

Hướng nghiên cứu BM CSKTĐ

My-Ha Le

Ho Chi Minh City University of Technology and Education

halm@hcmute.edu.vn

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HCMUTE

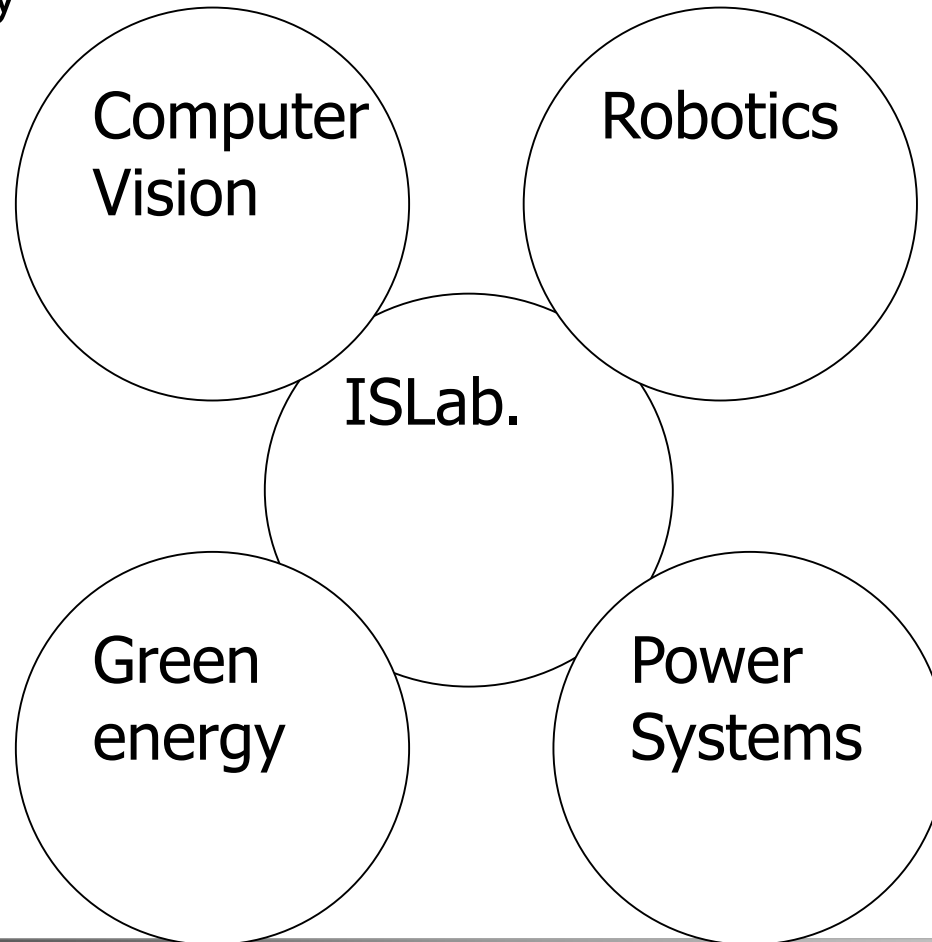


- **Đáp ứng nhu cầu thực tế trong công nghiệp**
- **Giảm chi phí/giá thành**
- **Chuyển giao công nghệ**
- **Tham gia các đề tài nghiên cứu khoa học**
- **Viết bài đăng trên transaction/journal/conference**
- **Tham gia các hội nghị quốc tế**
- **Hỗ trợ GV trẻ cách nghiên cứu, xin HB**

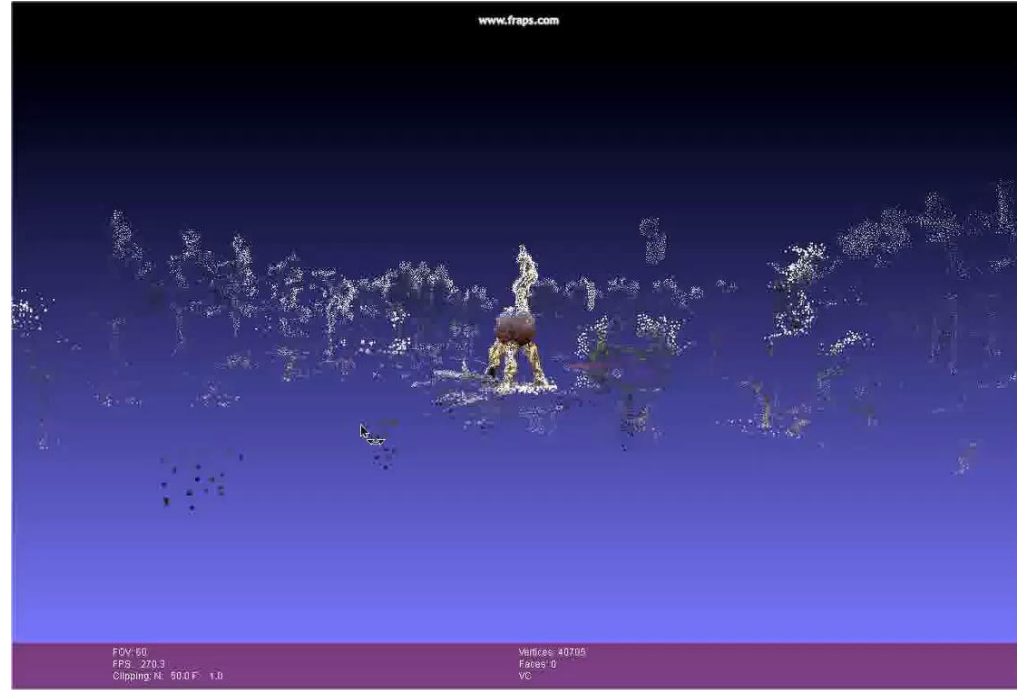
Research Orientations



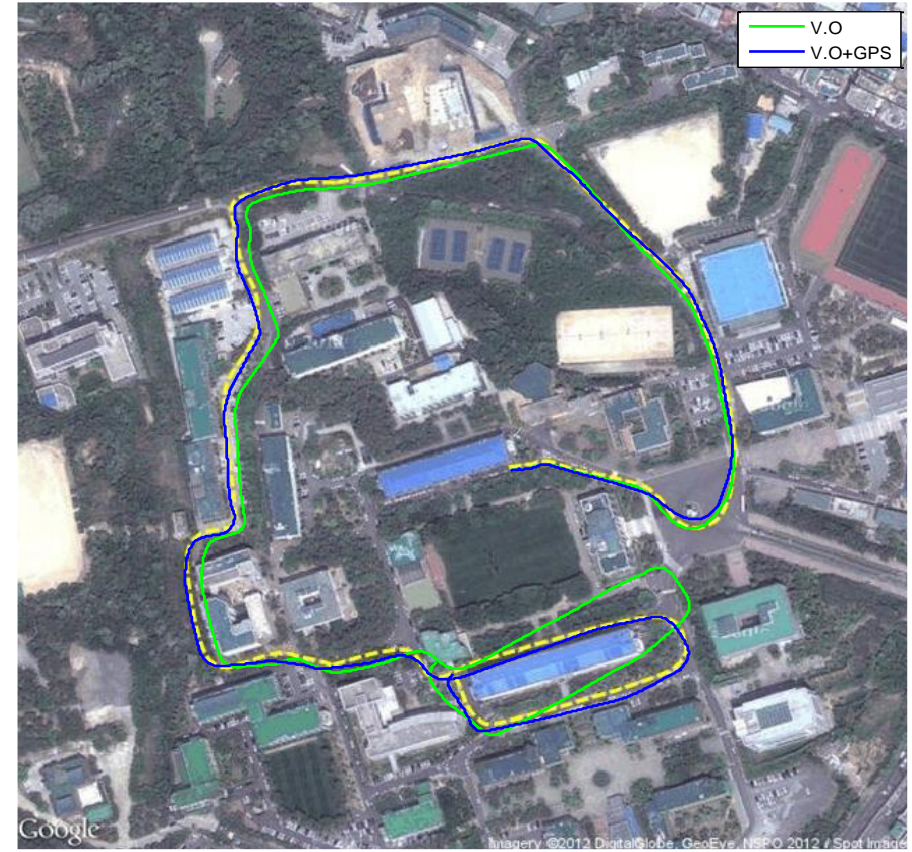
- Computer Vision/ image processing
- Robotics and automation
- Dynamic stability of power systems
- Green energy



How to model the scene?



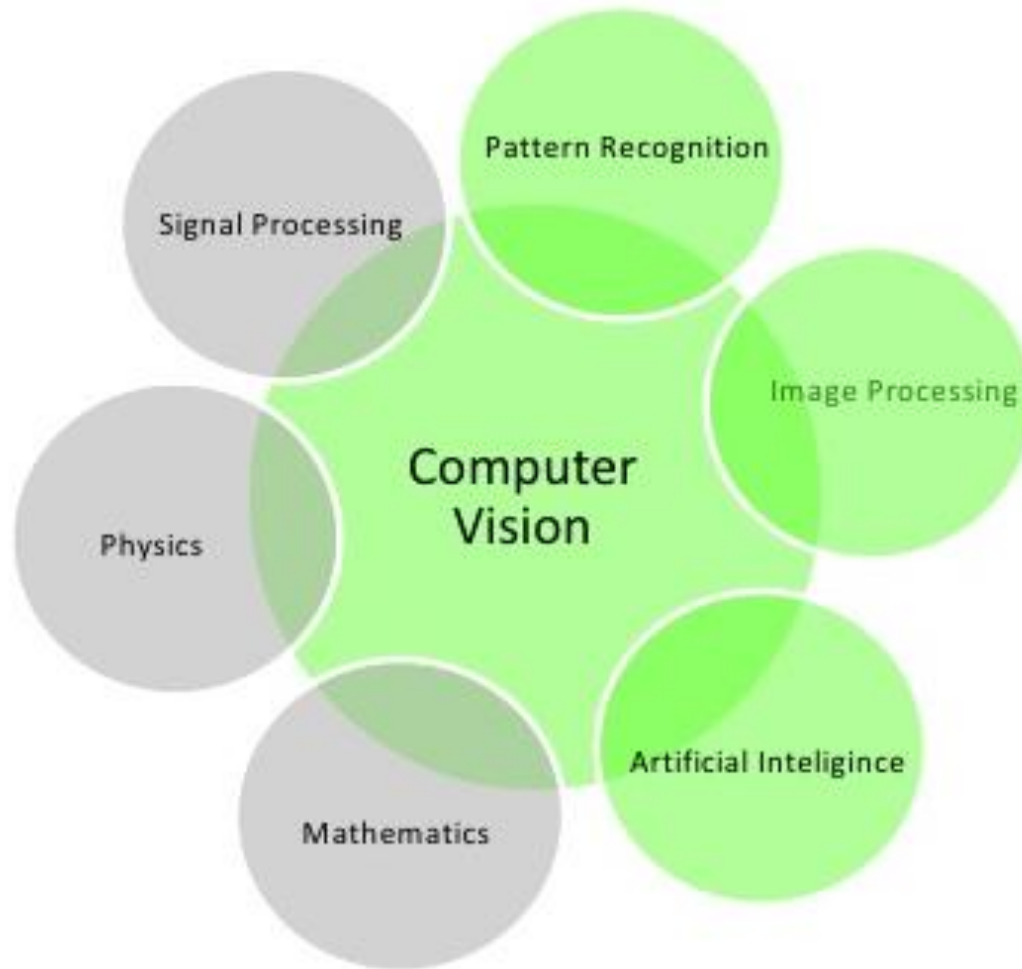
How to recovery camera motion



Computer vision introduction



- **Computer vision** is a field that includes methods for acquiring, processing, analyzing, and understanding images





I. Convex optimization approach for multiple views geometry

1. 3D scene modeling

2. Omnidirectional camera motion recovery

II. Localization of Vehicle-Mounted Vision Sensor

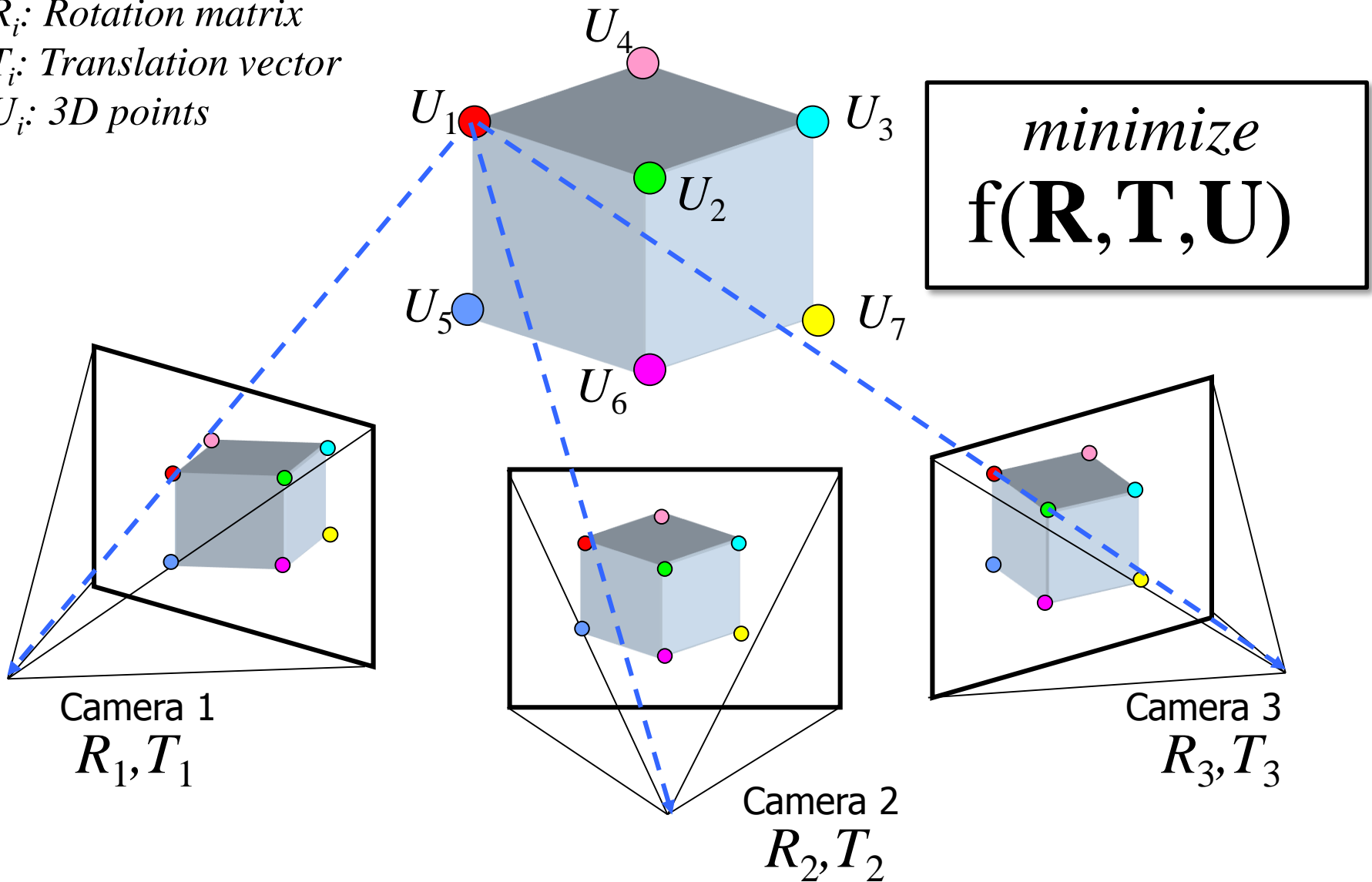
1. Omnidirectional camera in long-range motion

2. CCD camera for real-time application

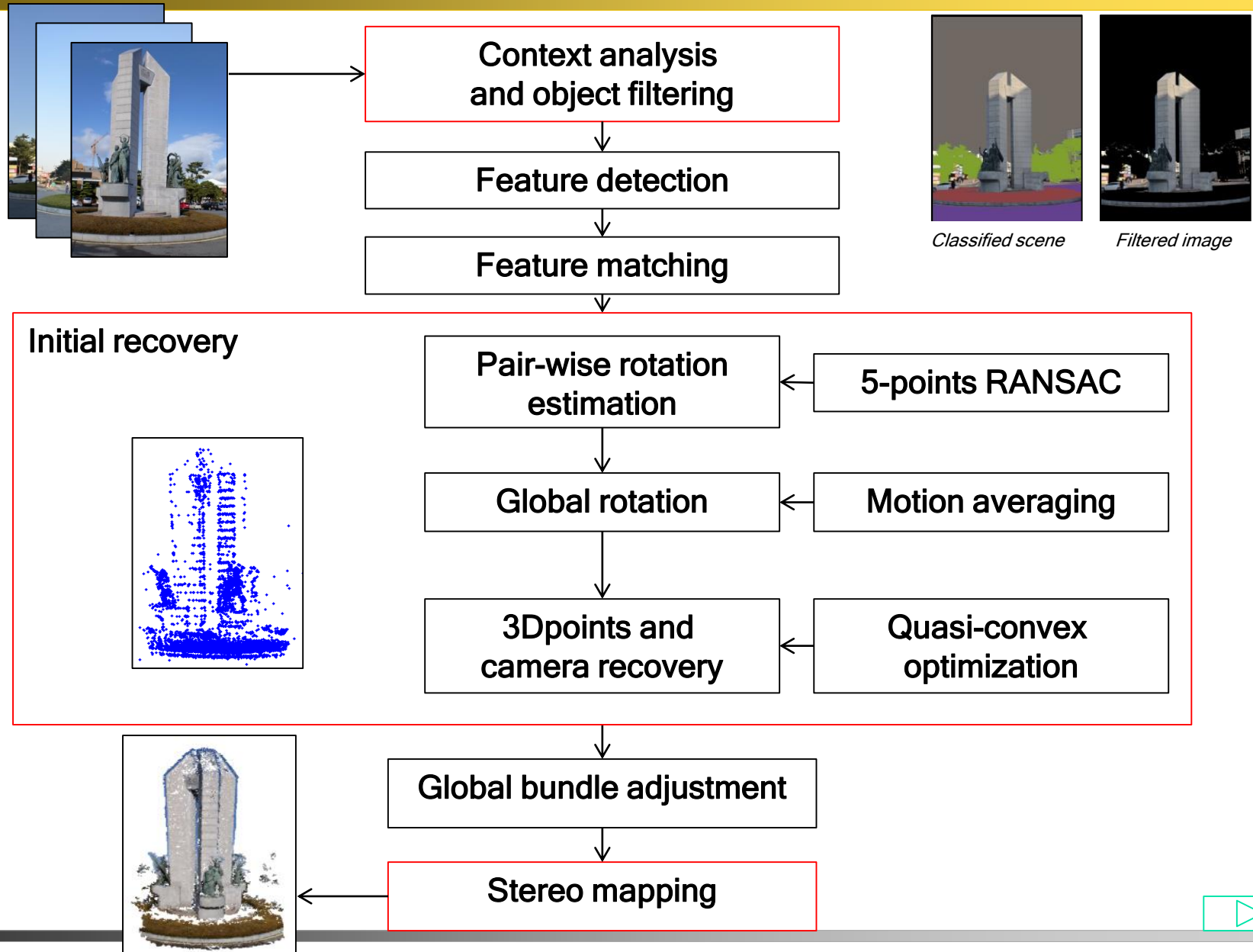
Multiple views geometry



R_i : Rotation matrix
 T_i : Translation vector
 U_i : 3D points



Proposed scheme for 3D scene modeling



Large scale scene model



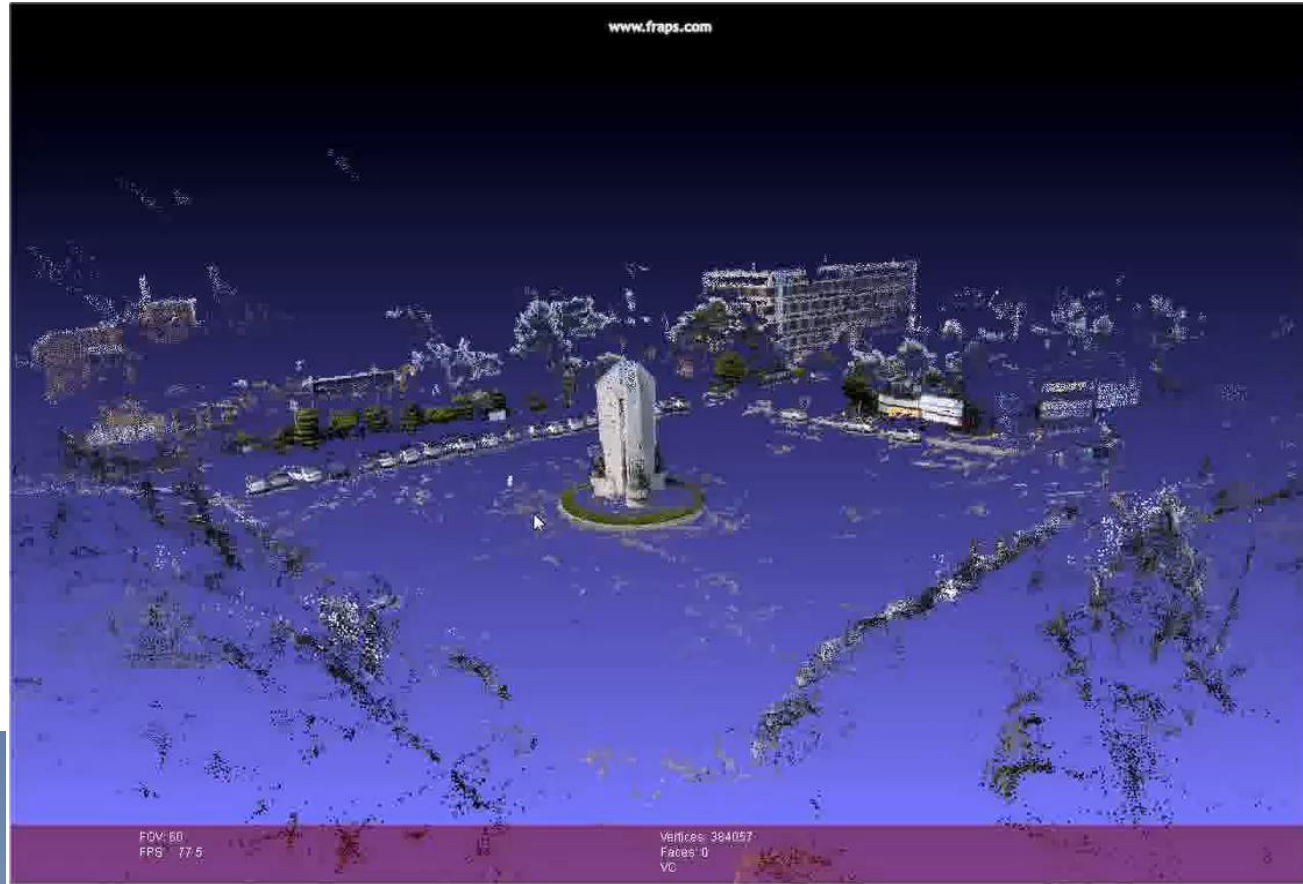
- Data: 322 images
- Size 2048x1536



Large scale scene model



- Data: 322 images
- Size 2048x1536



My-Ha Le, Andrey Vavilin and Kang-Hyun Jo, "3D Scene Reconstruction Enhancement Method based on Automatic Context Analysis and Convex Optimization", Neurocomputing, Volume 137, Pages 71-78, ISSN 0925-2312, 2014

Proposed scheme for camera motion recovery



Omnidirectional images

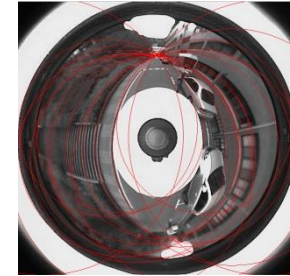
Vanishing point extraction

Pair-wise rotation estimation

Global rotation estimation

Convex optimization

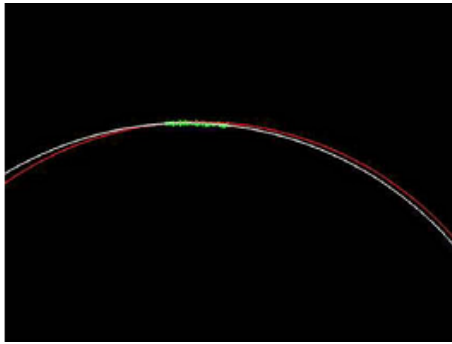
Camera motion recovery



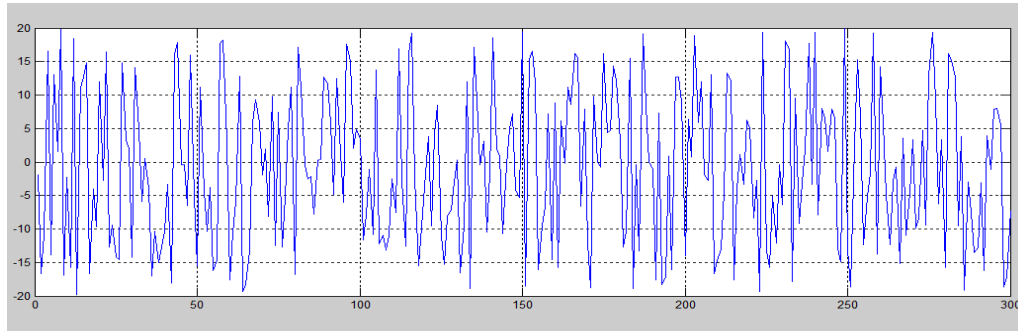
Camera motion recovery



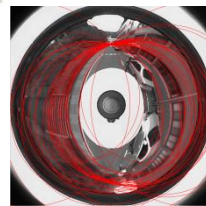
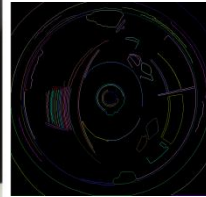
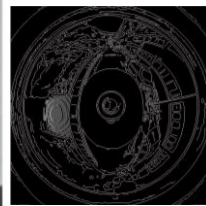
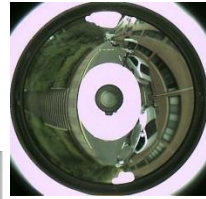
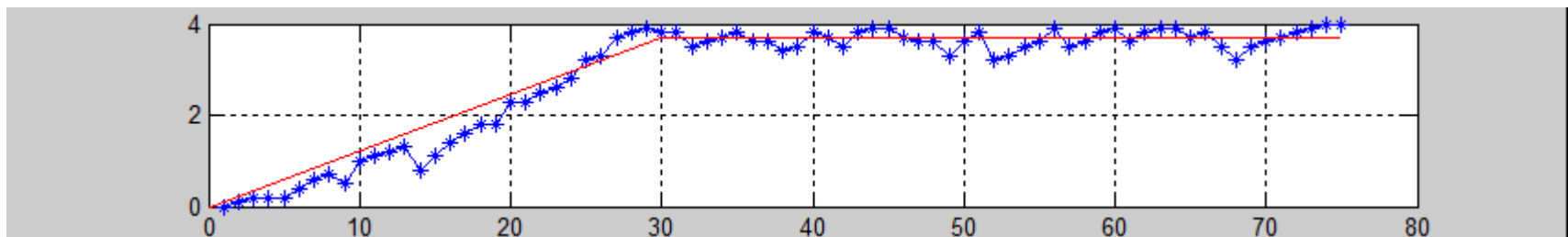
- The line extraction is robust and high accuracy



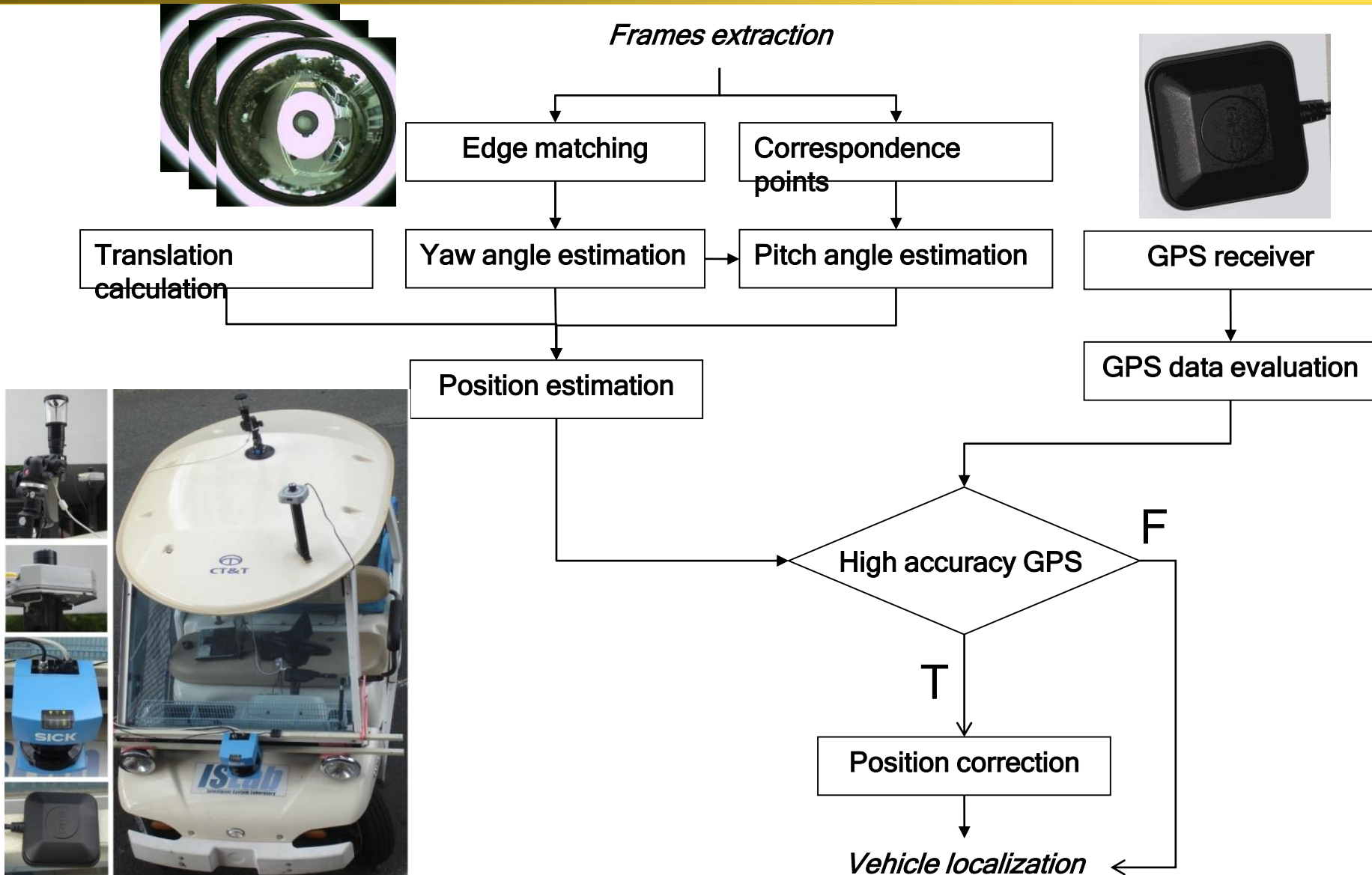
- Rotation angle



- Camera motion recovery



Localization of Vehicle-Mounted Vision Sensor



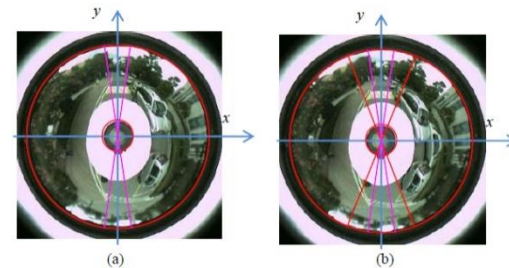
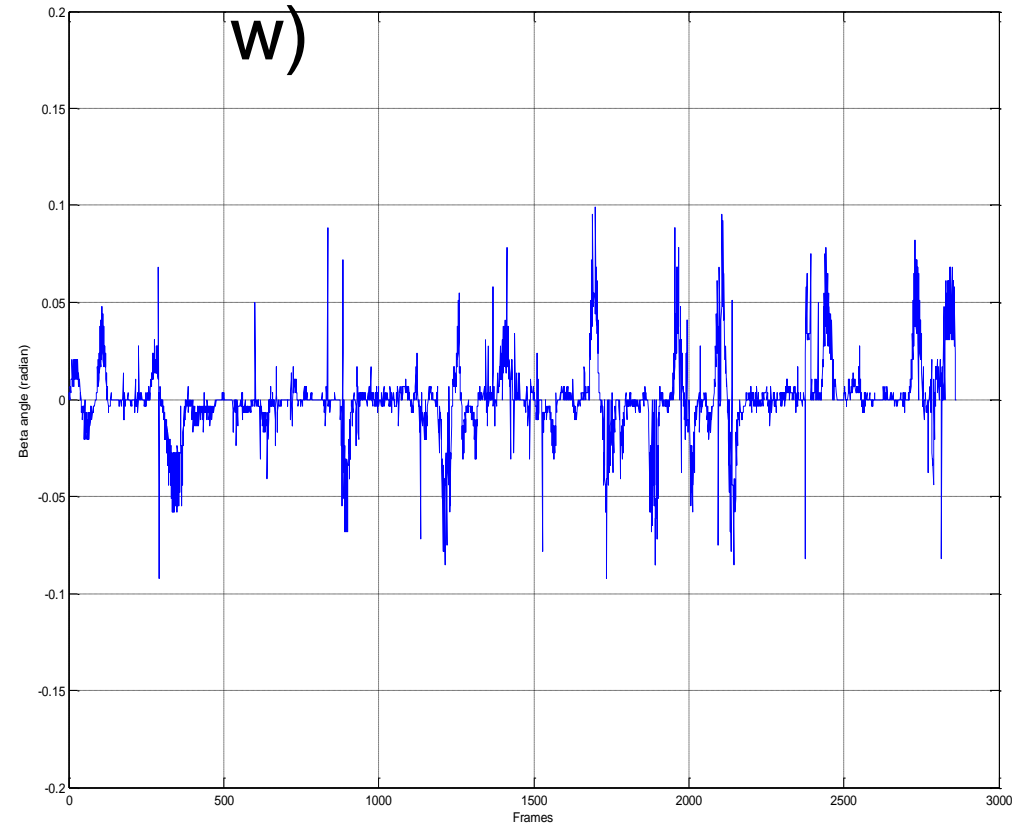
Omnidirectional camera in long-range motion



Hardware



Rotation angle (γ)



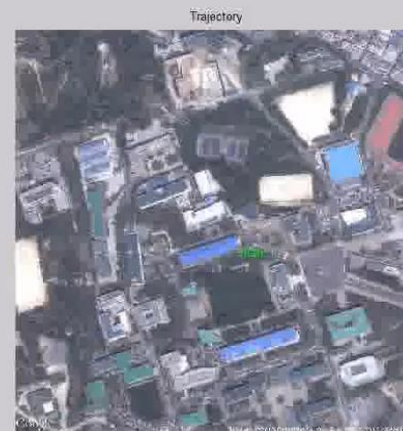
Omnidirectional camera in long-range motion

→ Error analysis [m]

Method	VO	VO + GPS
Max. error	23.35	0.53

→ Localization result

Method	2D assumption	3D trajectory
Distance	1758	1557
Error	10.85%	3.89%



My-Ha Le, Van-Dung Hoang, Andrey Vavilin and Kang-Hyun Jo, "One-Point-plus for 5-DoF Localization of Vehicle-Mounted Omnidirectional Camera in Long-Range Motion ", IJCAS, Vol.11, No.5, pp.1018-1027, 2013

CCD camera in long range motion



Hardware systems



CCD camera in long range motion



- Simultaneous 3D reconstruction and localization
- 621 frames are processed



Lê Mỹ Hà, Ngô Văn Thuyên, “xây dựng môi trường làm việc 3D và tự định vị cho robot”, Đề tài cấp trường trọng điểm, SPKT.TPHCM, 2015



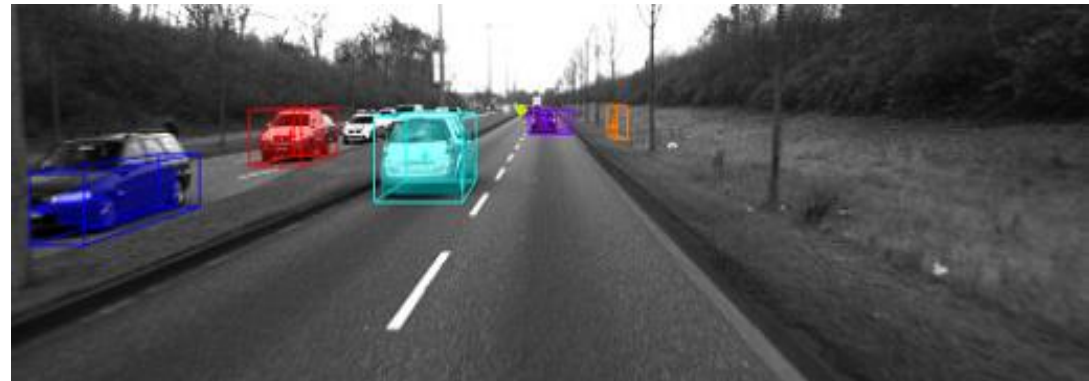
- **Convex optimization approach for multiple view geometry**
- **Advantages**
 - Removing outliers by context analysis in pre-process
 - Comparing with increment BA,
 - This method overcome poor results cause by bad initial points chosen,
 - Overcoming drift and local minima problem
 - Generating robust structure with small baseline images
- **Disadvantage**
 - This method is sensitive to outliers
 - Time consuming



- **Application to long-range navigation**
- **Advantages**
 - Improved the 2D motion assumption
 - Solved cumulative errors in long-range odometry
 - The visual odometry obtained for GPS position correction
 - Compensate each other when losing one of two guidance
- **Disadvantage**
 - Sensitive to fast moving objects
 - Require high frame rate

Future works

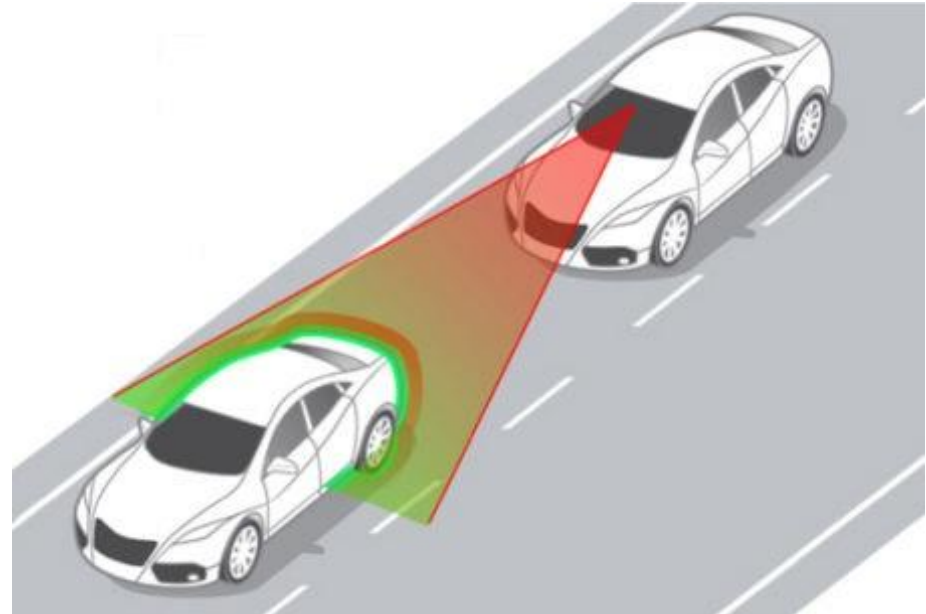
- ➔ 3D object measurement and tracking for collision avoidance
- ➔ Develop the Driver Assistance Systems (DAS)
- ➔ Autonomous/intelligent vehicle



- Install the controller system
- Scene understanding
 - 3D modeling
 - Object recognition
- Autonomous localization
- Performing individual task



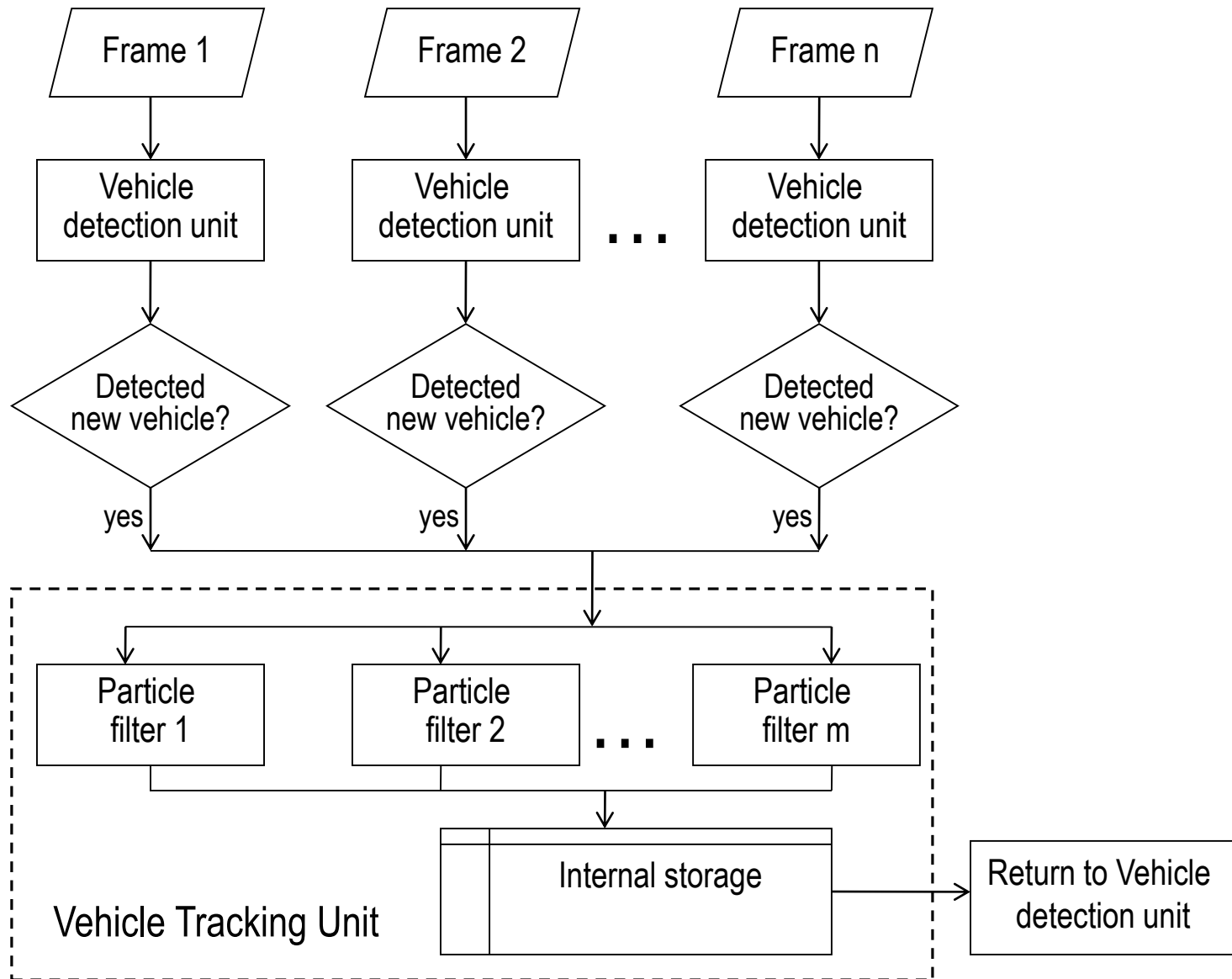
Main Goal: Multiple vehicle detection and tracking



Challenge work:

- Different environment(illumination, distance, background...)
- Tracking windows scale dynamic adjustment
- Vehicle partial occlusion
- Vehicle temporary missing

System architecture



Experiments Result



Frame 2



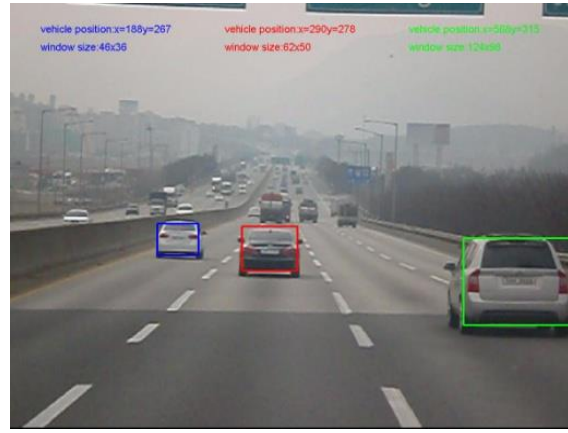
Frame 80



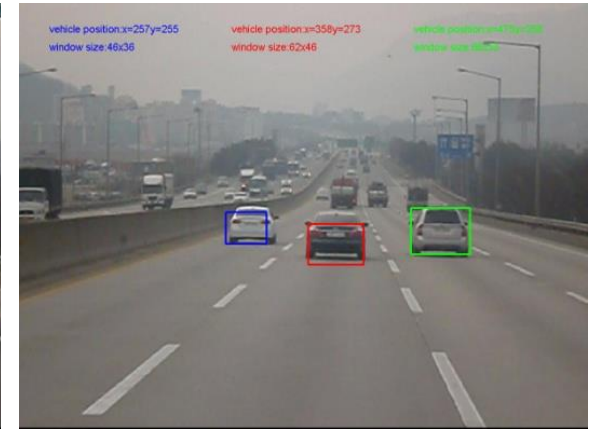
Frame 180



Frame 260



Frame 280



Frame 390

Hoạch định đường đi

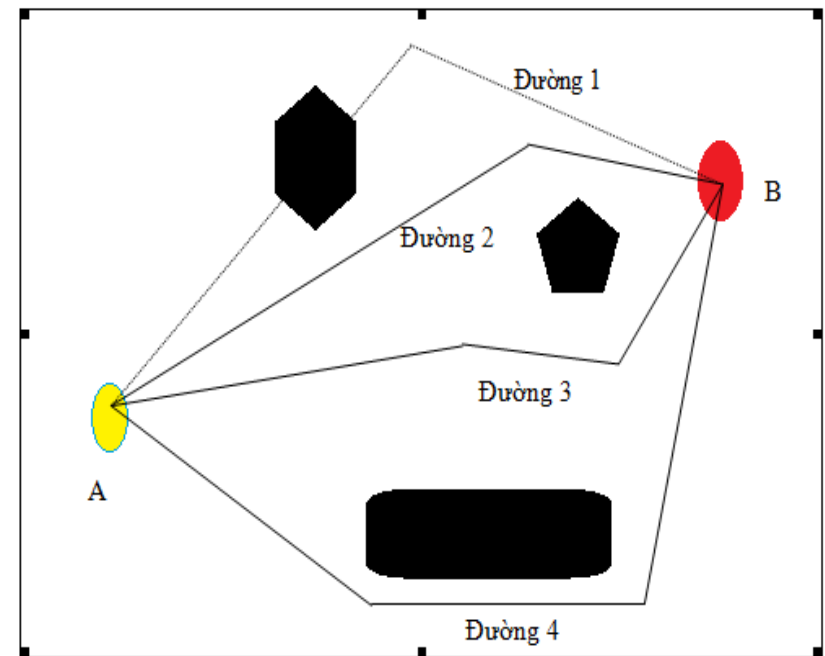


Tìm đường đi là vấn đề quan trọng nhất trong lĩnh vực robot tự hành.

Hoạch định đường đi giữa 2 điểm

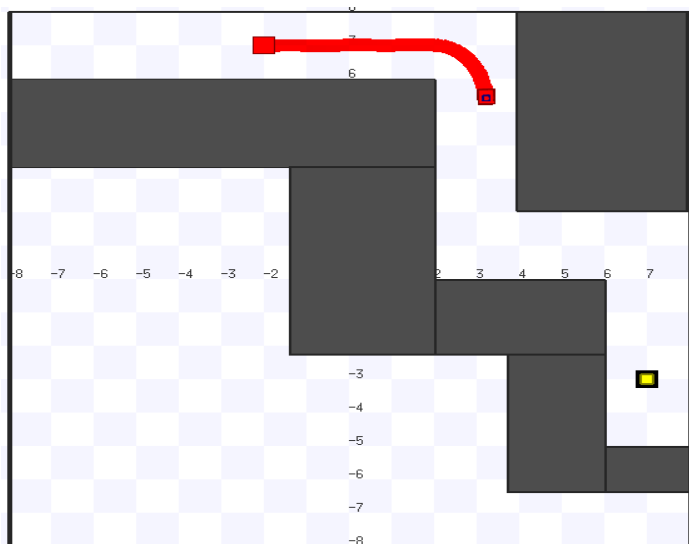
Đường đi giữa 2 điểm A và B

- Quỹ đạo đường đi phải bằng phẳng.
- Đường đi phải ngắn nhất.
- Đường đi phải an toàn.



Đường đi giữa 2 điểm A và B

Kết quả mô phỏng



So lan khoi tao: 38

van toc v duoc radom lan 0 la, 0.26
van toc w duoc radom lan 0 la, 0.05
van toc v duoc radom lan 1 la, 0.92
van toc w duoc radom lan 1 la, 0.12

van toc v duoc radom lan 51 la, 0.88
van toc w duoc radom lan 51 la, -0.15

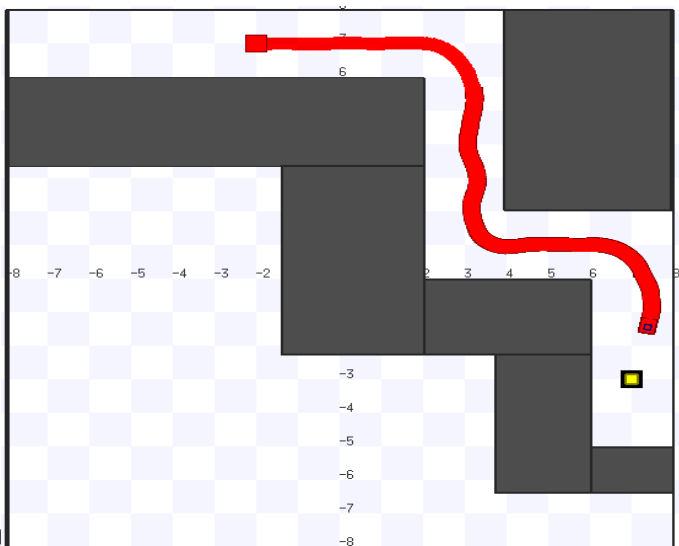
van toc v duoc radom lan 52 la, 0.35
van toc w duoc radom lan 52 la, -0.13

van toc v duoc radom lan 53 la, 0.18
van toc w duoc radom lan 53 la, -0.09

van toc v duoc radom lan 99 la, 0.81
van toc w duoc radom lan 99 la, -0.06

Van toc v tot nhat la: 0.35

Van toc w tot nhat la: -0.13



So lan khoi tao: 65

van toc v duoc radom lan 0 la, 0.39
van toc w duoc radom lan 0 la, -0.10
van toc v duoc radom lan 1 la, 0.71
van toc w duoc radom lan 1 la, -0.18

van toc v duoc radom lan 59 la, 0.76
van toc w duoc radom lan 59 la, 0.12

van toc v duoc radom lan 60 la, 0.50
van toc w duoc radom lan 60 la, -0.17

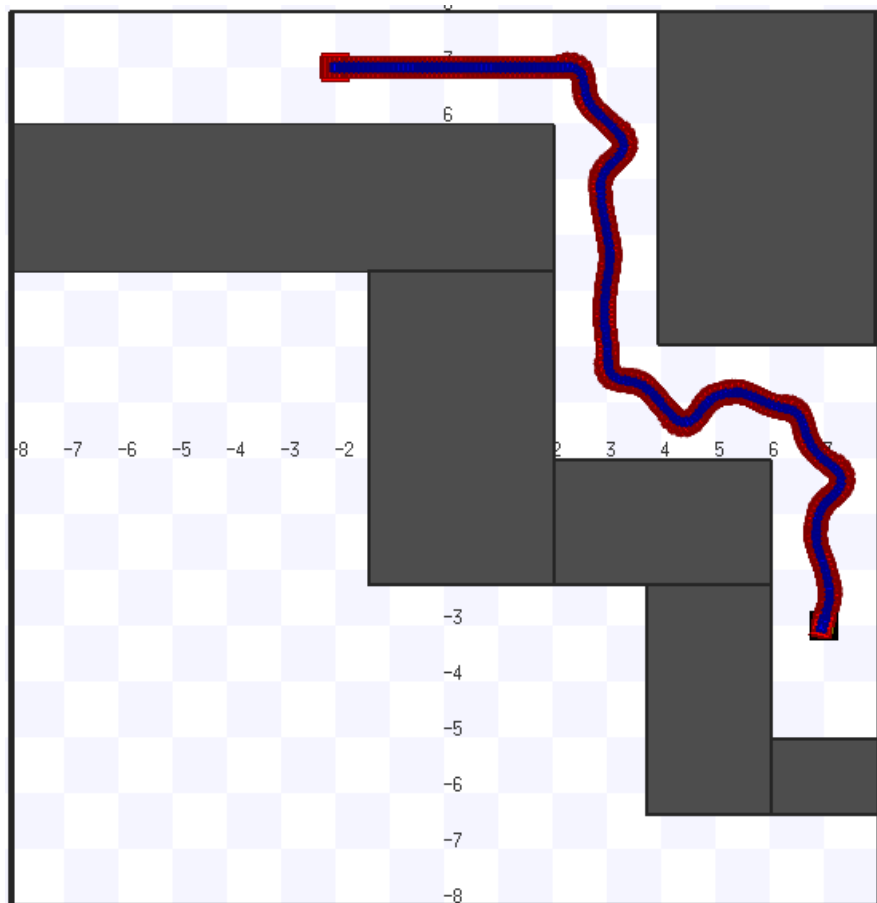
van toc v duoc radom lan 61 la, 0.91
van toc w duoc radom lan 61 la, 0.07

van toc v duoc radom lan 99 la, 0.20
van toc w duoc radom lan 99 la, 0.06

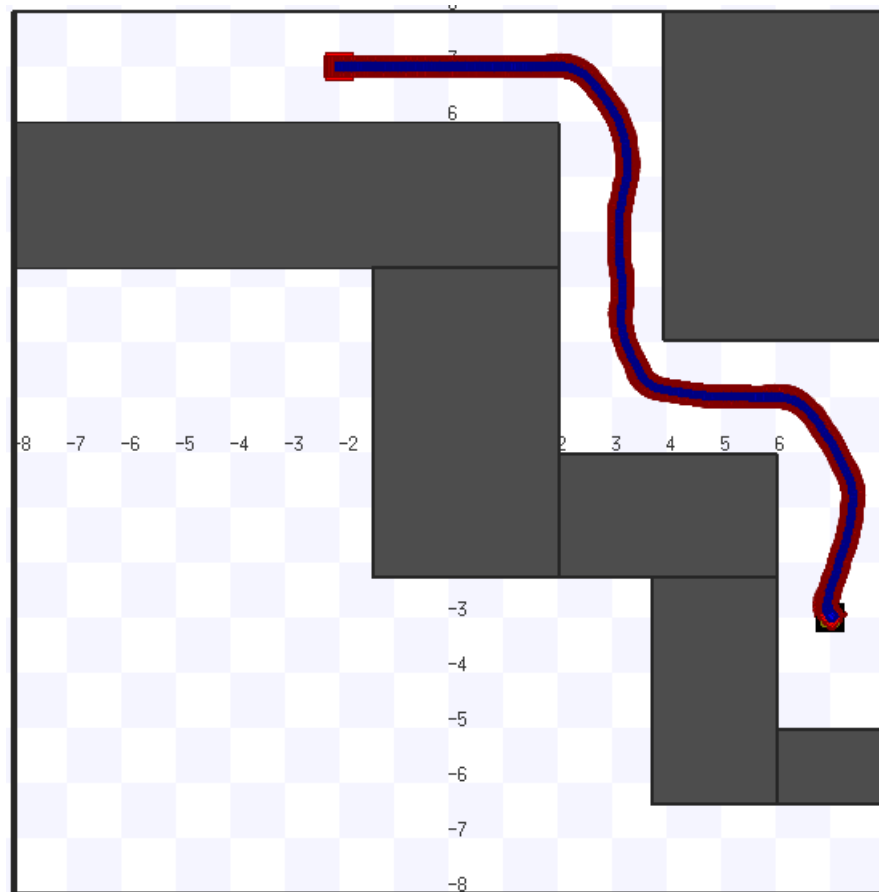
Van toc v tot nhat la: 0.50

Van toc w tot nhat la: -0.17

Kết quả mô phỏng

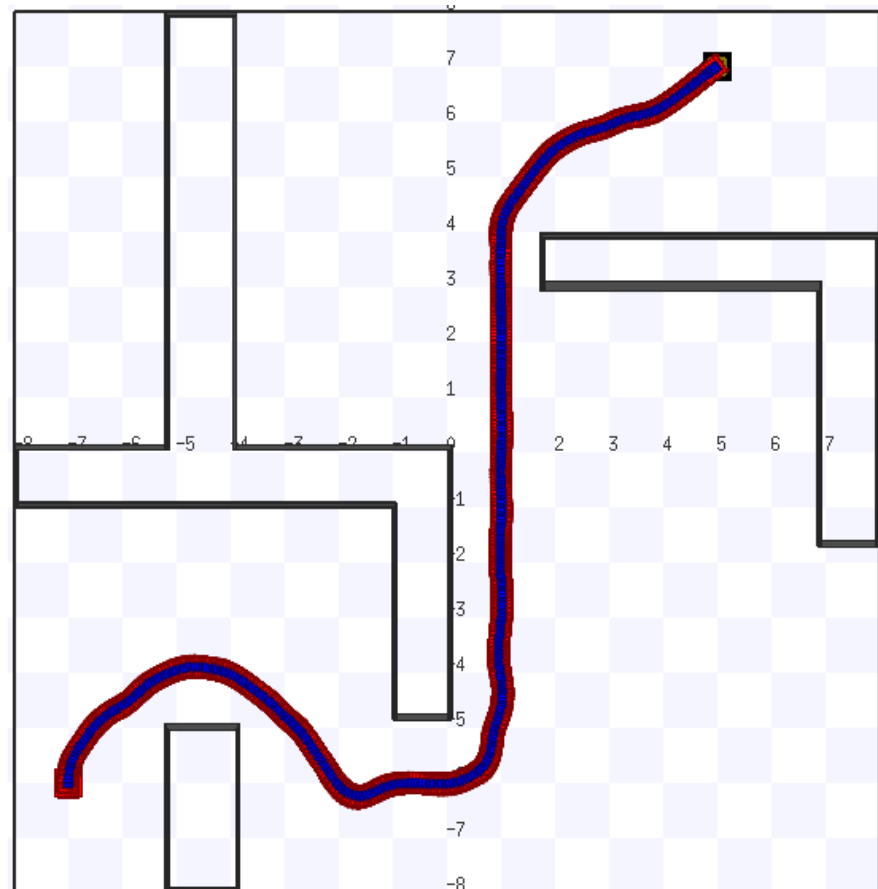
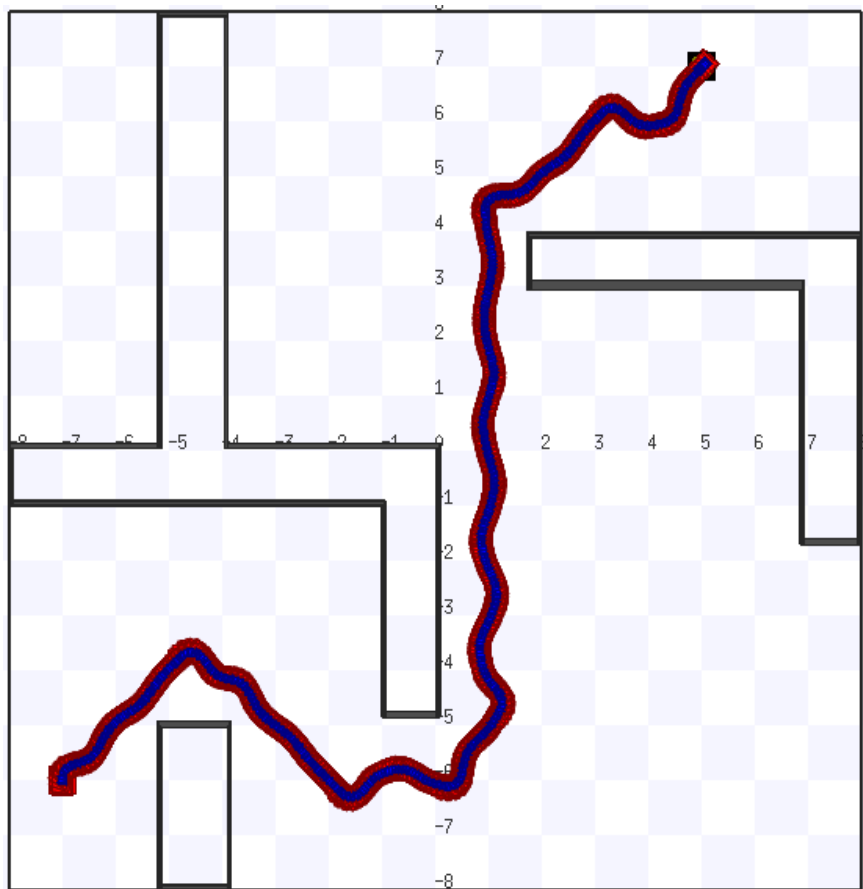


*Đường đi theo phương pháp D*_PF*



Đường đi theo phương pháp PSO

Kết quả mô phỏng



*Đường đi theo phương pháp D^*_PF*

Đường đi theo phương pháp PSO

Human detection



Training stage



Examples

Features description

Training

Model

Detection stage

Input image

Candidate regions

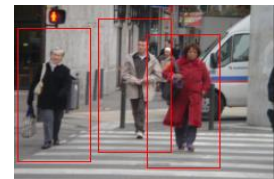
Features description

Classification

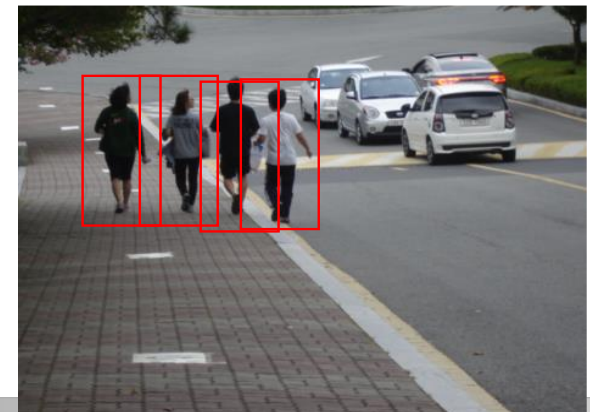
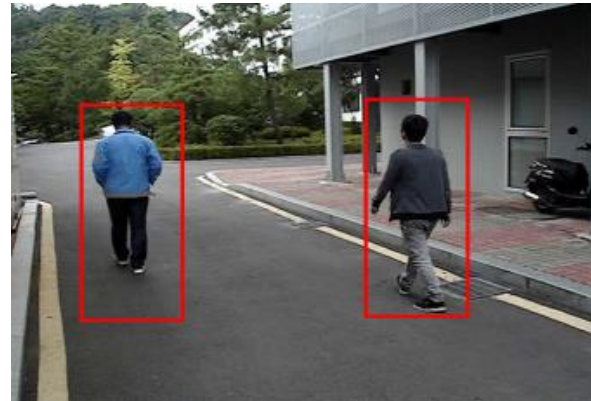
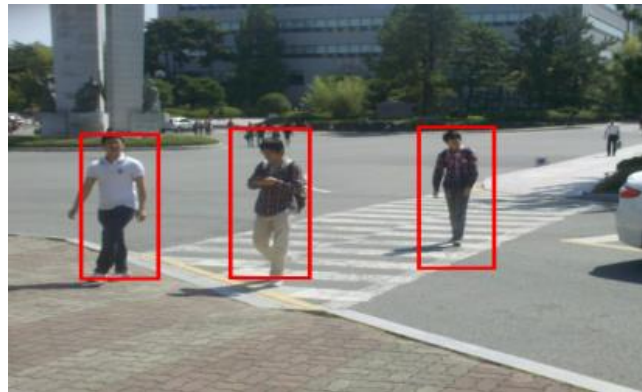
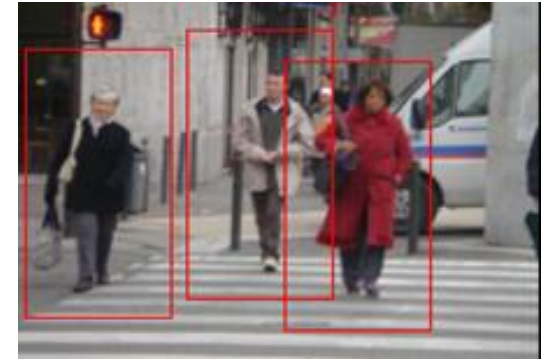
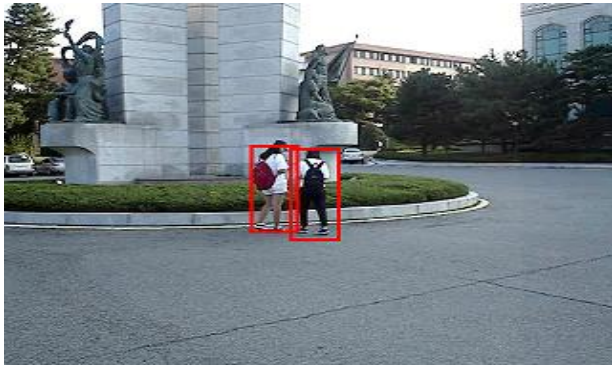
Human regions

Post-process

Human regions

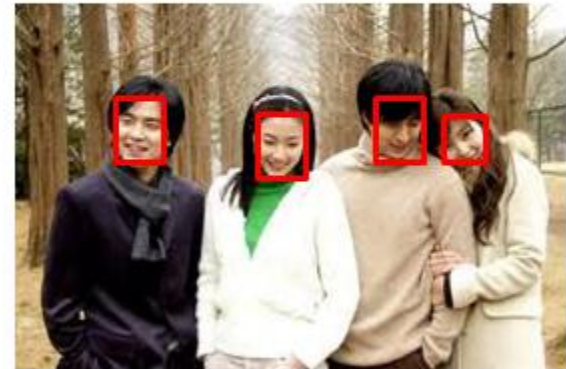
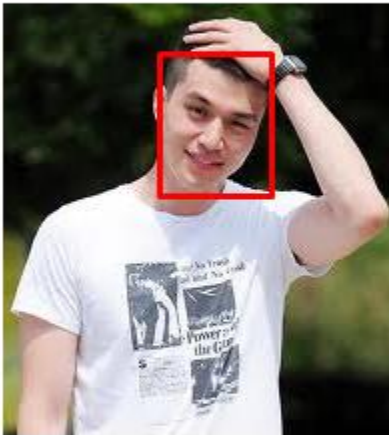


Experimental results



Human face detection

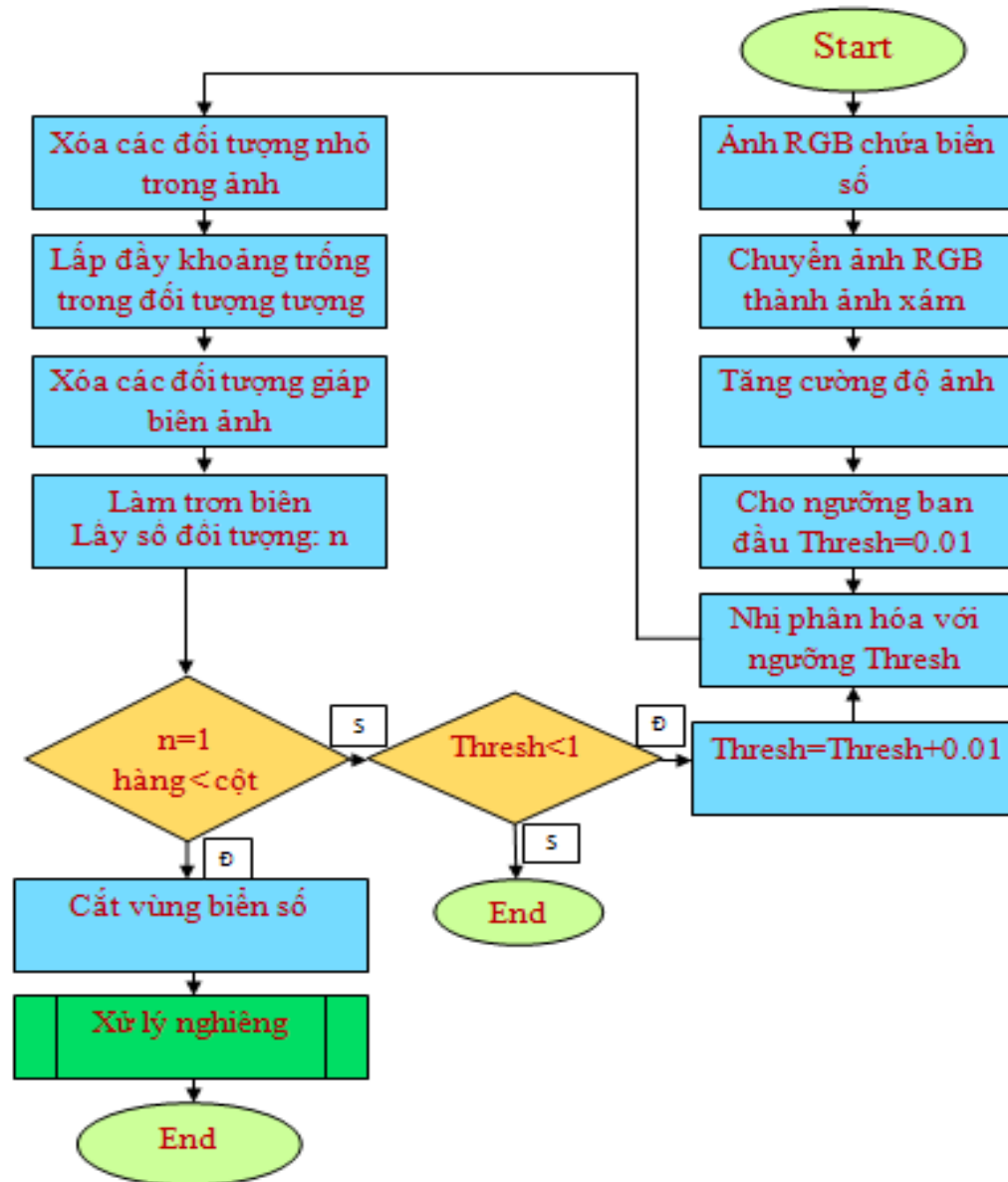
- Application use for face detection and recognition that enables tracking or identification of users when intelligent robot captures video sequences.



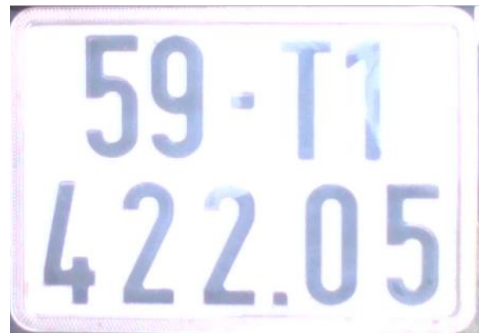
Method



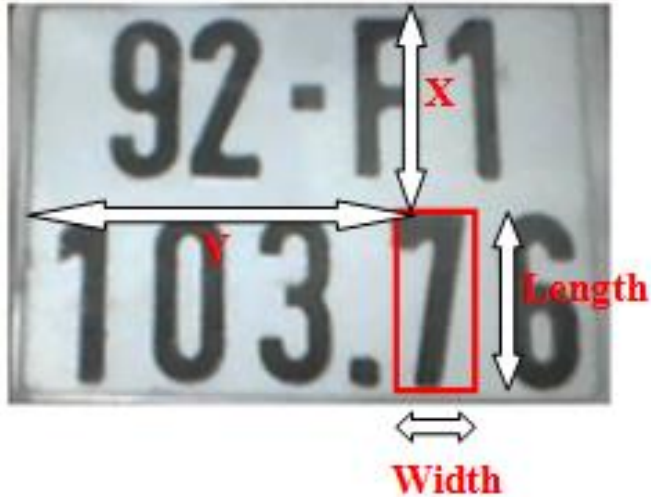
License plate recognition algorithm



Problems



Characters separation



Character recognition



Nhan Dien Bien So Version2

CAMERA



BIEN SO



KET QUA NHAN DANG

92F1-10376

	STT	Ngay	Gio	Bang So
1	STT	Ngay	Gio	Bien So
2	1	21 - 6 - 2014	14:11:7	92F1-10376
3	2	21 - 6 - 2014	14:11:13	49G1-03677
4	3	21 - 6 - 2014	14:11:28	47B1-63237
5	4	21 - 6 - 2014	14:11:35	55Y1-4789
6	5	21 - 6 - 2014	14:11:40	59X2-01803
7	6	21 - 6 - 2014	14:11:49	55Y1-4789
8	7	21 - 6 - 2014	14:11:59	59X2-01803
9	8	21 - 6 - 2014	14:12:9	59X2-45823
10	9	21 - 6 - 2014	14:12:20	59Z2-2085
11	10	21 - 6 - 2014	14:12:36	60B4-91538
12	11	21 - 6 - 2014	14:12:49	17T6-7587
13	12	21 - 6 - 2014	14:13:7	92F1-10376
14	13	21 - 6 - 2014	14:13:14	92F1-10376
15	14	21 - 6 - 2014	14:13:24	49G1-03677
16	15	21 - 6 - 2014	14:13:34	59X2-01803
17	16	21 - 6 - 2014	14:13:41	47B1-63237
18	17	21 - 6 - 2014	14:13:48	92F1-10376

Init

Select Camera

Camera Preview

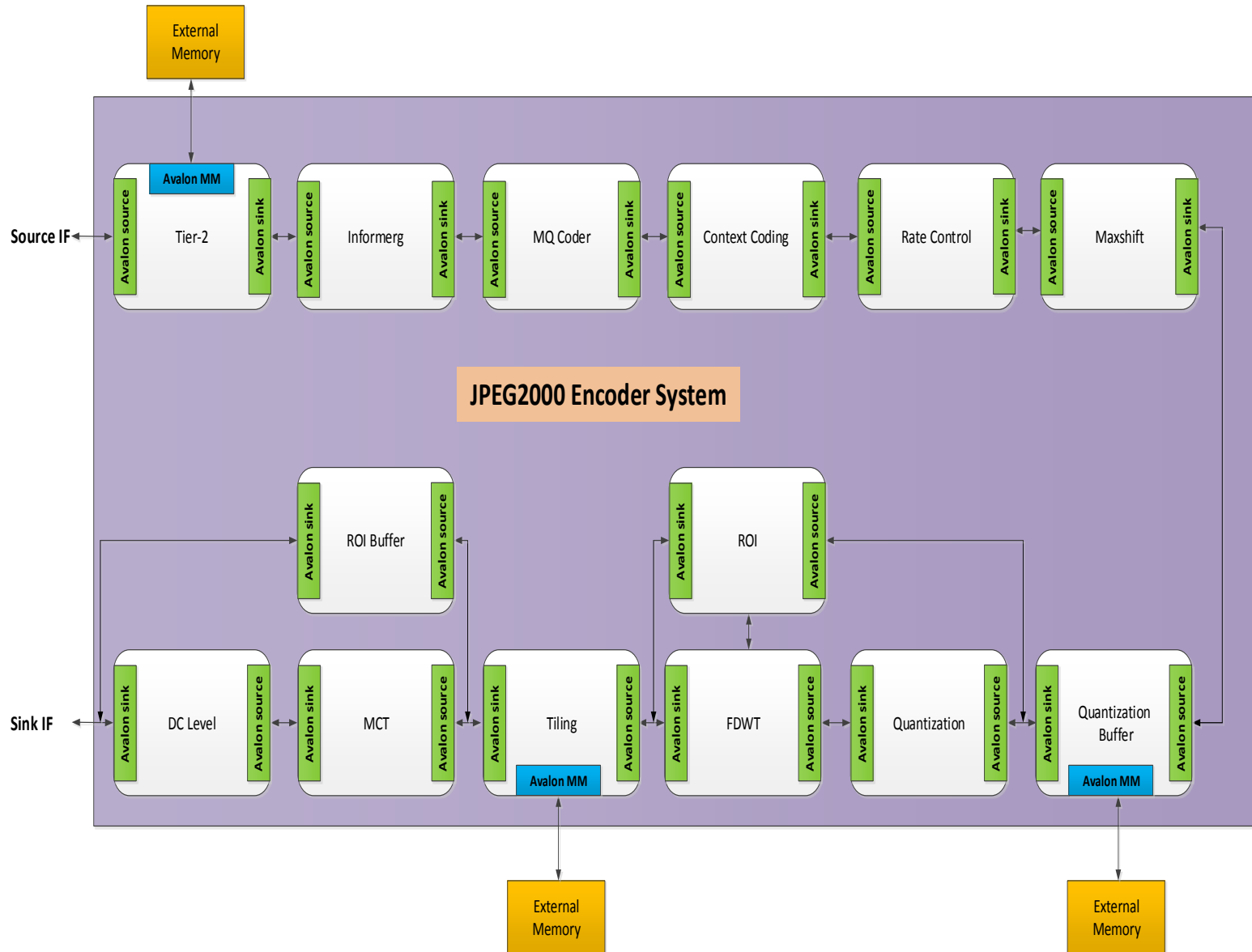
Offline Test Run

Data Base

Close

Back

Decreasing capacity of jpeg2000 standard image on FPGA board



Experiments





Cảm ơn!

Contact information:

PTN Hệ Thống Thông Minh
(Intelligent Systems Laboratory)
Khoa Điện-Điện Tử,
Đại Học Sư Phạm Kỹ Thuật TPHCM
Website: www.hcmute.edu.vn
Phone: 0938 81 1201
Email: lemyha112@gmail.com