THE HELM

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ELC Industries – EDSGN 100 014 submitted to AT&T

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Overview

Executive Summary

The aim of this report was to satisfy the objective requirements given to us by AT&T to incorporate real-time connectivity for products and systems to better our lives in either a connected home, car, or a wearable. Our project revolved around the Internet of Things (IoT) as well as Machine-to-Machine (M2M) solutions for devices readily and reliably able to connect and share data. Research was conducted to better our understanding of the use of GPS and other features. As a result, we generated the idea for a connected helmet that provided health as well as recreational features to the user. This design may provide better safety and information for a variety of activities.

Introduction

Our technology has evolved at incredibly fast rate, and as a result, we are never far from information that rides on waves. Whether these bits of data arrive to the miniature computer tucked into your pocket or come out as music from the car radio, this connectivity provides great potential. Thus, the idea of automatic transfer of data, like wireless technology, created a scenario broadly called the Internet of Things. IoT is also closely paired with Machine-to-Machine communication, whose products with this ability are often dubbed 'smart.' Further, these products span from being in a home, car, or on the user. The purpose of this project was to identify a problem or need in one of these three categories and examine the system for inputs and outputs; and finally to create a M2M solution that could be part of the IoT.

Use Case

A helmet is capable of providing more security through calling for help and tracking location as well as recreation use of gathering data related to location and live video of a user. Currently, helmets provide elementary safety for its user, mainly as physical protection from falls. Equipping a helmet with Bluetooth and connecting it to a smartphone can allow data such as speed and location to be collected. Further, when the helmet hits the ground or other surface too hard, the phone can call and send coordinates for help. Overall, increasing safety and recreation regarding helmets.

Research

AT&T

The parent company to AT&T was formed in 1876. Alexander Graham Bell invented the telephone and founded the company that became AT&T. AT&T was later founded in 1983.

The four values of the company are

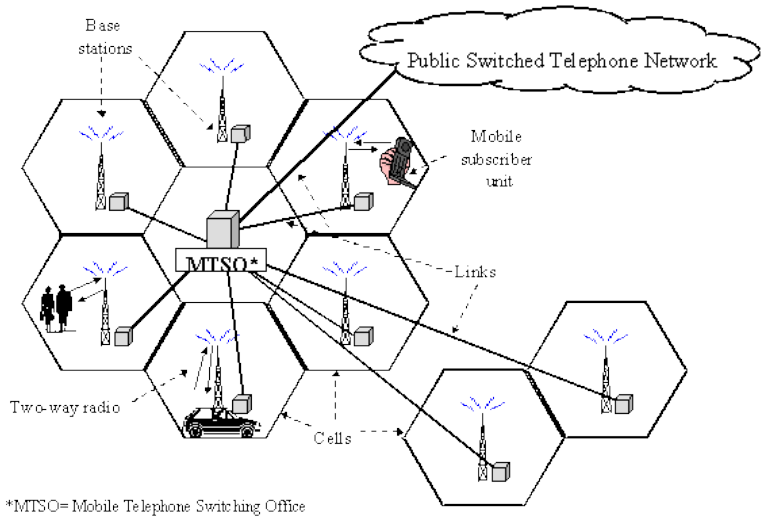
- Deliver the future first
- Build strong customer relationships
- Unleash our human capabilities
- Operate with integrity and trust

AT&T has around 110 million subscribers, covers 195 countries in voice coverage, and won a vast amount of awards.

AT&T caters to cell phone users and provides the latest technology in communication from person to person, person to machine, and machine to machine. Some of this technology can be described in cellular communications.

Sources: http://www.att.com

Cellular Technology



Cell phones are complicated devices that use radio frequencies broken up into divisions of frequencies. Frequencies can be used within areas that don not include a boundary edge adjacent to a division with the same frequency. Cell phones use full-duplex technology that utilizes two frequencies: one for talking and one for listening. They can pick up more channels and more frequencies than a walkie-talkie, and the grid system of frequencies allows it to communicate through different divisions of frequencies. Information is transmitted through electrical signals (or code in digital) which are divided into separate amplitudes. The signals are represented in code or signals and translated back to the original format to the receiver.

Analog transmission switched to digital because it is easier to compress more channels in a given bandwidth with code. Analog is converted to digital with Frequency shift keying- a manipulation of combinations of 1s and 0s to send and retrieve information. Information is retrieved and sent by the cell phone using, a circuit board, an antenna, a liquid crystal display (LCD), a keyboard, a microphone, a speaker, and a battery2G can be broken into FDMA, TDMA, and CDMA, all using different methods of transmitting information separately. While it is possible to intercept codes, transmitted information AT&T uses GSM, a global networking system that encrypts information to make it more secure.

Sources: http://electronics.howstuffworks.com/cell-phone.htm

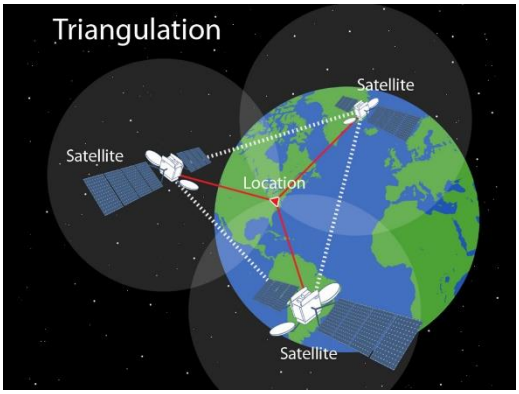
Internet and M2M Communication

M2M relates to the automated monitoring and controlling of objects, it connects machines together in order to better communicate between them allowing for an exchange of information, or initiating operations without human interaction. Machine to machine communication can be transmitted from wireless devices to wired devices. Information is sent and received over the internet or radio frequencies to connect machines. This process includes automated communication of input to another machine. The input

is processed and an output, or action can then be taken by the machine. This M2M connectivity is the basis for IoT. Generally, IoT is a broader form of connections as it aims to connected machines to machines or people to machines. IoT emphasizes the idea of connectivity and constantly available data. As M2M dominates spheres of industry, business, and commercial applications, IoT is seen more in consumer applications. Nonetheless, both aim to improve efficiency, decrease costs, and improve service. We are using this technology to take in data from a helmet, send it to a helpline, or the police, and translate the information into a communicable report.

Sources: http://en.wikipedia.org/wiki/Machine_to_machine

GPS

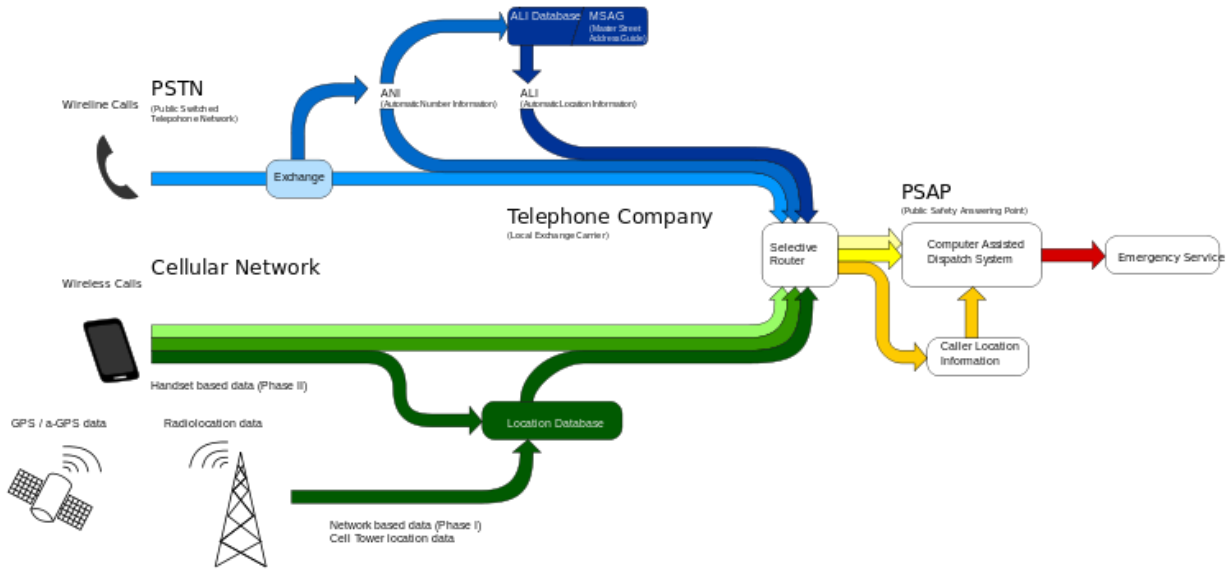


Global Positioning System (GPS) utilizes a constellation of 27 satellites that orbit Earth. A GPS receiver locates at least four of these satellites and can calculate its distance and thus own location from these satellites using the principle of trilateration. A GPS picks up a signal from multiple satellites by analyzing high frequency and low power radio signals emitted by a satellite. The receiver then calculates how far the signal traveled by how long it took the signal to arrive. With a known distance from a satellite, a sphere can thought to be swept out with your location on the surface. The receiver, with four of these spheres, finds the intersection of all of them, in other words, finding your location complete with latitude, longitude, and altitude. Leaving a GPS on allows you to trace your path as the receiver remains in communication with the satellites and plots how your location is moving, giving outputs such as distance traveled, current speed, and estimated time of arrival based on current or average speed.

Often, there are inaccuracies that affect the receiver from computing the correct location. Environmental factors may cause extra delay or signals may bounce off objects causing distance calculation errors. However, a differential GPS (DGPS) aids in correcting these problems by gauging inaccuracies based on a stationary receiver with a known location. The DGPS receiver at the station knows it's own location and can then calculate the mobile receiver's error, allowing for information correction; thus, DGPS receivers are often more exact than ordinary ones.

Sources: http://electronics.howstuffworks.com/gadgets/travel/gps.htm ,
http://education.nationalgeographic.com/media/photos/000/282/28251.jpg

Enhanced 911



Enhanced 911 (E911) is a system in the United States that allows the location of emergency calls to be found a variety of ways in order to provide quicker responses. Currently, when we dial 911, the call is automatically sent to a public-safety answering point (PSAP). The operator is provided with the automatic location information (ALI) of the caller. However, such locations may be general, without a pinpoint location. The government has also pushed to improve the accuracy of E911 and the Federal Communications Commission (FCC) provides phases of accomplishing this. Phase 0 is the basic 911 process, with calls being sent to PSAP and then to an emergency service if needed. Phase I allows the phone number to be displayed for a 911 call, allowing operators to call back if problems or a disconnection. Finally, phase II allows GPS receivers to deliver specific locations. A caller's automatic number identification (ANI) with address and location of receiving antenna is sent to the closest PSAP. The operator can view the caller's location as well as storing the address data and information, which can be sent to other services.

Sources: http://en.wikipedia.org/wiki/Enhanced_9-1-1 , http://electronics.howstuffworks.com/everyday-tech/location-tracking4.htm

Why Helmet Technology?

Helmet technology is important for the safety and well-being of the active public. Recreational activities are a major cause of head injuries in the U.S. The connected helmet would protect the head while doing what other helmets cannot do; alert authorities in case of serious injury. Table regarding traumatic brain injury (TBI):

ACTIVITY	TBIS		ALL VISITS FOR SPORTS AND RECREATION--RELATED INJURIES		% OF ALL VISITS FOR INJURIES THAT WERE TBIS
	No.*	95% CI	No.*	95% CI (±)	

		(±)			
BICYCLING	26,212	(6,809)	323,571	(48,566)	8.1
FOOTBALL	25,376	(4,845)	351,562	(47,448)	7.2
PLAYGROUND	16,706	(5,198)	210,979	(37,050)	7.9
BASKETBALL	13,987	(3,077)	375,601	(47,607)	3.7
SOCCER	10,436	(3,736)	135,988	(39,167)	7.7
BASEBALL	9,634	(2,401)	121,309	(22,175)	7.9
ALL-TERRAIN VEHICLE RIDING	6,337	(3,481)	59,533	(14,061)	10.6
SKATEBOARDING	6,004	(2,455)	101,577	(31,907)	5.9
SWIMMING	4,557	(1,699)	62,745	(14,500)	7.3
HOCKEY†	4,427	(2,749)	45,450	(24,405)	9.7
MISCELLANEOUS BALL GAMES§	4,065	(1,477)	66,543	(15,306)	6.1
HORSEBACK RIDING	3,638	(1,266)	23,842	(5,169)	15.3
MOPED/DIRT BIKE RIDING¶	3,370	(978)	39,363	(9,209)	8.6
SCOOTER RIDING	3,336	(779)	54,561	(11,784)	6.1
GYMNASTICS**	3,319	(948)	71,248	(13,881)	4.7
COMBATIVE SPORTS††	2,981	(786)	50,639	(10,941)	5.9
SOFTBALL	2,735	(756)	49,345	(10,002)	5.5
EXERCISING	2,406	(825)	77,069	(11,731)	3.1
TOBOGGANING/SLEDDING	2,377	(948)	23,306	(8,383)	10.2
TRAMPOLINING	2,323	(823)	86,584	(17,540)	2.7
GOLF§§	1,887	(609)	17,078	(3,510)	11.0
ICE SKATING	1,673	(631)	14,608	(4,241)	11.4
VOLLEYBALL	1,396	(483)	34,513	(7,568)	4.0
AMUSEMENT ATTRACTIONS¶¶	1,266	(470)	15,781	(3,844)	8.0
ROLLER	1,126	(316)	34,717	(8,280)	3.2

SKATING/UNSPECIFIED SKATING					
GO-CART RIDING	875	(308)	11,078	(2,280)	7.9
IN-LINE SKATING	853	(335)	25,350	(7,515)	3.4
TRACK AND FIELD	449	(171)	15,553	(3,003)	2.9
RACQUET SPORTS* **	323	(125)	9,306	(1,984)	3.5
BOWLING	153	(74)	6,574	(1,524)	2.3
OTHER SPECIFIED†††	9,059	(4,630)	136,210	(44,511)	6.7
TOTAL	**173,285**	**(40,284)**	**2,651,581**	**(403,378)**	**6.5**

There are also many bicyclists throughout Penn State, as well as many students who participate in more extreme sports. Thus, there is no doubt a problem of how to better increase safety with our new technological advances.

Sources: http://www.aans.org/Patient%20Information/~/media/Files/Patient%20Information/Patient%20Safety%20Tips/RecreationRelated20Head20Injuries.ashx

Similar Products

The Skully motorcycle helmet uses GPS, voice navigation, and other implementations of internet connectivity. The cameras, sensors and microprocessors pick up information and enhance the ability of the wearer. Our connected helmet is different in that it transmits information in order to protect and monitor the wearer before and after a fall.

Source: http://www.skullyhelmets.com/

ICEDot, a sensor that is targeting bikers, detects falls or motion and calls a family member or programed in emergency contact if needed. An account can be made with health information that can be retrieved by responders based on a code corresponding to a user's profile. Our helmet will not only provide similar emergency help, but also provide recreational data to track and map a ride and an integrated camera.

Source: https://icedot.org/site/

Camera Specs

GoPro: HERO3+ Silver Edition

VIDEO RESOLUTION	**1080P**	**960P**	**720P**	**WVGA**
FRAMES PER SECOND (FPS) NTSC/PAL	60 50 30 25	60 50 30 25	120 100 60 50 30 25	120 100 60 50
FIELD OF VIEW (FOV)	Ultra Wide Medium Narrow	Ultra Wide	Ultra Wide Medium Narrow	Ultra Wide
SCREEN RESOLUTION	1920x1080	1280x960	1280x720	848x480
ASPECT RATIO	16:9	4:3	16:9	16:9

BATTERY LIFE

The chart below indicates the approximate continuous recording time (hr:min) you can expect when shooting in various video modes using a fully-charged battery.

	With Wi-Fi Off	With Wi-Fi On + Using Wi-Fi Remote	With Wi-Fi On + Using GoPro App	With Wi-Fi Off + Using LCD Touch BacPac™
VIDEO MODE	ESTIMATED TIME	ESTIMATED TIME	ESTIMATED TIME	ESTIMATED TIME
1080P 60 FPS	2:15	2:00	1:30	1:30
1080P 30 FPS	3:00	2:40	1:50	1:50
960 60 FPS	2:30	2:15	1:35	1:35
720P 120 FPS	2:20	2:05	1:30	1:30
720P 60FPS	2:45	2:25	1:40	1:45

AUDIO

- Mono, 48kHz, AAC compression with AGC (automatic gain control)
- Increased audio range by approx. 10dB compared to HERO3: Silver Edition
- Handles approx. 2x greater volume without distortion compared to HERO3: Silver Edition
- Supports optional 3.5mm stereo microphone adapter (sold separately)

WEIGHT

- Camera: 74g (2.6oz)
- Camera with housing: 136g (4.8oz)

Source: http://gopro.com/cameras/hd-hero3-silver-edition#technical-specs

Contour Wearable Cameras

	Contour ROAM2	Contour+2
Instant On Record Switch	✓	✓
Record Lock Switch	✓	✓
Waterproof to one meter	✓	
Built-in Tripod (1/4" - 20) Mount	✓	✓
Flush Front Lens	✓	✓
Still Photo Mode	✓	✓
Laser Alignment	✓	✓
Removable Lithium-ion Battery		✓
GPS		✓
Bluetooth		✓
HDMI		✓
USB Connection	✓	✓

Internal Mic	✓	✓
External Mic Jack		✓
microSD Memory Card Included	4GB	4GB
Wide Angle Lens	170°	170°
Lens Rotation	270°	270°
Weight	5.1oz	5.5oz
Dimensions (mm)	100 x 55 x 34	98 x 60 x 34
Included Mounts	Profile Mount, Rotating Surface Mount	Profile Mount, Rotating Surface Mount (2)
Included Cables	USB	USB
Included Case		Waterproof Case

Source: http://contour.com/collections/cameras/products/contour-2

Falling Detection

While researching ideas for our project, there appears to be algorithms already for detecting falls from a helmet. From the research of Ho-Rim Choi, Mun-Ho Ryu, Yoon-Seok Yang, Nak-Bum Lee, and Deok-Ju Jang from Chonbuk National University, they claimed to have found an accurate fall detection. Their conclusion from their research is:

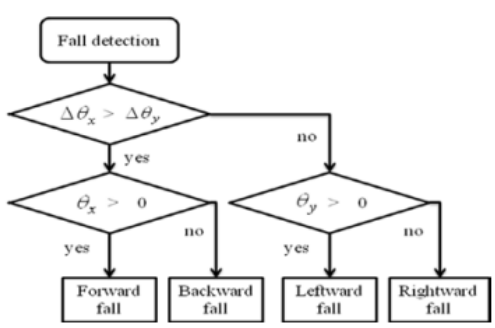


Fig. 2. Flow chart of the fall direction detection algorithm.

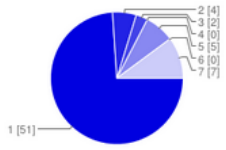
"In this study, we developed system to detect falls during bike rides while wearing a leisure helmet on the head. We developed algorithms to detect the occurrence and direction of falls using signals of acceleration and rotation angle vector of quaternion. When fall detection by applying the developed algorithm of the third method, it demonstrated perfect classification capability. Also, fall direction were detected during a bike ride by applying the developed algorithm, it demonstrated excellent detection capabilities for both."

With such a formula already in place, we could utilize this or a similar process in a piece of the helmet in order to detect accurately when a fall has taken place as well as attain information as to what kind of injury a person could have sustained.
Source: http://onlinepresent.org/proceedings/vol25_2013/37.pdf

Survey Results

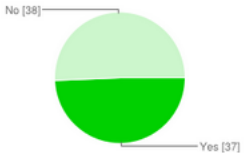
We conducted a survey in order to better understand our customer needs and comfort regarding the features we planned to add. We created the form and posted it for fellow PSU students to respond and express their feelings.

How many days a week do you use manual transportation (bike, skateboard, etc.)'



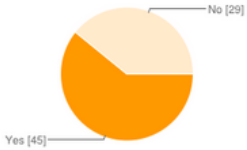
1	51	74%
2	4	6%
3	2	3%
4	0	0%
5	5	7%
6	0	0%
7	7	10%

Would you use a connected helmet that could alert someone automatically in the event of an accident?



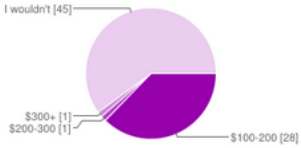
Yes	37	49%
No	38	51%

Have you ever fallen on/from one or more of these types of manual transportation



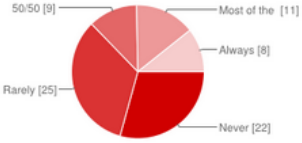
Yes	45	61%
No	29	39%

How much would you pay for such a product?



$100-200	28	37%
$200-300	1	1%
$300+	1	1%
I wouldn't	45	60%

How often do you use a helmet for protection?

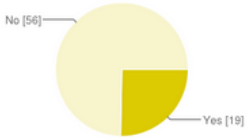


Never	22	29%
Rarely	25	33%
50/50	9	12%
Most of the time	11	15%
Always	8	11%

Would you be comfortable with a GPS in this helmets tracking you?

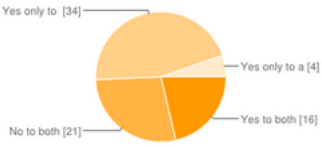
Yes	39	53%
No	35	47%

Do you ever choose to not use manual transportation for fear that you may fall?



Yes	19	25%
No	56	75%

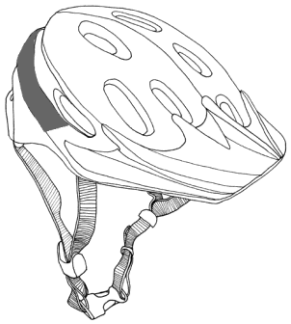
Would you be comfortable with the authorities (i.e. an ambulance) or an insurance company having access to this?



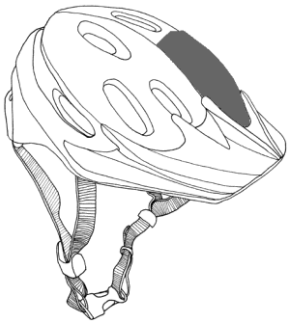
Yes to both	16	21%
No to both	21	28%
Yes only to authorities	34	45%
Yes only to an insurance company	4	5%

However, this survey focuses mainly on Penn State student bikers, so information regarding these needs cannot be taken absolutely for our entire customer base. In other words, a different sample could yield very different opinions. Nonetheless, this research brought us new information regarding how some of our peers feel about the problem and the solution we generated.

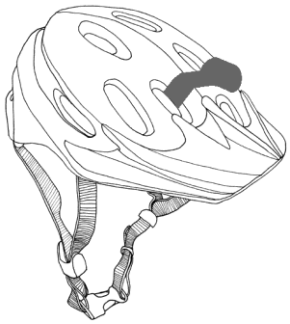
Concept Generation



Concept 1



Concept 2



Concept 3

Concept 1 was based mainly on parts we found when looking a concussion detention hardware, which placed sensors near the base of the neck to measure movements and impacts. Thus, we created this design with the same placement through a band that would wrap around the back of the helmet and would ideally measure whether the user's head hit a hard surface during a crash. However, this design did not take into account the camera we later decided to add. We then generated concept 2. This concept would use a flexible material that could be, similar to concept 1, attached adhesively or physically to the top portion of the helmet. From this placement, impacts could still be measured throughout the helmet as well as providing a place to put the camera. Finally, we generated concept 3, which uses a strap or mount between the holes of a helmet to attach the interface and camera to the helmet. The wrapped strap could be configured to measure impact or vibrations as well, still providing our main objective while giving the camera a better placement and easer ability to be attached or detached.

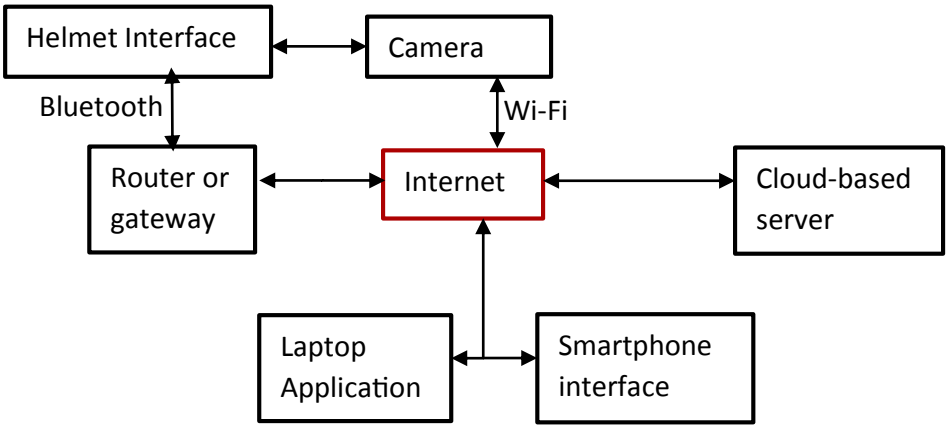
Concept Selection

	CONCEPT 1	CONCEPT 2	CONCEPT 3
COST	0	0	+
FEASIBILITY	-	0	+
INTERFACE PROTECTION	+	0	-
CONCUSSION SENSTIVITY	+	+	0
WEATHER RESISTANT	+	0	+
COMPACTABILITY	-	-	+
POWER CONSUMPTION	0	0	0
COMPATIBILITY WITH	+	+	0

HELMET MODELS			
AESTHETICS	+	+	-
CAMERA VIEW OPTIMIZATION	-	0	+
TOTAL	**+2**	**+2**	**+3**

After ranking our concepts in a concept selection matrix, concept 3 added to the highest score, though each design was very close in rankings. Concept 3 provided a design that would be easy to construct as well as put on or off a variety of helmets. While concept 1 provided great protection for our device, the placement lacked the placement of the camera. Concept 2 scored similarly to concept 1, with comparable styles, this was expected. However, this provided less protection but a better placement of the camera. Finally, aesthetics took away from concept 3 due to the bulky design. Nonetheless, concept 3 allows for a compact and compatible design, which we decided to choose.

System Diagram



Design Analysis

Bandwidth and Data

	WIFI	BLUETOOTH	ULTRA WIDEBAND	ZIGBEE	ISA100.11A
BUILT ON	IEEE 802.11	IEEE 802.15.1	IEEE 802.15.3	IEEE 802.15.4	
FREQUENCY BANDS	2.4 GHz	2.4 GHz	Variable	2.4GHz, 915MHz, 868MHz	
PRIMARY APPLICATION	Wireless LAN	Cable Replacement	Indoor Short-Range	Home and Office	Industrial Process Control
DATA RATE	150 Mbps	1 Mbps	1.6 Gbps	250 kbps	< 250 kbps

NODES PER NETWORK	30	7	200+	65,000	65,000
RANGE	100 m	10 m	5 m	100 m	100 m
TOPOLOGIES	Star, Tree	Star, Tree	Star, Tree, Mesh	Star, Tree, Mesh	Star, Tree, Mesh
POWER CONSUMPTION	High	Medium	Very Low	Very Low	Very Low
COMPLEXITY	High	Medium	Medium	Low	Very High

Connecting our interface to the phone we plan to use Bluetooth Low Energy (BLE) sends small packets of data instead of a continuous stream that Bluetooth sends. Thus, BLE consumer less energy than a device running Bluetooth, better suited for a battery-operated device such as smart watches and other wearables. It has a standard of IEE 802.15.1 and has a frequency band of 2.4Gz. BLE can monitor our user's location and speed through access to the phone's GPS as well as communicate with the camera attached to turn on or off. Further, BLE requires less energy and bandwidth than normal Bluetooth and would greatly reduce the cost and data requirements. We also do not need to use a network protocol over a large distance, the distance from a smartphone to our device mounted on a helmet is only a few feet away at most; for communicating location in the event of an emergency, our device can utilize the smart phone for long distance communication. Further, most operating systems for smart phones support BLE and is becoming a more popular option as well.

	CLASSIC BLUETOOTH TECHNOLOGY	BLE TECHNOLOGY
DATA PAYLOAD THROUGHPUT (NET)	2 Mbps	~100 kbps
ROBUSTNESS	Strong	Strong
RANGE	300m	250m
LOCAL SYSTEM DENSITY	Strong	Strong
LARGE SCALE NETWORK	Weak	Good
LOW LATENCY	Strong	Strong
CONNECTION SET-UP SPEED	Weak	Strong
POWER CONSUMPTION	Good	Very strong
COST	Good	Strong

Source: http://www.connectblue.com/technologies/bluetooth-low-energy-technology/

However, if users want to live stream video, a stronger connection, with a larger data transfer is needed. In fact, many cameras, such as GoPro include a wireless Wi-Fi connection for such a purpose. Thus, our camera will be equipped with BLE for a low power connection between the helmet interface and the user's phone in order to track GPS location and turn on or off the camera, and the camera will have a Wi-Fi connection if users would like to live stream video. Video will also be saved to the camera's storage device when recording regardless of connectivity.

Overall, 54 Mb/s will transfer video over the internet and be able to communicate and about 1Mb/s is needed for our BLE data transfer, providing an estimate of about 55 Mb/s needed of data transfer.

Cost & Revenue Generation

Camera - Based on GoPro (market standard) HD HERO (first generation) and Contour wearable cameras. Both have similar specs and are both priced at $199.99. Considering their popularity and use for recreational means, this price range comparison should be quite accurate.

- 1080p definition w/ 5Mp camera
- 1280 x 720 frame
- 30 frames per second
- 170 degree frame of view
- **Cost: $200.00**

Interface – Based on pricing on concussion detectors and similar products such as ICEdot and Skully helmets, an estimated price could be from $100 to $200 or more (+$1,000). For our product, we estimated:

- Water proof covering
- Communications: Bluetooth 4.0 Low Energy (range up to 30 feet)
- Battery: Rechargeable Lithium (operating for about 20 hours)
- Charger: USB micro connector (5V)
- **Cost: $130.00**

Overall, our product's cost to the public can be estimated to be around $330.00 when assembled. To note, this price could drop because we took the price of the camera and interface at market value with all of their features, while our product may vary. Although this price seems large, we are offering many different types of advanced technology in one interface, so a starting price of a few hundred is not too unreasonable. However, we understand that not every household would be able to purchase one due to high costs. To note, many helmets for some sports can be priced in the hundreds of dollars as well, some special made Skully helmets can be as high as $1,000. They manage to sell these helmets regardless because it is important to the rider to have all the information and safety possible; the success of this product shows our helmet may also be a success, and in comparison, making our device seem reasonably priced.

Further, our helmet was meant to provide a service of calling an emergency contact or paramedics in case of an emergency. Comparable to OnStar, a GPS location safety serviced used in vehicles all over the country, we could generate some revenue by a subscription fee. Currently, OnStar plans can range from $15.95 to $30 per month depending on the plan, with a $1,200 installation cost. While OnStar's vehicle service is not analogous to our service aimed at bikes or snowboarders, we estimated that a price around $9.95 would be a reasonable charge, as our service would not provide all features OnStar offers. Nonetheless, this is similar to our product as it enhances the safety of the operator, even during recreational activities or daily activities. In addition, many sport activities are seasonal, so charging year round would not make economic sense. Instead, we plan to provide seasonal fees, allowing a plan for approximately $30 for 3 months and discounts for longer durations, if the user utilizes our helmet device for multiple activities. Thus, with a price for the helmet device to be $330 and a monthly rate of $9.95, a unique yet antiquated design would be created that has almost been market proven. The technology is already a given and there is most likely a demand. With revenue generation from both selling the physical

product and from a subscription fee, our device is very likely to make profits while greatly benefiting the recreational part of weekly activities by placing a similar service in a new situation.

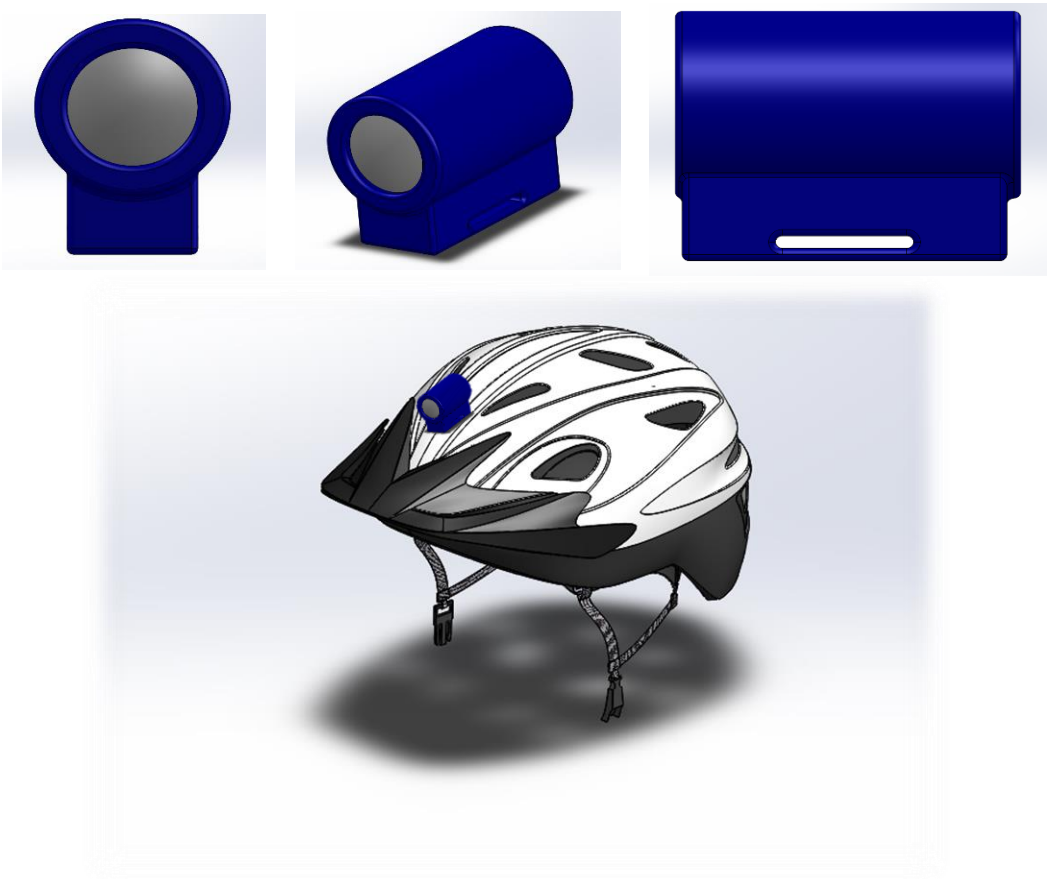
Source: https://www.onstar.com/web/portal/planspricing?g=1, http://contour.com/collections/cameras/products/contour-2 , http://gopro.com/cameras/hd-hero3-silver-edition#technical-specs

Privacy & Security

One thing to keep in mind is the issue of privacy and security. Lately, there have been many outcries to companies collecting information on users, making those users feel uncomfortable. Dealing with issues of internet privacy, there is concern for corrupted files, but the most daunting fear is the potential for identify theft. Even our surveys indicated that people are not entirely comfortable with being tracked and monitored. However, most often these internet trackers, or cookies, are used to better place advertisements a user would more likely buy based on internet history. The product we are designing requires some tracking of data, such as physical movement through GPS coordinates in order to present the user as well as any emergency contact with the necessary data. Ideally, a person's account will have security, with a username and strong password as well as from other malware or spyware. In addition, our device must follow any regulations put in place regarding data protection regulation. Nonetheless, most users will probably feel no discomfort as many applications already track similar data, as our product needs. Smart phones already track location and applications such, as MapMyRide used for bicycle routes, are already quite popular regardless of the information they track. Our helmet device does give access to location to authorities, which is not completely comparable to other products, but there are limits on what this information can go in a non-emergency situation. Thus, while our product will surely tracking information, reassurance can also be given to users that their privacy is secure.

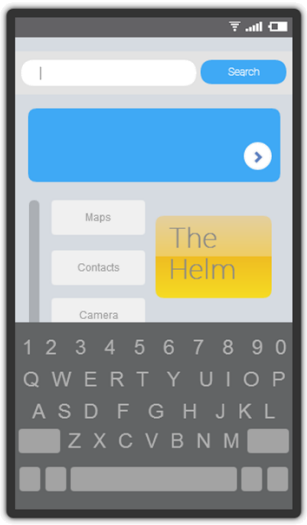
Sources: http://en.wikipedia.org/wiki/Internet_privacy#Other_potential_Internet_privacy_risks

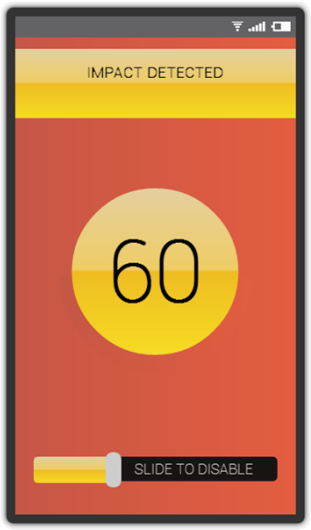
3D Model



From our 3D model, we planned to have our interface include almost all the features necessary for our overall device in a compact design that could attach to almost any helmet as well as provide a good vantage point for video.

App





The app would provide a place for a user to log information, find data, and discover new places to go. We plan the app would plot and map each ride, with summaries including average speed and distance traveled. A user could also add emergency contacts and access their camera's video feed or files if the camera has access to Wi-Fi.

When the helmet device detects an impact, the right picture provides an example of the countdown timer, with and fast and easy way to disable the countdown if the fall is not severe.

Prototype

The small Styrofoam device was meant to represent our helmet interface. This would include the camera and other pieces of technology required to keep the device running as well as processing data. This would come equipped with BLE to connect to a smartphone while the camera would be able to access Wi-Fi when a user would like to live stream video. The elastic strap is connected to the helmet interface and would have sensors that would detect when a fall had taken place. These sensors would be connected to the helmet interface via the BLE connected for a low power and consistent connection. Additionally, this elastic strap provides the interface with an easy way to detach and reattach the device to a variety of different types of helmets.

Concept of Operations

Scenario 1

If a bicycle rider is subject to an accident, the helmet will register sudden jolts of the head. It will monitor position and speed at a certain time. After detecting the accident, the helmet will be set on a timer of 45 seconds at the end of which it will make a call to PSAP (or 911) with GPS location, health information, and any other monitored data need for emergency help. However, if the user's fall was not bad, and no help is needed, the alert can be cancelled, and the user can call any of their contacts with knowledge of their location.

Scenario 2

If another driver hits a motorcycle rider or bicyclist, the helmet will detect the accident and place itself on the timer of 45 seconds. The camera, if on, will stop filming and save the last fifteen seconds before the accident. This information will be sent, at the volition of the rider, to the insurance company or nearest police station for analysis of fault. If the timer is not cancelled, GPS location will be sent to paramedics for emergency help.

Scenario 3

If a dirt bike rider falls in the woods, the helmet will detect the fall and the speed of the vehicle before the fall. GPS location and health information of the subject will be sent to paramedics after the timer goes through the countdown. If the rider is away from civilization, without a proper helicopter landing zone nearby, the helmet will detect the nearest clearing and transmit information on the location and landscape of the clearing, as well as compute the location relative to the rider.

Conclusions

Our goals for this project were to make a product that would enhance people's lives through machine-to-machine wireless connectivity, and we believe that the Helm satisfies this. It improves the wearer's safety by being able to contact emergency services automatically in the event of an accident. This is indispensable for many action sport enthusiasts such as dirt bikers, snowmobilers, and ATV riders.

The Helm is something we think could be a significant success in the market. There is a demonstrated interest in the market for this product, as seen in our survey. Granted, our survey was done of primarily university students, but the market pool of this demographic is large enough that the product could be successful. In addition, we are neglecting the entire rest of the population, which we think would also have significant interest. Most importantly, it could be made for a price that is well within the spectrum of what our customers would want.

An important point of our product is that the technology required is already available; it is just a matter of compiling everything together. GPS tracking is already widely used in running watches for tracking routes, and cell phones are already capable of providing locations. The video technology and durability is already used extensively in cameras such as the GoPro Hero and the Contour, on which we based much of our research. Finally, impact detection is already in use in many products right now and connecting the camera to a phone is simple. The birth of this product is just a matter of integrating all of these technologies into one unit.