

## Goal

- Design an access control system, utilizing facial recognition as its method of authentication.
- Store authorized users and entry attempts (with timestamps and identifying images) in a SQLite database.
- Enhance real-time capabilities and increase processing speed to reduce latency in identification, via FPGA acceleration.

## Motivations

- Modern technology is moving away from traditional password based authentication in favor of biometric identification.
- Facial recognition is the superior method of biometric identification in terms of efficiency.
- Very few physical control entry systems that rely on facial recognition exist.

## Future Goals/Plans

- Use industrial scale equipment to improve camera and locking mechanism quality
- Applicable to businesses where access restriction is necessary
- Increase dataset to increase the accuracy of the facial recognition system

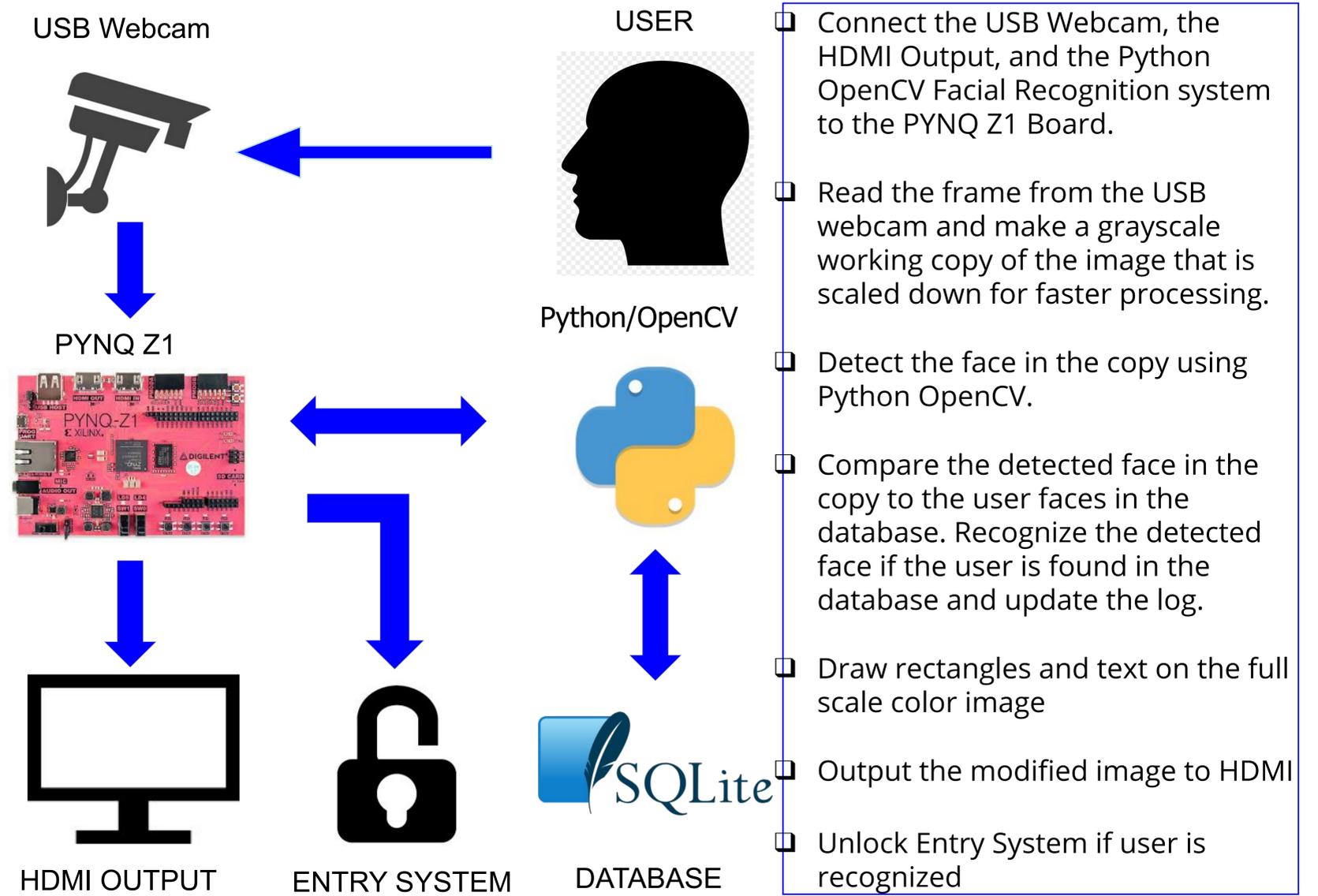
## Research Challenges

- Compare methods of Facial Recognition
  - Optimizing Speed vs. Quality
- Identify bottleneck and replace portions of the OpenCV with hardware implementations.

## References

- <https://pynq.readthedocs.io/en/v2.4>
- <https://github.com/Xilinx/PYNQ-HelloWorld>
- [https://groups.google.com/forum/#!forum/pynq\\_project](https://groups.google.com/forum/#!forum/pynq_project)

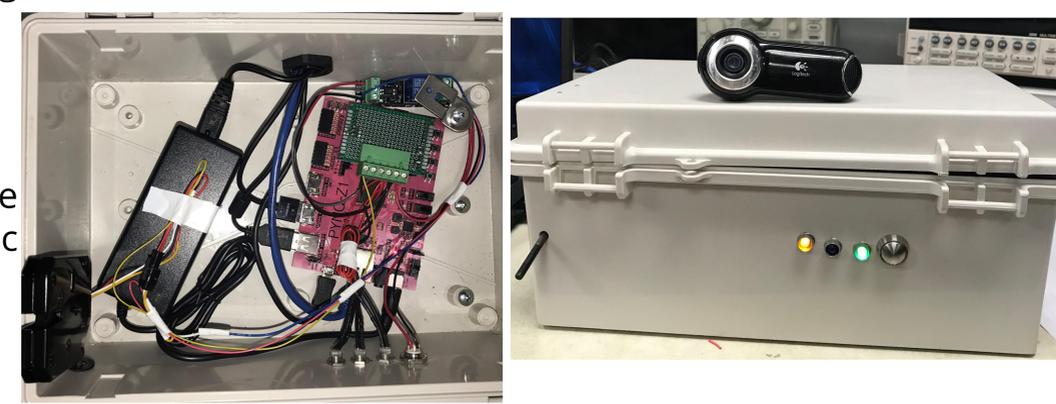
## Methodology



- Connect the USB Webcam, the HDMI Output, and the Python OpenCV Facial Recognition system to the PYNQ Z1 Board.
- Read the frame from the USB webcam and make a grayscale working copy of the image that is scaled down for faster processing.
- Detect the face in the copy using Python OpenCV.
- Compare the detected face in the copy to the user faces in the database. Recognize the detected face if the user is found in the database and update the log.
- Draw rectangles and text on the full scale color image
- Output the modified image to HDMI
- Unlock Entry System if user is recognized

## Results

- The system is able to detect and recognize faces with acceptable speed
- The latch is unlocked only for faces with a high enough access level
- Portions of the image processing code have been moved into the FPGA fabric



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