

Robotic Navigation and Exploration

Week 1: Introduction

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CS, NTHU / CSIE, NCKU

!!! Notice !!!

- 若有任何身體不適的感冒症狀，請勿出席課程
 - 將提供Youtube課程影片供在家自主學習
 - 清大上課版: <https://ppt.cc/ffwHOx>
 - 電腦版: <https://ppt.cc/fGKy9x>
- For NTHU
 - 為落實疫情防範與個案接觸者追蹤，將採**固定座位**上課
 - 每週上課前，請於門口座位表簽到，並按座位表入座，未簽到者，請勿進入教室
 - 因自走車數量有限，僅開放10個加簽名額
 - 若需旁聽，請務必向助教登記，以利安排座位圖

Outline

- Syllabus
- Overview of Mobile Robot

Syllabus

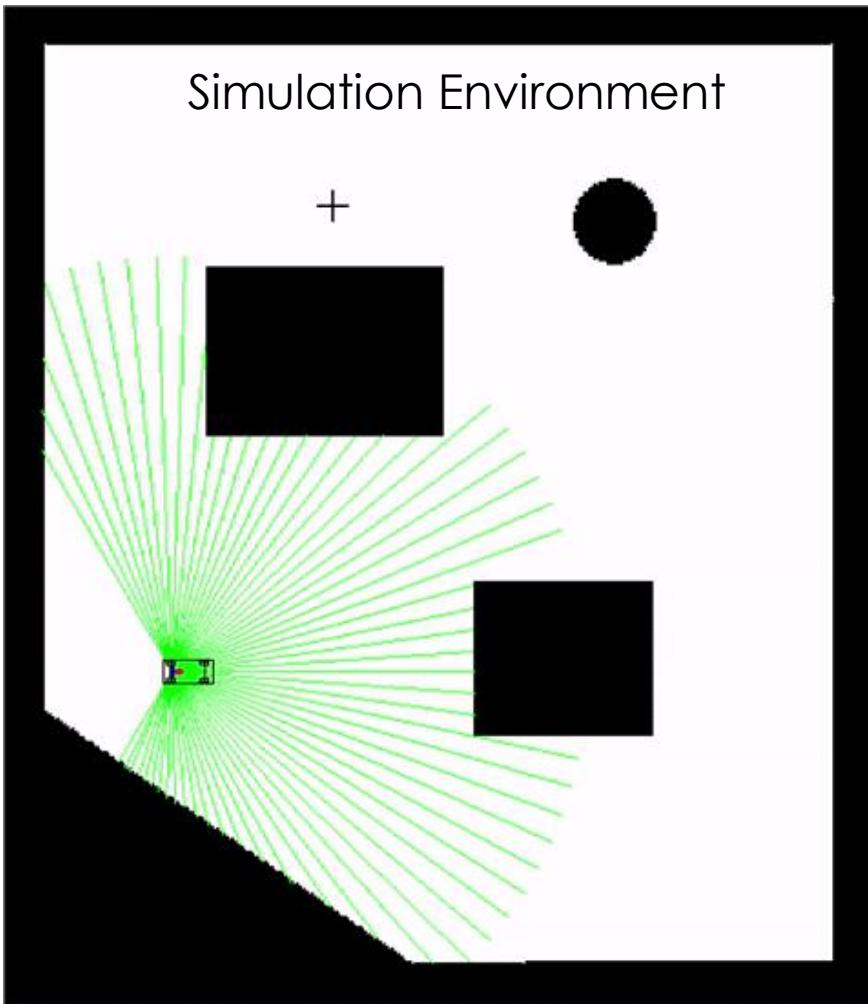
Syllabus

Grading

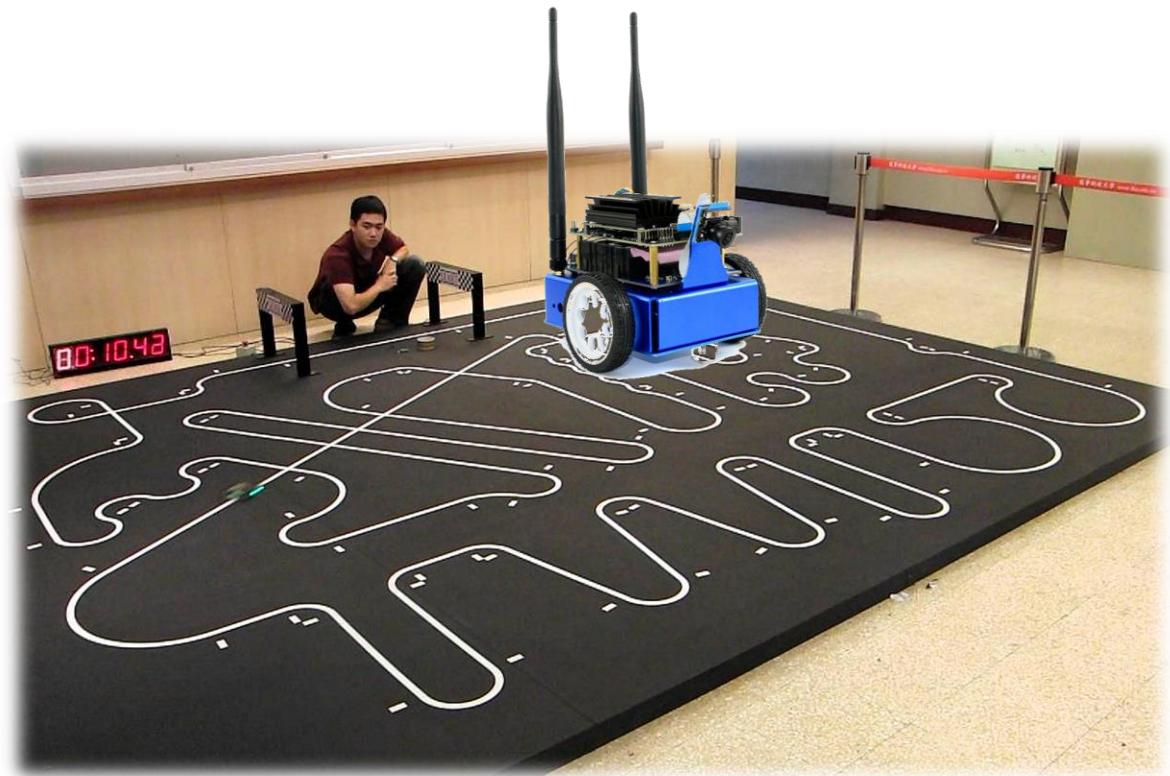
- Homework: 45%
 - HW1~3(15% for each HW)
- Paper Presentation: 20%
 - Presentation (10%)
 - HackMD Report (10%)
- Final Project: 35%
 - Presentation (10%)
 - Demo (15%)
 - HackMD Report (10%)

Date (NTHU)	Date (NCKU)	Course
3/5	3/6	Syllabus & Overview of Mobile Robot
3/12	3/13	Kinetic Model & Vehicle Control Lab1: Feedback Control
3/19	3/20	Path Planning Lab 2: Path Planning + HW1
3/26	3/27	Probabilistic Robotics
4/2	4/3	Spring Vacation
4/9	4/10	Filter-based Localization & Mapping Lab 3: EKF SLAM
4/16	4/17	Camera Model & Multiview Geometry + HW2
4/23	4/24	Modern RGB-based SLAM Methods Lab 4: ORB SLAM & DSO
4/30	5/1	Machine Learning & Deep Learning Basics for CV Lab 5: Street View Segmentation (Pytorch)
5/7	5/8	Advanced CV Algorithms
5/14	5/15	Reinforcement Learning (I) + HW3
5/21	5/22	Reinforcement Learning (II) Lab 6: Mapless Navigation
5/28	5/29	Talk by Trista Chen & Wei-Chao Chen
6/4	6/5	Paper Presentation
6/11	6/12	Talk by 李志清 (Taiwan Drone 100)
6/18	6/19	Demo Day
6/25	6/26	Dragon Boat Festival

Goal of this course



NVIDIA JetBot in Real World



Paper Presentation List <https://ppt.cc/fYYC1x>

The screenshot shows a HackMD document interface with the following content:

Document URL: <https://hackmd.io/9zh9IROSTsqBHTI4DbsAPQ?view>

Tags: RNE Course 2020

Recent changes: 变更於 1 分鐘前 (Changed 1 minute ago)

Notification: 訂閱 (Subscribed) | 電子郵件 (Email) | 微信 (WeChat) | QQ (QQ)

Groups (Group 1 to Group 10):

- Group 1:
- Group 2:
- Group 3:
- Group 4:
- Group 5:
- Group 6:
- Group 7:
- Group 8:
- Group 9:
- Group 10:

Actions (Bottom right): 全部展開 (Expand All), 回到頂部 (Go Back to Top), 移至底部 (Move to Bottom)

Paper Presentation List for RNE Course

Category 1: Path Planning / Navigation

- PRM-RL: Long-range Robotic Navigation Tasks by Combining Reinforcement Learning and Sampling-based Planning [HackMD Link]
- Curiosity-driven Exploration for Mapless Navigation with Deep Reinforcement Learning [HackMD Link]

Category 2: Environment Exploration

- Learning Exploration Policies for Navigation [HackMD Link]
-

Category 3: Controlling

- Lyapunov-based Safe Policy Optimization for Continuous Control [HackMD Link]

Category 4: Localization/Mapping/SLAM

- Unsupervised Learning of Depth and Egomotion from Monocular Video Using 3D Geometric Constraints [HackMD Link]
- Teaching a Machine to Read Maps with Deep Reinforcement Learning [HackMD Link]
- GeoNet: Unsupervised Learning of Dense Depth, Optical Flow and Camera Pose [HackMD Link]

Facebook Group <https://www.facebook.com/groups/623146941563602/>

2020 機器導航與探索

Private group

About

Discussion

Members

Events

Photos

Watch Party

Moderate Group

Group Quality

Joined ▾ Notifications Share ... More

Search this group

Shortcuts

CGV/MIS LAB 1

忠厚老實不嘴砲29家

多媒體資訊系統實驗室

統一企業籃球社 3

成大資工女籃隊 4

See more

Write Post Photo/Video Live Video ... More

Write something...

Photo/Video Watch Party Tag Friends ...

Recommended Groups

Link groups you recommend and they'll appear in this group.

Anita Min-Chun Home Create

CATEGORIZE POSTS + Create Topic

Add topics to posts to help group members find the information they're interested in.

INVITE MEMBERS Embed Invite

+ Enter name or email address...

INVITE FRIENDS

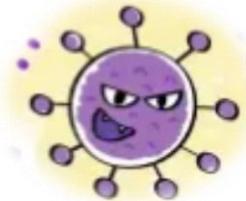
Ask your friends to join the group and add to the discussion.

Tsai Wan Lun Invite

Robotic Navigation and Exploration

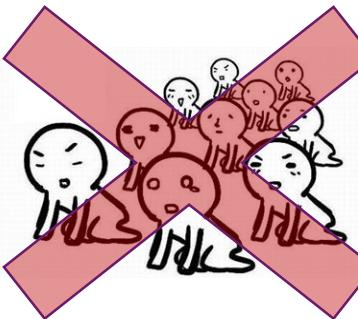
Course Q&A

- Take attendance?
- Food? 
- Zzz...? 



Be Responsible for Yourself

- Cheating or plagiarism will result in zero score
 → Final score=0
- Under 60 or 70 ?
 → See you next year ~



TA



陳文正



李侑霖



王奕翔



許承佑



黃琮耀



古慶宸



彭建璋 (NCKU)

Any Question



Overview of Mobile Robot

Kiva Robot (Amazon)



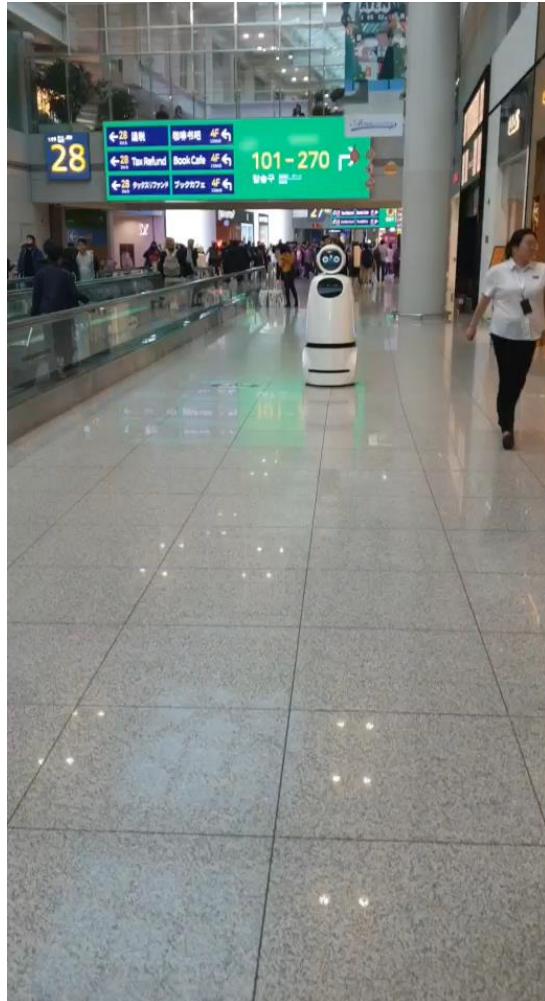
<https://www.youtube.com/watch?v=HSA5Bq-1fU4>

Bossa Nova's Robot (Walmart)



<https://www.youtube.com/watch?v=KRJV1SPYpIE>

Airport Guide Robot (Incheon)





自动驾驶视觉综合感知

主办方: 四维图新

无人驾驶

队伍 / 人数

629 / 708

奖金

¥ 106,500

【2019/11/11 17:09:56】 DF1542424200459参加了自动驾驶...

开赛

A榜

初赛 2019.09.23 ~ 2019.11.11

B榜

结束

赛制规则

数据与评测

排行榜

参赛队伍

常见问题

不可报名

大赛介绍

赛题名称

赛题背景

赛题任务

赛题赛程

奖池奖项

大赛介绍

2019 第五届“四维图新”杯创新大赛，由北京四维图新科技股份有限公司主办，由中国地理信息技术协会指导，中国地理信息产业协会位置服务工作委员会协办。大赛以前沿技术与应用为导向，汇聚创新技术与行业先进经验。

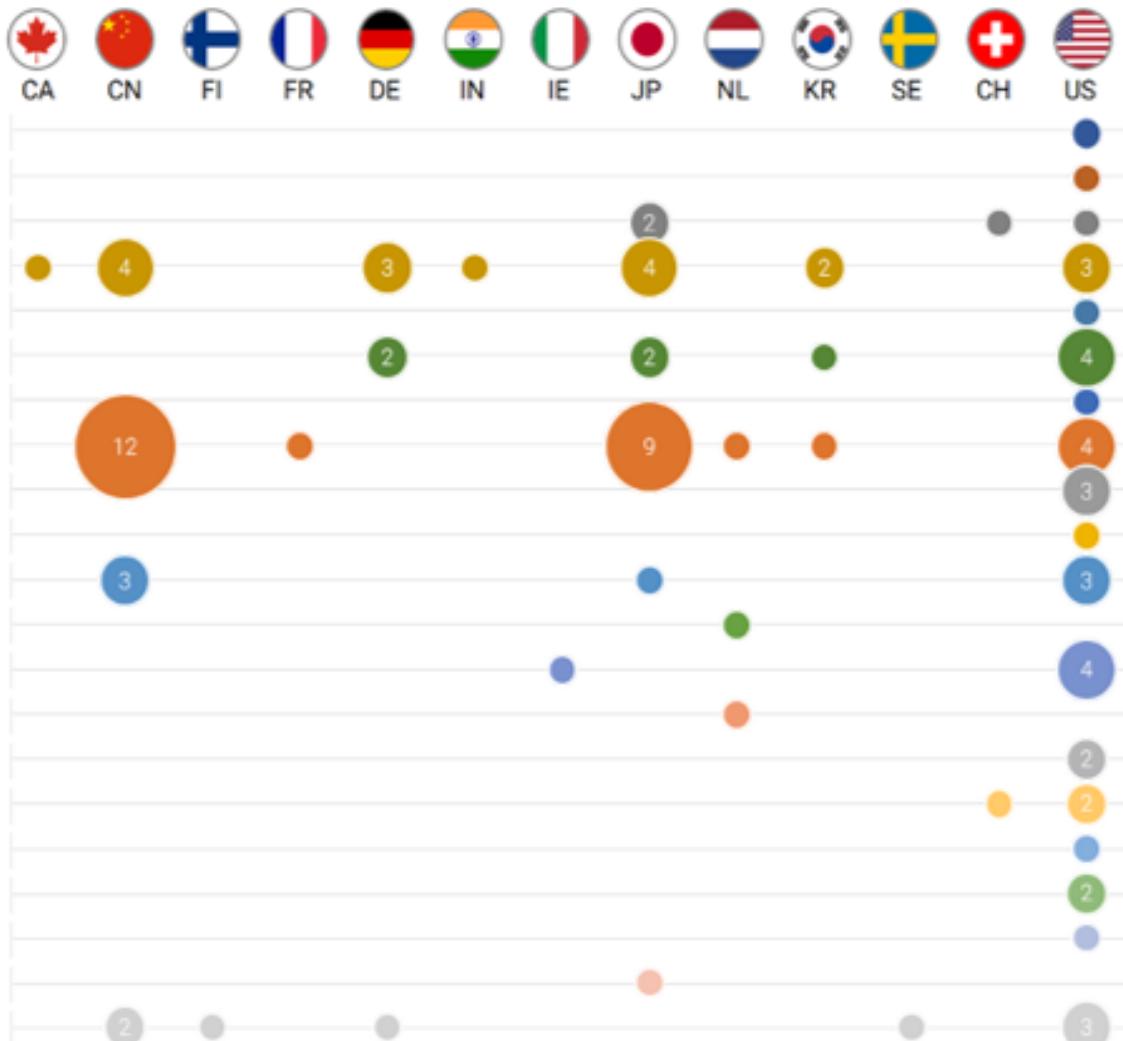
创新大赛连续五年举办，累计吸引全国各大高校在校生以及企业在职人员累计千余人参赛，已成为颇具影响力的行业赛事。大赛秉承“专业·专注·合作·创新”精神，旨在寻找拥有才华和梦想的个人与团队参与赛事，培养地理信息复合型人才。2019年，大赛融入自动驾驶业务和位置大数据元素，立足产业化、规模化、普及化，面向计算机为主、同时覆盖电子信息工程、GIS（地理信息系统）、自动化等专业方向，大赛面向全球开放报名，旨在吸引行业顶尖人才，挖掘领先技术，助力产业升级。

<https://www.datafountain.cn/competitions/366>

2019年前100最具創新力公司

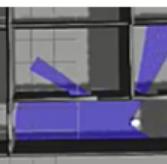
2019 Global Ranking
Top 100 Companies

3D-Printing
Agricultural Machinery
Automation Technology
Automotive
Aviation
Conglomerate
Consumer Goods
Electronic
Hard/Software
Intellectual Property
Internet
Lighting Technology
Medical Technology
Navigation
Oil Exploration
Pharma
Robotic
Semiconductor
Services
Technology
Telecommunication



Mobile Robotic in Your Mind

2D laser
scan

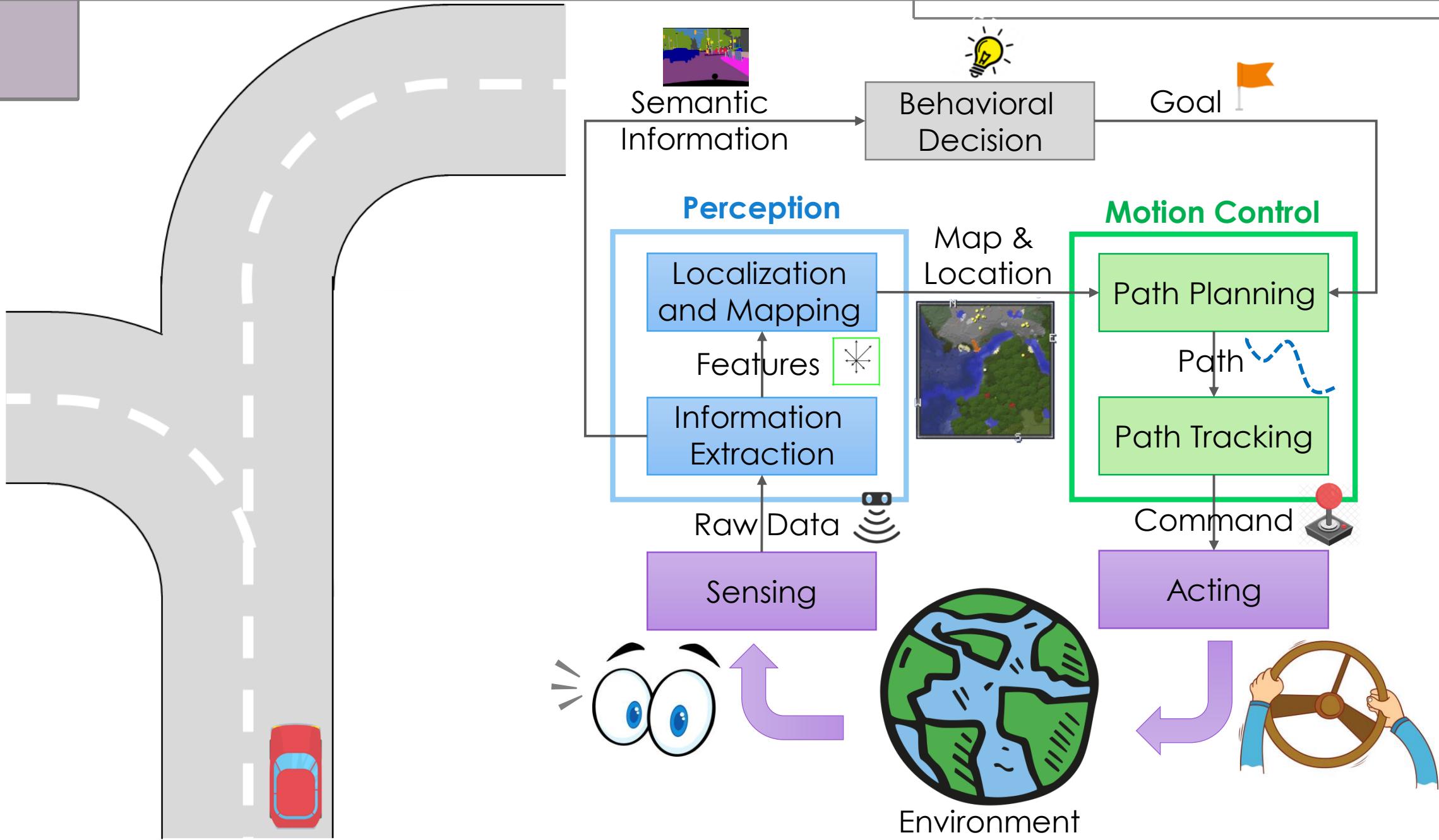


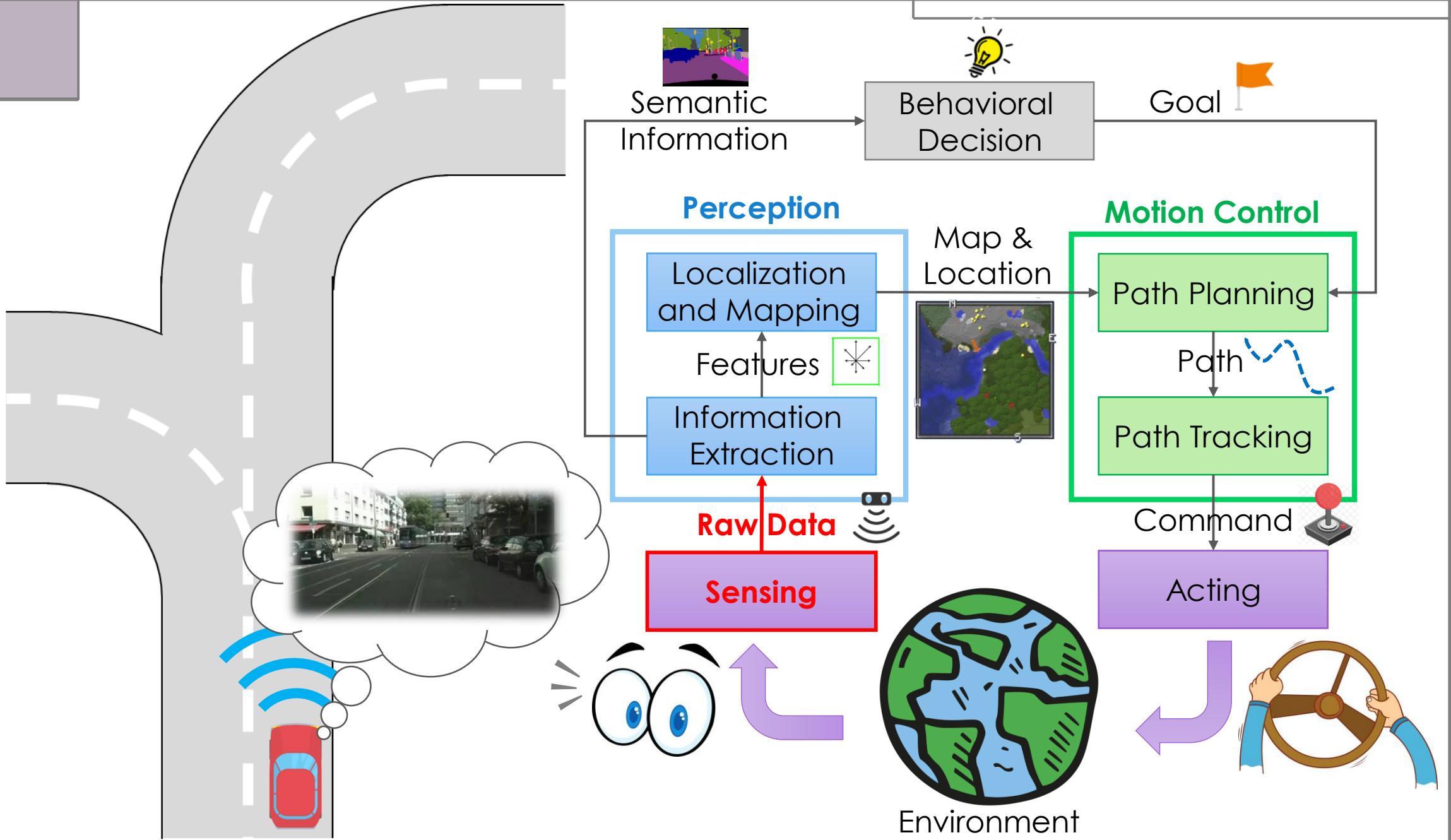
Wheel
odometry

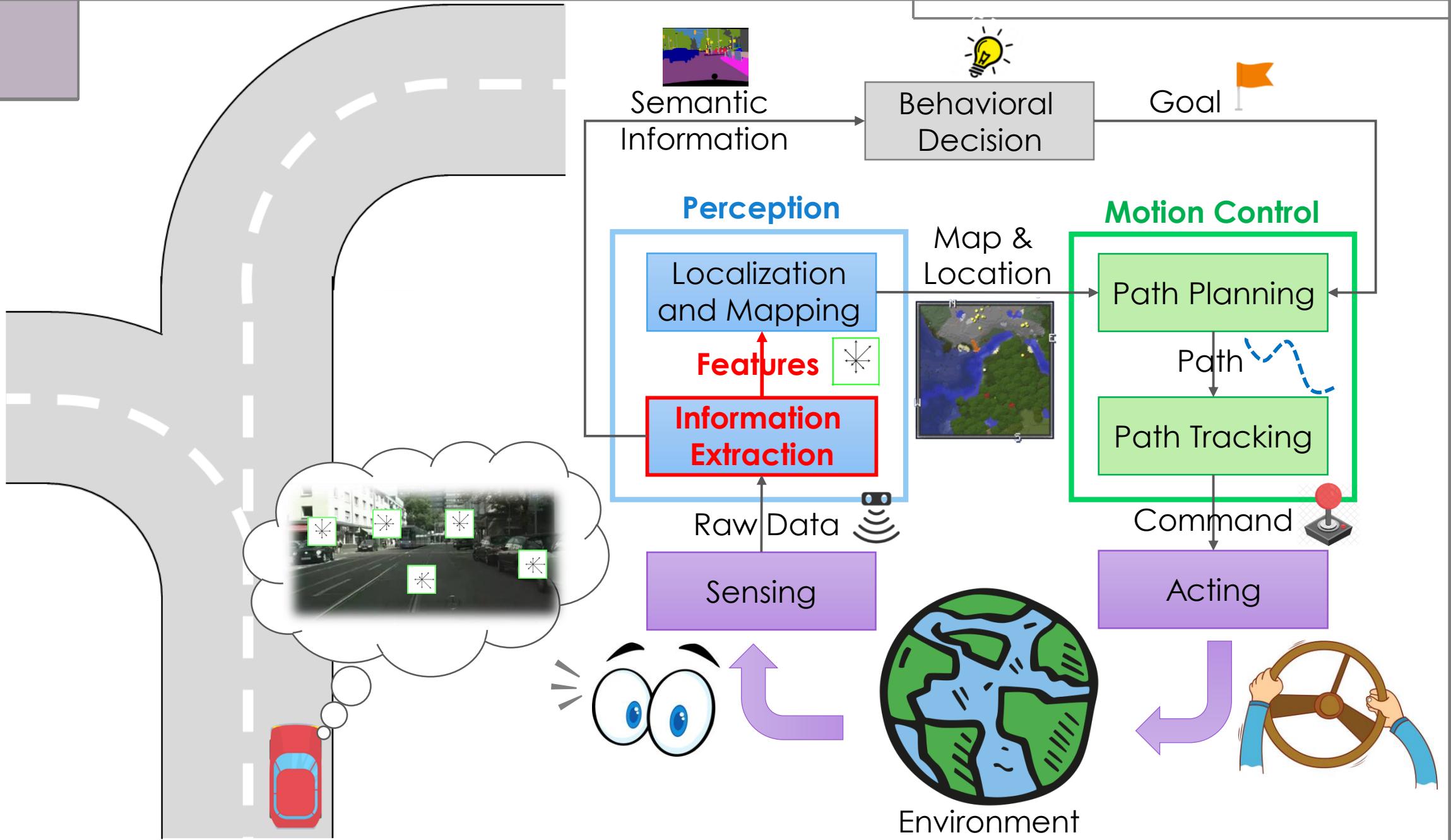


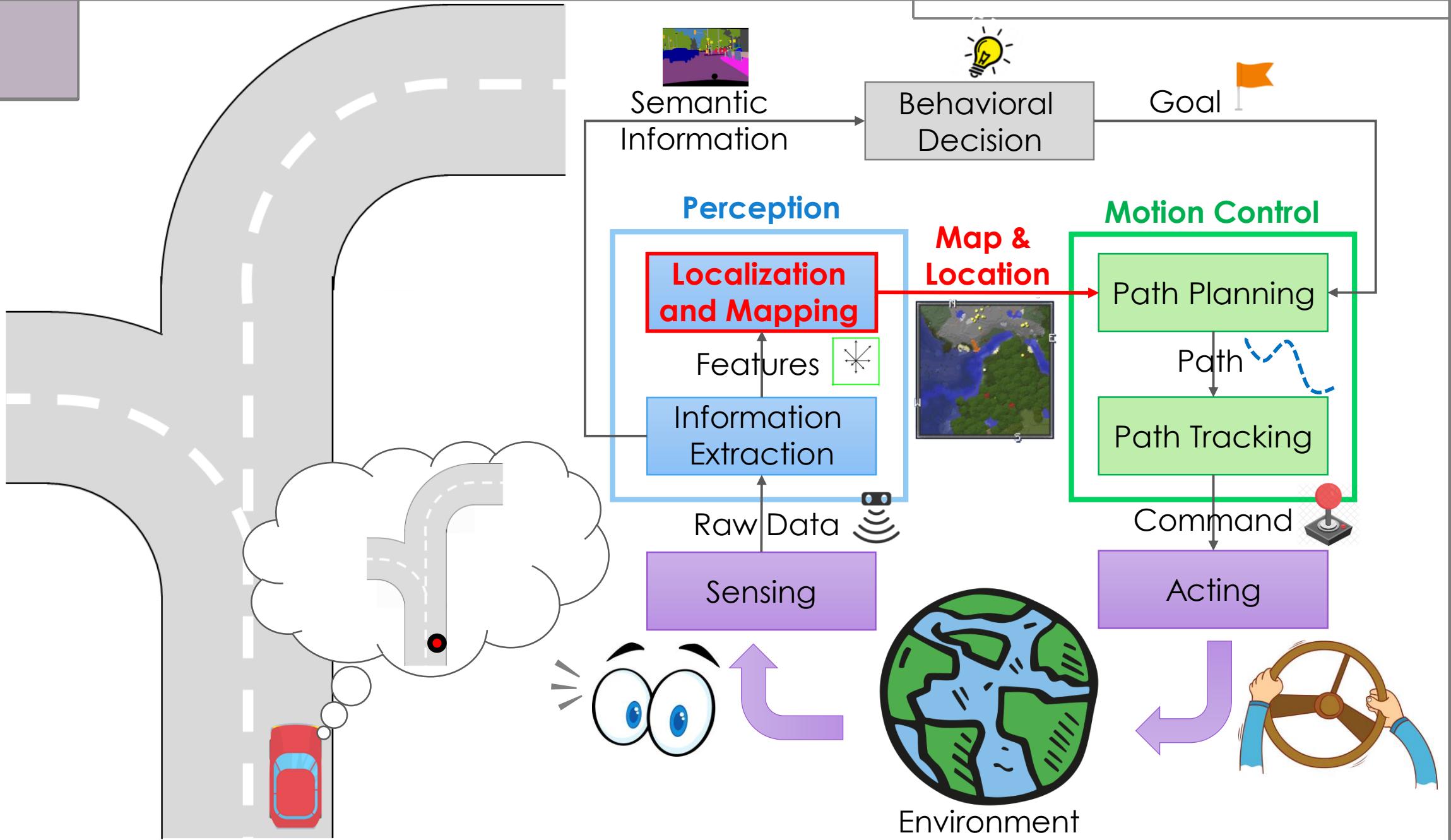
Time's Up

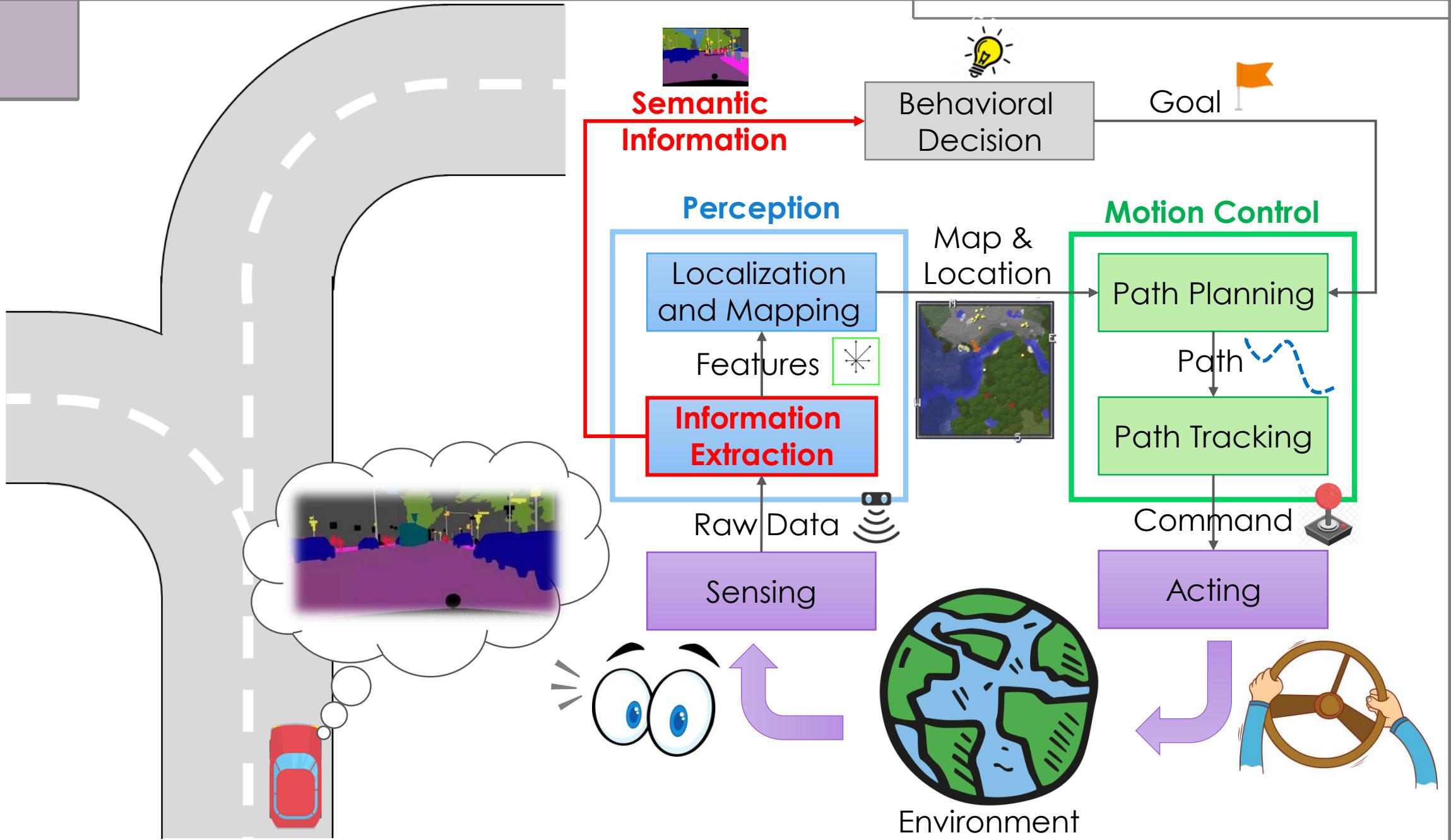


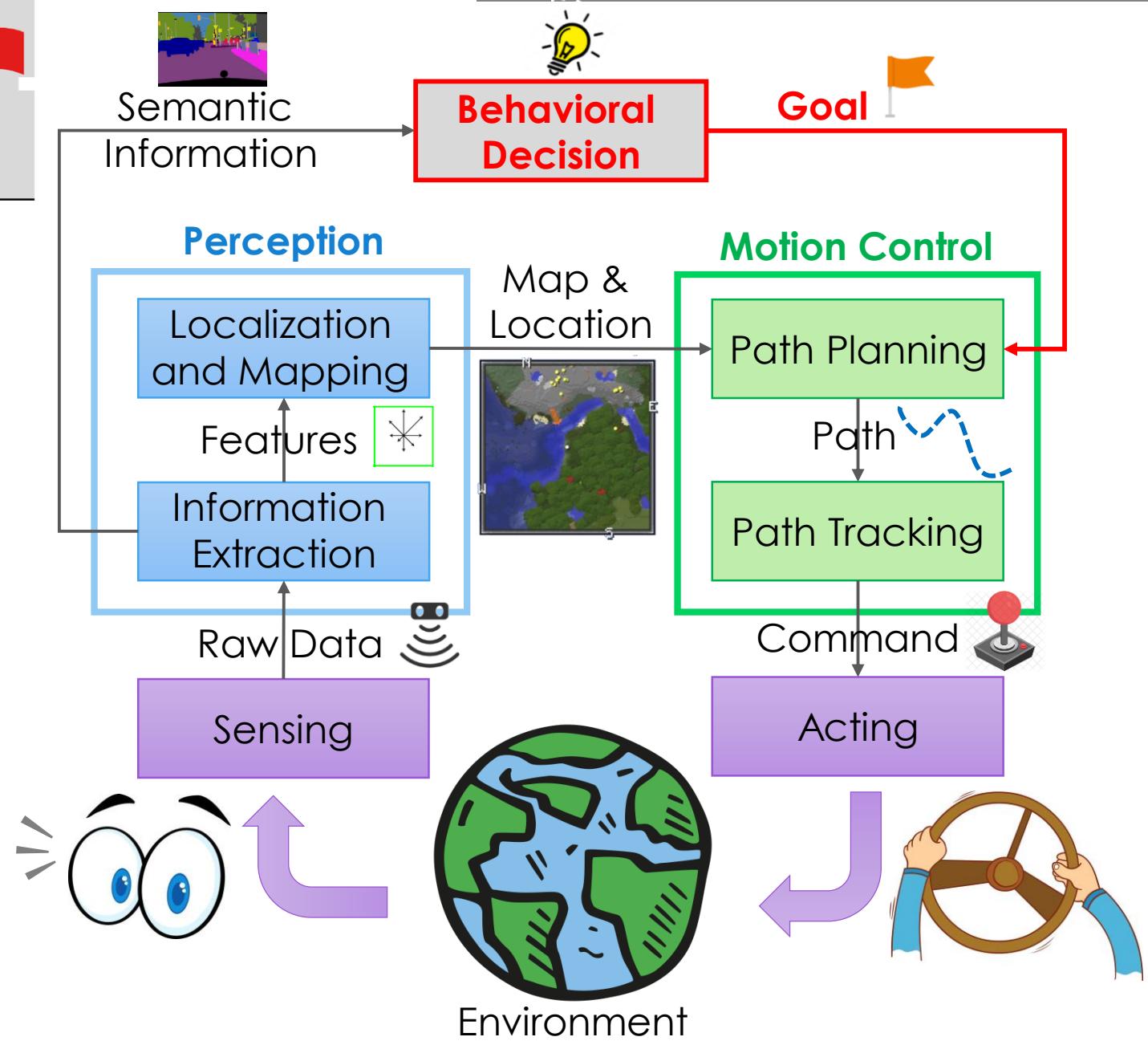
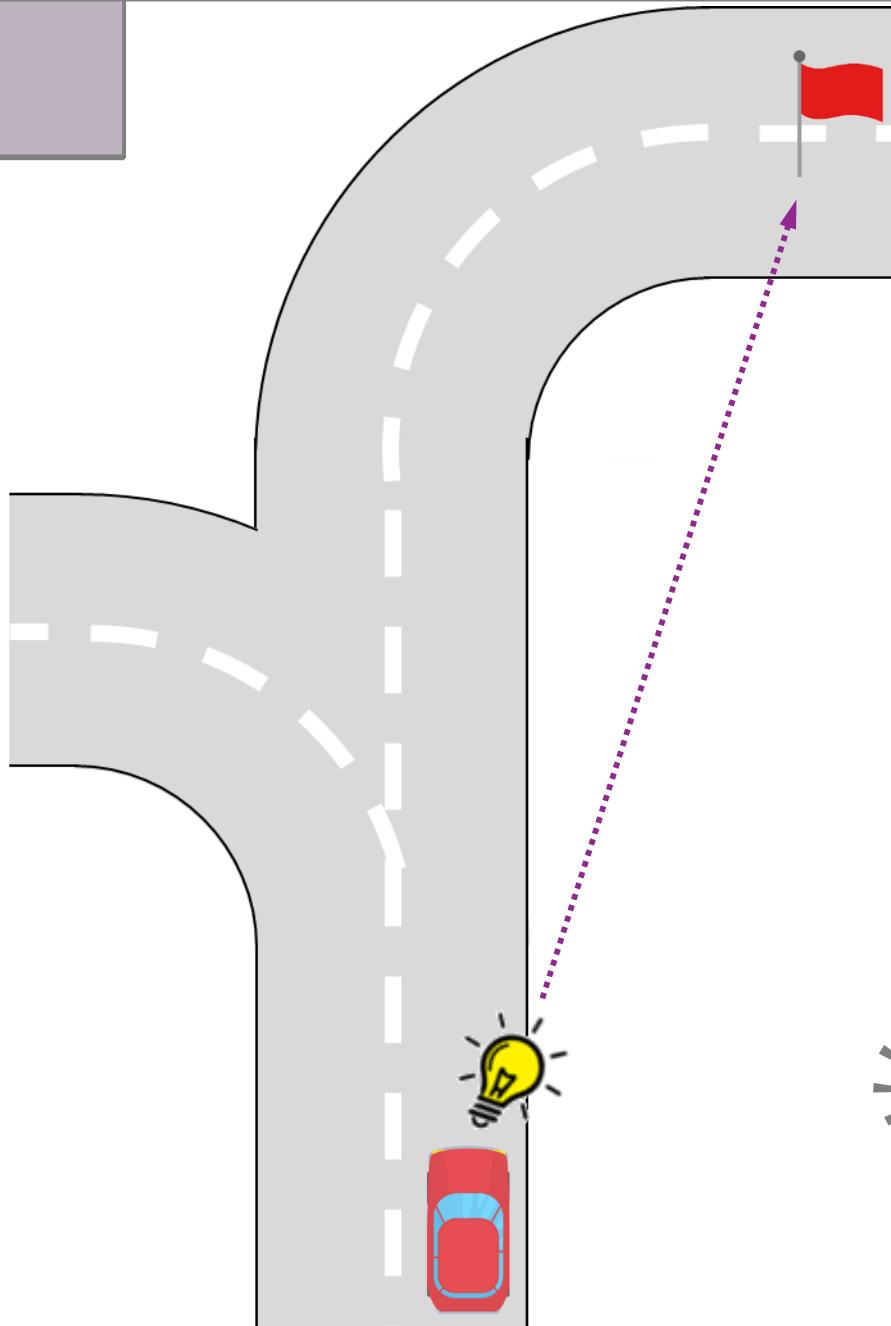


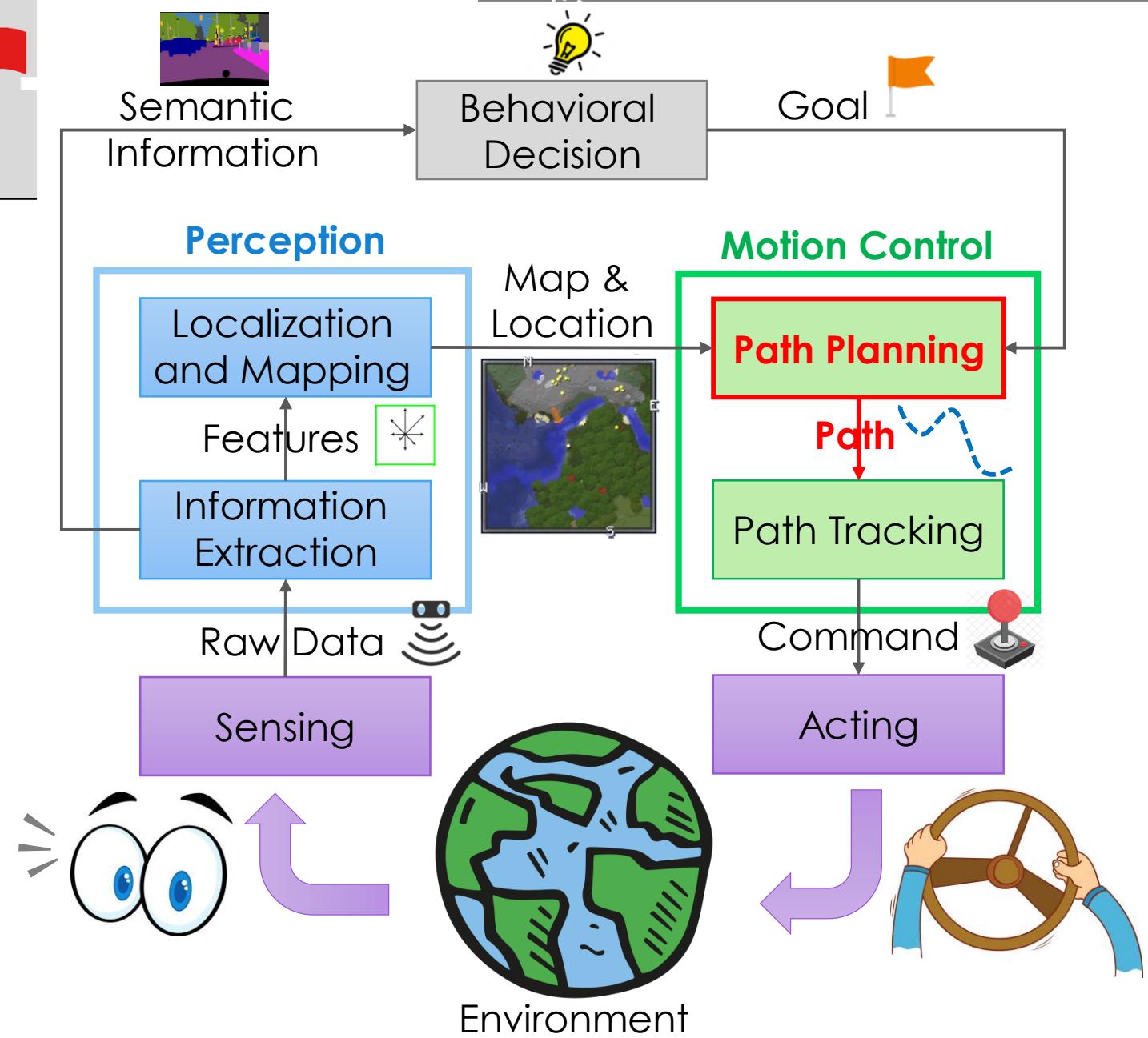
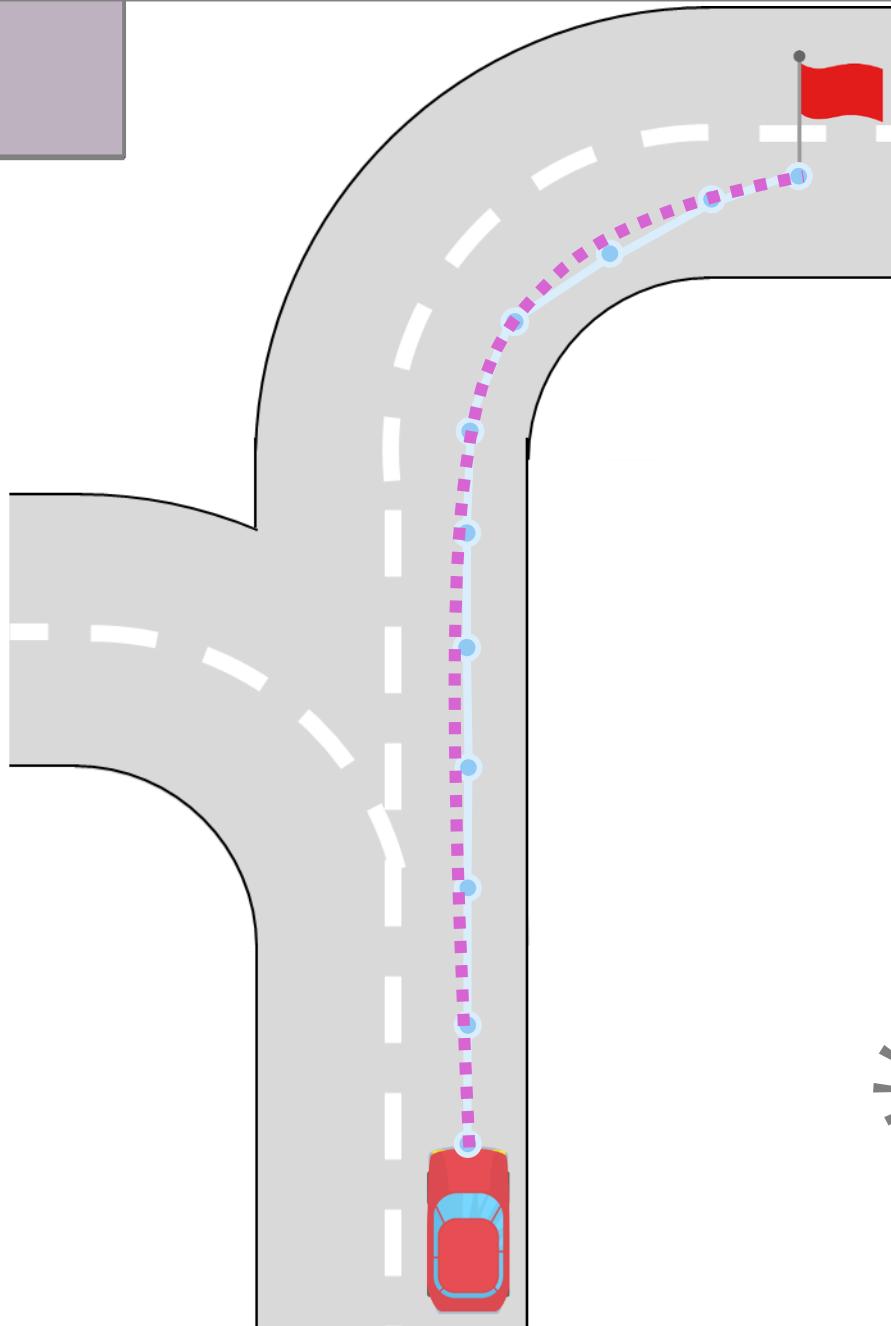


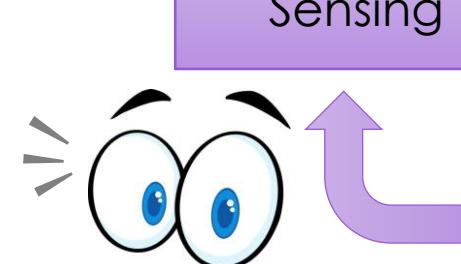
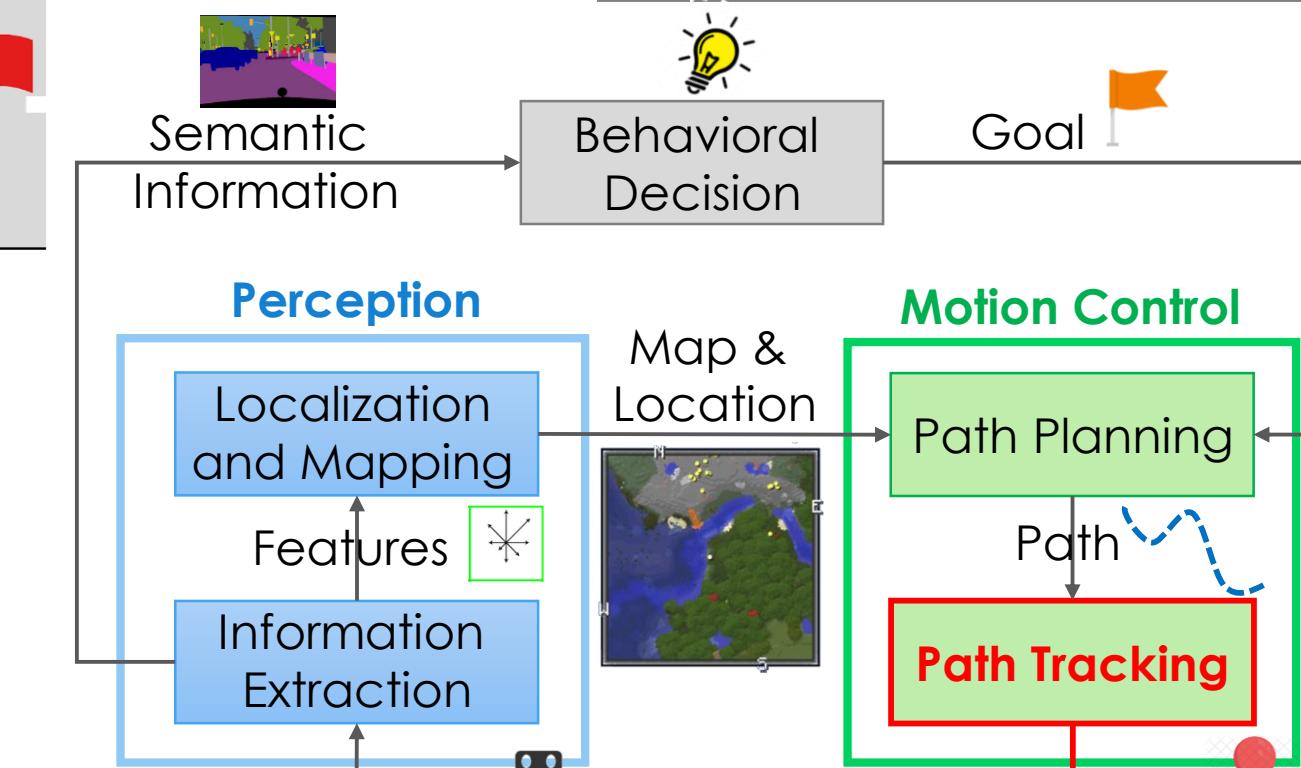
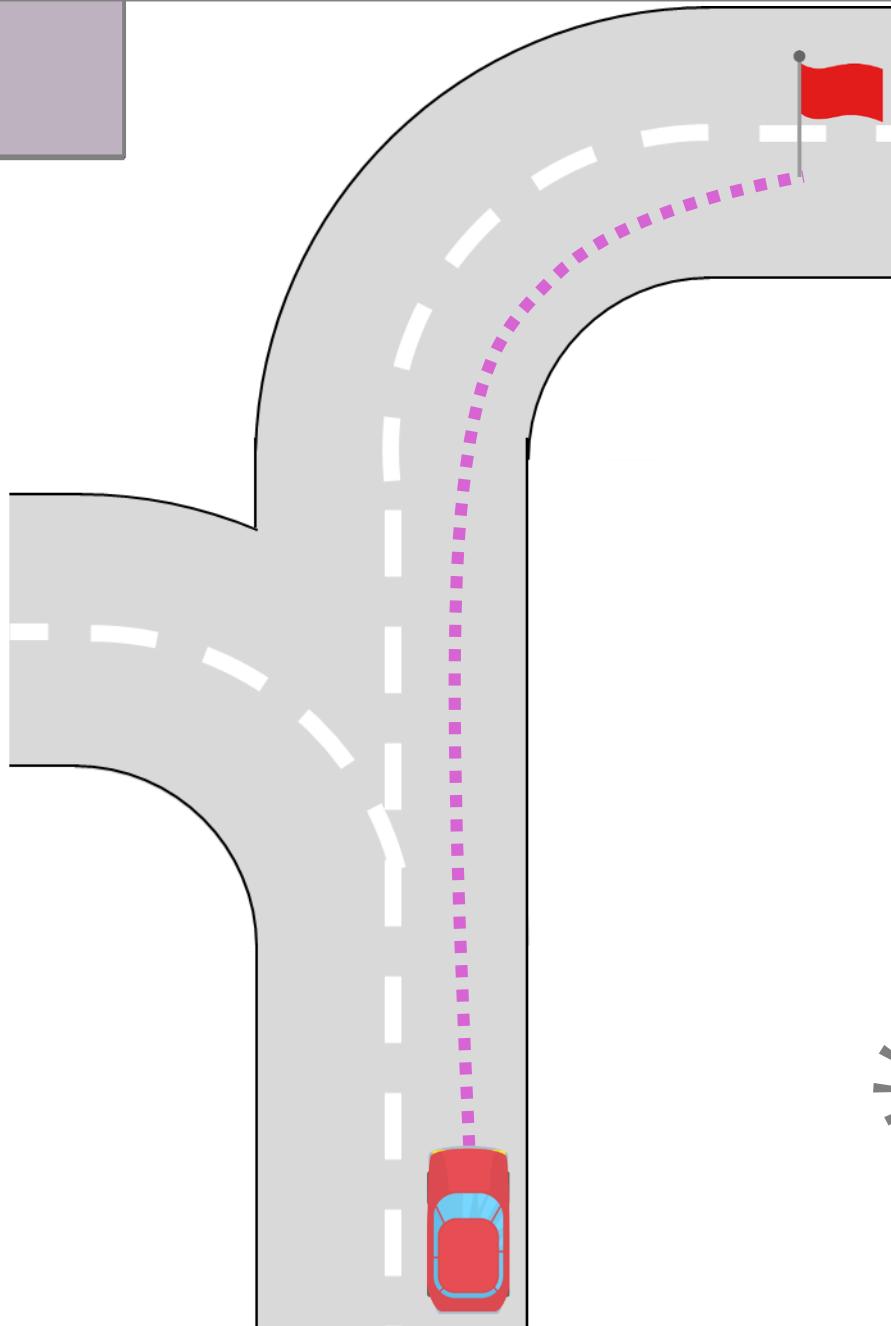






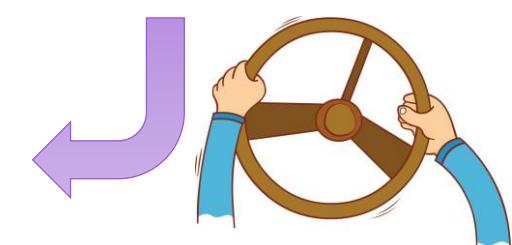




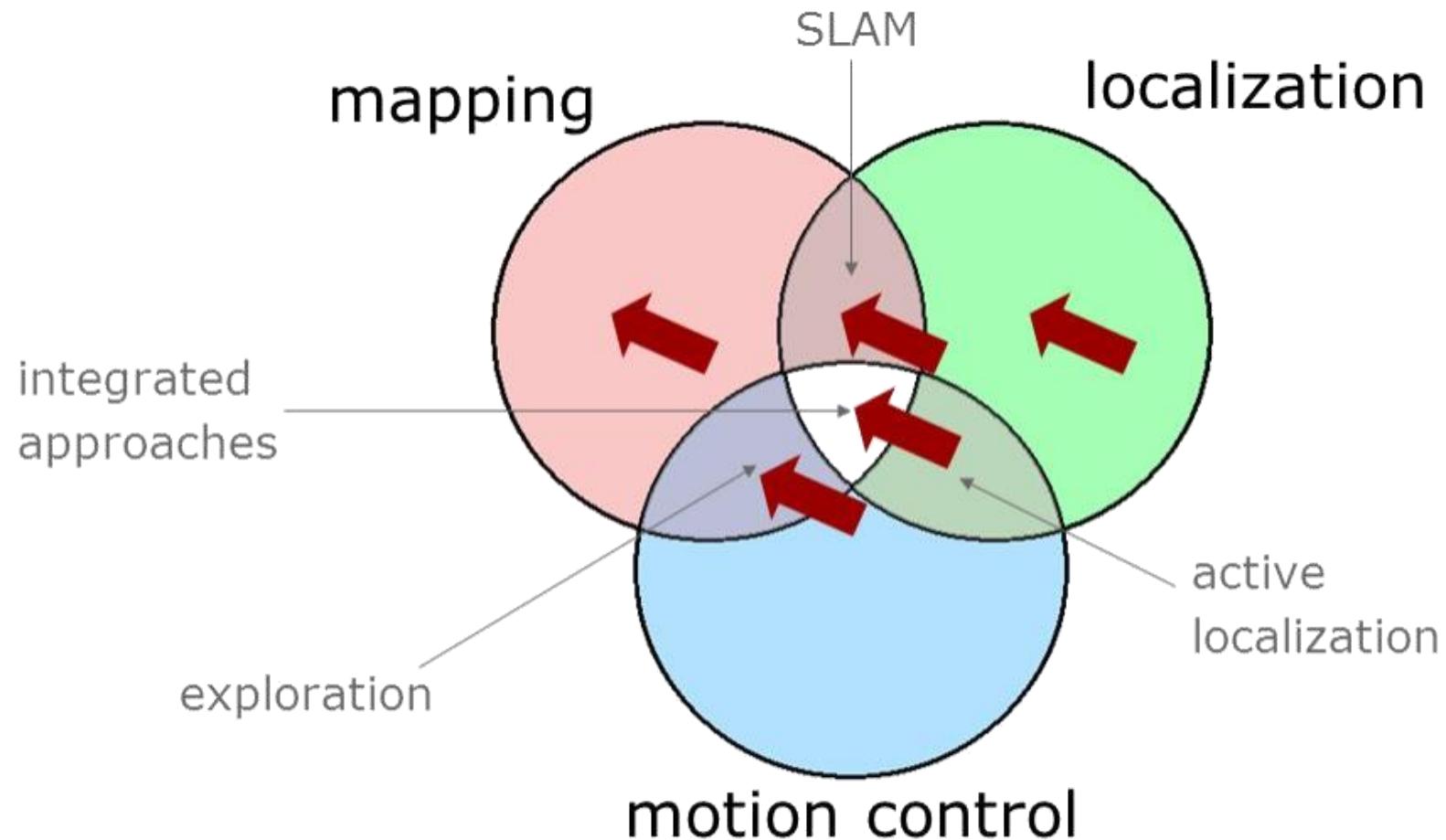


Environment

Acting

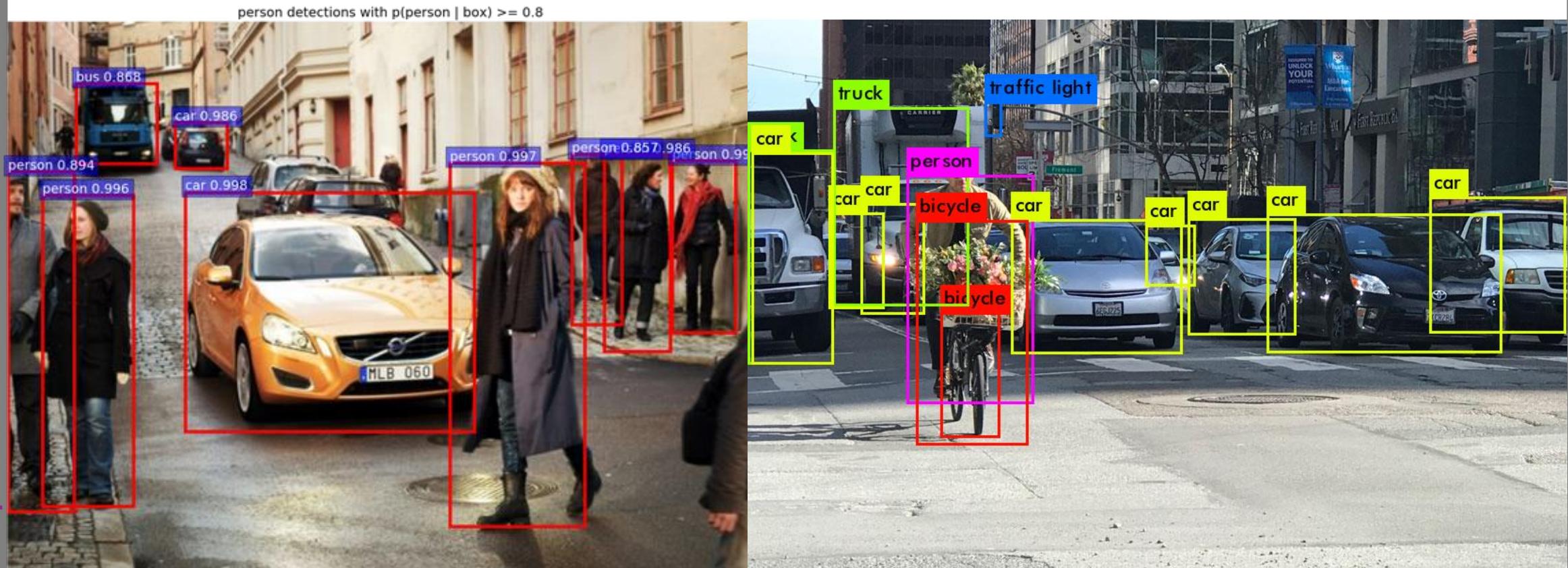


Dimensions of Mobile Robot Navigation



Other Issues

Pedestrian/Car Detection



Road Lane Detection



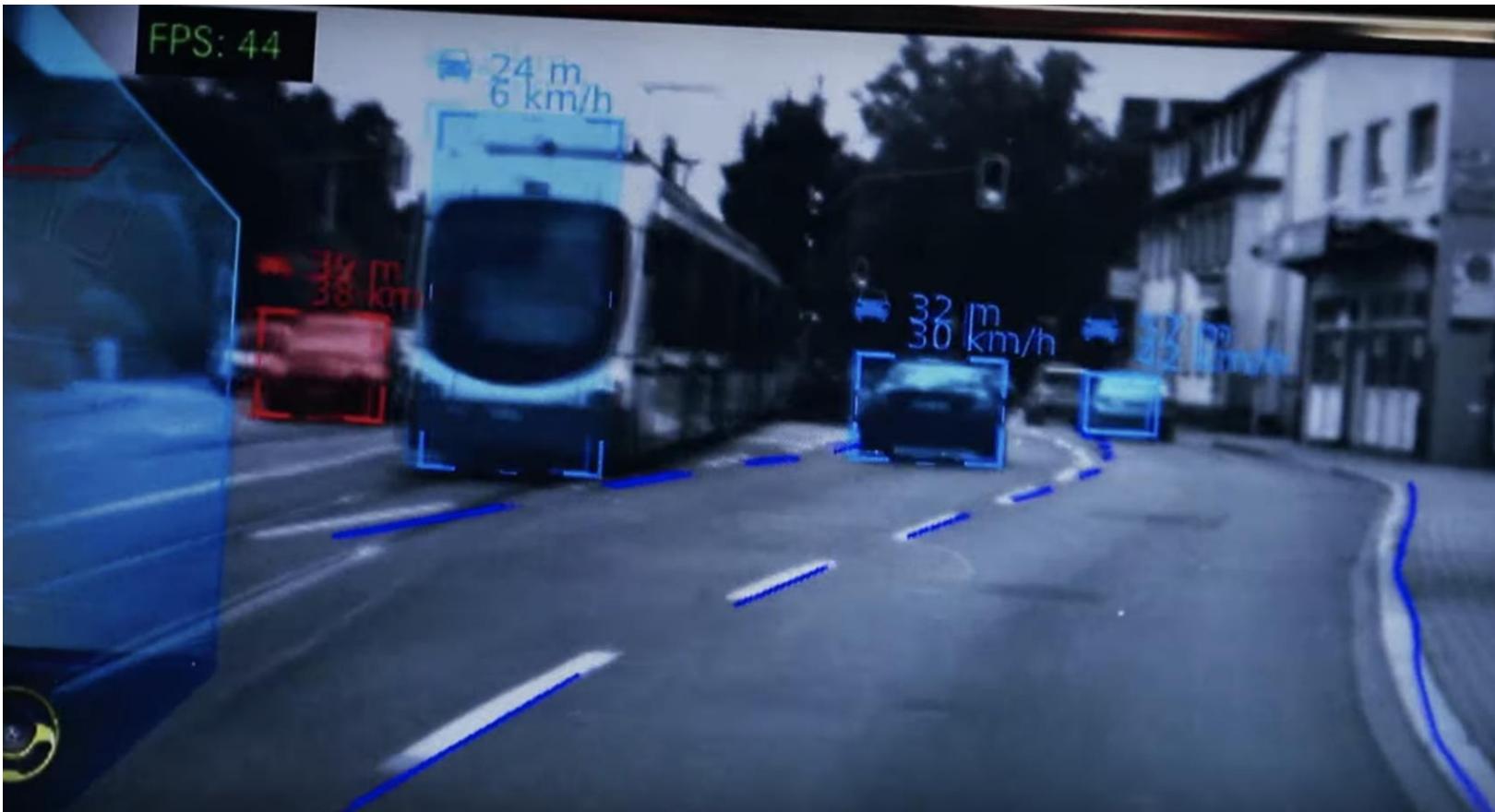
Mercedes-Benz S 500 INTELLIGENT DRIVE | research vehicle

Traffic Light Detection & Identification



Mercedes-Benz S 500 INTELLIGENT DRIVE | research vehicle

Movement Prediction



Mercedes-Benz S 500 INTELLIGENT DRIVE | research vehicle

Accident Avoiding



Motion Estimation



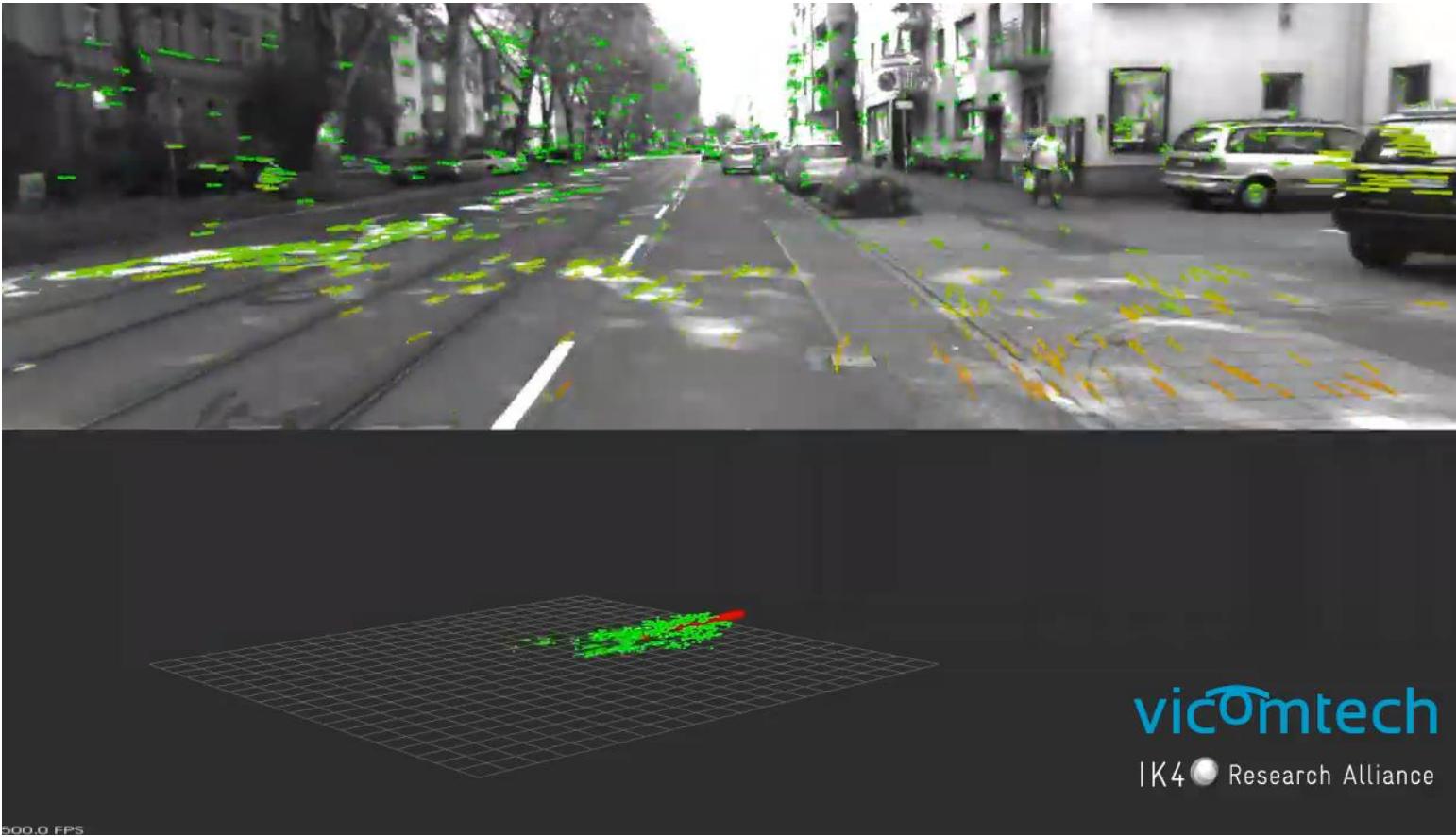
Recognize hazards faster than the human and avoid accidents especially in complex urban traffic situations.

Stereo Reconstruction

- Determines depth to almost every image point in the scene precisely



Ego-Motion Estimation (Visual Odometry)



Real-Time Stereo Visual Odometry and 3D Mapping for Autonomous Navigation
<https://www.youtube.com/watch?v=ITQGTbrNssQ>

Driver Status Analysis



STONKAM Vehicle Security Products



thanks

<https://www.facebook.com/groups/623146941563602/>