PCB Pick and Place Project

Team JFL

Version 2.0
9/23/2023

Jailine Contreras Marquez, Fernando Zavala-Ortiz, and Lap Nguyen
jailinecontrerasmarquez@my.unt.edu, fernandozavala-ortiz@my.unt.edu, lapnguyen@my.unt.edu.

Requirements Document

Version 2.0

Contents

A. Project Overview

In the semiconductor engineering industry, device testing is one of the important steps. Testing device is necessary to make the whole machine accurate and reliable. Throughout this process, it is really costly and time consuming. To optimize device testing, people can create advanced technology to automate this process. Reducing the human's role in device testing, it can increase the accuracy and reliability of the testing. This also decreases the employee cost and optimizes the speed of this process.

Our team JFL will solve this problem by improving the tracking system to make it easier to access and control. The system includes a camera that can identify the PCB in a particular area. The system will move the PCB location and slow pick up the PCB. Then it will move the PCB and place it on the PCB tray which is the decided target location. The system also has a web framework system that lets people remotely control. This system will be able to precisely place PCBs up to 300mm by 500mm that are under 200g. This system should be made using existing infrastructures.

B. Current Problems and Proposed Solutions

This project is used to automate the process of picking up the PCB and placing it on the PCB tray. We need to figure out how the mini-PC connects and communicates with the camera to identify the PCB. The new camera lens needs to have a wide enough view for image recognition. The feedback from the camera for the mini-PC should be real-time operation so the pick up arm can get the PCB.

For this project, our team needs to control the pick-up and place the PCB in the correct location. We have to add the algorithms for the mini-PC to control the whole system. We will use code in python FastAPI for REST API for the mini-PC. The code will implement the algorithm for the system to move the camera around to identify the PCB, pick up and place the PCB in the correct location and run as a server for the user to control it remotely.

The system uses the bessel camera. The system needs to use an open-source platform (Open CV) for camera interaction. Then send the signal when it identifies the PCB to the mini-PC for pick-up.

We also need to create a web framework for users to control the system remotely. The system needs to use React to form the web front end. This needs to have an easy access interface for users and have enough function to control the system.

C. Requirements

1. Functional Requirements

ID	Functional Requirements	Team Member Responsible	Effort (in %)	Verification
FR1	A machine learning model will use the camera to find the location of the fiducial.	Fernando Zavala	40%	Test
FR2	A fiducial will be created for the PCB.	Fernando Zavala	10%	Inspection
FR3	Images of the fiducial should be created and used to train the model.	Fernando Zavala	25%	Test
FR4	The mini-PC should be communicating with the camera and arm to control when the system should be picking up and placing the PCB using the web interface.	Jailine Contreras Marquez	15%	demonstration
FR5	Web interface should show the results from the system to the let the user know when task is completed	Jailine Contreras Marquez	30%	demonstration
FR6	The system should have a front end for user to remotely control	Jailine Contreras Marquez	30%	demonstration
FR7	System finds the pcb by jogging the camera in a specific area.	Lap Nguyen	20%	demonstration
FR8	When the PCB is identified, the system should pick up the PCB	Lap Nguyen	10%	inspection
FR9	When the arm move to the test tray, the system place the PCB	Lap Nguyen	10%	inspection
FR10	The mini-PC should control the pick-up arm to the precise location	Lap Nguyen	20%	test

FR11	The camera should be mounted high enough to have a clear and large image	Fernando Zavala	15%	Inspection

2. Non-Functional Requirements

ID	Non-Functional Requirements	Team Member Responsible	Effort (in %)	Verification
NFR1	The speed for moving the PCB should be 10mm/s	Lap Nguyen	20%	test
NFR2	The system must handle PCBs of size 300 mm wide by 500 mm long.	Lap Nguyen	20%	inspection
NFR3	The PCB lifting mechanism should be capable of lifting up to 200 g	Fernando Zavala	5%	Inspection
NFR4	The system should pick and place the PCB in 8 seconds	Jailine Contreras Marquez	10%	test
NFR5	The system should use the ethernet for most standard communications.	Jailine Contreras Marquez	5%	inspection
NFR6	The miniPC should be mounted onto the system	Jailine Contreras Marquez	5%	inspection

3. Constraints

a. The budget for the project is $2000
b. The miniPC needs to fit on the system's control tray
c. Weight of the miniPC needs to be less than 3 Kg to be mounted on the system
d. This project should be completed on or before April 19th 2024
e. The system consumes 24V to work