DEIS Project

Tollgate - 1

Presented By
Christo George
Ioannis Broumas
Martin Varghese
Meerashine Joe
Neenu Ajilkumar

On 2020-09-25

Functional Requirements

- Lane Keeping Robot
  - Stay in the lane
  - Change lanes if needed
- Platooning and inter robot communication using ROS2
  - Move together with other robots
  - Appropriate action on distress signals
- Safe Crossing at intersections
  - Respect traffic lights
- Safe stopping on detection of Passing emergency vehicles
  - Look out for emergency vehicles and stop when needed.

Non Functional Details

Reliability:

- The system will work in a controlled environment.
- A mixed sensor configuration provides robustness.

Performance:

- Arduino - raspberry pi hybrid design will give better performance.

Security:

- Communication between the robots using ROS2.
- Affirmation with multiple robots to confirm scenarios.

Non Functional Details

Scalability :

- The proposed system is a prototype.

Maintainability :

- Requires domain knowledge and technical knowledge.

Usability :

- Autonomous with minimal engagement with human users.

System Model

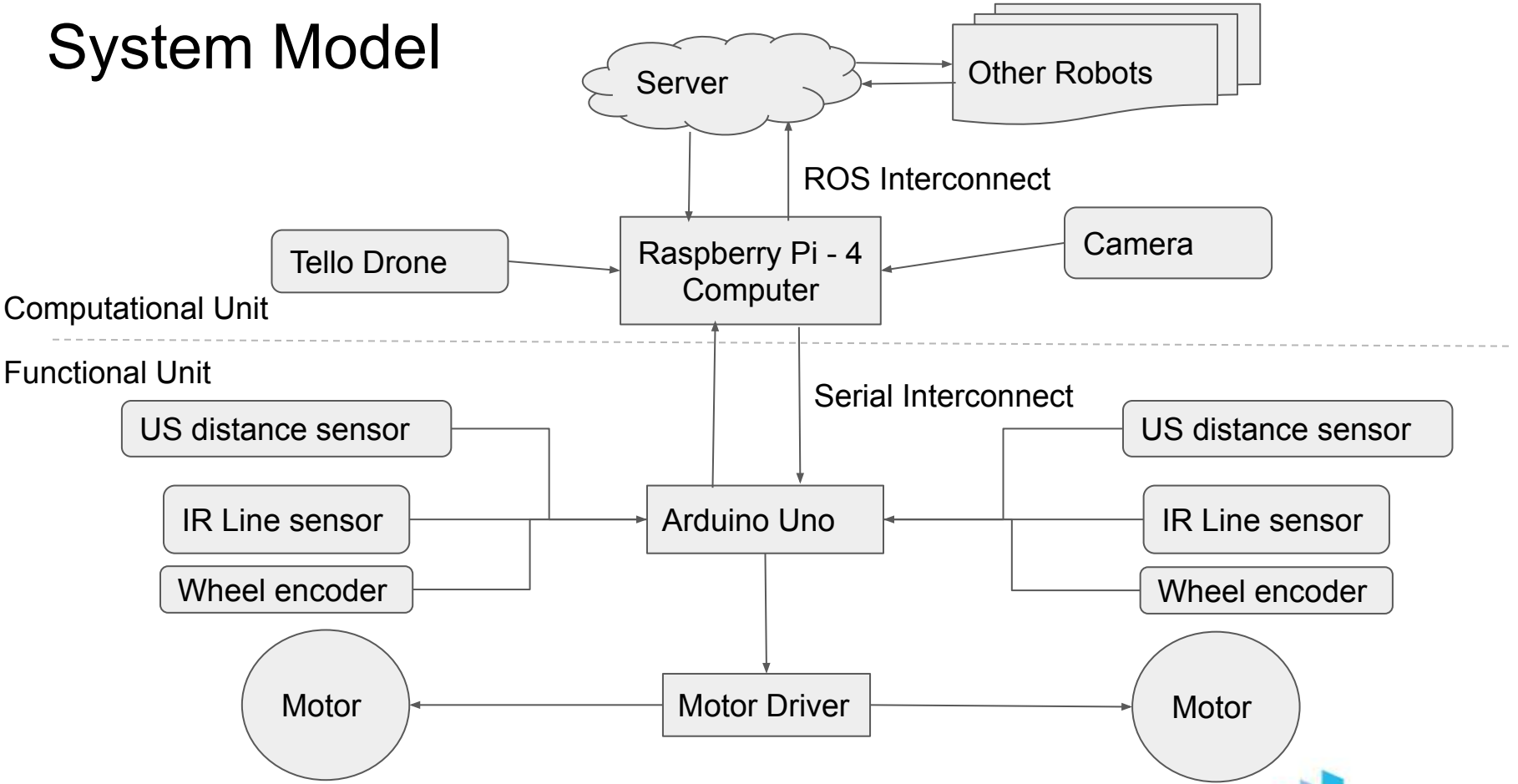
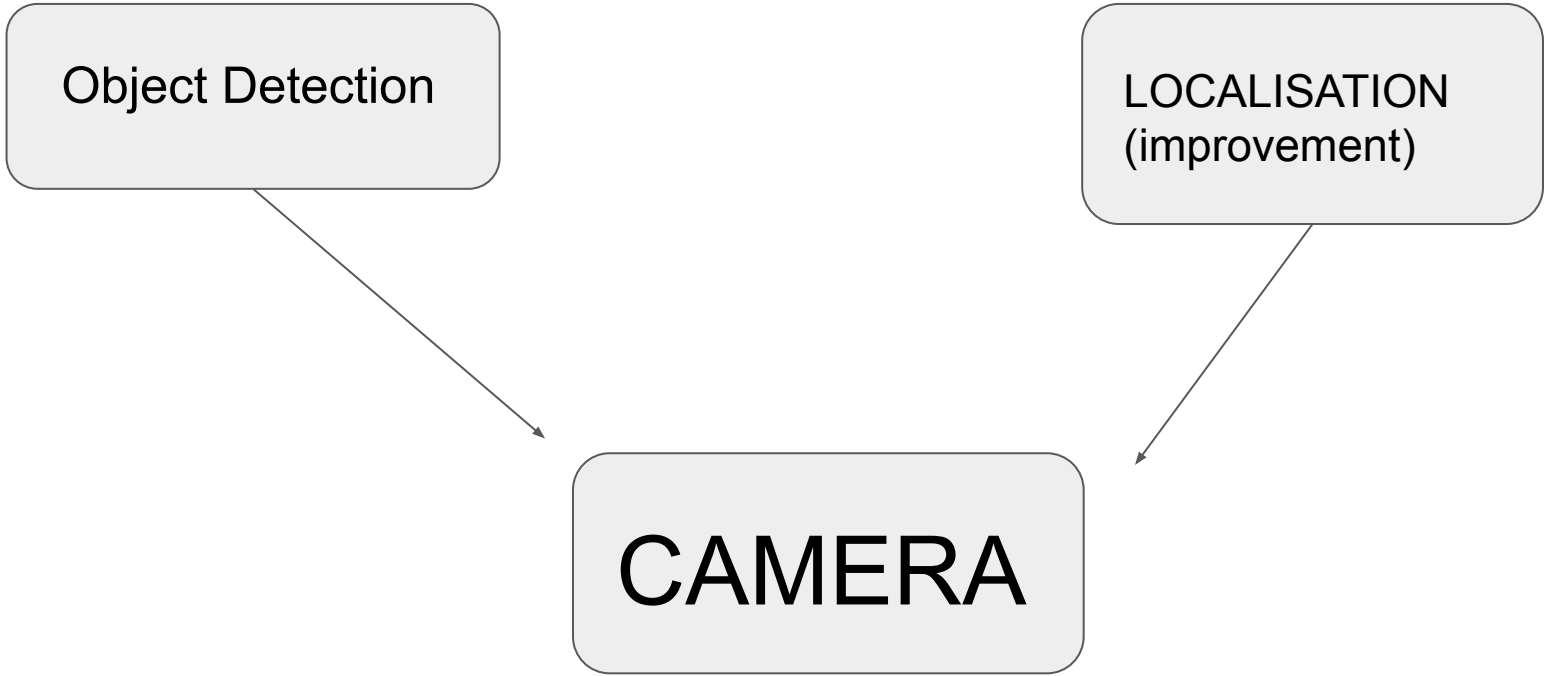
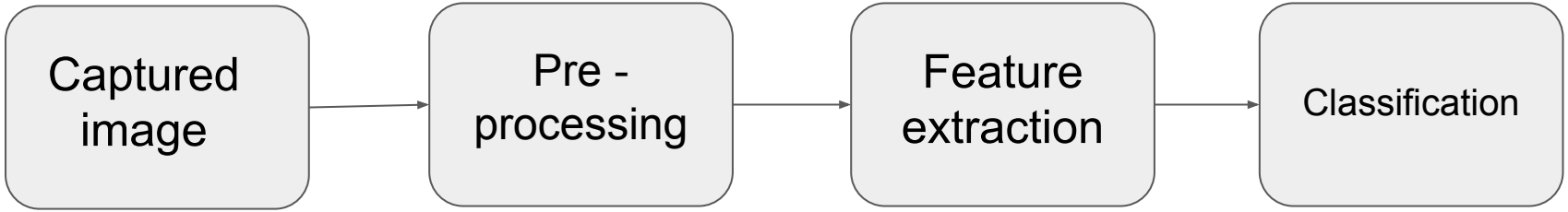


Image Processing



Object Detection

- Detect Obstacle and Color Detection(RGB).
- Traffic Light and Ambulance detection.
- OpenCV, Numpy and Python(combined with ML techniques).



Localisation (DRONE)

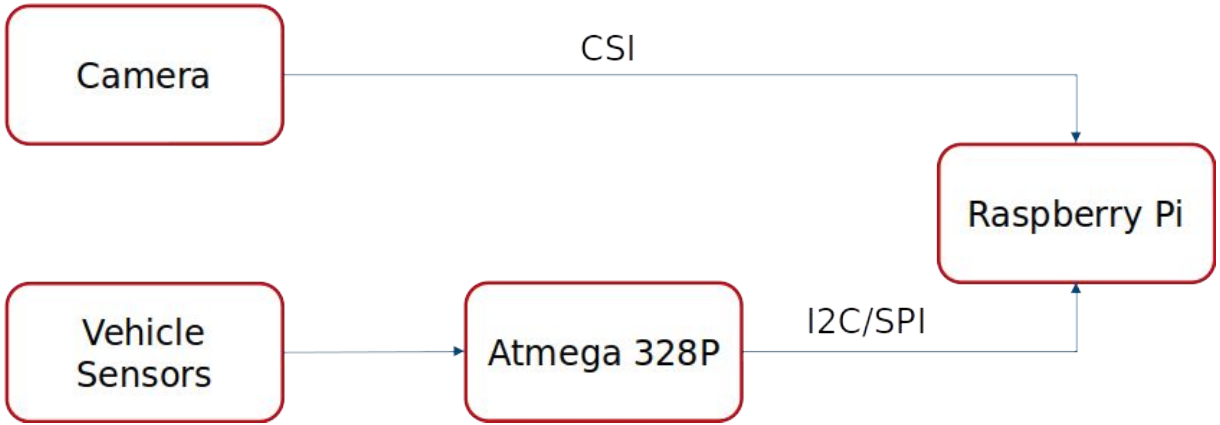
- Additional localisation for the robot.
- Drone at predefined Height.
- Images at certain Interval.
- For re-tracking and positioning.
- Beacon based detection of robot and localising on map.
- Reconfirmation with the robot localisation.

Sensor Fusion

Why?

Sensor fusion is a process by which data from several different sensors are "fused" to compute something more than could be determined by any one sensor alone.

How?



- Programming languages: Arduino(C++), Python.
- Libraries: Pypi, Pygame, NXP® Sensor Fusion.
- Algorithms: Kalman, Extended Kalman, Unscented Kalman, Particle.

What ?

- Line following:

  - Wheel encoder & IR.

- Platooning with safe distance:

  - Wheel encoder & IR

  - Camera & Sonar

Challenges

- If the timing of one sensor drifts with respect to the others, then fusion results can get jittery in odd ways.
- The sensors have different data-rates, package sizes (lengths), it is important that the filter can deal with this.
- Must achieve sufficient computational resource balancing and handling.

Conclusion

A System model for the proposed project is developed.

Hardware and Software components are identified

Tasks and challenges are identified.

References

- https://www.nxp.com/design/sensor-developer-resources/nxp-sensor-fusion:XTRSICSNSTLBOXX
- Real Time Multiple color tracking using Opencv with Python- Aquib Javed Khan[pdf]

Cheers to the day we will run our Robots in E1.