Computer-Vision-Based Defect Detection for LM2596 Power Supply Boards

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***Abstract*—This undergraduate project builds a small conveyor-based prototype for inspecting LM2596 power supply boards. A camera captures each board; Python image processing and a YOLO-based recognizer distinguish acceptable boards, scratched boards, and boards with a missing chip. An Arduino UNO coordinates sensors, the conveyor, and servo sorting, while results are logged to an Excel file. The source report tests 60 boards: 30 acceptable, 15 scratched, and 15 with a missing chip. The prototype classifies 58 correctly (96.7%): 29 of 30 acceptable boards, 14 of 15 scratched boards, and all 15 missing-chip boards. A reported inspection and sorting cycle takes about 3–4 seconds. A 30-minute continuous trial is described without a reported crash or communication loss. These findings concern a limited prototype and test set; lighting and board orientation caused some errors, and other fault types were not evaluated. The summary preserves the source's measured results without claiming industrial-scale validation.**

***Index Terms*—computer vision, LM2596 board, defect inspection, YOLO, Arduino UNO**

I. Introduction

Visual inspection of electronic boards is repetitive and can be inconsistent when defects are subtle. This project explores whether a camera, image recognition, and a simple conveyor mechanism can perform a limited first-pass inspection of LM2596 power supply boards. The source defines three relevant conditions: an acceptable board, a scratched board, and a board missing a chip. Its aim is to build an integrated demonstration that recognizes those conditions, physically separates boards, and records the outcome. The work is a prototype assessment rather than a study of factory production or a comparison with trained human inspectors [1]. Earlier ICTU undergraduate theses on related topics provide context [5], [6], [7], [8], [9], [10], [11]. These works were selected for this English summary and are not attributed to the source thesis bibliography. Published background sources on the methods and domain of this project provide context for the English summary [2], [3], [4].

II. Methods

The source describes a conveyor carrying boards past a light sensor and camera. When a board reaches the inspection position, an Arduino UNO stops the conveyor and Python processes the captured image with a YOLO-based recognition model. The recognition result is sent back over a serial connection; sensors and servos then guide defective boards to sorting locations, and Python logs the classified result in Excel. The test set contains 30 acceptable boards, 15 scratched boards, and 15 missing-chip boards. Reported evaluation compares system labels with the boards' known conditions, records cycle time, and observes operation during a 30-minute run. No external validation set, confidence interval, or factory throughput test is reported [1].

III. Results

The source's aggregate table records 58 correct classifications among 60 boards, or 96.7%. Category results are 29/30 acceptable (96.7%), 14/15 scratched (93.3%), and 15/15 missing-chip (100%). Thus two boards were classified incorrectly in the reported trial. The cycle-time table gives about 3–4 seconds per board, including approximately 2–3 seconds for capture and image processing and roughly one second for sorting control. The report also describes a 30-minute continuous run without an observed software crash or loss of the Python–Arduino connection. Inspection outcomes were written to an Excel log. These are results from the reported small test, not estimates of performance across all LM2596 board variants [1].

IV. Discussion

The prototype links recognition to physical sorting and a simple audit log, which demonstrates an end-to-end workflow on the three chosen conditions. The two errors are attributed by the source mainly to lighting or board angle during capture. The reported 100% result for missing-chip boards is based on only 15 examples and should not be generalized without broader testing. The 3–4-second cycle also constrains use on a faster line. Other defects, changing lighting, camera placement, and different board layouts were not systematically tested. Earlier ICTU projects on image classification, YOLO, and conveyor sorting provide related implementation context, but their results are not used as a performance benchmark here [1].

V. Conclusion

The project produced a working prototype that inspected and sorted LM2596 power supply boards in three categories, logging its decisions in Excel. The source reports 58/60 correct

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decisions, a 3–4-second cycle, and a 30-minute trial without a reported interruption. Future evaluation should use more boards, additional defect types, and controlled changes in lighting and orientation before claiming reliable deployment on a production line [1].

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