Detecting People with an FPGA + a Thermal Camera

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Introduction

- The aim of the project is detecting people with covid-19 disease from their body temperatures via 32x24 IR Thermal Camera.
- The main motivation of the project is to create a system that can diagnose covid-19 according to the temperature of people in closed places such as airports, shopping malls, schools, etc.
- The system presense and measure of people body temperature. When people's body temperature is above the threshold value, system gives a warning.

Specifications and Design Requirements

- Detecting human presence using the motion detection method, and presence of disease using the morphological features of the synthetic image stream that taken from a thermal camera video record.
- FPGA can process larger data with few clock cycle. Whereas this is not possible with the processor.
- Therefore, live stream video processing with FPGA is highly efficient and fast compared to other systems.
- In this way, our system can process serially incoming images without delay.
- If we integrate a 32x24 thermal camera, the system can be used mobile.

Solution Methodology

- The project has two main objectives. The first is to detect human presence and the other is to measure human temperature.

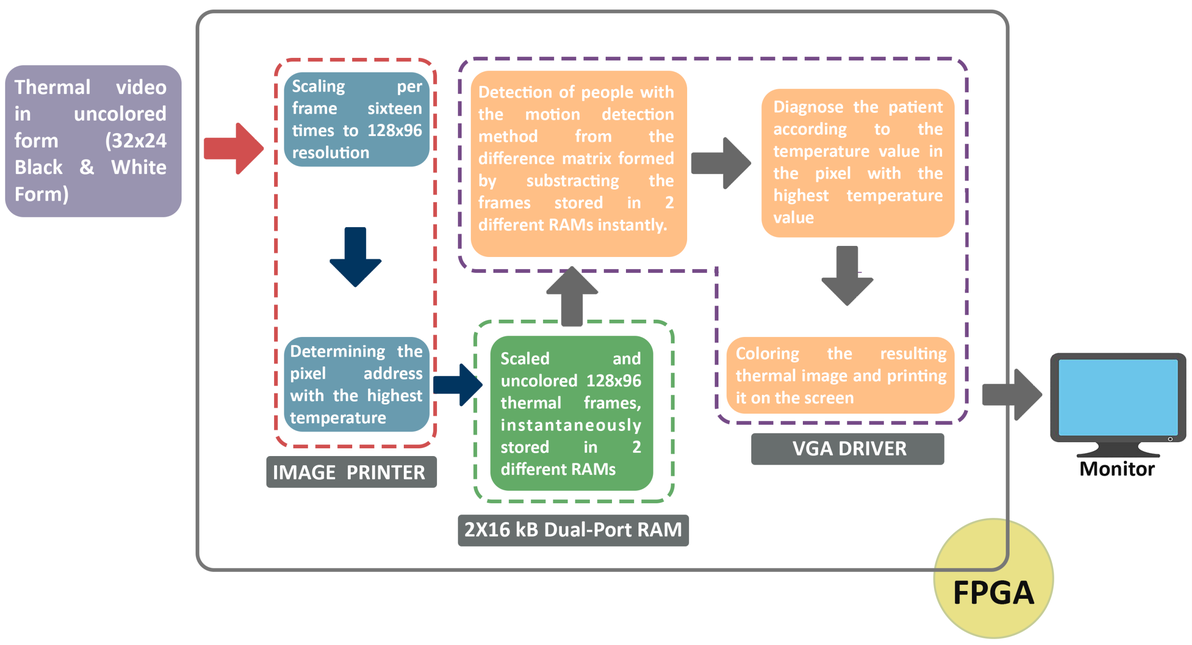

Figure: An overall description of the project components.

- In this project, we used difference matrices formed by subtracting consecutive frames from each other in order to detect human presence.
- In order to find the temperature of the person we detected, we filtered each pixel in the image and determined the maximum pixel address. We determined the temperature of the pixel at the address according to the 8-bit black and white color code.
- Finally, we colored the 8-bit black and white thermal image with the color map we created in fpga. We marked the hottest pixel on a human. If the body temperature of the person is above the determined threshold value (37°C), the system gives a warning.

Application Areas

- The probability of being infected with Covid-19 is much higher indoors than outdoors. The Project offers an economical solutions for indoor areas such as; Airports, Hospitals, Malls, Schools, Factories

Results and Discussion

- In the project, thermal images were obtained externally and stored on the ROM memories we created on the FPGA.
- The 32x24 thermal image has been scaled sixteen times for better viewing on the monitor.
- The 128x96 thermal images we took as black and white were colored in the orange and purple spectrum band.
- Thermal images were filtered and the pixel with the highest temperature was determined.
- We subtracted the frames from each other in order to detect the human presence. We detected the human existence by processing the resulting difference frames.

- As it can be seen, the system can detect people and gives a warning if the temperature of the person is above the specified threshold temperature (37°C).
- Since we do not have a thermal camera, we only tested the system on certain videos. If a camera is integrated to the system in future, system can be used mobile, in indoor area.

References

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- Donald G.Bailey , ' Image Processing using FPGAs ', 2019
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