

arGeoDetector

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Objective

Provide real time geographic position information to mobile operators during amateur radio contests

Requirements

Standalone - No Internet required

Work with standard GPS hardware - Dongles / Radios

Why?

Safety

Stop looking for County/City markers and keep eyes on road

Accuracy

No concerns about pulling off the road and making a quick contact

No concerns about diverting from a pre-planned route

What?

Maidenhead Grid Locator

Currently 6 digits of accuracy

https://en.wikipedia.org/wiki/Maidenhead_Locator_System

County or Independent City

Leverages Chuck Sanders (NO5W) boundary files from CQ/X

<http://no5w.com/CQxCountyOverlays-DL.php>

Screenshot

C:\WINDOWS\system32\cmd.exe - cmd.bat - python arGeoDetector.py

```
2019-08-05 20:18:45,347 INFO Loading RHM(Rockingham)
2019-08-05 20:18:45,349 INFO Loading RUS(Russell)
2019-08-05 20:18:45,350 INFO Loading SAX(Salem)
2019-08-05 20:18:45,351 INFO Loading SCO(Scott)
2019-08-05 20:18:45,352 INFO Loading SFX(Suffolk)
2019-08-05 20:18:45,353 INFO Loading SPS(Spotsylvania)
2019-08-05 20:18:45,354 INFO Loading STX(Stafford)
2019-08-05 20:18:45,355 INFO Loading SWA(Swain)
2019-08-05 20:18:45,356 INFO Loading TAY(Taliaferro)
2019-08-05 20:18:45,357 INFO Loading TCH(Teachey)
2019-08-05 20:18:45,358 INFO Loading TFX(Taxahoe)
2019-08-05 20:18:45,359 INFO Loading TIS(Tidewater)
2019-08-05 20:18:45,360 INFO Loading TOL(Tolson)
2019-08-05 20:18:45,361 INFO Loading TUN(Tunstall)
2019-08-05 20:18:45,362 INFO Loading VBX(VirginiaBeach)
2019-08-05 20:18:45,363 INFO Loading WAR(Warren)
2019-08-05 20:18:45,364 INFO Loading WAS(Washington)
2019-08-05 20:18:45,365 INFO Loading WAX(Waynesboro)
2019-08-05 20:18:45,366 INFO Loading WES(Westmoreland)
2019-08-05 20:18:45,367 INFO Loading WMX(Williamsburg)
2019-08-05 20:18:45,368 INFO Loading WIX(Winchester)
2019-08-05 20:18:45,369 INFO Loading WIS(Wise)
2019-08-05 20:18:45,370 INFO Loading WYT(Wythe)
2019-08-05 20:18:45,371 INFO Loading YOR(York)
2019-08-05 20:18:45,372 INFO Boundary file loaded
```



arGeoDetector by K3FRG

File Edit Tools Help

Grid Square

County or City

FM18cr

Fauquier (FAU)

2019/08/05 23:15:18 UTC - 3843.638N 07746.941W

Algorithm - Maidenhead

Divisions of standard latitude / longitude system with origin mapped to lower left

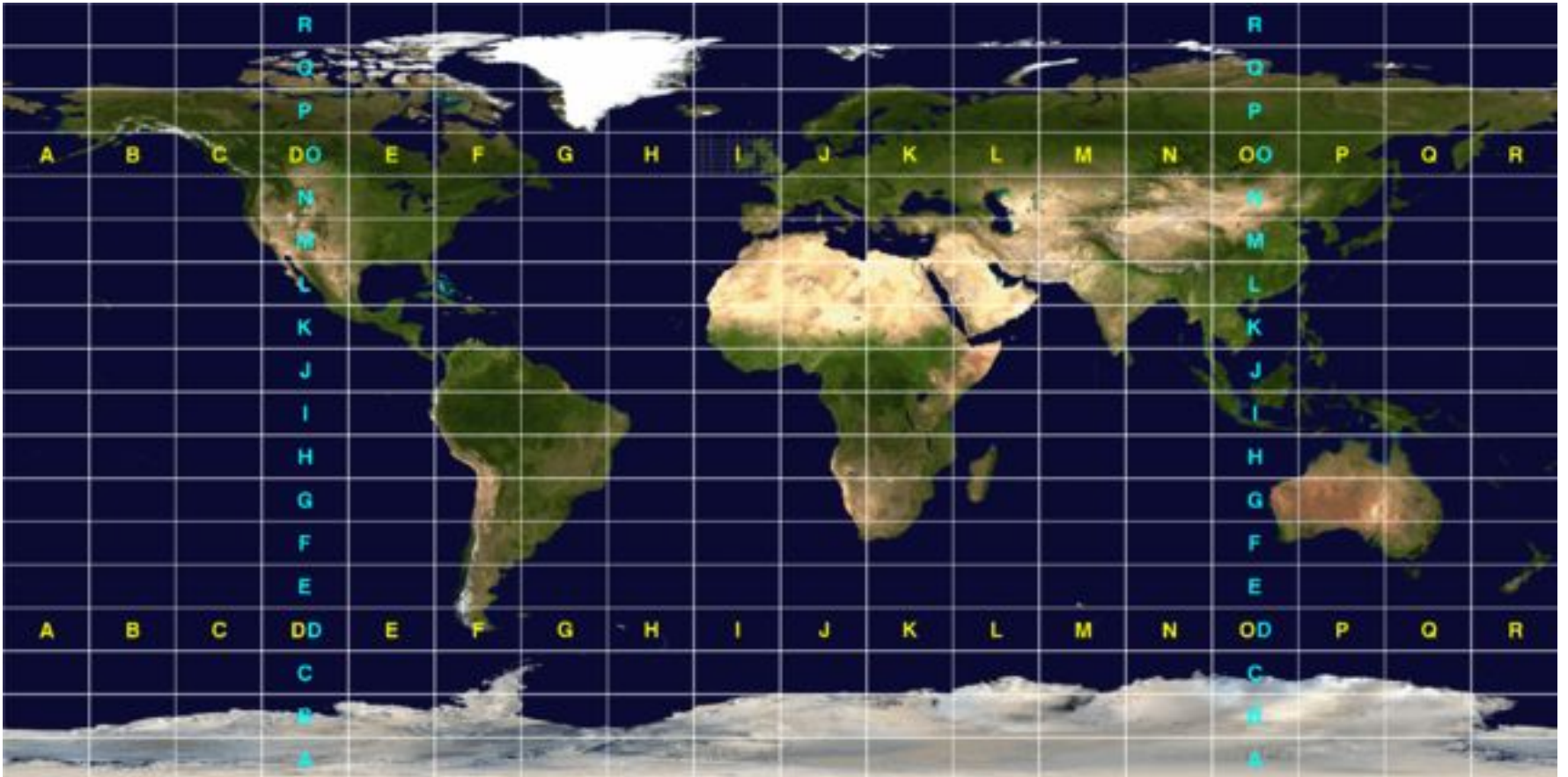
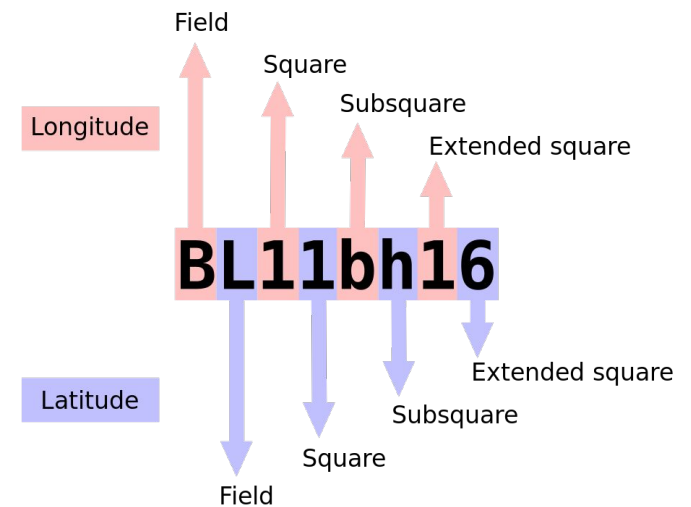
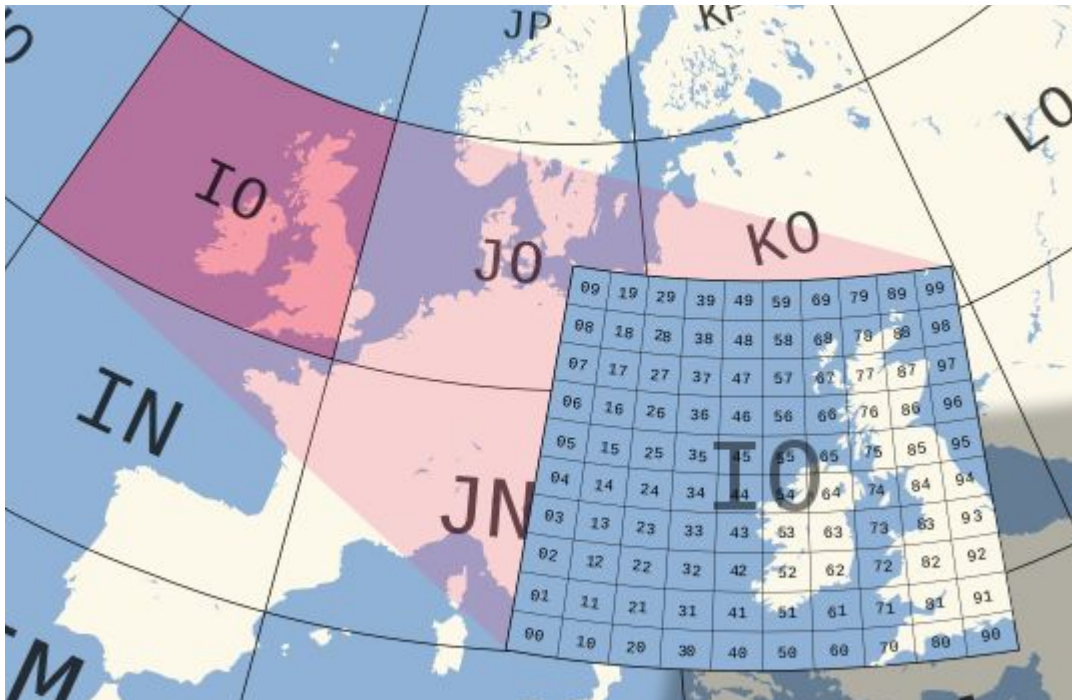


Image courtesy of Wikipedia

Algorithm - Maidenhead

Each square is further divided into additional sub-squares



Algorithm - Maidenhead

```
def calcGridSquare(self, xy):
    (nx, ny) = xy

    # move origin to bottom left of
the world
    nx += 180
    ny += 90

    # field is 20x10 degree rect
    xf = math.floor(nx / 20)
    yf = math.floor(ny / 10)

    # convert to ascii capitals A-R
    xfc = str(chr(65 + xf))
    yfc = str(chr(65 + yf))

    # square is 2x1 degree rect
    xs = math.floor((nx-(xf*20)) / 2)
    ys = math.floor((ny-(yf*10)) / 1)
```

```
# convert to ascii numbers 0-9
    xsc = str(xs)
    ysc = str(ys)

    # subsquare is (2/24)x(1/24)
degree rect
    xss =
math.floor((nx-(xf*20)-(xs*2)) /
(2/24))
    yss =
math.floor((ny-(yf*10)-(ys*1)) /
(1/24))

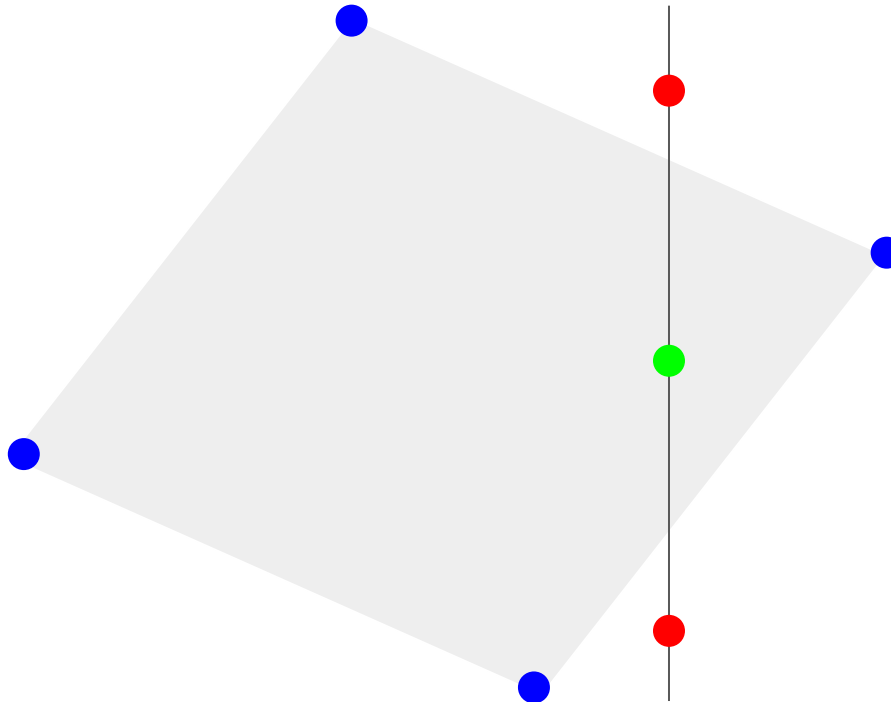
    # convert to ascii capitals A-R
    xssc = str(chr(97 + xss))
    yssc = str(chr(97 + yss))
```


Algorithm - County / City

Find coordinate inside sequence of coordinates forming a loop

Scan coordinates for pairs that have X coordinates on both sides of location

Solve line equation, identify if location is both above and below a coordinate pair



Line Equation: $y = mx + b$
 m = slope
 b = y intercept

Algorithm - County / City

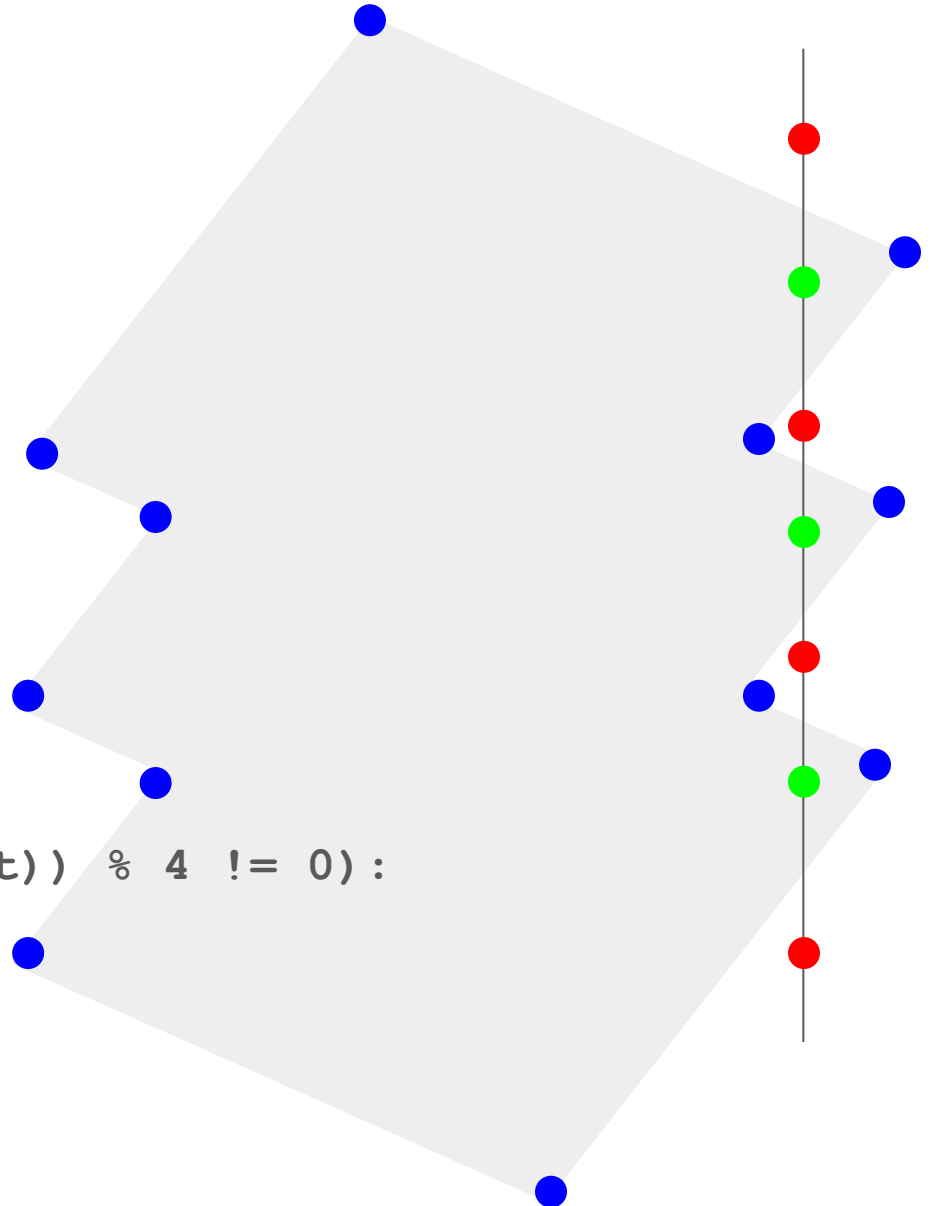
County lines are no so easy
Can fold back on each other

If coordinate is above the line
Subtract 1

If coordinate is below the line
Add 1

Eval coordinate count vs test count

```
if ((coord_cnt - abs(test_cnt)) % 4 != 0):  
    return True  
else:  
    return False
```



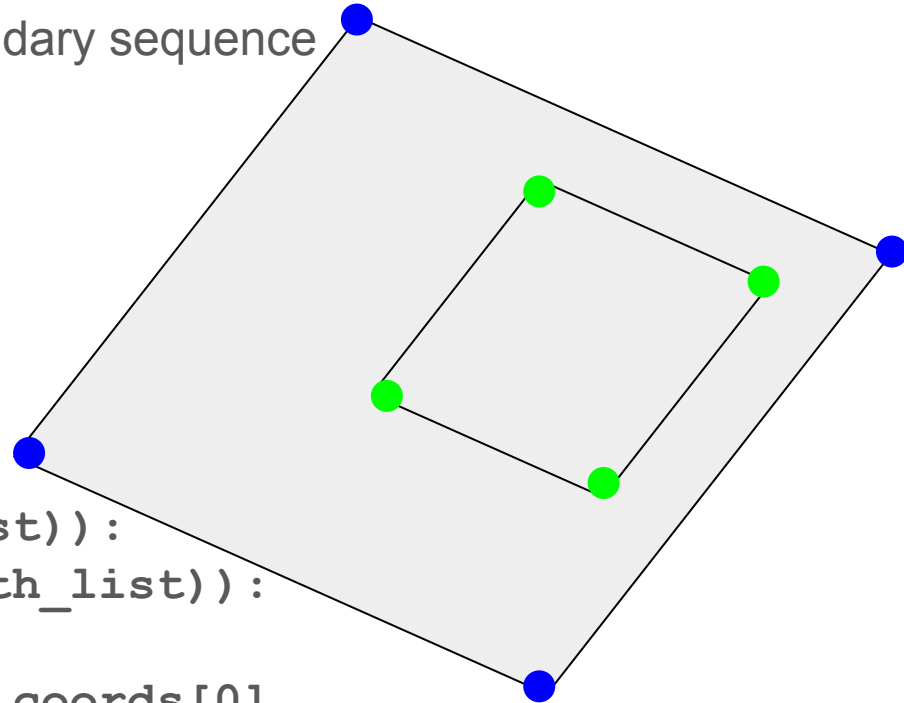
Algorithm - County / City

If you are in a city, your location will match multiple boundaries

Pick a coordinate from matched each boundary sequence

Test which boundary is in the other

```
qth = False
if len(qth_list) == 1:
    qth = qth_list[0]
elif len(qth_list) > 1:
    for i in range(0, len(qth_list)):
        for j in range(0, len(qth_list)):
            if i != j:
                c = qth_list[j].coords[0]
                if not qth_list[i].contains(c):
                    qth = qth_list[i]
```



Hardware

Tested with inexpensive Amazon GPS dongle

Tested with Kenwood TH-D72A

Testing with Yaesu FTM-400XDR soon...

Need help testing additional GPS inputs!



~\$15 Amazon

How can I try arGeoDetector?

Source and Installation executables are located on github

<https://github.com/ufergus/arGeoDetector>

<https://github.com/ufergus/arGeoDetector/releases>

There will likely be bugs! Please report them to me at k3frg@arri.net

Thank you!