

The RoboScanner

Overview

A UVIS is used widely to detect abnormal objects & threats hidden underneath vehicles.

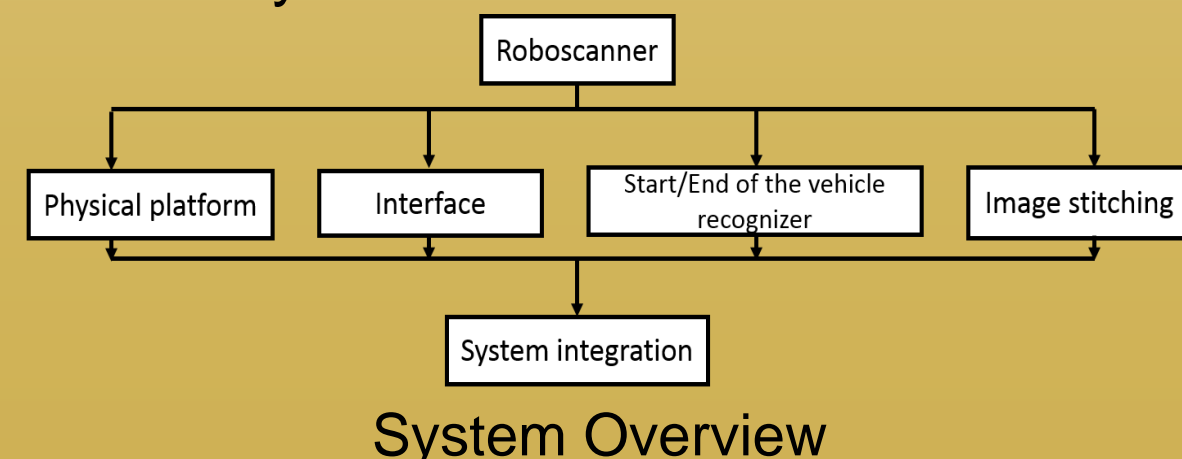
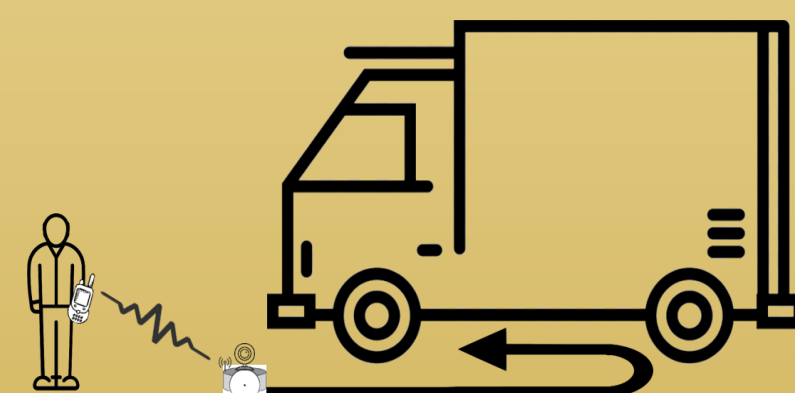


Roboscanner concept

Instead of making move under the camera, we decided to fix the vehicle and move the camera.

Advantages:

- Safety and speed
- Flexibility
- Day/Night all weather operation
- Affordability



The Scanner RC Platform

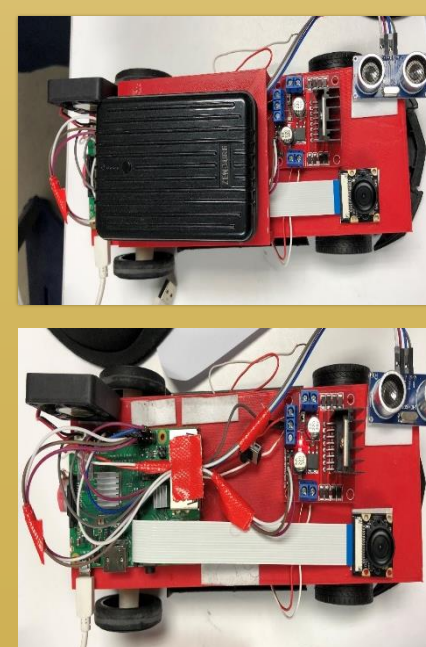
- An RC toy car is adjusted to carry the Scanner components



- 3D printing is used to construct the mechanical structure for the Scanner components

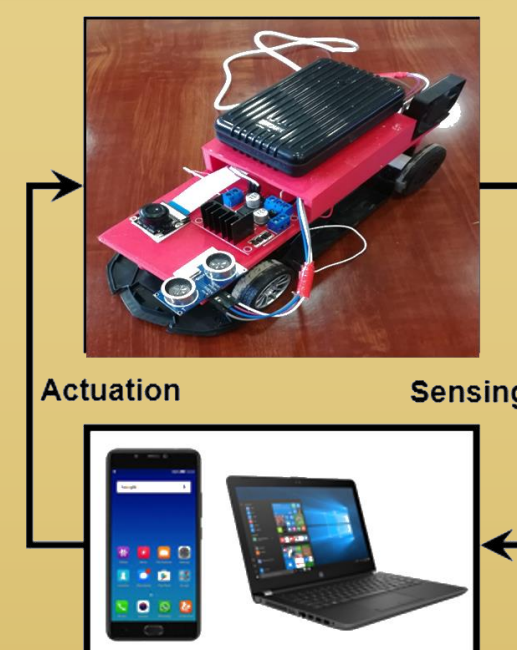
The RoboScanner components:

- Raspberry Pi
 - PiCamera,
 - Ultrasonic sensor
 - Power bank
- were installed on the mechanical structure



Connection establishment

Establishing connectivity requires the remote processing unit and the mobile platform to be on the same network. Thus, IP addresses the subnet mask of both devices must be obtained.



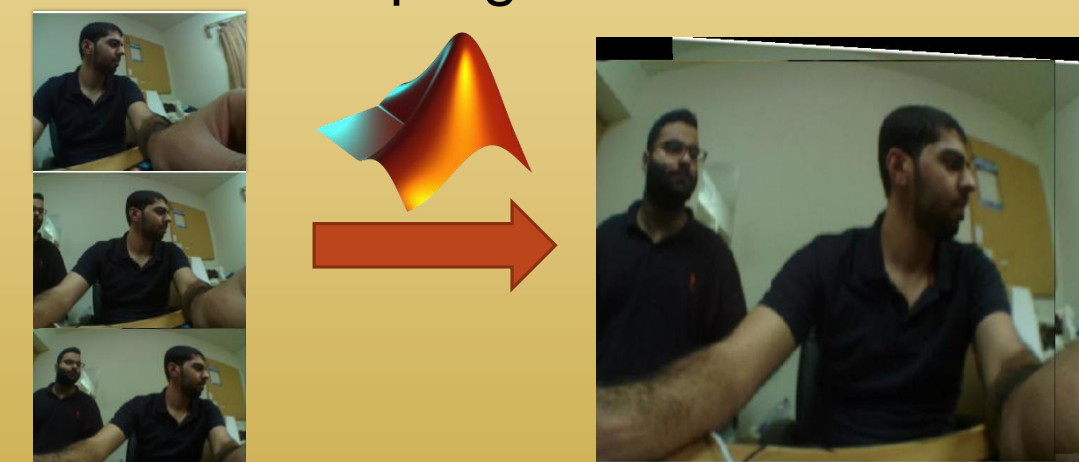
```
Connection-specific DNS Suffix . : fa80::5fd:41f8:f4fa:dc39%13
Link-local IPv6 Address . . . . . : fe80::5fd:41f8:f4fa:dc39%13
IPv4 Address. . . . . : 192.168.43.123
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : 192.168.43.1
```

```
wlan0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.43.40 netmask 255.255.255.0 broadcast 192.168.43.255
```

the following programs are used to connect the two devices.



A MATLAB based program is used for stitching:



The input images

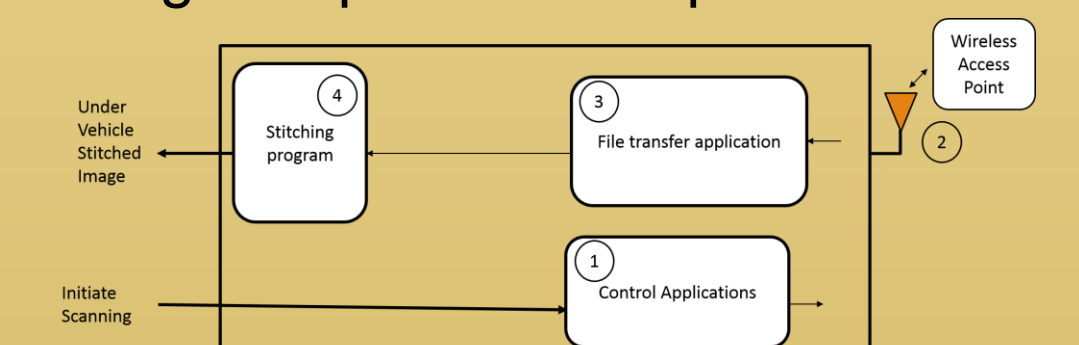
Stitched image

System integration

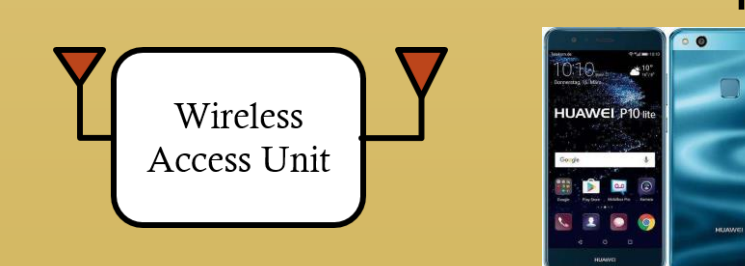
The overall system consists of three parts:



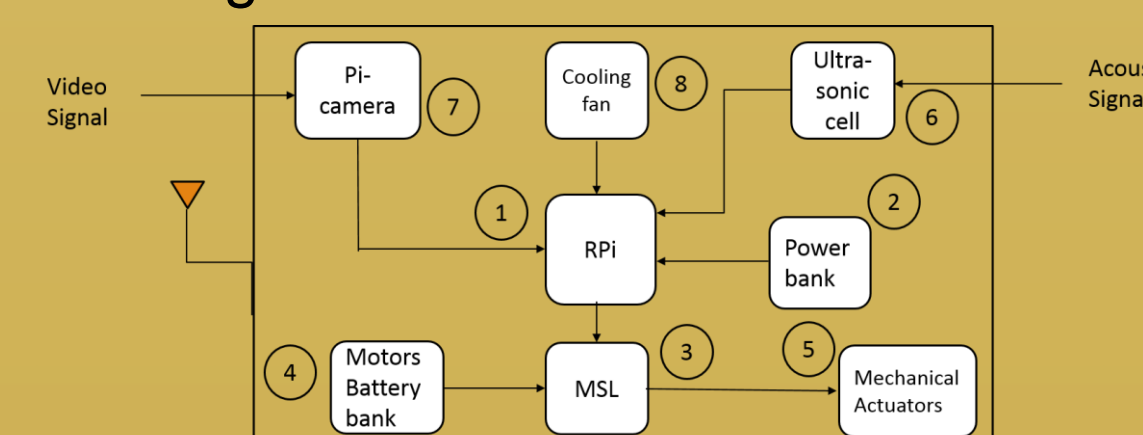
The remote processing unit "RPU" initiates scanning and provides output to the user.



The wireless access point extends connectivity between the RPU and the mobile platform.

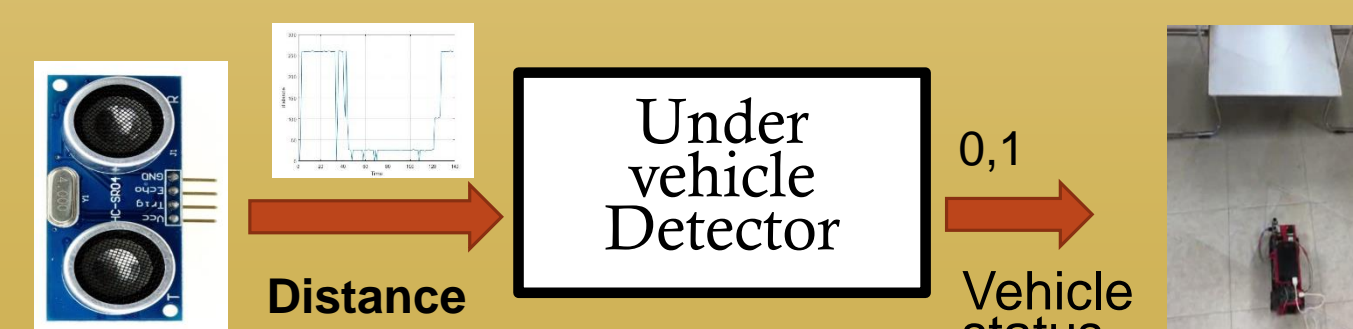


The mobile platform performs the physical scanning and communicate data to the RPU.



Start – End Detection

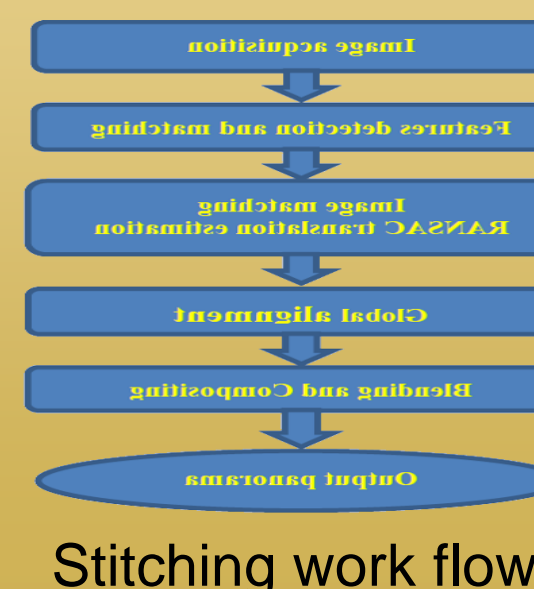
Ultrasonic sensor is used to provide the Roboscanner with the signal indicated that interned under the vehicle so the camera can start capturing the vehicle's bottom.



1: Outside the vehicle 0: Under the vehicle

Image Stitching

To counteract the limitations on the camera field of view and obtained full recorded of under vehicle the image from the camera have to be stitched to be one image



Experimental Testing

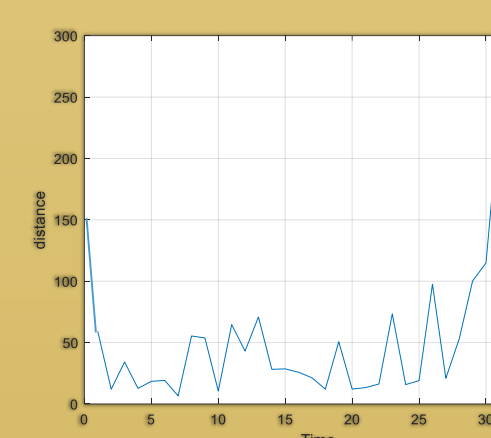
The test was done in real environment on Nissan Sunny 2015. The output was the measured distances and the captured images.



- The Roboscanner was placed in front of the car.
- Command to initiate the scanning was sent.
- The Roboscanner performed the test and relayed images to the RPU.

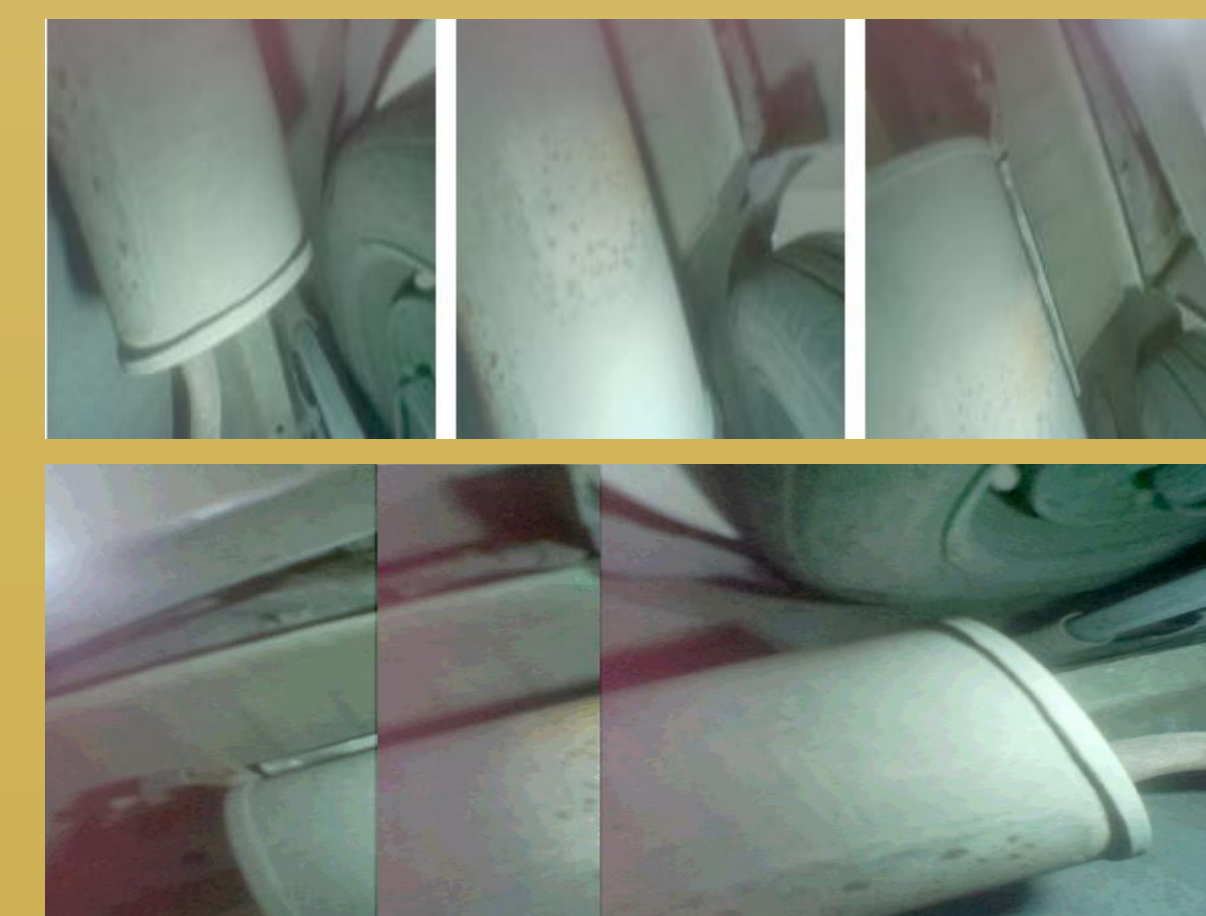


Samples of the image fed from the mobile platform to the RPU



The distance to the vehicle bottom measured by the acoustic sensor

Samples of the image feed along with the stitched image



Recommendations

- 1- Improve the mechanical platform design to handle rough terrains.
- 2- A better camera can remove lens distortion, increase field of view, and reduce difficulties in image stitching.