IoT Air Draw

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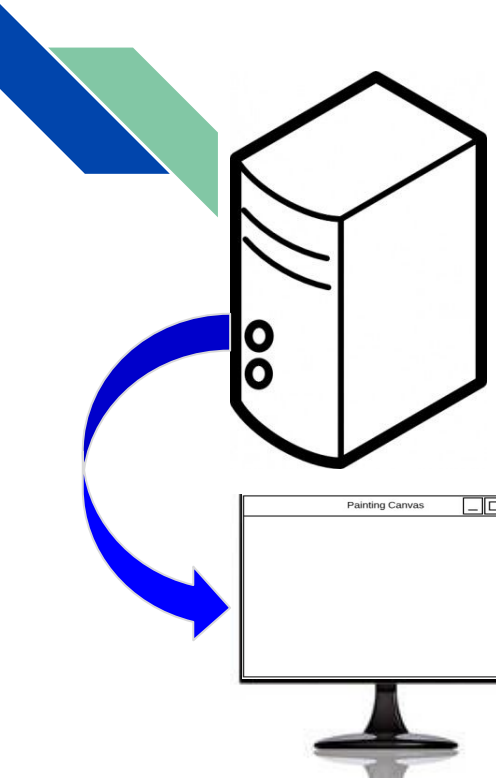
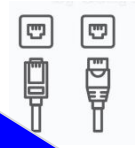
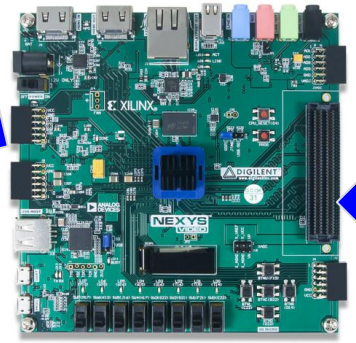
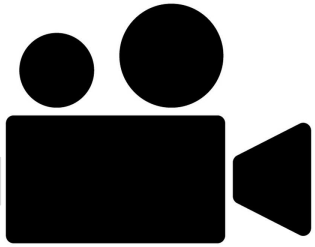
INTRODUCTION









OUTPUT

PROCESS

INPUT

Goals - Custom IP

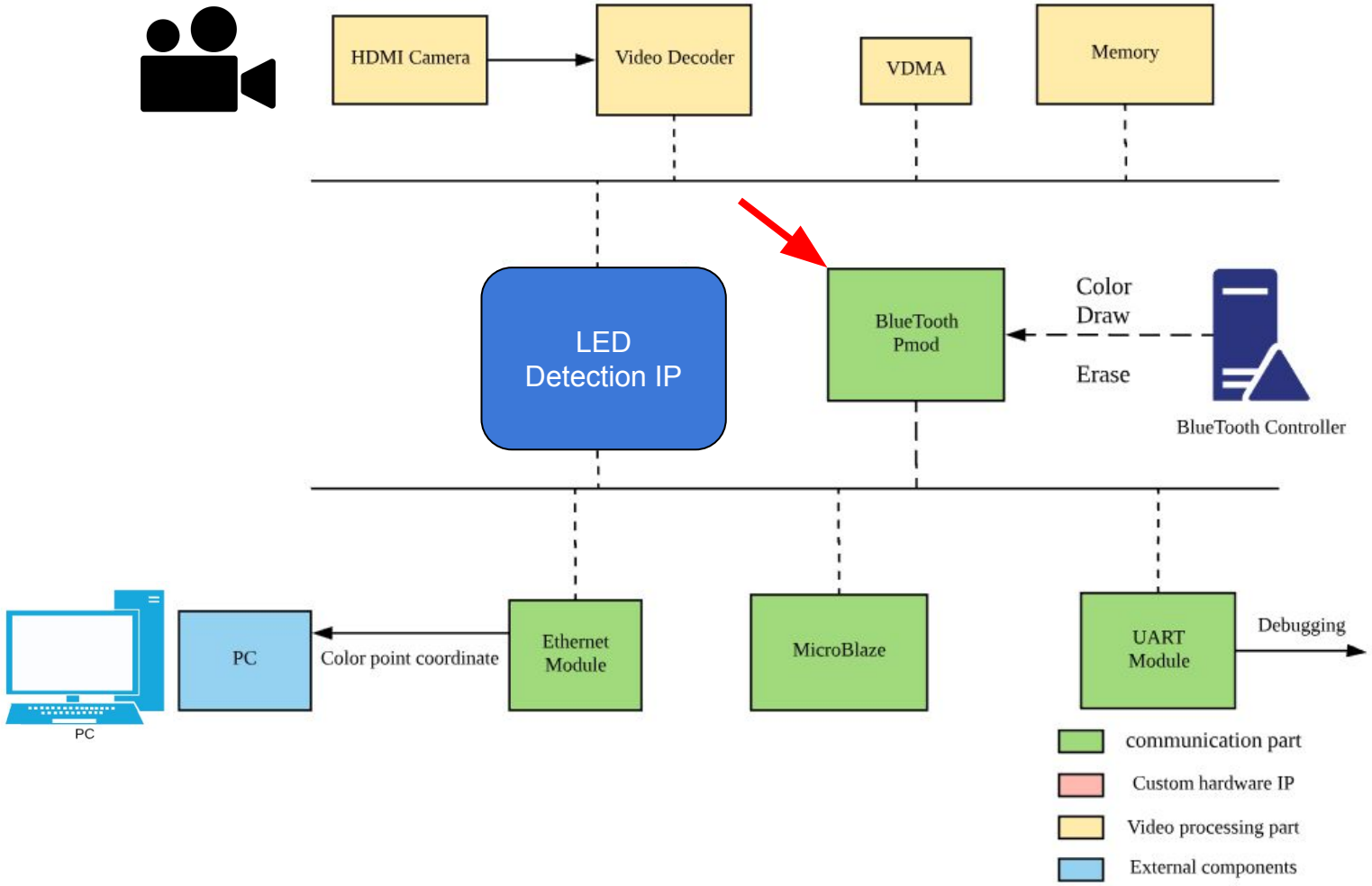
Fast processing speed at 30HZ on HD video

Simple algorithm with high detection accuracy

Multi color detection

Capability of detecting size of LED (using bounding box)

Final SYSTEM Block Diagram


HDMI Camera
Video Decoder
VDMA
Memory
LED
Detection IP
BlueTooth
Pmod
Color
Draw
Erase
BlueTooth Controller
PC
PC
Color point coordinate
Ethernet
Module
MicroBlaze
UART
Module
Debugging
communication part
Custom hardware IP
Video processing part
External components

Change in Plan

- Moved away from custom IP interrupt
  - Turned out not necessary
  - Conflict in interrupt

- Used Bluetooth
  - Allow remote control
  - Adding more usability

Code Blocks - Hardware

- Borrowed
  - Initial video setup
  - Some VDMA functions in sdk

- Created (own IP)
  - LED detecting IP
  - External Bluetooth controller
  - SDK code integrating ethernet and video

Code Blocks - Software

- Borrowed
  - Python OpenGl
  - Python library for filtering

- Created (own IP)
  - State machine for drawing
  - Data structure to store points in mem

Design Process

Work Distribution

Nafis

- Software frontend & external controller
- Integration of Ethernet and video in SDK
- Bluetooth module

Haiqi

- Ethernet and video path setup
- Custom IP testing environment setup

Mariko

- Implemented Custom LED detecting IP (HLS)
- Investigated and experimented prototype algorithm in software

Design Steps

Initial Phase

- Basic Ethernet and Video path setup
- Algorithm investigation & Prototyping

Development

- Implemented & tested custom IP in hardware
- Integrated custom IP into data path

Design Steps (cont'd)

Integration (Mid project Demo)

- Integrated Video and Ethernet in SDK
- Integrated with Software server and Bluetooth

Optimization

- Increased detection accuracy
- Software side improvements

Lesson and Learned

- Hardware is fast(er than python)
- Vivado is VERY slow :’(
- Be aware of License access
- Xilinx software is buggy

Q&A