RETHINKING REFUELING

Technology Innovation
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Predisposition

Drivers must locate and visit gas stations and manually fuel their cars every time they need gas.

Research Methods

To collect data and insights about how people fill their cars with gas, we did primary and secondary research. Our primary research consisted of taking a survey of six people between the ages of 21 and 23 who either currently have a car or had a car in the past year. We asked each person to tell us about their favorite and least favorite parts of filling their car with gas as well as what habits they have while they fill their car. Habits included standing outside or sitting in your car while it is filling, going to the closest gas station or a certain gas station brand, and letting their tank run all the way down or filling up in more frequent intervals. Our secondary research consisted of reading recent news and blog articles about current innovations in how people fill their car with gas.

Insights

- Drivers must get out of their car at some point to pump gas.
- Drivers outside of California must go to a gas station to get gas.
- Drivers must pay a service charge on top of the price of gas for delivery services.
- Drivers must unlock the gas cap themselves in order to fill their car.
- Drivers must swipe their credit card and choose a type of gas each time the need gas.
- Drivers do not like standing in the cold weather while their cars fuel.
- Drivers stand outside their car while it fuels because of fire hazards.

Alternative Insight

Drivers do not have to get out of their car to get gas.

Research Results

50%
Ratio of people that fill their tank when it is totally empty

2-3
Times per month that drivers refuel

Cold Weather
Biggest inconvenience while fueling

Fire Hazard
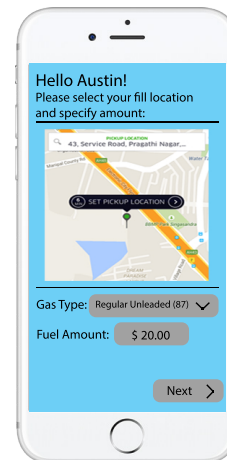Biggest reason for not sitting in car while pumping gas

Filld
WeFuel
Purple
Gas delivery start ups

$7.49
WeFuel Service fee per fill up in addition to regular gas price

Solution 1 - Gas Delivery

A user would get to work or get home and know that they're going to need gas soon. The user would then pull up our Gas-ordering app. They would be prompted by many things such as what vehicle they want to fill up, the license plate number, what gas they want, and how much of it they want. The user's location would also be tracked. The user would then confirm their order and their method of payment. As soon as the user hits confirm, their invoice would be sent directly to our company's delivery truck that is closest to their location. The GPS system in the delivery truck would notify the driver of the new order. The operator would then set their estimated time of delivery and the system would then notify the customer what their expected delivery time was. Our truck would go to the customer's car to fill up. If the customer has an electronic-locking gas cap, the driver would unlock it using our RFID unlocker, which only unlocks if the customer has authorized the unlock, which is done when they submit an order. The operator would begin fueling the car to the desired amount. After the fueling, the operator would close the fuel cap and confirm the fueling with our app. The customer would receive a notification that their car had been fueled. While gas delivery companies do exist, none offer a system that unlocks just the gas cap. Users of those companies either have to meet up with the gas deliverer or they have to leave their gas cap unlocked, which risks siphoning.

Gas delivery app. This would be very similar to Amazon Go Gas app seen below; however, this app is dependant on the vehicle the user is in. The user must register the vehicle with the license plate number to the application.

Solution 2 - Amazon Go for Gas

A user would pull into a fueling area. The alignment would recognize a weight change and would notify the central control system. The central control system would scan for the users control device. The system would recognize which vehicle the user is driving and alert the alignment system. If the customer was out of alignment for their specific vehicle, then the system would direct them in order to become aligned. If the customer was aligned or after they become aligned, they would then be allowed to select fuel type, amount, and method of payment. The central system would verify the purchase and notify the pump. The robotic fill arm would then connect itself to the one-way valve and fill the tank to the user-specified amount. The arm would detach and let the central system know the filling has been completed. The system would then alert the customer that fueling has been complete and they're safe to pull away. Please see implementation section below for sketches and further details.

Solution 3 - Gas Pods

Our ideal use case for our gas-pods would be someone who has become stranded because they are out of gas. The user would go to wherever they have their emergency gas pods stored in their car and retrieve the pods. They would then take the pods to their gas tank and slide them in. The pod would reach the popping mechanism located on the anti-siphoning device. The mechanism would sense the pod and proceed to pop it in order to release the fuel into the gas tank. An extruder would then release the plastic from the anti-siphoning device.

Plastic pods that hold gas.

Container that pods come in at grocery stores

Siphoning guard that catches and dispenses pods.

Implementation of Solution 2 - Amazon Go for Gas

Our innovation is a gas station that does not require drivers to get out of their car to fill their tank. Instead, drivers simply drive up to the station, order the type and amount of gas they want from an app on their phone, and let technology do the rest.

An alignment system senses when a car comes into the filling-area. This system will alert the pump to recognize the user's vehicle and sync with the user's application. The sensor will learn what type of vehicle the user is driving and notify them if they are in the correct spot to get filled. If the user is not in the correct area, the system will notify them, over a speaker, to realign themselves according to the systems directions (pull forward, reverse and go left, stop, etc.).
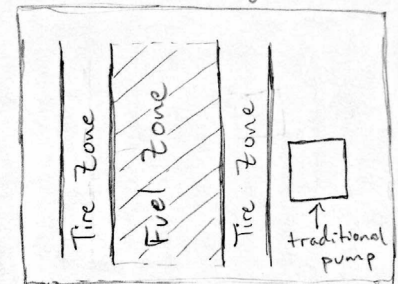

Tire Alignment System

This system would require software developers to create the alignment system's alignment software. We would also need sensor engineers to help make the alignment systems sensor software and hardware. Audio engineers will be needed as well as software engineers to create the audio system and a program can calculate where individual vehicles need to be positioned. Finally, we would need network engineers in order to get the alignment system on the network and be able to communicate with the central system.

This type of station will also need an automated bottom-filling gas pump. In order to remove the human intervention from the current model, we need to implement a technology that can fill up our gas autonomously. This technology would be an automated arm that would sit under your vehicle. It would then connect to the bottom of your fuel tank using a one-way valve, and it will fill your tank from the bottom.

For this we would need robotics experts in order to create the technology as well as software developers and network engineers to link the pump with the central system. We would also need car manufactures to buy-in to this solution to allow all newly-manufactured cars to have the bottom-filling valve installed on the gas tank and make sure the valve is easily accessible for the pump. Another buy in we would need is a car-parts manufacturer to produce the valves to install on older cars or to manufacture entire gas tank replacements that include the value to be installed on older vehicles. This installation could simply replace the "fuel tank drain plug" that currently exists in vehicles in order to empty their gas tank, and allow them to fill from this access point instead.

The next concept would be the user interface. This would be an application that could be installed on a mobile device or in
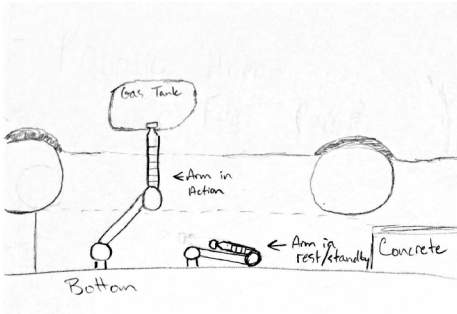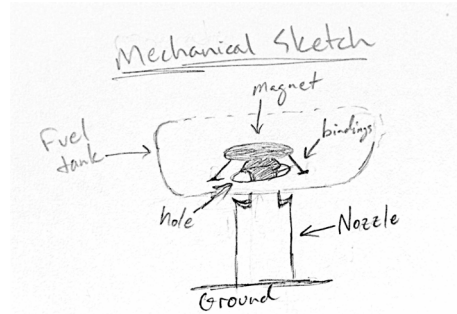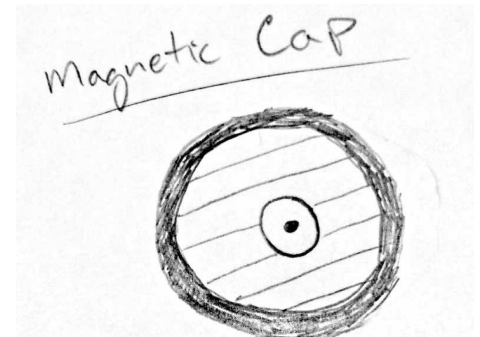
View of automated bottom-filling gas pump at rest and in-action.


Pump nozzle displaces the magnet cap on the car. Rubber ring presses against the tank to prevent spillage.


Magnetic cap. Dark region is the base material thats holds the magnetic cap (striped region) in place. The dot represents the lazer alignment device that communicates with the robotic arm.

the case of newer model cars, into the dash display. This application would allow you to order your gas, all in the luxury of your car. It would allow a user to specify the fuel type (diesel, regular gas, midgrade, premium, etc.) as well as how much, and the method of payment. The amount could specified in cost or in gallons, this would allow a user to also specify full tank, quarter, half, etc. For this we would need software developers to develop the application as well as designers to make sure the application is user-friendly.
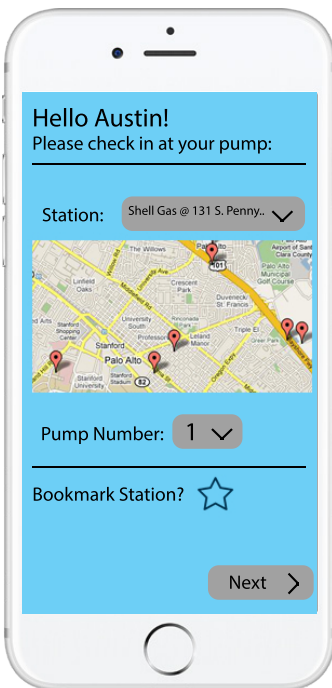
Gas station and pump identification screen
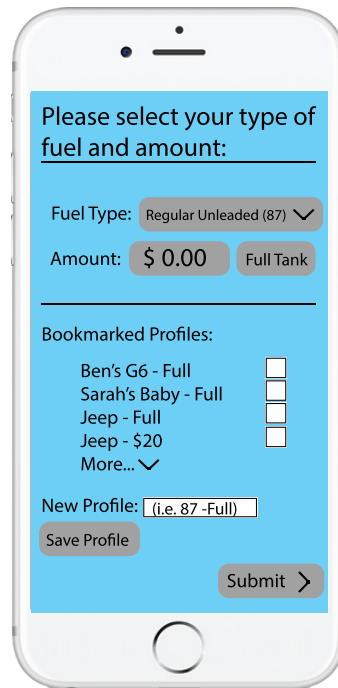
Gas type and amount selection screen
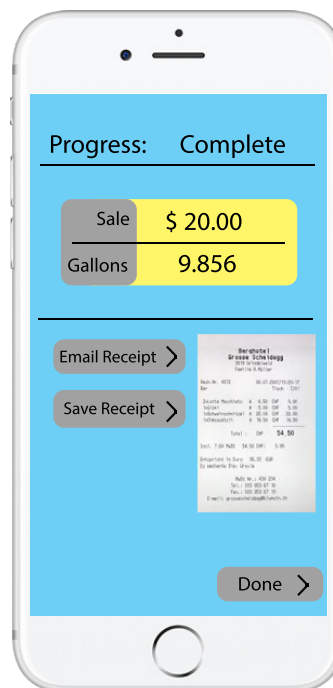
Filling screen counts price and gallons as gas is dispensed

Complete screen shows the total and receipt for transaction

Another concept that would be needed is the control system for all the gas stations. We would need each gas station to have a central server in order to take the fuel orders from the customer, activate the pumps, fill the customer's tank to the specified level, and charge the customer. For this we would mostly need network engineers to help build the central server.

Challenging an Orthodoxy

People think that getting gas is a hassle, they have to go to the gas station, get out of their car (which can be miserable during the winter), go inside and pay or pay out at the pump with their credit/debit card, then remove the gas nozzle, select the grade of fuel they want, stand there and pump their gas, stop pumping when they get the amount of gas they want (which isn't always perfect), put the nozzle back, grab their receipt, and then finally get in their car and drive off. Our system challenges this because users will no longer need to get out of their car or even lay a finger on the gas pump. All they need to do is drive up and choose the type and amount of gas. The gas put in their car will always be precise. They will no longer have to deal with getting gas on their hands or clothes. They will not have to worry about leaving children alone in the car will they fill the tank, getting attacked at a gas station at night, or being cold while wait to stop the gas flow. Our system makes getting gas an effortless, safe, and clean experience.

Sources

[Amazon Go](#)
[Wired](#)
[YouTube - How to Drain Your Car Fuel/Gas Tank](#)
[YouTube - How Nozzles Work](#)
[YouTube - OPW 11B Pressure-Sensing Automatic Nozzle](#)
[YouTube - How Automobile Fuel Tanks are Made](#)
[Bottoms Up Beer](#)
[The Verge](#)