
Project Review

P19501 Blind Turn Warning Signal

Multidisciplinary Senior Design 1

Team

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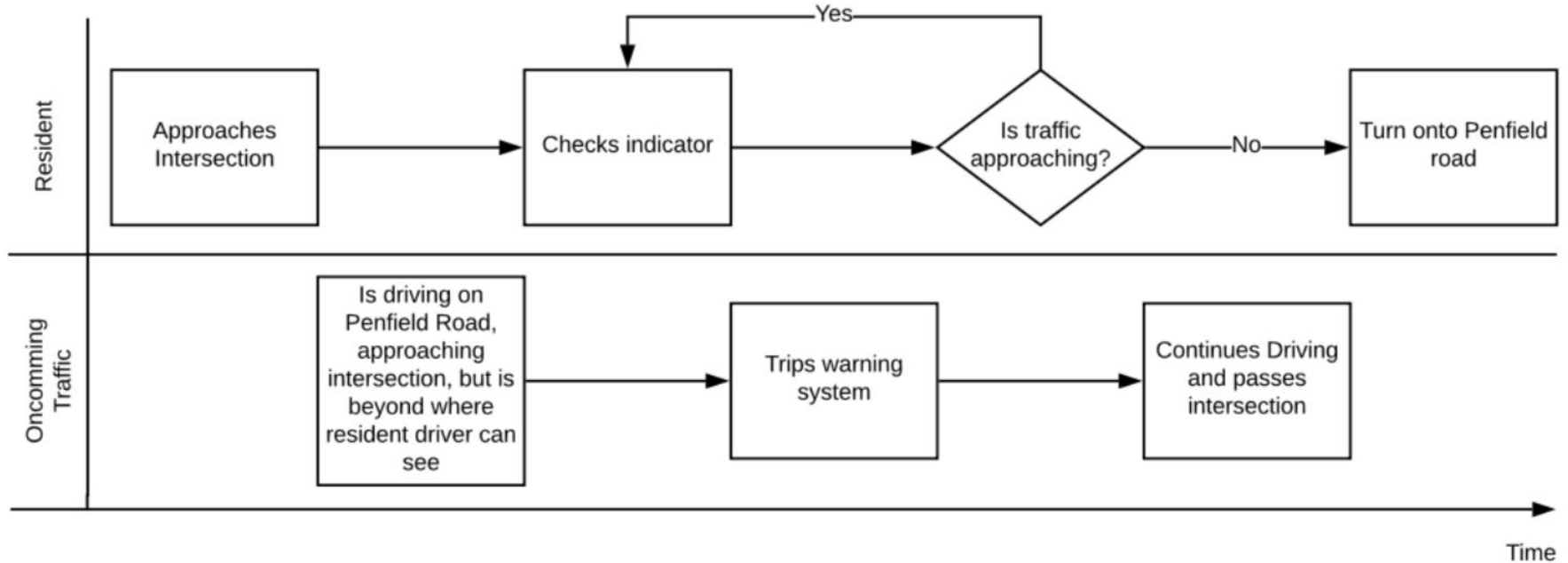
RIT

Problem Statement



Allen Creek Valley residential drivers are in danger of an accident coming out of the development, due to low visibility when merging onto the main road. Merging into traffic poses a hazard from both the left and right sides of the intersection.

Use Scenarios



Customer Requirements

P19501: Blind Turn Warning System Customer Requirements - Updated January 28, 2019

Category	Number	Rank	Customer Requirement	Comments
Functional	CR1	9	Detect if there is oncoming traffic	Need to know if there is an oncoming vehicle (car/truck/motorcycle)
	CR2	9	Easy to understand	Must be clear whether indicating oncoming traffic or clear
	CR3	9	Prefer car-based system	Due to liability issues, device must be something that can be sold or given to individual drivers.
Safety	CR4	1	Fails Safely	Driver must know the device is failing (low battery, no signal, etc.) so that they do not turn blindly into oncoming traffic
	CR5	9	Not a distraction to the driver	Possibly use a sound signal to warn driver so they do not have to look at the device. Could have light in case driver is hearing-impaired
	CR6	9	Clearly alerts driver	Driver can't be unsure of signal
Durable	CR7	9	Functions in all weather	In snow, ice, fog, rain, etc. device has to be fully functional.

Engineering Requirements

P19501: Blind Turn Warning System Engineering Requirements - Updated January 28, 2019

ERs	Importance	CR#	Description	Function	Unit of Measurement	Target Value	Tolerance
ER1	9	CR1	Traffic detection range	System Operation	Meters (m)	20	±10%
ER2	9	CR1	Timing from detection system to car	System Operation	Seconds (s)	Less than 0.5	--
ER3	9	CR2, CR6	Clear LED indicators	System Operation	N/A	N/A	--
ER4	3	CR4	Low-battery indicator	System Operation	Volts (V)	2	±1
ER5	9	CR3	Wireless connection range	System Operation	Meters (m)	500	±10%
ER6	3	CR6	Frequency of buzzer	Sytem Operation	Hertz (Hz)	20 to 20,000	--
ER7	3	CR5	Adjustable volume	System Safety	Decibels (dB)	Max 70	--
ER8	9	CR7	Operating temp	System Robustness	Degrees Celsius (°C)	-30 to 80	--
ER9	9	CR7	Waterproof housing	System Robustness	N/A	N/A	--
ER10	9	CR3	In-car device input power	System Portability	Volts (V)	Max 12	--
ER11	1	CR3	In-car device weight	System Portability	Kilograms (Kg)	Less than .5	±10%
ER12	1	CR3	In-car device size	System Portability	Centimeters (Cm)	5x10x15	±10%
ER13	9	CR3	Max power consumption	System Portability	Milliwatts (mW)	Max 600	±10%

House of Quality

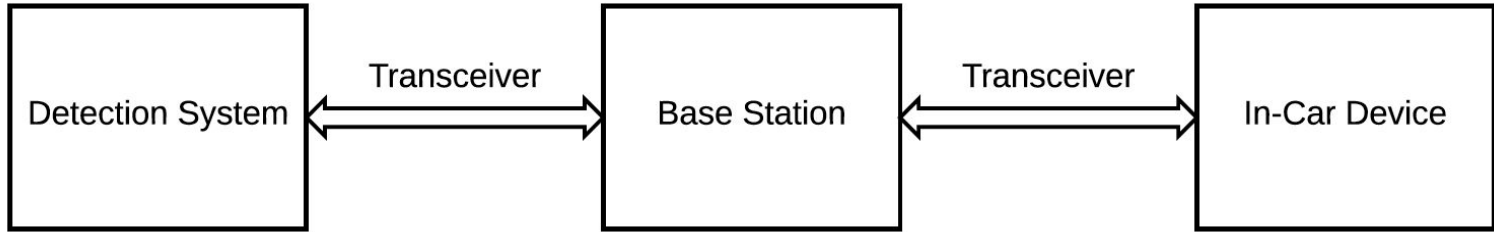
		ER1	ER2	ER3	ER4	ER5	ER6	ER7	ER8	ER9	ER10	ER11	ER12	ER13
		Engineering Requirements												
Customer Requirements	Priority	Traffic detection range	Timing from detection system to car	Clear LED indicators	Low-battery indicator	Wireless connection range	Frequency of buzzer	Adjustable volume	Operating temp	Waterproof housing	In-car device input power	In-car device weight	In-car device size	Max power consumption
CR1	Detect if there is oncoming traffic	9	9											
CR2	Easy to understand	9		9										
CR3	Prefer car-based system	9				9					9	1	1	9
CR4	Fails Safely	1			3									
CR5	Not a distraction to the driver	9						3						
CR6	Clearly alerts driver	9		9			3							
CR7	Functions in all weather	9							9	9				
	Raw Score	81	81	162	3	81	27	27	81	81	81	9	9	81
	Relative Weight	10.07%	10.07%	20.15%	0.37%	10.07%	3.36%	3.36%	10.07%	10.07%	10.07%	1.12%	1.12%	10.07%

Benchmarking

Brand	Safe-T-Signal Warning System	Intersection Collision Warning System, DOT	Collision Sentry
Detection range	Adjustable detection zone	N/A	20-25 feet
Operating temperature	From -40 C to 60 C	N/A	N/A
Power supply	100-240VAC 50/60 Hz	Electrical grid/Solar panel	N/A
Power consumption	< 10W standby, <50W maximum	N/A	N/A
Warning method	LED stop/yield signals	LED flashing	Visual and audio warning
Cost	Unknown, possibly expensive	From \$15,000 to \$35,000	282.95
Comments	Not in-car device, mainly for in-door use	High cost, not in-car device	Not in-car device

Design Concept

1. Main function:



2. Sub-functions:

- Detection System
 - Base station
 - In-Car Device
 - Transceiver
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Risk Management

#	Risk	Type	Cause	Effect	Likelihood	Severity	Importance	Action to minimize risk
3	Unsyncronized real-time detection and in-car device alerts	Technical, Safety	Communications method is to slow	Driver may think it is clear to go when it is unsafe to do so	9	9	81	Use efficient coding practice that won't take too much time
5	Transmitter/receiver signals not connecting properly/not being in range	Technical, Safety	Errors in code	Driver may think it is clear to go when it is unsafe to do so	3	9	27	Exhaustive tests and writing clean code with full documentation of code
6	Unstable wireless connection between systems	Technical	Too many electrical signals in the area	Driver may think it is clear to go when it is unsafe to do so	3	9	27	Test in multiple environments, might have to use some wire communications
20	Weather may cause visibility issues with devices	Environmental, Safety	Bad weather	We can't test certain features of our device(s)	9	3	27	Try to make system as robust as possible and make users aware that in cases of extreme fog or whiteouts, etc. the device may not be 100% accurate
