Maxim Desyatov
Siddh Bhagat
Shahriar Khan
Anthony Achille

Preliminary Proposal

Provide a current draft of your problem statement. Why did you choose this problem?
The current problem we are trying to solve is finding a reliable and economical method for automatically inspecting the quality of PCB solder joints. The reason we chose this project is because we wanted an AI component, and an interesting board-level hardware component. We also liked that required mechanical assemblies (3D printers) are available COTS, which would allow us to focus our efforts on the board and software.

What are the goals for your system? What do you want your system to achieve?
The goal of our system is to be able to identify faulty soldering when given a PCB board. We want to use a machine learning model, to be able to find the faulty soldering and point out where the faulty soldering is.

Describe your proposed design at this point. Provide as much detail as you have so far.

Mechanical: 3D printer chassis, mounting hardware for camera

Hardware: Custom carrier board for an NVIDIA Jetson module, which interfaces with the camera and runs ML inference.Will also interface with the 3D printer control board.

Software: Using NVIDIA's available Linux distribution for Jetson, Python/CUDA for ML and considering using Gerber files to guide the camera on the physical board.

What are the major technical challenges you foresee for your project?
Hardware/System: Board bring-up

Mechanical: Choosing a correct 3D printer that will be able to move a camera to the desired angles

Software: If we use a YOLO algorithm, it is poorly documented and may be difficult to work with.

What have you found so far in your survey of similar solutions?

Many Automated Optical Inspection (AOI) solutions exist. They are a standard part of the PCB manufacturing process. Entry-level commercial solutions start at around 30.000 USD, which is inaccessible to small PCB fabs.
https://www.allpcb.com/fr-FR/blog/pcb-assembly/solder-joint-inspection-equipment-a-buyers-guide-for-pcb-manufacturers.html

What will you need to test about your system, and how might you test these things?

We need to test that the model works as intended. This can be achieved through simulation using test images. We also need to test if we can control the camera correctly and integrate the images from it. It can also be tested through simulation.

The hardware design should go through a thorough check and be properly documented with a functional specification and a test plan. As well as a bring-up plan.