Title	Design of Bicycle Simulator to reduce the risks of traffic accidents : Design of Bicycle Simulator to reduce the risks of traffic accidents
Sub Title	
Author	東芝システムテクノロジー株式会社(Toshiba System Technology) 西村, 秀和(Nishimura, Hidekazu)
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Abstract	Our projects theme was aimed to "reduce the risk of bicycle accidents," which was proposed by Toshiba System Technology Corporation. We took two risk reduction measures. First, we specified the function of the Bicycle Simulator (BS). Second, we created a feasible business model of the BS. Even though the BS itself is effective to reduce the number of bicycle accidents, it's meaningless if promotion fail and strategy to enter the market collapse. Taking into various aspects into account, Cycle K's bicycle simulator was narrowed down to the concept "Moving Box." There are 3 reasons to be explained. First, the reason was to avoid the violation of patents to Honda's BS. In the first line of the document which guards the interest of Honda's BS, it is stated "Honda's BS was designed so as to make it similar to actual design and dynamics of bicycles." By creating a whole set of BS system which move by a truck and have user's bicycle installed in it, we came up with a solution to bypass the patent. Second, the purpose was to reduce risks in selling the BS. At first, we ourselves working on this project were suspicious about working towards the designing of the BS. We thought that consumers would also feel the same anxiety. The question "How can we invite people to come to ride our bicycle simulator?" always hanged about. In the beginning, we have discussed about including factors of entertainment so that it would attract many people. However, we had a paradigm shift in our idea, "If the customers won't come, why don't we go for them?" By promoting the BS by a truck, we can promote and find secret sales at the same time while developing products other than the prototype version. Third, we wanted to deliver the consumers an image of a gift box. Our catch copy for the bicycle simulator is "Moving Box, Blooming Happiness." We used a rhyme so it would sound nice. After sales come stable, one can remove the truck part out of the package provided and sell only the part of box. For the moment, we end our project in proposing the concept design and business design of BS. We have left a margin to discuss about the design of BS itself. In the thesis "Bicycle Dynamics and Control" published by the IEEE association, it's stated "Control is important for design. Engineering systems are traditionally designed based on static reasoning, which does not account for stability and controllability." Studying control would give limitations on design options. Hereafter is described the systems engineering approach to our project.
Notes	Student final reports Group 17
Genre	Research Paper
URL	https://koara.lib.keio.ac.jp/xoonips/modules/xoonips/detail.php?koara_id=KO40002003-00002010-0717

Group 17

Group 17's Theme Proposed by Toshiba System Technology

Theme 14:

ALPS "safety and security" theme title:

Design of Bicycle Simulator to reduce the risks of traffic accidents

Proposer Organization's Name: Toshiba System Technology

Supporter Name and contact info: Kensuke KAWAI (kensuke.kawai@tst.toshiba.co.jp)

Abstract of your project theme :

Background : In 2009 more than 156,000 bicycle accidents occurred in Japan.
(155,581 people were injured and 695 people were killed.)
Fig.1 shows the high risk of the bicycle accidents at intersections.

Goal: To propose a new conceptual design of bicycle simulator that could reduce the risks of bicycle accidents.

Issues to be reviewed during the project:

1) To observe the location/site with high traffic risks and record the results.
2) To investigate and analyze the statistics of traffic accidents of bicycles including fatality of senior people (more than 65 years old).
3) Hearings to bicycle associations/manufacturers for safe design of bicycles now available.
4) To model the bicycle dynamics and to specify the process of riding-skill acquisition especially for small kids.
5) To discover and identify the possible risks while driving and to understand how to mitigate them.
6) To propose a basic requirement specification of bicycle simulator.
7) To review a system configuration of the proposed bicycle simulator.
8) To evaluate the feasibility of the proposed bicycle simulator.

Remarks: Fig.2 shows the "Safety Bicycle" in 1885.
(An appropriate project name such as "Safe Rider" are to be decided by the team.)

Fig. 1:

Fig. 2:

ALPS Final Report 2010

Group 17

PROJECT TITLE:
"Design of Bicycle Simulator to reduce the risks of traffic accidents"

Theme:
"Design of Bicycle Simulator to reduce the risks of traffic accidents"

Proposer Organization: Toshiba System Technology

Proposer Organization's Supporter: Kensuke Kawai

Keio Mentor: Hidekazu Nishimura

Members:
IWASAWA, ARIA
WANG, GONGTAI
TAKAMURA, SEIGO
LI, RONGSHUAI
SATO, YOSHINORI

Graduate School of System Design and Management
Keio University

FINAL REPORT

Team 17 （ Alphabetical Order ）

IWASAWA	ARIA	岩澤	ありあ
LI	RONGSHUAI	リ	ロンシャン
SATO	YOSHINORI	佐藤	良徳
TAKAMUR	SEIGO	髙村	清吾
WAN	GONGTAI	王	公太

PREFACE

We did the final report based on the solution that we presented last lesson.

Because this work was a summary like activity more than a creative activity, it was proceeding by way as allocating each part to the members after dividing the report.

The persons in charge in each part are as follows.

01. Executive Summary --------------------------------------	Iwasawa Aria	岩澤　ありあ
02. Table of Contents ---	Wang Gongtai	王　公太
03. Problem Statement---------------------------------------	Iwasawa Aria	岩澤　ありあ
04. Analysis and Discussion of ALPS Methods ---------	Takamura Seigo	髙村　清吾
05. Design Recommendation ------------------------------	Wang Gongtai	王　公太
06. Competitive Analysis ------------------------------------	Sato Yoshinori	佐藤　良徳
07. ALPS Roadmap and Reflections --------------------	Sato Yoshinori	佐藤　良徳
08. Conclusion and Future Work -------------------------	Wang Gongtai	王　公太
09. Acknowledgments ---------------------------------------	Li Rongshuai	リ　ロンシャン
10. References --	Iwasawa Aria	岩澤　ありあ
11. Appendix ---	Takamura Seigo	髙村　清吾
	Iwasawa Aria	岩澤　ありあ

1

EXECUTIVE SUMMARY

Our projects theme was aimed to “reduce the risk of bicycle accidents,” which was proposed by Toshiba System Technology Corporation. We took two risk reduction measures. First, we specified the function of the Bicycle Simulator (BS). Second, we created a feasible business model of the BS. Even though the BS itself is effective to reduce the number of bicycle accidents, it’s meaningless if promotion fail and strategy to enter the market collapse. Taking into various aspects into account, Cycle K’s bicycle simulator was narrowed down to the concept “Moving Box.” There are 3 reasons to be explained.

First, the reason was to avoid the violation of patents to Honda’s BS. In the first line of the document which guards the interest of Honda’s BS, it is stated “Honda’s BS was designed so as to make it similar to actual design and dynamics of bicycles.” By creating a whole set of BS system which move by a truck and have user’s bicycle installed in it, we came up with a solution to bypass the patent.

Second, the purpose was to reduce risks in selling the BS. At first, we ourselves working on this project were suspicious about working towards the designing of the BS. We thought that consumers would also feel the same anxiety. The question “How can we invite people to come to ride our bicycle simulator?” always hanged about. In the beginning, we have discussed about including factors of entertainment so that it would attract many people. However, we had a paradigm shift in our idea, “If the customers won’t come, why don’t we go for them?” By promoting the BS by a truck, we can promote and find secret sales at the same time while developing products other than the prototype version.

Third, we wanted to deliver the consumers an image of a gift box. Our catch copy for the bicycle simulator is “Moving Box, Blooming Happiness.” We used a rhyme so it would sound nice. After sales come stable, one can remove the truck part out of the package provided and sell only the part of box..

For the moment, we end our project in proposing the concept design and business design of BS. We have left a margin to discuss about the design of BS itself. In the thesis “Bicycle Dynamics and Control” published by the IEEE association, it’s stated “Control is important for design. Engineering systems are traditionally designed based on static reasoning, which does not account for stability and controllability.” Studying control would give limitations on design options. Hereafter is described the systems engineering approach to our project.

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CHAPTER 1

PROBLEM STATEMENT

Number of Bicycle Accidents

To address the grave danger of the environment surrounding the bicycles, we start from looking at the statistic of bicycle accidents in Tokyo, Japan. In the year 2009, 156,000 bicycle accidents occurred and among them 695 people were killed. Remind that this data only account for the partial area of Japan. The data is referenced from the Metropolitan Police Department. From the past, countermeasures to bicycle accidents have been taken so the numbers of death caused by bicycle accident are gradually decreasing. However, occupancy of bicycle accidents among overall traffic accidents is increasing (ref. Figure1-1, Metropolitan Police Department). Evidence could be shown from Figure 2 as well. When we compare the number of death caused by bicycle accidents in Japan and Netherlands, which is famous for its bicycle rider population and its advanced road infrastructure for bicycles, we could see that the death rate of Japan is very high. It is difficult to draw any conclusion but the one of the challenges in decreasing the number of bicycle accidents may be due to the increasing number of bicycle users (ref. Figure1-3). Also, the increase in the number of electric assisted bicycles could be taken into account (ref. Figure1-4). Referring some facts from China, which country has the largest population of cyclists, 400,000 electric assisted bicycles are in Shenyang. The number of death by electric assisted bicycles increased by 81% in the year 2007 compared from the year 2006. Lack of road traffic manners by the bicyclists, design of bicycle itself and lack of public sector to check the speed of products should be discussed. Measures have been already taken to ban the traffic of electric assisted bicycles on some roads.

What's Behind Bicycle Accidents

In this section, we indicate several problems which lie within bicycle accidents.

- No license required for riding bicycles
- Unlike cars, bicycles have no protection devices such as seatbelt or airbags
- Bicyclists often not buying insurance for bicycle accidents
- Bicyclists remarkably lacking the recognition of bicycles as light “vehicle” which is determined by traffic law
- High bicycle accident hours: 8am-10am and 4pm-6pm
  (1/3 of accidents are happening at the above time frame)
- Lack of Helmet Wearing Law

(1/3 of bicycle accidents cause head injuries. Among people who died from head injuries, 85% of them would have survived if worn helmets) (ref. Foreign Country Bicycle News No 94, 99)

- Increase of travel distance by bicycles (Increase of 14,850 km in 10 years)

Market Growth of Bicycles

In the year 2005, the number of bicycle possession in Japan reached 86 million. It is reported 1.045 million bicycles are manufactured every year. (ref. Japan Bicycle Promotion Institute) Current bicycle sales ranking is marked from the top in the following order. Bridgestone, Panasonic, Miyata and Maruishi. Company Yamaha is growing its market share by selling electronic assisted bicycles.

Current Solution -Competition with Existing Product and Services

There is statistical data that 25,000 bicycle safety educations were held in 2006 and 2.76 million people attended the lecture in Japan. Budget for traffic safety education is spent 6.729 million yen a year (ref. Japan traffic safety education association) At present, the police department deliver lectures using a method called “Scared Straight Education” to raise awareness of traffic accidents, to acquire adequate judgment when biking and to detect high accident possibility scenarios beforehand.

The market price of relevant product and service is as follows. In the market share of bicycle simulator, only Honda is the major player in Japan.

- Honda Bicycle Simulator: ￥73,2900 (tax included), ￥69,800 (tax excluded)
- Scared Straight education by stunt man: ￥250,000 per lecture

Problem Extracted from Interviews

From the interview with the high school teacher whose school applied scared straight education in their traffic safety education lecture, officer of Kanagawa Police Department and an employee of Kawaski City, we discovered problems regarding road infrastructure, traffic safety education and bicycle simulator.

Road Infrastructure

Traffic accidents are not only due to human errors but also from the defective road infrastructure. To name a few, the set of traffic signals and installation of maintenance hatches. They are managed uniformly by Prefecture’s Public Safety Commission and Ministry of Land, Infrastructure, Transport and Tourism, respectively. These boundaries create the inflexibility to work towards the common goals by separate sectors.

Traffic Safety Education

The traffic safety lecture given out by police departments is lecture-centered so its content turns out to be very passive. Attendees tend to get bored easily. A lecture in combination with bicycle simulator may alleviate boredom (ref. Figure1-5)

Bicycle Simulator

High school students who are teenagers at their adolescence tend to be overconfident lacking risk awareness and traffic morals to even practice to look to the right and left before crossing roads. Scared straight education is effective in the way that it conveys fear and the feeling of responsibility psychologically. The disadvantage it holds is the expensive cost per lecture and actual injuries occurring in the performance to replicate the accident scenes.

Bicycle simulators can be the alternative to scared straight education. It's attractive enough for young students to lean over and hold interest in traffic safety education. However, the sound and display lack reality. Also, the current BS takes 5 to 10 minutes to finish one learning course so the time efficiency is bad for all the students to try out the simulation. For the instructors, the initial set up of BS is a burden.

Project Requirements

Our project was established to propose a new conceptual design of bicycle simulator that could reduce the risks of bicycle accidents. Issues reviewed during the project were as follows.

1) Identifying the location/site with high traffic risks and defining the reasons
2) Investigating and analyzing statistics of traffic accidents
3) Hearings to bicycle associations for safe design of traffic education
4) Modeling the bicycle simulator functions
5) Discovering and identifying possible risks while driving and understanding how to mitigate them
6) Reviewing the proposed basic requirement specification of bicycle simulator
7) Reviewing the system configuration of the proposed bicycle simulator
8) Evaluating the feasibility of the proposed bicycle simulator

Our specific solution to mitigate the risks of bicycle accidents is described from the next chapter.

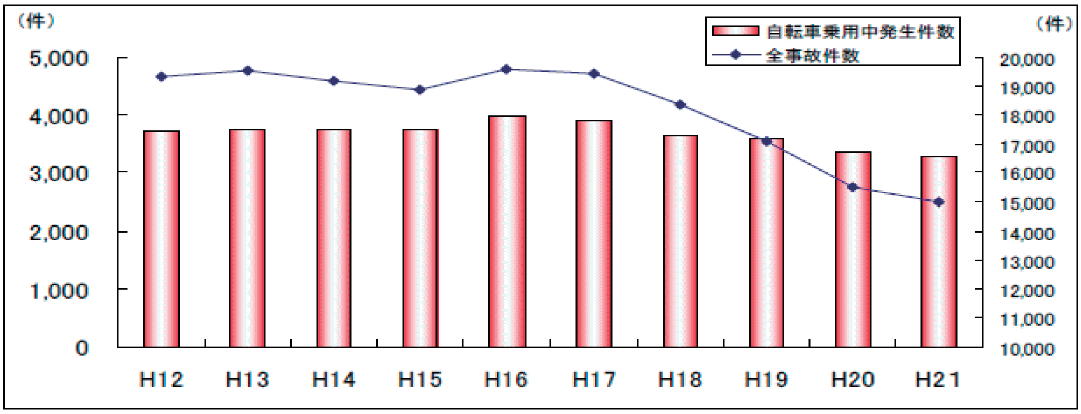

Figure1-1 Bicycle Accidents versus Traffic Accidents

	Number of Death Caused by Bicycle Accident			Total Number of Death in Accidents		Ratio of Bicycle Accident (%)	
	1980	2002	Increase Rate (%)	1980	2002	1980	2002
Japan	1,366	1,305	▼4.5	11,388	9,575	12.0	13.6
USA	965	665	▼31.1	51,091	43,005	1.9	1.6
Germany	1,338	583	▼56.4	15,050	6,842	8.9	8.5
France	709	223	▼68.5	13,672	7,655	5.2	2.9
England	316	133	▼57.9	6,239	3,581	5.1	3.7
Netherland	425	169	▼60.2	1,996	987	21.3	17.1

Figure1-2 Data of Bicycle Accidents
(07.2.9 Ministry of Land, Infrastructure, Transport and Tourism)

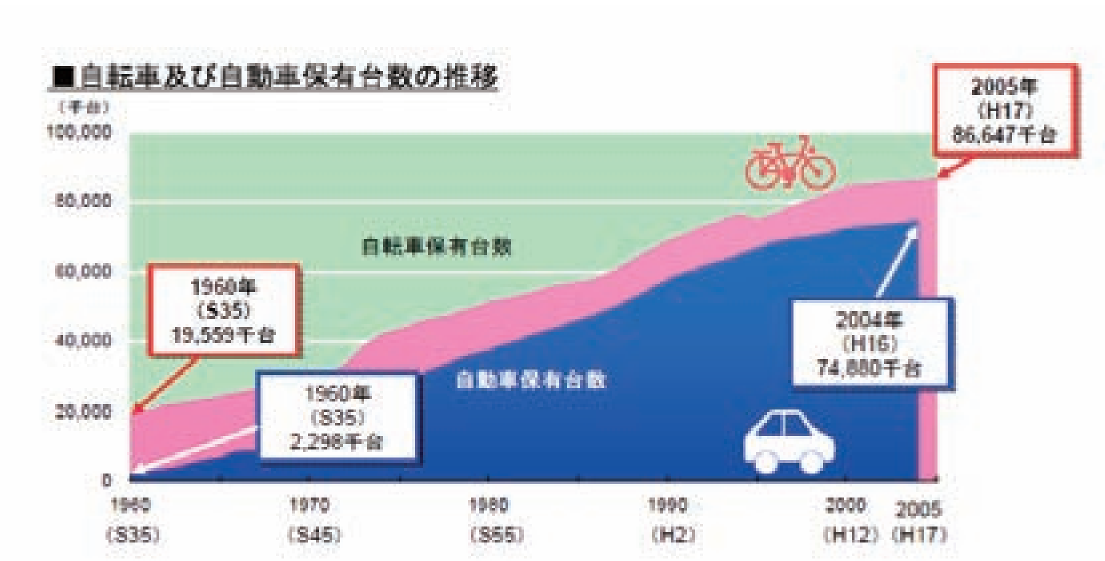

Figure1-3 Increase of Bicycle Possession
(Ministry of Land, Infrastructure, Transport and Tourism)

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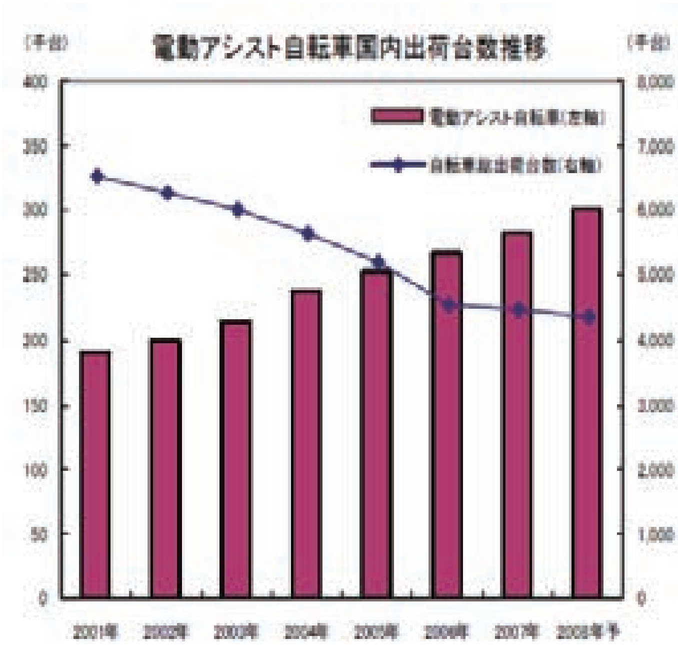

Figure1-4 Transition of Number of Electric Assisted Bicycles

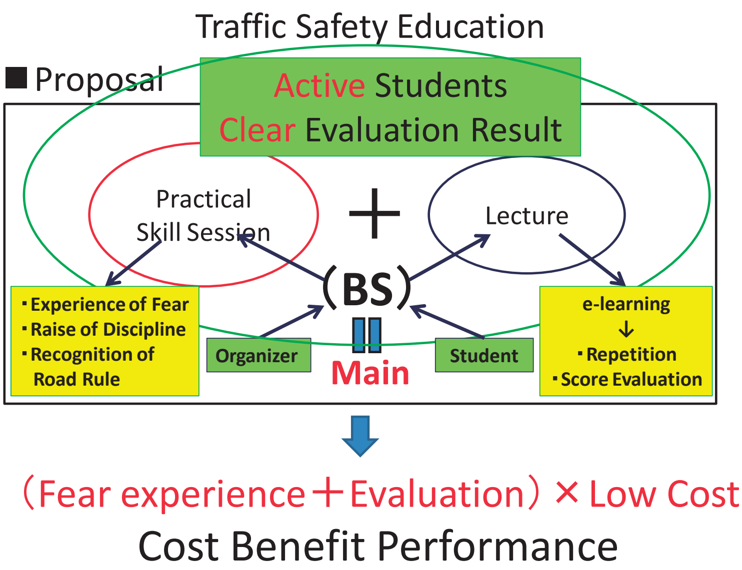

Figure1-5 Concept of our Traffic Safety Education

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CHAPTER 2

ANALYSIS AND DISCUSSION OF ALPS METHODS

Scenario Graph

We narrowed down our ideas to the key scenario from the mind map. On making the Scenario Graph, we made a mistake by mixing factors of “bicycle simulator” and “bicycle rider” on the same chart. For example, when we see the chunks in “where”, we have depicted places where bicycles are used (e.g. Pedestrian road, park, tunnel) and places where bicycle simulators would be installed (e.g. home, amusement park) as well. We should have organized a scenario graph for each. At the moment, we have extracted the scenario “Home use bicycle simulator for children to train the skill of riding a bicycle for the purpose of reducing risk.” Gathering information on bicycle accidents, we will then reselect the key scenario which would most effectively reduce the risk.

We came up with several questions during this activity, “Can we put catch phrases such as [anywhere], [anyone] and [anytime] in the graph?”, “Could we have many main functions?” and “If so, how do we choose the main function and which would we work on first?”

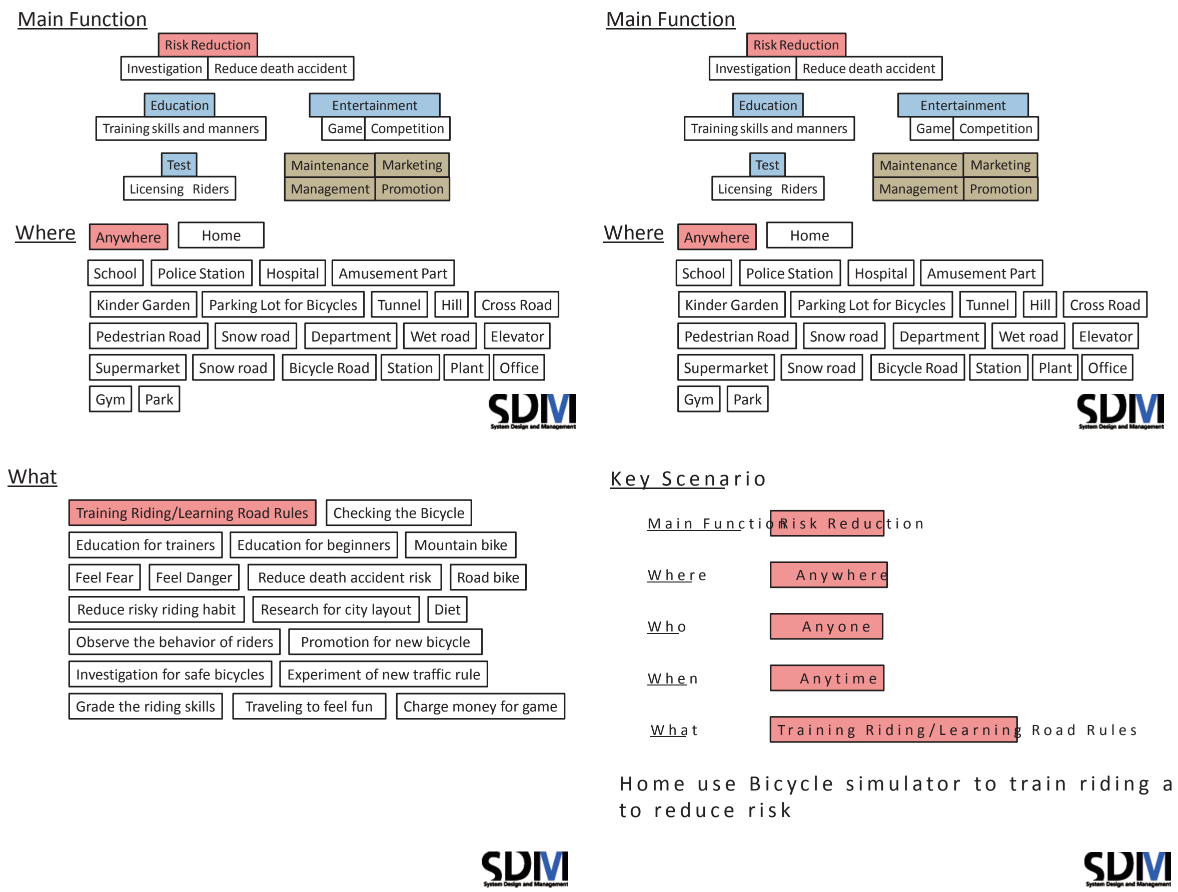


Figure2-1 Scenario Graph and Key Scenario

CVCA

We made the CVCA based on our “key scenario” and “tentative product image.” By using the CVCA tool, we were able to define business opportunities. So that many people could casually use the simulator, our team had come up with a product using i-pad. The key feature of our tentative product is to use bicycle already owned by the rider. It reduces the manufacturing cost of the bicycle simulator thus leading the customers to pay less. We thought this could be realized by creating easy-to-install applications downloaded from i-phone or i-pad. Our concern for the CVCA is “How will the insurance company relate with bicycle simulators?”

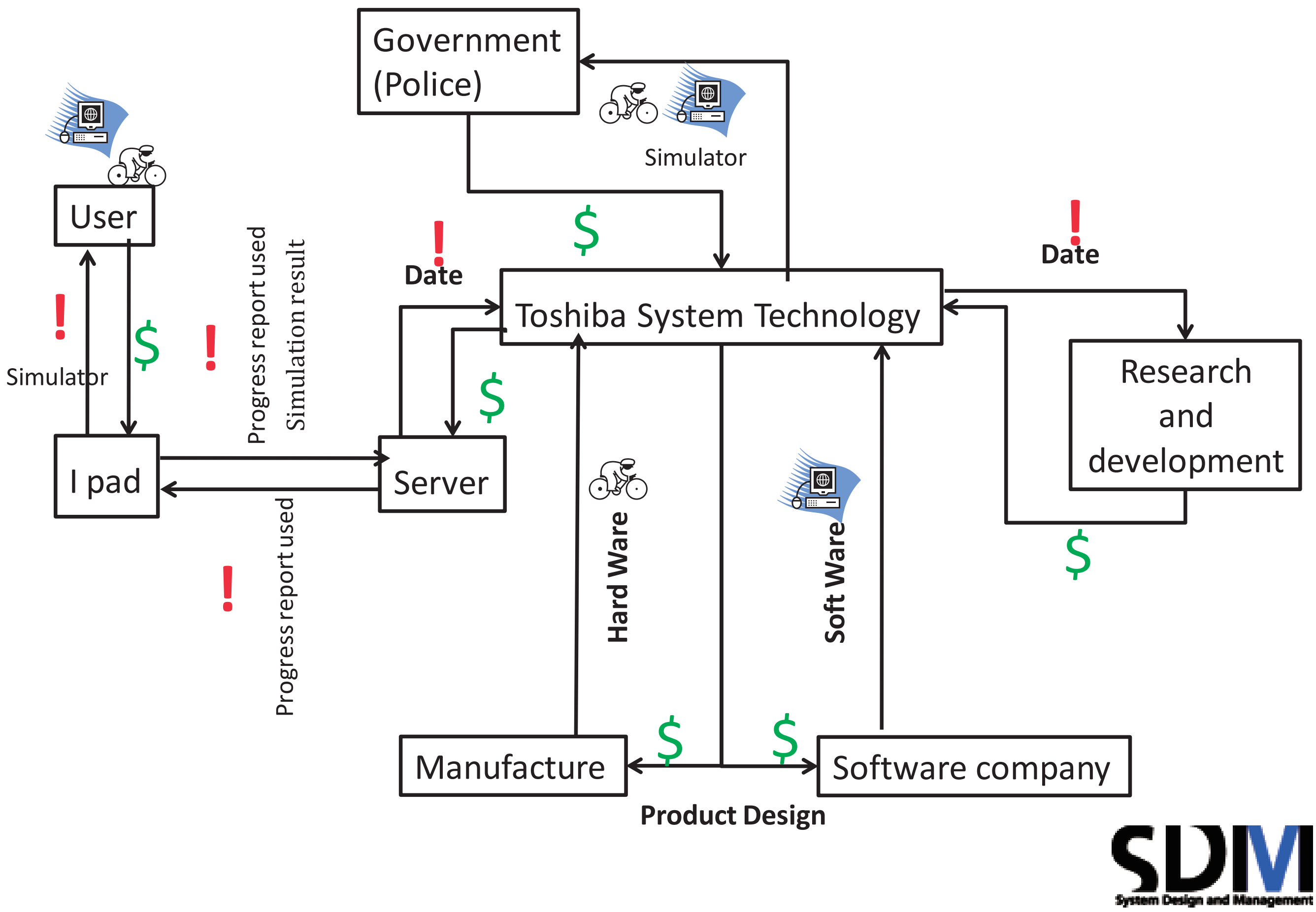


Figure2-2 CVCA Diagram of Bicycle Simulator

OPM Level 0 Diagram

We made the OPM Level 0 Diagram based on our “key scenario” and our “tentative product image”. From the result we were able to depict interrelation between the bicycle simulator system and its surroundings. Since it was the first time for our team members to use this tool, it turned out to be the longest activity we had worked on. What made it difficult for us was the fact that there weren’t any explanations in the handout. For the next step, we would move onto Level 1 of OPM Diagram. However, this OPM Level 0 Diagram was made before defining the core problem so the product system is subject to change.

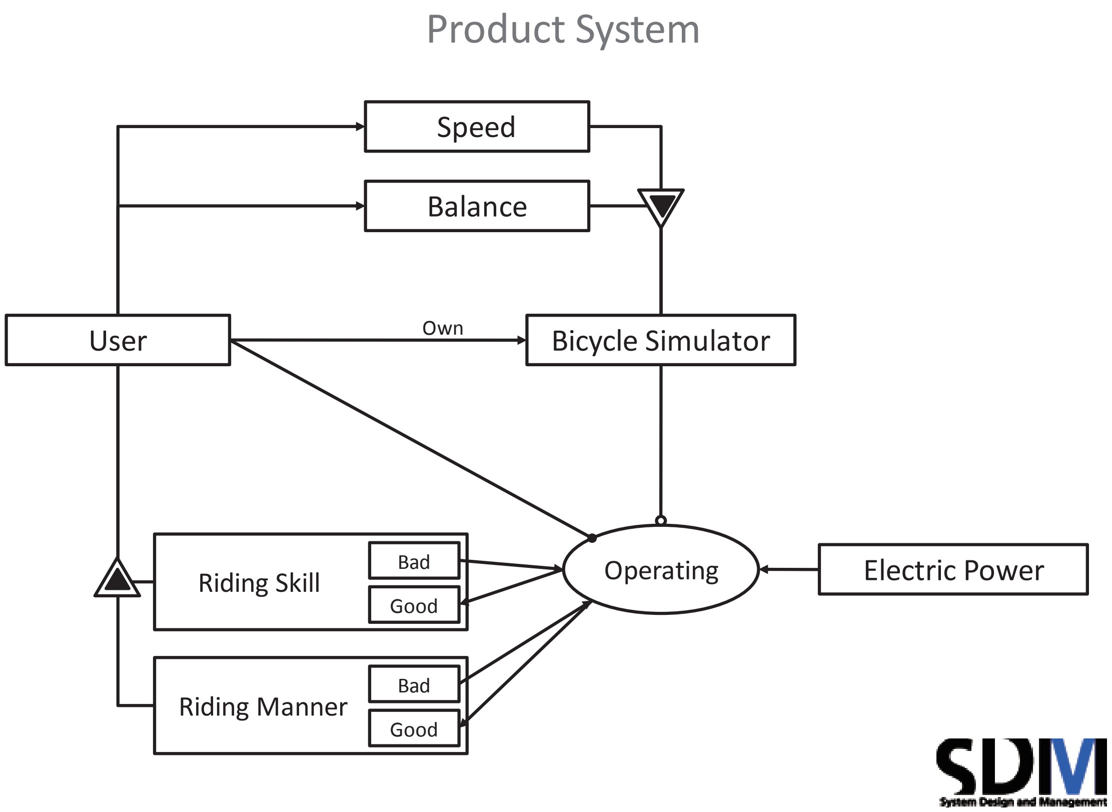


Figure2-3 OPM Level 0 Diagram

Interview

The stakeholder interview which we plan to conduct is progressing at the moment.

We chose 3 stakeholders to interview.

1. Employee of AXA DIRECT Non-life Insurance Company
2. Parents and children in Jingu-Gaien park
3. Prefectural Engineering High School of Kawasaki

The employee of AXA DIRECT Non-life Insurance Company is an acquaintance of our team member Mr. Takamura. We are asking to provide us information of accident data (where, who, when, why the accidents occurred) and of insurance products.

Interviewing and observing people in Jingu-Gaien Park, we expect to gain information on how children obtain their bicycle riding skill when they first learn how to bike.

The reason we chose the third stakeholder is because we found an article with the headline “Experiencing Fear of Accidents – Road Safety Lecture.” The school held a demonstration of bicycle accidents using a stunt man. We have made appointment with the school next Thursday, 2010/6/24.

After all, we were not able to obtain excellent information about No1 and No2 because of other party's all matters affection.

However we were able to obtain excellent information about No3.

In addition we have conducted interview to one of the doctoral student in SDM. He mentioned “No one would go and ride bicycle simulators if it’s not fun.” This word greatly impacted our team motivating us to create an enjoyable bicycle simulator.

More Observation Interview

We conducted interview with 2 organizations, the Prefectural Police Department of Kanagawa and the Prefectural Engineering High School of Kawasaki.

From the interview with the Prefectural Police Department of Kanagawa, we were able to reveal the current status of Traffic Safety Education cooperated by the police. Currently, the program is consisted of 2 parts, the lecture and the skill practice session. The lecture takes up most of the program and is considered the most important factor in traffic safety education. Bicycle simulators are used in skill practice sessions but are subsidiary in the program.

From the school interview, we heard from the school teacher complain about students lacking interest in such traffic safety lectures mentioned above. They claimed that without the essence like bicycle simulator, students would not be attracted their curiosity. To overcome the status quo, the school provided a lecture using a stunt man where actual people performed the scene of a bicycle accident. These kind of education implanting the sense of fear in one's mind is known as the "Scare Trade Education Method." It aims people to be more cautious about their action they take by inputting sense of fear. The teachers told us that this kind of education is very effective to attract students. However, they've mentioned that they weren't able to organize lectures periodically because of the expensive cost (￥250,000 per lecture) it takes. The teachers had a wishful thinking that installing a bicycle simulator could solve the problem of cost.

Although we have gained much information from interviews, on the whole, we learned that questions on "safety" issues are very delicate. Mr. Takamura had arranged all the interviews with the police. He told us that the police officers weren't willing to share information on bicycle accidents to the public besides information shown on the internet. Looking at our team's struggle with interviews, our mentor taught us how to conduct efficient interviews. He introduced us the term "Investigative Negotiation" which is a basic approach to persuading someone in negotiations. He also taught us the concept of "the Danger of last hours", a term meaning that the 80% of important things would be decided in the last 20% of the negotiation time.　We have also learned that when interviewing, we can't relax until the last minute.

To_By_Using

The first draft of our To_By_Using statement is expressed in Figure 10. So far we have examined through the accident data of the Tokyo Metropolitan Police Department (refer Figure 11). The number of bicycle accidents which occurred in 2009 was 156,373 out of 736,668 of the total accidents. 155,581 people were injured and among them 695 people were killed. The main victims were elderly people of more than 65 years old. 54% of the accidents occurred at intersections. By using this tool we tend to make a concrete project goal.

By sharing clear vision with our team members, we are expecting to tighten our teamwork to head forward our final goal. Our next step is to gather data from different associations so as to compare and evaluate the reliability of data. We would then target the main user of the bicycle simulator to decrease the accident rate by maximum. We would then define the exact number to fill in the blanks of the sentence.

Table2-1 Table of To_By_Using

TO	reduce bicycle accidents and the number of people who die from accidents, reducing bicycle accidents --% by the year ----,
BY	training the skill and manner of the rider
USING	Bicycle Simulator

QFD / Cost Worth Analysis

QFD is meant to specify customer's requirements. We defined our "customer," the user of bicycle simulator. For the customer requirements, we picked up 7 statements, which 7 is a magical number to make things simple to explain. They are "reality, easy interface of software, easy initial set up, universal (meaning, the machine could be used in various countries), low initial cost and low running cost." For the engineering metrics, we chose elements which are measurable in numbers.

The result for the QFD Phase 1, the key engineering metrics for the bicycle simulator turned out to be "3D-Capable Video" and "Sound Sensitivity." QFD Phase 2 yielded the result that the solution element which fulfills the engineering metrics would be the "display" and the "headphone." The difficulty in making the QFD was trying to line up the statement in a MECE (Mutually exclusive and Collectively Exhaustive) way.

Using the Cost Worth Analysis, we set our bicycle simulator prime cost to be approximately ￥200,000. This cost would have the advantage over Honda bicycle simulator which costs ￥700,000.

Engineering Metrics

Customer Requirements	Customer Weights	The number of display	Screen size	Brightness	Total number of pixels (pix)	3D-capable video	Sound sensitivity	Play audio frequency	Voice range	Menu of software for language	Sound menu guidance	Mechanical noise when driving	Volume of the machine	Machine weight	Number of pople needed to assemble	Time needed to assemble	Need of tool to assemble	Weight tolerance	Proper machine height	Voltage range of adaptation	Power consumption	Engine oil consumption
Reality	9	3	3	3	3	9	9	3	3			1	9									
· interface for software	3		3	3					3	9	9											
ttribute of the machine	1	1	1										9	9								
Convenient to assemble	3	1													9	9	3					
Universal	1									3								9	9	9		
Low initial cost	9	3	3	3	3	3	3	3	3	1	1	1								1	1	1
Low running cost	3			1					1												9	9
Technical Targets																						

Customer Perception

Customer Requirements	1 Worse	2	3	4	5 Better
Reality			b		A
· interface for software				Abc	
ttribute of the machine		b	A		c
Convenient to assemble		b		A	c
Universal			b	Ac	
Low initial cost			b	A	c
Low running cost		b		Ac	

Technical Benchmarking	The number of display	Screen size	Brightness	Total number of pixels (pix)	3D-capable video	Sound sensitivity	Play audio frequency	Voice range	Menu of software for language	Sound menu guidance	Mechanical noise when driving	Volume of the machine	Machine weight	Number of pople needed to assemble	Time needed to assemble	Need of tool to assemble	Weight tolerance	Proper machine height	Voltage range of adaptation	Power consumption	Engine oil consumption
Better 5	Ab	A	A	A	A	A		Abc	Ac	A	c	c	c	c	c	c	Ab	Ab	A	c	
4		b	b	b			A		b		Ab			A	A					A	
3			c			bc	bc					A	A			A			b	b	Ab
2	c			c						bc											
Worse 1		c			bc							b	b	b	b	b					
Raw score	58	64	66	54	108	108	54	66	39	36	18	90	9	27	27	9	9	9	18	36	36
Relative Weight	6%	7%	7%	6%	11%	11%	6%	7%	4%	4%	2%	10%	1%	3%	3%	1%	1%	1%	2%	4%	4%

Existing System or Competition
A: Cycle K BS
b: H's BS
c: BS software

Figure2-4 QFD Phase 1

Table B: Cost Worth Matrix

Part #	Solution Element	Cost	Relative Worth * ** From QFD Phase II*	Relative Cost	Cost / Worth
1	*display*	$829.00	*41%*	40%	0.98
2	*Bicycle*	$150.00	*17%*	7%	0.41
3	*Balance Sensor*	$160.00	*3%*	8%	2.97
4	*Speed Sensor*	$80.00	*3%*	4%	1.48
5	*GUI of software*	$5.00	*8%*	0%	0.03
6	*3D glasses*	$220.00	*1%*	11%	9.28
7	*Headphone*	$500.00	*26%*	24%	0.94
8	*Transformer*	$130.00	*2%*	6%	3.35
9	**Total Cost**	$2,074.00	100%	100%	

Figure2-5 QFD Phase 2

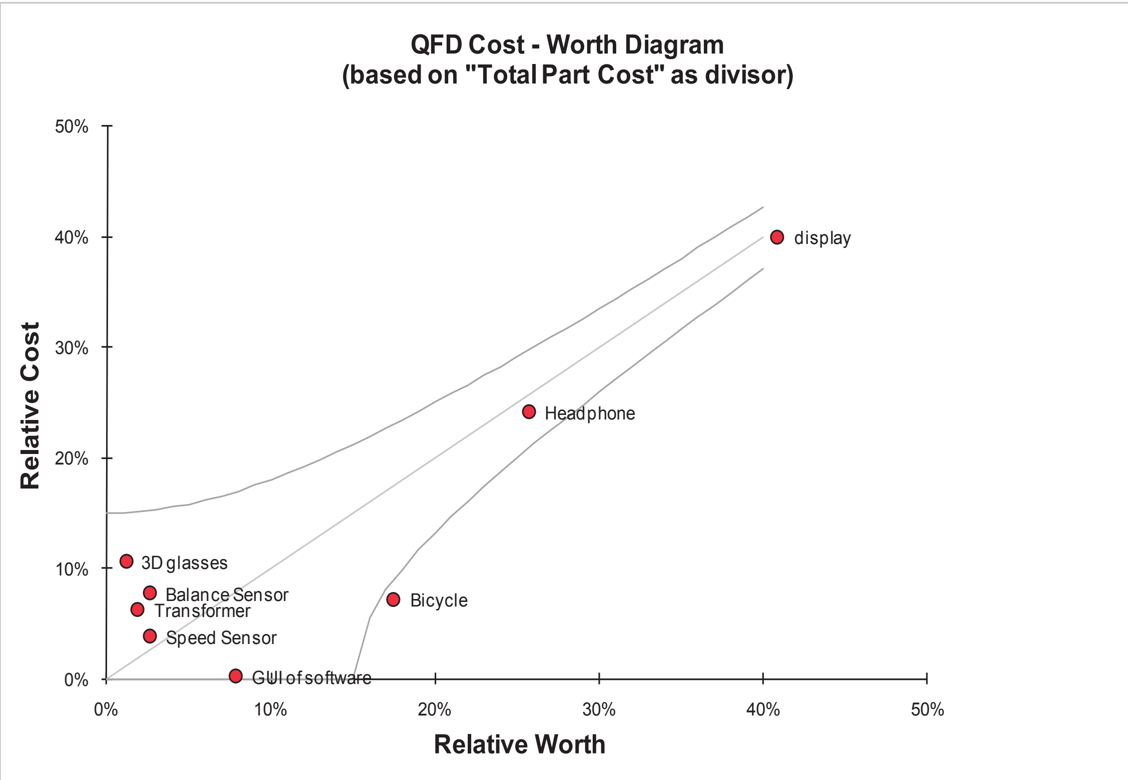


Figure2-6 Cost-Worth Diagram

Use Case / VOC

Our team had come up with the use case “Half Learning – Half Teaching Bicycle Simulator.” This idea emerged from the word “半学半教”, one of the concepts in SDM, which means that each individual have the roll not only to teach but also to learn from others, or the other way around. The person who rides the bicycle simulator not only learns the manner and road rules when riding bicycles but also teaches what they have learned to others after when he or she experience riding the bicycle simulator.

Use Case “Half Learning – Half Teaching Bicycle Simulator” (VOCs are show in blue)

- The teacher brings a bicycle simulator
  - Portable
  - Initial set up capable by one person
  - Initial set up done in 15 minutes
- A student gets on the bicycle simulator
  - Adjustable seat height
- A student press the start button
  - Easy to press-button
  - Clear function by color discrimination
  - Provision of error sound
- A menu for profile (age, occupation, affiliation) input pops out on screen
  - Various language selection
  - Audio Output
  - Abundant choice
- Scene of 3D bicycle simulation displayed on screen
  - View of the landscape around a particular school
  - Reality
- A student finished riding the bicycle simulator
  - Conduct of Feedback Survey
  - Hand out of revision sheet
- The student goes back home and shares his experience with his/her family

Morphological Concept Generation based on Functions

Using Morphological Concept Generation, it made it easier to generate ideas creating an image in our mind. We learned that many solutions exist towards solving a problem. Our team challenges to make a bicycle simulator which provides “reality.” It was interesting when we got the idea of a Vibration Suit when thinking of how to reproduce the body sensory information in an accident. To realize the reality of speed, we have come up with an idea of setting a fan next to the bicycle simulator. Although we generated many solutions, we were able to decide which one should be excluded from our bicycle simulator by comparing the diagram with the result of QFD.

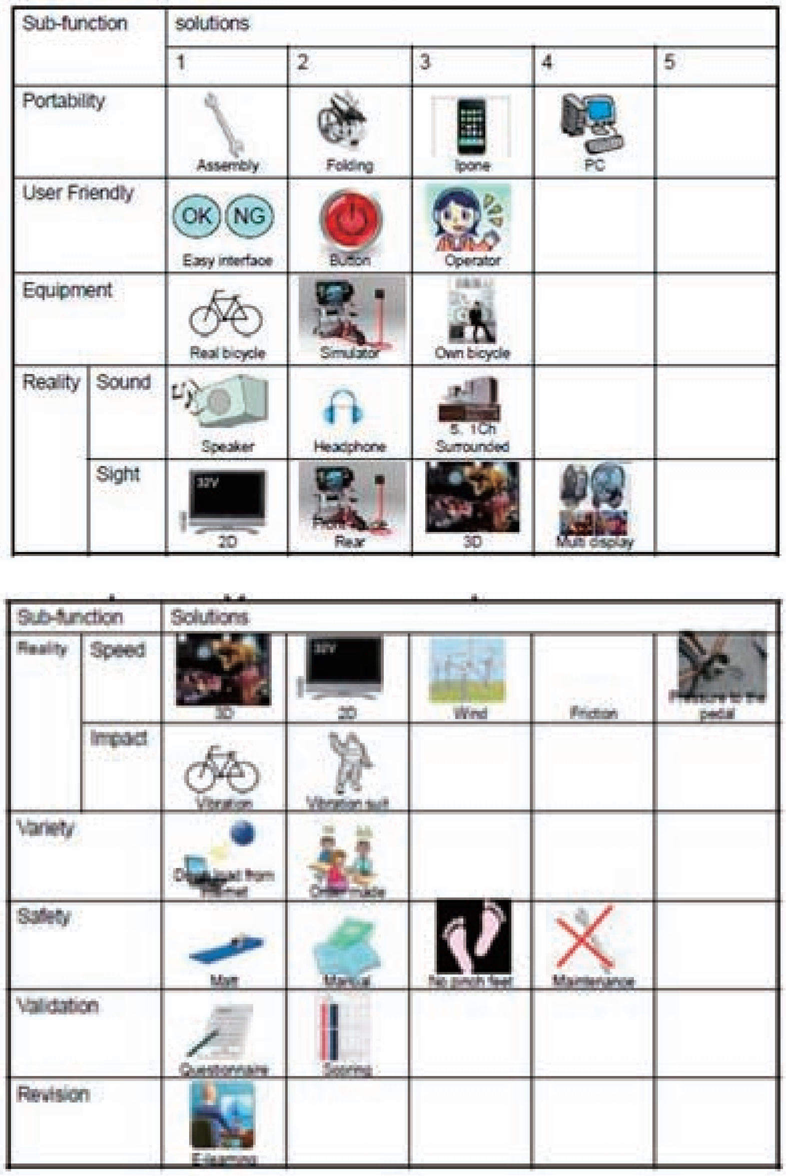


Figure2-7 Morphological Concept Generation on Bicycle Simulator

Project Charter/Milestone Chart

Making the Project Charter and the Milestone Chart, we learned that they could keep track of what must be done and what should be done in the near future. They have the function to provide capability to share the same consensus among team members. We would keep on revising the documents until the end of ALPS.

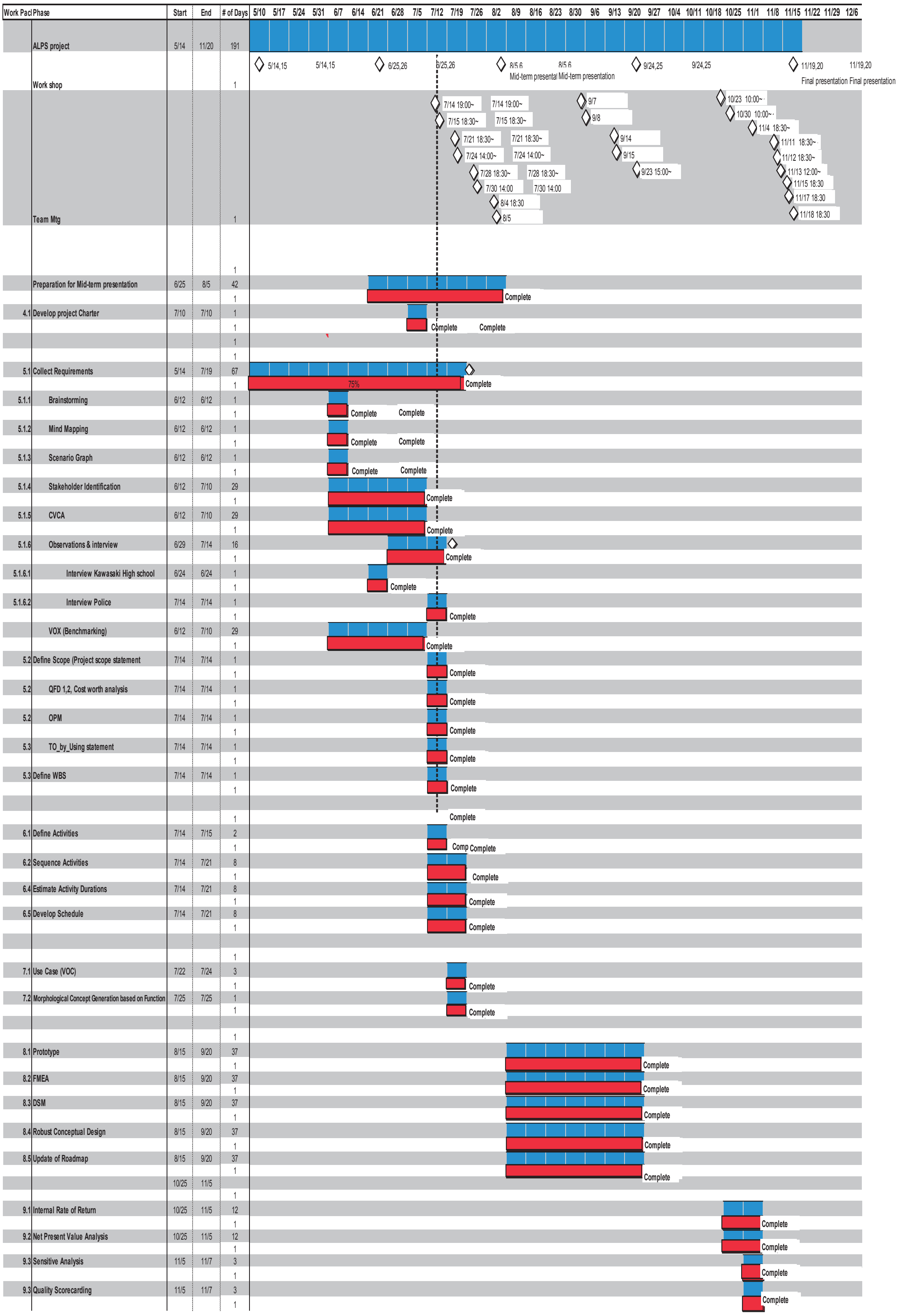


Figure2-8 Morphological Concept Generation on Bicycle Simulator

20

Prototype

Our team had difficulty in prototyping since this time the keyword “tangible” appeared on the assignment. When we consider bicycle simulators, simulation is the critical issue to be discussed thoroughly. However, simulation is categorized into software. We were confused whether testing the software, the content of the bicycle simulator, would be called as a “tangible” prototype because the user would not be able to touch anything but only intellect with the conceptual mind. We thought that the design of bicycle simulator itself, the hardware, would be called as a tangible prototype.

As we researched about bicycle accidents, we soon discovered that injury caused by bicycle accidents is partly due to the fact of bicycle riders not wearing helmets. Our initial requirement from the proposal was to decrease the number of bicycle accidents. It may not meet the requirement but we realized that decreasing the injury level in bicycle accidents may also be possible by promoting people to wear helmets.

For one of the scenarios to be shown to the audience, we generated an idea of a bicycle simulator that controls the power ON and OFF of the monitor by the removal of helmets. This way, it may raise the awareness of bicycle riders to put on helmets while they bike.

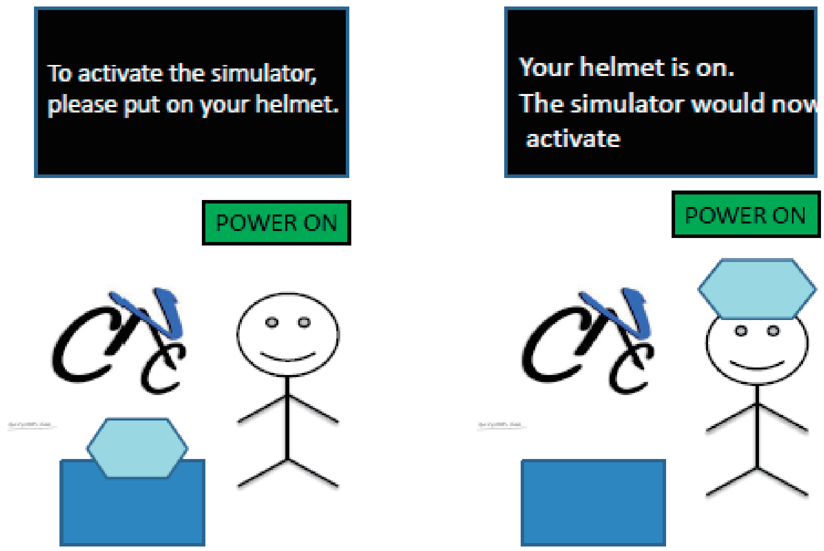


Figure2-8 Image of a part of function of bicycle simulator

Prototype has the purpose to share the same thoughts among team members as well as generating ideas. Since prototype is fairly destined to result in failure, we assume that prototyping “rapidly” is the most effective way to save energy and time for project members. Repeating the process of reflecting feedback to the prototype as many times possible may be the solution to modify the project to stay or shift to the right track.

Figure2-9 Image of prototype

FMEA

We revisited the Use Case to come up with potential failure modes. Although we have detected potential mechanical errors which may occur, we learned by calculating the Risk Priority Number, the content of simulator would have fatal effect on the user if the content is wrong or perhaps misperceived by the user. For example, if a wrong road rule is taught in the simulator, it may harm the user to come across with accidents on actual roads riding a bicycle.

Function or Requirement	Potential Failure Modes	Potential Causes of Failure	Occurrence	Local Effects	End Effects on Product, User, Other Systems	Severity	Detection Method/ Current Controls	Detection	RPN	Actions Recommended to Reduce RPN	Responsibility and Target Completion Date
Transfer	Heavy to Carry	Material of BS	5	Strained Back/finger pinched	Hernia/No Grip	10	weighing	1	50	making it compact/choosing the right material	manufacturer/ designer
	Width of BS too big to enter in the room	Mistake in architectre of BS	4	wreck of wall	impossible to enter the room	8	measuring	2	64	making it compact/decomposable parts	manufacturer/ designer
	Injury caused by sharp edge	Defect in manufacturing process	4	skin cut	bleed	10	rounding of edge	3	120	correct manufacturing line	manufacturer
Mounting on BS	Impossible adjustment of chair	Falled off screw	1	damage to BS by forcefully trying to move the BS	give up using the BS	7	test before releasing product	2	14	have someone with strength hadle the BS	manufacturer
	Falling off the seat after seating	Unbalanced seat	2	injury of user	bruise	6	undetectable	2	24	spreading mattress on the floor	user
Pressing the button	Break of button	Pulling of the button	2	damage of BS	payment of reparing cost	3	undetectable	2	12	repairement	manufacturer/ user
	Electric shock	Tangled wire	1	shock to user	decrease of reliability	10	undetectable	10	100	wipe off water beforehand using the BS	manufacturer/ user
	Button too stong to push	Something stuck in	2	impossible to start up	no use of BS	3	test before releasing product	2	12	checking the spring	manufacturer/
	Pushed button not coming back	Strength pushing the button	2	decrease of user satisfaction	payment of reparing cost	3	undetectable	2	12	repairement	manufacturer/ user
Interface with screen	Input mistake	Error in touching the screen	8	unmeaningful screen movement	decrease of user satisfaction	1	check of screen	9	72	warning signal	user
	Freeze of screen	Software error	6	impossible to move on	no use of BS	5	test	7	210	re-booting	software
	Sudden power down	No battery	3	impossible to move on	decrease of user satisfaction	5	undetectable	7	105	dual power	machine
		Unpluging of wire	3	imposiible to move on	decrease of user satisfaction	5	undetectable	7	105	dual power	machine
Operation (riding the BS)	Lack of equipment (such as 3D glass)	Shortage in packaging	3	impossible to see the screen clearly	tiredness in eye	7	list checking	5	105	checking the package before sending to customer	manufacturer
	Sudden power down	No battery	3	impossible to move on	decrease of user satisfaction	5	undetectable	7	105	dual power	machine
		Unpluging of wire	3	imposiible to move on	decrease of user	5	undetectable	7	105	dual power	machine
	Foot stuck between the pedal	Misuse of BS by the user	6	injury of user	bruise	10	undetectable	6	360	locking feet on the pedal by belt	user/designer
	Break of chain	Rusted chain	2	impossible to operate	no use of BS	7	test	2	28	material test	manufacturer
	No effect of brake system	Signal error	2	impossible to operate	ask for repairment	8	test	6	96	regular check	machine
	Light not illuminating	Unconnected Wire	2	decrease in effectiveness	switching the light bulb	8	test	6	96	regular check	manufacturer
Content of Software	Wrong Traffic Rule	Lack of research	4	misconception	accident	10	referrencing latest information	10	400	mutiple-check by professionals	software maker
	Wrong Language	Lack of study	2	misconception	decrease of user satisfaction	8	checking with language checking sofware on the net	1	16	multiple-check by native speakers	software maker

Figure2-10 Failure Mode and Effect Analysis

DSM

We chose task-based DSM for it to better fit the project. Before we've made the DSM on the excel sheet, we listed the tasks and organized them to the project graph as follows.

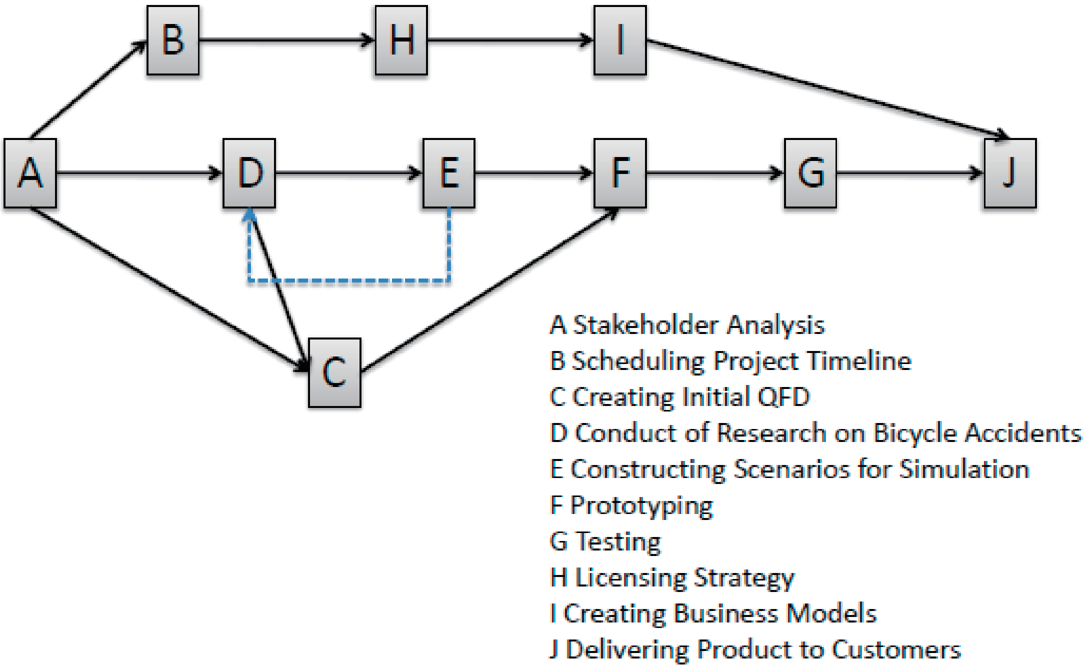


Figure2-11 Design Structure Matrix

Through creating the DSM, we found out that "Conduct of research on bicycle accidents," "Creating initial QFD" and "Constructing scenarios for simulation" must be done in parallel because they are interdependent on one another. Also, we found out that other themes could be discussed in sequence.

Bicycle simulator needs tremendous researches to actually reduce the accidents by simulating real bicycle accidents. To simulate effectively we have to choose which function to spend more money on than others by using QFD. We understood that our bicycle simulator project always has to start from robust researches. Before using DSM, our discussion went back and forth because we have not done enough researches on bicycle accidents itself. We will research more on bicycle accidents to develop a good simulator.

Robust Conceptual Design

- Manufacturing/Performance Variation

  Production Variation, Environmental Variation

  An epoch-making change in the product is Moving Box that can receive the bicycle classroom always freely.

- Conceptual Robust Design

  Biggest opportunities are up front

  We designed the following compositions of Moving Box.

□ The sight is made three-dimensional by 3D image.

□ Aural puts out power by building the speaker into high sound quality.

□ The vibration and the wind are produced and the jolt of an accident and natural environment are caused.

- Poka Yoke/Error Proofing

  Customer & External Interaction

  The bicycle simulator will offer the model of a bicycle accident decrease and a new traffic safety classroom.

- Variety/Platform Architecture

  Customer Needs, Technology Changes

  Customers' needs are to experience the cyclist accident realistically in the traffic safety classroom.

  We think that I newly develop an advanced bicycle simulator that can realistically reproduce the cyclist accident.

- Business Model

  Competition, Development Challenges

  The maker will be able to establish a new business model who can have abundant, excellent data, manages data, and supplies it by using Ipad.

Update of Roadmap

Refer to CHAPTER5 ALPS ROADMAP AND REFLECTIONS

Internal Rate of Return(IRR) & Net Present Value (NPV)

Estimate（“y” represents years from on sale.）

Cost

- **Fixed Cost = ￥1,561,480,000・y + ￥2,863,290,000**
  - Management team with one director, two section chief, five old-timer engineers

    = (salary of one director per year +

    salary of one section chief per year +

    salary of five old-timer engineers per year) × years

    = (10000000 × 1 + 8000000 × 2 + 6000000 × 5) × (y + 1)

    = 56000000・y+56000000
  - Engineer from headquarters for development

    = salary of one person per month × months × years × person

    = 6000000 × 12 ×(y + 1) × 10

    =720000000・y + 720000000
  - Engineer from headquarters for software upgrade

    = salary of one person per month × person

    = 6000000 × 12 × y × 10

    =720000000・y
  - Accounting & Finance Div.

    = salary of one person per month × months × years × person

    = 3000000 × 12 × (y + 1) × 5

    = 180000000・y + 180000000
  - Planning Div.

    = salary of one person per month × months × years × person

    = 4000000 × 12 × (y + 0.5) × 5

    = 240000000・y+120000000
  - Public Relations Div.

    = salary of one person per month × months × years × person

    = 3000000 × 12 × (y + 0.5) × 5

    = 180000000・y + 90000000
  - Databank Company = 25000000

- Material of prototype = 1000000 + 8291000 =9291000
- Research Company = 25000000
- Subcontractor(Software)

  = salary of one person per month × months × years × person

  = 130000 × 12 × 1 × 50

  = 78000000
- Subcontractor(CM) = 500000000
- IT Infrastructure

  = price of super computer + price of database

  = 400000000 + 60000000

  = 1000000000
- Legal Div.

  = salary of one person per month × months × years × person

  = 10000000 × 12 × (y + 0.5) × 1

  = 120000000・y + 60000000
- Logistics Div.

  = salary of one person per month × months × years × person

  = 180000 × 12 × y × 3

  = 6480000・y
- Repairman

  = salary of one person per month × months × years × person

  = 180000 × 12 × y × 10

  = 10800000・y
- Stuff of call center =

  = salary of one person per month × months × years × person

  = 220000 × 12 × y × 5

  = 13200000・y
- Subcontractor(Logistics) = 25000000・y
- Communication = 10000000・y

- **Variable Cost = ￥8,291,000**
  - Subcontractor(Maker)

    = (3D projector × 4) +

(Full HD Screen × 4) +

Butter zoon +

Vibration Machine +

Car(Nissan Civilian) +

Computer +

Speaker

= 2880000 + 108000 + 123000 + 300000 + 4570000 + 160000 + 80000

= 8221000

- spare part from Subcontractor (Maker)

  = cost of per time × probability

  = 700000 × 1%

  = 70000

Revenue

- **Price**
  - Pricing Strategy

    For being able to get Accumulated Sales Amount twice as Accumulated Cost before the market saturation, we do such pricing following.
  - Numerical result

    Price = ￥50000000
  - Sales Volume (market size, market share, market growth)
    - Market size: 1,000
      - 1000 is calculated based on the number of cities which will become our potential customer.
      - Some of the cities are expected that have a possibility of buying two or more.
    - Market share: 100% (in the first 20 years)
      - Our product is a simulator with a very high reality that has never been achieved. And we will apply for a patent for this product.
      - It is called "Bicycle Simulator" but not in the existed "Bicycle Simulator" market. The market it will entry is a completely new mark “Super Reality Bicycle Simulator ".
      - Therefore, in this new niche market, under patent protection, our product can possess 100% of the market share.
    - Market growth: 17.5%

It is a forecast that refers to the market growth rate of the super computer.

Calculate (and Visualize the results)

- Internal Rate of Return (IRR)

  Please refer to Table2-2

- Net Present Value (NPV)

  Please refer to Table2-2

- Payback Period

  We will get profit from the fifth year.

Table2-2 Calculate of NPV and IRR

Project Year	Free Cash Flow	Initial Investment	Discount Rate	IRR	NPV	t	1+r	(1+r)^2	FCFt	FCFt/((1+r)^2)
2011	-1361770000	2863290000	10%	43%	￥13,203,933,265.64	8	110%	2.14358881	-635275755.1	16067223266
2012	-2022330000								-943431870.2	
2013	-2159630000								-1007483334	
2014	-1469790000								-685667882.4	
2015	527490000								246077978	
2016	4591350000								2141898660	
2017	11921600000								5561514384	
2018	24414600000								11389591085	

Sensitive Analysis

1. At what price would you consider the product/service is too expensive to buy?
   Answer: 200,000,000-

2. At what price would you start to consider the product/service is expensive?
   Answer: 100,000,000-

3. At what price would you start to consider the product/service is cheap?
   Answer: 40,000,000-

4. At what price would you consider the product/service is too cheap to buy?
   Answer: 15,000,000-

The fire engine of 15m class of the fire engine costs 50 million yen. The fire engine of 40m class of the fire engine costs 180 million yen. A chemical car for the airport is 280 million yen. The fire engine of a chemical car for the airport is 280 million yen.

And a general price of earthquake simulation vehicle is about 100 million yen. A general price of a high-level recreational vehicle is 16.5 million yen.

Moreover the price of the pedestrian and the crowd simulation software in Japan is 14 million 175 thousand yen.

CHAPTER 3
DESIGN RECOMMENDATION

Features of Bicycle Simulator System

There are three features as following can be used to illustrate this new bicycle simulator.

- Super Reality

  "Super Reality" means this bicycle simulator will provide 360-degree high-definition 3D video, multi-directional high-fidelity stereo audio. And Users can not only through visual sense, auditory sense to get feedback, but also through tactile sensation to feel the bumpy roads or impact of traffic accident.

  With this feature, the effect of training will be significantly better than other simulators looks like a game machine from game center, and the risk of feeling fear of traffic accident will be zero.

- Movable

  "Movable" means this bicycle simulator can be transported by trucks. The bicycle simulator is assembled in to a container and can be installed onto a truck.

  With this feature, instead of make people to come to use the bicycle simulator, we make bicycle simulator to go to people. Therefore, we can reduce the users' time cost such as spending a long time waiting in a boring traffic jam and money cost such as gasoline fee, and can increase the chance of people know the bicycle simulator to gain more users.

- High degree of customizing freedom

  "High degree of customizing freedom" means users can select and combine environment elements or traffic route by themselves to make an original course. And the original course can be shared between users.

  For the Corporate intelligence theory proved that group of amateur may perform better than experts, we will also encourage users to download a common raw course and to modify it, and the history of modification will be saved. For such collaboration, the raw course will get better and better, and finally it will be perfect. The perfect course will be fixed in the simulation system for ever.

  With this feature, we can maximize the collective wisdom to overcome the problem that our engineer cannot enumerate the whole circumstances of the bicycle related traffic accident. But, the most important thing is that users' motivation of taking training will be improved, because they are not being trained by others but by themselves.

- Training progress can be memorized

"Training progress can be memorized" means the simulator will send different users' training progress to the database server in the IT center of the simulator company after the simulation, and receive the data of progress next time for users can proceed from where last time stopped.

The training course of existing bicycle simulator is short and users have to train from start each time. Therefore, after using several times they may know the whole content of courses and feel boring. With this feature, users will not get boring, and have motivation to finish the training left.

Designs of bicycle simulator system

- Function Design
  Refer to Figure3-1 Function Design of Bicycle Simulator System, Page 41.

- Function flow
  Refer to Figure3-2 Function Flow, Page 42.

- Physical Design
  Refer to Figure3-3 Physical Design of Bicycle Simulator System, Page 43.

Features of Business Model

- Stakeholders

  - Buyers
    - Government
    - Bicycle driving skills training institution

  - Users
    - Normal people
      The people take the training using this bicycle simulator as a compulsory education which is a part of people's public welfares.
    - People who met an accident
      The people take the training using this bicycle simulator as a part of the psychology treatment after a bicycle traffic accident.
    - People who causes accident
      The people who caused a bicycle related traffic accident have to take the training for restudying the traffic rule and law. And this bicycle simulator will be used not only teach them, but also test them.
    - Maniac of such a simulation
      The people who are interested in simulation technology and have service spirit to make it perfect.

We will also regularly release new plug-in packages for the bicycle simulator system. Users need to download license for using them and they may collect them for fine.

- Financing

Refer to Figure3-4 Costs of Bicycle Simulator Business, Page44.

In this figure, the items in the tail end of each narrow composed the items in the forepart.

The cost of development will cost 8,000,000,000 yen. We need to get it from head office.

The first year of production start-up capital needs 2 billion. We need to get such a big money from both head office and venture capital.

The fixed cost from the second year will be 1,561,480,000 yen per year, and the variable cost will be 8,291,000 each bicycle simulator. This money is calculated based on situation of building a new company from zero, so it is a reasonable figure.

The price of each bicycle simulator will be 50,000,000 yen. It sounds like huge money. But we calculate it based on existing product released by Sony. The price of Sony 3D Truck is 4,000,000,000 yen. Our price is only 12.5% of it. And our main buyer is government who value performance more than the price. Therefore, this is a reasonable price. And with this price, we can recover the cost within five years.

Table3-1 Chang of Accumulated Profit of Bicycle Simulator Business

Time (Year)	"Accumulated Sales Value" Runs: Current	Accumulated Sa	"Accumulated Sales Amount" Runs: Current	Accumulated Sa	"Accumulated Cost" Runs: Current	Accumulated C	"Accumulated Profit" Runs: Current	Accumulated Profit
1		36		1.8e+009		3.16177e+009		-1.36177e+009
2		57.6		2.88e+009		4.90233e+009		-2.02233e+009
3		92.16		4.59072e+009		6.75035e+009		-2.15963e+009
4		147.456		7.3005e+009		8.77029e+009		-1.46979e+009
5		235.93		1.15928e+010		1.10653e+010		5.2749e+008
6		377.487		1.83918e+010		1.38004e+010		4.59135e+009
7		603.98		2.91614e+010		1.72398e+010		1.19216e+010
8		966.368		4.62204e+010		2.18058e+010		2.44146e+010
9		966.368		7.3242e+010		2.33673e+010		4.98747e+010
10		966.368		9.99933e+010		2.49288e+010		7.50645e+010
11		966.368		1.26477e+011		2.64902e+010		9.99869e+010
12		966.368		1.52696e+011		2.80517e+010		1.24644e+011
13		966.368		1.78653e+011		2.96132e+010		1.4904e+011
14		966.368		2.0435e+011		3.11747e+010		1.73175e+011
15		966.368		2.2979e+011		3.27362e+010		1.97054e+011

- Development

We will organize the development team with one director, two section chief and five old-timer engineers from head office. And they will be the management team after the production.

- Production

We will organize our production as outsourcing and offshore business model to reduce cost.

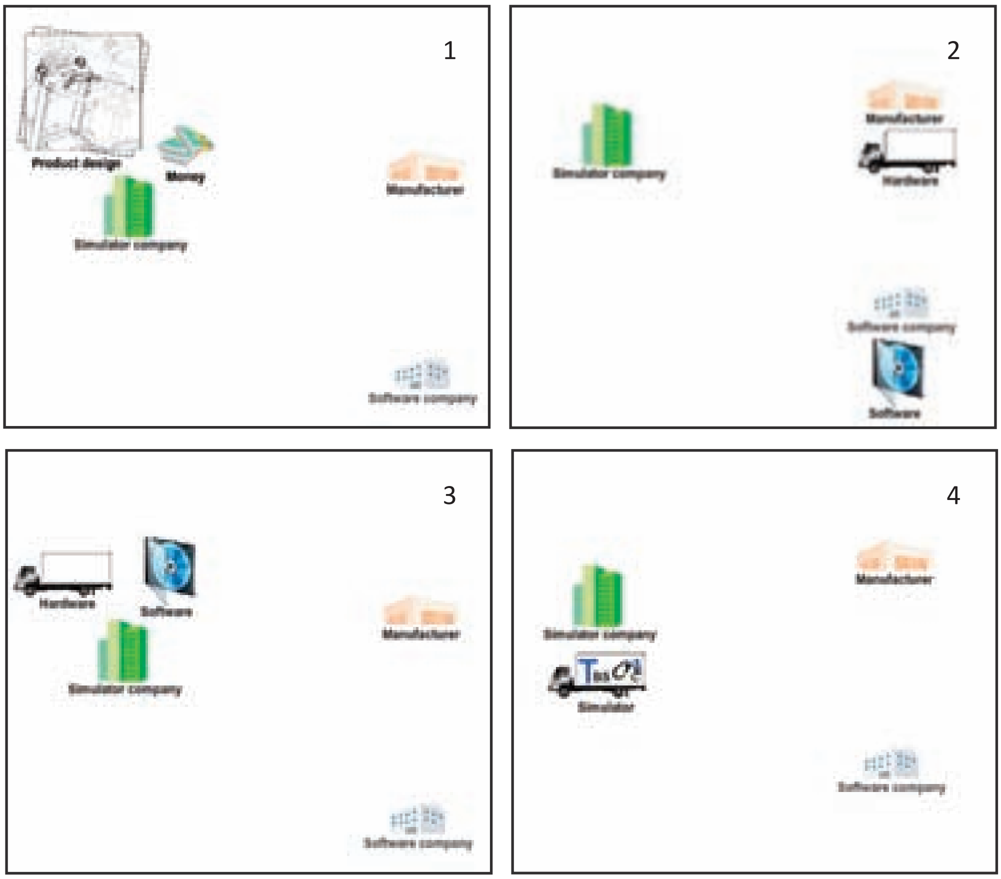
Our company provides the product design and money to start the business.

Our product mainly consists of two parts, software and hardware.

For production of software we will build a project team with 10 good engineers from our company to manage the software production. They have to do Requirements analysis, Functional specification, manage the offshore software company and test the delivered software.

We will contract with manufacture to product hardware part for order. It will reduce the risk of holding stock.

We will assemble the software and the hardware into simulators and print our logo on them.

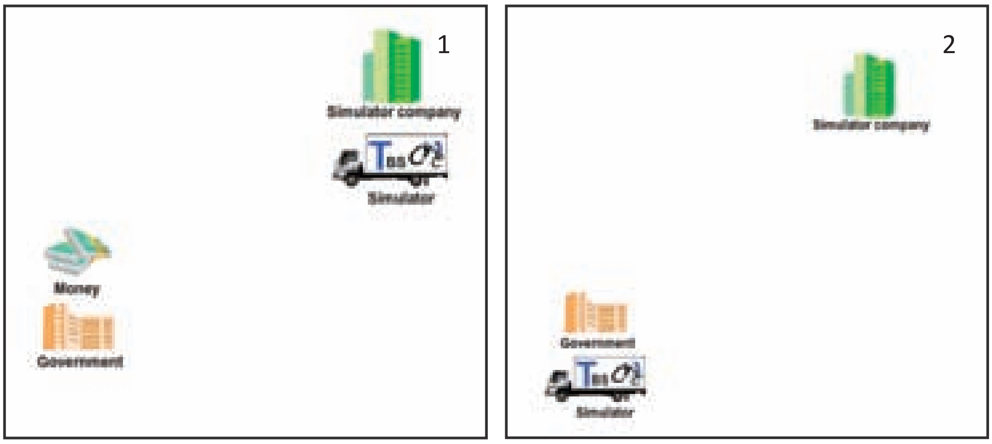


- Marketing

Because of the buyer is government and the user is people, we will execute two kinds of marketing strategies.

First, we will broadcast commercial message during half a year. The target of our commercial message is users. We use the commercial message to rouse people's safety minds and create demands of using the bicycle simulator. It the demands of using the bicycle simulator is big, it will be an incentive for government to buy this bicycle simulator.

Second, we will use statistics of bicycle related traffic accident to lobby the government, to make the government realize the importance of bicycle safety education.



- Using

Users need to download license by iPad from software server in the simulator IT center, for using the simulator. The iPad which installed license will be used as a remote controller of the bicycle simulator.

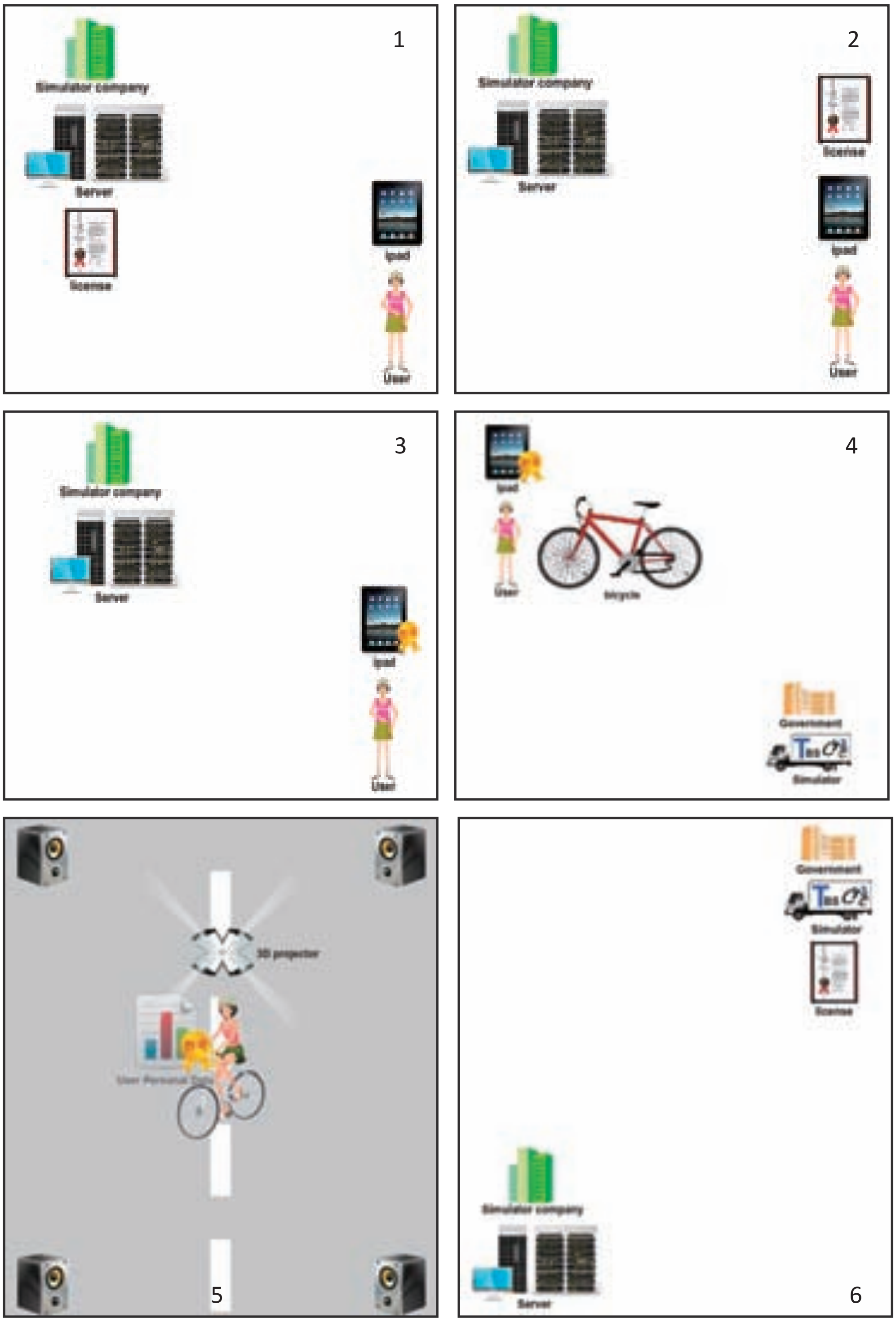
After get the license, users take iPad and their personal bicycle to the bicycle simulator. They have to install their personal bicycle onto the bicycle simulator, and then use the iPad to start-up the system. The license will be send to the bicycle simulator and transmit to the software server in the IT center of our company.

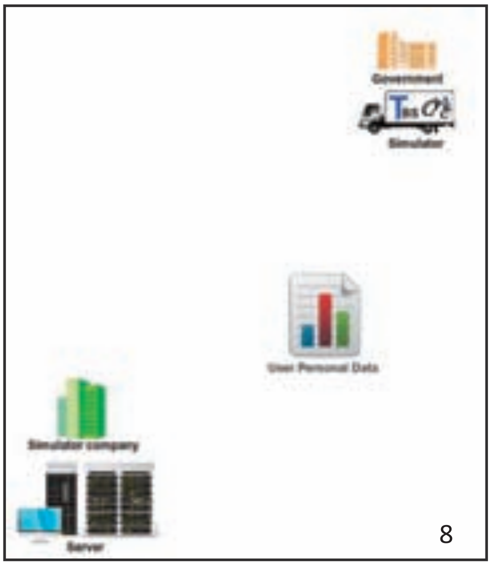
Software server gets the license and verifies the validity of license. If the file is valid, the software server will retrieves corresponding version information of available software and progress information of users by license and send the data back to the bicycle simulator.

Bicycle simulator gets the version information of software and progress information of users, and start-up the simulation system that corresponds to the license. The simulation will begin from will where users stopped last time.

During the simulation, the bicycle simulator will provides 360-degree high-definition 3D video by four 3D projectors, and provides multi-directional high-fidelity stereo audio. And Users can not only through visual sense, auditory sense to get feedback, but also through tactile sensation to feel the bumpy roads or impact of traffic accident. If users encounter traffic, they will follow from their bicycle onto the buffer made by airbags.

At the end of simulation, the bicycle simulator will send the progress information of users to the software server in the IT center of our company. And it will be stored for using next time.



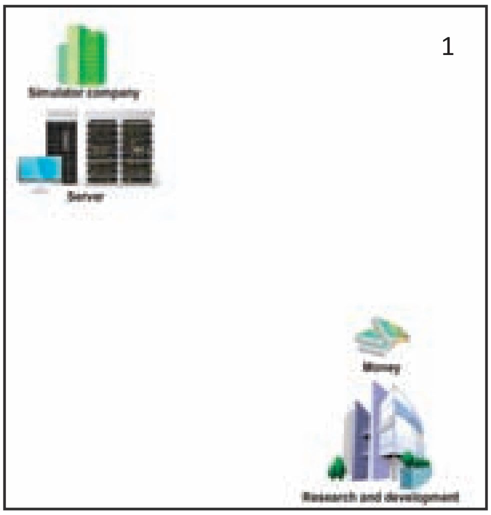


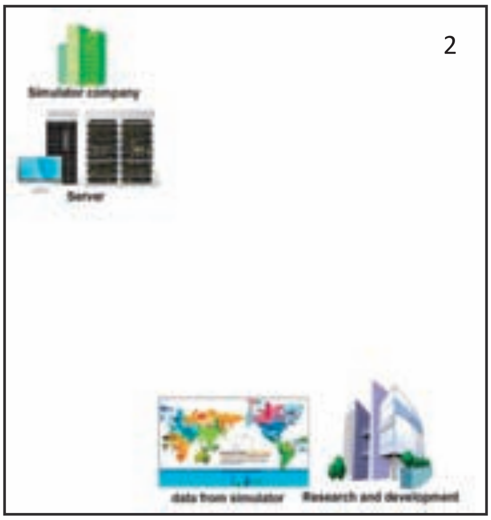
- Data Business

We will sell the statistics data which gathered from simulations to the research and development institute, the government, or the lab of college.

The data without user's personal information just include information such as "there are 1000 times accident at the cross road".

The data will be used to develop Geographic Information System, decision making of new traffic policy, developing of new bicycle related product and so on.





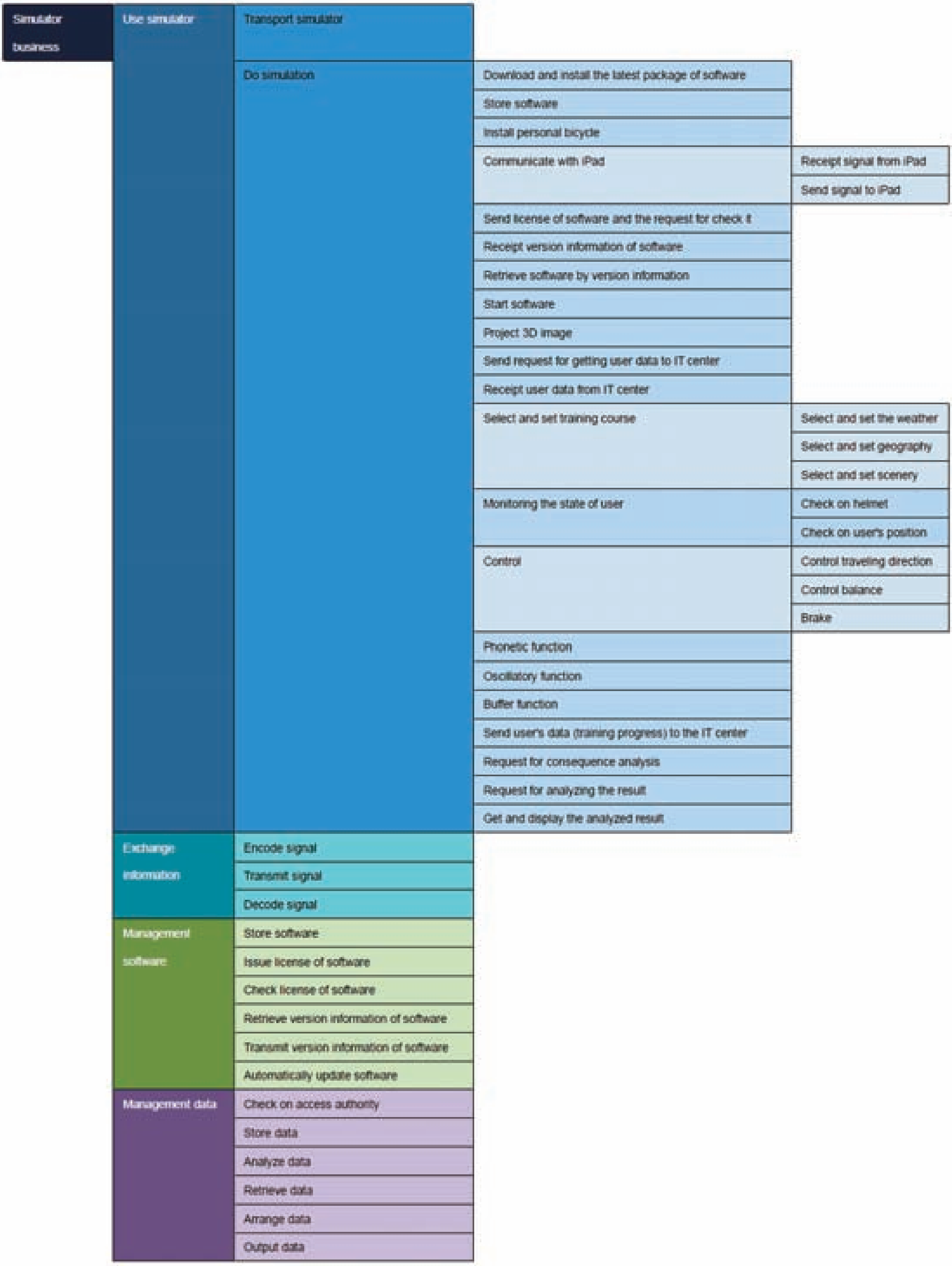


Figure3-1 Function Design of Bicycle Simulator System

Figure3-2 Function Flow

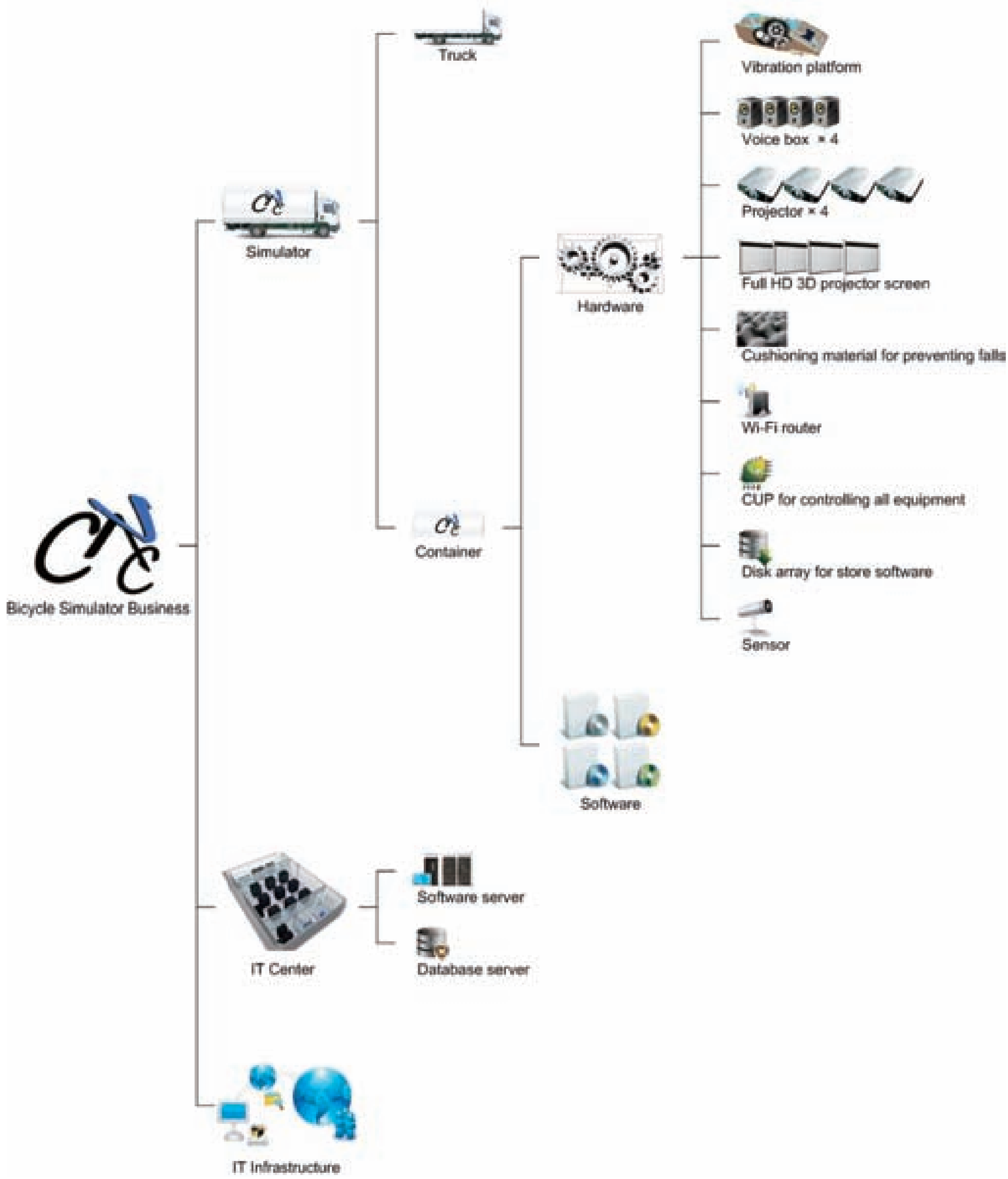


Figure3-3 Physical Design of Bicycle Simulator System

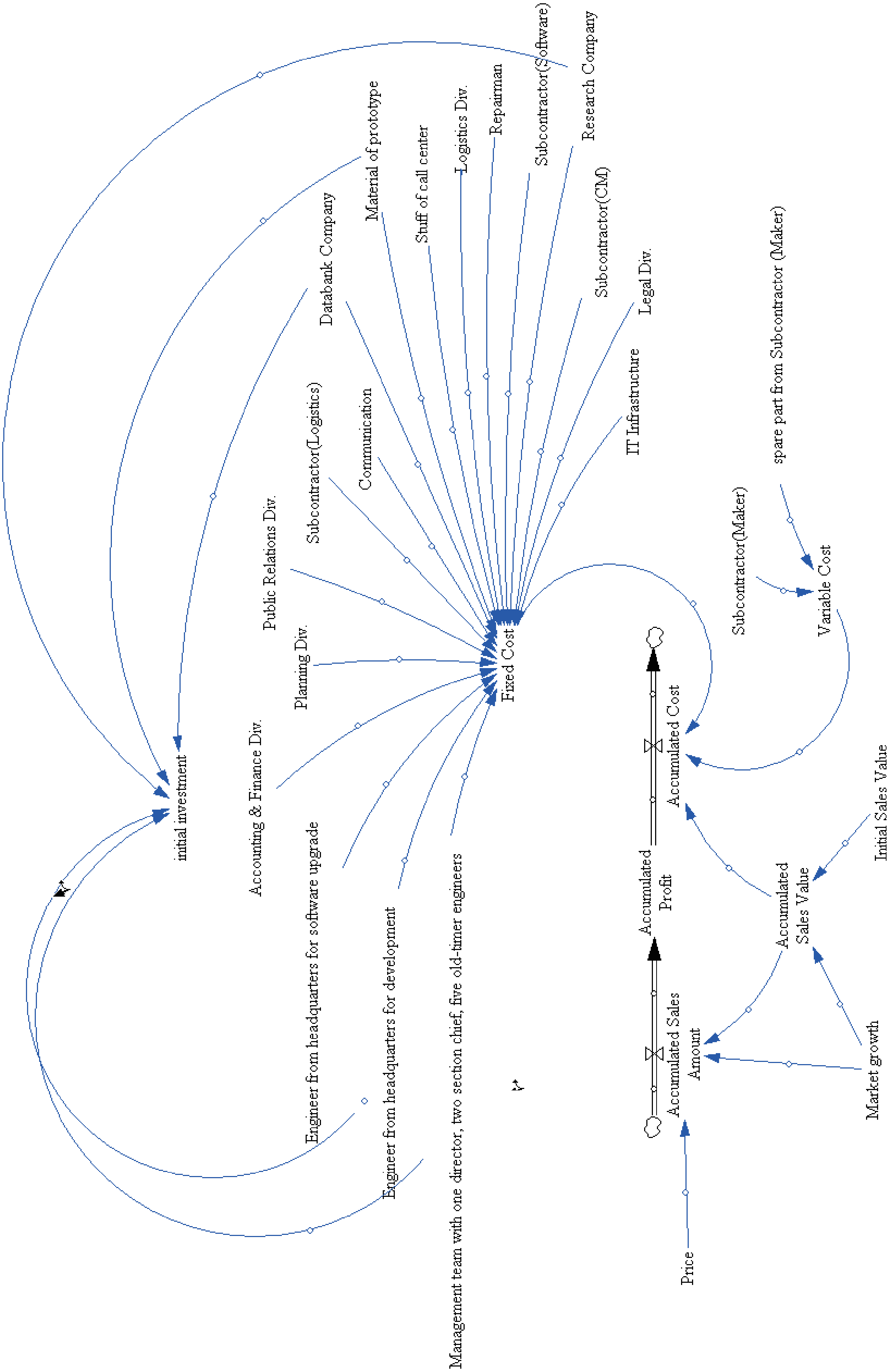


Figure3-4 Costs of Bicycle Simulator Business

CHAPTER 4
COMPETITIVE ANALYSIS

Business model overview

Alps team 17's business model is shown below. We are to reduce bicycle accident by bicycle simulator. We make revenue from several sources. First revenue source is the government and cities by selling the simulator itself. Second revenue source is a bicycle simulator user by charging them the use fees. Lastly, we sell accident data to research center for the future road development. We set the price of this product to 50 million yen. Since this simulator is not low price, we install this simulator to the truck to increase the portability for the users and to market our bicycle simulator to as many people as possible in the initial stage of our business. Not only the portability, but also this simulator has a lot of function so that anyone from kids to elderly can try this simulator.

- ✓ What
  - ✓Reduce bicycle accident by bicycle simulator
- ✓ Where
  - ✓Any where by carrying it by truck
- ✓ Who
  - ✓Anyone who ride a bicycle
- ✓ How
  - ✓By simulating real riding situation with 3D views and surround speakers etc...
- ✓ How much
  - ✓50 million yen / the simulator

Figure4-1 Cycle K business model

Revenue sources and cost structure

- Revenue
  - Source 1. Bicycle simulator sales.
    - Bicycle simulator Pricing Strategy
      - For being able to get Accumulated Sales Amount twice as Accumulated Cost before the market saturation, we do such pricing following.
      - Price = ￥50,000,000
      - Sales Volume (market size, market share, market growth)
      - Market size: 1,000
        - 1000 is calculated based on the number of cities which will become our potential customer.
        - Some of the cities are expected that have a possibility of buying two or more.
      - Market share: 100% (in the first 20 years)

        - Our product is a simulator with a very high reality that has never been achieved. And we will apply for a patent for this product.
        - It is called "Bicycle Simulator" but not in the existed "Bicycle Simulator" market. The market it will entry is a completely new mark “Super Reality Bicycle Simulator ".
      - Market growth: 17.5%
  - Source 2. Use fee of bicycle simulator from user
    - Normal user ¥0
    - User with car accident history ¥1000
      - 24,000 students per year
  - Source 3. Sale of the accident data to data research center.

- Cost

  Refer to Internal Rate of Return(IRR) & Net Present Value (NPV),

- Net Present Value (NPV): ￥13,203,933,265

  Net present value of our product in 2011 is ￥13,203,933,265. and payback period from 2011 to 2015

- Development time and risks

  Our product takes some time to develop because it consist of not only the hardware but also the simulation software. We estimated development time of our product to be one year. As far as we know, since no other makers are developing the similar product and the product development is quite high, we think that the risk of time development time is low. Instead, we use a lot of money for development therefore we need to persuade the sponsor to finance us.

- Protection strategy against other bicycle simulator.

  In this new very niche market, our product would be possible to possess strong leadership in the market. Unlike bicycle simulators produced by other maker, our product is super real so that it would not be comparable. Their simulator should be sold to elementary school to get attraction from kids, but our product is for cities to teach road rule through our product. Other possible competitor is “Scare trade education” done by stunt. This education is very real and could be a potential competitor but it cost quite a lot of money. For example a school pays 250.000 yen / one time. They are very expensive compare to what we are going to offer. Also with the strong brand “Toshiba system technology” not many company can come after us

CHAPTER 5
ALPS ROADMAP AND REFLECTIONS

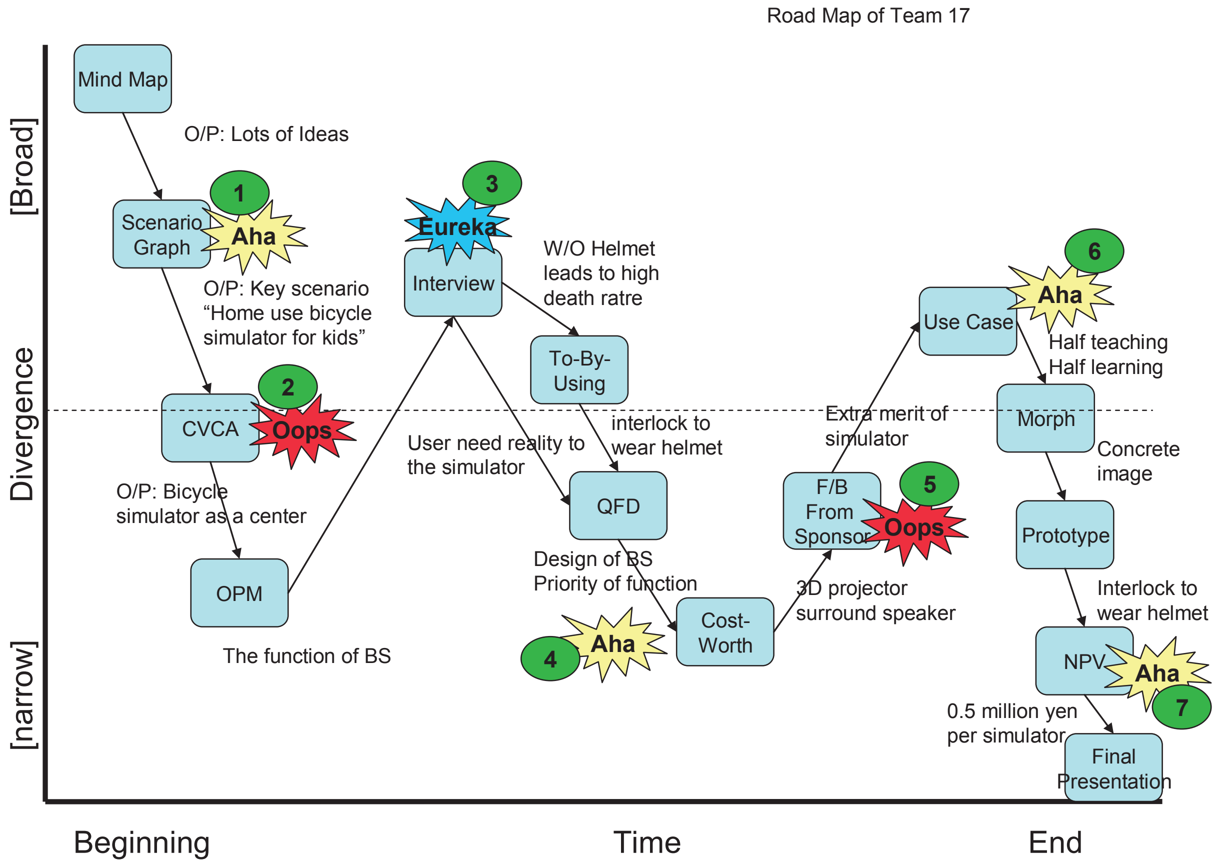


Figure5-1 Road mapping and Reflection

Figure above is a roadmap which thanks team took since may. Reviewing our roadmap remind us that there were several moments we discovered and depressed. By repeating "Aha" and "Oops" over time, there was a timing where we find "Eureka". In our case which is an interview with potential user.

First "Aha" moment(1) was a scenario graph. First we have done mind map to generate ideas, then we organized the result by 5W (When, Where, what etc…). At that point we had too many ideas to discuss, but by organizing the ideas by scenario graph approach, we successfully focus our scenario to "Home use bicycle simulator for kids" from many ideas. It gave us a good hypothesis to start analyzing.

We encountered "Oops" moment (2) when we conducted on CVCA based on our "key scenario" and "tentative product image." To make the simulator available to many people, our team had come up with a product using i-pad. The key feature of our tentative product is to use bicycle already owned by the rider. It reduces the manufacturing cost of the bicycle simulator thus leading the customers to pay less. We put too much focus on the "tentative product image", so that we put "Bicycle simulator" on the center of our CVCA by mistake instead of "Bicycle rider". Since we put "Bicycle simulator" on the center of the CVCA, we only could come up with limited ideas to get money. For example, main business is only to sell the simulator to government not any other. If we could have put “Bicycle rider” on the center, we could have been come up with ideas such as charging money to use and charging money for the accident information acquired from bicycle rider.

First and last “Eureka” moment (3) was an interview. Before the interview, we assumed that reasonable price bicycle simulator will make us possible to distribute the product to many people and it leads to reduction of the accident. However, interview with high school teacher made us realized that, simple bicycle simulator would not help students to learn bicycle safety because the students would just enjoy riding “game like” bicycle simulator. Instead, the teacher was choosing a method called “Scare trade education method” which lecture use a stunt man to show the actual scene of a bicycle accident to make student realize how scary the bicycle accident is. By this method students pays much more attention to learn the road rules. Also the teacher notified us that the “Scare trade education method” cost them 250 thousand yen per one time so that they cannot do it many times. With those finding we decided the key word of the bicycle simulator from “Wide spread by reasonable price” to “Real and scary experience” Although it cost a lot to make students to feel scary by the simulator, it worth investing.

After the “Eureka” moment “Aha” moment(4) has come again. The “Aha” moment has came when we were doing the cost worth analysis after the QFD. From the interview we start focusing on reality to the simulator. To simulate the reality, we came up with many ideas. For example, we tried to simulate the speed by wind from electric fan. At that point we generate many ideas regardless of the cost. However, by using cost worth analysis, we successfully prioritized our investment to 3D visual goods, surrounded speaker and vibration equipment to the simulator.

The mistake was pointed out when we ask for F/B from mentor(5). By that time, we focused our discussion on bicycle simulator to pursue reality. But the mentor told us that we should define the cause of the bicycle accident. In fact, we spend a lot of time what kind of function we apply to the simulator instead of problem defining. From that time, we started to investigate the cause of the accident and we found out that 1/3 of bicycle accidents cause head injuries, and 85% of them would have survived if worn helmets. By this findings, we added a key function interlock for wearing helmet to the simulator. F/B from mentor is very valuable as the project become more and more concrete. The team member tend to become narrow view because they researched so much on the subject.

We came to the “Aha” moment (6) when we did the use-case diagram. The tool showed us that only the students who tried our simulator would learn the road rule. That fact realized us the need of the way to spread what the simulator experience tell the students. To spread the experience of the simulator we concluded that part of our concept of the simulator should be “Half learning, Half teaching”. By this way we can teach not only the experiences but also the people who meet with him/her.

Finally, the last “Aha” moment (7) has come by doing the NPV study. Before we calculate the NPV, we had a business ideas but it was not real. By trying to think about costs and investment, the ideas start to have more and more reality. In our case, sponsor was an actual simulator company, therefore it was possible to check the reality with him. In conclusion of our study we came up with an ideas to reduce the cost by outsourcing software development to China.

By reviewing the roadmap from the beginning, we realized it was a quite good roadmap. We start with a “Aha” and the going through some “Oops”, those helps us to narrow down and broaden our ideas over time. Then after the “Eureka” moment, our project went through quite smoothly. Important moment on our team was always F/B from mentors and sponsors. They gave us not only fruitful advices but also severe comments and those comments harden our project. If there were improvement points, I recommend to have NPV and Business model lecture on the middle of the ALPS. Those lectures helped us to evolve ideas. By reviewing NPV on the middle of the project, we can always come back from dream world to real world. In the real world, investment cost is always a concern, therefore watching the NPV overtime would definitely helps to make the project more real.

Lastly, we appreciate faculty members big supports. I always liked prototypes. It was fun and exciting moments. On the contrast, theme development has a problem. Our theme “Bicycle simulator” fit with ALPS very well, however some of the themes were not. For instance Adidas theme was too ambiguous to solve by ALPS. Therefore, I would like to recommend that theme should be reviewed very carefully by faculty stuff. You should have advices sponsor members to be more concrete on what they want to solve. Because when students choose theme, we never knows what would happen in the next step, therefore it will be faculty members job to pick and modify candidate theme.

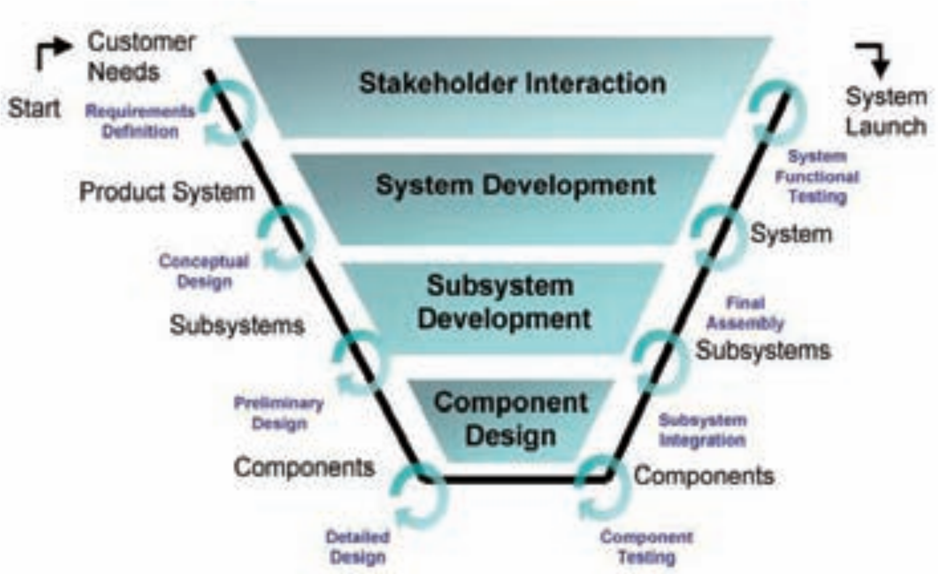
CHAPTER 6
CONCLUSIONS AND FUTURE WORK

The problems we need to overcome in order to complete our project

As we will see in the following table, the problem about production management will be just restricted by Gantt Chart. But we often hear that project doesn't proceed according to Gantt Chart. So, to develop a new tool may help the organization that will overcome such a problem.

Problems	Solution	ALPS Tools for Seeking Solution
The cost of development will cost 8,000,000,000 yen. And start-up capital of the first year production needs 2 billion. We need to get such huge money from both head office and venture capital. To persuade them will be a problem.	This figure is calculated based on situation of building a new company from zero. So, it is reasonable and feasible. We will show the financial prediction result to the head office and venture capital. To make them know that if they invest us they will get profit from fifth year and the Net Present Value will be 13,203,933,265.64 yen.	Financial Analysis Elevator Pitch Business Model Function Diagram QFD I & II Cost Worth Analysis Physical Design
We will operate production by the way of outsourcing and offshore. Whether the outsourcers can deliver products in time or not will be a problem.	We will collect and compare historical data of some famous outsourcers, and choose the one has a high confidence. And we will build a project team to manage the whole progress of production to make sure that production can be done according to schedule.	Gantt Chart
To persuade the government to buy our bicycle simulator will be a problem.	We will produce a prototype which has nearly same performance that looks like end-products, and presents it to the government to let them experience the super-reality.	Interview, Observation CVCA Business Model Scenario Graph Pugh Selection Prototyping
In data business, leakage of user individual information will be a problem.	We will strengthen the management of the authority of the access between servers. The user information database server can access the software server, and the software server can access the simulation statistics database server. But the access of reverse order is prohibited. In data business, the traded data will be just from the simulation statistics database server; therefore no one can infer related user's information by using the data.	—

Plan of future work for the organization that will take over our project results (goals, dates)



(http://esd.mit.edu/HeadLine/keio010308/V-model.jpg)

As analyzing it in accordance with the V-model shown above, the things we did are Requirements Analysis and Conceptual Design. The left work will be Specification, Architecture, Implementation, Testing, Documentation, Training and Support, and Maintenance. So, we suggest the organization that will take over our project results to do according to the following plan.

Refer to Table6-1 Plan of future work, Page 53.

Needed resources for future work

Refer to Table 6-2 Resources for future work, Page 54.

The table shown above illustrates the resources for future work.

In this table, the first line and the second line represent works, and the third line represents period of resources. The first column represents that required resources should be procured from outside or inside.

Because of we suggest adopting Company Structure for operating this new bicycle simulator business, the procured resource from inside of our company includes “Management team with director, section chief, old-timer engineers”,” Accounting & Finance Division”,” Legal Division”,” Engineer for development from headquarters”,” Planning Division”,” Public Relations Division”,” Logistics Division”,” Engineer for software upgrade from headquarters”, and ” Repairman Call center”.

And the money be raised from the head office and venture capital, will also be used for connecting process and make sure they can advances well, and to build IT Infrastructure just as IT center with database server, software server and network equipment. Due to they are belong to Sunk Cost and Fixed Assets, we treat these two as inside resource.

For we will organize production as outsourcing and offshore, so the procured resource from outside of our company includes “Databank Company”,” Market Research Company”,” Subcontractor=Outsourcer” and “spare part from Subcontractor=Outsourcer”. The reason why the data collection is also done by outsourcing is that it can makes engineers concentrate on the product design. By this way, the efficiency of the product development will heighten.

Contingency plan/guidance of expected problems

Expected problems	If the problems are not resolved	The organization should proceed
The cost of development will cost 8,000,000,000 yen. And start-up capital of the first year production needs 2 billion. We need to get such huge money from both head office and venture capital. To persuade them will be a problem.	The project cannot be begun.	The organization should stop the project because it doesn't invest money yet, the loss is near 0. Or seek two or more investors to decrease the risk that they will owe.
We will operate production by the way of outsourcing and offshore. Whether the outsourcers can deliver products in time or not will be a problem.	It is not possible to put it on the market according to time.	The organization should monitor progress of the projects frequently and explain to customers timely.
To persuade the government to buy our bicycle simulator will be a problem.	The cost cannot be gain back.	The organization should develop overseas market. And produce a final product of this bicycle simulator and supply it for free; by this way, we can make people to know the advantage of using our bicycle simulator, to expand the market demand.
In data business, leakage of user individual information will be a problem.	The law lawsuits occur.	We have to check the history of access and find the culprit. And to compensate the victim timely, to strengthen the protection of database system, for retrieving reputation of company.

Guidance for unexpected problems

Refer to Table6-1 Plan of future work, Page 53.

This schedule is established after consider the worst situation. So, we left plenty of time (25% of needed) when developing the plan of future work, for the unexpected problems. (The green bar in Table8-1 means the time for dealing with unexpected problems.) If the project goes well we can accomplish it ahead of schedule. If not, we will have nearly 25% of fixed time of per stage to solve the problem.

The point for avoiding the disastrous effects of project caused by unexpected problems will be “managers frequently supervise the production site” and “the manufacturing division arrange data of project neatly and report it every day”. By this way, the problems will be identified promptly. To discover problems and to solve the problems in the early stage can reduce the cost and risk.

ALPS tools need to be revisited and key tools of project

Refer to Table6-1 Plan of future work, Page 53.

The right column of Table6-1 shows the ALPS tools we learned will be used in the future work. We also did them during the ALPS lecture, but due to our limit of usable resource may be there are some important data we could not gather. So, we hope that organization that will take over this project to do these tools again based on our analyzed result, to compare their results with ours will improve the safety of their future business。

The tools have been highlighted by red color are the key tools in each stage.

NO	Project	2010		2011												2012												Expected product (Analysis by ALPS Tools)
		11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	
01	Founding																											Financial Analysis Elevator Pitch Business Model
02	Business Analysis																											CVCA Scenario Graph Interview, Observation Pugh Selection
03	Product Architecting																											Prototyping Rapidly To-By-Using Robust Conceptual Design FMEA
04	Product Detail Design																											Function Diagram QFD I & II Cost Worth Analysis Physical Design
05	Beta Testing																											Prototyping
06	Market Testing																											PSM
07	Software Development																											Gantt chart
08	Hardware Production																											Gantt chart
09	Advertisement																											-
10	Logistics																											-
11	Software Update																											-
12	Hardware Maintenance																											-

Table6-1 Plan of future work

	Product Conceptualization				Product Development				Product Release					
	Idea Generation	Idea Screening	Concept Development and Testing	Business Analysis	Product Architecting	Product Detail Design	Beta Testing	Market Testing	Production		Advertisement	Logistics	After Service	
									Software	Hardware			Software	Hardware
Time Cost	1 year								1year	continued	0.5 year	continued	continued	continued
Resource Inside	Management team with director, section chief, old-timer engineers													
	Accounting & Finance Div.													
									Legal Div.					
									Engineer from headquarters (for development)					
											Planning Div.			
											Public Relations Div.			
												Logistics Div.		
													Engineer from headquarters (for software upgrade)	Repairman Call center
									Communication					
													IT Infrastructure	
Resource Ourside				Databank Company				Research Company	Subcontractor S	Subcontractor M	Subcontractor C	Subcontractor L		
							Material							spare part from Subcontractor M

Table6-2 Resources for future work

ACKNOWLEDGMENTS

One year is a very short period of time because we enjoying the experience of working as a team in the ALPS program. Group 17, nicknamed cycle K, 5 members in group 17 learning together during school teaching, doing research about bicycle simulator and also discussing about our objectives, methods at any time through emails, really working as a team. Passed all the difficulties and at last find out the solutions to the problems of creation of bicycle simulator, we are happy that we got so much from attending the ALPS program.

Many thanks go out to Mr.Kensuke Kawai from Toshiba Technology who worked as a supporter of group 17, the topic of creation of bicycle simulator is the one of the choices that be given by him for we to choose, also discussing with us about the new ideas and difficulties that we encountered in the process, and giving our directions to the right objective also make us feel grateful.

As the director of group 17, professor Hidekazu Nishimura help us to understand the knowledge of system design, give us the suggestions that what and how we should do in the next steps, all of this is the most important support for the improvements of our designs.

Also we must give great thanks to the professors that come from USA, it's whom that gave us all the knowledge which we need to create anddesign the whole model of bicycle simulator, without the courses they gave to us we can not carry out the whole process, and the style that they make the lecture just like a show impressed all of us very much.

At last, great thanks should be given to all the faculty of department of system design and all the students attending ALPS who make it be so successful.

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URL

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APPENDIX

Cooperation group

- AXA Life Insurance company
- AXA Non-Life Insurance company
- Prefectural Kawasaki engineering department high school
- Kawasaki City citizens life part regional safety promotion section
- Kanagawa police headquarters Traffic Administration Section

Reference literature

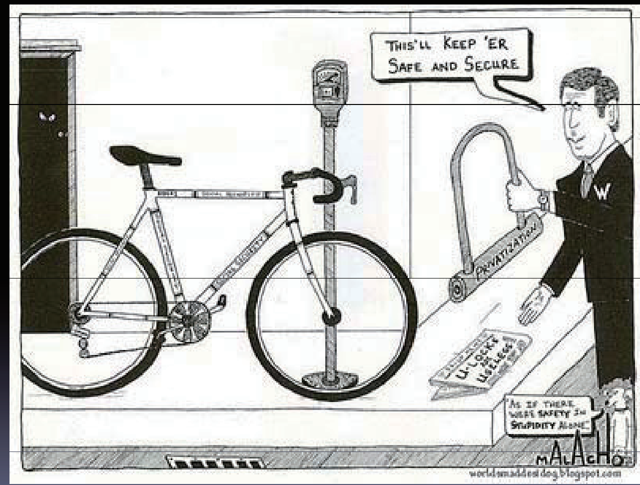
- Proposal concerning promotion of safety use for bicycle
  (Bicycle measures examination informal social gathering)
- About the safety training in the bicycle (Masumi Akiyama)
- Bicycle traffic safety education targeted with grade-schooler and research on the effect
  (Atsushi Nakamura: The Sumitomo Trust & Banking Co., Ltd. and Oomori Nobuaki and Noboru Harada: Tokyo University graduate school engineering system research course)
- The realities analysis concerning bicycle traffic safety measures in the police
  (Nihon University Department of science and engineering Social traffic engineering department)
- Bicycle traffic safety education manual (Tokyo)

Group 17's Final Presentation Slides

ALPS 2010 Project Team Cycle K

DESIGN OF BICYCLE SIMULATOR

In the year 2004 …



Problem Statement ①

- Number of bicycle accidents per year

-2009 (Japan)
156,000 bicycle accidents
945 people were killed

-Occupancy of bicycle accidents among overall traffic accidents are increasing

Data of Metropolitan Police Department

Problem Statement ②

- Lack of Bicycle Helmet Law

-1/3 of bicycle accidents cause head injuries

-85% of them would have survived if worn helmets

Data of Foreign Country Bicycle News No.94,99

Problem Statement ③

・Defective road infrastructure for bicycle

	Number of Death Caused by Bicycle Accident			Total Number of Death in Accidents		Ratio of Bicycle Accident (%)	
	1980	2002	Increase Rate (%)	1980	2002	1980	2002
Japan	1,366	1,305	▼4.5	11,388	9,575	12.0	13.6
USA	965	665	▼31.1	51,091	43,005	1.9	1.6
Germany	1,338	583	▼56.4	15,050	6,842	8.9	8.5
France	709	223	▼68.5	13,672	7,655	5.2	2.9
England	316	133	▼57.9	6,239	3,581	5.1	3.7
Netherland	425	169	▼60.2	1,996	987	21.3	17.1

07.2.9 Ministry of Land, Infrastructure, Transport and Tourism

Initial Requirement

Proposer: Toshiba System Technology

To reduce the risk of bicycle accidents.

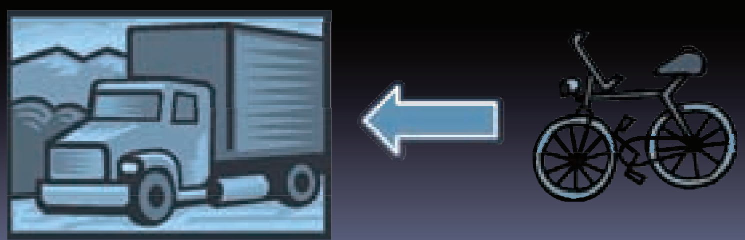
Risk Reduction Measure

①Function of Bicycle Simulator

②Feasible Business Model of Bicycle Simulator

Concept of Bicycle Simulator

"Moving Box"



Function Design of Bicycle Simulator

Function Design

- Simulator Operation
  - Simulator Transportation
  - Exercise of Bicycle Simulator
- Signal Conversion
  - Signal encoding
  - Signal Transfer
  - Signal decoding
- Software Management
  - Storage of software
  - License issue of software
  - License check of software
  - Retrieve of software version
  - Transmit of information
  - Automatic software update
- Data Management
  - Authority check
  - Storage of Data
  - Analyze of data
  - Retrieve of data
  - Output of data
  - Arrange of data

Function of Bicycle Simulator

Exercise of BS

- Download and installation of latest software package
- Update of software
- Acquisition of license
- Data (training progress) transfer to IT center
- Installation of personal bicycle
- Connection with iPad
  - Retrieve of signal from iPad
  - Signal transfer to iPad
- Retrieve of latest version of software
- Activate simulator
- Select ion of training course
  - Select ion of scenery
  - Select ion of weather
  - Select ion of geography
- Projection of 3D image
- Retrieve of user data from IT center
- Send request for getting user data to IT center
- Monitoring of User
  - Check of helmet
  - Check of user position
- Audio Output
- Vibration output
- Motion buffer
- Control
  - Brake control
  - Direction control
  - Inclination control
- Request of result
- Retrieve of analyzed result
- Retrieve of software version

Feasible Business Model

【Target】

・Investors
・Buyers (Prefectural and City Government)

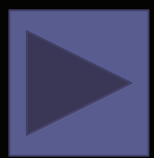
【Aim】

・Explanation of product life cycle

・Clarification of cash flow

・Description of Business Mechanism

Feasible Business Model



Review – Final Solution

・**Number of bicycle accidents per year**
→Function of bicycle simulator

・**Lack of Bicycle Helmet Law**
→Interlock helmet system of bicycle simulator

・**Defective road infrastructure for bicycle**
→Data exchange business model between bicycle simulator and research development center

Commercial

【Target】

・Stakeholders who buy the bicycle simulator
・End User

【Aim】

・Realization of training to avoid accidents by bicycle simulator

・Campaign for bicycle riders to wear helmets

You're hearing so much about …

Buy-Cycle

THANK YOU FOR YOUR KIND ATTENTION