



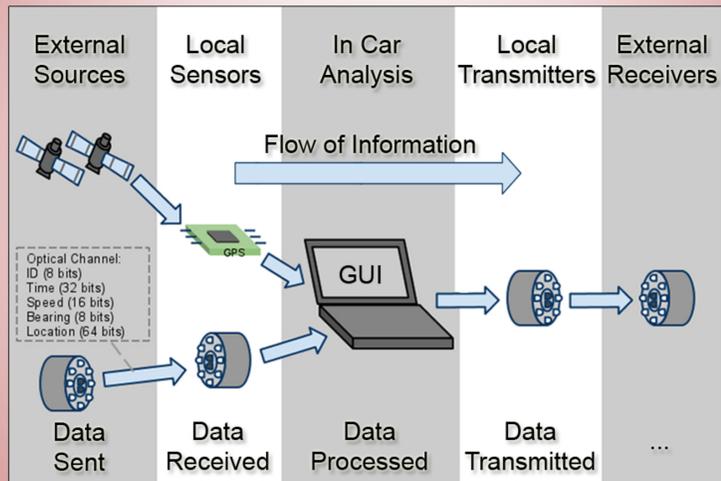
Vehicular Networking Using Optical Transceivers

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System Overview



Introduction

In this work we describe a system for exchanging vehicle state information using short-range directional optical transceivers. The system design is intended to mitigate contention associated with using a radio frequency medium; that which has been demonstrated to be severe enough to jeopardize latency constraints required for safety messaging. Our demonstration system consists of an onboard vehicle computer, four interfaced free space optical transceivers, I/O hardware, and vehicle state messaging, management, and distribution software.

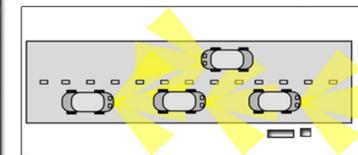


Future Test Vehicle (Photo courtesy of a team member and is non-affiliated with manufacturer)

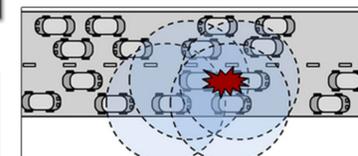
Applications

We foresee this technology to enable advancements in:

- Collaborative vehicle information sharing (braking, accel., etc)
- Safety broadcast messaging
- Traffic assessment and notification
- Custom application development



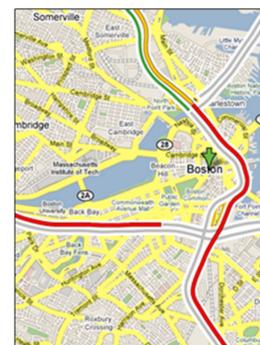
Directional Short Range Communication



Incident Awareness and Dissemination



Active Braking Notification (Multi-Hop Transfer)



Traffic Monitoring and Assessment (Image from google maps)

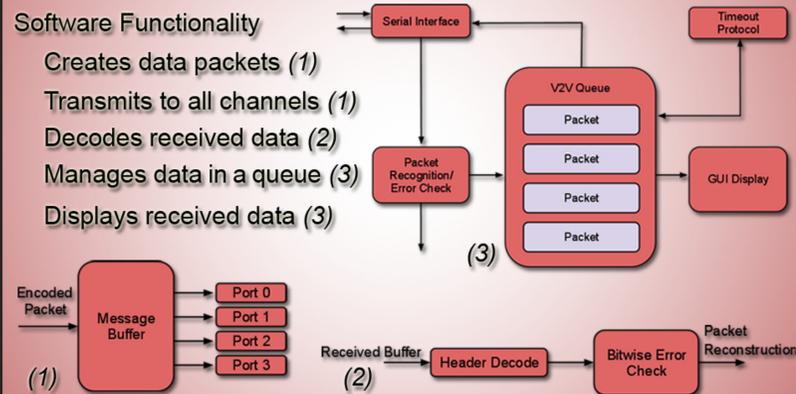
Deliverables

- Optical TX and RX circuit designs
- Supporting software and drivers
- Functional transceiver PCB's (10)
- Four-transceiver mobile prototype

Future Work

- LED head/tail light circuit modification
- Installation of prototype in a vehicle
- Integration with vehicle diagnostics
- Software expansion and enhancement
- GUI development to be end-user friendly

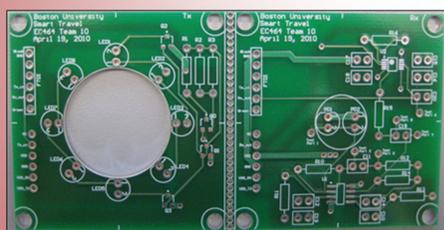
Software Overview



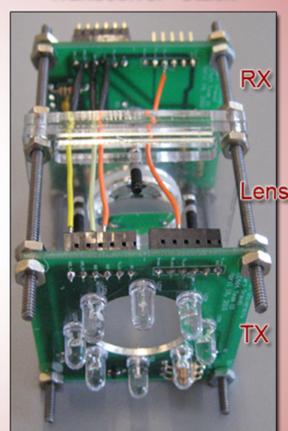
Transceiver Overview

Transceiver PCB Breakdown

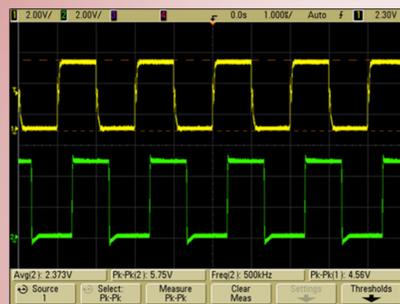
- Tx Board (left)**
- Transmits a digital signal
 - Modulates LEDs "On/Off Keying"
- RX Board (right)**
- Photodiodes receive signal
 - Digitizes incident waveform



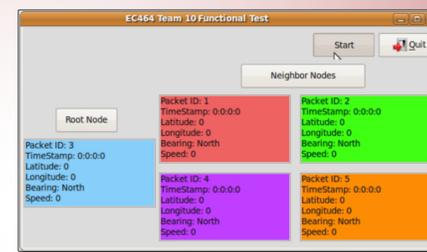
Transceiver "Stack"



System Operation



Transmitted and Received Signal (yellow/green)

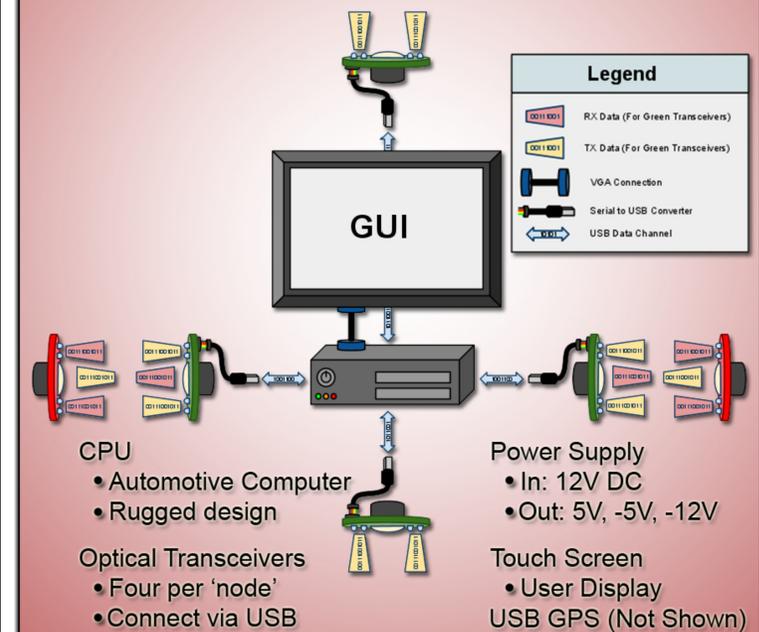


Data Queue Display GUI

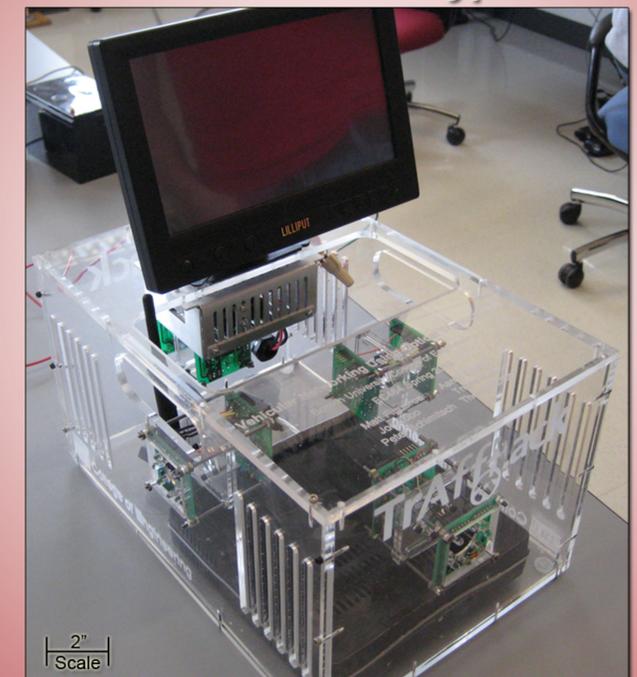
255	160	159	152	151	136	135	104	103	72	71	40	39	32	31	0
Empty Bits for Future Applications	Bearing	Speed	Latitude	Longitude	Time & Date	ID	Preamble								

Data Packet Structure

Hardware Overview



Mobile Prototype



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