

Microwave Advance

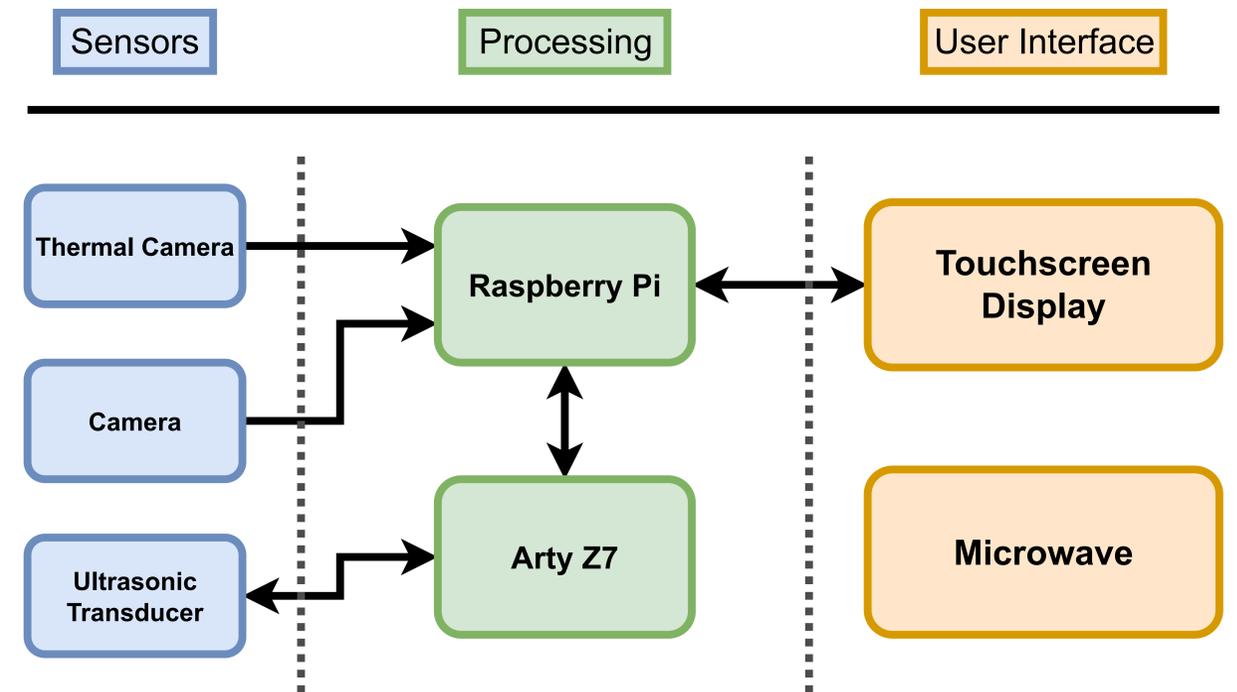
Project

For many years we have had the same basic technology used in microwaves. With the emergence of new and cheaper technologies, there are additional sensing capabilities that can improve the abilities of microwaves. Three of these technologies that the Microwave Advance employs, is a thermal camera, a regular camera, and an ultrasonic temperature sensor.

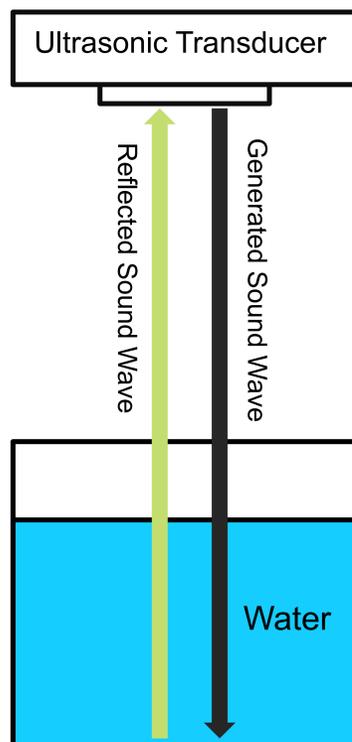
With the aid of these sensors, users will be able to read the internal and external temperatures of the things in the microwave. This will improve the cooking process by giving the user important information and will allow for more intelligent heating and defrosting.

As thermal cameras have been around for a long time and are well researched, the main objective of this project was to produce a temperature using an ultrasonic transducer. This is a lesser-known technology that is currently used in very specific applications such as in the heating and processing large steel beams.

System Diagram



Method



To measure temperature, the Microwave Advance:

- Records the time of flight of an ultrasonic wave
- Uses the specific properties of the medium
- Calculates the temperature of the material

As the material's temperature increases, so will the velocity of the wave.

Part of the wave will get reflected off the surface of the water.

Initial temperature measurement can come from the thermal camera.

Can track the temperature as the material heats up.

Conclusion

The camera and thermal camera worked well and would be useful by themselves in a microwave. The touchscreen allows a better view of the food and opens the door for smarter microwaves to be made.

Working on this project brought up other considerations that would need to be made to make an accurate measurement in future iterations. These include humidity, air pressure, air temperature, non-uniform materials. Most of these considerations would be calibrated at the beginning of cook time.

Things I learned were:

- Full SoC design with Vivado Design Suite
- OS building with Petalinux
- Embedded systems programming
- AXI protocol specifications

