

Team Description :

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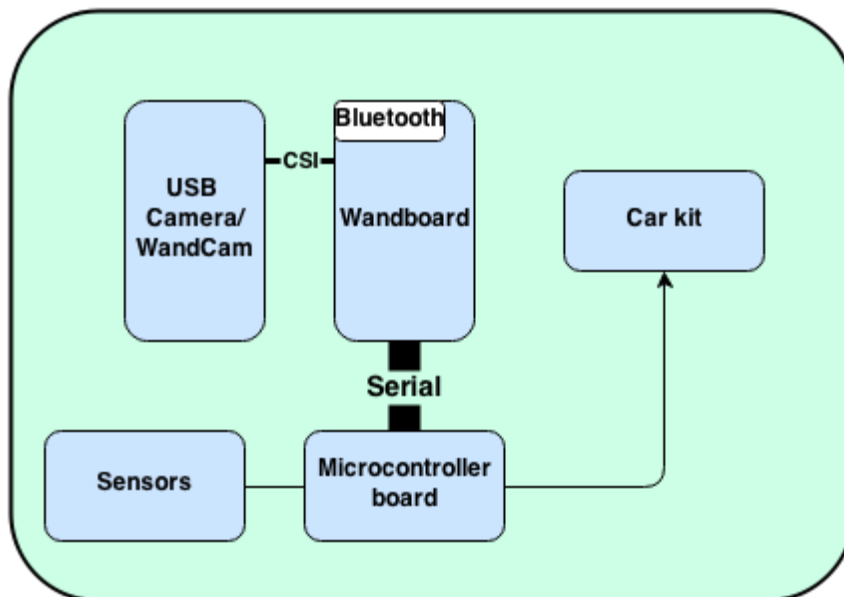
Real Time Collision Detection

1. Describe your idea in detail :

The purpose of our project is to provide cars with a sense of the road ahead and enable it to take preventive actions against collisions; In this way we hope to reduce accidents on the road. It will gather signals and informations from different hardware and will alert the driver or take immediate control of the car in order to make critical maneuvers in order to protect the driver from any life threatening event.

For the sake of this project we will equip a small car with a Wandboard and two USB cameras so we can track the environment. After initial object tracking we will incorporate Human Interaction by remote control. For this project we believe a simple warning system and/or breaking will suffice as a proof of concept.

2. Include architectural diagrams and used technologies :



The main control system will be the Wandboard board, provided by Freescale combined with a Freescale car kit and a set of webcams that will be used to get details of the road status in order to detect and avoid future collisions. We are using the Wandboard's advanced processing power in combination with OpenCV so we can predict the movements and the distances better.

The car will be controlled by a separate device, a microcontroller board, a Bolero Board provided from the Freescale Car Kit.

In the project I used several open source libraries. OpenCV stands at the core of the project, handling almost all of the low-level side of the application. It handles camera frames grabbing, image transformations (to reduce the size of the each frame), color transformations (colours are not needed for a clear detection; by transforming to a greyscale format we reduce the memory and increase the speed of processing). After OpenCV processes the input, we run the images through a blob detection algorithm, that tries to map pixels to objects using hue similarities. By comparing the blobs from both frames, and by taking into account specific constants regarding the cameras and the distance between them they program can estimate the distances between the cameras and various objects. After the processing is done, the system determines whether it should stop and also feeds the user interface with several screens for feedback and debugging purposes.

3. Mention the improvements it brings to Automotive world :

By refining the features provided by this project multiple paths can form from this project:

Better self-driving cars -> Self driving cars should use multiple systems for detecting distances and obstacles, as the system cannot allow any room for error. Multiple systems used in a feedback loop would complement each other. Also, as the technology is just starting, any negative experiences from the customers would greatly impact the technology adoption rate.

Driver assistance -> before complete automation of the driving is complete, the human element will still play a huge role in automotive. However the burden on individuals can be lessened with smarter tracking of the road and its participants and by providing smarter alerts to the driver.

4. Issues encountered:

- The cameras had poor driver support and we had to experiment with different configurations until we could get two working cameras on Wandboard. Also the board itself has its own configuration broken, as the USB port is not running USBv3 software and hardware stack. The final configuration uses a camera on the USB port and another one on the USB OTG port.
- The Bolero chip did not have a RS232 connector needed by the serial. We did attempt to add a MAX232 chip on the Bolero chip but it seems that there are more issues.
- The software used to track independent objects only had support for Windows systems; an OS independent version of the project was built.

5. Tools used:

- Software library for tracking objects ->
 - project link and description <https://www.youtube.com/watch?v=PR9tlFay0U8>
- Wandboard
- Freescale Car kit
 - Bolero Board
 - Motor driver
- Code warrior