Reverse Engineering the Future of Parking

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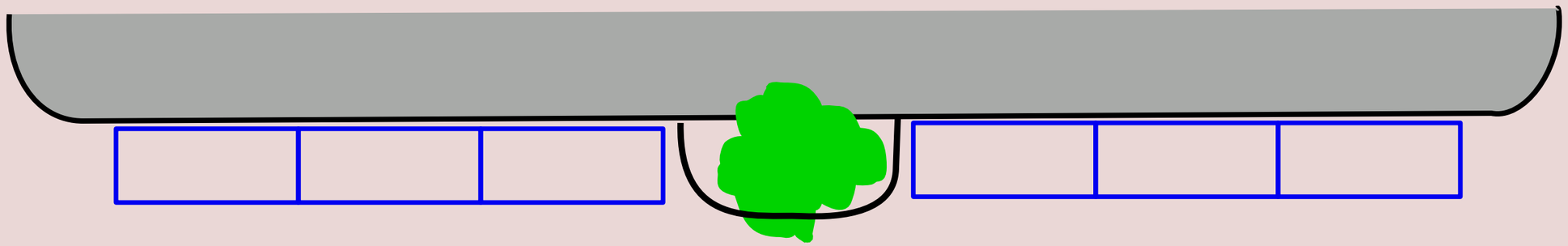
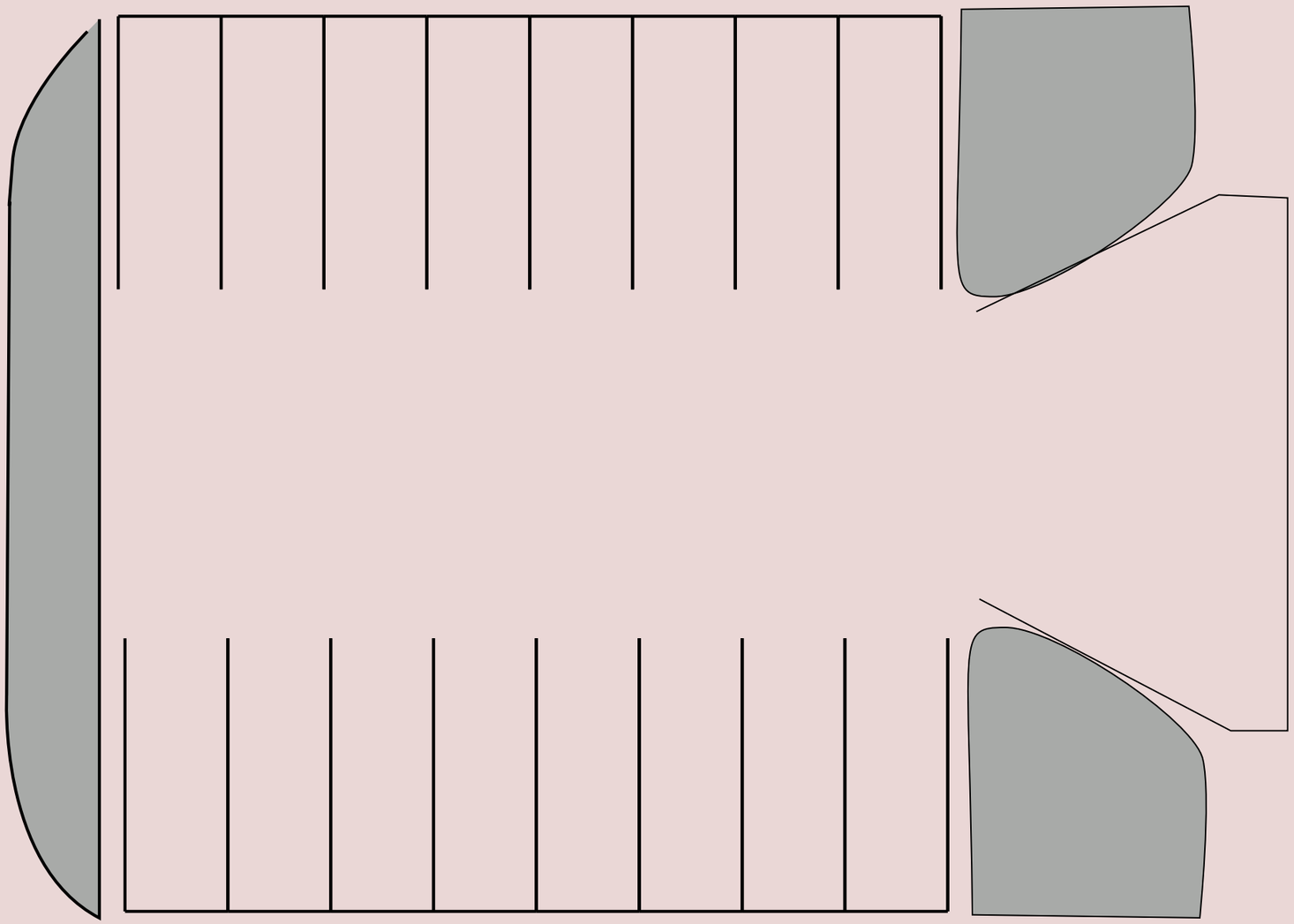
ParkTransit

The On-street problem



Forcing Turnover
Pay Parking
Mobility Parking
Forecasting Occupancy

The At-grade problem



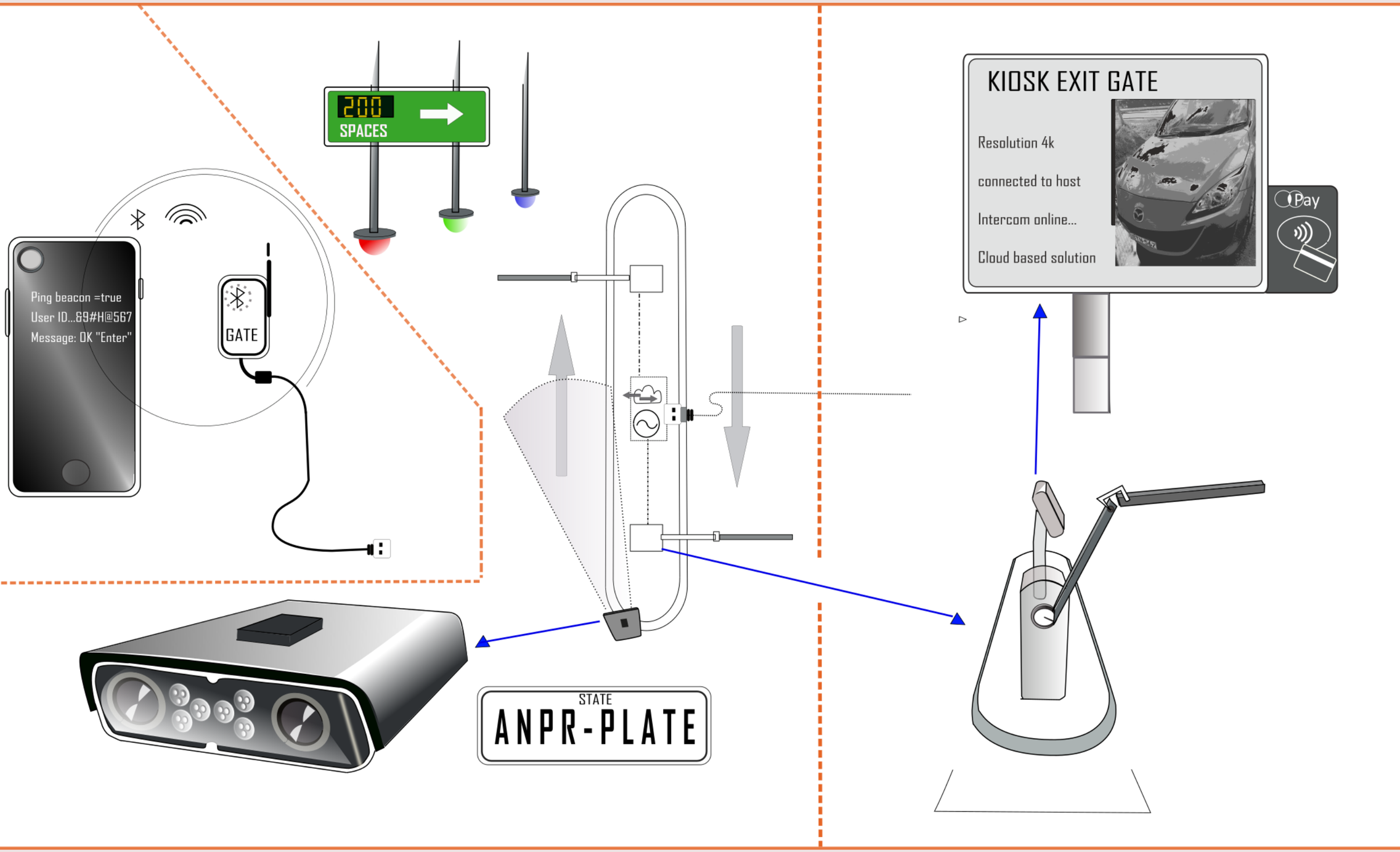
How to -
Enforce Turnover

Pay Parking without Gates

Gates or Meters

Wayfinding –
calculating occupancy

Off-Street Parking



Which user group ruined it for all of us??????

The Resident

Permanent Parkers

The ”Friend” of the Resident

The Contractor

The Shopper that buys nothing

The Freeloading Commuter

Reverse Engineering the Future of Parking

For the Purposes of Research I attempted to code 2 parking solutions

1 - Car Park Occupancy Solution

2 - Licence Plate Recognition

By attempting to code a solution myself, I was able to understand the technical 'Barrier of entry'; and fromthere understand how Pre-existing third party solutions could speed up the development of certain technologies

- I had started a bluetooth gate control solution, but this was unfinished

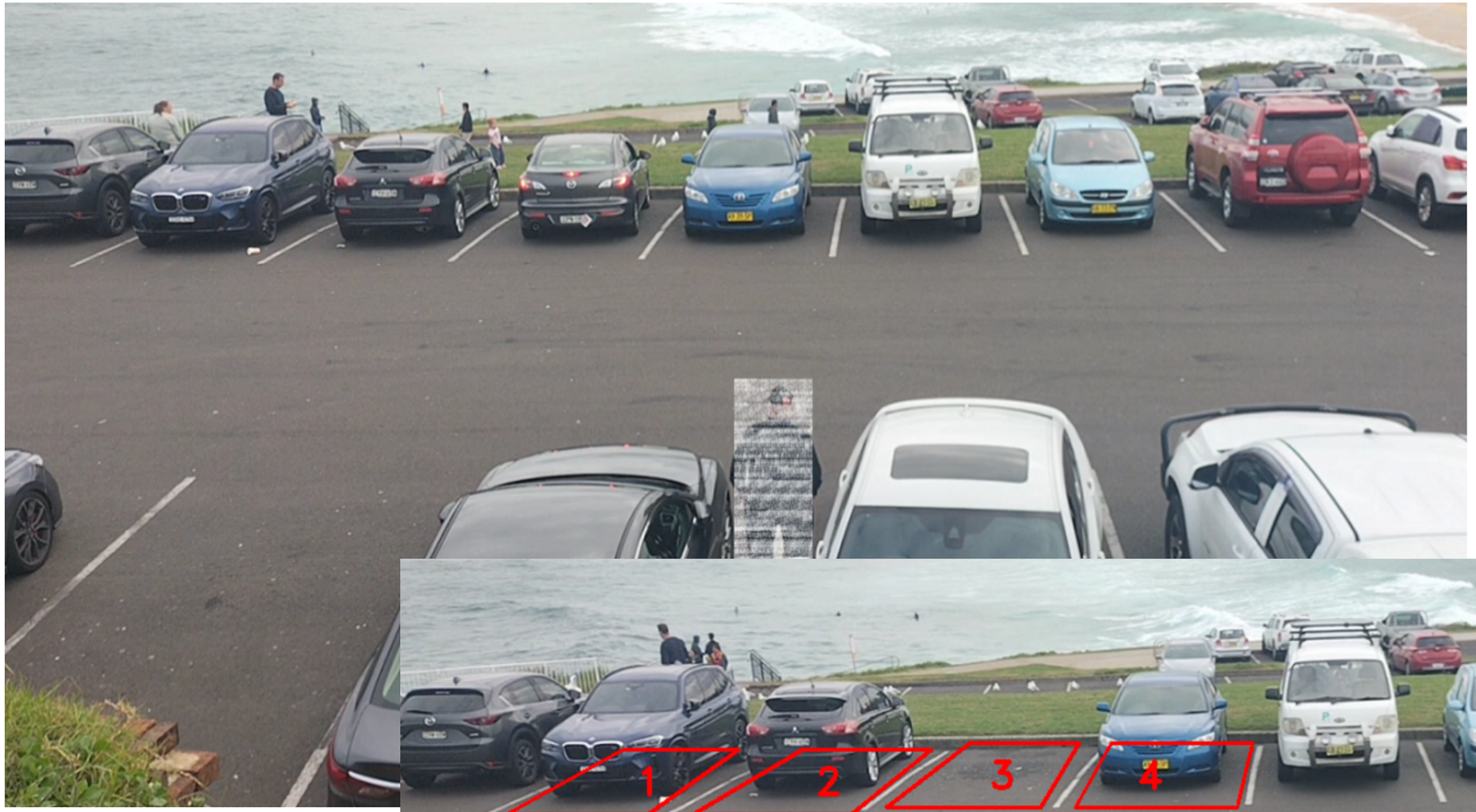
Car Park Occupancy Counter

Platforms

- Visual Studio 2019
- C++
- Open source code plus my own code

Logic

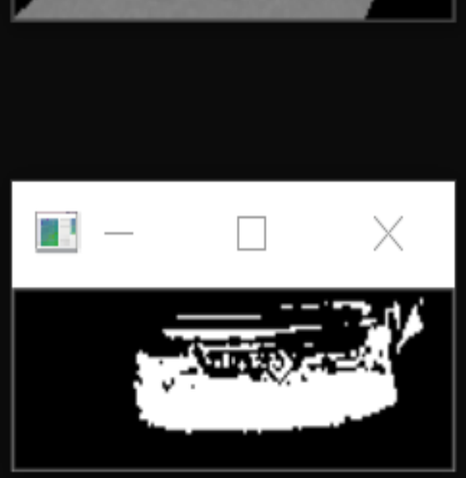
- Define a car parking space
- Find two images from a video
- Substract the difference between the first and second image using various methods - for each space separately.
- Note if there is a change in space - by seeing if the change surpasses a pre-defined threshold

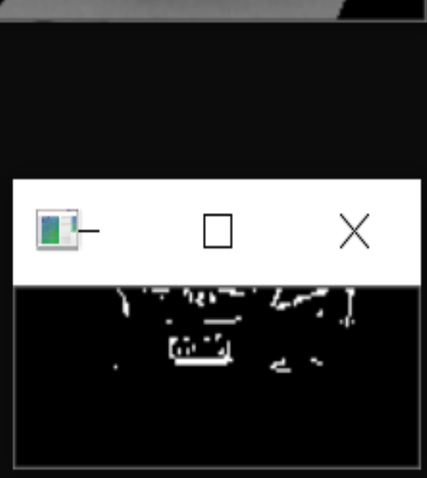



1
2
3
4

C:\Xammpy\htdocs\Car Park Counting\carparkcounter\x64\Release\carparkcounter.exe

```
Space 3 pixels: 1923 New Status: CHANGED
Space 4 is UNCHANGED
```





Car Park Occupancy Counter

What I learned

- Can use mid-quality images
- Relatively easy to code
- Many tools are available to adjust the algorithms

Problems to Address

- The lower the camera position the harder it is to define a car space. Otherwise the image of a car overlaps to nearby spaces.
- Defining each space is time consuming
- Camera must stay still
- Changing light conditions throughout the day will mean that: a vacant space at night will look dark, while a vacant space during the day will look gray. This means that the solution must test each space based on the current conditions

Licence Plate Recognition

Platforms

- Visual Studio 2019
- C++ for image testing; c# for App
- .NET framework
- MySQL
- Open source code plus my own code

Logic

- Determine field of view where a number plate will appear
- Test for Plate
- Grab a snippet of car around plate – test for colour
- Character Recognition

File Edit View Git Project Build Debug Test Analyze Tools Extensions Window Help Search (Ctrl+Q) PlateCapture GC

inalScene

e Share

C:\Xammpy\htdocs\LPR\PlateCaptu...

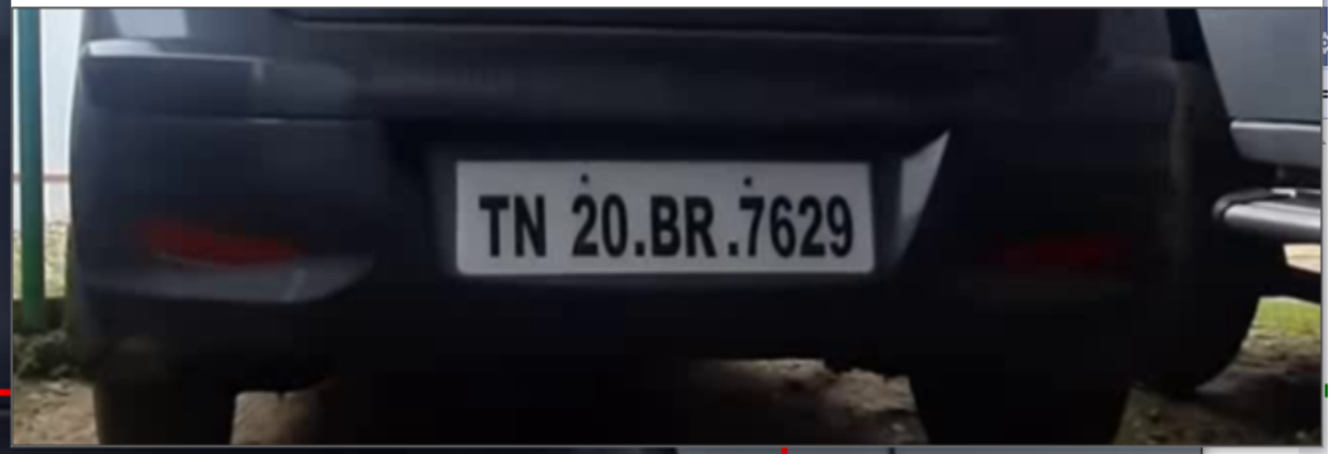
```
Car Present

12 possible plates found

license plate read from image = 20BR7629

----------------------------------------
Colour of Car  Gray
currentDateTIme = 2022-06-16.15:07:26
Connected to MySQL
```

imgPlate



PC CRLF

imgThresh

Funky Disco Car Park

Car Parking for Parkers that like to park in car parks

Time Now	Parking Duration	00 hours 04 Mins
16/06/2022 3:12:38 PI	Fee Payable	$ 0

No Fee Payable - Please Drive Safely

Button

http Connect

Payment Progress.....

ID	Entry Time	Vehicle Registration	Other
43	06/16/2022 15:07:26	20BR7629	Gray

Test Button
Check for Fee

Press for HELP

Licence Plate Recognition

What I learned

- Can use low quality cameras
- Relatively easy to code
- Can achieve high levels of accuracy

Problems to Address

- Complexity of modern number plates
- Finding an efficient solution to search entry events, based on number plate, to find a close match against exit events
- Reflective number plate covers

The Future Parking Solution

It will be indistinguishable from:

- Licence Plate, Bluetooth, NFC
- Social / Peer Application like AirBnB, Building access management
- Include Mobile Payment
- Involve minimum effort for user to subscribe

But the precise technology and timing will DEPEND on:

- Motivation of solution providers to develop one technology over another
- Market Dominance of emerging parking apps that can better horizontally integrate other solutions
- NFC adoption