WonavCT - Position Mapping System

A system which can be used in GIS applications by capturing images of areas and recognize objects with high precision of location.

#gps #camera #mapping

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Archived Project

1. Overview

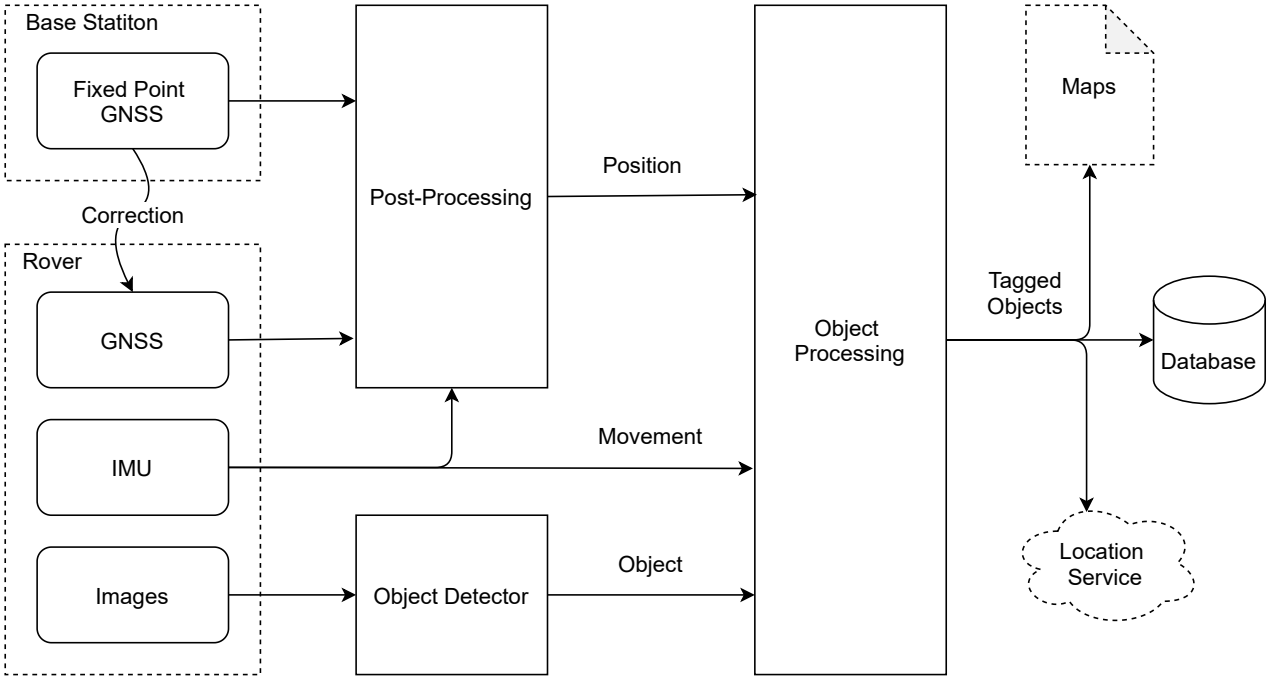
This product consists of 3 components:

A rover:
which will be mounted on a vehicle and capture images with location information.

A base station:
which has a main role of providing location correcting information to the rover to archive higher accuracy

A software:
which has ability to recognize objects in captured images, calculate their coordination and export the geographical information to Map, or any GIS application.

Block diagram:



WonavCT System Overview

2. Hardware

Raspberry Pi B+

- Broadcom BCM2835 (700 MHz)
- 512 MB RAM
- 5 MP Camera

Navio RAW

- U-blox NEO-6T GPS, 5Hz
- NMEA, RTCM3 message
- GPS/SBAS (WAAS, EGNOS, MSAS) L1 Band
- 3-axises IMU at 100 Hz

GNSS Antenna

- LNA: 40 dB

Wi-Fi W725N

- Access Point for Mobile Control

EDGE/3G SIM Modem

- Internet access for communication between Rover and Base Station

3. Software

Real-time Kernel from Navio

- Based on Raspbian (Debian), repo: https://github.com/emlid/linux-rt-rpi
- Overclock (optional)

```
sudo nano /boot/config.txt
# add below lines
force_turbo=1
arm_freq=1000
gpu_freq=300
sdram_freq=600
```

- Increase GPU memory for camera work

```
sudo nano /boot/config.txt
# add below lines
gpu_mem=256
```

- Increase USB current

```
sudo nano /boot/config.txt
# add below lines
max_usb_current=1
```

- Open SPI and I2C port

```
sudo nano /etc/modprobe.d/raspi-blacklist.conf
# add `#` before below lines
blacklist spi-bcm2708
blacklist i2c-bcm2708
```

```
sudo nano /etc/modules
# add below lines
i2c-bcm2708
spi-dev
i2c-dev
```

RTKLib

Repo from Emlid: https://github.com/emlid/RTKLIB

Base repo: https://github.com/tomojitakasu/RTKLIB

Wi-Fi Driver

TPLink WN725N diver version 2 is used.

Refer to https://wikidevi.com/wiki/TP-LINK_TL-WN725N_v2 and

http://elinux.org/RPi_USB_Wi-Fi_Adapters#Working_USB_Wi-Fi_Adapters.

3G Modem Driver

GPRS/EDGE/3G modem driver is built from https://github.com/sk-vpohybe/stopa-monitor/wiki/3G-modem-Huawei-E169-E620-E800,

refer more in http://elinux.org/RPi_VerifiedPeripherals.

⚠ **This option only work when 2 modems have the same 3G provider for their SIM, and the IP addresses are publicly accessible.**

✎ **Only RTK mode need internet communication**

Setup on Rover and Base Station

```
sudo nano /etc/wvdial.conf
# add profile
[mobi]
```

```
Init1 = AT
Init2 = AT+CPIN="0000"
Init3 = AT+CGDCONT=1,"IP","internet"
Init4 = ATQ0 V1 E1 S0=0 &C1 &D2 +FCLASS=0
Phone = *99***1#
ISDN = 1
Username = mms
Password = mms
Modem = /dev/ttyUSB0
Baud = 460800
Stupid Mode = on
```

Dial to connect to the Internet:

```
sudo wvdial mobi &

# check the IP address
--> WvDial: Internet dialer version 1.61
--> Initializing modem.
--> Sending: AT
AT
OK
--> Sending: AT+CGDCONT=1,"IP","internet"
AT+CGDCONT=1,"IP","internet"
OK
--> Sending: ATQ0 V1 E1 S0=0 &C1 &D2 +FCLASS=0
ATQ0 V1 E1 S0=0 &C1 &D2 +FCLASS=0
OK
--> Modem initialized.
--> Sending: ATDT*99***1#
--> Waiting for carrier.
ATDT*99***1#
CONNECT 7200000
--> Carrier detected.  Starting PPP immediately.
--> Starting pppd at Tue Apr 30 19:15:34 2013
--> Pid of pppd: 2475
--> Using interface ppp0
--> Authentication (CHAP) started
--> Authentication (CHAP) successful
--> local  IP address 10.144.158.201
--> remote IP address 10.64.64.64
--> primary   DNS address 213.151.200.31
--> secondary DNS address 85.237.225.250
```

4. Operation

1. Get a precious accurate location of the Base Station
2. Turn on Base Station, setup to send RTCM3 messages on a `tcpsvr` through 3G IP address
3. Turn on Rover, and setup to receive RTCM2 message from Base Station on a `tcpcli` through 3G internet