Active Vision Platform

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In order to achieve real-time active 3D vision, the team designed an active vision platform based on Digital Micro-mirror Devices (DMD). The platform utilizes the high-speed switching characteristics of digital micro-mirror devices to generate structured light based on time modulation, driving high-speed cameras to take pictures and processing at high speed, and displaying 3D information of objects in real time on the screen.

The active vision platform system hardware adopts 10-layer PCB lamination structure. The system board is divided into FPGA subsystem and embedded subsystem. The FPGA subsystem is centered on K7 series high-performance FPGA chip, and the embedded subsystem is a 4-core Cotex-A9 ARM embedded chip-i.MX6Q as the core. Both subsystems are equipped with high-speed data memory DDR3, up to a maximum data transfer rate of 1.8Gbps, and there are challenges in signal integrity, power integrity, and electromagnetic interference in hardware designs.

The active vision platform software algorithm is complex and divided into three parts: FPGA algorithm design, embedded algorithm design, and Web interface design. All are developed and designed by the team. FPGA software implements structured optical coding algorithms and digital micro-mirror display coding algorithms. Embedded software implements high-speed camera driving and three-dimensional image processing algorithms, including: image binarization, structured light decoding, structural light distortion variable acquisition and generation and display of three-dimensional point clouds. The platform also uses a Web server (BOA) to enable users to control and monitor the entire system using the Web interface independently developed by the team. This system is based on different platform software development, many software modules, complex communication between each other, development is difficult.

Figure 1 Custom System Board

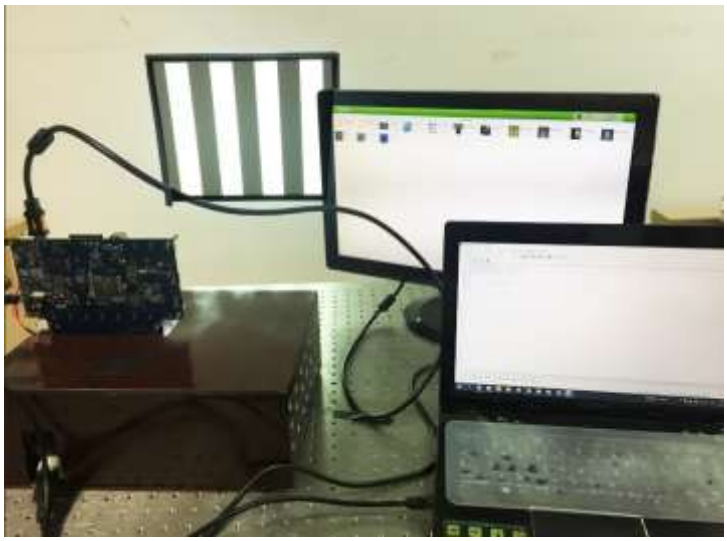

Figure 2 Physical Connection

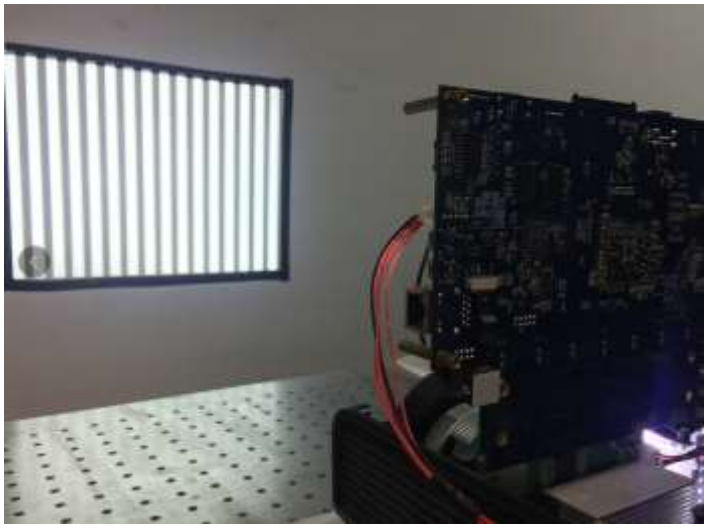

Figure 3 Structure Light Projection

Figure 4　3-D Vision