



Timothy Symonds
Scoop Distribution

presents

Mobile WiFi with GPS Tracking using MikroTik's LtAP



MUM SOUTH AFRICA 2020

Timothy Symonds

- CTO at Scoop Distribution
- First exposure to MikroTik 2008
- Attended my first MUM in Zagreb in 2013 then later in Johannesburg that same year.
- MikroTik Certified Trainer since 2015



Scoop Distribution

- MikroTik distributor since 2003
- National presence with branches in JHB, CPT and DBN
- International supply to SADC regions in Africa
- Online ordering, payment and shipping
- Certified training



Project Objectives

- GPS tracking of company vehicles with simple web interface for use by our managers
- WiFi connectivity for our driver to have access to basic services like maps and voice calls
- Notifications during after hours
- A low maintenance solution

Why use MikroTik's LtAP?

- Inexpensive (No recurring hardware costs)
- Integrated WiFi and GPS
- Durability
- Flexible power input options
- Size - Easy to install and conceal
- Functionality - It's MikroTik 😎

Topology



GPS OVER HTTPS

GPS OVER HTTPS

GPS OVER HTTPS

SIM



LTAP

SIM



LTAP

SIM



LTAP



CAPE TOWN



JOHANNESBURG



DURBAN



LtAP-Mini vs LtAP-HD






| | |
|---------------------------------|---------------------------------|
| 2x SIM slots (Mini) | 3x SIM slots (Mini) |
| 1x Mini-PCIe | 2x Mini-PCIe |
| 1x R11e-LTE Modem | 1x R11e-LTE Modem |
| 3di LTE Antenna | 4di LTE Antenna |
| 2.4GHz-N WiFi Radio | 2.4GHz-N WiFi Radio |
| 1.5 dBi WiFi Antenna | 2.5 dBi WiFi Antenna |
| Fast Ethernet | Gigabit |
| Internal GPS Antenna Connection | External GPS Antenna Connection |




Project Requirements




3 Items in Cart

Cart Subtotal :
ZAR2,047.00
Excl. VAT: ZAR1,780.00

[Proceed to Checkout](#)

 MikroTik Active GPS antenna for LtAP mini LTE Kit | ACGPSA
See Details ▼
ZAR109.25
Qty:  

 U.FL to SMA Female Bulkhead
See Details ▼
ZAR40.25
Qty:  

 MikroTik LtAP Mini LTE Router Dual SIM and GPS | RB912R-2nD-LTm
See Details ▼
ZAR1,897.50
Qty:  

[View and Edit Cart](#)

- LtAP or LtAP-HD
- UFL-SMA-Female (LtAP-Mini only)
- GPS Antenna
- Web Server
- A few spare hours

Hardware Preparation

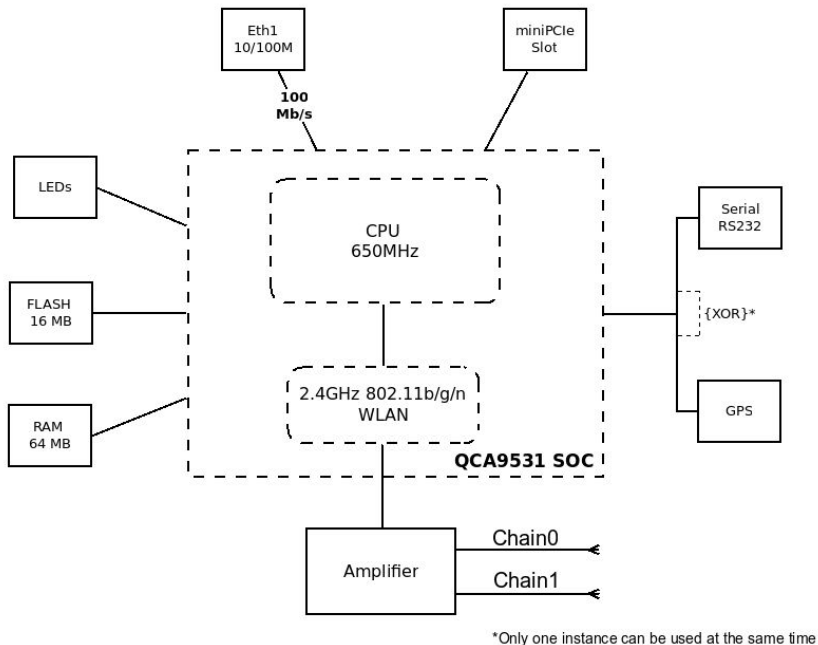
- When using the LtAP-Mini, the internal GPS antenna is compromised when the LTE modem is enabled so you will need to attach an external antenna.
- The GPS uses an active 3.3v antenna and the connector is sensitive to damage if touched while powered on.
- Power off the LtAP prior to installation!

Hardware Preparation



GPS Configuration - LtAP-Mini

LtAP mini (RB912R-2nD)



When using the LtAP-Mini, the serial port and GPS cannot be used concurrently.

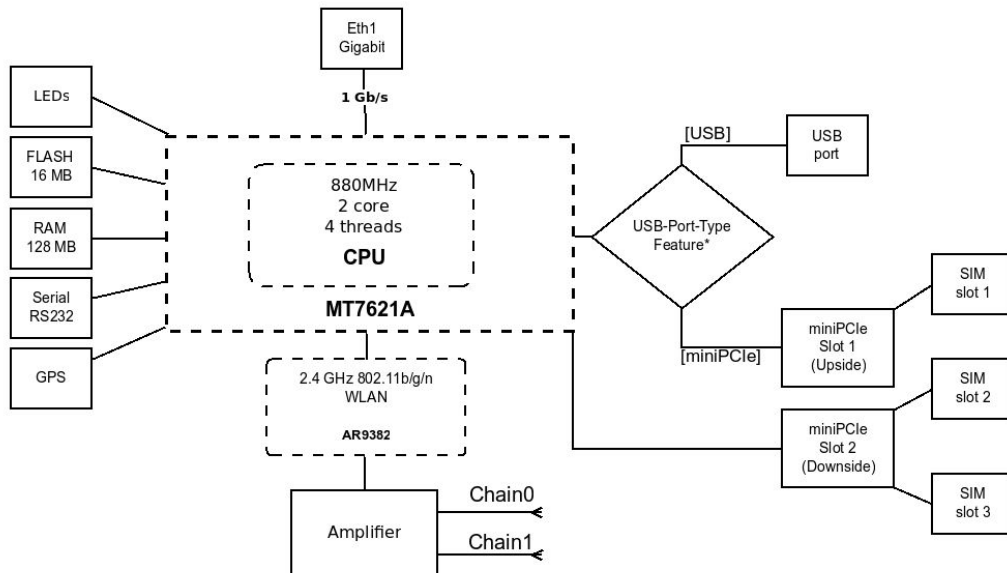
RS232 is enabled by default in RouterOS

```
/system console  
set [ find ] disabled=yes
```



GPS Configuration - LtAP-HD

LtAP (RBLtAP-2HnD)



*https://wiki.mikrotik.com/wiki/Manual:USB_Features#USB_port_type

When using the LtAP-HD, it is not necessary to disable the default serial port as they do not share the same hardware path.

GPS Configuration

GPS configuration window showing settings:

- Enabled:
- Port: serial0
- Channel: 0
- Init Channel: [empty]
- Init String: [empty]
- GPS Antenna: external
- Set System Time:
- Coordinate Format: dd
- Date And Time: May/24/2019 07:40:44
- Latitude: -33.873671
- Longitude: 18.522241
- Altitude: 117.800003m
- Speed: 0.203720 km/h
- Destination Bearing: none
- True Bearing: 120.889999 deg. True
- Magnetic Bearing: 0.000000 deg. Mag
- Valid:
- Satellites: 4
- Fix Quality: 1
- Horizontal Dilution: 1.86

Decimal degrees (DD) express latitude and longitude geographic coordinates as decimal fractions and are used in web mapping applications such as OpenStreetMap

```
/system gps  
set coordinate-format=dd  
enabled=yes  
gps-antenna-select=external  
port=serial0
```

Web Server Requirements

- Web server of your choice - We used Digital Ocean, 1Gb Memory, 25Gb Storage, Ubuntu 16.04.6 x64 = \$5p/m
- Apache
- PHP
- SQLite
- SSL Certificates

Check out our walk-through guide on Github [HERE](#)

Posting GPS Coordinates



WEB SERVER

PHP Script on Web server inserts coordinates into SQLite Database

Front end libraries - Bootstrap Data tables and Nominatim OSM reverse geo-coding API



OPEN STREET MAP

RouterOS sends POST HTTP request to Apache web server over SSL in a JSON format



LTAP

HTTPS

HTTPS



USER

Posting GPS Coordinates

- RouterOS 6.40rc30 or above - Required for getting the the coordinates from the router to the server.
- Set GPS coordinates to 'dd' format
- Uses '/tool fetch' parameter (CLI only)

Example:

```
/tool fetch http-method=post  
http-content-type="application/json"  
http-data="{\"lat\": \"56.12\", \"lon\": \"25.12\"}"  
url="https://test_server/index.php"
```


Posting GPS Coordinates

```
{
:global lat
:global lon
/system gps monitor once do={
:set $lat $("latitude")
:set $lon $("longitude")
}
tool fetch mode=http
url="https://test_server/index.php"
port=443 http-method=post
http-data="{\"lat\": \"\" . $lat .
\", \"lon\": \"\" . $lon . \"}\""
http-header-field="Content-Type:
application/json"
:put ("{\"lat\": \"\" . $lat .
\", \"lon\": \"\" . $lon . \"}")
}
```

The screenshot shows the Mikrotik WinBox interface for configuring a script. The window title is "Script <gps>".

- Name:** gps
- Owner:** admin
- Don't Require Permissions
- Policy:** A grid of checkboxes for various actions: ftp, read, policy, password, sensitive, dude, reboot, write, test, sniff, romon.
- Last Time Started:** Jan/16/2020 09:48:24
- Run Count:** 19
- Source:** A text area containing the script code from the left image, with the URL "https://test_server/index.php" highlighted in orange.

Posting GPS Coordinates

```
/system scheduler  
add interval=1m name=gps on-event=gps
```

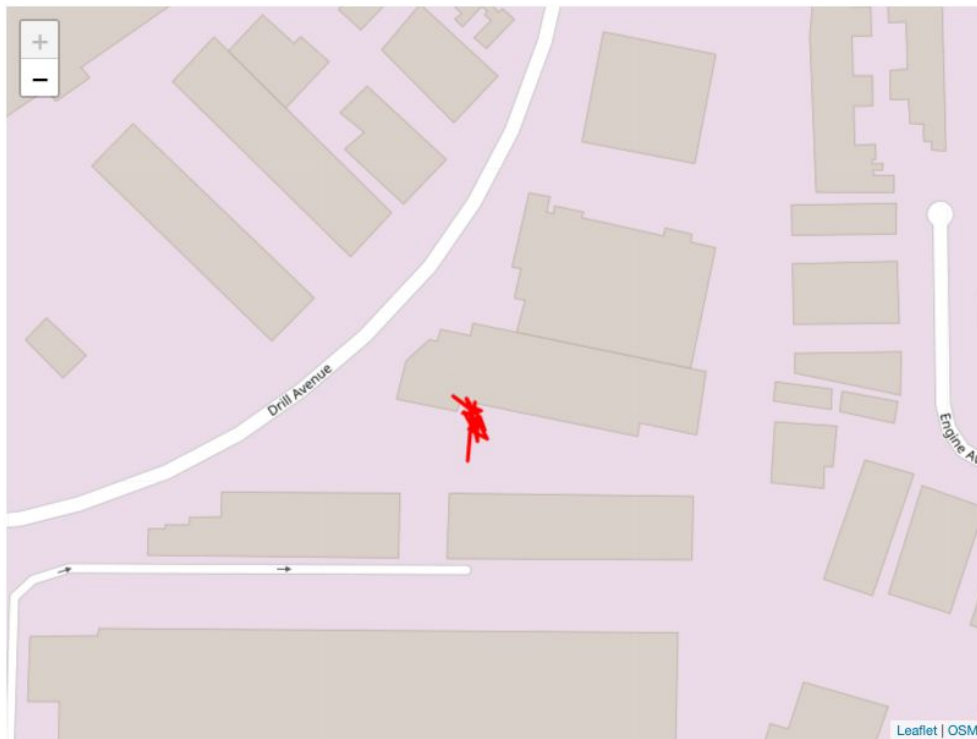
Check the HTTP access logs on the server to confirm everything is working

```
- - [16/Jan/2020:07:30:44 +0000] "POST /cpt.php HTTP/1.1" 200 3491 "-" "Mikrotik/6.x Fetch"  
- - [16/Jan/2020:07:31:25 +0000] "POST /cpt.php HTTP/1.1" 200 3491 "-" "Mikrotik/6.x Fetch"  
- - [16/Jan/2020:07:32:25 +0000] "POST /cpt.php HTTP/1.1" 200 3491 "-" "Mikrotik/6.x Fetch"  
- - [16/Jan/2020:07:33:25 +0000] "POST /cpt.php HTTP/1.1" 200 3491 "-" "Mikrotik/6.x Fetch"  
- - [16/Jan/2020:07:34:25 +0000] "POST /cpt.php HTTP/1.1" 200 3491 "-" "Mikrotik/6.x Fetch"  
- - [16/Jan/2020:07:35:25 +0000] "POST /cpt.php HTTP/1.1" 200 3491 "-" "Mikrotik/6.x Fetch"
```

Web server address https://test_server/index.php

A map with plotted coordinates should appear on the web server address

Double check the 'gps' script if coordinates are incorrect on the map

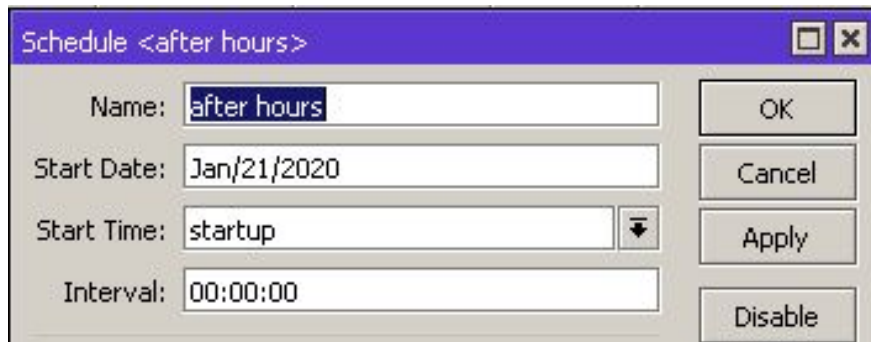


After Hours Notification

E-mail notifications when the vehicle is started after hours and on weekends

MikroTik's scheduler is limited to 'Start Time' and 'Interval'. This is an issue as the LtAP could be off at any given time.

Additional scripting is required when making use of the e-mail feature to achieve 'after hours'



The screenshot shows a window titled "Schedule <after hours>". It contains the following fields and buttons:

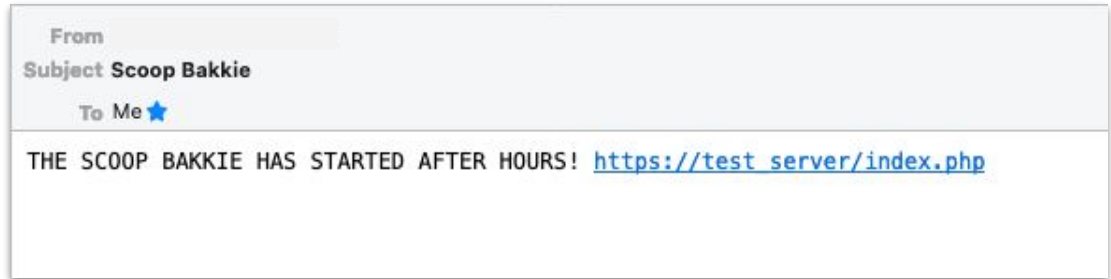
- Name: after hours
- Start Date: Jan/21/2020
- Start Time: startup (with a dropdown arrow)
- Interval: 00:00:00
- Buttons: OK, Cancel, Apply, Disable

Notification Script

Checks what day of the week it is and sends an email based in these two variables

- If it's not Sat or Sun between 18:00 and 07:00
- If it is Sat or Sun

Get a copy of the script [HERE](#)



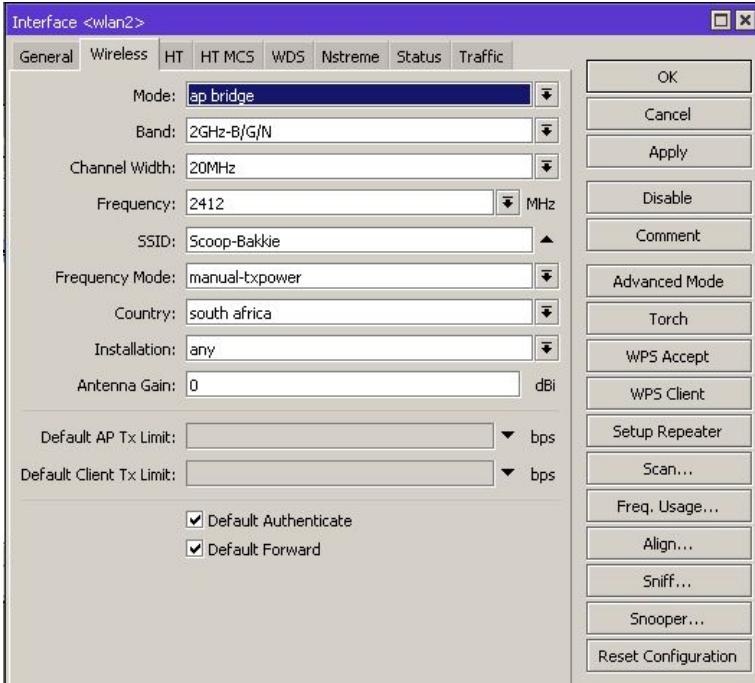
```
/system scheduler  
name="after hours" on-event=after-hours start-time=startup
```

WiFi Configuration

Basic AP with PSK for our implementation.

Adjust your TX power once installed in the vehicle to reduce cell size if necessary.

Mobile hotspots will require the 'Hotspot' package to be installed separately.



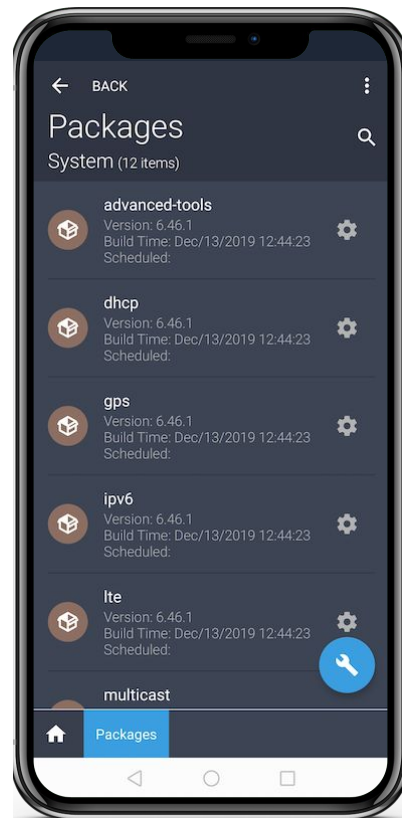
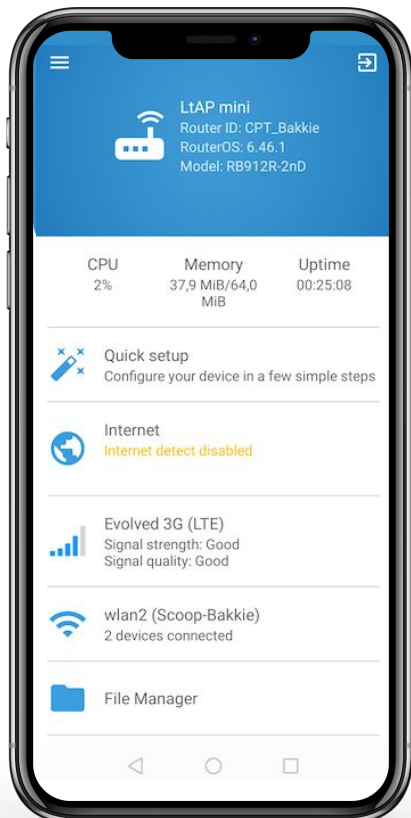
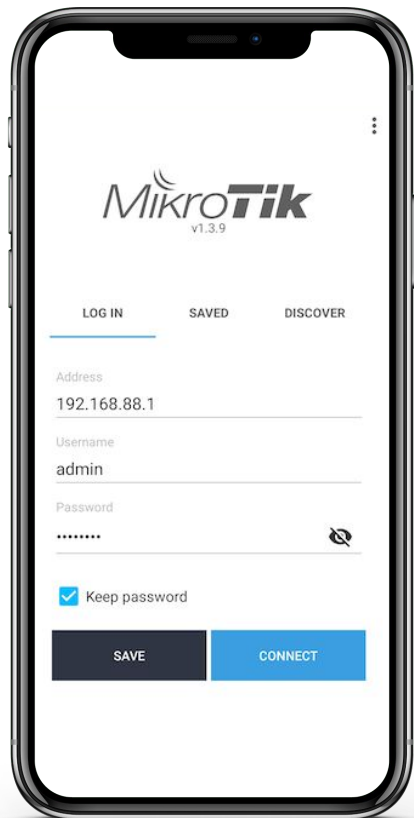
The screenshot shows the MikroTik WinBox configuration window for the wlan2 interface. The 'Wireless' tab is active. The configuration is as follows:

- Mode: ap bridge
- Band: 2GHz-B/G/N
- Channel Width: 20MHz
- Frequency: 2412 MHz
- SSID: Scoop-Bakkie
- Frequency Mode: manual-txpower
- Country: south africa
- Installation: any
- Antenna Gain: 0 dBi
- Default AP Tx Limit: (empty) bps
- Default Client Tx Limit: (empty) bps
- Default Authenticate:
- Default Forward:

Buttons on the right include: OK, Cancel, Apply, Disable, Comment, Advanced Mode, Torch, WPS Accept, WPS Client, Setup Repeater, Scan..., Freq. Usage..., Align..., Sniff..., Snooper..., and Reset Configuration.

```
/interface wireless
set [ find default-name=wlan1 ]
antenna-gain=0 band=2ghz-b/g/n
country="south africa" disabled=no \
frequency-mode=manual-txpower
mode=ap-bridge name=wlan2
security-profile=Profile1
ssid=Scoop-Bakkie
```

Management using MikroTik's App



We manage our routers via WiFi (mainly for ROS updates) as our fleet is small

For larger fleets and remote management you could use tunnelling and RoMON

Vehicle Installation

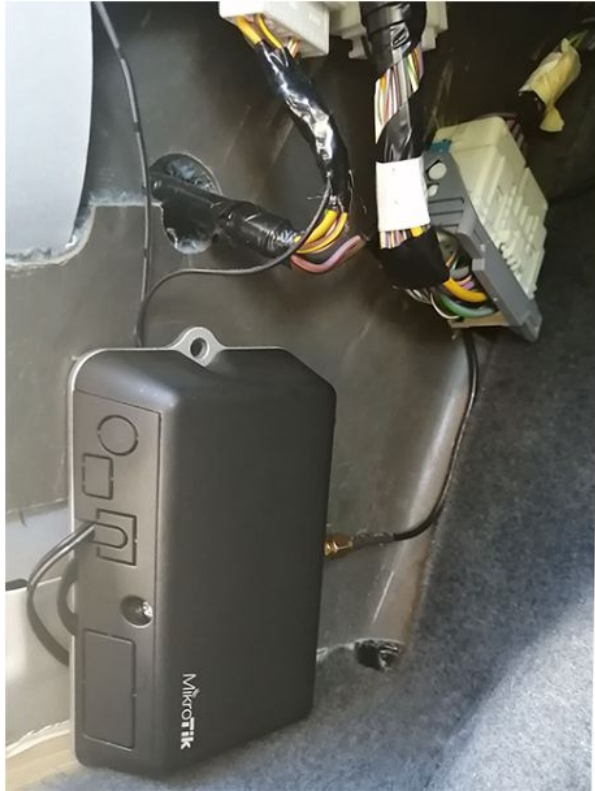
- Option 1 - 5v USB for Plug & Play (Awesome for testing)
- Option 2 - 12v connection to ignition switch. Requires tapping into your vehicle's PSU. Your vehicle warranty could be affected
- LtAP-HD - 12v connection via the automobile connector



Vehicle Installation



Vehicle Installation

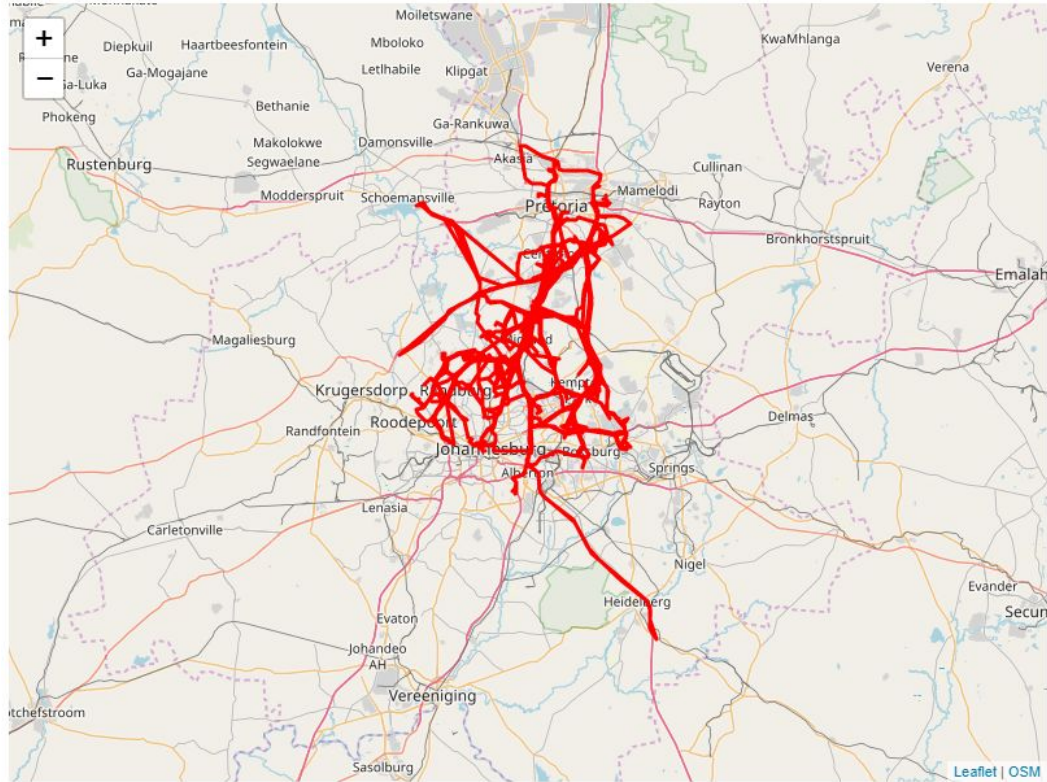


Vehicle Installation



- Install the GPS antenna in a fixed location where it has access to the satellites
- We chose to install on the dashboard to reduce the risk of tampering
- MikroTik's antenna is magnetic for easy fitting to the body of the vehicle

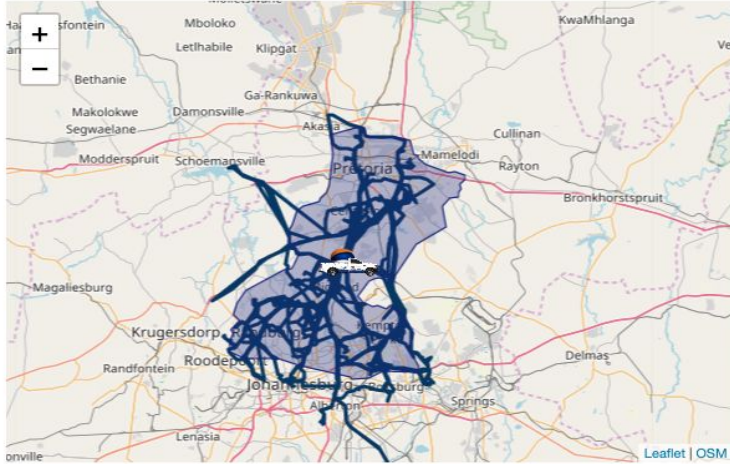
Pre Customisation



Post Customisation



JHB CPT DBN



Show 10 entries Search:

| Latitude | Longitude | Time Added | Details |
|------------|-----------|---------------------|----------------------|
| -25.940558 | 28.144784 | 2020-01-09 17:06:36 | View |
| -25.940566 | 28.144814 | 2020-01-09 17:05:37 | View |
| -25.940193 | 28.144308 | 2020-01-08 12:54:39 | View |
| -25.934141 | 28.147369 | 2020-01-08 12:51:36 | View |
| -25.921512 | 28.153541 | 2020-01-08 12:49:37 | View |
| -25.911608 | 28.159333 | 2020-01-08 12:48:37 | View |
| -25.908471 | 28.159176 | 2020-01-08 12:47:37 | View |
| -25.897256 | 28.159545 | 2020-01-08 12:46:37 | View |
| -25.892528 | 28.160138 | 2020-01-08 12:45:37 | View |
| -25.884671 | 28.161245 | 2020-01-08 12:44:37 | View |

Showing 1 to 10 of 15,924 entries

Previous **1** 2 3 4 5 ...
1593 Next

Old Pretoria Johannesburg Road, Johannesburg Ward 92, City of Johannesburg Metropolitan Municipality, Gauteng, 1683, South Africa



Data Usage



Scoop DBN

Active

data plan:
pay as you use

gig limit balance:
10.00GB left of 10GB

view



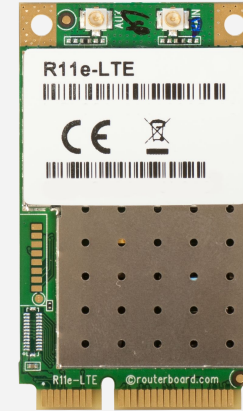
Scoop JHB

Active

data plan:
pay as you use

gig limit balance:
9.80GB left of 10GB

view



Scoop CPT

Active

data plan:
pay as you use

gig limit balance:
9.73GB left of 10GB

view

Objectives

- GPS Tracking with simple user interface for our management team
- WiFi connectivity for our drivers for VoIP, IM and Maps
- Alerts when our vehicles are started at irregular times
- Low maintenance solution



Further Possibilities

- Content filtering
- Mobile hotspot
- SIM redundancy and/or roaming
- SMS and/or IM alerts
- Tunnelling for remote management

Links

scoop.co.za

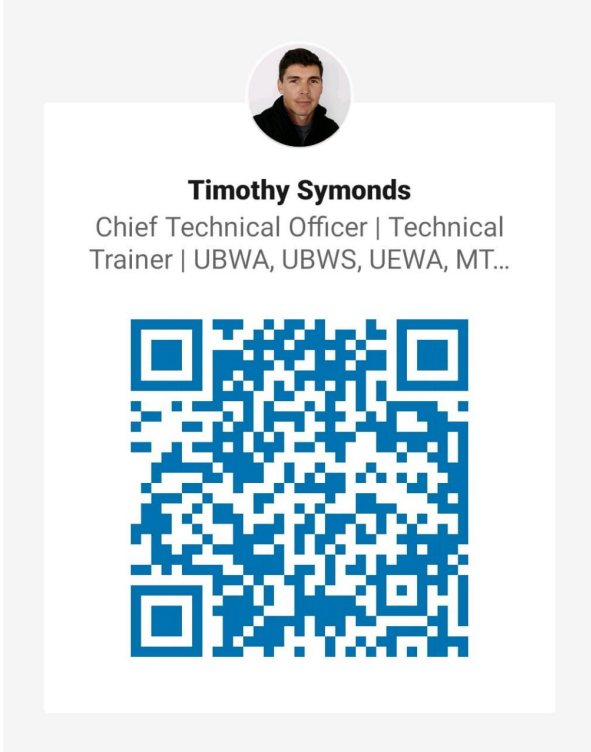
[Blogs](#)

[Scoop Distribution LinkedIn](#)

[Github Walk-Through Guide](#)

Visit our stand in the exhibition area we would love to chat about all things MikroTik with you!

Thank You!



A profile card for Timothy Symonds. It features a circular profile picture of a man with short dark hair. Below the photo, his name 'Timothy Symonds' is written in bold. Underneath, his title 'Chief Technical Officer | Technical Trainer | UBWA, UBWS, UEWA, MT...' is listed. At the bottom of the card is a large blue QR code.

