1.0.0 Purpose of the document
To create a reference for general goals and purposes, future implementations, and application styling.

2.0.0 Mindset behind Park@State
Park@State is a user driven parking and navigation tool for those commuting to or driving around Michigan State University’s campus. We hope to create a fluid process for users to become knowledgeable of MSU parking, use that knowledge to their advantage, and overall take the stress out of the parking process by assisting people from the beginning to the end of their parking experience.

3.0.0 Initial research
Once we came up with the initial idea of a “smart park meter application” we wanted to observe other people and ourselves interacting with meters to see where the touch points are and how we could improve this kind of system. After the initial round of observations where we observed the entire process, we identified three mains points that we wanted to observe specifically in future research. These major points were the ability for someone to find a spot near their destination, come back to their car before getting a ticket, and being able to find their car once they come back to it.

3.1.1 Spot finding research method
During research we would periodically check adjacent lots to the one we were observing to see if there were open spots. When there was open spots in the adjacent lots and not in the one we were
observing then we would count the amount of cars that would circle the full lot and end up driving away in defeat rather than parking at the adjacent lot that was open and close but simply out of sight. This is where an application that someone could quickly reference would be helpful.

3.1.2 Parking Ticket Research

To find out how often tickets were given out we asked a parking enforcer on campus how many tickets were written on average and to our surprise we found out that anywhere between 60-80 tickets are written per enforcer per day and there are about 10 enforcers. This shows a clear need for some kind of assistance from technology and something that our application could fulfill.

4.0.0 Use cases

Based on research and feedback we have created two lists to exemplify the main users process of commuting and parking on campus

4.1.0 Student/faculty use case

As a student/faculty member parking on MSU's campus I want to...
1. Find a lot I can park in that is close to my destination
2. Find an open spot I can park at long enough that I won't get a ticket
3. (Do the previous steps in as little amount of time as possible)
4. Pay for my spot (meter)
5. Be reminded when my meter is about to expire
6. Know that if I stay long enough parking is free
7. Pay for my spot (ticket system)
8. Leave parking lot

I may want to...
1. Find a schedule to fit my parking needs
2. Feed my meter so as not to get fined
3. Pay with a credit card

4.1.2 Visitor use case
As a visitor parking on MSU's campus I want to…
1. Find a lot closest to my desired venue
2. Find an open spot within my price range or that can be validated.
3. Pay for my spot (meter)
4. Be reminded when my meter is about to expire
5. Know that if I stay long enough parking is free
6. Pay for my spot (ticket system)
7. Leave parking lot
I may also want to…
1. Purchase spots in local streets or driveways during big game days.
2. Procure a contract for said spot through the sports season.

5.0.0 Front-end functionality and features
Each page should have a flat design to it. With buttons that are discrete, clickable, and easy to recognize. Navigation should be as intuitive as possible due to expected use while driving. Any possible hindrances should be mentioned on the apps help page with clearly defined instructions.

5.1.0 Minimum Viable Product features
These are the features we believe will serve our core purposes most effectively and without much need for further integration with any established infrastructure or organization.

5.1.1 Lot ranking based on destination
This will mostly be created through backend work allowing an algorithm for sorting lots surrounding campus buildings.

5.1.2 Save GPS location of car
Integrating with Google maps or another map engine to allow this capability will hopefully be simple but may cause further backend issues.

5.1.3 Information about each lot
Will provide a basic service to users and guests about the parking availability around campus.

5.1.4 Bookmark capability
Is a way for users to save their most used lots or frequently visited build is.

5.1.5 Lot status marker
Shown in the form of a color filled circle from a distance percentages can be displayed when clicking on circle (green=empty-60%, yellow=61-90%, red=91-100%)

5.2.0 Description of every view and function
Where each function is placed and how many are on each page is important to keep in mind. What follows is how we imagine each function to work along side another based on what page the user is at.

5.2.1 User sign in page
This is the first screen that the user sees when entering the application and its purpose is to identify which type of user they are. They will have 3 options to pick from: student, faculty and visitor. Depending on what they pick their experience within the application won’t change much structurally, but the data delivered to them will
vary. For example the permissions to park in certain lots will change between student and faculty, and for visitors the information provided will be more thorough to make up for the lack of knowledge they have of campus.

### 5.2.2 Buildings page

This page will presumably be the first page seen once leaving the landing page. It will have a menu button to access your profile, settings and any other affordances needed for users but not important enough to have its own place on the page itself. Next to the menu button will be a search bar for users to quickly find the building they are looking for. The results will be displayed as the user is typing so reduce time spent looking. Below the search bar will be the alphabetical list of buildings that are on and around campus. Below the list we have our toolbar/navbar that consists of a buildings tab (this view), a parking lot tab, bookmarks, and an event/venue tab. (These tabs and their views will be explained later, but the navbar will only be explained here as well as the menu button.)

### 5.2.3 Lot Rank page

The user will be lead to this page after selecting the building they are going to on the buildings page. Based on the building they pick, 3 “cards” will be displayed which have the top 3 recommended lots on them; this is the view of our lot rank system. On each card it shows the lot number along with predominant info regarding the lot such as its status color coded into green, yellow or red, the distance away from the building and its price. For information that is not predominant to your decision, you will have an information button that will flip over the card to display more detailed info regarding the lot.

### 5.2.4 Navigation page
This page is displayed once a user selects a lot and it is simply Google maps navigation embedded into our application. This will direct the user to the lot they chose via navigation.

5.2.5 Set Timer/GPS page

Once the user arrives at their location they will be prompted with this screen. It will have a timer that the user can set to match the time on their meter, and a button which will drop a pin on the map showing where the location of their car is. The timer will send a push notification to the phone 5 minutes before it runs out to give the user time to feed their meter. Based on the distance from the building to the lot the warning notification will adjust accordingly.

5.2.6 Embedded Lot status tab

There is only one view that falls under this tab and it is just a map of campus showing all of the lots with the color of them representing the status. (Red= full, Yellow= <10% open, Green= >10% open) This view is intended for quick reference especially for those who are familiar with campus. Due to the fact that they are familiar with their daily routine they probably don’t need to be walked through the process of the lot rank system and would rather just reference lot status to decide for themselves. If they click on the lot balloon it will display additional information regarding the lot.

5.2.7 Bookmark tab

This tab only has one view as well and it is simply a list of the users bookmarked lots displayed on cards including general information of the lot. These bookmarked cards will also show the status of the lots embedded into the card so the users can know which of their favorite lots are taken with minimal effort. Users will also have the ability to name these favorites to be able to recognize
them better. For example instead of Lot 71 it could say Chemistry or Monday/Wednesday lot.

5.2.8 Venue/Event tab

This tab can be accessed directly from the nav bar on the bottom of the screen. The page that will first be displayed will show game day/event-parking information that will change based on the events occurring that day or week. Below this will be a button that will lead to a separate view displaying our peer-to-peer game day parking.

5.2.9 Peer-to-peer game day parking page

This page will be a Craigslist type listing where people can list parking spots available in their driveway or yard along with pictures, description and a price to park their for the day. Once people create these listings others will be able to scroll through and reserve spaces for the day. This is a feature we plan for future implementation and not in version 1.0 so we don’t have all the details thought out and drawn out but this is a rough idea of how it would work.

5.3.0 Wireframes
From left to right (referencing section 5.2.0);

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6.0.0 Back-end functionality

The largest back-end function is integrating Google maps or a map source to show buildings and the surrounding lots as well as adding a GPS location for when users park. Also a lot ranking algorithm will need to sort lots surrounding each building and venue on campus. There is also the need to refresh data from kiosks and possible native data from users to display lot availability. For the peer-to-peer capabilities there will be extra security needed and payment functionality as well as a communication aspect.

7.0.0 Future features

These are the features that we hope to introduce in later versions of the application. They aren't essential to launching the application but they will definitely improve the functionality and usability of the app once we have opportunity to do so.

7.1.1 Specific singular spot openings
In the future when more of the “pay by plate” kiosks are installed throughout campus and we gain a larger number of users we will be able to gather data so accurate that we can specify how many spaces are open down to the exact spots. This in turn will make the application even more reliable and increase the number of users therefore increasing accuracy again. This cycle will ensure that application is successful once we have a good start but this is also our biggest challenge when we are trying to introduce it to campus.

7.1.2 Pay by mobile phone

When users park they don’t always have enough change nor do they have a credit or debit card handy, but one thing you can count on is that they have their phone handy. For this reason we want to offer mobile payment with tap to pay via NFC. Another option could be to put RFID tags on the meters so the user can scan the meter and make a payment to MSU via PayPal or another mobile banking application. With either of these options it would make the overall parking experience better for people and also allow for the option to extend time and automatically pay while doing so.

7.1.3 Peer to peer private property spot sales

For game days on campus parking is always an issue and by standardizing this process with an online parking space market it can solve any logistics problems that currently exist. With our application we want to allow users to list available spots that they may have in their driveway or yard along with a price. Users on the other end will therefore be able to browse available spots from their smartphone and reserve them for when they arrive to tailgate. This is a win-win system for people as college kids will get money, and visitors to campus can find parking easy and cheap without worrying if they are going to get a spot. This will also improve the overall
logistics of campus as parking will be more dispersed and not concentrated in one area.

7.1.4 Traffic analysis

Based on our data from the parking lots we should be able to determine patterns of traffic flow through campus and include it into the data delivered with our application. This will make any given commuter going to campus even more predictable and therefore less stressful, which is the end goal of all these features.

8.0.0 Conclusion

Overall the park@state application is intended to assist the user from the beginning to the end of the parking process to mitigate stress and make parking one less thing to worry about for already busy students and professors. To begin, through gathering data from newly placed “pay by plate” meters, native app users and interconnecting campus meters via our application we will be able to deliver data to the users that is both timely and accurate to ensure parking is a breeze. At first the data won’t be extremely accurate; however, as the number of users grows and the “pay by plate” kiosks become more ubiquitous across campus the data will become increasingly accurate to the point that users can trust the application and rely on it as apart of their daily routine. As the status of lots becomes more accurate, so will the suggestions of the lot rank system, therefore people overpaying and being late to class will be a thing in the past. Once the user actually parks, this isn’t the end of the troubles. Based on research roughly 500 tickets are written every day on campus, from this it isn’t hard to tell that people can’t manage their time all that well so our application will help them do so. By prompting them with a timer right when they park they can’t possibly forget to set it and with a push notification warning them before the timer runs out it is one less thing for them to worry about when they are trying to focus in class. Also by
allowing users to set the GPS location of their car it is one less thing for them to remember especially if they are unfamiliar with campus. Once the user returns to their car to go home for the day, they will have the ability to bookmark these lots to remember for future use and an even easier experience later. Eventually we hope to perfect and generalize the system enough for it to be applied to other cities and campuses. With all the features of the application walking the user through the process of parking it will give them a peace of mind as they go about their daily routine and also save them a considerable amount of money throughout the semester.