Development of Camera Module for Microbolometer Based Infrared Imaging Applications

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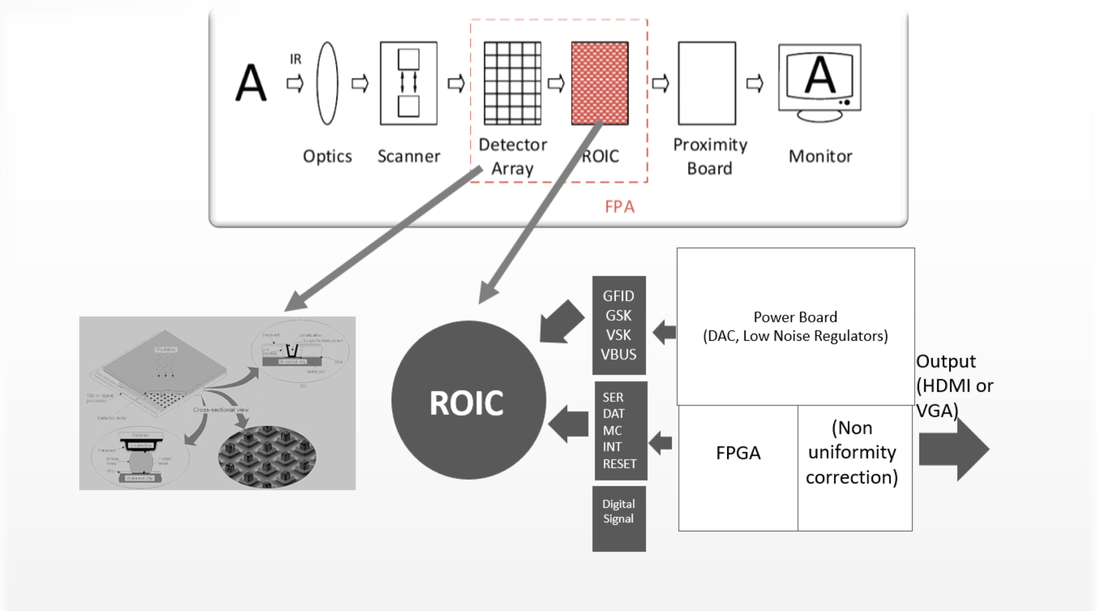
PROJECT INTRODUCTION

This project aims to develop a microbolometer based infrared camera module that includes optics, detector, readout integrated circuit (ROIC), power board and field programmable gate array (FPGA).

The power board which has been designed by project members in order to provide bias voltages.

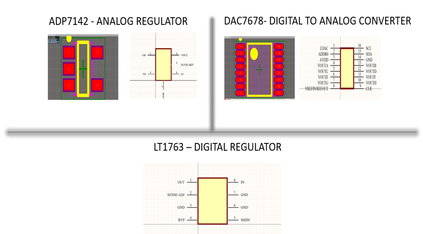
FPGA is providing clock signals to the system to synchronize operations between every individual part.

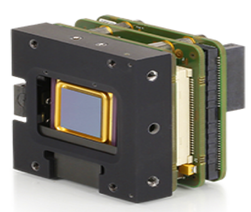
After all of the data processed by FPGA, it gives a video as an output.



OBJECTIVES

- Selecting the components for the power board and model of FPGA
- Power board PCB design / Printing the board
- Coding FPGA to generate control signals for detector .
- Reading data that delivered by ROIC in FPGA.
- Assemble the microbolometer, power board, and FPGA.
- Transferring the contunious stream that has been color mapped to the HDMI.





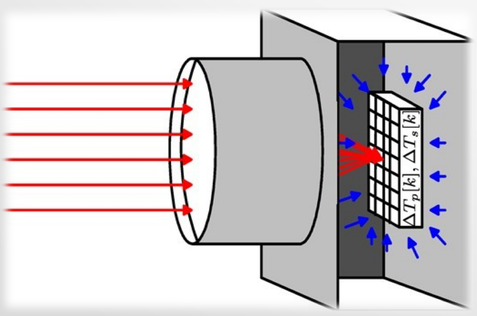
PROJECT DETAILS

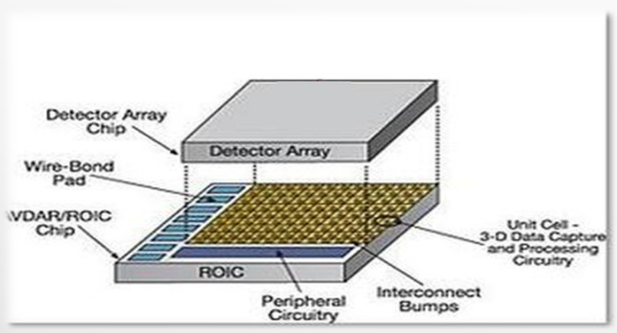
There are 5 main components in this project:

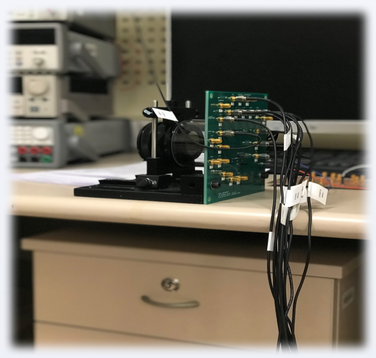
Optics: Use for coupling and focusing IR radiation to the detector.

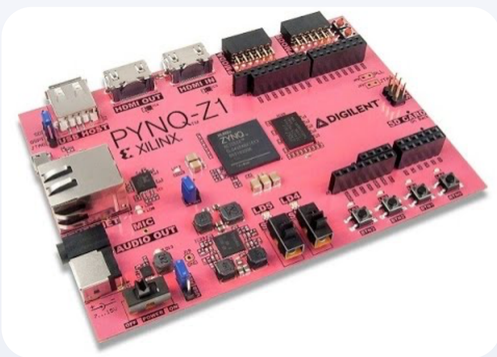
Detector: IR radiation being sensed by the detector. Consequently resistance values of the detector changes due to absorbed IR radiation.

ROIC: Changes in resistance value in every pixel is reading by readout circuit and delivering to the FPGA as a digital signal.







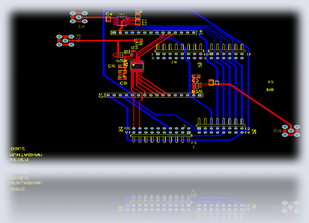


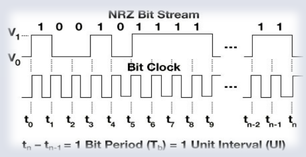
Power Board: This board provides the bias voltage to the system and converts digital signals to analog.

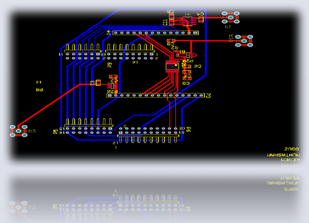
FPGA: Analog signals that are obtained from ROIC are converted to digital and processed by FPGA e.g.(gray-color coding).

APPLICATIONS AND MATERIALS

- Altium Designer software is used to design schmatic and the layout of the PCB.
- Board has been printed by using LPFK S63 board printer.
- Components of power board has been soldered manually.
- Clock signals are produced with FPGA by using Python programming language.
- The data that has been collected by FPGA delivered to the HDMI and 12-bit signals are obtained. In that process Python is used to colormap the datas that are stored in RAM.
- Processed data is printed out by HDMI output.

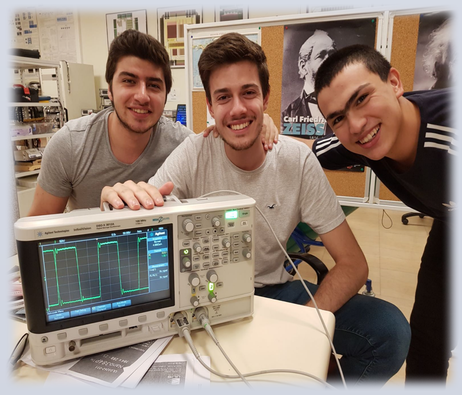






CONCLUSION

- In this project, the functionality of the infrared camera has been studied and a camera module is developed.
- PCB design of a power board is done with Altium Designer Software.
- Clock signals are produced from FPGA by using Python.
- Processed data is printed out by HDMI output.



REFERENCES

Infrared Sensors and Imaging
http://www.attolloengineering.com/infrared-sensors-and-imaging.html
Modeling and Compensating Temperature-dependent Non-uniformity Noise in Ir Microbolometer Cameras
Alejandro Wolf-Jorge Pezoa-Miguel Figueroa - http://www.mdpi.com/1424-8220/16/7/1121
Pynq-z1
https://reference.digilentinc.com/reference/programmable-logic/pynq-z1/start
Xenics - Infrared Cameras, Cores and Detectors - Emea
http://www.xenics.com/en/application/lwir-uncooled-bolometer-cores