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ParkAid Proposal

The Problem

Parking inefficiency and cybersecurity concerns related to smart parking applications in United States metropolitan regions.

Context

We are living in an era where there is a mobile application for just about everything. These applications, or apps, are intuitively designed to make daily activities easier, by enhancing the user's overall productivity and efficiency in all sorts of environments. One such example of this can be seen in the automobile parking sector in the United States metropolitan regions, where drivers often face a number of difficulties. It cannot be overstated just how important the parking sector is to metropolitan transportation programs around the world. Today, car owners can use intelligent parking systems that communicate with their mobile devices, such as a smartphone, via an app interface to find the best parking spot available. This Internet-of-Things (IoT) approach to parking considerably increases the efficiency of parking lots in densely populated areas. Mobile applications like these are being developed at a rapid rate, but they often lack proper security implementations. This can lead to significant information security and data privacy issues that can seriously impact end-users as well as organizations.

Year after year, cities in the United States have seen a steady increase in automobile ownership:

Figure 1

Vehicle Registrations in the United States (1980-2020)

USA**FACTS**

OUR NATION, IN NUMBERS

Vehicle registrations

275,913,237 in 2020
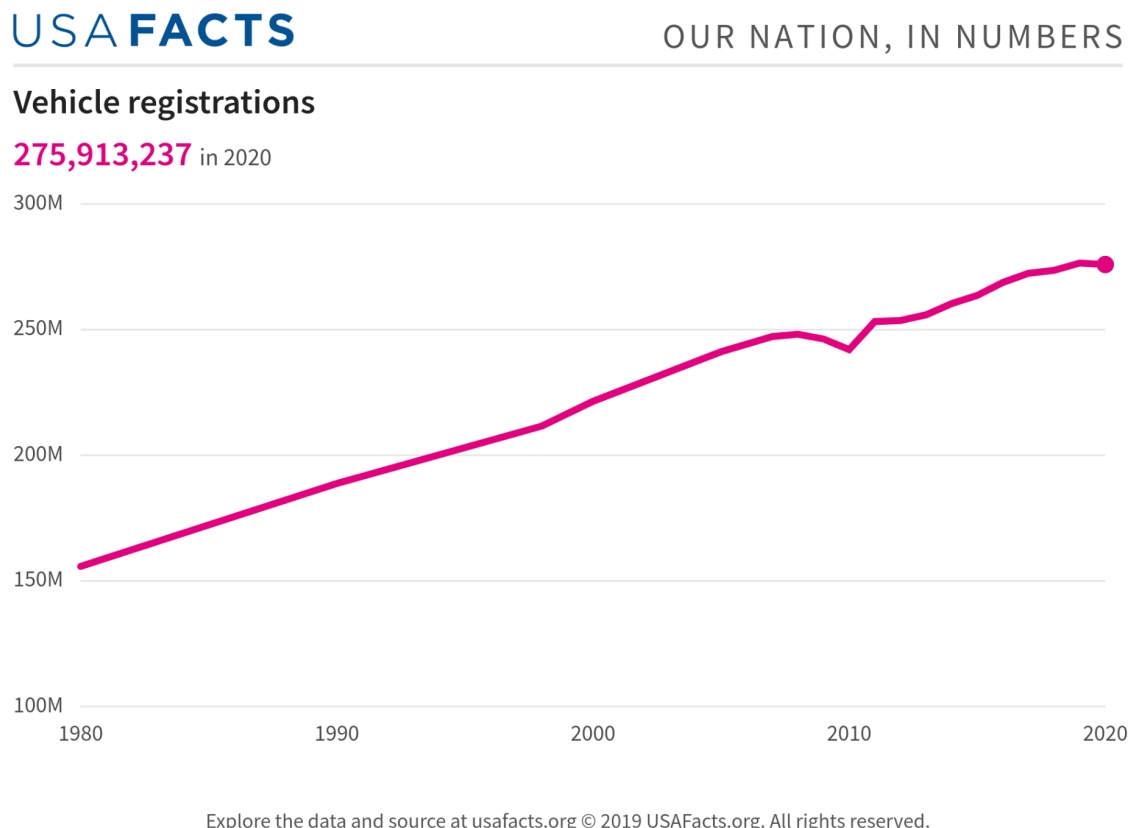
Note. The graph above was made by USAFacts, using information retrieved from highway statistics gathered by the Federal Highway Administration under the U.S. Department of Transportation.

As vehicle ownership increases, the amount of traffic and congestion in metropolitan areas will increase as well. It has become more difficult to find accessible parking in many places within metropolitan areas, such as airports, transit stops, retail malls, etc. The types of difficulties that often arise in communities include a lack of easily accessible parking, inefficient parking, and smaller parking areas. Lack of easily accessible parking may be detrimental to local commerce and impact the quality of life for local inhabitants. Inefficient parking schemes, such as parking garages with confusing layouts, often result in reduced customer engagement with businesses, as well as paying for unused parking spaces. It is also becoming more evident that cars are getting bigger, making parking spaces smaller in comparison. This, coupled with the fact that metropolitan areas are sprawling at a rapid rate, places an additional burden on businesses that don't have enough resources to meet the demand of their customers. Not to mention, all the time spent driving around and

looking for a space to park in only increases air pollution that harms the environment. Lastly, drivers can have trouble avoiding parking fines since they are either unaware of parking rules in certain locations, or forget when their parking time is set to expire.

Drivers would greatly benefit from a system that aids them in achieving a fast and reasonable parking experience, viewing helpful positioning and navigation information in many different places, and having a quick and convenient vehicle pickup process. This service exists in the form of mobile parking apps, and they have become more prevalent in cities of all sizes. Parking apps solve the issue of heavy traffic through advanced parking space booking or information on vacant parking spots in the area. Many drivers are unaware of just how many accessible parking spots are available in the city, and these apps allow for the discovery of such options, saving time and stress. As good as this solution is, it is not without flaws, namely concerning the security and privacy of the application and its users.

There are some parking apps that do not ask users to prove their identity when registering a license plate. This means that anyone can track the location of any vehicle simply by giving a license plate number to the app. This feature can be easily exploited by stalkers or criminals. These vulnerable parking apps can even be used by attackers to view a target's current parking sessions and receipts–all that is needed is the victim's phone number and license plate number, which the attacker then uses to "prove" their identity to the system. This is why all applications need to follow the security by design approach in their development. Focusing on the security of the end-user and the confidentiality of their personally identifiable information (PII) should be the top priority–the user experience comes after.

Evidently, citizens need an advanced technological solution to solve the increasing traffic problems. With more and more services and information becoming digital, implementing a smart parking system would likely be the easiest approach towards improving the traffic management program and the parking sector, while also being able to integrate seamlessly into the community.

The Solution

The solution we are proposing to the problem of parking inefficiency and cybersecurity concerns in parking apps will be executed in the form of a security-focused cyber-physical platform called ParkAid.

ParkAid will use GPS technology to analyze and process the positioning and navigation information of a vehicle with absolute precision. It will include a smartphone app that will work in real time to quickly find the most accessible parking locations for its users in any given region in the United States. With the ParkAid app, users will be notified of the remaining time they have left in a parking space, eliminating worry, uncertainty, and the

potential for parking fines. This solution provides all the economical and eco-friendly benefits mentioned earlier, but it will go a step beyond by effectively addressing security and privacy concerns. The app will be developed by a team of cybersecurity experts who understand cyber threats and vulnerabilities, and how to mitigate risks posed by hackers. ParkAid will make paying for parking hassle-free thanks to the encrypted in-app payments. Users can also find the parking spot that best suits their preference by using the filter feature that can define certain criteria, such as the number of available parking spots, the cost of parking per hour, and the maximum amount of time a vehicle can be parked in a spot. ParkAid will utilize in-pavement antennae and cameras across a multitude of parking services which will be used to detect when and where spots become available (Giampaoli & Hessel, 2021).

The IoT component of the ParkAid platform, which includes all the devices that will communicate with each other as well as the app itself, will be designed with security as its top priority. All ParkAid users will have to create an account with an email address, phone number, username, password to login into the application, as well as the vehicle license plate number and the Vehicle Identification Number (VIN) issued by the Department of Motor Vehicles (DMV) upon registration of the automobile in the state of residence. To confirm the creation of the account, the user can choose to have a code sent to them via SMS or email, to which they submit on the app or on the web. The user will then be required to set up two-factor authentication (2FA) with Authy, a 2FA app that creates a time-based one-time password (TOTP) that expires after 30 seconds. The user must use this code to authenticate themselves to ParkAid. All data that is transmitted or stored will be encrypted through the use of a public key infrastructure (PKI).

We believe that ParkAid will gather broad appeal from its users who would welcome the benefits of an economical and eco-friendly parking program. ParkAid will provide the efficiency and ease of use that today's hard working professionals yearn for and will put their security and privacy above all else.

Barriers

There are certain challenges that may be a cause for concern for the ParkAid program. It would take considerable political support to implement such a program, which would not be easily attainable, especially given the present economic circumstances. Moreover, it would take a significant amount of financial resources to broadly implement the program over large metropolitan areas. In addition, many users will need to be educated on how to use the program, since not all people are accustomed to such technology. Security breaches are also a large area of concern that will need to be constantly monitored and assessed for threats and vulnerabilities. The last barrier consists of the monitoring and evaluation activities used to assess the effectiveness of ParkAid's ability to solve parking issues, as well as its security posture.

Assessment

The ParkAid program's success can be measured by tracking parking records stored on the ParkAid app and observing metrics such as the amount of parking spots found per week, how many spots were filled, reviews on the iOS/Android app store and social media, etc. This information can then be used to identify trends in the usage of the app and determine its success in being an effective solution to the parking problem. Also, by identifying user trends, we can gain useful insights into how our users behave, and how we should continue developing the platform to meet their demands. If we find that users have lost interest in the platform, consumer research and reputable surveys will be utilized to discover the reason(s) behind this behavior. The resulting data will be analyzed and it will inform strategic solutions accordingly. Security assessments of the mobile application will be conducted to expose security gaps, and we will subsequently address any vulnerabilities that appear.

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