The Peerspun Project
Usability Studies and Project Proposal

1. Introduction

We plan to implement a system which acts as an extension to the viaCycle system : a rent-a-cycle service within the University. The viaCycle service can be accessed via the web, allowing the user to locate viaCycle stations. On review of the service as well as our interactions with the students, we have realized that the transit system within Georgia Tech's campus could be made to facilitate easier and more seamless student transit. Thus, we aim to provide a solution for this problem which will fill the gaps that exist and provide a more user-centric system.

1.1. Motivation

Most users access nextbus.com to get the arrival time of their bus. The bus service itself is not very reliable and is subject to constant delays due to traffic, among other reasons. In such situations, students must walk to class, and are often late due to waiting then eventually being forced to walk. Our initial user surveys show that delays in the trolley service ranked as the most frustration-inducing aspect of navigation around our campus. Our team's system will help bridge these gaps in intra-college transit by notifying users about trolley delays and suggesting to them nearby viaCycle stations along with their availability.

1.2. System Overview

We plan to provide a decision making service which would leverage the Google Maps API to get the user's current location. We will then get the data from nextbus.com to provide bus delay times. Based on the delay findings, the app will intuitively point to the nearest viaCycle station and show the availability of cycles. This automates the decision making process and gives an alternative to waiting for the trolley or walking to the classes.

2. Existing systems in the problem space

There are a number of systems initiated by Georgia Tech to ease transit inside the campus.

2.1. Trolley, Stinger

Pros:

- Runs at a regular interval and carries students around the campus.
- Free of cost service
- Uses NextBus to show the time remaining for the bus to arrive at some of the bus stops.

Cons:

- Static maps displayed at the bus stops are not very helpful as they do not give any information about the waiting time or location of buses. This causes unnecessary waits at the bus stop leading to the students arriving late for their lectures.
- The time remaining is displayed at only some of the bus stops. At the other bus stops the users have to rely on other means of guesstimating the arrival time of the bus.

2.2. ViaCycle

Pros:

- Gives the students access to bikes anytime on the campus based on availability.
- Easy unlocking of the bike using call, text or an app.
- Low-cost of use which makes it easily usable by the students.
- Proprietary locking system to ensure security and rid the user of worrying about the bike.
- Use of latest technologies like wireless communication and GPS to reduce infrastructure costs.

Cons:

- The system is not very popular now and needs to be publicized to draw a wider user group.
- The number of bicycles available right now is low. (Approx 35)
- There is no functionality to give the availability of cycles at the station.
- Doesn't have an app where information could be easily retrieved or entered.
- Doesn't provide a comparative analysis showing the use of viaCycle versus trolleys or walking.

2.3. GTBuses

Pros:

- Gives real-time visual information of location of buses within the campus. Overlays the information onto a map of Georgia Tech to show relative position.

Cons:

- Doesn't give the users current location.
- Doesn't inform about alternative transport.

We conducted surveys and interviews in order to better gauge the users of this problem space.

3. Methodology

3.1. Participants and Process

The user group for this project was chosen from students on the Georgia Tech campus though an initial set of short (approximately 5-15 minute) interviews where a broad range of questions pertinent to the semester's theme were fielded. The range of questions revolved around the theme of wheels in terms of **travel, navigation and social circles.** Travel questions were further divided into subgroups based on **mode of transport** (walking, biking, commuting, and transit) as well as **reasons for travel** (such as having to travel to campus versus around campus). **Demographic questions,** such as major, class standing, country of origin, technological familiarity, and hobbies, were asked during interviews to better define our potential user group. For all scenarios, participants were asked what **problems or frustrations** they encountered, as well as what ways their experiences might be improved.

During the in-person interviews as well as the survey, participants were ensured that **no personal information was collected, and their responses would remain anonymous.**

These questions were further refined and pared down to a set that was then incorporated into an online survey. Respondents were primarily asked questions regarding **navigation and travel on campus, concerns about such, and opinions and preferences regarding current electronic systems used for transit**. Several open-ended questions were asked in order to allow for unforeseen issues participants may face. Demographic data taken was reduced to class standing and determination of whether students lived on or off campus was neglected since the main focus became inter-campus transit.

4. Results

4.1. Behaviorial Observations

The interviews yielded a broad array of results in terms of demographics, means of travel, and personal concerns, as expected. Six students gave impromptu interviews in Clough Commons. Of those six, one was a grad student and the rest were undergraduates. Half lived off campus, but none held jobs on or off campus. Two owned cars, but only one commuted to campus and neither parked on campus. Two respondents regularly rode bicycles (those being among the off campus residents). Those who did not ride bicycles said that they routinely walked to traverse the campus, and rarely rode buses or trolleys. From nearly all respondents it was discovered that their worst frustration regarding on campus transit was lack of time to get from class to class and the fact that buses and trolleys are not available frequently enough. Many respondents who primarily walked also indicated that travel by bike might be enticing under the right conditions.

Note about the interview process: The first interview request was with a student in line at Starbucks. Initially, this seemed like a good use of time, since the potential participant would just be waiting with nothing to do. While the participant readily agreed to the survey, he steadily seemed to tire of the process (apparent through the swinging of arms and a slowed response to later questions). In retrospect, we learned that people in confined social settings, among persons not involved in a study are not good potential participants. This may have been due to his feeling as though he couldn't readily excuse himself and be free of the interview (he would lose his place in line), or that he may not have wished to discuss some of the topics in such close proximity to strangers. We did not approach any other potential participants in similar situations.

4.2. Empirical Observations

Once these responses were reviewed, a refined online survey was created and potential respondents were emailed a link with the request to fill it out at their convenience. Twenty-six individuals responded to the questions, 25 of which were graduate students.

4.2.1. Favored Modes of Transport in Campus

Favored modes of transit on campus in descending order were walking, bus, bike, and car. Bus riding was twice as popular as bikes or cars, while walking was twice as popular as bus riding, as seen in Figure 1.

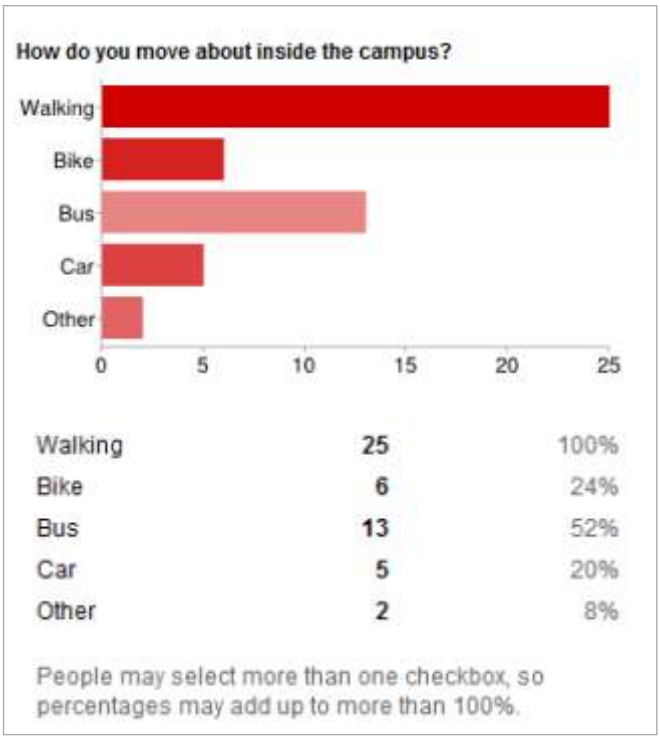


Figure 1. Survey responses regarding popular modes of transit on campus.

4.2.2. Hated most about traveling in campus

We did, however, find that many participants may be more willing to use the buses and trolley if they regularly arrived at the correct time. In Figure 2, it is clear that nearly half of respondents would like to see this situation improved.

4.2.3. Missing Classes due to slow transport

When rating the degree of negative impact slow transport has on students' schedules, we find that 62% of respondents consider this more than a minor concern, with 20% feeling that it is a major issue. See Figure 3.

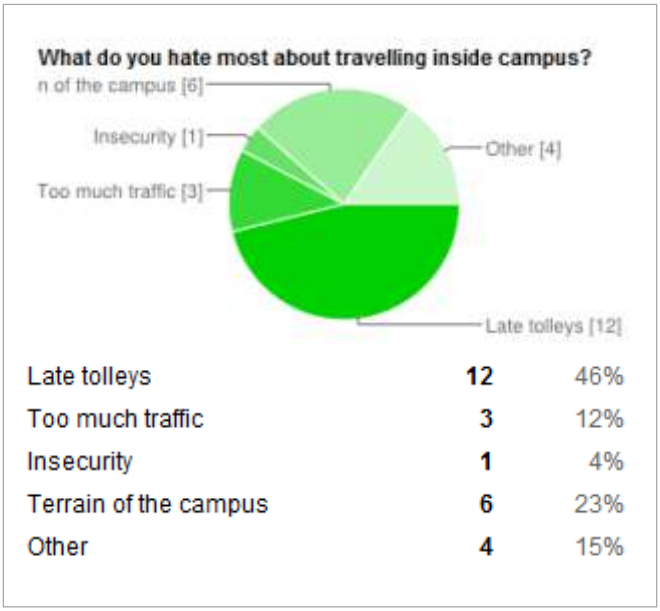


Figure 2. Survey responses regarding least popular aspects of transit on campus.

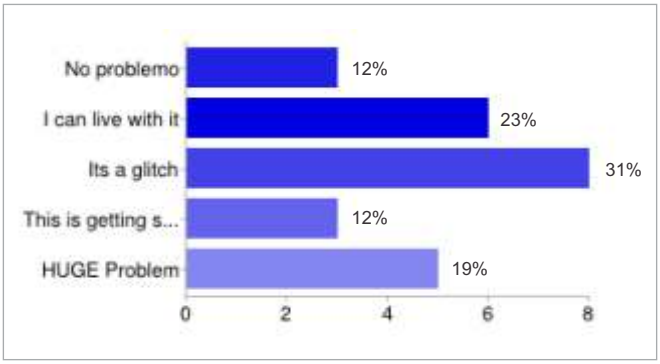


Figure 3. Survey responses regarding problems with popular modes of transit on campus: Missing Classes.

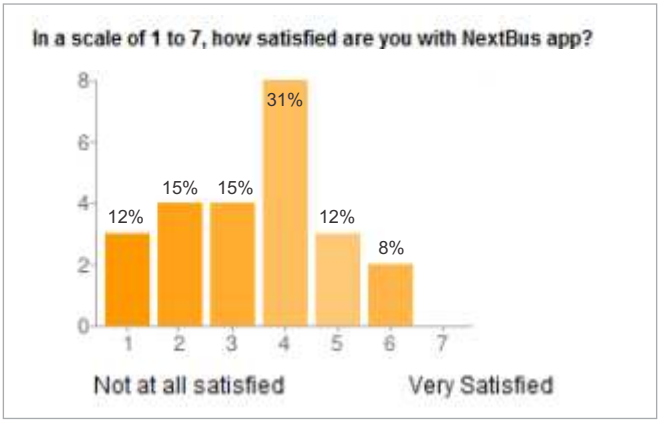


Figure 4. Survey responses regarding satisfaction with NextBus.

4.2.4. Unsatisfied with NextBus System

A further look at the state of the bus system shows that twice the number of students are unhappy with the NextBus system, versus those who are happy. Furthermore, nearly a third do not have an opinion, which may be due to their total lack of knowledge of the system's existence. See Figure 4.

4.2.5. Reasons to take up cycling on campus

As an alternative to the two most popular modes of transit, it was found that bicycles may have to overcome many hurdles before becoming accepted as a viable option. It took the prospect of bikes that are free for use in order to entice respondents to agree to biking between classes. A close second was the severely negative effects of even shorter times between classes, as seen in Figure 5.

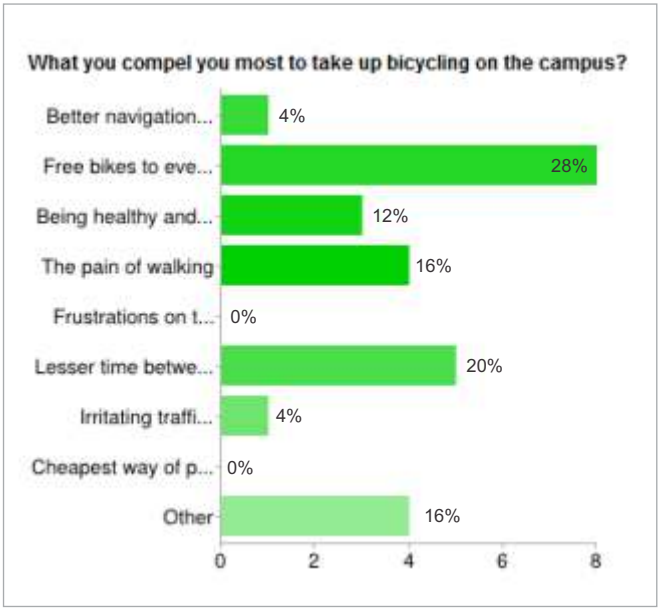


Figure 5. Survey responses regarding bicycle riding incentives.

4.3. Discussion

The task that the proposed system focuses on is on-campus travel. The most used modes of transport on campus, apart from walking, are the trolley and shuttle services followed by bike. When asked about travelling between classes, the majority of the responses were nearly neutral. But when the question was rephrased to problems with on-campus travel, nearly half of the

respondents cited late trolleys as an issue. Analysis of these responses revealed that majority of students had classes in the same area so travelling between classes did not require using bus services. But for other travels within campus use of trolleys seemed to be irritating for them because of the wait time. We asked all our respondents whether they would prefer using bike on campus. The majority of them replied yes. When further asked about motivation to use bikes on campus, about a third chose 'availability of free bikes on campus' followed by 'lesser time to travel' as their reasons. These findings encouraged us to further explore on-campus travel for enhancements/modifications.

Personas

Jason Smith

CSE Sophomore, Georgia Institute of Technology

Jason is a CSE Sophomore at Georgia Tech. Born in Alabama, he has lived in Atlanta for the past 3 years. He loves reading and playing basketball. Recently he started developing interest in music, particularly in playing guitar. Apart from studies and hobbies he loves teasing his kid brother.

Daily Tasks

- Go to college
- Hanging out with friends in the evening
- Practice guitar

Goals

- Play in a Band
- Reach Classes in Time
- Stay Safe on Campus

Likes

- Hanging out with friends in the evening
- Listening to Music

Dislikes

- Getting into traffic jams
- Waiting for the trolley

QUICKTAKE on Jason

Age	18 Yrs
Sex	Male
Marital Status	Single
Occupation	Student
Year	Sophomore
Major	CSE
Tech Status	Tech savvy

QUICKTAKE on Manoj

Age	25 Yrs
Sex	Male
Marital Status	Single
Occupation	Student
Year	2nd year grad
Major	ECE
Tech Status	Tech savvy

Manoj Khera

MS- ECE 2014, Georgia Institute of Technology

Manoj is an ECE Grad at Georgia Tech. He loves photography and is often found carrying his camera. He stays in the home park area near campus and is worried about safety at night. He works as a research assistant at IAC Deans office and prefers walking or travelling on buses on campus.

Daily Tasks

- Go to college
- Travel to IAC office for work
- Study in Library

Goals

- Complete working hours
- Move efficently on campus
- Getting home early

Likes

- Taking Photographs of campus events
- Indian food at student centre

Dislikes

- Delays in buses
- Campus terrain

5. Personas and Task Analysis

5.1. Description of Characteristics of the Task

The three most common methods of transport on campus are walking, trolley buses and bikes. Each one has tasks and sub-tasks which are characterized as follows:

a. Walking

In addition to being a way of traversing, it is a task in itself. The efficient execution of this task requires the user to have sufficient time to reach his/her destination and a knowledge of internal, shorter routes that are normally not accessible using vehicles.

b. Trolley /Stinger

The preferred mode of transport on-campus this requires the user to perform tasks such as walking to bus station, waiting, finding a seat inside the bus, greeting the driver, etc. These tasks requires user to have knowledge of where the bus station is located, time for arrival of next bus, patience to stand inside the bus if seat is not available and many others.

c. Bike

Another preferred/desired mode of transport is using bike for travel. This mode requires the user to not just perform tasks and sub-tasks but also have skills to perform those tasks. The major tasks are driving the bike, following traffic rules, finding parking space, etc. Each of these tasks are further divided into sub-tasks. In addition to knowledge and skills for riding the bike these tasks require user to have ability to make quick decisions in certain situation to avoid accidents. Also the terrain of the campus might pose a challenge and requires user to have physical abilities to overcome such challenges.

5.2. Description of the task environment

The campus environment is where the tasks related to travelling will be performed. The environment is characterized by a lot of buildings, vehicular traffic, pedestrians and hilly terrain. Being a technical institute the campus is a place filled with tech savvy and technology oriented people who have a tendency to easily adapt to new technology. The campus provides its own means of transport and also has dedicated lanes for bicyclists.

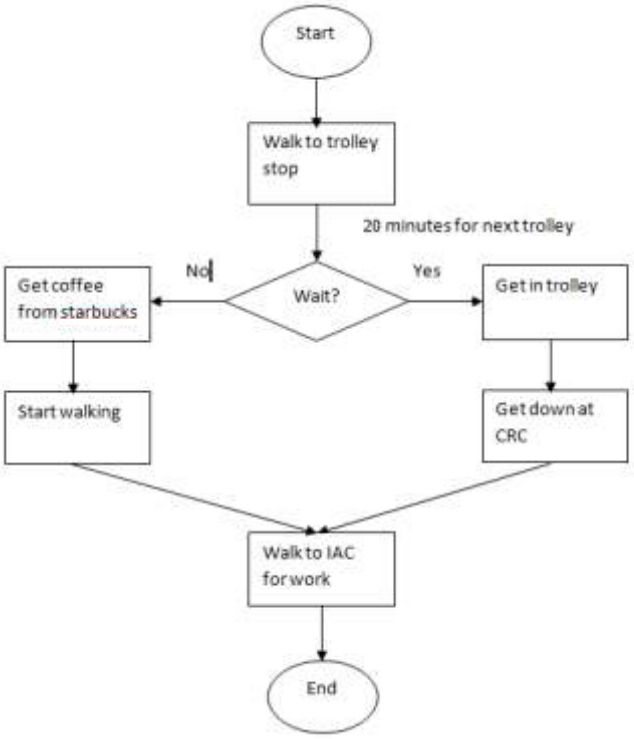
5.3. Task Flows

5.3.1. Task 1

Jason needs to travel from Library to Walk to transit hub TSRB in 10 minutes for his next class. The following are the tasks he performs

5.3.2. Task 2

Manoj has to go to IAC for his GRA Startat 6.30 PM. He is currently at Management building has 15 minutes at hand. Following are the tasks he performs



6. Design Proposal

6.1. Design Recommendations

An overview of what the system will do and why it's needed.

Based on the comprehensive results of this study, both empirical and observational, we developed the following list of design recommendations / solutions contextual to the 'problem space'. While many of these recommendations are not novel, they are expected to provide a functionality and usability upgrade to the existing system.

6.1.1. Provide Real-time and Efficient Trolley tracking:

Majority of the participants pointed out that buses arriving late was the biggest drawback about travelling inside campus. They were not satisfied with the current solution (NextBus). Poor time tracking and unusability of the smartphone application were the most common complaints against the NextBus solution.

6.1.2. Display Interactive Maps and Wayfinding Graphics:

Participants found it difficult to comprehend with the maps at the stinger/trolley stops. By providing interactive maps to the users, we can significantly improve the likelihood finding places/ routes on the map and decrease the time taken to complete the task.

6.1.3. Provide information about bikes available:

Almost a third of the participants pointed out that they would prefer riding bikes if they would get free bikes. A system that would point participants to free/rental bikes nearby would considerably improve cycling in campus and decrease the time taken in transit.

6.1.4. Help in decision making:

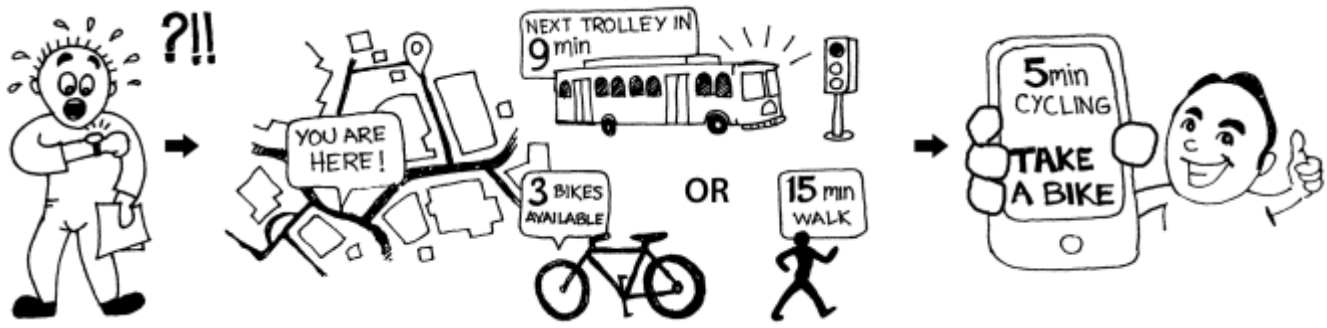
Participants often found it difficult to decide whether to wait for the trolley or to walk to the campus. A system to help them in making this decision will considerably decrease the cognitive load while helping users to reach in time for the classes.

6.2. Design Solutions

Our aim is to implement the design recommendations into a single system which aids the user to carry out multiple tasks of tracking the bus while providing information about the available bikes on an interactive map and help the user in making decisions on the most efficient medium of transport.

The system can be an extension of the viaCycle model : the rent-a-cycle service within the University. It will help bridge these gaps in the intra-college transit - notify users about trolley delays and suggest them nearby ViaCycle points and if they are available.

We plan to make a mobile app which would leverage the Google Maps API to get the users current location. We

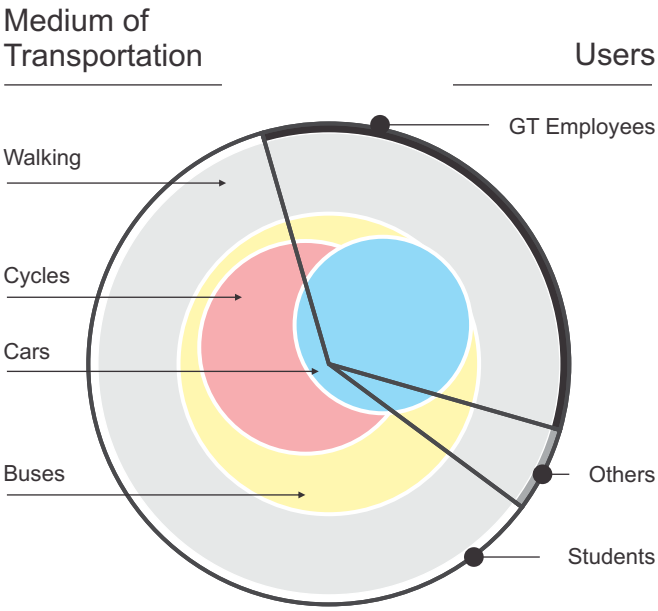


then get the data from nextbus.com to give us the delay times. Based on the delay findings, the app will intuitively point to the nearest viaCycle station and show its availability.

This automates the decision making process and gives an alternative to waiting for the trolley.

6.3. Socio-Technical Context

The design overlooks Georgia Tech in the socio-technical context. The students being the most prominent commuters on campus are the user-group for the design, campus transport infrastructure and the existing transport modules and application serve as the technical system. The socio-technical system can be broken down as follows



7. Usability Principles and Criteria for Evaluation

The following usability and design principles might be followed to evaluate the design at a later stage

Effectiveness: How good the product will do what it is supposed to do?

- The system is supposed to make decisions on the user's behalf and hence correct data must be used to make inferences. We should be able to accurately predict the delay of trolleys and buses so we don't provide false inferences to the users.
- The location of viaCycle stations must be accurately rendered to the user otherwise the time taken will be increased; contrary to the objective of the system.
- We would measure this metric by seeing if the transit decisions are taken correctly and if the right location is shown every time to the user.

Efficiency:

- Time is an important factor in the system and the system has to be responsive enough to minimize the lookup time.
- Our main aim is to make the users decide quickly and point to the the nearest viaCycle station.
- We would measure this metric by seeing how

quickly can the system make decisions and how satisfies the users are with the systems timeliness.

Safety:

viaCycle has a proprietary security system and hence will take care of the security aspect of the system.

Utility:

- Since time is of the essence, the utility of the app will be based of how effectively it enables the user to save time.
- If the user feels the system actually improves his current status of waiting period at the bus stops, the utility of the system served.

Learnability:

- The user group for the system are students who are quick at grasping new technology.
- We expect the users to get acquainted with a system in a short time.

Memorability:

Since minimum user interaction with the system is required, the learning curve for the system would be relatively flat.

Our design can also be evaluated with respect to design principles like

- Visibility
- Feedback
- Constraints
- Consistency
- Affordances

8. Implications of the exercise

Students at Georgia Tech are always pressed for time. Their main aim is to get to their classes on time. The transit system isn't quite suited to solve this problem. So our main focus while developing the system would be to ensure minimum time gap between student request and our response. We plan to achieve this by using minimalistic user interactions and optimizing our query system.

Another interesting thing we discovered in our survey was that people were not aware of the viaCycle service inspite of it being very useful. We would also have to focus on creating awareness about this service which can only be achieved by developing a system which would appeal to the students.

Since the students are looking for a free service, the viaCycle service is apt as it provides free service for upto 30 minutes which is more than enough to travel anywhere in the campus.

Even though the majority of the users walk around in the campus, the trend could be altered by pushing this service and making it available at a wider scale. The current capacity of 35 of viaCycle may not suffice and it might need to scaled up based on user response.

The Peerspun Project
Concept Evolution & Design Alternatives

1. The Problem Space: Introduction

This report discusses possible design alternatives for on campus travel within Georgia Tech. During the survey process we found that one of the most common problems for students on campus was waiting for the trolley. Also, when asked about bicycling as a possible alternative travel method, about one third responded positively, so long as the bikes were available for free. Apparently many students are not aware of ViaCycle, which provides bikes on campus. Our plan is to create a system that integrates ViaCycle service with the online trolley system. Once implemented it will help students and commuters decide the best possible mode of travel depending upon their preference.

2. The Process: Group Meetings

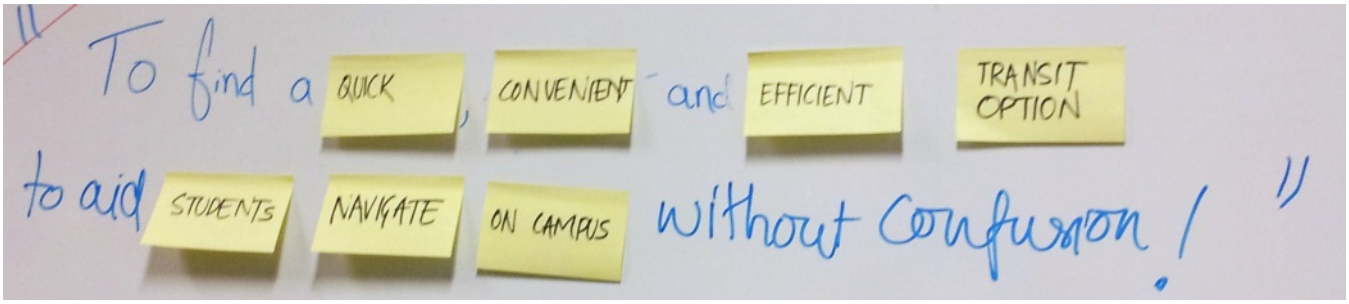
The group met on a number of occasions to determine the direction our brainstorming sessions should focus on.

2.1. First Meeting: Concept Generation

The first meeting started of with understanding the Problem Space and questions that need to be addressed by the system. We came to find out that we were looking for a solution that solves

- undependable Buses on the Campus
- the problem of being late for classes
- viaCycle's visibility on campus
- the problem of deciding between walking or waiting for the bus
- finding places on the campus
- problems with walking: tiredness, sweat, uneven terrain

The keywords that resonated with our problem space and user group were - Quick, Convenient, Efficient, Transit Option, Navigation, Confusion, Students and Campus.

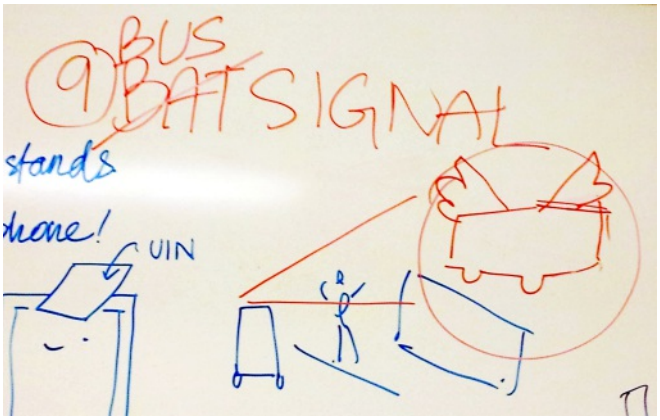


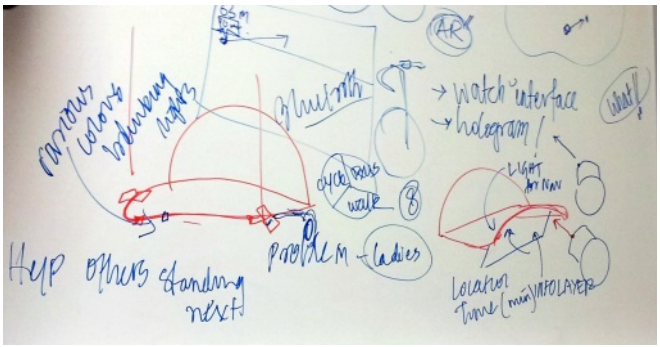
We decided to work specifically on a "transit choice decision aid for GT students."

2.2. Second Meeting: Informed Brainstorming

This meeting was our first "informed brainstorming" session to develop as many divergent ideas as possible. Here, the group took turns sharing ideas we had previously worked on alone, as well as developing new ideas together based on combinations of aspects from prior ideas. The short list of proposed designs we considered were as follows:

1. **Text to Go:** Simple text-based "Best Course" phone directions system
2. **Cycle Stands:** LED lit viaCycle stand displays (with map system incorporation)
3. **Transit Score:** Participatory website/ mobile app system. Allows users to compete for (and share details of) best campus transit times, ranked on a leader board
4. **Tactile feedback navigation systems:** ring / wristband vibration feedback devices
5. ViaCycle integration with Bus Stands
6. **Augemented Reality:** Transparent glass navigation system (interface similar to google glass)
7. **Hat-based navigation by light**. Also considered similar lanyard-based system
8. **Bus-Signal! ...Bike Signal?** Light projecting position/availability into the sky
9. **AR Smartphone transit information system**
10. Bus stop projection of interactive campus map for transit information system





Our final choices were amalgamations comprised of the most interesting and diverse qualities from many of these basic concepts.

The hat interface (#7) was morphed into a version of the transparent glass AR display (#6). It initially included a fold-down, transparent "infolayer," but that was abandoned to emphasize the simplicity of the light navigation system. It also initially incorporated smartphone based input (like that of #1), but was scaled back to use the simpler voice recognition input while in transit. After considering other wearable devices, such as a watched-based system, we chose the hat over all other options because it seemed most novel--none of us had heard of such a simple, elegant interface. We went with light-based navigation (#7) over vibration (#4) because the means of relaying spatial navigation information seemed more intuitive. Also, the lit-up hat would look cooler.

It was necessary to choose between the 3 phone based systems (#1, #3, & #9) on the grounds of which provided the most added benefit and novelty in contrast to the other two designs. Since we had removed the AR functionality from the hat interface, but still wanted to explore the possibilities of such a system, we went with #9. This concept also provided the best means of incorporating the option to navigate through environments not normally traversed, such as cutting through buildings on foot. Another benefit may be to tailor route information to those with reduced mobility, providing faster and more accessible transit routes.

Of the structure and/or display-based systems (#2, #5, #8, #10), the interactive bus stop clearly had the most potential to develop an all-encompassing transit decision aid, as well as an engaging user experience. Because it would only provide transit decision making on-site, we thought that it would best be coupled with one of the mobile options if we were to develop it further.

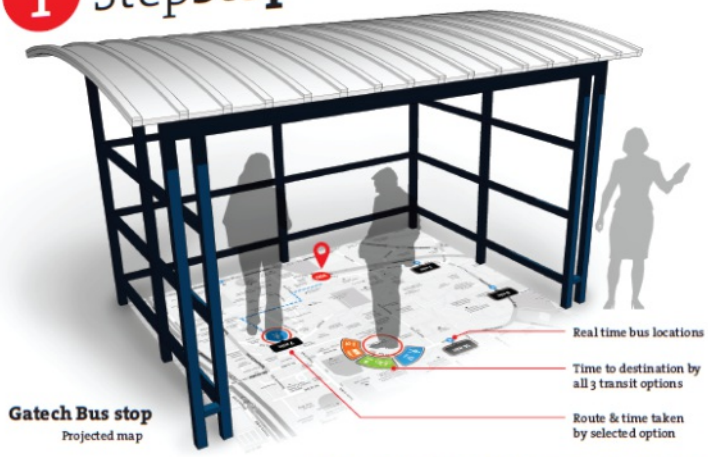
The Poster

the peerspun PROJECT

"SHOULD I WAIT FOR THE STINGER? OR SHOULD I JUST WALK INSTEAD?"

Decisions, decisions..

idea 1 StepStop



Gatech Bus stop
Projected map

"Projected interactive campus map to help users choose the quickest transit option"

64% Almost two-thirds of the Georgia Tech students are late due to **delays** in transit.

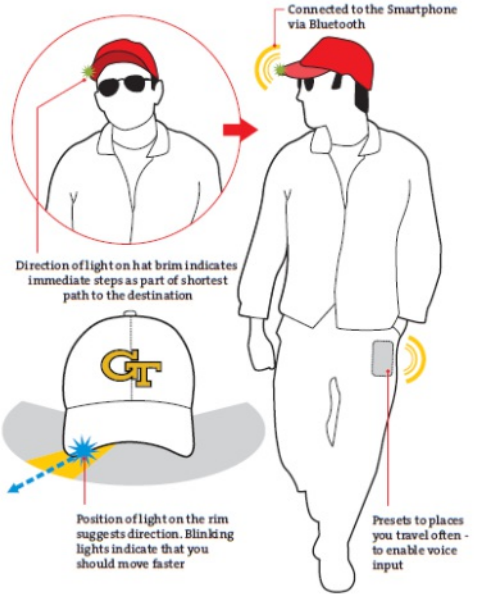
48% Almost half of the students blame this on the **unreliable** bus service.

33% Almost a third of the students would take up biking if given **free bikes**.

idea 2 GoGlow

"A Tangible user interface (TUI) that uses color LEDs and voice commands to navigate inside campus"

Color of the light suggests best transit option



idea 3 SpinPointAR

"Augmented Reality smartphone app to find approaching buses, available bicycles and walk-able routes"

Photos: https://photos.comm.gatech.edu Icons: thenounproject.com www.peerspun.com

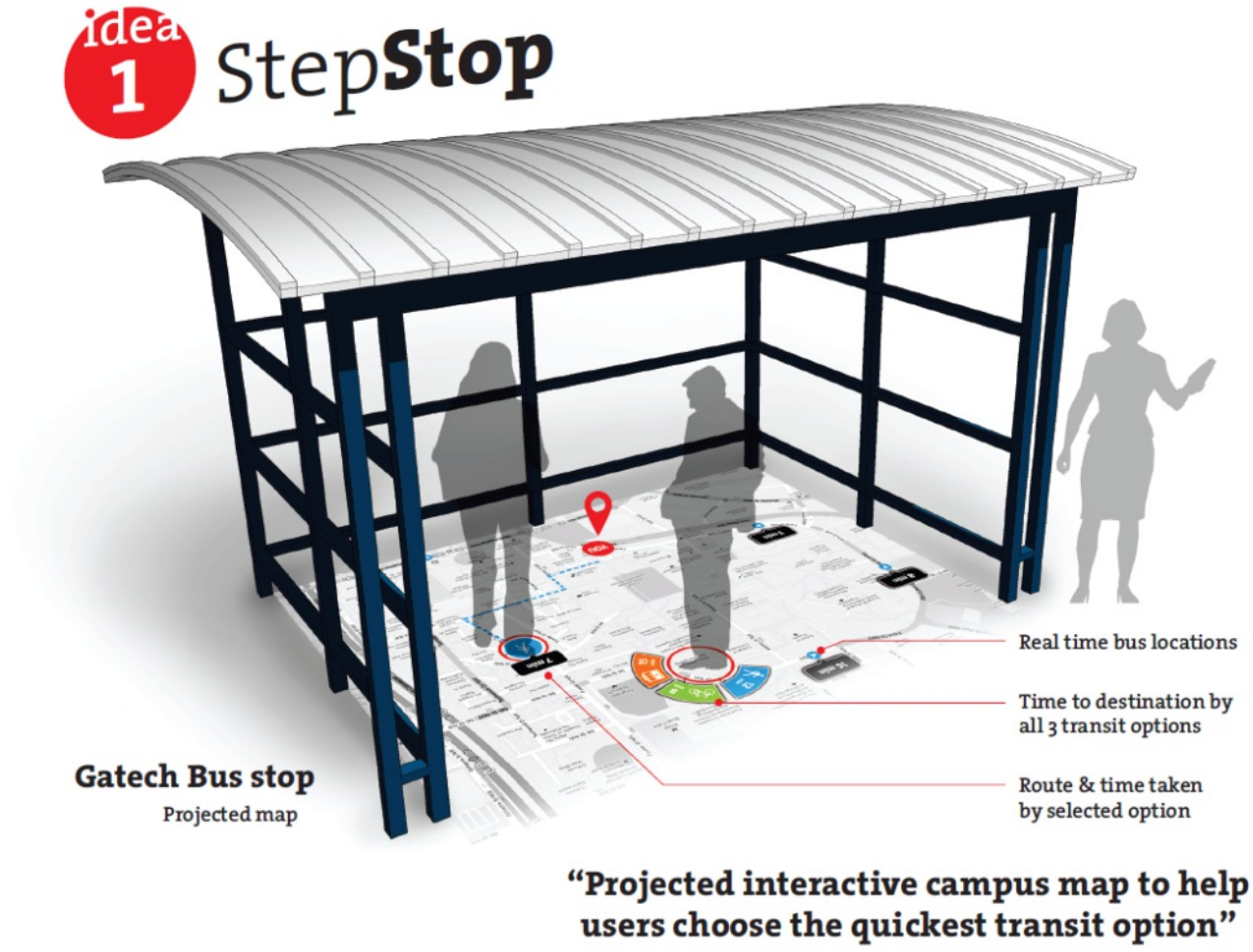
2.3. Third Meeting: Making Prototypes

During this meeting we continued to develop the final choices we planned to present during the poster session. We also worked on creation of poster designs, systems specifications, and prototypes.

3. The Outcome: Design Alternatives

3.1. StepStop: Interactive Bus-stop

This concept involves the projection of an interactive campus map on the floor of a Stinger bus stop. Also incorporated on the map are real-time bus locations and ViaCycle stands with available bike counts. Users may stand on the map in a position corresponding to their desired destination, which will then open up a pie chart with time estimates for transit by foot, by bike, and by bus/trolley. Selections are then made by pressing down by foot on the pie chart menu options.

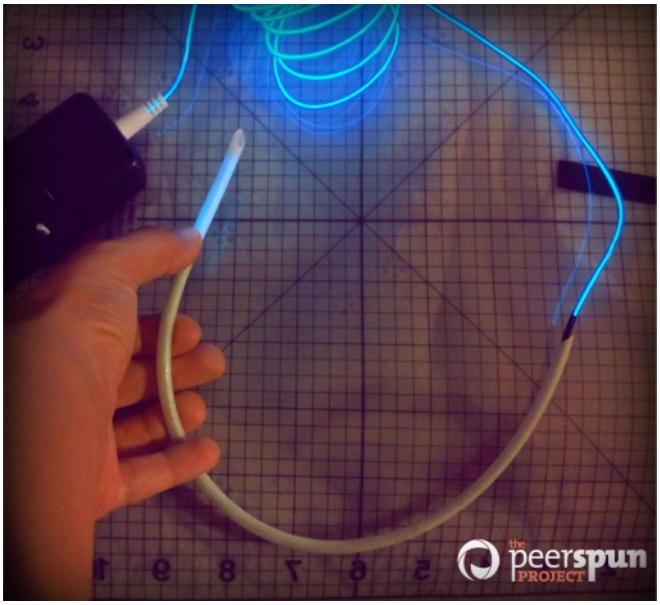


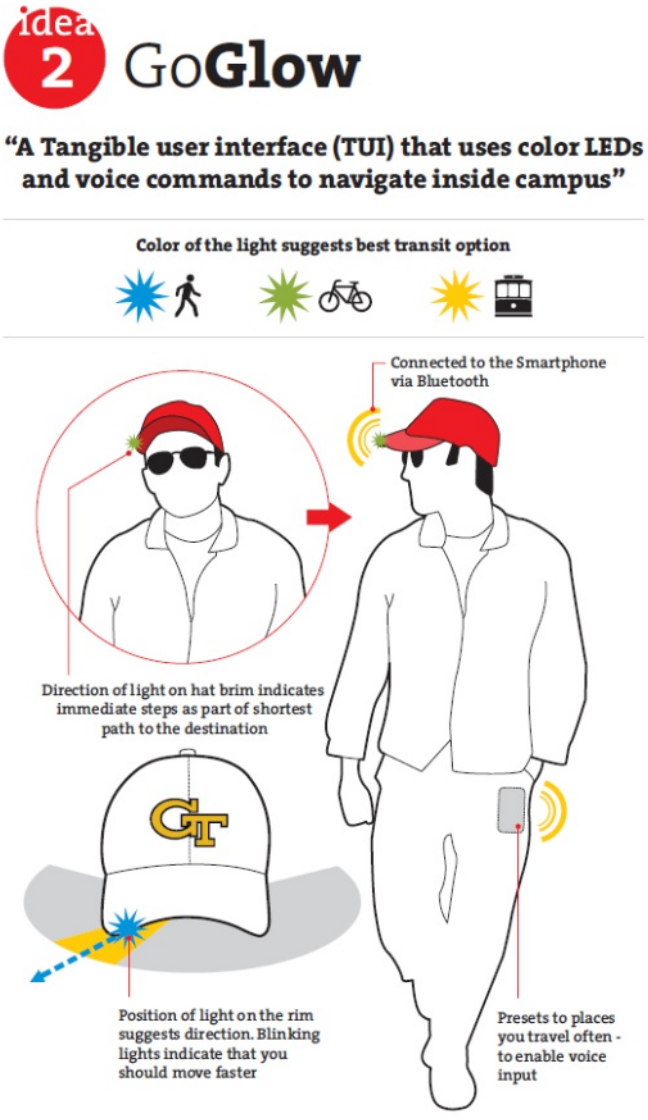
"Projected interactive campus map to help users choose the quickest transit option"

The actual scenario was replicated on a smaller scale with a model bus stand and a trolley. The prototype made for this design was essentially an HTML page containing the campus map projected with an iPad. The evaluators were prompted to touch the screen at different locations to find the best possible options of transit with times listed alongside.

3.2. GoGlow: Wearable Interface

This system, mounted on a cap, incorporates a tangible user interface (TUI) comprised of color LEDs and voice command presets to navigate on campus. The color of the light corresponds to the quickest transit option based on the user's location. The position of the light on the hat brim indicates the direction of steps to take in order to follow the shortest path to the destination. Blinking lights while in transit may indicate that the user should proceed more quickly, or that the user has passed a turn. They may also be used to confirm the destination choice at onset of travel--three blinks for preset 3, for example. The cap is connected to a smartphone via Bluetooth, with voice-activated presets enabling quick, effortless navigation to familiar locations throughout campus.





The conceptual prototype (above) involved manual positioning of the light on the edges of the cap. The light could be readjusted in different orientation as the user's head turned around. Further, on delay the light blinked on 2 presets – slow and fast. This gave the user a fair idea of the system.

3.3. SpinPointAR: Augmented Reality Application

This augmented reality app allows the user to select a preferred mode of transportation. By pointing the mobile device toward the desired direction, the application provides details about the selected transport option. The three available modes are Trolley, Bike and Walk.

Trolley: On selecting 'Trolley,' the user may point toward the direction from which the trolley will come. Depending upon the location and information available from NextBus/trolley services, the application will

show details such as estimated time of arrival for the trolley and vacancy inside each bus.

Bike: When the user selects 'Bike' the application will pinpoint the nearest available ViaCycle stand in that direction. Along with location, the user is also informed about the number of bikes available on that particular stand and the distance of the ViaCycle stand from the user's location.

Walk: The user can choose the 'Walk' option to travel by foot towards the destination, in which case a destination may be entered by typing or speaking the destination name (e.g. CRC). In this mode, the application will choose the best possible route for pedestrians. The screen will display an arrow that suggests the particular path the user should walk.

4. Poster Session Feedback

4.1. StepStop

Evaluators were really excited with the concept of an interactive bus stop. They could immediately relate to the problem they had faced on campus. The fact that they could see the real time position of the buses running without having to take out their smartphones was something that connected with them and was continuously referred to as 'well adapted' and 'efficient'. Further, the decision making task seemed much easier and straightforward to the evaluators with Stepstop. The fact that the system could intelligently guess the time taken for all the parts of the journey - walking, cycling or bus and sum it up to provide a single time per journey could prove to be a 'helpful' functionality according to the evaluators. Although a few concerns were raised in terms of brightness of the projected system, and the proximity of the users of the

system, the unanimous view was that the waiting experience would definitely be more engaging and informative.

Positive feedback:

- Interactive and engaging experience decreases perceived wait time
- Real-time position of all buses could prove handy
- The interaction is learnable, memorable and efficient
- Summative transit times are really helpful in decision making

Possible Issues:

- What if two persons have to go to the same location or nearby locations?
- How do you project the lights on a bright sunny day? Visibility might be an issue.
- There's a possibility of theft or damage to the system in real life scenarios. Safety is an issue
- Crowding might make the interface unusable
- What would the user do to get location information once he is off the bus stop?

Suggestions:

- To make a jump game out of it
- To use the back side of the bus stop as a projector screen in order to avoid glares of the sun, maintain cleanliness, increase visibility in general.
- Integrate with other systems to increase viability.

4.2. GoGlow

The voice activated, color-coded LED based intelligent tangible user interface got good reviews from the evaluators. They found the system to be simple and easy to use. They agreed to the fact that the system was the fastest in providing the decision to the user with minimal distraction. Again, it could be carried around as a navigation tool--this was another added advantage. The overall reaction was that the system was novel but there might be limited adoption due to the reluctance of some to wear a hat for such purposes. This simple system does one thing, and it does it well with minimal confusion- *a great combination.*

Positive feedback:

- No screens or user action involved implies fastest decision making
- Can be carried as a navigation system
- Presets can be used for quick actions
- Blinking lights provide good feedback to the user

Possible Issues:

- Everyone may not be willing to wear a cap around the campus
- The light changes might not be noticeable to the user all the time
- Its difficult to recall and interpret what the color of the light means in each case. This makes the system less learnable and memorable
- Safety / Constraints: Presets can be misunderstood by the system in case of wrong pronunciation or in crowded areas. There is no current feedback stating what direction the light is pointing to. For example, the user says Klaus and the system mis-interprets it as Clough.
- Privacy concerns: Some users might not be

comfortable with others being able to see which way they are heading

Suggestions:

- To add constraints to the system to decrease misinterpretation
- To add a visual / audio feedback so that the user knows where he/she is heading, or to know the distance of the next target
- To make similar Visors for women to sport
- A more generally accepted device might be a pin to attach to backpack or bag

4.3. SpinPointAR

"Oh! It will be so COOL to have an Georgia Tech AR app on my smartphone".

It was seen that the evaluators immediately related to the 'practicality' of this option and appreciated the 'experience' bundled with it. The behavioural response for this idea also hinted at the potential learnability and flexibility of the system. The evaluators could also relate to the times at the bus stop when they have decided to walk when the trolley is just around the corner, or when they find out that the trolley they waited so long for is already full. The most common suggestion received for the idea was to merge it with the functionality of the first idea (StepStop).. These findings encouraged us to further explore on-campus travel for enhancements/modifications.

Positive feedback:

- "I can now see buses round the corners"
- The trolley occupancy graph is useful
- Easy, straightforward interactions (need to be refined further)

Possible Issues:

- While cycling, it is really difficult to use Augmented Reality to find the next viaCycle stop
- Too much effort. Slowest time for decision making
- Showing all the trolleys running on the campus might make the interface really clumsy

Suggestions:

- Decide what buses to show and what not to. Make the UI minimalistic to the maximum possible extent
- Add 2D (from 1st idea) to the 3D (from this idea). This can be used when the user is actually cycling from one place to another
- Make the decision making time faster

5. Concept Integration

While each of these concepts has merit as a stand-alone system or device, many would be best suited to integration in a larger system of devices and services working together to aid with the decision-making process in all conceivable circumstances. The situational and environmental contexts within which each concept is best suited to address are varied and may overlap, but each does seem to serve an available niche. The main StepStop interactive system is only available at bus stops locations. GoGlow would be useful anywhere, but its simple, hands-free feedback system would be most useful while on the go (walking or biking especially) compared to the other options. SpinPointAR is not so useful while driving/biking, but good for navigation through buildings (where a signal is available). Another possible addition to this combination of systems would be a text-based phone direction system. This would provide a simpler and possibly quicker solution than might be possible with the AR smartphone app.

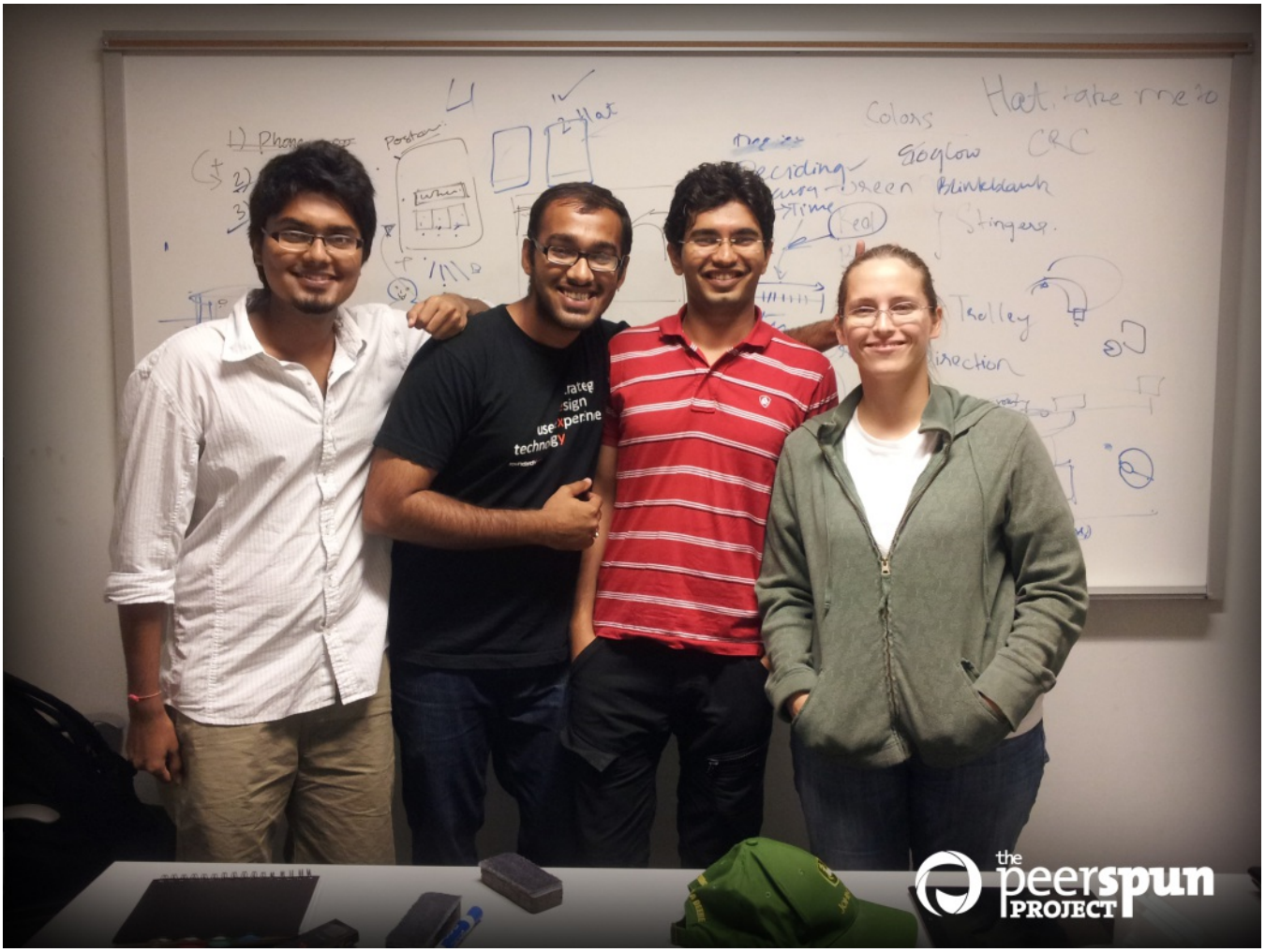
6. What we learnt from the exercise

We learned that:

1. Always remember to take pics

2. Crazy suggestions help create awesome ideas

3. Brainstorming sessions really are most productive when group members come in with sets of unique ideas, and then are able to combine and refine them together. Some of our best designs were developed through inclusion of aspects from multiple other ideas, which were then refined to cover divergent types of models, systems, or modes of interaction.



The Peerspun Project
System prototype and evaluation plan

1. Design Choice Criteria

SpinPointAR was the design choice we found to provide the best opportunity to develop a system of sufficient scope and complexity, compared to the other options we had developed. Of our 3 design alternatives from part 2, this option encompasses the navigation component of GoGlow, as well as the interactive decision making interface from StepStop. The actual interface is much more complex than GoGlow, allowing greater potential for creativity in design as well as utility for users. Because it is a mobile application, and can be used on practically any mobile device, users will not be hindered by the constraints of a static, non-customizable bus stop-based interface. Ideally, the three options could be used together within the same transit decision system. Since SpinPointAR encompassed the most features, flexibility, and potential for design challenges, we found this to be the best, most interesting choice to base the expanded and refined system upon. The evolved system has taken on the name PeerSpot.

2. PeerSpot: Features & Functionality

2.1. Feature List

Borrowing ideas from feedback and suggestions from the poster session and strong points of all three concepts, it was decided that the following features would be added to the system at the end of the fourth design meeting.

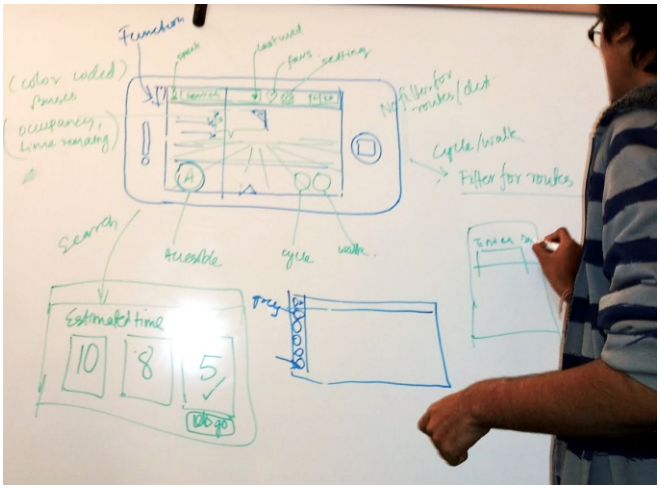
1. Transit option Suggestion
2. Navigation sytem, walkable routes
3. Trolley Occupancy
4. ViaCycle location and availability
5. Accessibility- voice search
6. Weather Data — In Prototype version 2
7. Show/Hide Layers
8. Add new paths — In Prototype version 2
9. Distance / Time to destination
10. Switch 2D & 3D modes
11. Slow movement Alert — In Prototype version 2
12. Last searched destination
13. Favorite destinations
14. Unlock viaCycle from within the app
15. Track this bus

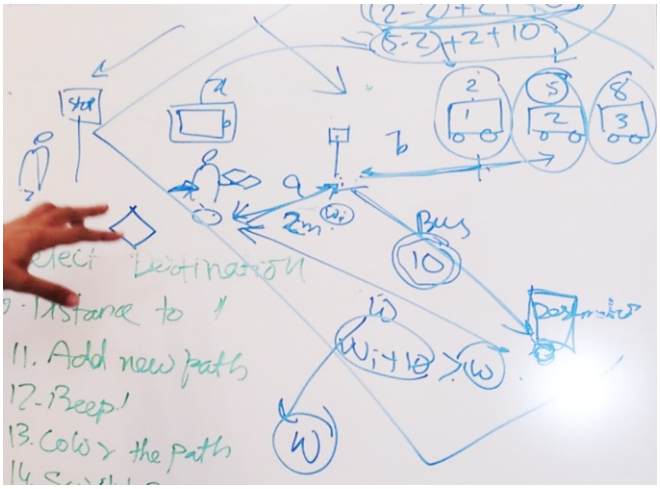
2.2. User Interface

The interface of the PeerSpot transit decision system consists of a viewport through which a user sees the landscape overlaid with markers detailing the various transit options available. 80/20 rule was followed while designing for the on-screen controls in this augmented reality smartphone application. The most used functionalities were kept most accessible (highest in the keystroke level model), whereas less frequent functions were kept a level down.

On screen controls include:

- Interactive search button (voice and type)
- Favorites
- 2D/3D Toggle switch
- Slider Menu with layers (Trolley, Stinger, Walk & Cycle) and Application settings





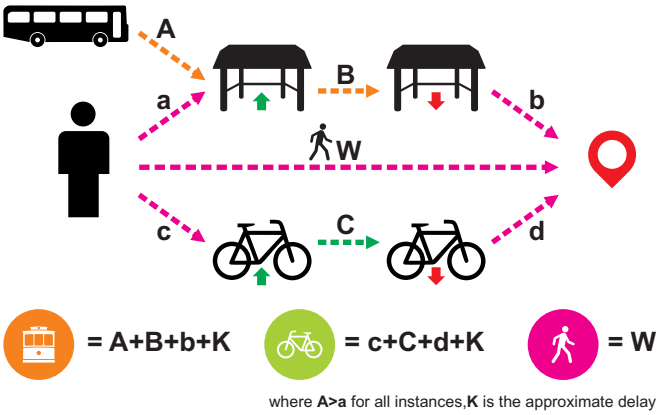
2.3. System Functionality

The system is designed to remove clutter from implementation models and appear closer to user mental model. Few functionalities that ensure this are:

1. The system recognizes voice input and maps it first to the names in the favorites list and then to the most common places on the campus map, followed by the rest.

2.The app dynamically asks if the favorited destination needs to have a short voice preset attached to it.

3. For a destination searched, the system calculates the transit time based on the current location of the user. The final time displayed for each option is inclusive of delays, walking time to the bus stop, or pick-up/drop-off of viaCycle. This is explained in the figure below.



4. Autosuggest functionality was added to so that the system can hint at the most probable destination from a list of most used and prominent destinations.

5. Turning layers on/off in the slide panel dynamically changes overlays on the viewport. However, users could track buses by pinning them onto the viewport. This functionality is independent of the layer activity.

6. The app could access and send messages to unlock ViaCycle for users looking forward to taking the transit option. This saves time and effort.

2.4. Usability Criteria

The following criteria were taken into consideration while making the wireframes for the app:

1. Time: Number of keystrokes were calculated for all functions and reduced to a minimum.

2. Visibility: Icons and fonts were made prominent and visible.

3. Feedback: Ample feedback was ensured with dialog boxes, alerts, prompts and audio response.

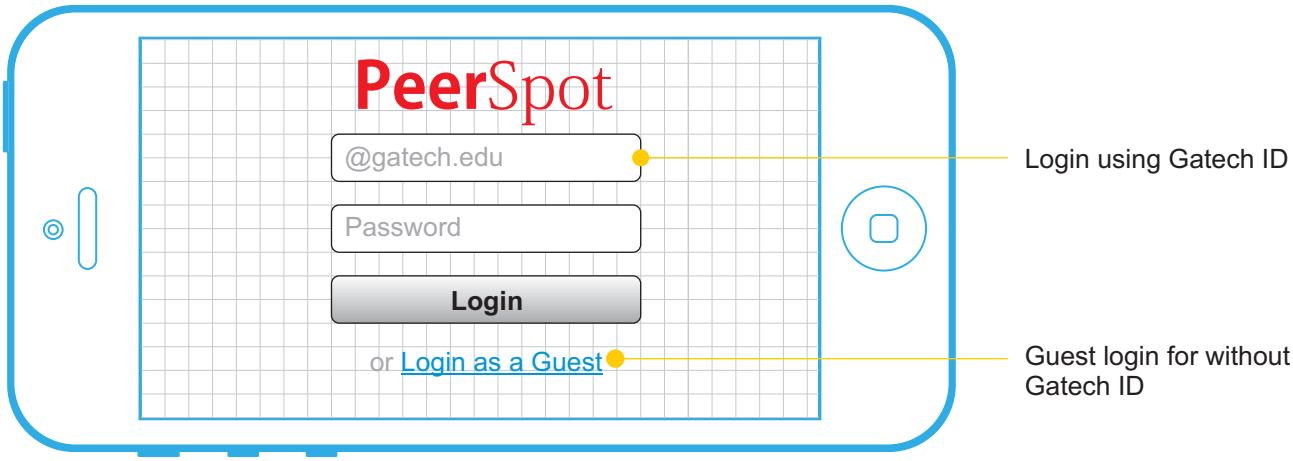
4. Other criteria includes efficiency, effectiveness, learnability, memorabiltiy and error correction.

2.5. Development

Development was made considering the iPhone 5 in mind. Initial low fidelity wireframes were sketched on paper and then transferred to CorelDRAW as high fidelity wireframes. Number of prototyping iterations were made in proto.io, JustInMind Prototyper and Jquery mobile before the final prototype was made with Wikitude API and HTML5/CSS3.

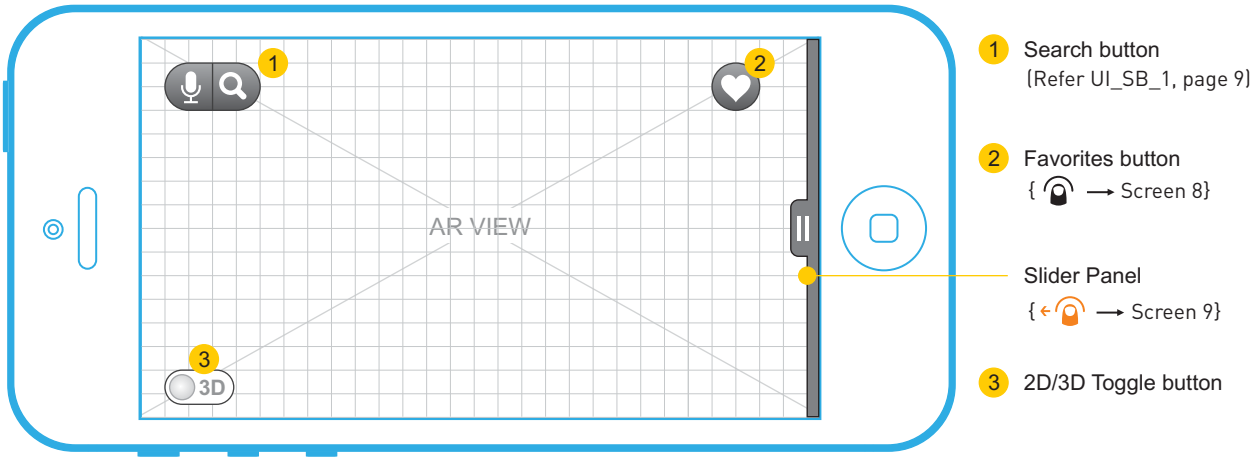
3. PeerSpot Wireframes

Screen 1: **Login Screen**



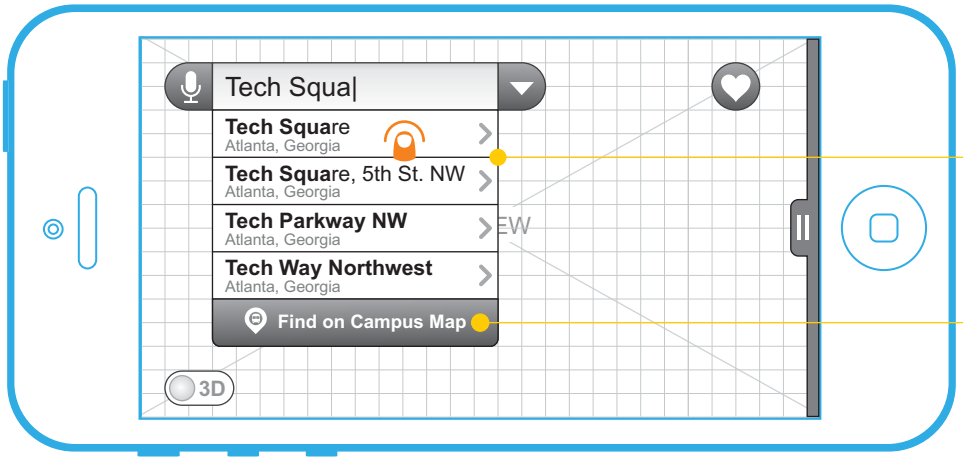
- When search terms are input by text or voice entry, the resulting drop-down listing of location presets provides the option to set as favorite and record a voice preset to select the destination at a future time. These preset functions are only available to be saved for a later date if the user is logged in, using the dialog shown in Screen 1.

Screen 2: **Home Screen / Landing Page**



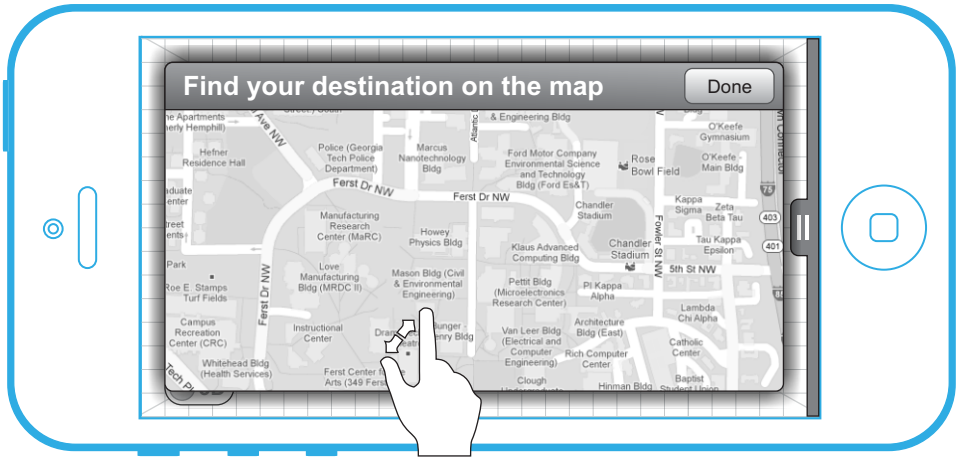
- **AR VIEW:** The three closest buses and the closest Viacycle stations are shown as tooltips, along with the default UI, overlaying the camera view.
- No information is presented regarding a 'walk' option until a destination is entered.
- In the top-left corner of the device screen, the voice & text search functions may be accessed. When the mic icon is pressed, the voice search dialog box pops up. When the magnifying glass icon is pressed, the text search bar slides to the right and the icon changes to a drop-down arrow.
- Slider panel hides the layers option and the application settings button. It slides out to the left on left swipe.

Screen 3: **Type to Search**



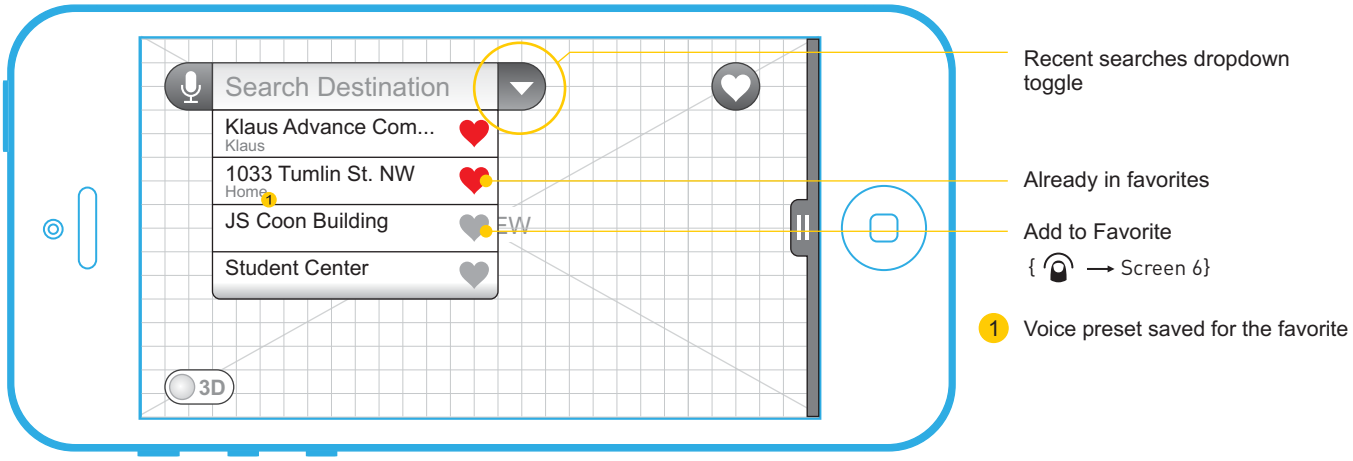
- Selection of a drop-down menu box results in appearance of cursor indicating that text may be entered.
- On typing, **Auto-suggest** lists possible destinations in order of relevance.
- In the case where the user may not know the exact name, or drop-down results do not contain the destination, the user can select the option, "Find on Campus Map." (refer Screen 4)

Screen 4: **Destination Selection by map**



- The map follows default touch screen interactions such as pinch&spread to zoom in&out, and tap-and-hold to drop pin (select location).

Screen 5: **Recently searched places**



- On tapping the dropdown button, a list of recently searched places is displayed.
- Places favorited have an 'active' heart icon in front.
- Favorited places with voice presets have transcribed text written below them.
- Destinations not favorites yet, have an 'inactive' heart icon in front.
- Long tapping the inactive heart icon adds the corresponding destination to favorites. (refer to Screen 6)

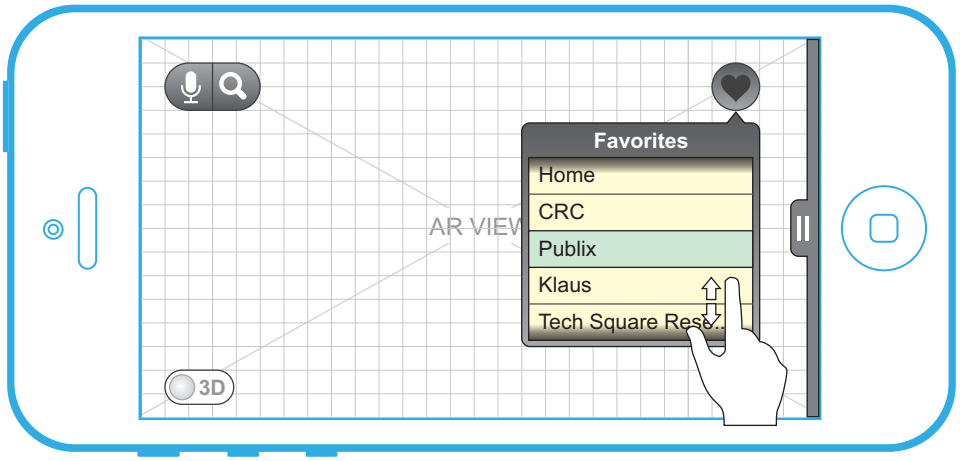
Screen 6: **Confirmation / Save preset dialog**

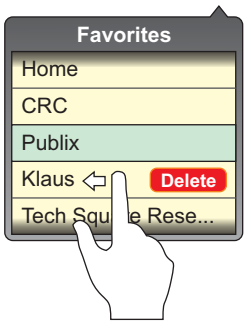
- A dialog box pops up confirming that favorite has been added. It also asks if the user wants to record a voice preset for the favorite destination.
- 'No, Thanks': To exit without saving a voice preset for the favorite.
- 'Record Now' allows users to record preset.

Screen 7: **Voice Search**

- On tapping the mic button, a dialog box pops out accompanied by a voice saying 'Speak your Destination'.
- The function can be cancelled anytime to go back to the last screen.

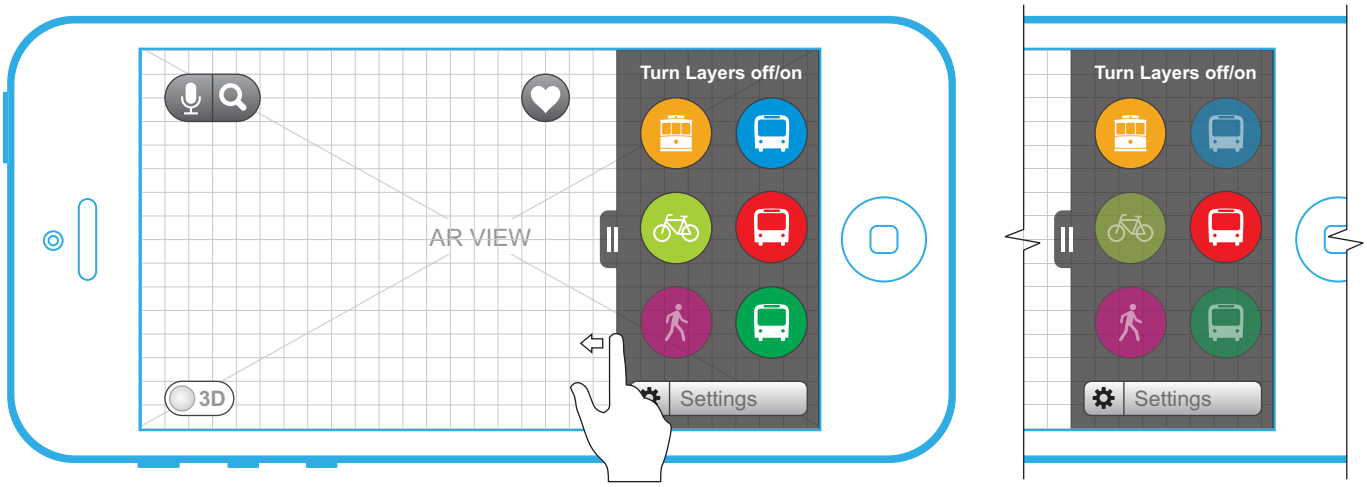
Screen 8: **Favorites**





- Scrollable drop-down menu appears when favorite (heart) icon is pressed.
- Favorites with or without voice presets are shown in the list.
- Touch and hold to add or edit voice presets to an existing favorite.
- Left swipe reveals the delete button.

Screen 9: **Slider Panel**



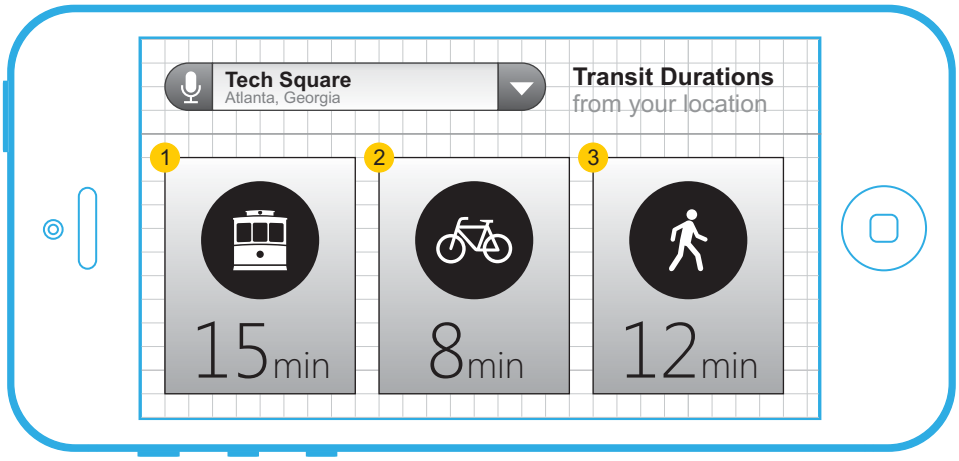
- Slider panel provides all transit options as toggle buttons, used to display or hide (when greyed-out) individual transit option layers in the AR View.

ON OFF

- The 'walk' option at lower left becomes accessible once a destination is entered.
- App settings are accessible through settings button.

Trolley viaCycle Walking Red Bus Green Bus Blue Bus

Screen 10: **Search Results View**



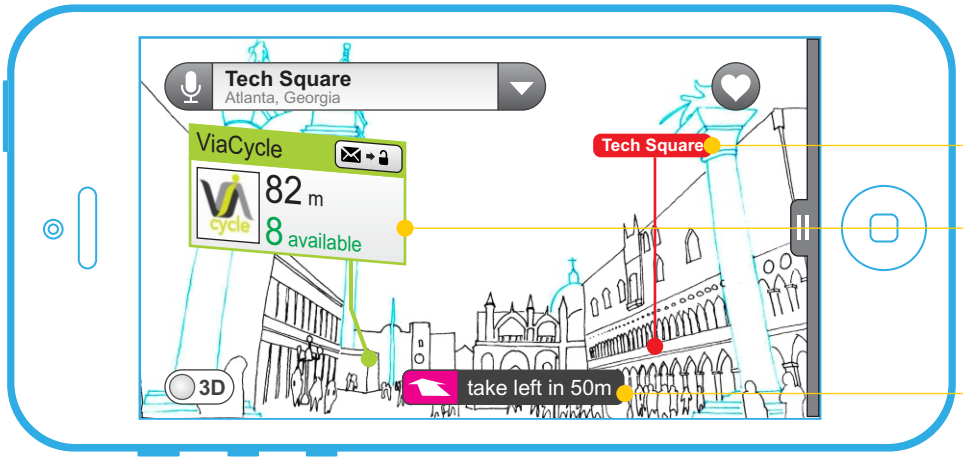
1 2 3

Shortest durations for all three transit option.

Tap one to follow the corresponding path.

- Upon selection of a destination, the transit durations for each active transit type that has been selected are displayed.
- From the possible bus/trolley option types, the bus route that best coincides with the fastest route to the user destination is automatically selected.
- The closest three buses (heading in the correct direction) are displayed by default, with the rest hidden.
- The user may then press one option to select, which will display the route overlaid on the 3D view (Screen 11) or 2D map (Screen 12).

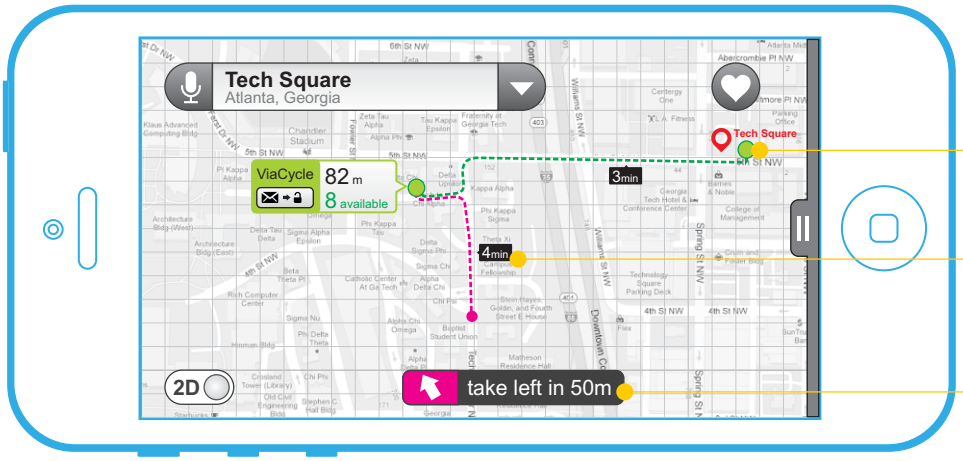
Screen 11: **Augmented Reality View**



- The screen showing the view from the current location is overlaid with AR VIEW Components indicating locations and transit option details.
- The next immediate step on the users route is indicated at bottom.

The only major roadblock encountered in the prototype development process was creation of tool tip overlays that accurately correspond to view screen information. We have accessed numerous prototyping tools, but are still working to refine this aspect of the system.

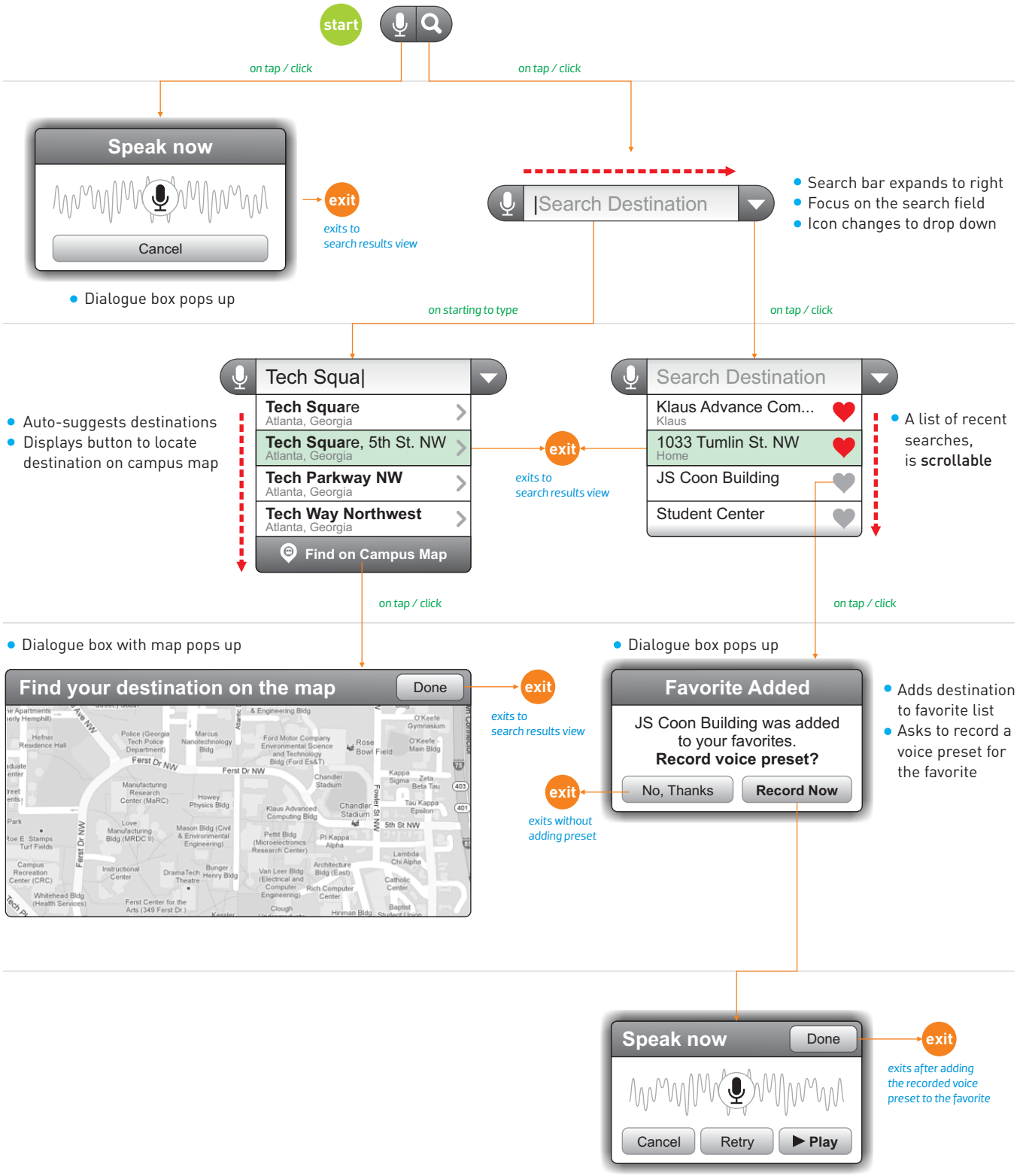
Screen 12: **2D Map View**



- The paths the user must take between each transit option are displayed on screen, with each path indicated by a dotted line of a color associated with that transit option type.
- This overview includes the AR VIEW Components indicating locations and transit option details .
- The next immediate step on the user's route is indicated at bottom.

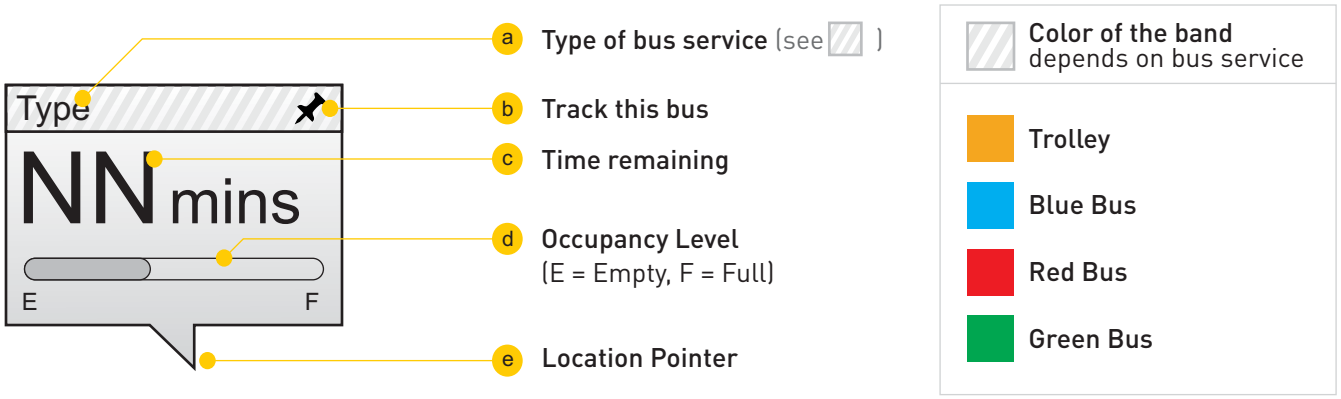
4. UI Components

4.1. Search Button (UI_SB_1)



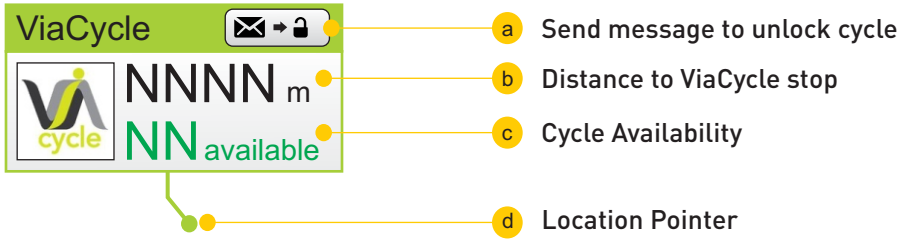
4. UI Components

4.2. Bus locator tooltip (TT_BL_1)



- Bus tooltips provide information about each individual bus. Type of bus service is indicated by color bar at top, time in minutes until arrival is displayed at the middle, and the occupancy of the bus is indicated by a bar at bottom.
- Selection of the pushpin icon at top right provides an opportunity to attach the individual bus to the transit view while interacting with other functions.

4.3. ViaCycle locator tooltip (TT_VC_1)



- The ViaCycle tooltip provides information about each ViaCycle station.
- Selection of the 'message unlock' icon at top right provides an opportunity to claim and gain access to the bicycle prior to arrival at the ViaCycle stand.
- Distance to the desired ViaCycle station is displayed at the middle (in meters or feet, potentially adjustable in settings), and the availability of bicycles is provided at bottom.

5. Scenarios

5.1. Trek by Trolley

Brendan has just finished a workout at the CRC and has no interest in further exertion. He's decided he's taking a trolley or bus to his apartment (at North Ave) tonight, so he would just like to know which is closest and likely to get him there fastest, in order to give his girlfriend a head's-up as to when he'll be home.

1

Brandon removes his phone and kicks in the app. He logs in with his buzzport credentials.

He is already happy with the nice AR view.

2

He directly goes to his presets and selects home which saves him the hassle of typing or entering the destination.

2

Brendan selects home from his favorites list. In the suggestion page, he chooses buses. He waits for the next trolley arriving in 3 minutes & in the mean time texts his girlfriend that he would be home in 13 minutes.

3

His past experiences suggest he can trust the system to calculate the time accurately so he can inform his girlfriend exactly when he is going to come home.

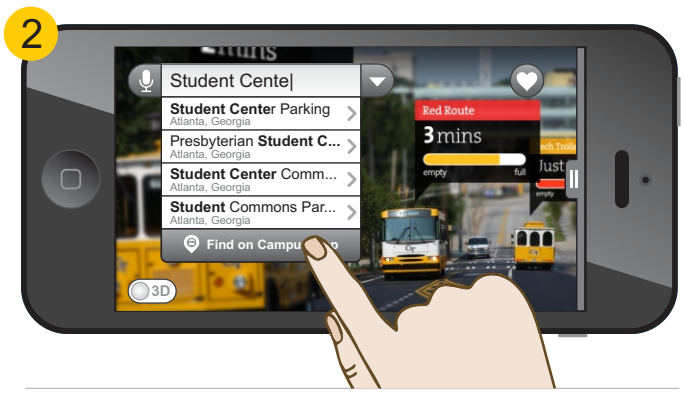
The cool AR view appeals to the tech side of Brandon and he finds the app damn cool and easy.

5.2. Way to Walk

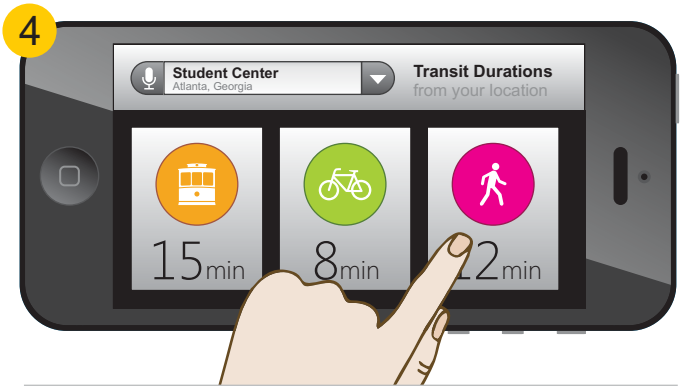
Jana, a first-year grad student, wants to make her way to meet a friend for lunch at the student center. Its a lovely day and she would like to walk, but isn't yet familiar with the campus, so she'd prefer to have an idea of the quickest path there from the TSRB.

Jana whips out her phone and switches on the app. She sees the available buses but would rather walk.

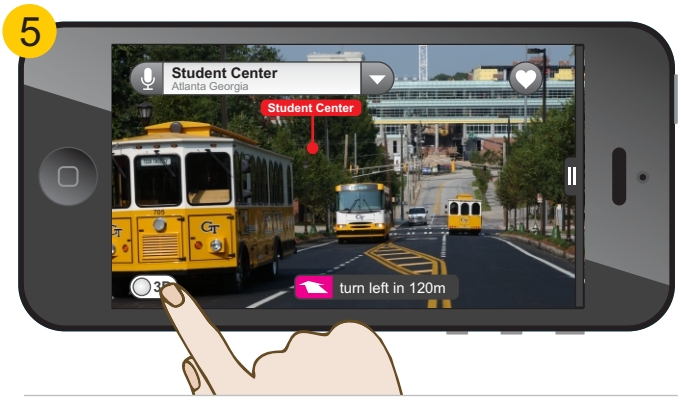
She selects the 'Find on Campus Map ' option to and selects Student Center as her destination.



The app intuitively calculates all the best possible routes for the various transit options and displays them for Jana.

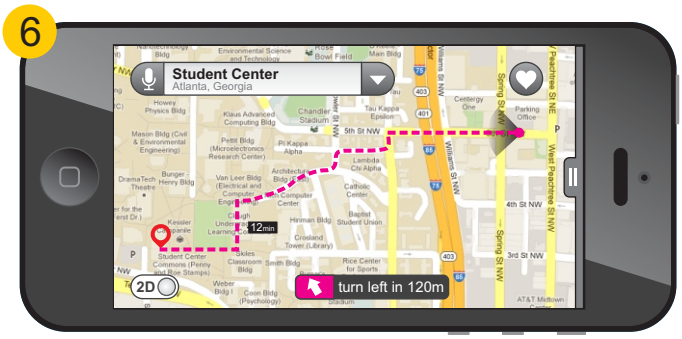


Since Jana would like to walk, she immediately selects that option to get the walking directions.



The app then provides AR navigation by suggesting walking routes based in arrows overlaid on the camera.

The toggle switch at the bottom enables Jenna to switch to 2D view to get a better perspective of the entire route if required.



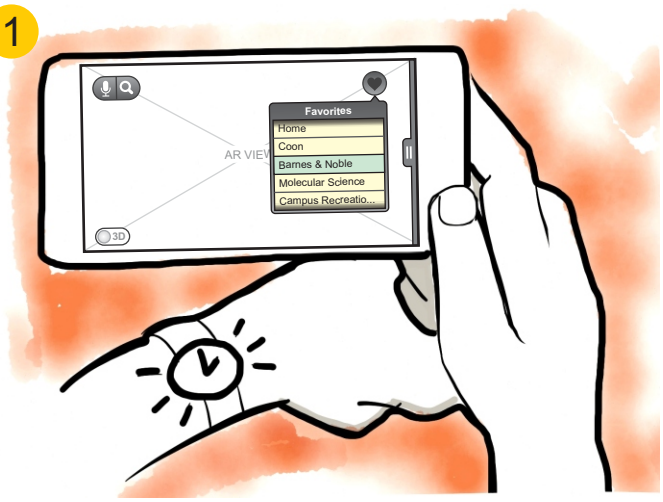
This is also useful if she doesn't want to pan her phone during the entire journey.

Jana reaches her destination and gets to enjoy the lovely walk. She doesn't have to spend the entire journey asking people for directions and reaches her destination on time for lunch, thanks to PeerSpot.

5.3. Fast Favorites

Lee is a PhD student who has very little time and likes to make use of every minute. He has a routine down, and is used to being able to rely on the PeerSpot system to get where he needs to be, using as fast a transit method possible. Today, his schedule is packed, so he would like to see whether he can rely on his Favorite locations to navigate to the Barnes & Noble at Tech Square, then to the Molecular Sci & Engr Building to pick up exams to grade, then back to Coon building (where his office is located) during his lunch hour.

He's familiar with all the transit options and is a regular user of ViaCycle, so he already has an account set-up for access.



Lee switches on the app and directly accesses his favorites. The system applies the algorithm at the backend and returns his best options, ViaCycle being the quickest one. Lee has come to trust the system and takes the suggestion.

Lee runs to the nearest viaCycle station. He sends a message from the app itself to unlock a bike. He takes the bike to complete all his chores in one go!

Lee finishes all his work in half an hour. He can now spend that extra time doing meaningful research rather than worrying about transit, thanks to PeerSpot

6. Usability Criteria for Evaluation

- The user must be able to accomplish their ultimate goal without substantial roadblocks or challenges
- The user must be able to successfully complete a series of navigation tasks and subtasks culminating in the determination of the quickest available route using desired transit method
- They must be able to quickly recognize the means to attain that goal, which should be visible on the initial screen.
- The user must be able to quickly determine the process necessary to achieve goals by either of two main methods:
  a. When looking for the closest available trolley/viacycle
  b. When looking for the fastest means to get to their destination
- The time it takes to find and figure out functionality that is not on first screen, should be minimal
- The time it takes to switch between functionality, should be minimal (e.g: switching from trolley mode to fastest route available)
- The time it takes to enter a search, and select destination should be no more than 20 seconds (8-10 secs x 2)
- The time it takes to create or modify a favorite location should be no more than 10 seconds
- Standards for functions should maintain that no operation should require more than 8-10 seconds to perform, once the user has had sufficient training in the task procedure. For most functions, the interaction with the device's system should be based on widely used standards for touch screen interfaces. So, few (no more than 3) errors should be expected to occur for most tasks.

7. Initial Evaluation Plan

7.1. Objective

Through use of the PeerSpot system participants will be able to successfully gain information regarding the quickest routes and transit options to make the best decision as to which to depend upon.

7.2. Process

Prototype evaluation participants will be run through a series of tasks that represent the most commonly used functions of the system. The potential participant pool is composed of Georgia Tech students recruited by word of mouth. The time frame of each evaluation will consist of two parts. First, a cognitive walkthrough of the system will be the first means of participant evaluation of the prototype interface. Once complete, a post-walkthrough interview should provide qualitative details regarding user perception of prototype functionality. Evaluation with each participant should take no longer than 2 hours, with breaks taken as necessary.

One group member will act as moderator during the evaluation, directing participants to commence with tasks, and asking questions when necessary. This member will speak with the participants about the consent process and be sure to present the consent form, asking the participant to sign, and informing them of their right to quit the study at any time. The remaining group members will take notes as to the system state, the actions and feedback from the participant, and any other extraneous information about the system, environment or circumstances. Both roles can be performed by all group members throughout the study.

7.3. Benchmark Evaluations

Action/Function Use Tasks:

1. Find the correct destination location using text search field
2. Add the last searched place to favorites
3. Find the correct destination location using

the voice search function

4. Add a voice preset to a favorite

5. Find the correct destination location using the campus map

6. Select desired transit options (change layers in sliding toggle button menu)

6b. Find the layer slider in the right side

7. Compare all options to determine quickest transit time

8. Successfully use the ViaCycle option

9. View route in 3D view and full path in 2D map (change between 3D and 2D views)

10. Customize settings

Perception Tasks

11. Differentiate between walking, cycling and trolley when each option makes up a portion of the route

Throughout each of these tasks, the ability of the users to successfully reach the specified goal will be observed, with any challenges or helpful insights recorded. Recorders will take note of any procedures that aided in successful completion of tasks. In addition to knowledge gained through observation of participants during task evaluation, post-walkthrough interviews should provide further insight into the experience from each user's perspective.

We would try to answer the following questions:

- How long did each participant require to: find a function control, determine how to interact with it successfully to initiate action, complete or cancel out of an action?
- How many errors occurred throughout each attempt? were these errors in perception, understanding of the task required, or based on motor skills?
- How did the participant react as they went through this process of discovery? Were they pleasantly surprised at any successes? Were they unduly frustrated when met with roadblocks? Is there any additional functionality that the users may desire?

Analysis of subsequent data collected will take into account variability of success with regard to program features, as well as any differences among participants and their experiences with the system.

7.4. Evaluation Timeframe

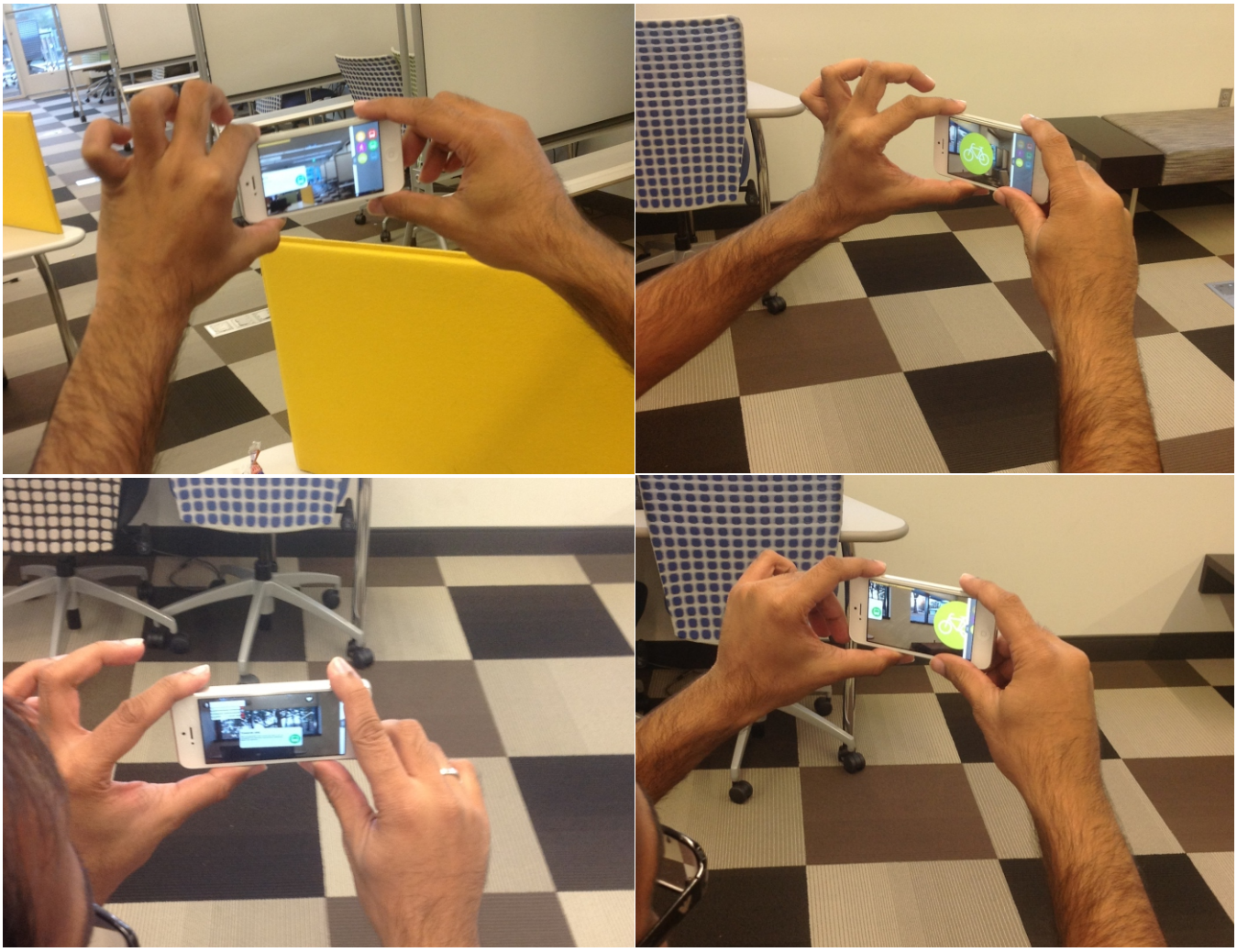
Evaluations are scheduled to begin as soon as possible. The earliest probable date that evaluations are likely to be possible is Nov 14th. Depending on how many participants are successfully recruited (estimating ten out of the maximum possible of 30), evaluations should be completed within a week. This assumes two participants per day, over five days.

Timeframe selection is primarily influenced by the IRB process, the need for adequate time to review collected data, and submission deadlines. Evaluation cannot begin before IRB approval had been granted. The earliest probable date that IRB certification is likely to be granted is approximately two weeks after submission, in the absence of any issues the review board may have. With approximately one week to complete evaluations, two weeks would remain to compile and analyze data.

8. Prototype status

Features implemented

- Augmented Reality API
- Search Functionality
- Voice function
- Slider Panel
- Layers on/off
- 2D/3D Toggle

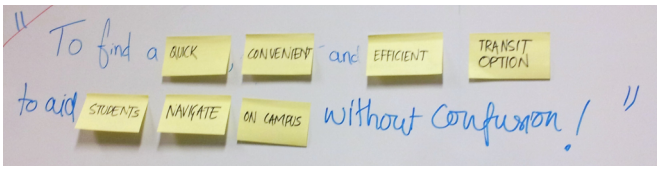


Screen views of system displaying slide out transit option menu (top-left), bus o(bottom-left), Viacycle option selection (top-right), and arrival at Viacycle station (bottom-right).ption tooltip information

The Peerspun Project
Evaluation Report

1. Introduction

In the course of our initial team meetings, we were able to determine the set of user requirements that led to the development of precisely defined problem space. Georgia Tech students need:



"To find a quick, convenient, efficient transit option to aid Georgia Tech students in navigating on campus without confusion!"

With this goal in mind, we initially began discussing the different types of systems that could be created or integrated with the existing systems so that the campus transit decision process could become easier and more enjoyable for our target user group, the students at Georgia Tech. A few brainstorming sessions coupled with discussion of design alternatives culminated in the first poster session, where we got feedback about what could be an effective system that involves components of HCI, functionality, and mobility. We finally designed and developed an Augmented Reality application.

2. Project Roadmap

The project roadmap can be seen below. We went through the following phases:

1. User group context description

We settled upon the user group comprised of GT students who have difficulty quickly and efficiently navigating around campus.

2. Interviews

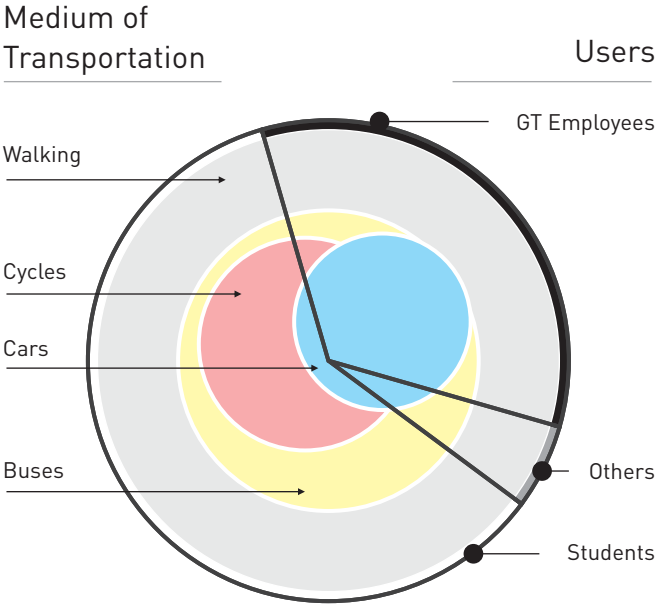
After preliminary interviews with our target group, we determined our problem space including issues and constraints involved, and the subsequent problem definition

3. Surveys and questionnaire

We sent our surveys and questionnaire to further narrow down the problem space and know exactly what problems in the campus need to be tackled by the system

4 Problem space definition

Analysed the constraints of the group: Short time between classes, uncertain bus schedules, users in transit & then prepared a feature list for the system



5. Solution design

Over 12 different design possibilities were proposed, with 4-5 strong options discussed and developed further based on the users' and environmental constraints, and the prospect of an interesting, challenging design space

6. Design alternatives and finalization

Poster presentation on the 3 design concepts and get feedback on the ideas: StepStop, GoGlow, & SpinPointAR

7. Concept integration

Aspects of each of the 3 design alternatives were combined to form a system with AR aspects of SpinPointAR, decision aid functionality of StepStop, and navigation properties of GoGlow

8. Mockups and wireframing

A series of iterations of both rough sketch mock-ups and subsequent wireframes was produced, illustrating all aspects of the systems user interface and its main functionality

9. Prototype development

The system prototype was developed as an Augmented Reality application for mobile devices. Based upon the user's location it provided information about the trolleys, stinger buses, ViaCycle stands and walkable routes present on the campus. The system was developed and tested on the iPhone 5.

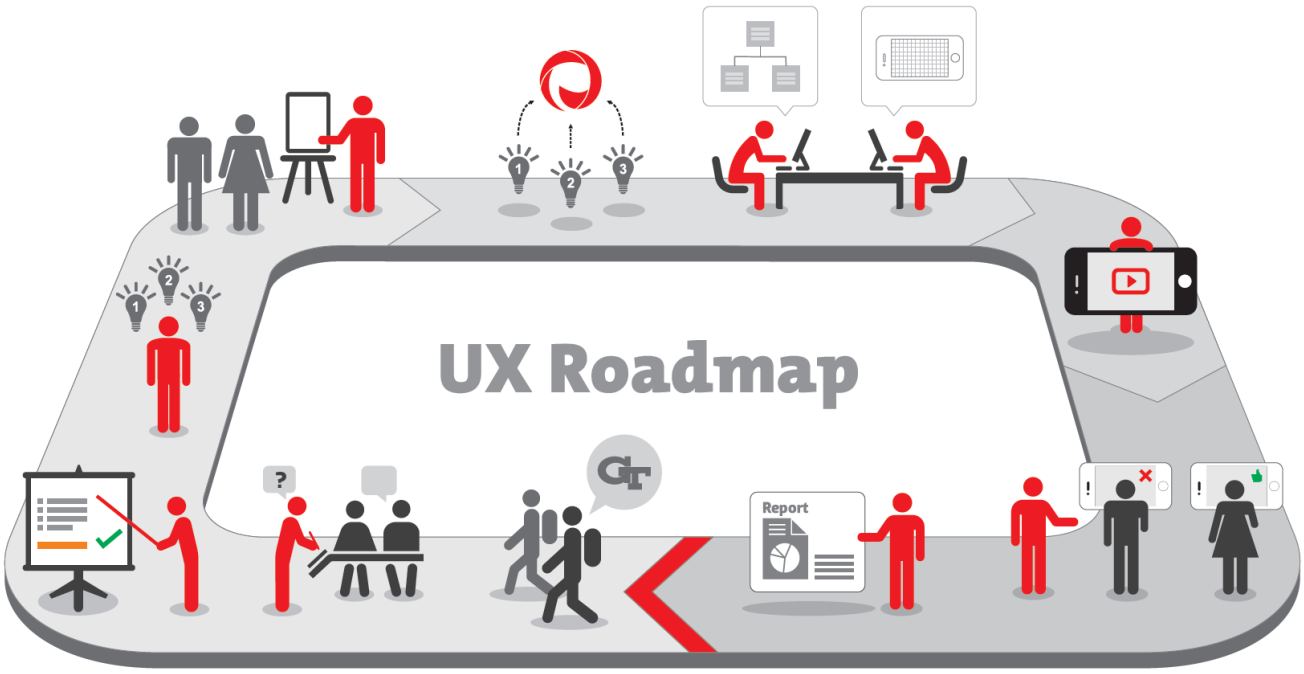
10. User evaluation and future work.

With IRB approval, usability testing commenced: the cognitive walkthrough with post-evaluation questionnaire resulted in numerous insights as to how the system may be improved for increased usability

3. Evaluation

3.1. Method

Before evaluation could begin, the IRB approval process was completed. The process progressed without any critical roadblocks, with approval upon the third protocol submission. Documents required by the IRB, such as consent form, are included in Appendix I.



3.2. Participants

The participants in the prototype evaluation (cognitive walkthrough and post-evaluation question session) included four Georgia Tech students, 1 female and 3 males. These participants were recruited through word of mouth, as well as enticement through a varied selection of donuts, in the GT student center.

3.3. User Evaluation

During the prototyping process, a set of user personas was developed to help refine the targeted task flows that typical users may follow in order to help shape the functionality of the system. The series of tasks associated with these personas was the basis of the benchmark tasks used on the cognitive walkthrough evaluation of the prototype. A series of questions was devised to better characterize users' experience with and opinions regarding the interface visuals and functionality. The estimated time for the cognitive walkthrough was approximately 15-20 minutes. An additional 10-15 minutes was allotted for completion of the questionnaire portion of the evaluation.

3.4. Cognitive Walkthroughs

During the hands-on portion of the user evaluation we asked that the participants run through a series of tasks. Due to the unfinished nature of the prototype, it became clear that it was unrealistic to attempt to gauge the speed with which the users were able to accomplish particular tasks, since most of the time this was dependent on the speed of the system. Instead we focused on recognition of those features that were ignored, misinterpreted or otherwise proved frustrating to the users through the course of the evaluation. The following benchmark tasks were meant to serve as a thorough exploration of the primary functionality a new user might encounter through use of the PeerSpot system.

3.4.1. Benchmark Tasks:

Task 1: Identify closest trolleys nearby

The user should rotate, while looking around through camera view, in an attempt to locate yellow trolley markers.

Task 2: Locate Buses in area (Red/Green/Blue)

The user should open the transit options slider menu to toggle on the bus option of choice, then rotate while looking around through camera view in an attempt to locate appropriately colored bus markers.

Task 3: Find closest ViaCycle station with available bikes. How many?

The user should open the transit options slider menu to toggle on the ViaCycle station option, then rotate while looking around through camera view in an attempt to locate appropriately colored ViaCycle markers. If the marker with the closest distance indicated has no available bicycles, then the user is encouraged to continue looking.

Task 4: Go to CRC from favorites. Which is quickest method?

The user should open the transit options slider menu to toggle on the desired transit options. Once the slider returns to original position, the user may press the heart icon in the upper-right to open the favorites menu and select the CRC. This results in the transit decision method being displayed, whereby the user may press the icon of the option that takes the least amount of time.

Task 5: Add a favorite

The user should press the search icon in the upper-left to enter a destination, or simply press the grey heart next to a recently searched destination in order to add it as favorite.

Task 6: Try to access recent searches

The user should press the text search icon in the upper-left to enter a destination. The recent searches should be in the drop-down menu.

If time allows:

Task 7: Determine whether a voice preset is available for a favorite

The user should press the search icon in the upper-left to enter a destination, or simply press the grey heart next to a recently searched destination in order to add it as favorite. Here, the option to record a voice preset is presented.

We expected evaluation of user interaction with the system based on completion of these tasks using a think-aloud protocol sufficient to determine the most complete set of aspects of the interface and functionality that may present problems within the given timeframe.

3.5. Post Evaluation Questionnaire

After completion of the cognitive walkthrough portion of the evaluation, the participants were asked a series of qualitative questions regarding the prototype system's interface and functionality. The questions were as follows:

1. What was your overall opinion of the functionality of the software?

2. What was the overall opinion of the appearance of the software?

3. Which features did you like most about the software?

4. Were there any other features that you found particularly difficult or frustrating to use?

5. Were there any menu or button positions that you found awkward to interact with?

6. What, if any, improvements would you suggest--including flaws in current functionality or additional features not already present?

7. Is this something you would be more likely to use compared to currently available options?

8. How often might you be willing to use this app?

9. Do you have any other comments on this app or this evaluation?

These questions served to gauge the overall opinion of the system, its visual appeal, and its perceived usefulness. They also were meant to provide a means of gaining insight into specific interface faults or functionality issues, or any other parameters we had not expected which may pose a usability

4. Results

4.1. Cognitive Walkthrough - Findings Summary

All participants involved in the user evaluation were unaware of the ViaCycle service available on campus. Half of participants expressed a preference to walking over other modes of transport. At least one individual felt more comfortable using the app in portrait mode rather than landscape, regardless of the limitations imposed on the field of view.

Every participant had difficulties determining what the occupancy bar indicated. One participant incorrectly identified it as a gauge of how far along its route the trolley had traveled. Nearly all participants hesitated or became confused at the decision screen, after attempting to search for a destination or incorrectly selecting an already active 'Favorite.' The transit options slider on the main screen and its option toggle functionality was not readily apparent to most users. The method of adding a destination to the favorites list was also not readily apparent to most users.

The full transcripts of the cognitive walkthrough may be found in Appendix II.

4.2. Post-evaluation Questionnaire Summary

1. What was your overall opinion of the functionality of the software?

The system response to user inputs (such as toggle button visibility) was slower, thus the functionality initially seemed to confuse the user. However after recognizing the application's response time, the users were able to use the application in a better way.

2. Was the overall appearance of the app pleasing?

The representation of buses and cycle stands was appreciated by many, but the overall appearance failed to put a lasting effect on any of the user's mind.

3. Which features did you like most about the software?

Expected location pop-ups, occupancy/ availability, and walking path.

4. Were there any other features that you found particularly difficult or frustrating to use?

Transit option toggles when activated at the same time slowed down the system. It was unclear what the estimated time of the buses represented. Was it time to reach to the user's location or was it to the bus stop.

5. Were there any menu or button positions that you found awkward to interact with?

Issues occurred when the system was put into configurations it has not been designed and developed for yet (portrait mode, zooming).

6. What, if any, improvements would you suggest--including flaws in current functionality or additional features not already present?

There was no indication of which direction the trolleys and buses were heading.

7. Is this something you would be more likely to use compared to currently available options?

No, only if I was new to Tech, a freshman.

8. How often might you be willing to use this app?

Rarely, or not at all.

9. Do you have any other comments on this app or this evaluation?

Decision function is nice, this is more creative than current options. Would be good to use when visiting new places to find transportation/restaurants. Would be useful for more people if there were more features, or it was made more fun/easy to use.

Positives:

The overall impression users had of the prototype was positive. Each commented on the novelty of the AR view and the ability to identify locations of real vehicles and places as well as occupancy and availability. Most thought that the system would be especially useful to users who were new to the campus.

Negatives:

About half of participants voiced concern that there were already other systems with similar functionality. At least two also mentioned that such a system would not be as useful for users who were already very familiar with the campus

The full transcripts of the questionnaire, with responses may be found in Appendix III.

4. Discussion

Users were routinely able to locate trolleys, buses, and ViaCycle stations. They also had little trouble determining the closest ViaCycle station with bikes available. From this we determine that the transit option markers worked effectively. Since the participants had such difficulty with the decision screen, an integral element of the system's core functionality, a clearer or alternate means of exiting the decision screen should be made available. The AR aspect of the interface was met with praise from all participants, and was also quite easily adapted to throughout the cognitive walkthrough task trials.

While the system as a whole received praise from a technological innovation standpoint, the functionality of the system was subject to rigorous critique. It seems that no matter how many interesting features were included, some users could not see past its use as another alternative to NextBus. It was also made clear that students familiar with Tech campus would require even more innovative functionality or speed in order to motivate them to use the system regularly.

We found that users would often comment on the speed and stability of the system, even after being reminded that it is a prototype. Many times, the users would repeatedly tap an option without allowing the system time to register and respond. We learned that, although it may be useful to allow a given user free reign of the system at some point in the evaluation process in order to see where their curiosity may take them, too much freedom detracts from the time necessary to complete the given tasks and may lead to unrecoverable system instability.

As a result of user studies the 'Favorites' system has been updated to allow multiple modes of adding a search destination to the favorites list. Further additions and corrections to functionality are addressed in the following section.

5. Future Work

Preliminary evaluations resulted in numerous opportunities to incorporate additional elements, features, and functionality that may improve the system. These include:

1. Usability for new users may be aided by incorporating a pop-up instructional message when users first begin exploring the app.

2. Additional help in the form of a '?' or 'info' icon may be useful as well.

3. The 2D map or AR view will be displayed depending upon phone orientation.

4. The natural way of handling a phone is in portrait mode. Thus further work is needed to see if the AR app can be used in portrait mode instead of just landscape mode.

5. The capacity indicator bar on the trolley/bus marker should be labelled more obviously.

6. The transit options slider should be more prominent, with a clearer indication of its functionality.

7. An obvious means of returning to the previous function from the transit decision options screen.

8. A clear indicator to notify user about direction they should turn to locate nearest bus stop and cycle stop.

•

Continued user testing would also be of great benefit. Once the prototype's interface is refined and its functionality is optimized, then we might be able to test the system through more quantitative means. This would no doubt lead to additional refinements and improvements.

6. Implications of the exercise

Students at Georgia Tech are always pressed for time. Their main aim is to get to their classes on time. The transit system isn't quite suited to solve this problem. So our main focus while developing the system would be to ensure minimum time gap between student request and our response. We plan to achieve this by using minimalistic user interactions and optimizing our query system.

Another interesting thing we discovered in our survey was that people were not aware of the viaCycle service inspite of it being very useful. We would also have to focus on creating awareness about this service which can only be achieved by developing a system which would appeal to the students.

Since the students are looking for a free service, the viaCycle service is apt as it provides free service for upto 30 minutes which is more than enough to travel anywhere in the campus.

Even though the majority of the users walk around in the campus, the trend could be altered by pushing this service and making it available at a wider scale. The current capacity of 35 of viaCycle may not suffice

Appendices

Appendix I: IRB consent form

Georgia Institute of Technology
Project Title: Decision Aid System for Georgia Tech Campus Transit Options
Principal Investigator: Dr. Bruce Walker

Research Consent Form

You are being asked to be a volunteer in a research study.

Purpose

The purpose of this study is:
This research should give insight into the usability of a proposed interface which would provide help with the decision-making process when determining which of the transit system options on Georgia Tech campus are fastest.

Procedures

If you decide to be in this study, your part will involve:
Before your participation in this study, you will be given a briefing as to what is expected of you during your participation in this study and the intent behind it. During your participation in this study, you will be asked to interact with various multimedia systems, which can include websites on mobile phones or other devices, computers, and video systems. You may also be asked to work with prototypes or mockup systems and devices. Throughout your participation in these tasks, you will be asked to think aloud as you work with the devices. We will also be asking you questions as you go along. Afterward, you will be given a debriefing, and asked some follow-up questions. The study should take about two hours, with breaks as needed.

Possible Risks and Discomforts

The following risks/discomforts may occur as a result of your participation in this study:
The risks involved in participating in this study are no greater than those involved in daily activities such as viewing television programming or working with a computer.

Benefits

The following benefits to you are possible as a result of being in this study:
You are not likely to benefit in any way from joining this study. But we hope that your participation will provide us with valuable information, which will help us to evaluate and improve use of the transit system options for Georgia Tech students on campus.

Compensation to You

You will receive no compensation, monetary or otherwise, for your participation in this study.

Confidentiality

The following procedures will be followed to keep your personal information confidential in this study: The data that is collected about you will be kept private to the extent allowed by law. To protect your privacy, your records will be kept under a code number rather than by name. Only the study staff at the Georgia Institute of Technology will be allowed to look at them. Your name and any other facts that might point to you will not appear when results of this study are presented or published. To make sure that this research is being carried out in the proper way, the Georgia Institute of Technology IRB may review study records. The Office of Human Research Protections may also look at study records.

Costs to You

No financial obligations will be incurred due to your participation in this study.

In Case of Injury/Harm

If you are injured as a result of being in this study, please contact Bruce Walker at telephone number (404) 894-8265. Neither the Principal Investigator nor Georgia Institute of Technology have made provision for payment of costs associated with any injury resulting from participation in this study.

Subject Rights

Your participation in this study is voluntary. You do not have to be in this study if you do not wish to be. You have the right to change your mind and leave the study at any time without giving any reason, and without penalty. Any new information that may make you change your mind about being in this study will be given to you, and you may choose to leave at any time. You will be given a copy of this consent form to keep. You do not waive any of your legal rights by signing this consent form.

Questions about the Study or Your Rights as a Research Subject

If you have any questions about the study, you may contact Bruce Walker at telephone number (404) 894-8265. If you have any questions about your rights as a research subject, you may contact Ms. Kelly Winn, Georgia Institute of Technology at (404) 385-2175.

If you sign below, it means that you have read (or have had read to you) the information given in this consent form, and you would like to be a volunteer in this study.

_____

Subject Name

_____

Subject Signature Date

_____

Signature of Person Obtaining Consent Date

Appendix II: Cognitive Walkthrough - Tasks and Notes

Participants:

P1 - Participant 1
P2 - Participant 2
P3 - Participant 3
P4 - Participant 4

Notetakers:

R1 - Recorder 1
R2 - Recorder 2
R3 - Recorder 3

Tasks:

T1 - Identify closest trolleys nearby
T2 - Locate Buses in area (Red/Green/Blue)
T3 - Find closest ViaCycle station with available bikes. How many?
T4 - Go to CRC from favorites. Which is quickest method?
T5 - Add a favorite *[they should click on heart]*
T6 - Try to access recent searches

If time allows:

T7 - Determine whether a voice preset is available for a favorite

Cognitive Walkthrough: Tasks and Notes

P1 - R3

T1 - Identify closest trolleys nearby
T2 - Locate Buses in area (Red/Green/Blue)
Asked: What do you see around you?
User action: Rotates phone to locate red bus
Says: there is the red bus, it goes that way, User action: motions counterclockwise with hand
Says: looks like its has 34% of its route complete, and is due in 10 minutes
User action: Rotates again. locates Trolley

Says: here is the trolley, going ***this** way, *User action: motions clockwise with hand
Says: with 78% of route complete, and is due in 7 minutes

Asked: Now, please try to select a location.
User action: Press on search
Says: there seem to be 2 search options available, voice and text entry

Says: I prefer text
User action: Begins to enter a destination
Says: Ok, so it suggests this...
User action: Clicks the middle option (CRC)

System: Displays Transit option time comparison screen
Says: So it looks like the bus will take 14 mins to get here
User action: Stops, seems confused

Asked: What is here?
Says: Ok, well I prefer walking...

Asked: Please select ViaCycle
Moderator needs to toggle ViaCycle button

T3 - Find closest ViaCycle station with available bikes. How many?
Asked: Please try to find the nearest ViaCycle station with cycles available
User action: Rotates phone to locate a viaCycle marker (tooltip)
Says: So the closest is at CoC, 156m....

T4 - Go to CRC from favorites. Which is quickest method?
Asked: But are there any bikes there?
Says: Uh, none available
User action: Rotates phone to locate another viaCycle marker
Says: nearest to CRC is 400m with 2
Says: This is nice.

T5 - Add a favorite [they should click on heart]
Asked: Could you please add a destination to the favorites list?
User action: Clicked already favorited search history item > sent to options decision panel
User action: Tried to click heart in up-right corner to add favorite

T6 - Try to access recent searches
> Time is up

P2 - R2

T1, T2
-Seen green bikes
-What percentage (awesome)
-Saw 6 trolley
T3
-Had to be told about side menu

-Saw blue bus one minute away
-Searched for library rather than CRC
T4
-Saw 'walking'
> Time is up

P2-R1

T1, T2
-What is percentage?
-Like occupancy?
T3
-Can't click
T4
-Tapped more than once for search
-Tried searching for library
T5
-Pressed search
-Got decisions and selected walking
T6
-Tried favoriting
-Places were already favorited
> Time is up

P3 - R2

T1, T2
What does it mean? 2min/8min (did not ask about percentages)
Asked: what do you see here?
"tells me which direction to reach destination faster"
T3
Tried to select green bus > selected viacycle instead, and vice versa
T4
Search menu entry:
Drop down menu and text entry keyboard collide...
Especially when zoomed
User asks? "how to let this [the text search drop down] go?"
T5
Tried to refavorite items in recent searches > directed to decision page
No undo/way to go back cause confusion
T6
> Time is up

P3-R3 (moderator notes)

Multiple taps for most attempts
Orientation issues & zooming
Commented on lack of stability
Confused by reaction rate
Visibility unclear . clicked viacycle, did not respond
Played with all the options rather than doing as asked

P4 - R2

-Also liked to walk
-Liked portrait mode
-Pretty cool!
-not necessary
-!(economically sound)
-Appearance 4/10
-Awkward keyboard
-Options are slow
-Prefer portrait

> Time is up

P4 - R1

Was a developer (chem engineer)
-Said the app was pretty cool
T1, T2
-Set distances
-Could not understand the concept of occupancy <initially>
T3, T4
-Working slow <he wanted to press all the options>
-Accidentally got the decision page
T5
-"What should I input?"
-"What will happen when I do a particular destination input?"
-World not loading

> Time is up

Appendix III: Post-evaluation interview results:

Moderator: *What was the overall opinion of the functionality of the software?*

P1- It covers all options (understands its under development)
P2- Really liked design, innovative
Figuring out all aspects (only one normally)
P3- <In a rush, hurried off with (2) donuts>
P4- Cool, but maybe not necessary or economically sound

Moderator: *What was the overall opinion of the appearance of the software?*

P1- Clean & easy to use interface
P2- Very friendly, touch friendly
P3- Looks ok
P4- 4/10 (he'd prefer landscape mode, which it was not optimized for)

Moderator: *Which features did you like most?*

P1- <Ran off with donut>
P2- Pop-ups (objects), occupancy/availability features
P3- <In a rush, hurried off with (2) donuts>
P4- Expected location of buses
Walking directions

Moderator: *Which features did you find difficult or frustrating?*

P1- <Ran off with donut>
P2- No problems
P3- Prototype slow/unstable when many functions being used at same time.
No undo.
P4- The right top options (favorites or bus toggles?) were slow

Moderator: *Were there any menu or button positions that you found awkward to interact with?*

P1- <Ran off with donut>
P2-
P3- Many (when the system was being taxed by too many interaction)
Zoom features made menus unreadble when switched to landscape
P4- the keyboard, especially in portrait mode

Moderator: *What, if any improvements might you suggest--including current flaws in functionality or additional features not already present?*

P1- <Ran off with donut>
P2- Helpful for new people, might not use later
P3- <In a rush, hurried off with (2) donuts>
P4- Wants to use portrait mode

Moderator: *Is this something you would be likely to use?*

P1- <Ran off with donut>
P2- Only if I was new to Tech
P3- May be useful for Freshman
P4- No, I walk and have my own bike

Moderator: *How often would you use it?*

P1- <Ran off with donut>
P2- Rarely, I already know places
P3- <In a rush, hurried off with (2) donuts>
P4- Not likely at all

Moderator: *Do you have any other comments on this app or this evaluation?*

P1- <Ran off with donut>
P2- Cool interface
Decision function is nice
More creative than current options
+Find restaurants based on menu search (would be a good addition)
+For use when in new places, new cities (to find transportation)
P3- Would be useful for more people if there were more features,
or it was made more fun/easy to use
P4- Its cool that it uses the camera
Prefers to hold phone so that app is in landscape mode
He mentioned that we should be able to get bus stop demographics

Appendix IV: Debriefing Script

We appreciate your time and effort spent in this software evaluation research process. The information provided will help us to improve the software, which we hope will help Georgia Tech students to travel more quickly and easily around campus. Please be assured that, all information we have gathered will be kept anonymous.

If you have any additional questions or comments at this time, please let us know.

Further information about the results of this study can be made available to you, if you have further interest. You may also access the results of this study at any time by visiting our website at: http://www.peerspun.com

Thanks again, and have a great day.