Printer Signal Simulation and Analysis System

Introduction

Zebra is a manufacturer of thermal printers, which print by coordinating stepper motor motion with precise control of heating elements via a full-width print head. Motion is often synchronized to different types of marks appearing on the print medium such as black bars or spaces between labels. These marks are sensed via optical sensing systems.

We are looking to create a system by which to analyze and test the signals generated by our electronics in terms of both the motor motion and digital signals delivered to the print head in order to create automated tests for motion, registration, and print quality.

In addition, this system must simulate values of various sensing systems on the printer to ensure consistent results. These sensors include a thermal temperature sensor, a battery voltage sensor, a media registration sensor.

The project is split into phases, with phase one being around motor and registration sensor features, and phase two being print head features.

Long-Term Design Objectives

- Create system that can precisely measure motor motion via analog signal analysis
- Create system that can precisely measure and record signal timing information from the print head, which is an entirely digital device
- Create system that, in synchronization with the above two objectives, simulate values for 3 8-bit A/D sensors.
- Create system that, in synchronization with the above two objectives, can read out 3 8-bit A/D sensors to be played back at a later date.

- Create a control language for the system such that it can be that can be remotely controlled via Ethernet, returning all its data to a host.
- Create a software application to convert the captured data into virtual printouts.
- Design the system with sufficient processing power to handle approximately 67000 transactions per second while running the test, with no less than 10000 per second at the end of phase 1.
- Device must be able to be manufactured at end of project for internal use with a cost of less than 500$ per unit.

Development Phases Considered For This Project

- **Phase 1**
    - Create Motor Motion Analysis System and compare to internal counters. System must be able to analyze analog motor driver output.
    - Create Simulation of Registration Sensor and synchronize simulated outputs to motor motion
    - Create system to record sensor data from live sensors during operation for later playback.
    - Create system to communicate data sets to the device and get results to an external system via Ethernet interface.

The system must be architected in such a way that it can be expanded to do the second phase of the project without substantial redesign.

Required Skills

The project will require the following skill sets:

- Communications
- FPGA Development
- Digital Signal Timing Analysis
- Analog Signal Analysis and Generation
- Embedded Firmware Development

Zebra has a number of test and firmware engineers who designed the systems that will be under test who can assist with the project.

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