

ADMINISTRATIVE INFORMATION:

- Project Name (tentative): Rear-View Video System for Bicycles
- Project Number, if known: _____
- Preferred Start/End Quarter in Senior Design:
 Fall/Winter Fall/Spring Winter/Spring
- Faculty Champion: *(technical mentor: supports proposal development, anticipated technical mentor during project execution; may also be Sponsor)*

Name	Dept.	Email	Phone

For assistance identifying a Champion: B. Debartolo (ME), G. Slack (EE), J. Kaemmerlen (ISE), R. Melton (CE)

- Other Support, if known: *(faculty or others willing to provide expertise in areas outside the domain of the Faculty Champion)*

Name	Dept.	Email	Phone
Dr. Adriana Becker-Gomez	CE/EE		

- Project “Guide” if known:
- Primary Customer, if known (name, phone, email):
Sharief B’dour [Bert’s Bikes]
- Sponsor(s): *(provider(s) of financial support)*

Name/Organization	Contact Info.	Type & Amount of Support Committed

PROJECT OVERVIEW:

Bicyclists often have difficulty being able to view traffic that is approaching from behind. Eighty percent of the catalogued bike wrecks involved rear approaching vehicles, so therefore a more effective and universal rear-view system has much potential. Current rear-view systems have issues with providing a proper viewing angle, having a device located in a desirable location, and allowing riders to easily adjust the system. In order to address these problems, your team is charged with creating a rear-view video system that enables a bicyclist to see traffic approaching from the rear through their smartphone. This task will need to be done in a way so that a camera on the bike will connect with a smartphone and provide the cyclist a clear view of rear traffic on their smartphone screen. The smartphone application should be configured to optimize the battery life of the smartphone while it is displaying the video stream from the camera.

The project goal is to create an integrated package that contains a smartphone application that will work in conjunction with a camera located on the bike. The team will be required to display an image of rear-approaching traffic on smartphone screen as a rider travels down a road.



a) Smartphone application



b) Rear-view camera on the market

DETAILED PROJECT DESCRIPTION:

Currently, there are multiple different types of rear-viewing systems for bicyclists, ranging from attachable mirrors to the bike, helmet, or sunglasses to digital video systems that exist on the market. All systems have their pros and cons however. Mirror systems tend to be fairly inexpensive, ranging from \$10-\$30 but current issues with the mirror systems involve lack of image clarity, blind spots, and safety hazards due to materials that the mirrors are constructed of. The current video system available transmits an image from a rear-facing camera to a video module interface that goes on the handlebars of a bike. The cost for the system is \$299.50. The innovation of the proposed project is that system integration of a smartphone application with the use of a rear-facing camera that will transmit an image to the smartphone. The innovation will be less costly in comparison to the current digital video system due to the fact that the image will displayed on a user's smartphone, so no additional display device is necessary.

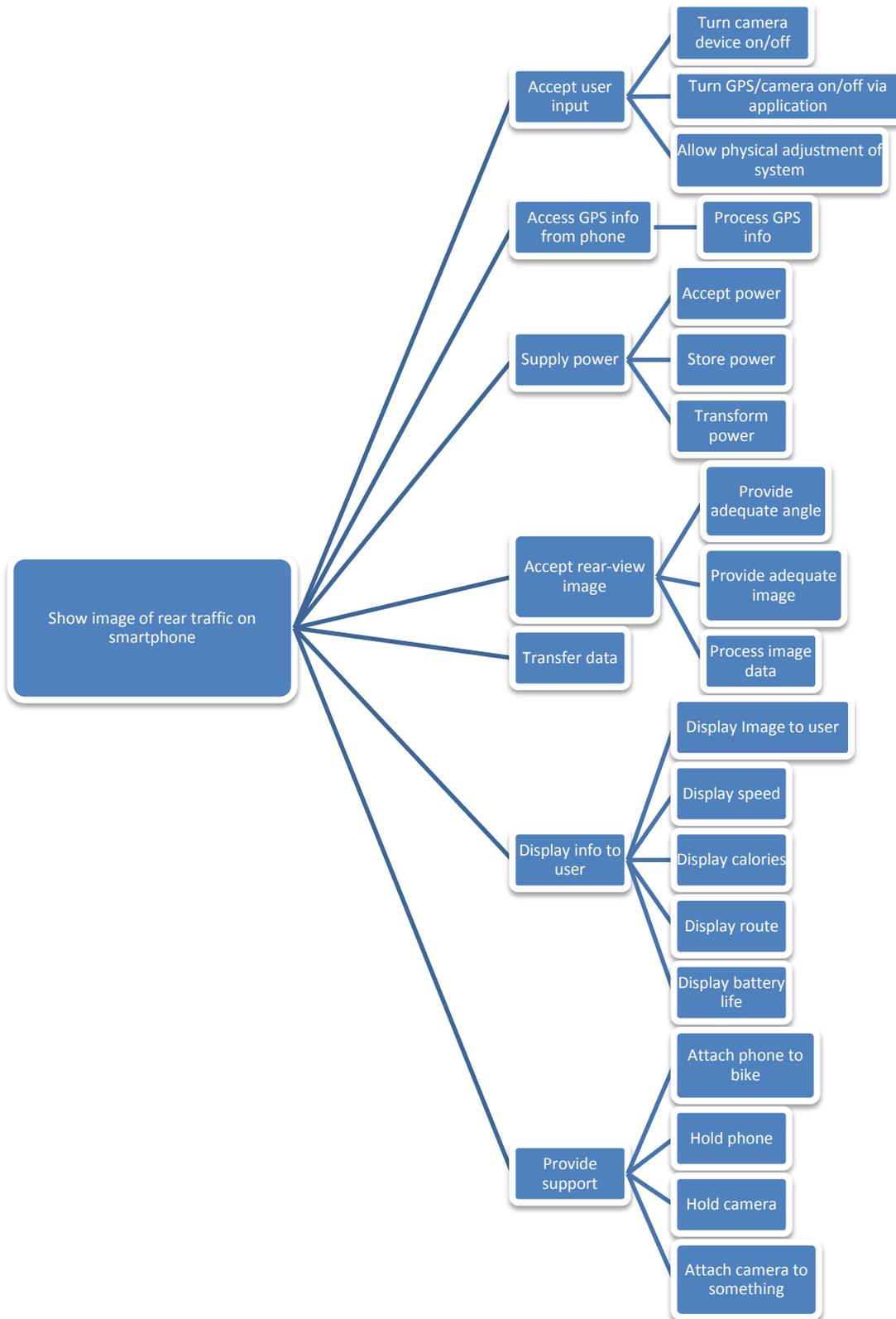
CUSTOMER NEEDS AND OBJECTIVES:

Customer Need #	Importance (Rated 1-3, 3=most important)	Description
CN1	9	The device enables the bicyclist to view rear approaching traffic.
CN2	9	The camera battery is capable of lasting at minimum, the length that the smartphone battery lasts.
CN3	3	The system is capable of being detached from the bike, [for security reasons]
CN4	3	A quality image is produced on the screen.
CN5	3	The application contains a smartphone battery power saving feature [i.e. able to turn off video on the application if no longer need to see rear approaching traffic]
CN6	1	The system is reasonably priced. [\$50-150]
CN7	3	The system does not interrupt the cyclist during riding. [i.e. if wired, wires do not interfere with rider]
CN8	3	There is limited variability in system performance once system is placed on bike.
CN9	1	The entire system is intuitive for cyclist to use.
CN10	3	The system is capable of being dropped from the bike without breaking.
CN11	9	The system is adjustable for the rider to get the best possible rear-view image
CN12	3	The application can track statistics for the rider such as speed, mileage, calories burned, etc.
CN13	3	The system is lightweight.
CN14	9	The external camera is housed in a weather resistant mount.

Stakeholders:

- MSD Team
- Mark Smith and MSD Faculty
- Sharief B'dour (Bert's Bike)
- Bicyclists
- Ant + company (if wireless transmission is chosen)
- Camera manufacturer

- Functional Decomposition:



- Potential Concepts: *(see attached)*
- Specifications (or Engineering/Functional Requirements):

#	Source	Specification	Unit of measure	Marginal Value	Ideal Value
S1	CN1	Camera viewing angle	degrees	90	>160
S2	CN2	Camera battery life	hrs	5	>48
S3	CN2	Smartphone battery life	hrs	1	5
S4	CN4	An car can be clearly seen from X ft away on screen	Ft	15-20	>30
S5	CN3	Time to detach camera	sec	30	10
S6	CN6	Cost	\$	300	<500
S7	CN5	User interface on smartphone: The application can be turned on/off via the screen interface	?		
S8	CN7	The system does not restrict the rider in way, shape or form	?		
S9	CN8	The system can withstand X lbs (?) of vibration without disrupting the system	lbs?		
S10	CN9	Set-up time after initial installation	min		
S11	CN10	Impact resistance from being dropped	ft	3	>5
S12	CN11	Camera angle adjustment	degrees	45	60
S13	CN12	The system has potential for other stat tracking devices to be added to the application			
S14	CN13	Camera weight	grams		
S15	CN14	Rain/weather resistance	hr	1	>3

- Constraints:
 - The system is lightweight
 - The system is low cost
 - The system is weather resistant

- Project Deliverables:
 - Integrated video system that attaches to a bicycle which includes a camera, camera mount, weather resistant protective case for camera and means of image transmission
 - A smartphone application that works in conjunction with the camera and displays an image on the smartphone screen from the camera

- Budget Estimate:
 - Ant + adapter for iPhone (\$40-60) if wireless option is chosen
 - Camera for bike (\$5-20)
 - Materials to make mount and case for camera (\$?)
 - Wireless chip set (widely varies) if wireless option is chosen
 - Battery for camera (\$? → depends on battery chosen)
 - Wires to connect camera to smartphone (if wired option is chosen)
 - Cell-phone holder for bike (\$20-50)
 - Rapid prototyping/3D printing costs for camera mount and case (\$?) Brinkman lab

- Intellectual Property (IP) considerations:
 - In order to use Ant + wireless protocol must sign up on website (free)

- Other Information: *Describe potential benefits and liabilities, known project risks, etc.*
 - ANT+ adapters are only made for iPhones currently
 - Developing an application for iOS requires approval from Apple, not open source like the Android market
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- Continuation Project Information, if appropriate: *Include prior project(s) information, and how prior project(s) relate to the proposed project.*

STUDENT STAFFING:

- Skills Checklist: See attached
- Anticipated Staffing Levels by Discipline:

Discipline	How Many?	Anticipated Skills Needed (<i>concise descriptions</i>)
CE	2	Develop application, systems integration , power analysis
ME	1	Design camera mount, Vibrations analysis on camera mount, project management, systems integration,

ME HEAVY: Due to the fact that a major part of this project involves developing a smartphone application, a ME heavy project does not apply is not feasible for this project. One or maybe two mechanical engineers could work on the camera mount however; this project cannot be completed without CE engineers to program the application.

OTHER RESOURCES ANTICIPATED:

Describe resources needed to support successful development, implementation, and utilization of the project. This could include specific faculty expertise, laboratory space and equipment, outside services, customer facilities, etc. Indicate if resources are available, to your knowledge.

Category	Description	Resource Available?
Faculty	Image processing, wireless protocol → CE faculty support, Vibrations → ME faculty support	<input type="checkbox"/>
Environment	Large indoor space where a bike can be ridden or outdoors	<input type="checkbox"/>
Equipment	Bicycle, wireless protocol (Dr . Becker-Gomez said her husband who works in CAST has a wireless testing setup we could potentially use if Ant+ is not feasible), Brinkman lab for rapid prototyping/3D printing	<input type="checkbox"/>

Prepared by: _____

Date: _____