Project Objective

This project aims to collect electronic components, identify them using computer vision and machine learning techniques, and sort them into user-defined bins. The need for this arose when visiting the EE Labs at Level 1; resistors, capacitors, ICs, MOSFETs, and other components are often left on desks cluttered and it is up to the already busy technicians to sort them manually or throw them out. Every unique component may come in a set of unique values, further adding to this task.

Method Outline

I expect to complete this project in three stages; with each stage increasing the autonomy of the project. A detailed description of the stages is listed here:

For the initial stages of the project:

* I will focus purely on the computer vision and the ability of the system to correctly identify and classify a given component that an operator will place on a platform.
* The platform will be transparent and have cameras and light from underneath so the operator can place a component on top of it with minimal adjustments.
* A screen positioned nearby will tell the operator what component it is and what value (Ohms, Capacitance, etc) it is and direct the operator into the bin they should place it in.

The next steps are to automate the sorting process, still requiring a manual operator for component input. The focus now shifts onto mechatronics and design:

* The operator will place a component one by one onto a moving belt.
* After classification, a rotating fan would brush the component onto a secondary belt where it can then be grouped into bins.
* Depending on what is found to be the most feasible approach, either these bins are the final sorted bins, or these bins are buffers and interact with a much larger capacity system where you have a “matrix” of bins.

The final stages are to automate the sorting of the input system using methods found in industry, however, should this prove too difficult or does not overlap enough with my studies, I will opt for other features like IC testing, subject to change.

Provisional Timetable

I expect to have a working classification system by a month into the Spring term, given my module choices, and as I will develop the hardware at the same time, the initial stages of the project should be completed soon after. I then expect to prototype extensively where I will examine the feasibility and reliability of different approaches for the bin sorting mechanism, all while improving my existing system. I expect this to take no longer than a month and a half.

Finally, should things stay on schedule, I would have April onwards to expand, improve my designs, and ensure overall reliability and robustness.

Project Costs

As this is a physical project, there will be the costs of the components. I will use my own specially tuned and reliable 3D Printer to construct the physical structures for the project, so the cost of filament will need to be accounted for. The alternative is to use the printers available on campus, but the cost of filament remains the same for the department, and using my own printer guarantees parts with tolerances, quality, and speed that I am already familiar with.

There will also be the cost of the electronics, for example the main board will either be some Arduino based board or Raspberry Pi depending on the pinouts I require. There are also the smaller components such as servos, lighting, or cameras. I will keep a detailed expense sheet at all times during the project.

For an estimate, I expect to go through 3-4 rolls of filament, the board used would be under £25 and the components should also not be much larger than around £40. In total, I would expect the cost to be around £120, which again is only provisional.

Supervisor

I have discussed this project with Dr. Ed Stott, and they have confirmed that they are willing to supervise after extensive talk about what is examinable from an EE perspective for this project.