

Development of an Embedded Data Acquisition and Test system for the Characterization of Printer PCB Boards

Roopa Rathod¹, Dr. Siddesh G.K²

¹M.Tech student, Dept. of Electronics & Communication Engineering, JSS Academy of Technical Education, Bangalore, Karnataka, India

²Associate Professor, Dept. of Electronics & Communication Engineering, JSS Academy of Technical Education, Bangalore, Karnataka, India

Abstract - Electronic devices need testing to ensure that they work as designed after Production. Within the board and diverse array of PCB applications and one requirement is the same that PCBs are expected to function according to their design parameters with no failures or errors. This project Describes "Development of an Embedded Data Acquisition and Test System for the Characterization of Printer PCB Boards", the Test System described here is the final test stand built to test the customized Printer boards. The heart of the Project is NI PCIe 6509, it bridges between hardware and software of the test stand. The Software used is LabVIEW.

The Project mainly uses the Printer PCB boards as the Device under Test. To Acquire, Test, Validate the Printer PCB boards, the Test Stand is built. The main parts of the test stand are, NI PCIe 6509, NI Virtual Bench 8012, Electrical Relay connections, Power Supply, Windows 10 PC, Bed-of-Nails fixture and Clamp part. For a Printer PCB, to mark it as a valid for further process, certain number tests are to be passed. The project reduces the human intervention and improves the work efficiency by reducing the execution time with high speed.

Key Words: NI PCIe, LabVIEW, Virtual Bench, Front Foil, Bed of Nails.

1. INTRODUCTION

Testing done is very much different from that done after production. PCB tests are done by various methods, including optical examination and continuity testing. For testing a Printer PCB board, we used Functional Circuit Testing (FCT) because it can fully exercise the board and its components with minimal test setup and duration. The designer of such system can develop a custom test fixture and some test cases to fully validate the board. These test fixtures are as effective as an off-the shelf test fixture. One such system based on a bed-of-nails fixture has been developed in the project.

The heart of the Project is NI PCIe 6509, which is a National Instrument product, it bridges between hardware and software of the test stand. The Software used or built using LabVIEW; Laboratory Virtual Instrument Engineering Workbench is system-design platform and development Environment for visual programming language. To Acquire,

Test, Validate the Printer PCB boards, the Test Stand is built.

In conventional testing of PCB Boards, more time was required for testing. the Test stand is built to test the Printer PCB Boards, the Functionality test of the PCBs on the same piece of work. The different work place plots for different tests may lead to confusion and less ease in testing. So, the proposed system is designed using software and hardware design idea on a single test stand that gives the ease in conduction of the tests. With the advanced ideas of capturing the minute errors during the test gives the accuracy of the test results. Also, in the previous versions lot of human intervention was needed, so here in the present project is motivated to reduce the human intervention with efficiency. Additionally, to improve the work efficiency with speed.

2. DESIGN METHODOLOGY

2.1 Software

LabVIEW (Laboratory Virtual Instrument Engineering Workbench) is a graphical programming language that uses icons instead of lines of text to create applications. LabVIEW is more powerful as it can allow complex programming task to be achieved in a fraction of time. The code the LabVIEW is built on the VI (Virtual Instrument). VI contains of three parts Front panel, Block diagram and Icon/Connector pane. The Front panel is used for user interface, Block diagram is used for actual coding, the blocks execute by data flow and Connector pane is used for connecting the VI with the other VIs i.e. to make the VI as the sub VI and providing the connection for the same. In LabVIEW, user interface is built by using a set of tools and objects. When a VI is run, values from controls flow through the block diagram, where they are used in the functions on the diagram, and the results are passed into other functions or indicators through wires.

For the present project, the above VI parts lay the foundation for the further development. There are different VI's developed for the project serving different purposes. There are three screens viz. the user login screen, the production selection screen and the main screen, in the main screen the barcode selection mode and power on pop will appear.

Functional test is done to check the overall functioning of board. Login screen is used for safety reasons, so before starting with the test, the admin is having access to login to the project to do further testing. He is having access to add or delete or modify the users according to vendor convenience.

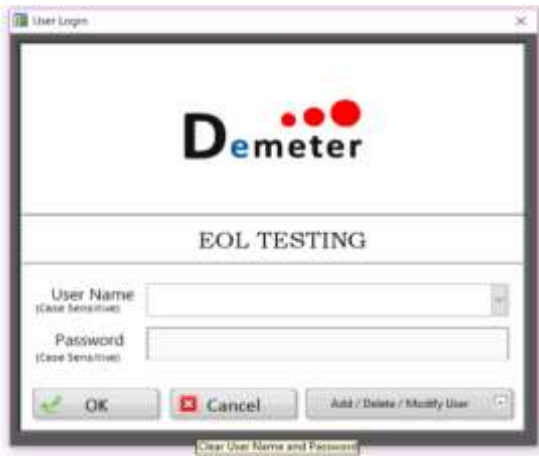


Figure 1: User Login Screen

The production number selection screen which gives the production number details or the production number details can be selected which is shown in figure 2.



Figure 2: The Production Number Selection Screen

User can add the total quantity of production to be tested per day or as per their requirement and among the total quantity of products, the tested quantity is also displayed in this screen. The user can add or edit the production ID, otherwise can select the continue option shown in Figure 2 to move to the main screen.

The final testing screen is as shown in figure 3, the barcode selection popup will appear on this screen. Barcode should be scanned that is presented on the PCB. After the selection of Barcode, the pop-up screen will appear to power on the front foil. Once you powered on the front foil press Ok. After power on the front foil only, the test starts otherwise pop up will come again until you power on the front foil. Once the Barcode is scanned then it will be shown on software window.



Figure 3: The Final Testing screen

The operator name, Date and Time, Barcode serial number which is scanned, Limit is used to set the minimum and maximum limit of the result, Report is optional to generate overall report whenever needed for vendor, Exit is used to come out of the software loop, Production number detail as entered in the production number selection screen is also visible in the final test window. The reset will be used to reset the total, pass, fail of number of tests completed in day and Execution time is also displayed to know the total time required for testing one PCB board that will indicate the speed of testing in the software.

After the Front Foil is powered on the test begins and it is shown in the software window that the testing is in idle state or test in progress or test stopped. Once the completion of all test cases, overall functionality test result of the present PCB board will be displayed on the main screen window as passed or failed followed by declamping. The software is as important as the mechanical setup built for the functional test.

2.2 Hardware

The block diagram shown in figure 4 gives the details how exactly the software and hardware interaction takes place.

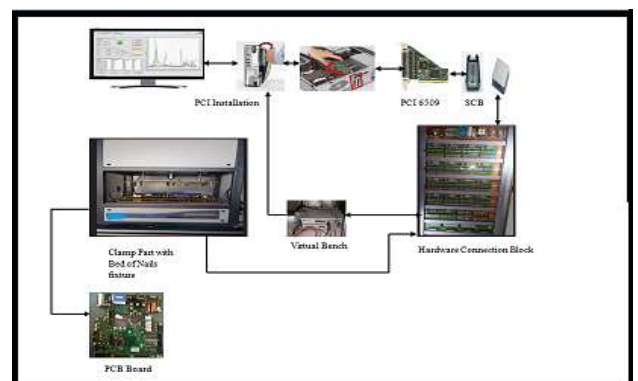


Figure 4: Hardware Block Diagram

The computer (host) is where the code for UI (User Interface) and RT programming is done. The software is communicated with the NI PCIe 6509. The functional tests and test results are simultaneously sent on the host screen and are recorded as data.

For a Printer PCB, to mark it as a valid for further process, certain number tests are to be passed. The tests are conducted by placing the boards on the PCB stand/Test stand, which is basically the Bed-of-Nails fixture. From the Bed of Nails, the connections from the pogo pins to the PCB boards are connected to the relays. To the relays the connections to the NI Virtual Bench are done. The Virtual Bench is basically used to acquire the measured data/signals from the board. The connections from relays, are done to the Connector Blocks which are called SCB (Shielded Connector Blocks) SCBs receive connections from the PCIe module to the SCB, the NI PCIe card is connected via two, 50-line probes. The communication of the voltage signal to the board is done via PCIe. The communication of protocols to the PCB board is done via TCP/IP Ethernet connection. The test is done by clamping the PCB board on the bed of nails, switching on the front foil and starting the software that is NI LabVIEW Platform. The series of tests are conducted on the board, and simultaneously, the result of each test is recorded in the table of the software main screen or dashboard. The test results will be generated in the form of report automatically after the completion of all tests, followed by De-clamping the PCB board. The Overall test result will be displayed on the main screen/dashboard of the software that is pass or fail of PCB board, based on the limits set for the tests and Depending on the overall result, the board is validated. Further boards can be tested in similar manner.

3 RESULTS AND ANALYSIS

The functionality test is conducted to check the wears and tears of Printer PCB's. Several tests are conducted during the testing to check each parts or connectors of Printer PCB's as shown in Figure 5. For different connectors of PCB/tests such as Test of measurement of modulation voltage, Pressure sensor, Ink flow sensor etc...Set of parameters are checked such as voltages, frequencies etc. For each tests minimum and maximum limit are set, if the measured value is within the limits then the result will be updated as pass as shown in Figure 5.



Figure 5: The Final Result of overall test

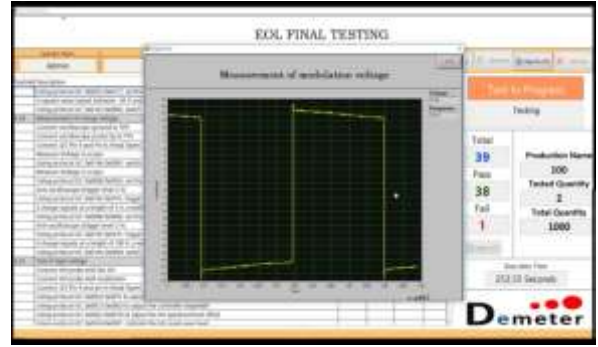


Figure 6: Measurement of modulation voltage test graph

The graph shown in the figure 6 explains about the frequency and amplitude of modulation voltage test. Once all the tests are completed the overall result will be displayed on the main screen/dashboard and execution time will also be displayed on the screen as shown in Figure 7. The Execution time plays important role for testing PCB Boards and the execution time of each PCB Board is around 9min in this project.

After completion of all tests declamp will be done then functional test will be stopped. The output data available as a pass / fail that is test results. The test results will be generated in the form of report in the main screen and displayed in excel file as shown in the Figure 8.



Figure 7: The Functional Test Result



Figure 8: Report Generation after Functional testing

4 CONCLUSION AND FUTURE SCOPE

This Project, "Development of an Embedded Data Acquisition and Test system for the Characterization of Printer PCB Boards", as the title itself explains about the acquiring data and overall functional testing of PCB Board for the application printer. The tests can be carried out manually or automatically. By all the procedures and installations, the software development for PCB testing was done under the tool of Lab VIEW real time module. The tests provided are completed successfully by the developed software. This will give 99% accuracy about overall functioning that is Pass or Fail of PCB board or DUT.

For the further development versatility in the usage of test board device for testing, then it can be done by only changing or alteration of the pogo pins position and can start testing. This test stand can be used by all types of PCB boards and for variable voltages and can be made to control via the Blue Bluetooth and IOT, which are the trending methods now.

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BIOGRAPHIES



Roopa Rathod:
Pursuing M.Tech in VLSI Design and Embedded Systems at JSS Academy of Technical Education Bangalore, Department of Electronics and communication Engineering. Received Bachelor of Engineering in Electronics and Communication from Alvas Institute of Engineering and Technology affiliated to Visveswaraya Technological University, Belagavi.



Dr. Siddesh G K:
Associate Professor in JSS Academy of Technical Education Bangalore , obtained his Bachelors and Masters Degree in Electronics and Communication Engineering from Bangalore University and Manipal Academy of Higher Education, Karnataka respectively. He also obtained his doctoral degree from Visveswaraya Technological University Belgaum, Karnataka, India. He has 19 international journal publications and 3 international conference publication to his credit. His research area and area of specialization includes Wireless communication, Computer Networks, Image and Data compression and Processing.