Element E: Application of STEM principles and practices

Our future solution used several STEM (science, technology, engineering, and mathematic) concepts. These concepts aided in the process of designing and testing our solution.

In the very beginning of this design process, we created a Gantt chart. This Gantt chart allowed us to visualize the future of our project and helped us with project management. For our Gantt chart, we printed out the months of the school year and wrote down our plans for each week of school. We referred back to this Gantt chart to stay on task, as well as make slight changes to the chart itself based on our progress. For example, we initially only gave brainstorming solutions two weeks. However, we missed with several days and worked on our class presentation, so we had to give this step another two weeks. Therefore, we pushed back our decision matrix and cut time from the testing process.

Examples of our Gantt chart:

Another engineering principle we used was engineering notebooks to record our progress each day. In our notebooks, we record thoughts, information, plans, and additional information. Therefore, all our information is stored in one place and can be accessed easily. Our engineering notebooks helped us organize our thoughts and continually work on our project from one day to the next. Therefore, we wrote down where we left off each day so that we could continue work the next day. This was especially helpful when we did not have class the next day.

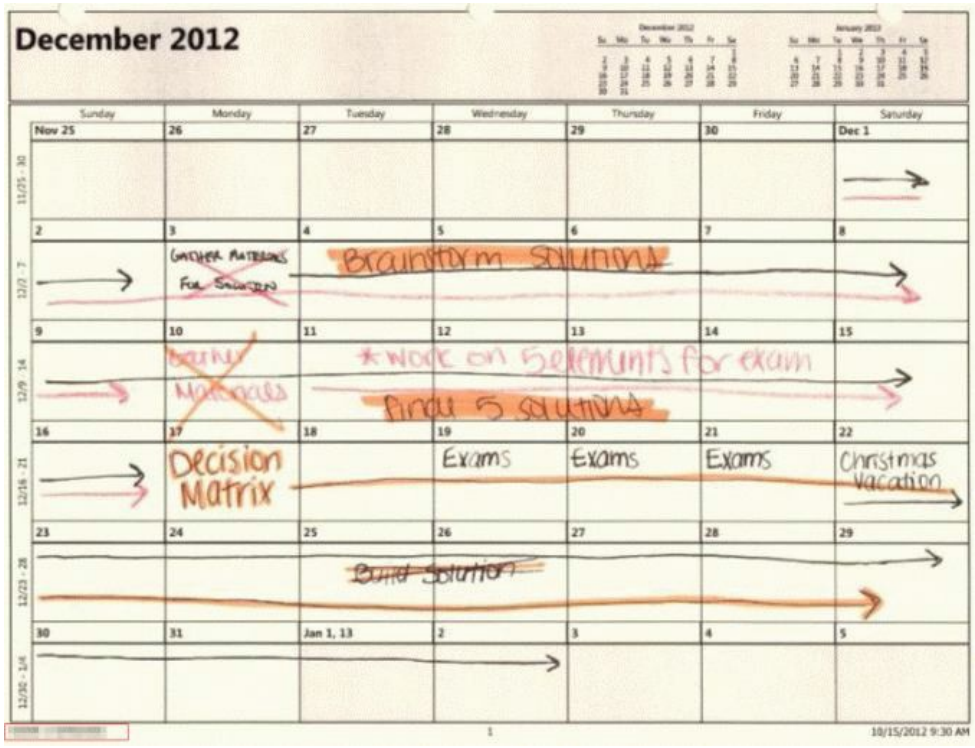
An example of our engineering notebooks:

Overall, our solution needed to use the OBDII (On Board Diagnostic System) System. Every car 1996 and newer runs on this system to give car diagnostics and all the codes are universal. Thus, it was crucial for us to learn how this system works.

We also needed to learn about the Engine Control Module which is a device located within the vehicle usually mounted around the passenger door area. We learned that This computer stores all information regarding all electrical systems within the vehicle. The computer has an OBDII output which transfers the information, stored on the Engine Control Module (ECM), and is then transmitted as an executable file. An OBDII reader then reads the code from the ECM to give car diagnostic.

We also had to look into how the electronics and switches within the car itself correspond to the onboard diagnostic computer. Once a problem occurs the code is stored in the ECM until it is read by an OBDII reader which then pulls the code. Usually, a system problem will trip the computer and send a signal to turn on the Check Engine Light. Once the problem is resolved, the computer resets and the light will turn off.

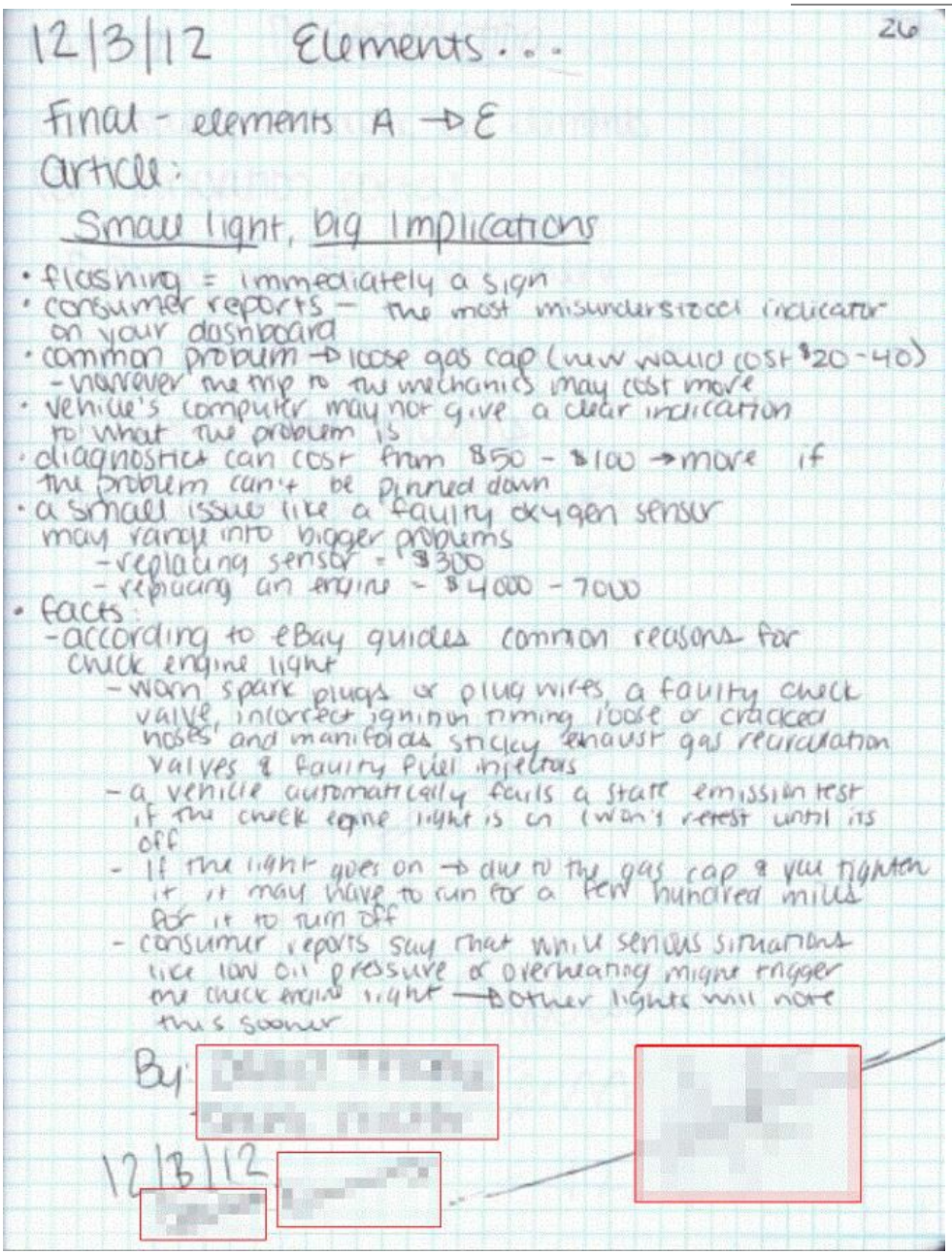
Another topic that we had to research is Bluetooth Technology became we planned to communicate with our Bluetooth OBDII reader. This



Bluetooth OBDII reader takes information from the car's onboard computer and sends it to any Bluetooth capable device.

Computer Programming and Application (APP) programming is another topic to learn about to complete our final design. In using programs such as Visual Basic, we need to learn how to code a program that will give us the desired output to complete our final design. We used Visual Basic Express to create a program that would be a prototype for our final design. It would display the information that we would want to see in our final product as an app.

To create our final design, we decided to combine two separate concepts. These two concepts consisted off the "Critical and Noncritical Display," and the "Repair Shops/Mechanics" ideas. We began researching Bluetooth technology. By researching Bluetooth technology, we discovered that the technology to fulfill the second part of our design does exist. We learned that Bluetooth is wireless and automatic. It works on a protocol system where there are various commands and responses. Thus, it works on two levels: physical and protocol. The physical level is radio-frequency standard. Secondly, there is the protocol level where different products have to agree on bits sent, how many bits sent at a time, and how the parties in conservation can be sure that the message is received in the same message sent. In Bluetooth networking there is data sent via low-power radio waves. These frequencies allow different Bluetooth abled devices to connect. For, devices to connect there must be universal protocols which allows for a successful connection**[1]**.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Final - elements A → E

article:

Small light, big implications

- flashing = immediately a sign
- consumer reports - the most misunderstood indicator on your dashboard
- common problem → loose gas cap (new would cost $20-40)
  - wherever the trip to the mechanics may cost more
- vehicle's computer may not give a clear indication to what the problem is
- diagnostics can cost from $50 - $100 → more if the problem can't be pinned down
- a small issue like a faulty oxygen sensor may range into bigger problems
  - replacing sensor = $300
  - replacing an engine = $4000 - 7000
- facts:
  - according to eBay guides common reasons for check engine light
    - worn spark plugs or plug wires, a faulty check valve, incorrect ignition timing, loose or cracked hoses and manifolds, sticky exhaust gas recirculation valves & faulty fuel injectors
    - a vehicle automatically fails a state emission test if the check engine light is on (won't retest until its off
    - if the light goes on → due to the gas cap & you tighten it, it may have to run for a few hundred miles for it to turn off
    - consumer reports say that while serious situations like low oil pressure or overheating might trigger the check engine light → other lights will note this sooner

By: [redacted]

12/3/12 [redacted]

Layton, Julia, and Curt Franklin. "How Bluetooth Works." Howstuffworks.com. How Stuff Works, n.d. Web. 5 Mar. 2013.