

# PENNSTATE

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**The Pennsylvania State University  
University Park Campus**

## **SUSTAINABILITY PLAN**

**Transportation Study**

**University Park**

EDSGN 100\_005  
Design Team 8  
Spring Semester 2013

Submitted to:  
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Photo by: Design Team 8

22 April 2013

Sustainable  
**STATE**

A stylized green leaf graphic with several leaves on a stem, positioned to the right of the word 'STATE'.

# ACKNOWLEDGMENTS

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## SECTION 1 EXECUTIVE SUMMARY

Sustainability is an important aspect of engineering to consider in our current world, because our continuously growing world population is consuming the dwindling resources available. This makes sustainability practices important for preserving our future. The EPA says, "Sustainability creates and maintains the conditions under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic and other requirements of present and future generations." These ideals must be present in every engineering endeavour to ensure our continued survival.



Photo by: Design Team 8

Currently, the main source of transportation pollution for inside campus traffic is the CATA Buses that provide transportation to the community of Penn State. These Buses run on natural gas and cut back the number of buses running at off hour times, both of these practices are help reduce the amount of pollution caused by the buses. However more can be done, by removing more traffic from the busses and instead moving it to bicycle traffic.



Source : <http://creativegreenius.files.wordpress.com>

Our mission statement is, "Our reason for being: helping the environment by decreasing the traffic, bringing the community closer together through bicycle sharing programs, improving the health of the community, providing a safer environment for cycling and instilling positive moral values."

Our goal has three parts to its completion. First we feel that the bicycle lanes and general riding safety need to be improved. To accomplish this we propose the addition of 8 and then 16 miles of bicycle lanes (both on roads and sidewalks) to allow for safer riding, driving and walking for the whole community. Secondly, we propose a bicycle sharing application that connects people who have a bicycle with those who do not have one to allow more people to use bicycle as their main means of transportation as opposed to riding the bus. This can be completed by first making the

application, and then advertising the application to expand the community that uses the application. Third we propose the addition of bicycle kiosks around campus that allow for students to rent bicycles and ride them to another kiosk. Similar systems are found in cities around the world. Just like the CATA bus it should be free within the campus and paid for out of campus riding.

These goals will reduce the traffic of people using the bus and allow for CATA to reduce the number of buses they run even at times of high traffic, which will in turn reduce the number of emissions and pollutants caused by the buses. The success of these goals can be measured quantitatively by examining the number of miles of bicycle lanes, the number of users who have downloaded the application, and the number of users using the bicycles at the kiosks. These three together will provide a complete analysis of the scale of the work done toward this plan and a comparison of other bicycle sharing systems in either small cities or other universities.



Source : <http://onwardstate.com>

In order to maintain the system, community feedback will be key. This can be done through the application which will provide an easy way to connect the community with the university. Maintenance crews will be needed to maintain the bicycle lanes, but this will be only a minor addition to the current maintenance cost of the roads and sidewalks. Once Penn State has the plan in full swing it will provide a wonderful publicity point to focus on whenever the topic of sustainability comes up in reports or just concerned people's questions.



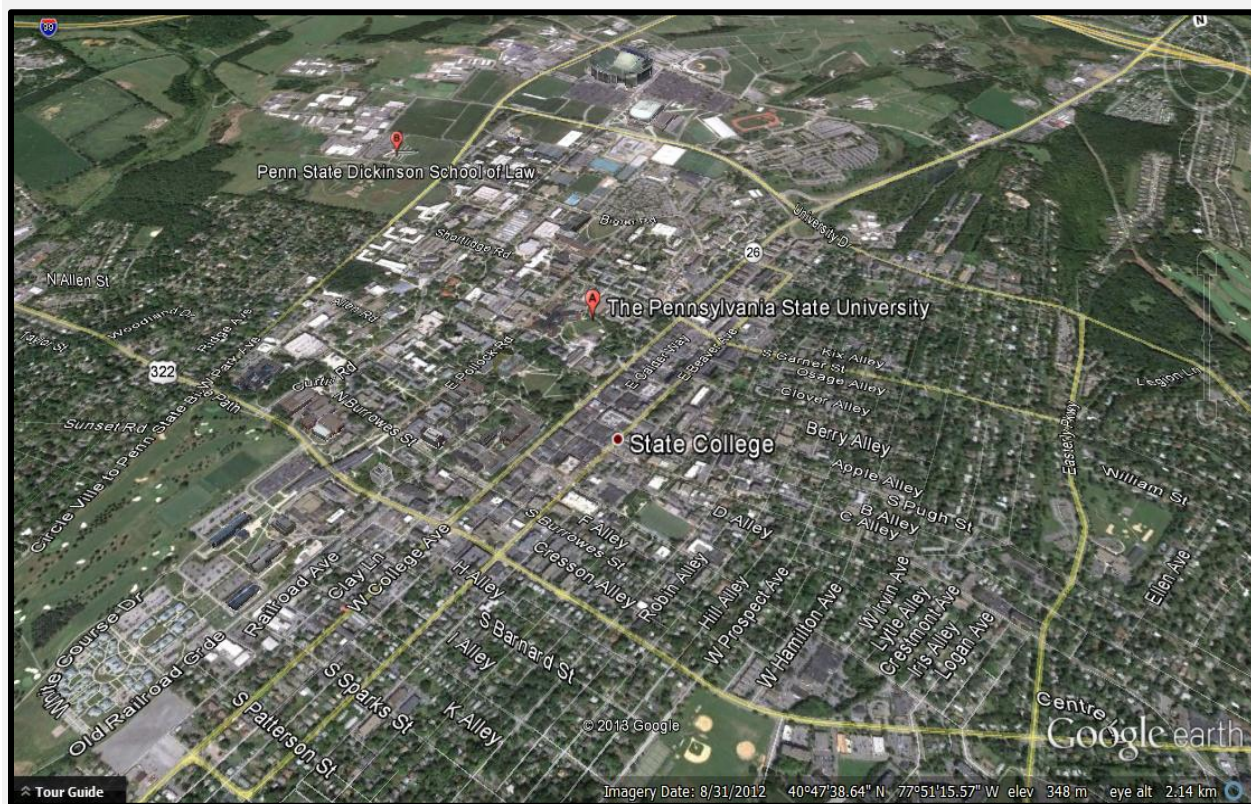
## SECTION 2 BACKGROUND

### 2.1 LOCATION.

Penn State University is located very near the geographic center of Pennsylvania. It is located in Happy Valley with Mount Nittany rising to the south east. The campus is positioned above a limestone shelf.



Source : [www.psu.edu](http://www.psu.edu)

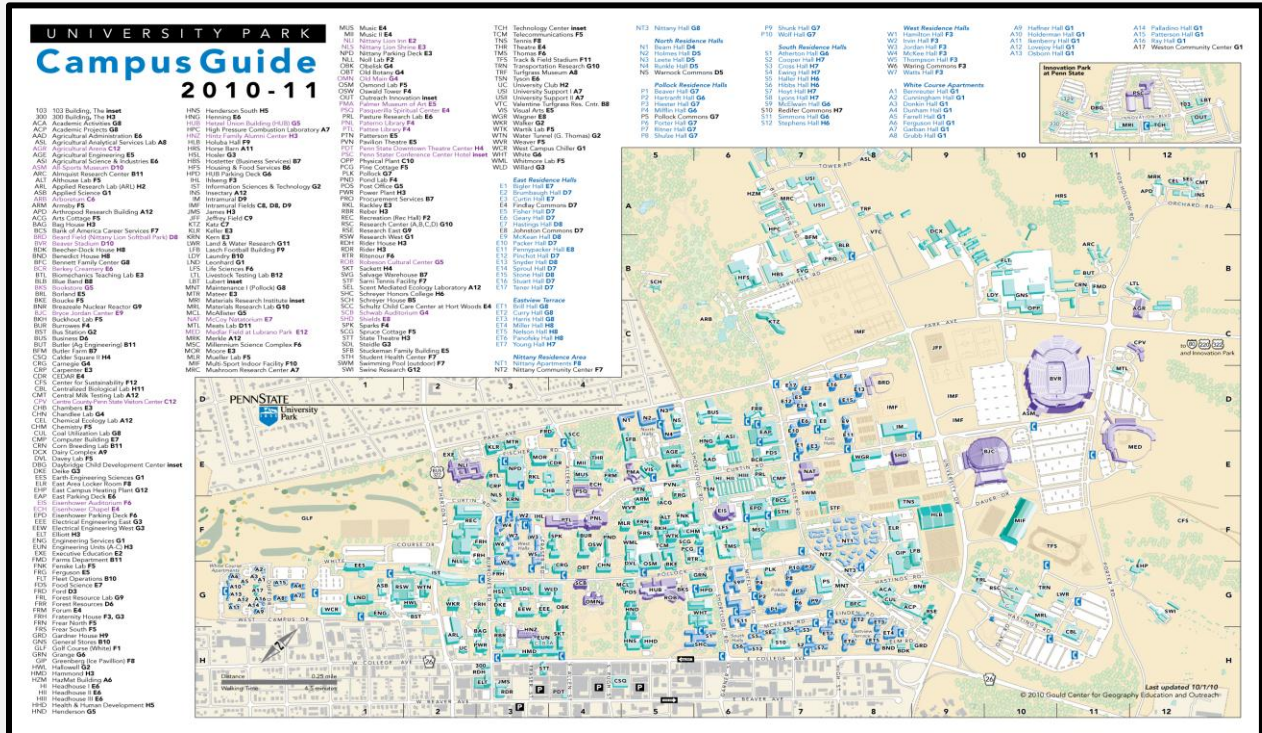


Source : Google Earth, Google Inc.

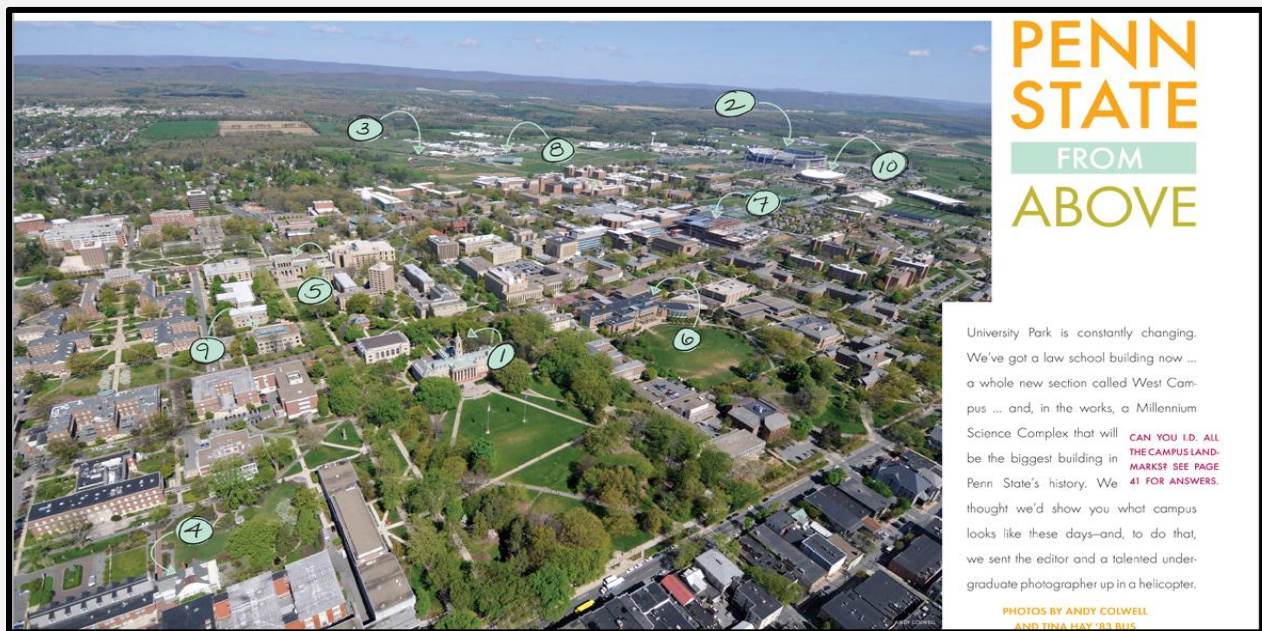


## 2.2 CAMPUS SETTING.

University Park is a suburban community with 31 miles of paved roads and 23 miles of paved walkways criss-crossing the campus. The whole campus is comprised of 1.51 sq. miles.



Source : [www.psu.edu](http://www.psu.edu)



Source : [www.psu.edu](http://www.psu.edu)

### 2.3 SCOPE OF THE PLAN.

To create a system exclusively for Penn State and its surrounding community that allows for more people riding bicycles as opposed to using heavier pollution alternatives. The project overall includes the Pennsylvania State University, the community and Borough of State College, CATA Bus System and the Siemens Company.



### 2.4 PROJECT OBJECTIVES.



Source : [www.thetransportationgazette.com](http://www.thetransportationgazette.com)

As the Penn State's University Park campus is a small city, our team considers sustainable transportation both to and from and also within the campus itself.

Our goal is to design and develop a form of transportation to take the place of CATA Bus within the Penn State University Park campus.

### 2.5 PROJECT BACKGROUND.

There are many different forms of transportation that students in our campus have taken the advantage of, such as CATA Bus, cars, motorcycles and bicycles.



Source : [www.iecp.psu.edu](http://www.iecp.psu.edu)



Source : [www.transportation.psu.edu](http://www.transportation.psu.edu)

The purpose of this project is to reduce the amount of energy we used annually and to determine which form of transportation is least costly and most green.



## 2.6 WHAT IS SUSTAINABILITY.

“Sustainability is based on a simple principle: Everything that we need for our survival and well-being depends, either directly or indirectly, on our natural environment. Sustainability creates and maintains the conditions under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic and other requirements of present and future generations.



Source : [www.uspartnership.org](http://www.uspartnership.org)

This means engineering not only for this generation but for the successive generations. The solutions conjured offer the benefit for the environment, community and society in general.

## 2.7 CURRENT SUSTAINABILITY PRACTICES.



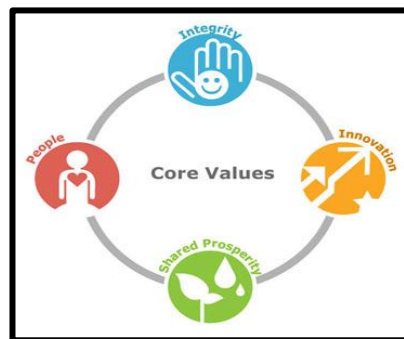
Source : [www.pioga.org](http://www.pioga.org)

Focusing on the transportation system throughout the campus, currently the CATA Bus system uses buses that run off Clean Natural Gas (CNG) to reduce emissions and they augment the number of buses running at off times to reduce wasted resources.

The team selected the transportation system to study and report findings as there is room for improvement within this system. Improvement within the system would lead to a more efficient transportation system.

## 2.8 GUIDING PRINCIPALS.

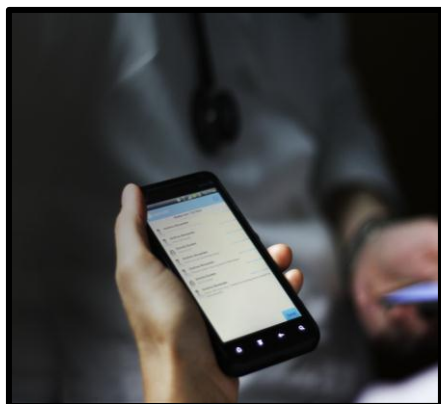
The research outlines several guiding principles within the transportation system. This includes the reduction of emissions by busses, reducing traffic density, safety and integrity, costs, continuous innovation and the overall effect to the environment.



Source : [www.insightgp.com](http://www.insightgp.com)

## 2.9 STAKEHOLDER ENGAGEMENT.

A committee which includes the community of State College, Pennsylvania State University and the CATA Bus System is created to discuss the problems arising from the planning, implementation and maintaining of the system. This committee is also responsible for public awareness issues and safety issues arising from the implementation of the system.



Source : [www.cureatr.com](http://www.cureatr.com)

Issues can be identified using the feedback from users of the application and this data could be used to modify the system as needed to make it as safe and effective as possible.

The committee would have to meet regularly for example 2 times a month to discuss the issues arising from the program. A voting system within the committee should be implemented so that a fair solution to each problem would be conjured.

## 2.10 DESIGN TEAM MEMBERS.

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Photo by : Design Team 8

## Section 3 MISSION STATEMENT, VISION GOALS, COSTS, AND METRICS

### 3.1 MISSION STATEMENT.

Our reason for being: helping the environment by decreasing the traffic, bringing the community closer together through bicycle sharing programs, improving the health of the community, providing a safer environment for cycling, and instilling positive moral values.



Source : [www.creativegroup.psu.edu](http://www.creativegroup.psu.edu)

### 3.2 LONG TERM VISION.



Source : [www.sustainability.psu.edu](http://www.sustainability.psu.edu)

We want to see the elimination of all unnecessary bus services to be replaced by a system of bicycle sharing programs and rentable bicycle racks. We also want to have a safe environment for cycling by having no more accidents. These together will bring the community closer and make it physically healthier.

### 3.3 SHORT TERM GOALS. (0-1 YEARS)

**Goal 1.** Planning location of the bike lanes throughout the campus to promote safe bicycling.

**Actions.** Create a committee to outline the primary location of the bicycle lanes.

**Barriers.** No Barriers identified.

**Estimated Costs.** Estimated costs are thought to be nominal.



Source : [www.pdsblogs.org](http://www.pdsblogs.org)



## Goal 2. Creating the bicycle sharing program.



Source : [www.digitaltrends.com](http://www.digitaltrends.com)

**Actions.** Creating an app that allows for the connection of individuals within the program.

**Barriers.** Disclosure of private information through the app.

**Estimated Costs.** Significant data collection and analysis will be necessary in order to determine a cost for this goal. Estimated costs are thought to be nominal.

## Goal 3. Promoting the bicycle sharing program.

**Actions.** Create a committee to identify the target audience of the program and use this to create audience specific advertising.

**Barriers.** Demographic statistics may not yet be present on this topic.

**Estimated Costs.** Estimated costs are thought to be nominal.



Source : [www.ecs.psu.edu](http://www.ecs.psu.edu)

### 3.4 INTERMEDIATE GOALS. (1-5 YEARS)

#### Goal 1. Create 8 miles of Bike lanes throughout the campus to promote safe bicycling.



Source : [www.ecevelo.info](http://www.ecevelo.info)

**Actions.** Finding a contractor to paint the bicycle lanes.

**Barriers.** Roads and walkways may need to be widened to allow for appropriate lane width for drivers, bicyclist, and pedestrians.

**Estimated Costs.** \$5,000 – 7,000 (subject to current price)

#### Goal 2. Have 1,000 users of the bicycle sharing program.

**Actions.** Extensive promoting of the free program to share bicycles, specifically at the orientation programs for incoming students.

**Barriers.** Swaying public opinion to be in favor of sharing their bicycles to strangers.

**Estimated Costs.** Zero Costs.



Source : [www.planningobserver.com](http://www.planningobserver.com)

**Goal 3.** Reduce the density of the bus traffic.



Source : [www.stateneews.com](http://www.stateneews.com)

**Actions.** Identify the unnecessary stops along each on campus bus route and contacting CATA Bus System.

**Barriers.** Seasonal changes may affect the usage and demand of the on campus bus services. Routes must be seriously considered for closure.

**Estimated Costs.** Significant data collection and analysis will be necessary in order to determine a cost for this goal. It is estimated costs to be low for spring and summer but costs are estimated to increase during fall and winter

**3.5 LONG TERM GOALS. (5-10 YEARS)**

**Goal 1.** Create 16 miles of additional Bike lanes throughout the campus to promote safe bicycling.

**Actions.** Expanding on the previous bicycle lanes and continuing the relationship with the road and walkway painting contractor.

**Barriers.** Planning of location of additional bike lanes throughout the campus.

**Estimated Costs.** \$5,000 – 7,000 (subject to current price)



Source : [www.richmondva.wordpress.com](http://www.richmondva.wordpress.com)

**Goal 2.** Have 10,000 users of the bicycle sharing program (about ¼ of the Penn State University Park campus population).



Source : [www.guardian.co.uk](http://www.guardian.co.uk)

**Actions.** Continuing advertising and promotion of the bicycle sharing program. Improve the design of the app to cater for the number of users.

**Barriers.** Public disclosing of personal information through the app and swaying public opinion of sharing a bicycle with a stranger.

**Estimated Costs.** Estimated costs are thought to be nominal.

**Goal 3.** Establish a bike renting system for the community.

**Actions.** Plan the scale and contact a contractor such as Bixi (Bicycle Sharing System).

**Barriers.** No Barriers identified.

**Estimated Costs.** Significant data collection and analysis will be necessary in order to determine a cost for this goal.



Source : [www.chfi.com](http://www.chfi.com)

### 3.6 METRICS.

The progress of our plan can be measured by the number of miles of bicycle lanes and the number of users of the bicycle sharing program. These together will give a numerical way of analyzing the progress of our plan. The application will provide easy data for the number of users.



Source : [www.amesphotos.com](http://www.amesphotos.com)



## Section 4 IMPLEMENTATION

### 4.1 PROCESS.

The first step of implementing the plan will be improving the current system of bicycle lanes throughout the University campus. Once the bicycling lanes are safe and accessible the number of bicycle users will naturally increase. The next part to work on is the bicycle sharing program. This needs to have two steps to its implementation. First the program needs to be made. The ideal method for this would be a smartphone app. They are easy to make and cheap to maintain. The second step to implementing the bicycle sharing program is to publicize it to the public to gain more membership. The final step to this plan is the implementation of a system of rentable bicycles that will be maintained by a contractor similar to the bicycle sharing organizations present in major cities such as Washington D.C. and Toronto. As more people switch to bicycles instead of using the bus system, the number of buses running and the number of stops can be reduced to fit the changing needs of the community.

### 4.2 STRATEGIES.

The implementation of this plan will take work and decisions. One method for making these decisions is to create committees that will deal with the specifics and work out the minor details of the application of this plan to University Park. If needed polls are a great way to monitor the changing opinions of students and users of the bicycle sharing program. Such polls can be used to observe the change in the number of people who use the bus to scale down the buses as necessary. Another way the polls can be used is to provide feedback from the community about the bicycle sharing program or just any suggestions for how to improve the system.

### 4.3 POINTS-OF-CONTACT.

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#### 4.4 IMPACT.

The implementation of this plan will reduce the necessary number of buses that need to run at any given time, thereby reducing the emissions of the campus. The bicycle program would provide a visible publicity point for advertising the sustainability of the University. The increase in bicycling will also increase the physical health of the community along with connecting its members in a common hobby to bring the community closer together.



Source : [www.communitycyclingcenter.org](http://www.communitycyclingcenter.org)



Source : [www.icc.org.uk](http://www.icc.org.uk)



Source : [www.communitycyclingrochdale.blogspot.com](http://www.communitycyclingrochdale.blogspot.com)

## Section 5 MEASUREMENT AND PERFORMANCE

### 5.1 MONITORING.

The goals in section 4 overall will be implemented through the close collaboration between Pennsylvania State University, students, the community, the CATA Bus System and several contractors to-be-appointed through discussions and committees that would be set up.

The short term goals would involve students in the team and Pennsylvania State University as it is only the planning and early stages of the project. Serious talks and a committee would be established in discussing current and future problems in the implementation and planning of the project. Data from these meetings would be collected and analyzed producing a preliminary report regarding the matter within a period of one year. The report would include the finished structure of the planned mobile app, the location of the proposed bike lanes, safety, cost and economics, the solutions to public disclosure of certain information and other problems intertwined with its solutions that were identified through the discussions. The report should provide a clear and lucid pathway for the execution of the project.

The intermediate goals put the community of State College and the CATA Bus System in the picture. A committee will be established which includes the students in the project team, Pennsylvania State University, CATA Bus System, the community and Borough of State College. This committee will review the proposed preliminary report submitted by the previous committee and address new issues that arise from discussions. This committee would meet regularly practically in a fortnight basis to discuss those issues which includes worries in the community, the pros and cons to each side and key discussions of the implementation of the project. The committee would be in charge of finding funds for the proposed project, carry out promotions and awareness campaigns regarding the project and launching Stage I of the project as a whole. This committee would also manage and maintain a direct oversight of the app which would be launched 1 year after the committee is established. Each meeting are recorded and put into a secure database as a record for future purposes. Data from the app is also included such as feedback from the users.

The long term goals will include all of the previous committees and discuss a more commercial sense of the project and the expansion of the current system or program. A bike renting company either a new one or previously established will be offered a bid to construct



and maintain a public bike renting system at key areas for the community of State College. Each side of the discussion must provide a say and reach a consensus in the talks. In the preliminary talks, the committee should meet every two weeks and after the preliminary talks, the committee would meet in a less regular time frame practically every month to discuss issues arising from the project. The committee must produce a quarterly report on the project in the first 2 years of Stage II implementation. After 2 years, a yearly report would suffice.

## 5.2 REPORTING.

As stated in 5.1, within 0-1 years, the committee which includes the students in the team and Pennsylvania State University will come up with a preliminary report regarding the matter of discussing current and future problems in the implementation and planning of the project within a period of one year. This report is essential to provide clear pathways to which the project will be executed. This report will be provided to the next committee which includes the previous committee and adds the community and Borough of State College and the CATA Bus System. This committee will take the previous committees report and discuss it further adding new perspectives from the community and the premium bus service provider, CATA Bus system. The committee will issue a yearly report regarding the progress and this report is publicly disclosed in the college newspaper, The Daily Collegian or on a project webpage on the internet. The public and the users of the program will have an insight of the project as a result. The app developed would also help in providing links for the report. For 5 years and above after the implementation of the project, the committee which now includes another side which is the bike renting company, will discuss the expansion of the project and a more commercial aspect to the project. The committee will issue a quarterly publicly disclosed report for the first 2 years of the Stage II implementation and a yearly publicly disclosed report for the subsequent years.

## 5.3 IMPROVEMENT.

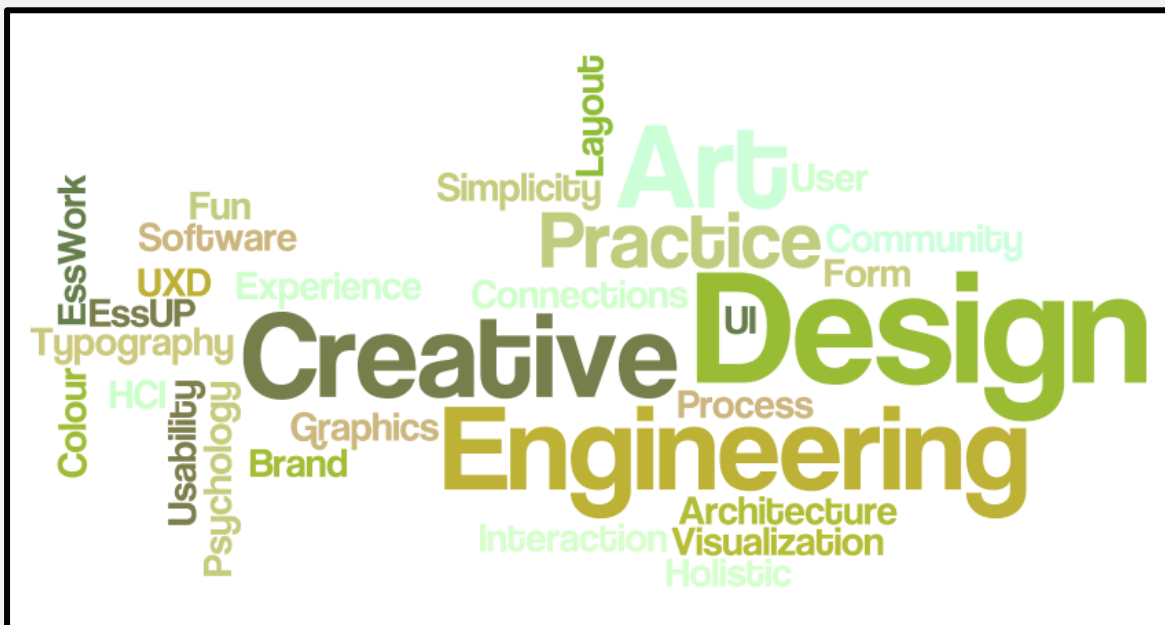
Throughout the execution of the project, the project team members which consist of students will be a part of all the committees that will be established discussing issues regarding the project. Our execution plan is always based on a consensus reached in a committee which members give different perspectives and views to problems regarding the project. A decision will be made only when everybody reaches a consensus. Therefore, improvements throughout the execution of the project are most likely inevitable and will happen as soon as discussions come to a start. The public could also provide feedback to the project by giving suggestions within the app that would be developed for the program. Each improvement or suggestion would be reviewed by everybody before being implemented in the project.

#### 5.4 LESSONS LEARNED.

Following the engineering design process; we first need to identify the needs of customers, then, to research these needs. We need to test the current state of the issue, current solutions and explore other alternatives by the internet. We need to develop some possible solutions by group discussion and select the best possible solution to meet the customers' requirements. Next, we need to model the selected solution and test whether it works or not.

From the engineering design lesson, we got used to complete the design project step by step. We first set our goal to design and develop. In this design, our goal was to design a project which was sustainable. From the various aspects, such as energy, transportation, we finally decided to design and develop bicycle sharing project. Before designing our project, we first need to decide the routes which were more suitable for setting bike stops. In our campus, the main road is Pollock road as many main buildings are built on this road. However, buses only stop at the white building yet do not pass through the Hub. The rest of the road does not have any bus stop. Our team decided to build bike stops on the Pollock road. After we roughly determined the locations of each bike stops, we considered to generate the virtually model which were fit the desired customers' requirements.

A graphical picture of the things the team considered during the research was embodied by the figure below.



Source : [www.akrosit.com](http://www.akrosit.com)

## Section 6 SUMMARY/CONCLUSIONS

By using sustainable transportation instead of the regular transportation system here at Penn State for the mobility to and from campus and within the campus as well, we will reduce the percentage of pollution from the emissions of the busses to a significant value and at the same time, providing a healthier environment for the community. Thus, transforming the campus from a high polluted environment to a green campus that is environmentally friendly is cardinally important. Moreover, using this type of transportation will help to trim down the amount of energy that is consumes annually, yet cutting down the energy bill and save a good amount of money that can be used in future projects for the development of the university. Nevertheless, having such transformation would increase productivity of Penn State people, improve working conditions of students and faculty staff and increase their loyalty to protect the environment.



Source : [www.psu.edu](http://www.psu.edu)



## Section 7 RECOMMENDED RESOURCES

Capital Bike Share	: <a href="http://capitalbikeshare.com/">http://capitalbikeshare.com/</a>
City's Bike Share program	: <a href="http://www.nytimes.com/2013/04/16/nyregion/bike-share-program-is-taking-customers.html?_r=0">http://www.nytimes.com/2013/04/16/nyregion/bike-share-program-is-taking-customers.html?_r=0</a>
Citibike (Operated by NYC Bike Share)	: <a href="http://www.citibikenyc.com/">http://www.citibikenyc.com/</a> <a href="http://bikeshare.com/">http://bikeshare.com/</a>
B-cycle	: <a href="http://bcycle.com/">http://bcycle.com/</a> <a href="http://www.sfmta.com/cms/bshare/indxbishare.htm">http://www.sfmta.com/cms/bshare/indxbishare.htm</a>
Denver Bike Sharing	: <a href="http://denverbikesharing.org/">http://denverbikesharing.org/</a>
Hubway	: <a href="http://www.thehubway.com/">http://www.thehubway.com/</a>
Bicycle Sharing Solution for University:	<a href="http://www.onbikeshare.com/">http://www.onbikeshare.com/</a> <a href="http://www.seattle.gov/transportation/bikeshare.htm">http://www.seattle.gov/transportation/bikeshare.htm</a>