Abstract/Introduction:

- Every year thousands of Americans are involved in automobile crashes as a result of simple problems with their car. Often times, it is the small things such as low tire pressure and worn down tread, especially in bad weather conditions, which can mean the difference between driving home from work safely and ending up in a fatal accident. For our project we are proposing to create a car tire with a chip installed that monitors the aspects of the road as well as the car tire including tire pressure, tread ware, road temperature and lane swerving. This chip will then relay real time information to an installed monitor in the front dash of the car. With this the information that we provide the driver, we hope that this will help them make better decisions on assessing roadways and improve the overall safety of the car.
**Mission Statement:**

- Our mission statement is to create a next generation tire that can gather and interpret real time information, in order to create safer roadways. Currently, car accidents are the leading causes of death, and a means reason for the accidents is because the driver is not aware of what is going on. For example, during the winter, ice can form in random locations which can be very hazardous to drivers. If we can alert the drivers that they are driving towards a patch of ice then we can limit these accidents. This is one example of how we can help make roadways safer with our SmartTire. We eventually hope to make this available to every automobile because the tire is independent to the car. And therefore we have a large market that we appeal to.

**Customer Needs Analysis:**

- Customers need tires that would last for long time and are affordable. Also, they need tires that can be reliable in almost all weather conditions. In addition, they need to know the conditions of the tires as well as the road conditions instantaneously and constantly which effectively make the car and the driver a lot safer.

**Target Specifications:**

- Our target specifications for the project are simulation of instantaneous data between the road and the customer’s smart phone. In addition, the conditions that will be measured are as follows, low tire pressure (as well as the other tire problems), road temperature, lane swerving, and tire life (how worn the tread is).

**External Research:**

- **Library/Online/Patent Research**
  - The technology that we are using for our product already exists. However, what makes our product different is the way we are using this technology and implementing it by making it easier to use and more reliable. We are combining multiple technologies into one.

- **Benchmarking**
  - The benchmarking specifications are talked about below.

- **Product Dissection**
- Sensor
- Wires
- Bluetooth Chip
- Tire
- Monitor
- Thermometer

**Global Marketplace**
- We hope to eventually make this tire available to car companies worldwide. The tire and chip can be used by any country because the only difference for the design would be the units of measurements.

**Concept Generation:**
- Once our idea was established we began researching more about our product. We did find products that were comparable to our product but no direct competitors. We set a target audience and used the basis of a quality tire to base our idea around. With the chip insert that relays the data, it was hard to incorporate how we would gather the information but we found that Bluetooth capabilities within the car was the best route to go. We are well aware that only modern vehicles offer Bluetooth capabilities, so since this is an aftermarket accessory, the audience will be direct to new vehicle owners. We are certain that the market is indeed large enough for this vehicle enhancement to be profitable.

**Concept Selection:**
- When we began brainstorming for this project, we had 4 concrete ideas to move forward with. Those included the SmartTire, Solar-powered car, speed limit restrictor, and a pedal powered car. Brief descriptions of the other three ideas are as follows:
  - Solar-powered car- a car covered in solar panels that relies entirely on solar energy to run the car
  - Speed limit restrictor- a device used to govern the throttle in a car, making the car unable to go above the speed limit in the designated area
  - Pedal-powered car- a car that is run on human propelled energy via a bicycle pedal system
After going through the Pugh Selection matrix, we determined that the SmartTire was the most effective product to move forward with. It placed high in almost all of our criteria that addressed safety, efficiency, and functionality. The solar car also placed well in our selection matrix. However, since it was already a well-researched and pretty concrete idea, we wanted to work with something that has been discussed but never formally implemented in vehicles.

**Benchmarking:**

- For our project we benchmarked our idea against two pre-existing products that were similar to our SmartTire. The first was the Sunpro Universal TPMS Kit. This tire sensor is designed to monitor real time data from all four car tires and relay this information back to a monitor located within the car. The tire sensor has a seven year battery life and transmits data every thirty seconds. This system is currently going for 201.26$. What makes our SmartTire different from the Sunpro Universal TPMS Kit is that we are creating an already existing sensor within the tire whereas the Sunpro is an aftermarket product.
accessory. Rather than buying a system to attach to your current tires, we are designing a tire that you can buy with the sensor already installed.

- The other product we benchmarked off of was the CycleAT. This product is also an aftermarket accessory like the Sunpro. It is designed to attach onto your motorcycle or bike tires to monitor tire pressure, alignment, temperature and other variables. This system is blue tooth enabled and sends real time data to your smart phone. This is one flaw that we wanted to eliminate from our SmartTire. Texting and driving has been a major issue in recent times due to the number of accidents it has caused. We felt that relaying data to a smartphone would be counterintuitive in regards to keeping people safe while operating a car. Because of this we decided to relay the information to a monitor that can be attached within the car much like a GPS unit. This will eliminate the safety hazard of using a phone while operating a car to check the conditions of the tire.

Financial:

- We estimate the price of our SmartTire to be roughly the cost of the tire plus the cost of the sensor which we estimate to be approximately $200 based on what we benchmarked off of the Sunpro Universal TPMS Kit.

House of Quality:
• This house of quality is used to compare our product to our competitors. It is also used to display the relationship between customer needs and technical characteristics. Both the customer needs and technical characters have many high correlated categories like being reliable in all weather and having a climate resistant chip. This also showed where the areas of improvements are in respect to our competition.

Life Cycle Assessment:

• Our Life Cycle Analysis closely resembles that of a modern tire. We used a standard tire life cycle as our baseline and further researched to account for the sensor as well as also incorporating sustainability into our product. Since it takes a large amount of time for the chip to be produced and installed, the SmartTire spends an adequate amount of time into the Material Production stage. Moving forward the SmartTire spends a short amount of time into distribution since supply and demand will be controlled accordingly within the Material Production stage. We don’t want to send faulty or out of date equipment out into the market. Next is the actual use of the tires. While it is hard to predict specifically how long the tires will last due to many external factors, we are confident that the customer will be satisfied in the longevity of the SmartTire. Finally the tires last a short amount of time in the End of Tire Collection stage, where it will be recycled or reused for other purposes. As for the sensor, it is predicted that it will last much longer and as a result the customer will have an offer given to them. When the customer sends the tire in, they will be given a rebate offer that will give them a new set of the SmartTires for a discounted price. This will keep our customers loyal to us and hopefully we can give them a quality product it return.
Embodiment Design and Final Design Description:
We will install the monitor on the dashboard of the car. If the car currently has a built in GPS, we will relay the information to that. The sensors will be installed next to the air intake valve on the cars tire.

Conclusion:

- Our overall goal is to make traveling safer. We plan to do this by making a SmartTire that reads and relays real time data from the road to your smart phone. Because the driver would know certain conditions like low tire pressure (as well as other tire problems), road temperature, lane swerving, and tire life (how worn the tread is). We believe that this will
appeal to all car companies because it will increase their safety rating. With a Bluetooth system, we hope that the information will be relayed quickly and accurately.

References:
http://www.smarttire.com/products