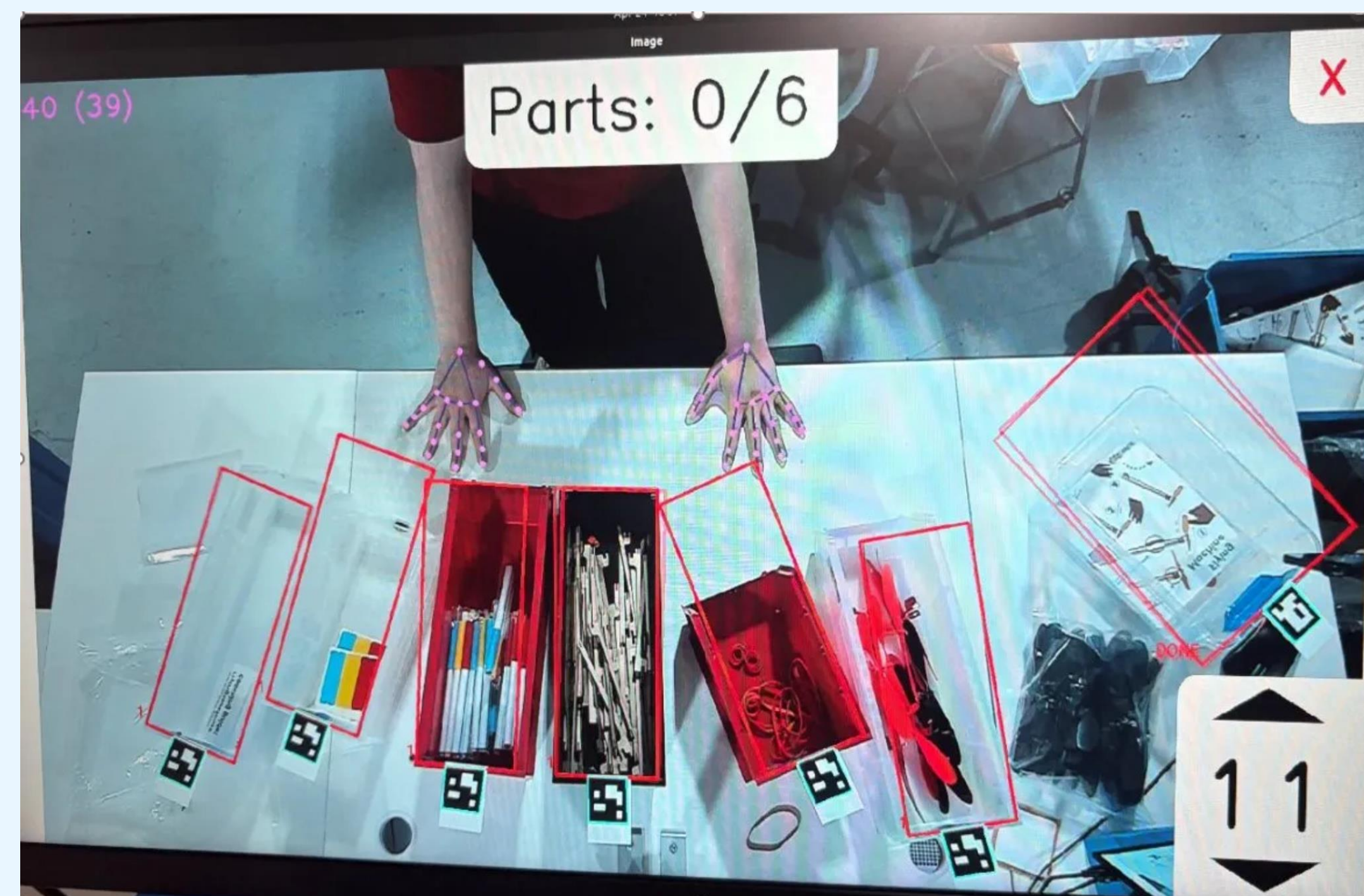


Fig. 1 — Computer vision system in operation

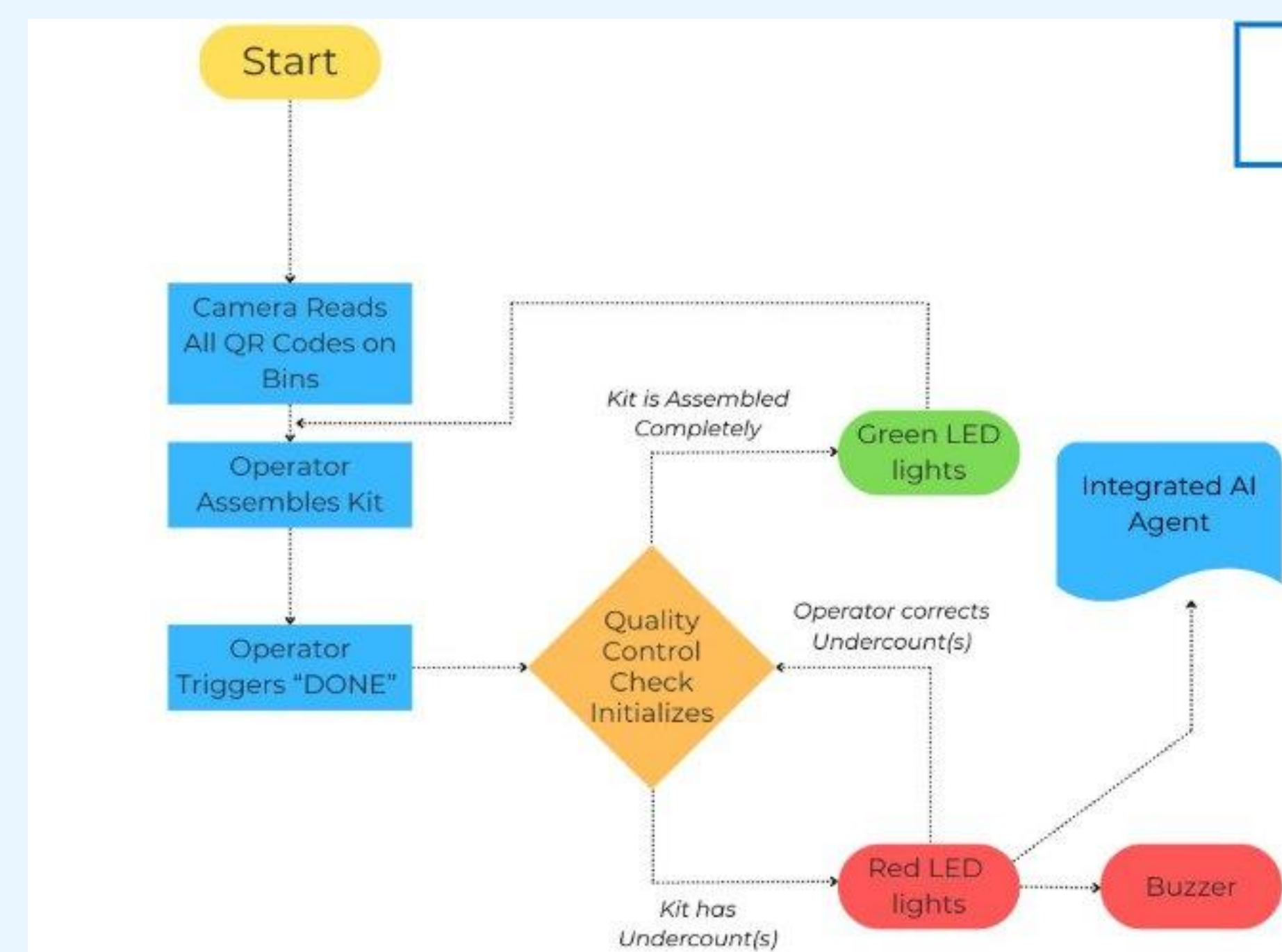


Fig. 2 — System logic diagram

TESTING RESULTS

98.5%

step-tracking accuracy

100%

error detection accuracy

Sample: 3 unique kits · 4 operators · 532/540 steps tracked · 40/40 errors detected

SUBSYSTEM 02

Bag Opener

Led by **KEVIN GALDAMEZ** · **CAMERON BRADFORD**

HOW IT WORKS

- Venturi-based ejector**
 Converts compressed air into vacuum for suction generation.
- Regulated 80 psi supply**
 Maintains a consistent vacuum flow rate.
- Solenoid-controlled engagement**
 Integrated blow-off provides rapid pressure equalization for release.



Fig. 3 — Bag opener CAD (closed & open positions)

TESTING RESULTS

95%

effectiveness on 1" lip bags

0.75"

lip — not reliable (low surface area)

Recommendation: client should standardize to bags with ≥ 1 " lip above the zipper.

Conclusions

BAG-FORMAT STANDARDIZATION

We recommend the client standardize on bags with a ≥ 1 " lip above the zipper. This single specification ensures reliable bag-opener operation across the production line.

CV BEYOND ERROR-CATCHING

The CV system not only catches assembly errors with high accuracy—it also significantly reduces cognitive load on operators, addressing both efficiency and accessibility in a single workflow.