

Service Design about the Recycle System of College Bicycles

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Abstract. Abandoned bicycles on campus may not only occupy the bicycle parking, but also a waste of resource. Green design provides a way to solve this problem. With the college students in Wuxi as survey objects, we designed a bicycle service system which was based on the use of abandoned bicycles, some methods are used in our investigation such as interview method, simulation method, statistical analysis method and questionnaire method. It is a school oriented system with the enterprise's support, and all the students can participate in. Techniques of Internet of Things are adopted to combine the existing the One Card through of the School (OCTOS) Network with banks. Meanwhile, Mobile Communication Technologies are adopted to connect our service system to communication terminal equipment which can help diversify payment query modes to provide real convenience for users. This system consists of some multiple subsystems like recycling system, maintenance system, rental system, interaction system and visual system. We hope that the school resources can be sustainable utilized including the bicycles, and students, school, enterprise, environment will benefit from this system. Also we are trying to give a suggestion to the school about the resources recycling.

Keywords: college bicycle, recycling, service system.

1 Introduction

Today as the environmental problems and the energy problems are increasingly prominent, the idea of sustainable development is widely appreciated. And actually sustainable design is to take the idea of sustainable development into the realm of design. Specifically, sustainable design is different from the general meaning design for the purpose of product output. The ultimate goal of sustainable design is to satisfy consumers' specific needs through the integration of products and services to construct sustainable solutions, instead results and benefit of the consumption of material goods, as well as reducing resources consumption and environmental pollution, changing people's social life quality [1]. In such a situation, products and services system (PSS) become a new idea and a new way to realize the sustainable development [2]. In recent years, many domestic universities move to the suburbs, so bicycles become students' commonly used vehicles. Due to the large bike purchase and use every year, the university campus leaves a lot of graduates' abandoned or

stateless bike. Such a substantial accumulation not only takes up a limited campus space, more causes a tremendous waste of resources. We conduct the vast thorough investigation and research by interview method, practice method, questionnaire method based on the user experience, then designed a university bicycle rental service system based on the use of old bicycles. This system consists of some multiple subsystems like recycling system, maintenance system, rental system, interaction system and visual system. Techniques of Internet of Things are adopted to combine the existing the One Card through of the School (OCTOS) Network with banks. Meanwhile, Mobile Communication Technologies are adopted to connect our service system to communication terminal equipment which can help diversify payment query modes to provide real convenience for users. We hope that the school resources can be sustainable utilized including the bicycles, and students, college, enterprise, environment will benefit from this system. Also we are trying to give a suggestion to the college about the resources recycling.

2 The Methods and Process of Service Design about the Recycle System of College Bicycles

Bicycle rental green concept early started in Lyon, the second-largest city of France. Nevertheless, our service system is based on the use of waste bicycle on campus, and discussed the interaction of each subsystem and the users' various needs.

2.1 Interview Method

We interviewed some typical students in each of the Wuxi's colleges. From it we know that bicycle is the main vehicle of college students. Bicycles are environmental and convenient, but there are still some problems in use. In general, the problems can be divided into three categories:

1. Purchase problems. The price of new bicycles is so high that some students cannot afford them. Old bicycles are of poor quality and the price is always unreasonable. Students always worry about the fraud activities in the deal.
2. Use problems. The use problems include too many bicycles, inconvenient parking, lack of repairing points, and safety. Many students mentioned their bicycles used to be stolen and second-hand bicycles are of poor quality.
3. Dispose problem. Dispose means the way students deal with their bike when they graduated or no longer need a bike anymore with other reasons. Generally the ways include discard, sale and donation. Direct discard not only causes a tremendous waste of resources, but also takes up a limited campus space. And it is hard to sell the bicycles for lack of transaction platform.

More than half of the interviewed students are interested in bicycle lease, and they said that they are willing to donate their bicycles to our system when they graduate.

2.2 Questionnaire Method

We did some field research by using the questionnaire method, the questionnaire consists of six single choices, one multiple choice, one Jmix and two background

surveys. We sent two hundred and fifty papers in three colleges (Jiangnan University, Taihu college and College of Vocational and Technical) and we got two hundred and forty-seven papers back. Among these, 78% were valid and here we got some result:

61.5% respondents thought the biggest problem is theft, 35.6% people thought the outdoor parking spots are too few, 27.9% thought the indoor parking spots are not enough, 21.9% thought the bicycle repair shops are too few and the rest said the old bicycles are broken easily. Based on the data above, we enhance the vision system for better management and preventing against theft, meanwhile we set up more bicycle shops so that student can easily find one nearby. When the system works normally, the freshmen could buy less new bicycles and the abandoned bikes will be less, therefore we can solve the problems that we find out before.

The following Figure 1 rental model shows that students prefer monthly rental and semester rental most, follow with the daily rental, the last ones are yearly rental and hourly rental. So most bicycles are used to semester rental, monthly rental and daily rental, a few bicycles are used to yearly rental. The new bicycles offered by the enterprise are used to hourly rental, they play a role in the brand-enhancement and system promotion.

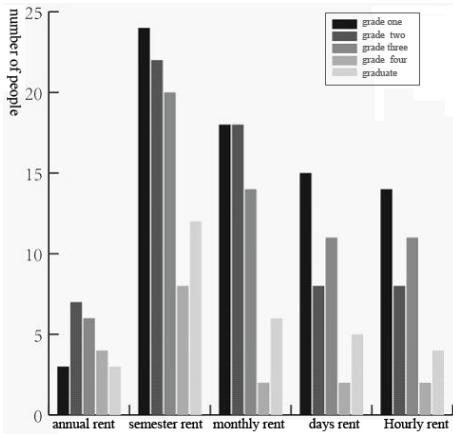


Fig. 1. Rental mode

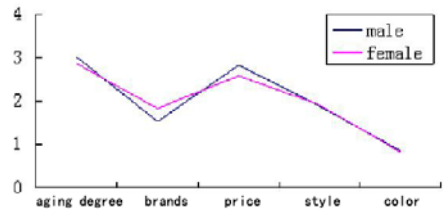


Fig. 2. Relation between students' focus and sexuality

According to Figure 2 relation between students' focus and sexuality (the taller the rectangle is, the more important they thought it to be). People care more about the bicycles' condition and rental price so how to recycle bikes and get them repaired are critical processes in our service system. Only if we make the bicycles attractive and durable, we can call on more students to take part in our system.

We take semester rental for example to survey the price factor, Figure 3 the interactions between the price of semester and sexuality shows 63% of the students chose the lowest price 38yuan per semester while still 38% chose the price 40yuan per semester or even higher. Consumption capacity of our students is growing but they are still rational consumers. However, funds are important because the service system will last for long, finally we decide to make it at 40yuan per semester.

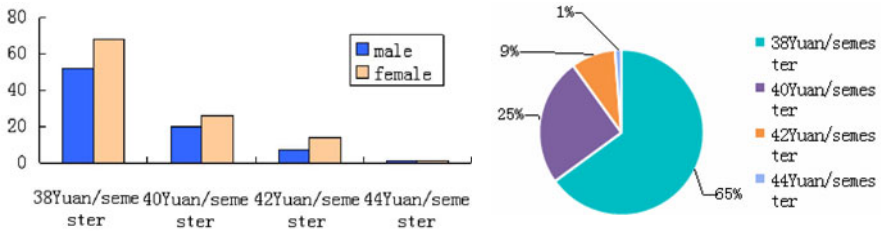


Fig. 3. Interactions between the price of semester and sexuality

2.3 Life Events Method

For sure bicycle recycling service system, we simulate system operation by campus life events method and determine the need to support the system based on the specific campus environmental.

We determined the system operation will use internet of things technologies as technical support. Take example by the "three generations plan" of bike sharing project in European city, we integrate existing campus card network and bank network to realize real name loan and payment. System is subdivided into six subsystems as recovery system, maintenance system, lease system, price system, interactive system and visual identity system, with each system interact and combine therefore sustainable system can operate well.

3 College Bicycle Circulation Service System Design Research Results Report

According to investigation result, College bicycle circulation service system composed by recycling system, maintenance system, lease system, price system, interactive system and visual identity system. Their good operation is the key of the stability of the system.

3.1 Recovery System

We designed three modes to solve the source of bicycle problem.

1. Donate used bicycle: the club through half donation and half feedback or some emotional feedback to recover graduates or other students' bike, and achieve the purpose of increase the bicycles and the transmission of emotion;
2. Compulsory recycling: With the help of the school authority to compulsory recycle the unused bicycle to achieve the purpose of effectively bicycle supply.
3. Add new bicycle: Take dividend return to invite bicycle manufacturers or related enterprise to join in, and through using such as Hangzhou public bicycle service system [5] complete the species of bicycle and enrich the lease way.

3.2 Maintenance System

With the cooperation of garage to classify, renovate the second-hand bicycles and maintenance bicycles in the system.

1. Classification: Put second-hand bikes into three classes as good, medium, poor. Good bikes can directly input use, medium bikes need renovate, poor bikes are as replacement parts or directly sell.
2. Renovation: For recovery bikes repairs, a rational daily maintenance system and maintenance outlets should be established to ensure the safety of bikes.

3.3 Rental System

Lease is one of the main parts in the service system, and is the important condition of the system running smoothly.

1. Lease way: Lease way points to long time rent and short time rent. Most rented bicycles are used for long time rent which is divided into year, semester, and month, the users rent and return by brush card (see interactive system) in the club's nominated site, Short time rent is divided into days and hours, most short time rent bicycles are new, the users rent and return by brush card in the short rent site of universities where has been set.
2. Timing system: Namely records using time. It as fee basis points to long rent and short rent two kinds. If exceed the time long rent will stipulate fee deduction. Short rent take single valuation time from start point to return point, the system automatically changes it into days rent when rent for more than four hours. If bike is lost, it is required to compensation as prime cost.

3.4 Price System

As the Table 3.1 of models and lease price list shows, according to different rental mode and the survey data we have formulated this. Among this, when rent for more than four hours, the price system will automatically change for days rent.

Table 1. Models and lease price list

model rental way	Annual rent	by semester	monthly rent	daily rent	by hour
New bike				2.2Yuan/d ay	0.6Yuan/ hour
Used bike	65Yuan/ year	40Yuan/ semester	12Yuan/ month		

3.5 Interactive System

Interactive system mainly consists of service terminals, website and mobile phones. Service terminals are equipment for users to borrow and return the bike. As the Figure 4

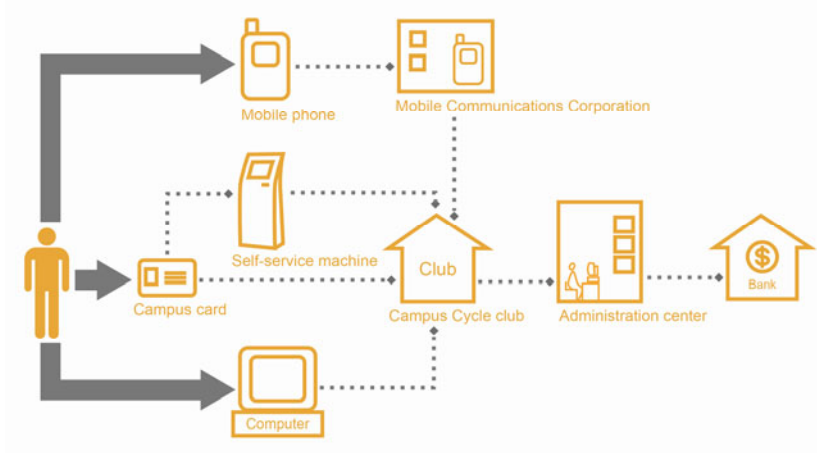


Fig. 4. Interactive ways

“interactive ways” shows, students are able to rent, inquire or pay through the computer, terminating machine and their own mobile phones.

It is divided into central type and lateral type, 16 or above parking pile generally chose the central type. Service terminals should try to use small size and do not exceed 2 m high. They should try to minimize the width and thickness [6].

1. Identity: campus card as lease system identification is the only tools, simultaneously build personal virtual account and individual information service system foundation.
2. Recharge: through club artificially deduct or transfer accounts into personal virtual account through service terminals.
3. Query: the user but inquires the use of records, the information such as the account balance by service terminals system or land the web side by computer or mobile phones.
4. Report the loss: as bicycle lost in use process, user can instantly report the loss in service terminals and mobile phones, terminate fee timing, reduce user loss.
5. Cancellation: when the card is lost or appear other need, user can cancel it at the club or service terminals to terminate the right of rent and protect customer rights.
6. Emotion exchange: it is conducted on the basis of redesign [7] school BBS, use the existing university network, build communication interactive platform, enhance the emotional communication for students, college and enterprise and promote service system development.

3.6 Visual Identity System

In the ‘emotional design’, Donald. Norman professor put forward by instinct, behavior and reflection on three different dimensions, expounds emotional based in the important position of design [8]. So during logo design process it should be more emotionally to consider the audience to approve environmental protection and the



Fig. 5. Visual identification design

pursuit of living on the concept of sustainable development. In the following Figure 5 “visual identification design” shows:

1. Basic elements system: logo through the club names initials "C" clever processing, blend in circulation concept and bicycle abstraction model, properly shows brand recognition of "name call + visual memory order", endowed with mark natural visual, make brand recognition level rich. Green symbolizes environmental protection and sustainable development idea.
2. Application design system: including card, badges, web site, software on the mobile phones and other office supplies recognition series: club volunteers T-shirt etc dress recognition series, old bicycles recognition series, Posters, terminals and website propaganda recognition series.

Visual identity system design implemented "redesign" concept. For redesign college original “One Card through of the School” and One Card through of the School earmark machine and integrate university bicycle club website with university BBS, made full use of the available hardware resources, promote design value in existing resources.

4 Epilogue

Above all, the main body of the service system consists of recycle system, maintain system and rental system. The price system provides financial support to the whole system, and the interactive system is used on both the website and terminating machine from which students can participate in our system. Our vision system is used as service system identification so it will play a vital roll through the whole program. Among the system, the difficulty lies in how to recycle the old bicycles and repair them, because that will be supported by the school, the enterprise and the student. We try to do something for the college bicycle system under the current conditions, it will never be perfect for every factor in the system is changing. In the following Graphic 3.4 relationships show:

Our system connects the school and the student with the enterprise, all of them will benefit. In addition to this, bicycles are managed so the college environment may be tidier. We hope that the service system can be used in other colleges only if we succeed to apply it to the colleges in Wuxi. It is an exploration to the sustainable design and we are trying to do our best.

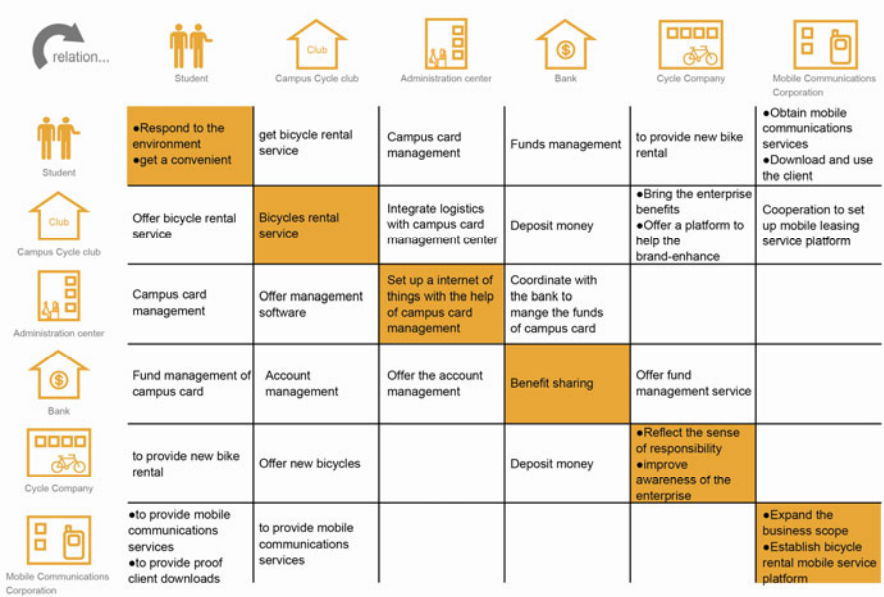


Fig. 6. Relationships

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