

## Element A: Presentation and Justification of the Problem

### Problem Statement:

**When the check engine light on a vehicle is on, it is not possible to know the exact problem. People often resort to taking their vehicle to the mechanic to check the car diagnostic code.**

*Upon researching topics for our Capstone Senior Design project, we came across the idea of an issue with check engine light. This idea sparked from a mutual interest in the mechanics of cars alongside the presence of a prevalent issue. The check engine light to us, as well as others, is an annoyance and a vague light that could be lit due to numerous reasons. This issue proved to be a justifiable problem in which piqued our interest*

*To validate our problem statement, we began searching for statistics to answer some questions we had. Some of these questions included: When was the OBDII system introduced? How many cars on the road have their check engine light on? How much is an average trip to the mechanic shop? We also choose to validate our problem through a survey and talking to experts who knew a lot about car mechanics. Additionally, we searched for scholarly articles to provide a new insight to this issue.*

### Our statistics we found to answer our questions include:

- Prior to 1996: Car makers instituted their own engine diagnostic systems with automobiles[1].
- Starting in 1996, Automobile makers standardized the system under a protocol called OBDII (On-Board Diagnostic System) which made the diagnostic codes universal and easier to access information[2].
- 10% of all the cars on the road have their check engine light on while half of these check engine lights are ignored[3]. -Spoken by

Kristen Brocoff (Spokesperson for CarMD)

- Average cost for a trip to the mechanic repair shop in 2011 was \$334<sup>3</sup>
- In 2010, 30 billion dollars were spent on DIY (Do It Yourself) Mechanics for car parts and repairs<sup>3</sup>.

*These statistics were the exact answers we were looking for, and helped prove that our issue is valid. Next, we talked to several experts who knew a substantial amount regarding car mechanics. We talked to them to get their opinion on our issue and inquire if they had ever encountered our issue. Thus, we planned personal interviews to gather outside opinions of those who are closer to the problem than we are.*

### Expert Interviews:

Thomas A. Kennedy[4]

- Credentials: Expert Mechanic, Previous Owner of Auto Repair Shop, and Previous Owner of Gas Station
- He provided us with insight to how little the general public knows about the mechanics of cars. From his previous experience with owning a repair shop, he understands the mechanics of cars and points out that the check engine light is too obscure. Therefore, the light that tries to help the driver proves to be useless without mechanical knowledge and ends up being burdensome.

Thomas Kennedy Sr.[5]

- Credentials: Electrician, Teacher (Milwaukee Area Technical College, Joint Apprenticeship and Training Committee), Electrical Inspector
- Contact Information: Email: [kennedtv@gmail.com](mailto:kennedtv@gmail.com); Cell Phone: (414) 217-0920
- Thomas Kennedy Sr. has helped us in our brainstorming process to identify a justifiable problem. He also validated our problem with his knowledge of car mechanics which he has learned from working with his father at his mechanic shop. Additionally, he has spent many of hours relentlessly repairing his own cars due to the check engine light.

Mr. Allen Malecki[6]

- Credentials: Expert Mechanic, Electrician, Teacher (Milwaukee Area Technical College, Joint Apprenticeship and Training Committee)
- Contact Information: Home Phone: (414) 282-6694
- Mr. Allen F. Malecki has helped us refine our problem into one that is simple, yet very useful. He told us of situations when he was trying to fix Check Engine Light issues with a used car he had purchased, and when he fixed one thing it would just lead to another problem. He would have to spend more time finding what the problem was.
- After discussing the problem with Mr. Malecki the best idea would be to have a 24/7 OBDII reading device going, so then the problem can be quickly identified, and fixed.

*From our experts, we concluded that the check engine light issue affects more people than we originally realized. Our experts proved that a solution to this issue is needed. Not everyone has the same level of knowledge of car mechanics. However, the check engine light provides a burden for those who lack the knowledge. Therefore, our experts' opinions helped validate our problem statement.*

### Consumer Report:

To further validate our problem we sent out a survey via email to teachers and other adults who would provide an insight into their experiences. Upon sending the survey, we received 31 answers. The survey consisted of several questions to address the expense of trips to auto repair shops, lack of mechanical knowledge on the general adult population, and the need for an in-car code-reading device. Their answers validated our problem thoroughly. The most important results were:

- 46.1% of those surveyed spent more than \$1,000 for any given trip to an auto repair shop for the check engine light.
- 85.76% of those surveyed said that an in-car check engine light decoder would be helpful.
- 50% of those surveyed said they were willing to spend \$25-\$50 for an in-car check engine light decoder.

### Scholarly Articles:

#### “What that Dreaded ‘Check Engine’ Repair Will Cost You[7]”

This article was found on an online website written by Joann Muller. This article gave basic statistics on the check engine light found in vehicles on the road today. These statistics include: The average age of the cars on the road is eleven years old. 80% of vehicles on the road are in need of service or repairs. Approximately, 9 million United States drivers have ignored their check engine light for three

one should limit driving. The check engine light monitors 80% of systems on most car, light trucks, SUV's, and minivans. Most small failures that set off the check engine light will cause more damage or more costly repairs over time.

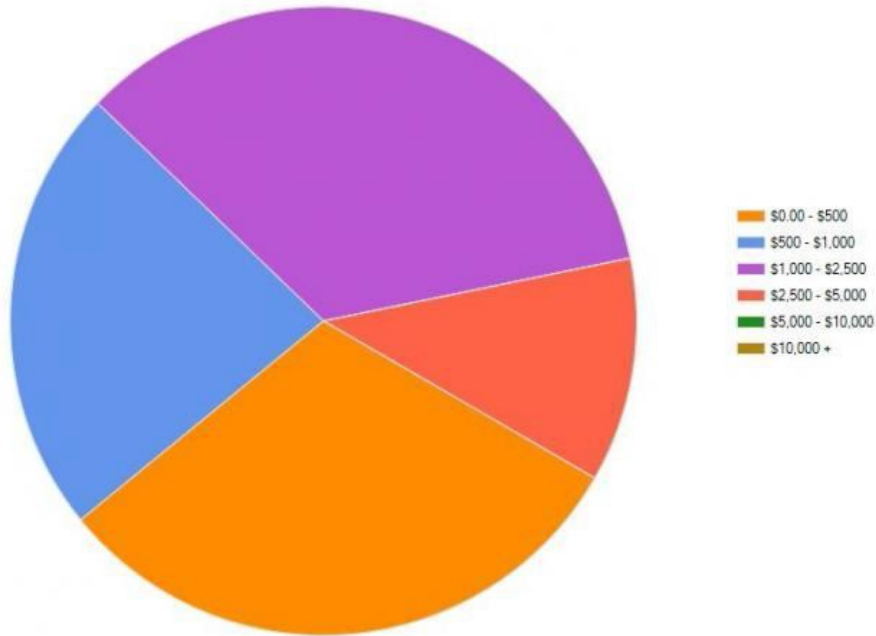
*This article gave us a vast list of statistics that validated our problem. This article showed the immediate need to understand the diagnostic of their vehicle in laymen's terms. For, a simple repair job can cost someone a great deal of money later or decrease the safety of one's car. Therefore, this validated our problem by showing the effects of ignoring the check engine light and the need for more information to be delivered to the driver.*

**“Small Light, Big Implications[8]”**

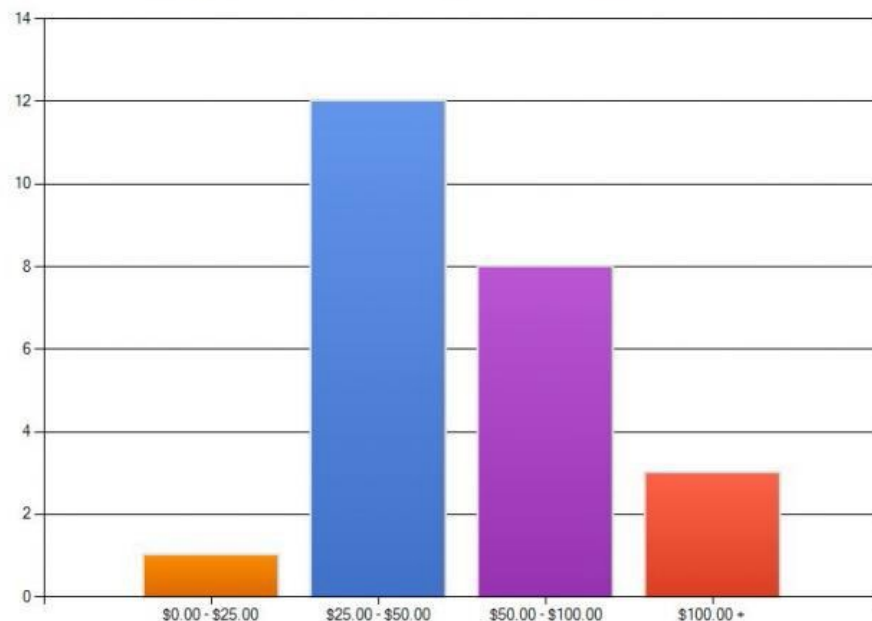
This article was found in the Milwaukee Journal Sentinel in the Auto section. It was written by David Thome as a part of the Techs Factor column. This article elaborates on the issue of the check engine light to validate our problem. According to Thome, consumer reports say the check engine light is the most misunderstood indicator on a car's dashboard. For example, a common problem is a loose gas cap. A new cap for the vehicle is \$20-\$40, but the trip to the mechanic may cost more. However, the onboard computer inside the car may not always provide a clear indication to the problem. Therefore, diagnostics at a mechanic may cost from \$50-\$100 or more even if a problem cannot be identified. Another issue is that small problems such as a faulty oxygen sensor that triggers the check engine light may cause larger issues. Replacing a sensor may only cost \$300, but ignoring the issue may escalate to replacing the engine which is \$4000-\$7000. Facts provided by this article:

- Common Reasons for the check engine light being lit: Worn spark plugs or plug wires, a faulty check valve, incorrect ignition timing, loose or cracked hoses and manifolds, sticky exhaust gas recirculation valves and faulty fuel ignition
- A vehicle will automatically fail a state emission test if the check engine light is on and is not allowed to retest until it turns off.
- If the check engine light is lit due to a loose gas cap, it may be turned off when the gas cap is tightened. However, the check

### What is the highest you have spent on your vehicle due to your check engine light being serviced?



### How much would you pay for an in car engine light decoder?



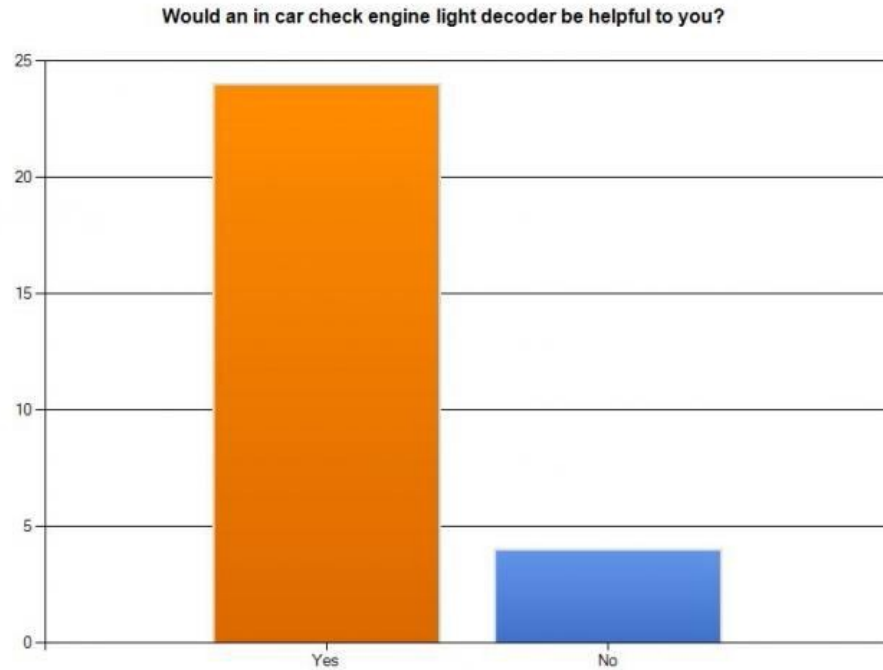
engine light may not turn off immediately and might take a few hundred miles to turn off.

- Consumer reports say that while critical situations such as low oil pressure or overheating might trigger the check engine light, other lights on the dashboard may note the situation sooner.

*This article helped us validate our problem statement as it gave us critical statistics. We learned common errors of automobiles regarding the check engine light. We also learned the consequences of the check engine light such as automatic fail in a state emission test. This knowledge allowed us to evaluate the criteria for our possible designs and provided evidence that our problem exists.*

### “Cars will be in tune with your needs: Automakers seek music, Wi-Fi apps[9]”

This article was found in the Milwaukee Journal Sentinel under the Business section. It was written by Ryan Nakashima as part of the Associated Press. In this article, it stated that General Motors and Ford recently launched programs to open their designs to developers by inviting them to create software applications for future car models. Additionally, they state that “the current systems inside cars have a long way to go to provide the functionality that smart phones offer.” Therefore, these automotive companies are progressing towards a usage of “smart” technology involving touch screens, voice control systems, and readily available in-car diagnostics. An example that this article uses is that Hyundai’s Blue Link technology is currently syncing iPhones and android devices to allow users to check car maintenance such as tire pressure, air bags, and fluids. The article concludes that more and more companies are focusing on this development. Additionally, automotive companies are focusing on voice controls inside the vehicle to use normal smart phone devices, but



hands free to avoid safety concerns.

*This article gave us a new insight on our project. It validated our problem by describing the desire for new technologies from automotive companies. Additionally, it gave us new ideas and concepts to incorporate into our possible solutions to fix our current issue. The desire want to sync iPhone and android devices to car applications gave us a new field to research and incorporate into possible solutions. Lastly, the article also mentioned an important design specification to consider. The statement about safety brought to light the importance of safety in regards to car operation. Therefore, this article validated our problem statement and safety as one of our design specifications.*

In conclusion, we found our problem to be common which justified our problem statement. Additionally, our research validated our problem. We justified the problem through statistics, scholarly articles, expert interviews, and a survey.

---

[1] "Find Your next Car." New Cars, Used Cars, Car Reviews and Pricing. N.p., n.d. Web. 9 Nov. 2012. <<http://www.edmunds.com/>> (<http://www.edmunds.com/>>).

[2] "Find Your next Car." New Cars, Used Cars, Car Reviews and Pricing. N.p., n.d. Web. 9 Nov. 2012. <<http://www.edmunds.com/>> (<http://www.edmunds.com/>>).

[3] "Find Your next Car." New Cars, Used Cars, Car Reviews and Pricing. N.p., n.d. Web. 9 Nov. 2012. <<http://www.edmunds.com/>> (<http://www.edmunds.com/>>).

[4] Kennedy, Thomas. Personal Interview. 15 Nov. 2012.

[5] Kennedy Sr., Thomas. Personal Interview. 30 Oct. 2012.

[6] Malecki, Allen. Personal Interview. 16 Oct. 2012.

[7] Muller, Joann. "What That Dreaded 'Check Engine' Repair Will Cost You." Forbes. Forbes Magazine, 07 Dec. 2012. Web. 17 Jan. 2013.

[8] Thome, David. "Small Light, Big Implications." Milwaukee Journal Sentinel 2 Dec. 2012, Auto sec.: 1-2. Print.

[9] Nakashima, Ryan. "Cars Will Be in Tune with Your Needs: Automakers Seek Music, Wi-Fi Apps." Milwaukee Journal Sentinel 11 Jan. 2013, Business Section sec.: 2D. Print