Park’n Go

Team L2A 01

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Problem – Parkades in 2021

For Parking Customers:

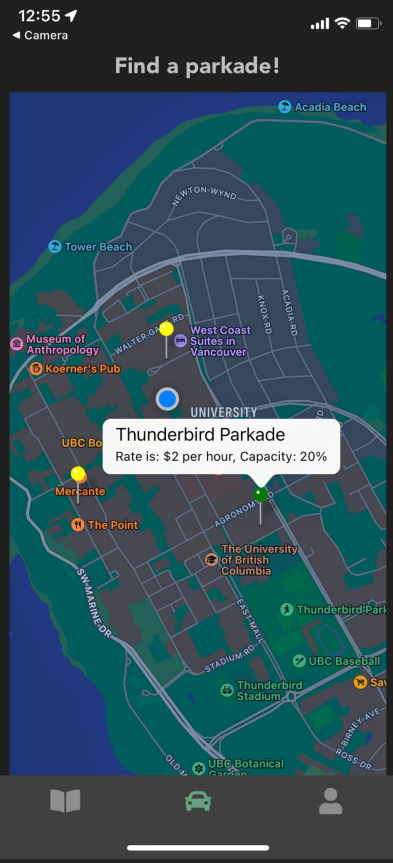
- Estimating how long you plan on parking
- Stand in long lines to pay for parking

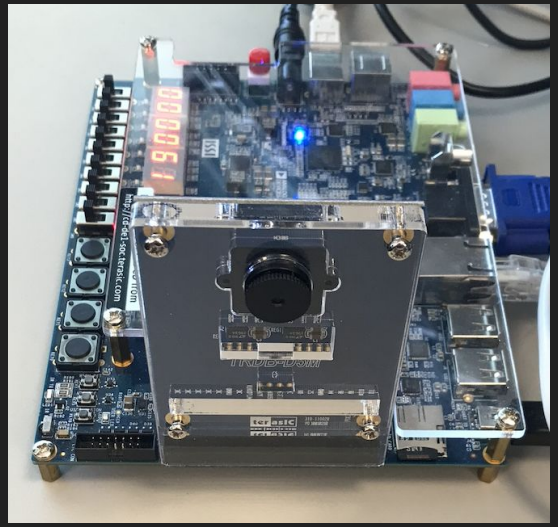
For Parking Companies:

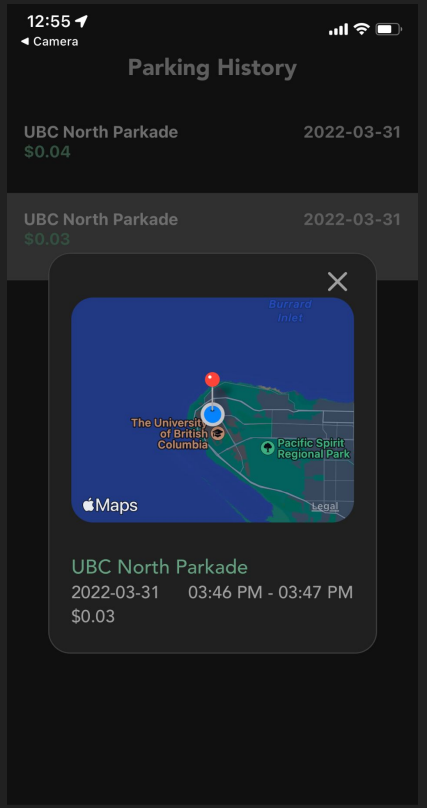
- Hire people to patrol the parkade

https://bgindependentmedia.org/parking-kiosks-take-too-much-time-many-drivers-say/

Solution – Parkades in 2022





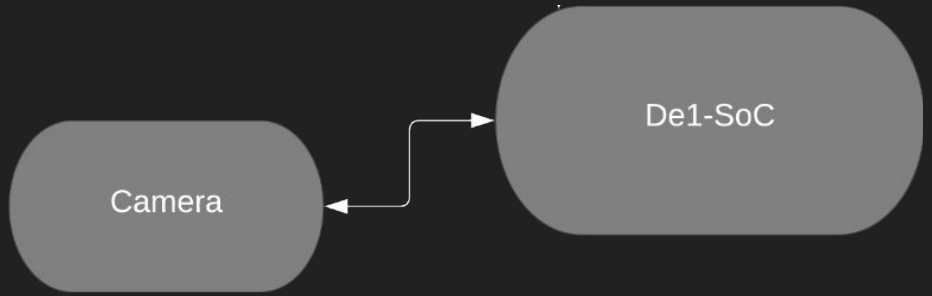


Contributions

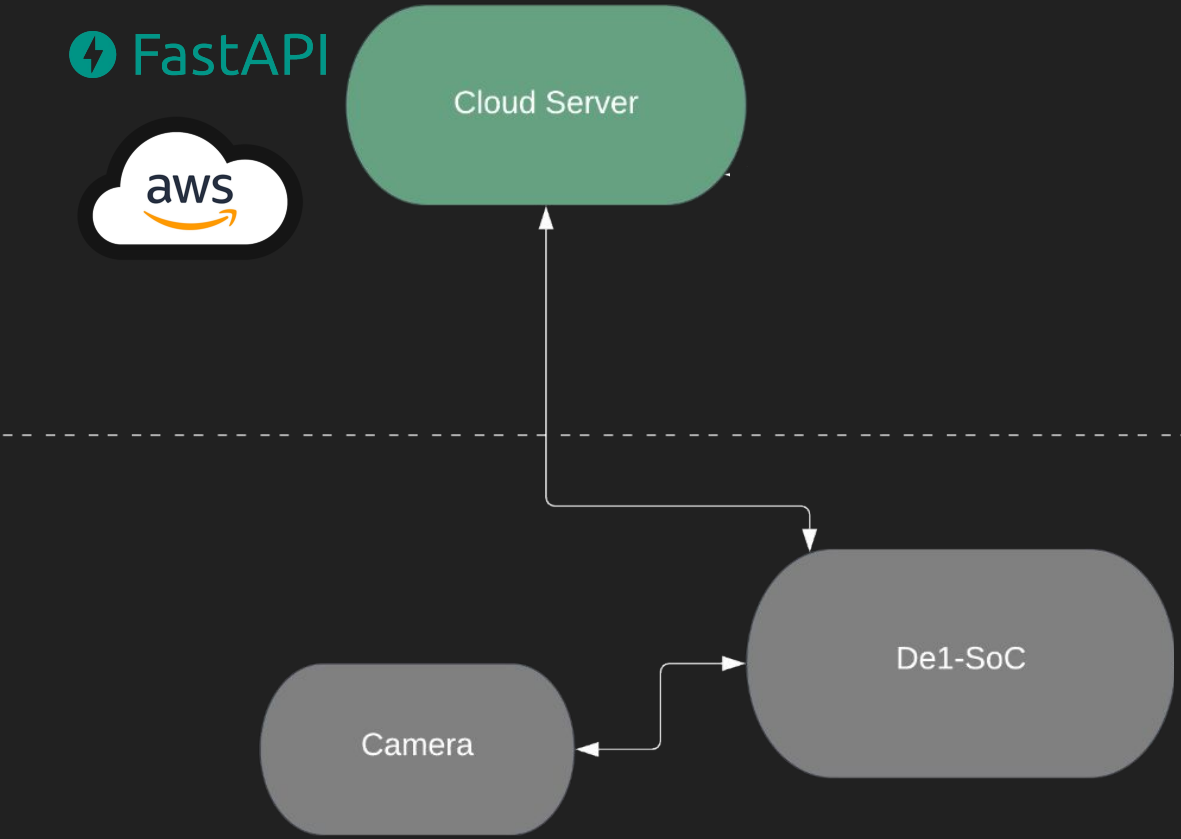
	Mason	Jerry	Ken	Francis
App Design			✅	
App Development	✅	✅	✅	✅
Server	✅	✅	✅	✅
Hardware Acceleration	✅	✅		✅
Camera	✅	✅		✅
License Plate Recognition			✅	
Testing	✅	✅	✅	✅

Demo Time!

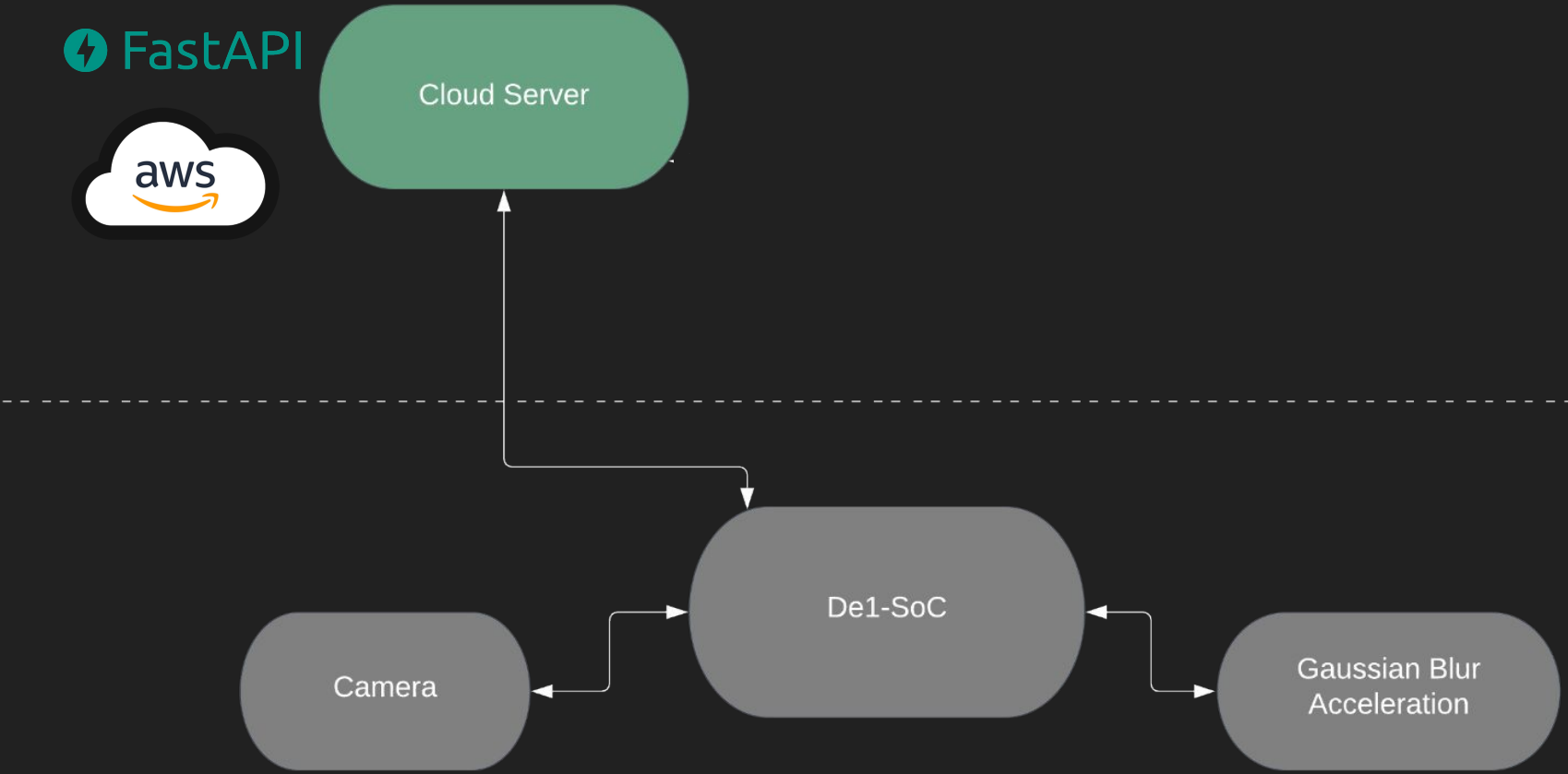
Overview



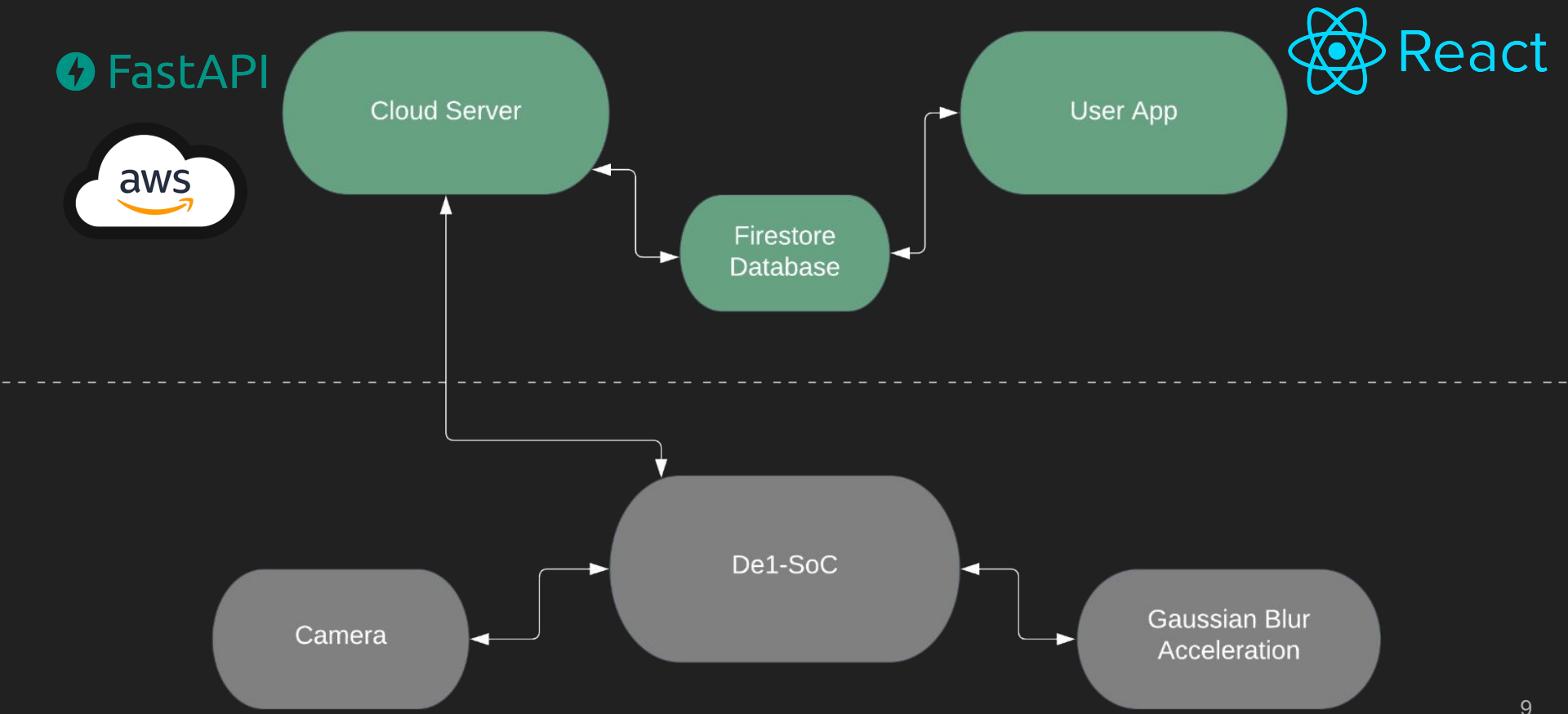
Overview



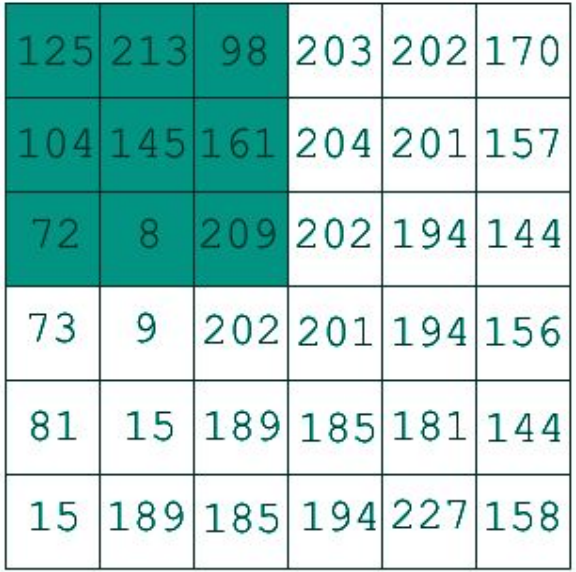
Overview

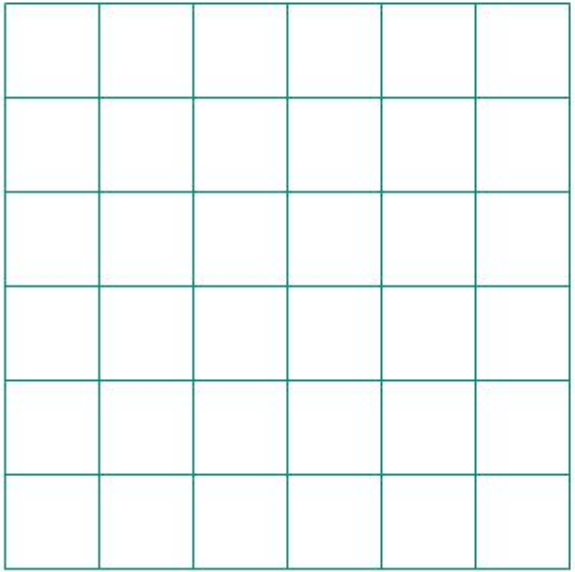

FastAPI
aws
Cloud Server
De1-SoC
Camera
Gaussian Blur
Acceleration

Overview


FastAPI
aws
Cloud Server
User App
React
Firestore Database
De1-SoC
Camera
Gaussian Blur Acceleration

Hardware Acceleration - Gaussian Blur





https://medium.com/hackernoon/cv-for-busy-developers-convolutions-5c984f216e8c

Challenges

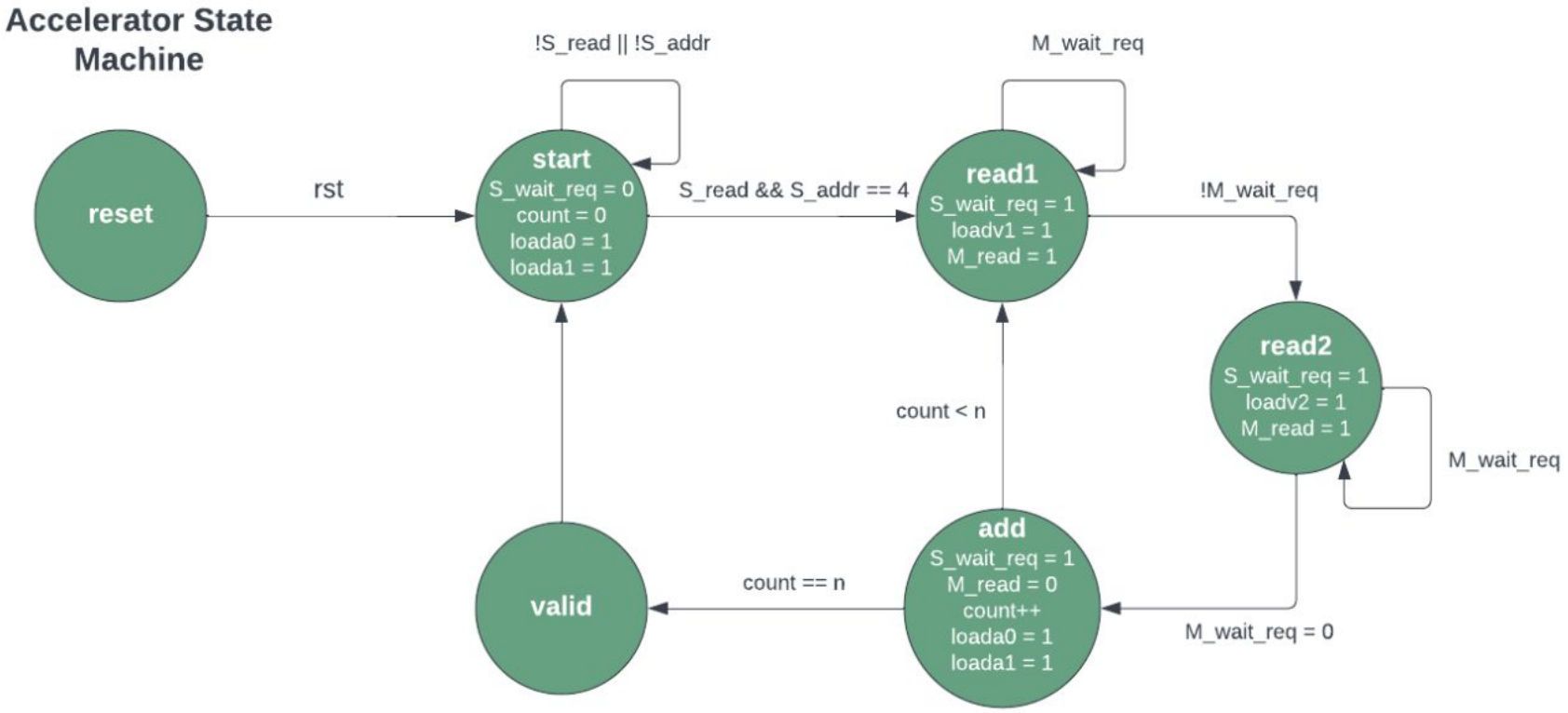
- Exporting image from camera
  - Synchronize frame/line counters and write a flattened image to the DDR3 RAM
  - Use kernel module to read from the RAM and export to AWS
- Acceleration kernel modules
  - Can’t read a kernel module after writing to it
  - Used 2 fstreams
- ALPR operating system dependencies
  - Inconsistent on Mac OS v.s. Linux

Results and Robustness

- Used latest libraries in order to future proof the app, hardware, and image detection
- Used dataset of 100 images to ensure ALPR accuracy
- Added CI and automated testing
- Wrote detailed comments and create block diagrams

Thank you!

Appendix I


Accelerator State Machine
reset
rst
start
S_wait_req = 0
count = 0
loada0 = 1
loada1 = 1
!S_read || !S_addr
S_read && S_addr == 4
read1
S_wait_req = 1
loadv1 = 1
M_read = 1
M_wait_req
!M_wait_req
read2
S_wait_req = 1
loadv2 = 1
M_read = 1
M_wait_req
M_wait_req = 0
add
S_wait_req = 1
M_read = 0
count++
loada0 = 1
loada1 = 1
count < n
count == n
valid

References

- https://pyimagesearch.com/2020/09/21/opencv-automatic-license-number-plate-recognition-anpr-with-python/
- https://sysprog21.github.io/lkmpg/
- https://uvispace.readthedocs.io/en/latest/camera.html
- https://courses.cs.washington.edu/courses/cse467/08au/labs/Resources/THDB-D5M_Hardware%20specification.pdf
- https://www.terasic.com.tw/cgi-bin/page/archive.pl?Language=English&CategoryNo=68&No=281&PartNo=3#contents