**Device Testing Validation and Characterization**

**What is the project?**

Silicon photonics is a rapidly growing field in the world of microelectronics, especially in computing power. A main bottleneck in computing power is the limited bandwidth of the interconnects between various subsystems in a microprocessor. Silicon photonics inherently has a larger bandwidth due to its use of photons rather than electrons. In our project, we hope to create a fully automated silicon photonics testing station that will allow for the testing of various issues within photonic circuits, i.e., thermal cross-talk, accuracy of bits, power dissipation, etc. The testing bench uses a 90-mm camera as well as servo motors to achieve optical fiber connections in 3D space. It also has a vacuum to hold the chip in place. The most extensive part of this project will be the coding that will run this machine. There does need to be a user interface that will allow one person to fully command the testing station and set various attributes for the specific test. Currently, all of the parts used in the project have been purchased and received by the ECSyD lab run by Professor Mahdi Nikdast. There is also a working silicon photonic testing station created by Maple Leaf Photonics. Within the coming weeks, we hope to discover a lot more about the specific requirements necessary to complete this project by testing and using the working testing station.

**Why is it important?**

This project will provide the ECSyD lab with new hardware and software directly tailored to their needs, allowing the testing of silicon photonic chips to be done automatically. This is important because Silicon photonics is a rapidly growing field in the world of microelectronics. As computational speeds continue to grow, our ability to transmit data through electrical connections becomes a bottleneck hindering the performance of systems. Silicon photonics presents a means to transfer large bandwidths of data faster and more efficiently that our current technology.

User Requirements:

* Full motion control
* Chip Registration and Device Homing
* Can Perform Device Characterization/Performance Tests
* User Interface
* Laser Control

Acceptance test: (Verifies Device Performance Tests)

* Locate a device and perform a device test. Compare results obtained on the same device from the already functioning testbench and see if results are comparable.

System Requirements:

* 6 Axis Motor Control
* Device Registration and Location
* Fine Alignment/Raster Scan
* GUI
* Laser I/O

System Testing: (Verifies Device Registration and Location.)

* To test Device Registration and Location, register the device and have the testbench locate and test the device from its home position. Repeat with multiple devices to verify repeatability.

Architectural Design (Interface Requirements):

* Communication between Computer and DC Motor drivers through Firewire.
* User interface controls can actuate stepper motors within 3 um.
* Current/Voltage control of motors is able to accurately control motors down to 3um precision.
* The optical interface allows for control of wavelength and time of beam propagation from the laser.
* Interface to the camera is high speed and low latency so as to not appear blurry when moving the fiber array.

System Integration Test: (Verifies Optical Interface)

* To verify the laser interface, we can check that the wavelength and intensity of the laser (displayed on the laser display) is being adjusted correctly via the laser interface.



* Using an oscilloscope test for connection between the subsystems. Check that the output voltage is above 2.5V and less than 5V.
* Verify that the output creates a secure connection to the subsystems by checking for user interface control affecting physical DC motors.
* The silicon photonics testing bench must have a standardized and compatible data interface that allows for seamless integration with external test and measurement equipment, such as optical spectrum analyzers, oscilloscopes, and photodetectors, to facilitate real-time data acquisition and analysis.















