Optical Inspection of Electronic Circuit Boards using Machine Learning

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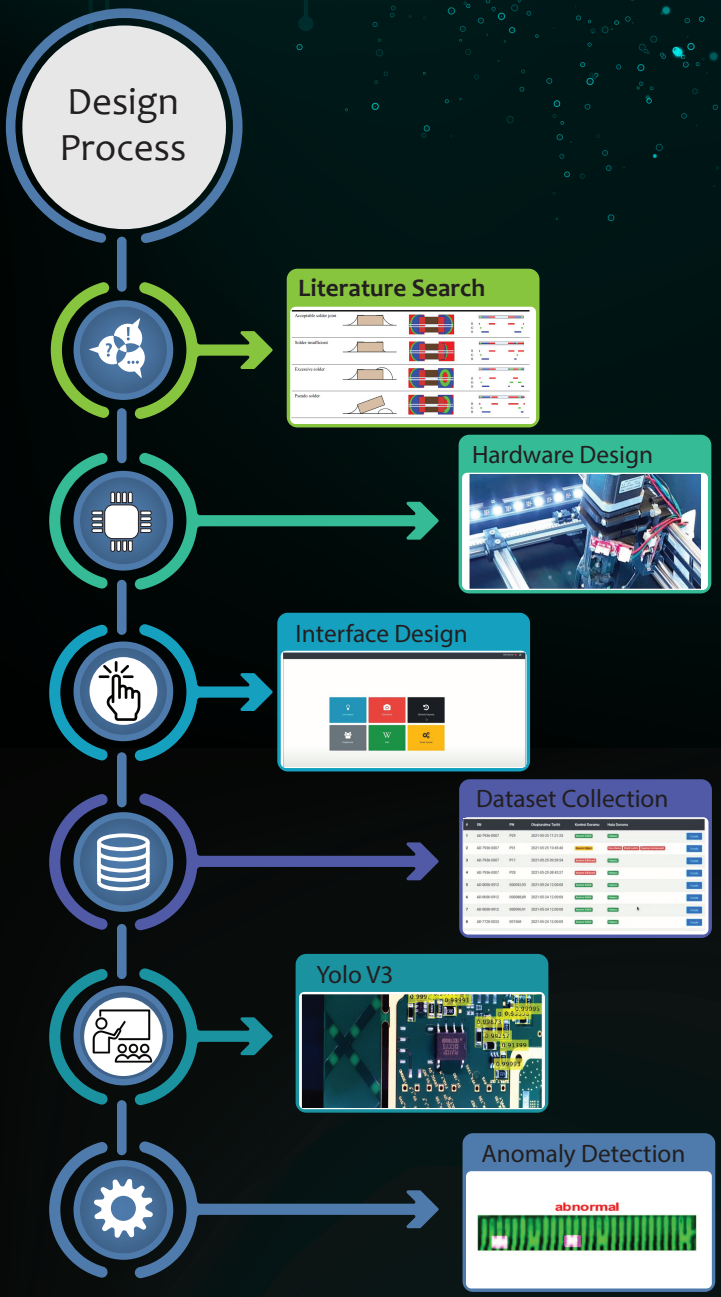
Introduction

The defects occurred in fabrication might be troublesome especially if you are dealing with small productions like PCBs. Most of the defects encountered during the PCB fabrication like short circuits, lack of solder, surplus of solder, tombstones etc. can not be detected by naked eyes. For this reason, Automated Optical Inspection Systems are presented.

This project aims to build an Automated Optical Inspection System which is portable and satisfy the industry's need. For this purpose, both hardware and software solutions are implemented.



Solution Methodology

In the light of the works in the field, the problems encountered were resolved and optimum operation of the device was achieved.

One of them was the excessive amount of reflection. To prevent this, lenses with light dispersive properties were used. In addition, the camera focus value was set to the most appropriate value according to rise in the camera temperature.

An interface has been designed to facilitate database creation. Images taken using this interface were stored in a unique folder. The images in the created dataset were labeled and prepared for the algorithms to be used later. With the generated dataset, the Yolov3 model was trained and the components on the PCBs were classified.

The defected components could not be classified due to the low number of card images containing errors in the dataset. For this reason, a model was created by passing the components classified as error-free through the autoencoder algorithm. This model was used in the anomaly detection method for the detection of defected components.

Results and Discussion

As can be seen,three of the six short-circuit faults occurring in the component legs have been detected. To increase this rate, it would be useful to use datasets created with better cameras with better resolution.

By enlarging the data set and increasing the data rate with defected components, a classification can be made without the need for anomaly detection. By this way, accuracy of identification and classification of defects occured during PCB fabrication can be increased.

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