

# FM4017 Project

**Title:**

Microcontroller based Automatic Optical Inspection (AOI) Module for Fault Detection in Printed Circuit Board Assembly (PCBA)

**USN supervisor:**

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**External partner:**

Hapro Electronics

**Task background:**

Hapro Electronics provides Electronic Manufacturing Service (EMS) for the electronics and data industry and produces prototypes and deals with industrialization, automatic and manual assembly, box building, testing.

PCB consists of a network of copper traces and insulators which connect clusters of components based on different of circuit diagrams from customers. Printed Circuit Boards Assembly (PCBA) based on some considerations is done manually, e.g., low-volume production runs, thru-hole components on low-volume runs, custom parts and sub-assemblies attached to a board, “stand-offs” and press-fit connectors. EMS in the manual and automatic PCBA of components is one of the major activities in Hapro Electronics.

To prevent critical “issues” cropping up in PCBs and as a measure of guaranteeing function and quality, PCBA is continuously tested using different techniques including Automatic Optical Inspection (AOI). Soldering machine used in PCBA and the AOI system communicate with each other based on the standard for communication between mechanical equipment, IPC-SMEMA-9851.

**Task description:**

The main goal of this project is the development of a versatile communication system between the AOI, and the soldering machine based on IPC-SMEMA-9851. At Hapro Electronics, the next generation AOI is under development. The system for AOI will be based on Raspberry Pi and at least one camera. Based on camera vision, different signals are transmitted to the Soldering machine and the operator.

In this project the tasks are:

- Give a list of reasons for manual PCBA and possible issues arising during this process with a good overview of the status of technology.
- Give an overview of the system for PCBA in Hapro Electronics
- Give an overview of different standards like IPC-SMEMA-9851 with a short literature survey of its applications.
- Describe scenarios of camera vision and the image characteristics and features useful in generating alert or alarm signals

- Design a communication system using camera vision, Raspberry Pi, and the Soldering Machine. Discuss different solutions.
- Development of a communication interface with AOI.
- Develop a GUI for the communication system with AOI for alerting the operator of missing components and of new components in PCBA
- Test the complete AOI communication system, with documentation of the plan for testing, and guidelines for executing these tests.
- Organize the codes and procedures in the form of a user manual.
- Submit a report with the details covering all the tasks for this master project following the guidelines of USN.

**Student category:** IIA

**The task is suitable for students not present at the campus (e.g. online students):** No

**Practical arrangements:** Hapro Electronics will provide necessary support for the candidate. USN, Faculty TNM, Dept. EIK will assist in providing software necessary from the existing software packages.