Rochester Institute of Technology

A Thesis submitted to the Faculty of the College of Imaging Arts and Sciences
In candidacy for the degree of Master of Fine Arts

City Bike Program in Taiwan

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C I T Y B I K E P R O G R A M I N T A I W A N

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Image 1.

This design project was inspired by Danish city bike program. I studied furniture design in Denmark; during my stay I experienced the joy and the convenience of public city bike.

Cycling is a life style and the expression of naturalism in Denmark. It is also considered as the main mode of transportation among the Danish people. The implementation of the city bike program is not only prosperous in Denmark but also in other Europe countries.

This cycling spate (rush) is affecting countries where environment consciousness appear to be of much concern. On the contrary, Taiwan (image1.) which happens to own the largest market share for exporting bicycles is also a country where its people are less motivated to using bicycle as their main mode for commuting.

From the above statement it is clear the implementation of the city bike program in Taiwan will be easy as long as there is some sort of government intervention.

Taiwan is such a small country and can proudly boost of its numerous mass rapid transit system and high speed rail way system. These systems are considered the best supportive elements to run the public city bike program. The Taiwanese government has implemented several bike friendly programs for years and has recently started paying attentions to a bike right of way. Which means the future and potential practice of the city bike program in Taiwan is bright.

Via observations and surveys, I am going to address various kinds of attractive designs which could draw people's interests to frequent the use of pubic city bike in their daily life's as well as improving overall city bike program to suit Taiwanese needs.

DESIGN STATEMENT

Background

Image 2.

Image 3.

Image 4.

Within the past twenty years, Taiwan has evolved from a developing to a developed country. The average national income compared to before has doubled if not tripled. The desire to want has increased massively from electronic products to replacing bicycles with motor-scooters and in the case of some family's cars.

According to a latest report by the Ministry of Communications in Taiwan 5, 707, 918 cars and 13, 066, 857 motor-scooters have been registered by 2007. In other words, almost every four people own a car and every two people own a motor-scooter. These numbers has skyrocket over the years. For this reason, Taiwan has been considered the worst country for discharging carbon dioxide in Asia.

Even though, Taiwan has an infrastructure to cater for the number of registered cars and scooters, the increment of registered cars and scooters over the years has led to traffic congestions in densely populated areas as well as difficulty in finding places to park.

In addition, accidents are caused due to poor design of the public transportation system which was designed for vehicles-use only. Bike riders exposed to these same conditions run the risk of getting hit or colliding with motor –scooter which may be threading through traffic because they are designed to be fast.

As a designer, I hope to use design as tool to create awareness among the Taiwanese community to help reduce our carbon foot print as well as educate them on some of the health benefits which could be gained by implementing a bike program and encouraging people to participate by establishing bike lanes for added security.

DESIGN STATEMENT
User survey

To understand a perspective Taiwanese bike user, I interviewed 12 Taiwanese who have lived in Taiwan for at least twenty years. This survey I hope will address some differences and considerations to design the program.

Image 5. interviewer

1. Nationality: Taiwanese
2. Gender: 8 males, 4 females
3. Age: 24~32`

DESIGN STATEMENT

User survey
Questionnaires and responses
Part1

Q1: Have you ever ridden a Bicycle?

A1: They all have experience of riding bicycle in Taiwan.

Q2: What motivated you to begin riding a bike?

A2: it was fun and a cool social activity when they were kids.

Q3: Do you still ride bicycle?

A3: Two out of the twelve keep the habit of riding bikes.

Q4: If yes, how often do you ride? What purpose?

A4: At least once a week

Q5: If no, why did you stop riding?

A5: All twelve members currently own motor-scooters and or a car.

Q6: What kind of transportation you usually take in Taipei City? (If interviewer says any kind of public transportation, go to question 10)

A6: Two out of the twelve use motor-scooter to commute in Taipei city. The others patronize the buses or MRT. (What is MRT?)

Q7: What kind of attractive advantages of using own vehicles to travel?

A7: The Convenience and self-mobility.

Q8: As you know the price of gasoline just keep going up day by day, does that influence you to take public transportation

A8: They all said yes!

User survey
Questionnaires and responses
Part1

Q9: If yes, what kind of public transportation will you considered when in Taipei City?

A9: MRT and bus are the common answers.

Q10: Would you like to ride bikes in Taipei City and Why?

A10: Only one member said he will like to ride a bike in the parks. They all agree it is too dangerous to ride bikes in the city. Besides, the weather is not promising considering it can be because really muggy during summer and rainy during the winter. It can be frustrating.

Q11: Do you know the benefits of riding bikes?

A11: For individual health and reducing the air pollution problem were the common answers.

DESIGN STATEMENT

User survey
Questionnaires and responses
Part2

After the interview questions, I showed them a short video about a well-developed city bike program which were filmed in Copenhagen, Denmark and Lyon, France.

Image 6. Lyon city bike system

Q12: After understanding the city bike program runs in these cities, would you like to ride a bike with that kind of circumstances?

A12: Ten of the participants were thrilled about the program and would like to ride bikes if this program can be implemented in Taiwan. The other two were simply not interested.

Base on the user survey, I was able to deduce three perspectives of Problem statements namely…

Mental perspective

1. Time is everything

   Taiwan has been highly industrialized since 1970. The unique geographical location of Taiwan helped it to become center of OEM (original equipment Manufacturer) industry on the global market. Taiwan's ability to boost of its diverse dense population, provide efficient logistics to it overseas customers at competitive rates over the decades altered their perspective by considering the importance of motor vehicles not as a luxury product but a tool to help save time. This with time has influence the way they do business as well as a lifestyle.

2. Physical excuse

   From the user survey, one could clearly observe that some interviewers prefer to use motor-scooters due to muggy weather conditions. However, to the exception of cars, riders of motor-scooters are still exposed to the same conditions as a bicycle rider. Although riding a bike requires the use of human power with byproduct of sweat and fatigue, I still think it shouldn't be a reason to stop people from enjoying the benefits of riding a bike. In other to counter this problem I envision trees be planted on the sides of bike routes to provide shade as well as beautification of the city.

3. Lack of security

   According to the participants of the User Survey, bike riding is not only a dangerous activity in the city, it also lack a sense of security. They worry that accidents may or can occur at anytime as well as their bike be stolen since there are no designated location to store them.

Design perspective

1. Dissatisfaction by functions

In the current bicycle market, most designs emphasize on speed, form and material as innovation and pay very little attention to the needs of the user. The end users pay for designed functions they never use. Example: integration of advanced gearshift and the sharpest brake system which in most cases don't get used. Let's face it the more functions we pack in a product, the more frustrated consumers get due to lack of education. The end result is consumers losing interest and need to want.

2. Cradle to grave production

One day, I was walking on a bridge in Copenhagen, Denmark with a bunch of my classmates and to our amazement we saw abandoned bikes lying by the railway tracks. We decided to go down the tracks to take a better look at the conditions of the bikes. After careful inspection of the bikes we realized the frames were slightly damaged otherwise they were in good condition. As suggested by one of my colleagues we ended up stripping all the good parts from the abandoned bikes for future use on our personal bikes. When I think about it, it was really thoughtful of him but not thoughtful for this classic example of "cradle to grave product".

Environmental perspective

1. Poor hardware facilities

Taiwan, just like most developing countries struggled economically in the initial developing stages. During this period, the government placed a lot of emphasis on the public constructions to prosper the economy. The endeavor was successful and it enabled Taiwan to become an important part of the global economy. However, there wasn't enough attention paid on bicycle users' right and to save road space for them.

2. Insurance coverage problem

Due to the lack of no restrictions on bicycle registration in Taiwan, insurance companies do not offer services for bicycle riders. This situation profoundly lowers the interests of people to consider riding a bicycle in such an ill-protected cycling environment.

DESIGN STATEMENT

Thesis statement

Since the beginning of the Industrial Revolution, people have used their intelligence to create innovative products to propel our daily lives. New technologies and methods are applied in our lives; meanwhile, the increase of the human population is becoming overwhelming to our natural habitat. The costs of depleted natural resources are disregarded while people enjoy these products. Sadly, if precautions are not taken now the worst global crisis may hit the generation yet to be born. We have one earth, yet this awareness advocated year by year, has yield the least support by just a few organizations.

As an industrial designer, it is my duty to incorporate green design with my productions without pollutants as well as offer ideal life to people and reduce injury to the environment. As a result, one may ask what is “Green Design”? The answer, Reduce, Recycle and Reuse. After reading the chapter “Waste equals food” from the book “Cradle to Cradle”, I realized the ecosystem is been destroyed due to unawareness of manufacture processes and products. For instance, the sneakers we go out jogging in emit toxic particles which contaminate our environment. The same can be said of other product and unmerciful factories.

The application of green design principles in manufacturing and production is been preached for years. Till today I have not associated any of its principles in my design process. In other to make my thesis more meaningful I look forward to incorporating these principles in my design process.

DESIGN STATEMENT

Thesis statement

My thesis will be based on a green-oriented approach. The three green principles that will be integrated into my city bike program are design for sustainability, design for sharing and design for disassembly.
The design category for public usage means the design have to last longer. This notion will have to be planted into the minds and lives of the people through comfort ability. Designing this product to extend it longevity will be the main consideration for this program. The above mention three principles will be the paths to address this issue.

According to Miles Park, a designer and researcher who dedicated most of his career investigating design strategies to influence sustainable consumption and minimize product obsolescence, the strategies to have product design embrace its longevity are;

- Design that facilitates emotional attachment to objects. (the behavioral level)
- Design that maintains quality over the passage of time. (the product level)
- Design that provides for ease of ongoing repair and upgrade. (the system level)

Deign For Sustainability

Cherry tree creates fruits for creatures, provides oxygen and water to enrich the ecosystem. Even its pit which was fall into the ground also grows another cherry tree. When the tree was dead, it enriched the soil and microorganisms. When I read the book “cradle to cradle” , one of its paragraphs mentions the concept “waste equals food” which inspired me a lot on rethinking about the definition of production. Trying to image this beautiful picture, a Designer came out with a stunning idea and his company put his concept through production. After a year with hard works and cooperation, the product finally publicized to market, and overwhelming praises came by. What the ideal accomplishment every designers chases for. However, while people are satisfied with using the product, they did not realize the product which they bought is the killer to the earth.

Here is a current example…Apple recently released a notebook called THE AIR a remarkable revolutionary design just like other products from Apple. Their biggest selling point is the aesthetics (very thin and weighs less). To achieve this accomplishment, unlike current notebooks on the market with multiple parts, Apple used CNC technology to construct the whole laptop into just one part. Though it may sound like an innovative approach to design, the waste generated from this type of manufacturing can be measured in tons. Apple, however market this product as green.

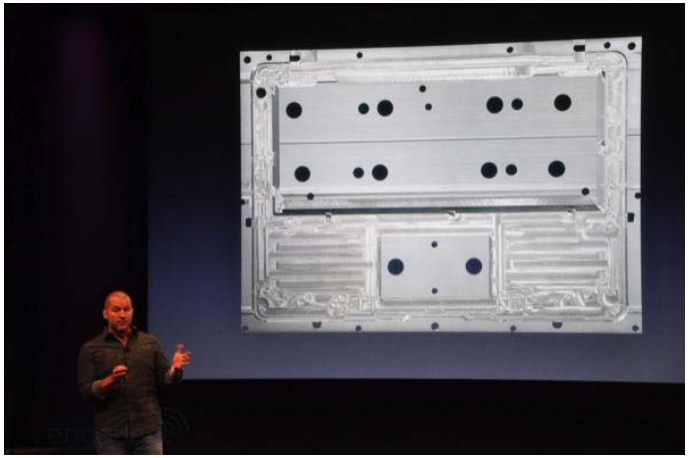


Image 7. Jonathan Ive presented the new Macbook design to the press

DESIGN STATEMENT

Thesis statement

Deign For Sustainability

The new Mac Books are made out of aluminum. Piles of 10mm extruded aluminum are formed into metal plates and then using CNC milling to cut to perfection. By this method ¼ pounds of every 2.5 pounds is used and the rest scrapped as waste material. Although these chippings are down cycled it cannot be considered sustainable. These expensive notebooks, high cost of electricity consumption as well as the damage caused by chemical wasteson the environment by Apple are easily overseen by the consumer due to lack of education and the idea of not wanting to know.

Image 8.The manufacturing process of new macbook

In recent years, innovation and revolutionary designs has brought lots of profits to companies. Consumers will buy anything. However, it will be fair to our environment if designers and manufacturing companies take the responsibility to educate people about the detrimental effect of certain products on our environment.

To design products for sustainability, I deduced four perspectives to follow:

- Efficient Design - Keep resource consumption & input to a minimum
- Safe Design - Avoid toxic substances in materials or processes
- Cyclic Design - Materials can be continuously cycled through industrial or natural systems
- Communication Design - Provide accurate, relevant, informative and verifiable information about environmental performance of products to consumers.

Deign For Sharing

Considering the limited resources by Mother Nature, the wisest way to conserve our natural resources will by cutting down wastes and using less.

Victor Papanek, one of the most eminent working and teaching designers, advocates the important perception “sharing not buying” in his book The Green Imperative. Is an example about the lawnmower; Almost all American families who have lawns own one in their garage. According to his study, there are 168 hours a week, during the summer lawns are cut at least once a week and it takes about an hour or two maximum to cut the lawn. This means the lawnmower is not in use for 166 hours a week. Not to mention places that experience the winter season. In a nut shell the lawn mower accounts for only 1% of use during the year. He further argued that these kinds of under-use and irreplaceable product such as the lawnmower, slide-projectors, printers, vacuum cleaners etc. can be shared by neighbors and communities to cut down material consumptions, energy and pollutions.

Sharing possessions could also enhance the close bond to society. Another example conducted by a student of Papanek’s in his design case study was of a designed playground in low-income area for kids to play. Kids were not allowed by their mothers to play without supervising. Until washing-machines were installed, mothers can do laundry and spend times with their kids at some time. Mover over, having more interaction with neighbors such as sharing information, sharing ride, swapping things and baby- sit.

Sharing is not a new perception to our society. This activity can be dated back to our ancestors. During this period, making of products was not easy and it was rear for multiple people to own the same product in a neighborhood. People had to share possessions to survive or to improve their quality of life. Sewing machines, cookware, and latrine were shared. Although times have changed, and technologies including our life conditions have improved, we will ultimately fail if we don’t control our rate of consumption, production and wasting.

Sharing doesn’t have to be a slogan it has to be practiced in design and further embodied in our product s as a way of life. I hope to establish a strategy to enhance the ideals of sharing which could one day be instilled in the minds of my consumers as a way of life.

Deign For Disassembly

The most beautiful house in the world is the one that you build yourself

——— **Witold Rybczynshki,1989**

One day, I opened the bottom drawer to the closet in my living room and stacked to the rear were several cell phones. For a second I wondered how they got there and if I had actually bought them all at one point. I soon realized three out of the lot used to belong to my family members. The dust on the phone suggested they have not been tempered with for while. I decided to probe each phone for its condition and functionality. To my amazement, the good conditioned phones had outdated functionality. The rest did not power up though aesthetically were in good condition. As a designer and helpless and shameful as I was immediate wished I had a sense of engineering to fix these phones or at least bring them back to life to be used once again. It got me thinking of what happened and it occurred to me my family and I had to abandon this phones due to the rise of new functionalities that were present in the new and not the old technology or product. Unconsciously, I thought of myself as a vampire who is sucking the life blood from the mother Earth.

Lack of craftsmanship between the owner and product seems to be the key for this abandon behavior. ***Victor Papanek*** suggested a way to solve this issue in his book ***Green Imperative***. He mentioned that every product should be designed in the form of built –it-yourself kits which can bring four distinct advantages to users.

1. The owner-builder would develop an understanding of how the product works, making troubleshooting, repair and replacement and update of parts much easier.
2. In Case of damage from malfunction or wear extra replacement parts would be available and easily fitted.
3. Extra parts would be low priced.
4. Building from kits would enable users to improvise, conceive alternative solutions and become both more innovative and creative in fitting products to their own needs. In addition, it allows users to critically understand what is necessary and superficial around them.

DESIGN STATEMENT

Thesis statement

Deign For Disassembly

To accomplish that product has disassembly DNA, designers and manufacturers will both have to play very essential roles. Designers will have to not only take a lead to guide the end-users on how to easily assembly and disassembly via design language of product-self, but also have to cooperate with manufacturers to contribute the appropriate materials and mechanics to decrease the chasm of misgiving and unknowing about materials affects the value of products. In addition, enable end-users to have a better understanding of the source their products, its formation as well as the maintenance of their products.

- For designers can implant disassembly DNA in ideation.
- For manufacturers can use recycled plastic body parts to make components requiring lesser mechanical and aesthetic properties.
- For end-users, products can be taken apart separately for easy repairing and recycling

To help increase product life-cycle, build -It- Yourself Kits can be combined In the product-process to establish product reliability and understanding for users.

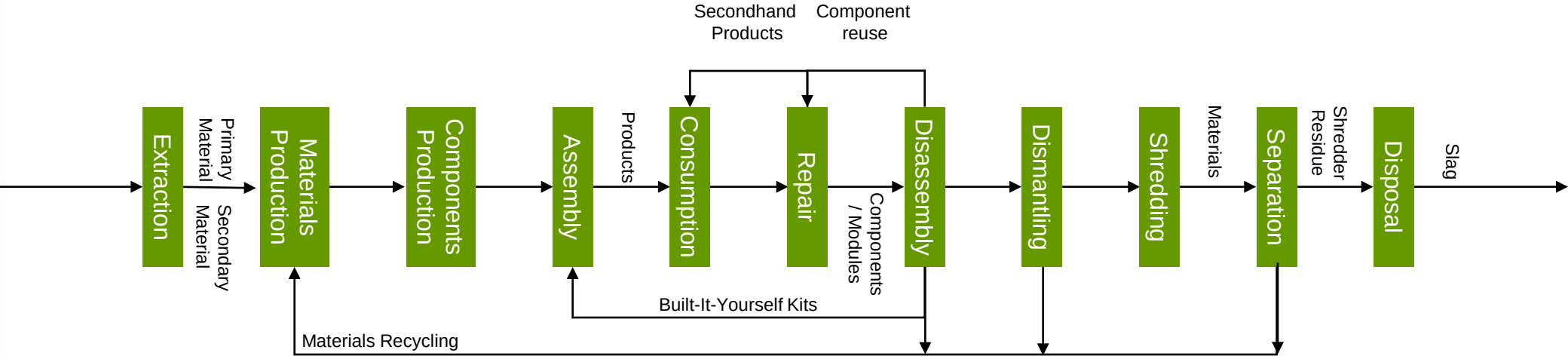


Image 9.

Product-Process Chain Of A Complex Product

DESIGN STATEMENT

Thesis statement

Deign For Disassembly

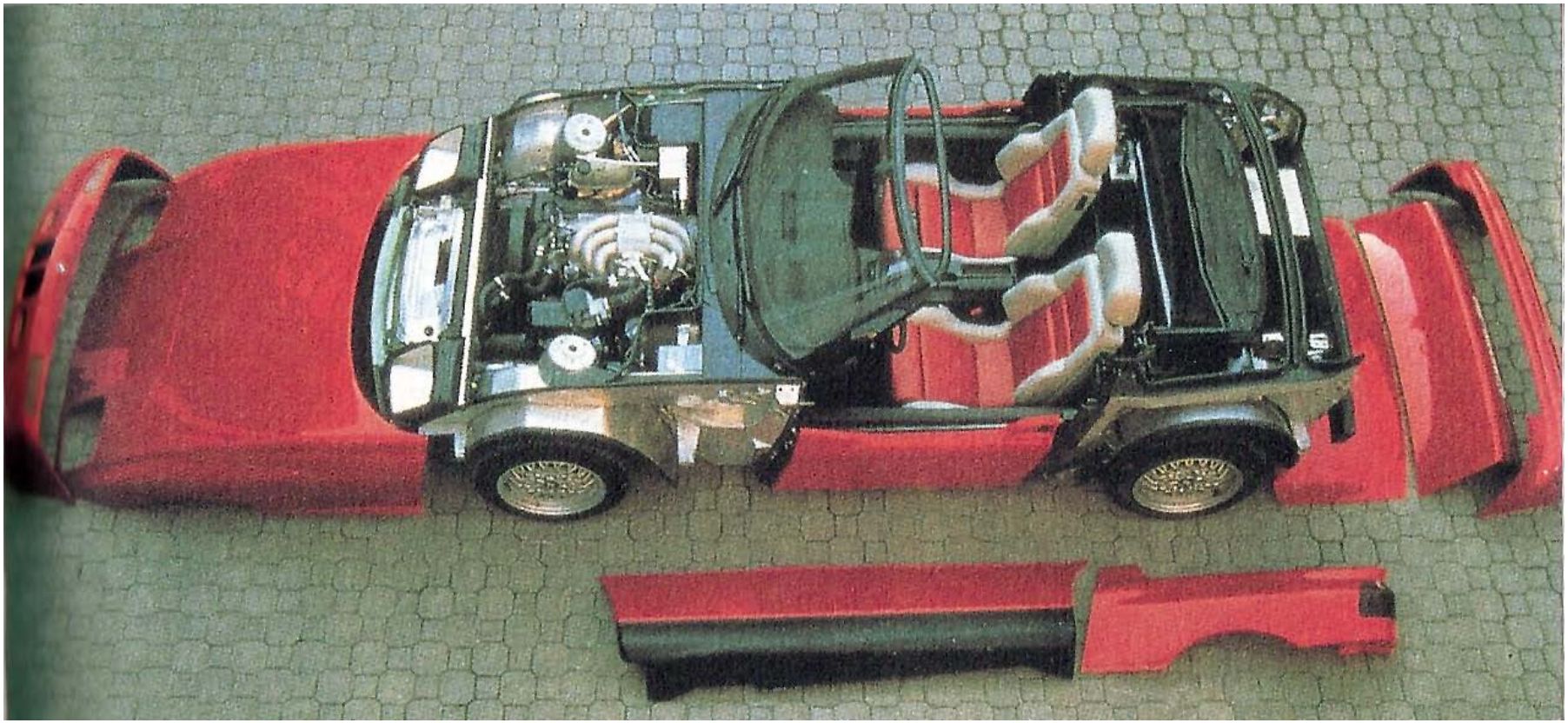


Image 10. BMW Z-I is easy to take apart for repair and for recycling.

DESIGN RESEARCH
Marketing review and analysis

For many years now, most cities in Europe have been converting into a people-oriented, rather than car-oriented zone. Their dedication to develop a people friendly environment began with the implementation of the city bike program. In Copenhagen, 34% of its residents commute by bikes to work, while 58% of its residents consistently bike daily. There are over a million bikes shuttling through the city every day. According to statistics by the government, almost every resident owns at least one bike. The popularity of bike usage can be traced back to the government's efforts as well as investments. The annual transportation budget for bicycle traffic planning is equal in amount as mass transportation system budget in Copenhagen. No wonder in Copenhagen alone there is about 300 miles of bicycle lanes. These miles keep increasing every year. Copenhagen offers 1300 free city bikes for its residents and tourists to use from 125 different locations. For riders' safety, the layout of the bike lanes has been carefully illustrated for easy legibility. Bicycle lanes are set among pedestrian pavements and stalls. The lanes are design to provide protection for the riders as well as to avoid heavy traffic and intimidation.

Image 11. Denmark city bike

Image 12. Copenhagen cyclists

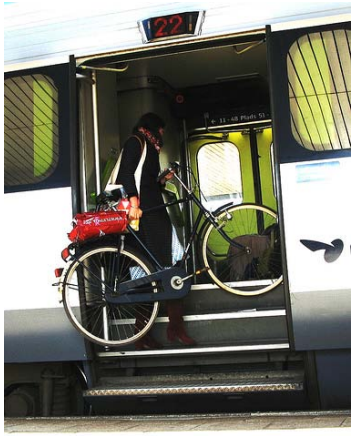


Image 13.

In addition to the riders safety is the consideration of their convenience. To increase the use of bike riding in the city, the government has built parking spots near train and subway stations. The provision of this amenity has made it possible for riders travelling long distances to have the convenience of parking and continuing their journey by mass transit. (image12) Riders also have the convenience of carrying on their bikes onto mass transportation system if the need be.

Here are three cities with years of developed city bike programs. In this chart, one can easily understand each distinguishing design feature between them.

City bike program	Characteristics
France, Lyon 	The RFID technology is embedded in the program, users can use RFID-enabled prepaid cards to rent bicycles. RFID is also used to track stolen or lost bicycles to be brought back to rental locations. Each bike is equipped with its own microchip card. The microchip card is capable of diagnosing and displaying maintenance records to insure proper conditioning and safety of the bike each time it is returned to location.
Denmark, Copenhagen 	The bikes are designed for utility and durability, not speed. The tires are solid rubber so one need not worry about getting flat. The seat is comfortable and height can be adjusted to fit any rider. Each component of the City Bike is designed only to be taken apart with custom tools solely by the company it belongs to.
Finland, Helsinki 	The Helsinki city bike concept was transplanted from Denmark. The difference from the Danish city bike is that once the bike is removed from its rack, the head and back lights will automatically turn on for rider's safety.

Image 14. city bike program comparison chart

Image 1.

Image 15.

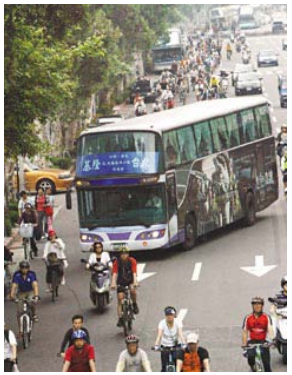


Image16.

Poor traffic configuration causes the death

It is not always easy to enjoy cycling in Taiwan. In 2008 alone, one thousand thirty-three Taiwanese died due to bicycle related accidents. Sixty percent of which were the elderly. Probing the causes, the elderly mostly wear dull clothes and prefer riding their bikes early part of the morning when the weather is nice and cool. Lack of reflective attire makes them vulnerable to getting hit by passing cars. These bike accidents could be prevented by reconfiguring traffic or creating bike lanes on all major routes.

In image1, this person is waiting to cross the road with no traffic sign to assist. In image 2 and 3 the cyclists have to watch out for the taxi and bus run into their paths leaving them no other options. These dangerous situations pose threat to cyclists.

Image 17.

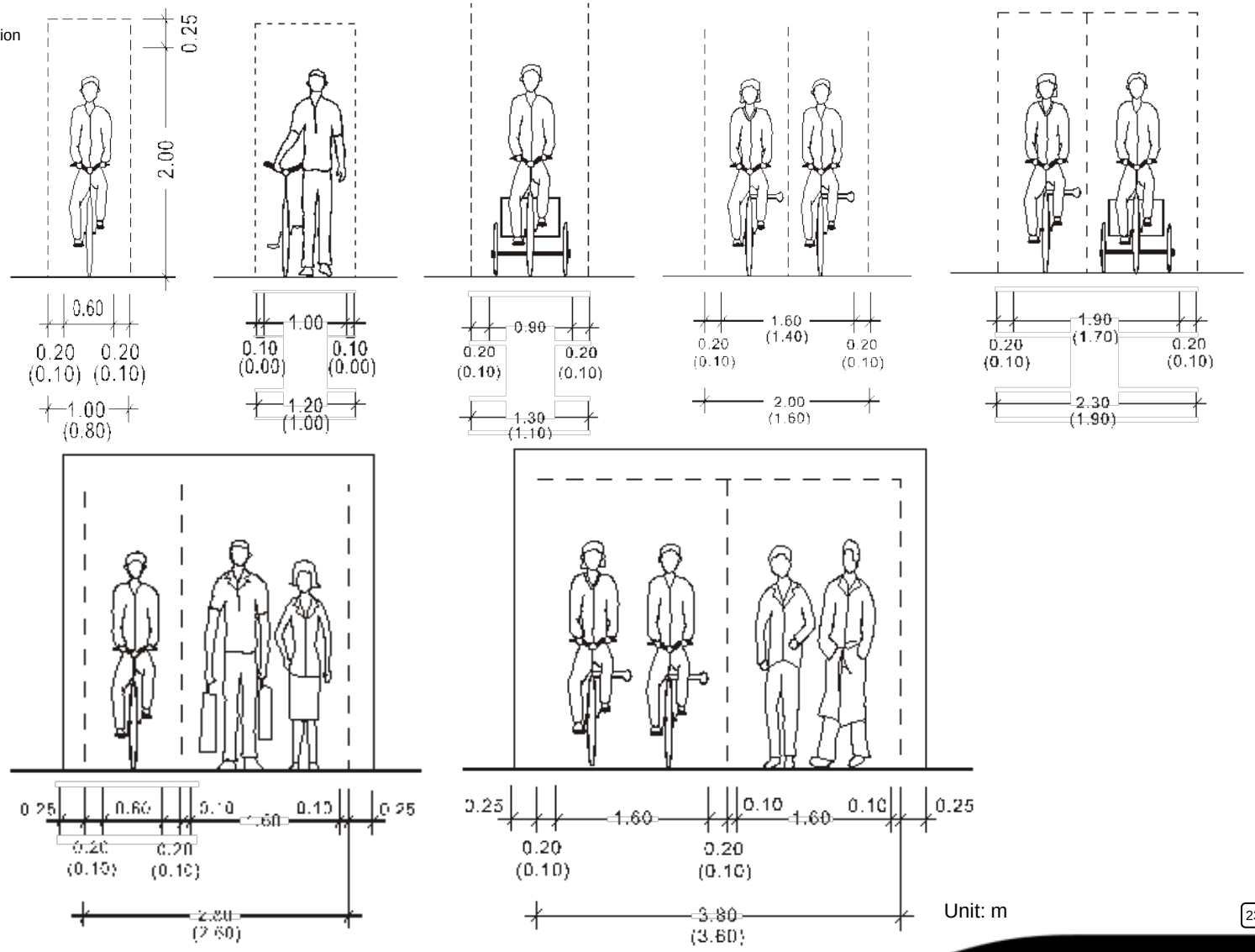
Look into the bike-right

It is not fair for Taiwanese cyclists who pay taxes to not have equal right on the road. Cyclists should be respected more than ever in this era. Unlike other transportations systems, Cyclists travel with zero pollution and burn nothing but human power to protect our environment. To enhance the quality of cycling, the government must institute a new law to have dedicated bike lanes established on every new route in the future. They can use Copenhagen as a model to put in places an effective bike lane system. (Image 4)

Secondly, existing routes can be improved and updated to be cyclist-friendly. Bike lanes can be planned to be at least 24 inches wide at places with restricted space (example pavements) and 79 inches on wider roads. Integration of special bicycle traffic sign systems will help with the distribution of equal amount time share of intersections as well as prevent unnecessary accidents. By having these advantages and implementing them steadily across all cycling infrastructures, I believe a time will come that the residents will be willing to use bicycles as a major source of transportation.

DESIGN RESEARCH
Environment research and analysis

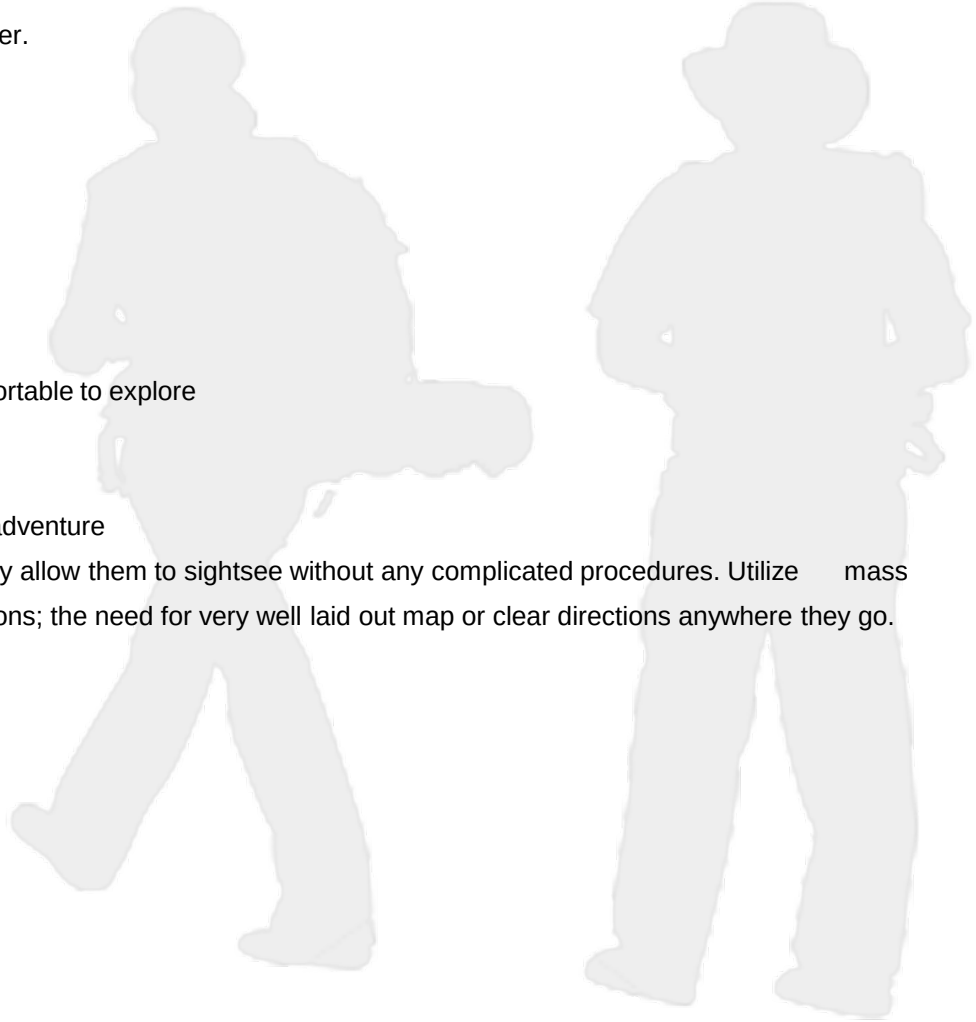
Image 18.
the standards of the bicycle lane construction which varies with different situations.



Unit: m

To have a better understanding on what users' may need while experiencing the city bike program. I made up four categories of user scenario to find out potential issues to enable me to have norms in design ideation later.

A Couple Of American Tourists



- **Name:** Chris (26), Sara (24)
- **Sex:** male and female
- **Ethnic background:** American
- **Economic status:** no restriction
- **Experience with my subject:** With the city bike, they will feel comfortable to explore
- **School Experience, their reading level:** graduate student
- **Geographic location:** no restriction
- **Interests and hobbies:** Both of them loving outdoor life and full of adventure
- **Their needs and requirements:** They need transportation to handily allow them to sightsee without any complicated procedures. Utilize mass transportation to reach their locations; the need for very well laid out map or clear directions anywhere they go.

DESIGN RESEARCH

User Scenario

A Couple Of American Tourists: One day trip scenario

Schedule	Potential Design issues
They check into a downtown hotel in the morning in Taipei city	
After taking some rest, they prepare to explore Taipei city.	What kind of stuffs do they bring with them?
The counter gives them information about city bike program, and they head bike rental station just few blocks away from hotel then.	
Via the clear description of rental machine, they paid rental fee using credit card, and kept the receipt to get the rental fee back after they return the bikes. They also get Taipei city maps for cyclist.	1. Could the receipt be one part of design for bike lock? 2. After they paid for rental, the clerk open the rack locker in the arcade by computer system
Moving the bikes out of rack	Bike Rack design
Begin to explore using city bike	1. Where to install the map on the bike. 2. They need a place to stow their belongings. 3. Cross body Bag and hand bag are not safe bags to take around while riding a bike (may cause a robbery)
They ride to National Palace Museum about 50 mins away from their hotel. During the 50 mins cycling to the museum, they get some ideas about Taipei and the life style of the people.	1.The bicycle lane design 2.Graphic Design for traffic cycling sign
They arrive in National Palace Museum, and lock the city bikes with the bike rack in the parking lot.	To prevent the loss of lockers, such as traditional lockers, the locker could be part of city bike design.
After finishing the visit, they ride to the next spot to eat.	
After eating, they decide to go back the Hotel by MRT, but there are still several blocks away for the Hotel. Thus, they take the bikes with them to MRT.	1. Apply light-weight materials for carrying 2. Is collapsible function important for city bike?
They return the bikes and get the money back following out of MRT	what if there has no space in the rack

Office Worker

- **Name:** Zu-Pin Wang
- **Age:** 30
- **Sex:** male
- **Ethnic background:** Taiwan
- **Economic status:** no restriction
- **Experience with my subject:** Because of heavy workload, he does not have enough time to exercise in the gym. Via the city bike program, he actually can get some exercise did by cycling during lunch, dinner or when out of the office for business.
- **School Experience, their reading level:** Bachelor
- **Geographic location:** no restriction
- **Interests and hobbies:** Workaholic
- **Their needs and requirements:** When he uses the bike for business, he needs a storage to put his briefcase or belongings, more over, he doesn't want the grease from the bike chain squirting on his expensive pants .

DESIGN RESEARCH

User Scenario

Office Worker: Lunch time

Schedule	Potential Design issues
He walks 3 mins to the bike rental station	During a lunch time, how can he get the bike sooner? Friendly rental system.
He got the bike and heads to a new location 10 mins away form company	
He arrives at the new location which is a small street and does not have any bike rack here.	There are too many people on the street. Is it safe to lock the bike without a rack? Or the bike is collapsible and small enough to bring into the restaurant
After finishing the lunch, he has to pack four lunch boxes for his colleagues.	How can he put the lunch boxes in the bike? Is it safe just hanging it on the bike?
He goes back to the bike rental station and returns the bike, also bought some soft drinks form bike rental station.	Could Bike rental station be a public café or shop for people to relax?

Housewife

- **Name:** Su-O Lee
- **Age:** 55
- **Sex:** Female
- **Ethnic background:** Taiwan
- **Economic status:** no restriction
- **Experience with my subject:** With the free bike, she will fell good to utilize it as much as she can. Because of globe warming, she also will fell good that she is contributing to the reduction of air pollution.
- **School Experience, their reading level:** Junior High
- **Geographic location:** no restriction
- **Interests and hobbies:** Gossip, shopping grocery and play Tachi Quan
- **Their needs and requirements:** she is an economical house wife, she would like to save money on gas and buy more family needs. However, if the way she saved causes inconvenience, she would like to spend money to make her life easier.

DESIGN RESEARCH

User Scenario

Housewife: Shopping trip

Schedule	Potential Design issues
She walks 2 mins to bike rental station	
She rents the bike using her cell phone	The system is already well developed in Japan, can it happen in Taiwan?
She plans to go to her friend's apt first, to chat for a while.	Basically, according to the configuration of urban city buildings in Taiwan, there are a lot of narrow streets between two buildings, usually just allow one car fitting in. therefore, how can she park the bike safely? Or can she just carry it up to her friend's apt.
Then, she goes to the mall to buy groceries	Can the bike be used like a shopping cart?
She buys a lot of groceries and heads back to her home.	Do many groceries cause unbalance while riding the bike? Can the bike transform to a tricycle to have a box to stow?
She thinks that she want to keep the bike for tomorrow without return it back.	Is there any penalty for this behavior ? Or to her convenience, she can sign up a contract for renting bike for days, months or even for a year.

Junior School Student

- Name: Cheng-Yang Lai

- Age: 15

- Sex: Male

- Ethnic background: Taiwan

- Economic status: no restriction

-**Experience with my subject:** via the bike storage design, he can get enough space to pack his heavy belongings without carrying them by himself. Without causing stress on his body.

-**School Experience, their reading level:** Junior High

- Geographic location: no restriction

- Interests and hobbies: playing video game

- Their needs and requirements: Lai need that the bike is adjustable and has big storage without carrying his belongings by himself; in addition, he wants to have some fun while riding his bike.

DESIGN RESEARCH

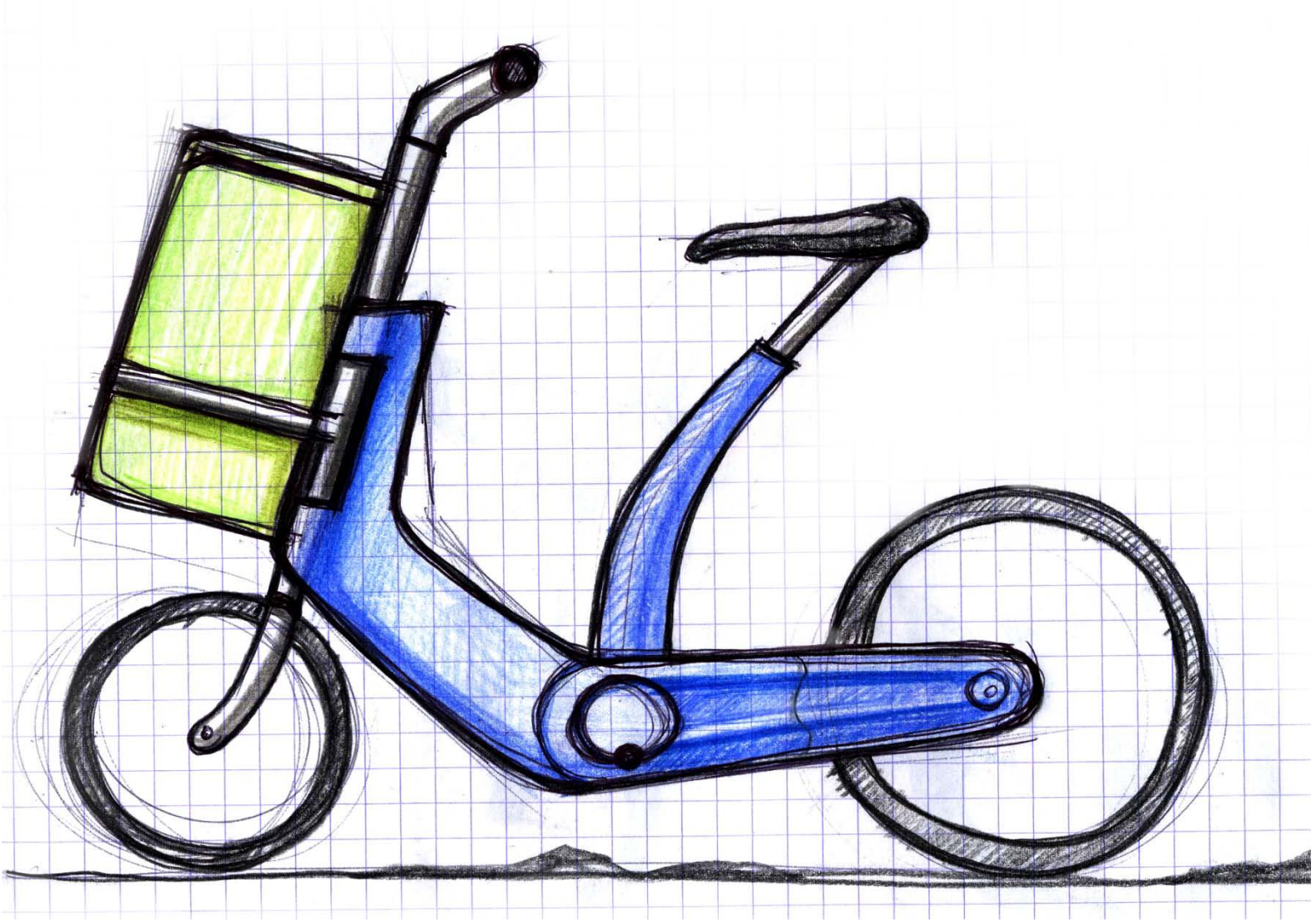
User Scenario

Junior High School Student: Going to school

Schedule	Potential Design issues
He walks 4 mins to a bike rental station	
He checks out a bike using his ID card and moves the bike out of the rack.	1. Almost of kids don't have credit cards, how could they rent bikes? Student ID? 2. The ergonomics between adults and kids are different, thus the design of bike and rack also has to be considered about kid's ergonomics.
He puts all his belongings into the bike storage, and leaves.	What if the space is not enough, can he put his belongings somewhere securely?
He parks the bike on campus after arrival.	
After his class, it is almost night time, he is heading to his home.	1.Lighting issue 2.the colors of bike covers can be designed much brighter.
He arrived at bike rental station safely and returned the bike back.	Like Lai's example, he belongs to long term customer. Can bike rental station help him to reserve fixed bike everyday?

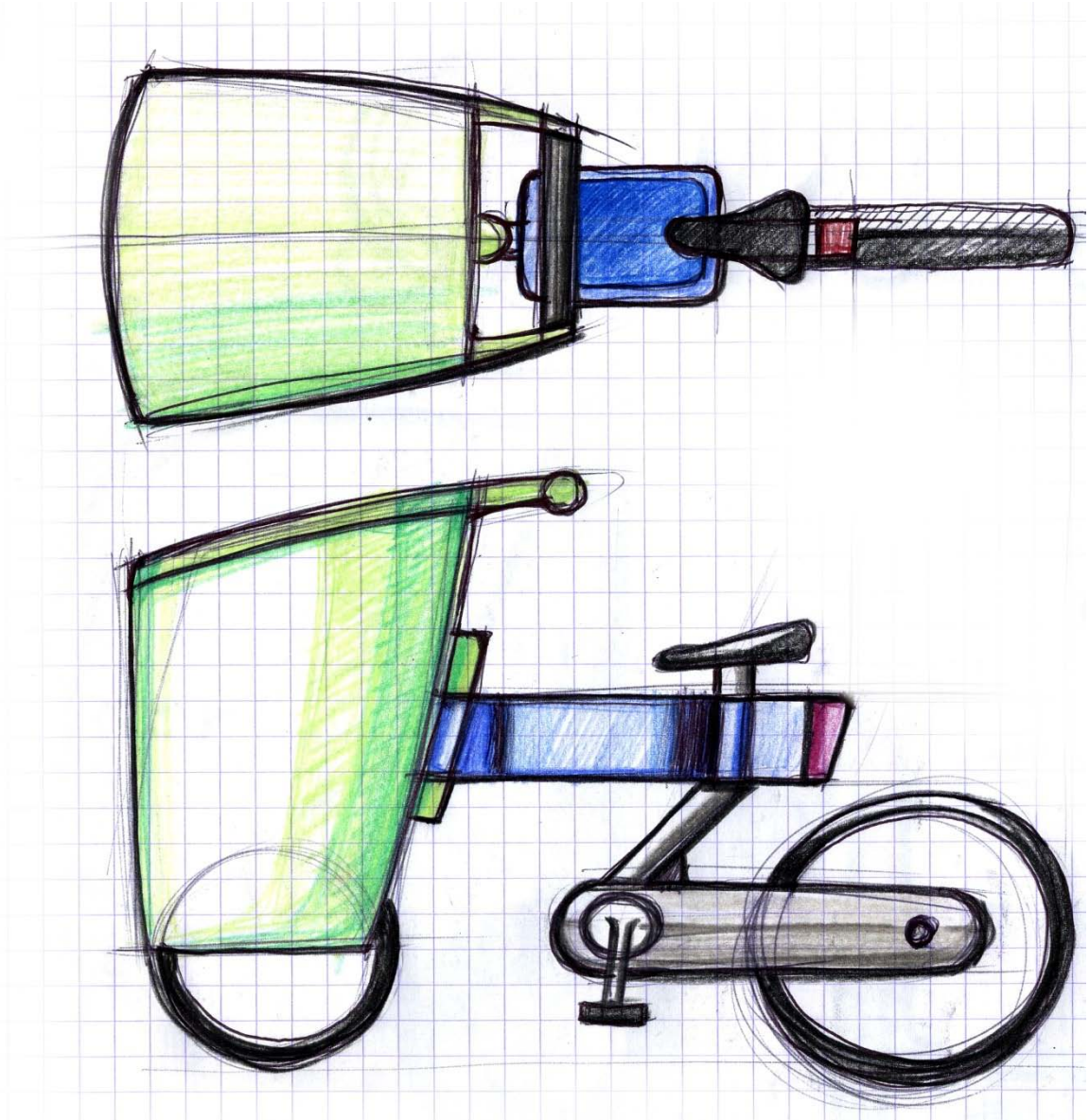
DESIGN PROCESS
Concept Development

Phase: Ideation 1



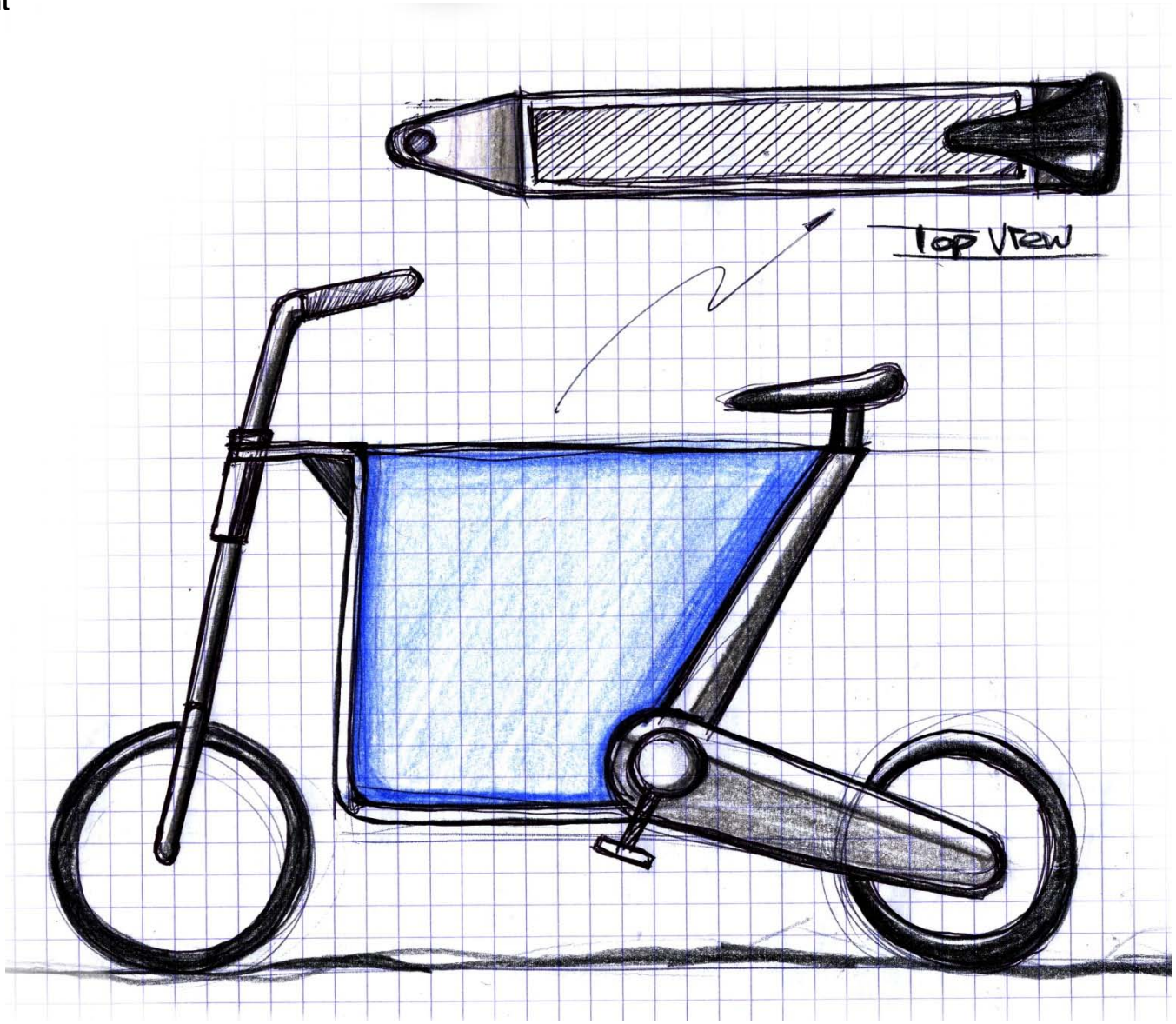
DESIGN PROCESS
Concept Development

Phase: Ideation 1



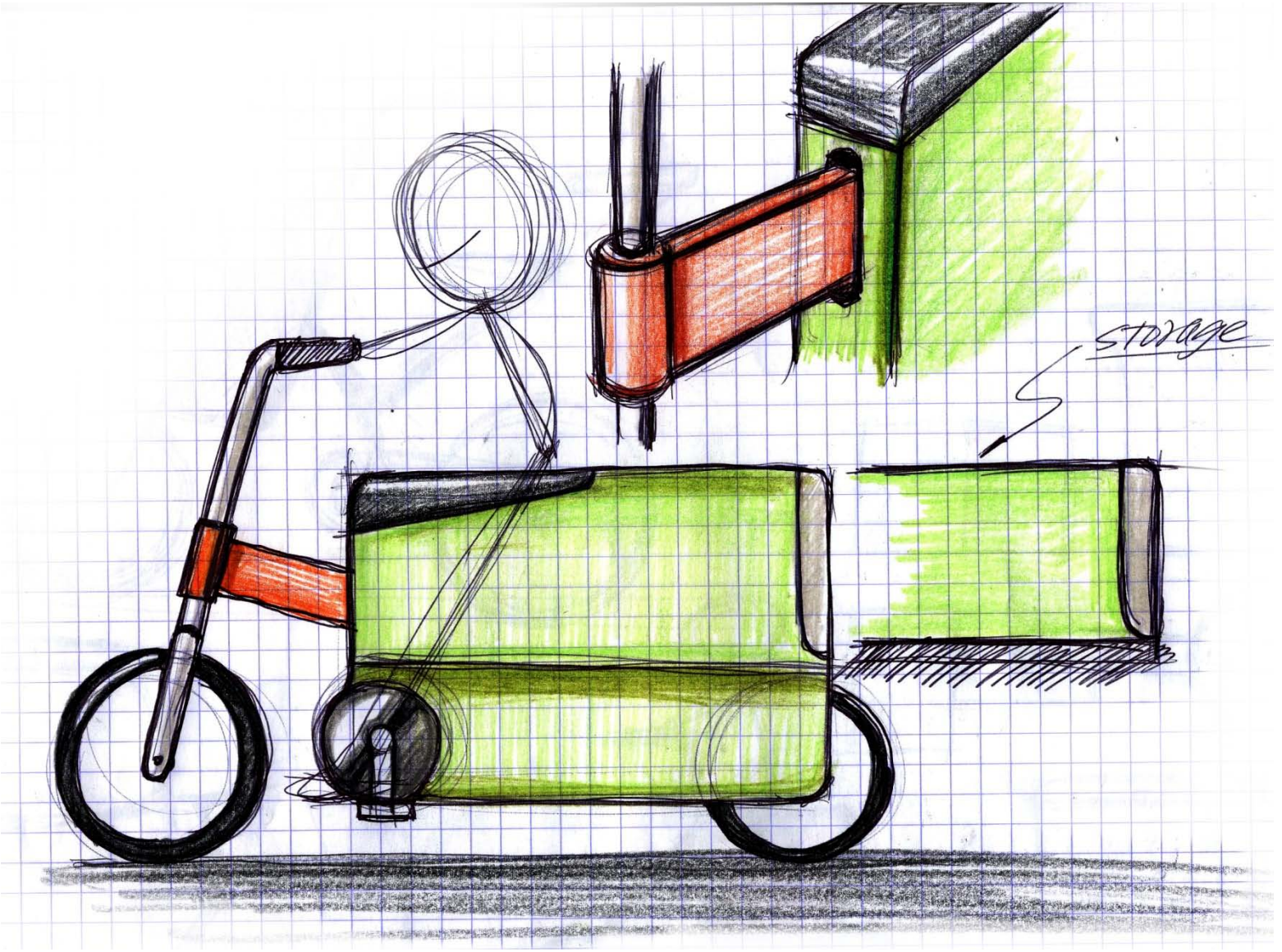
DESIGN PROCESS
Concept Development

Phase: Ideation 1



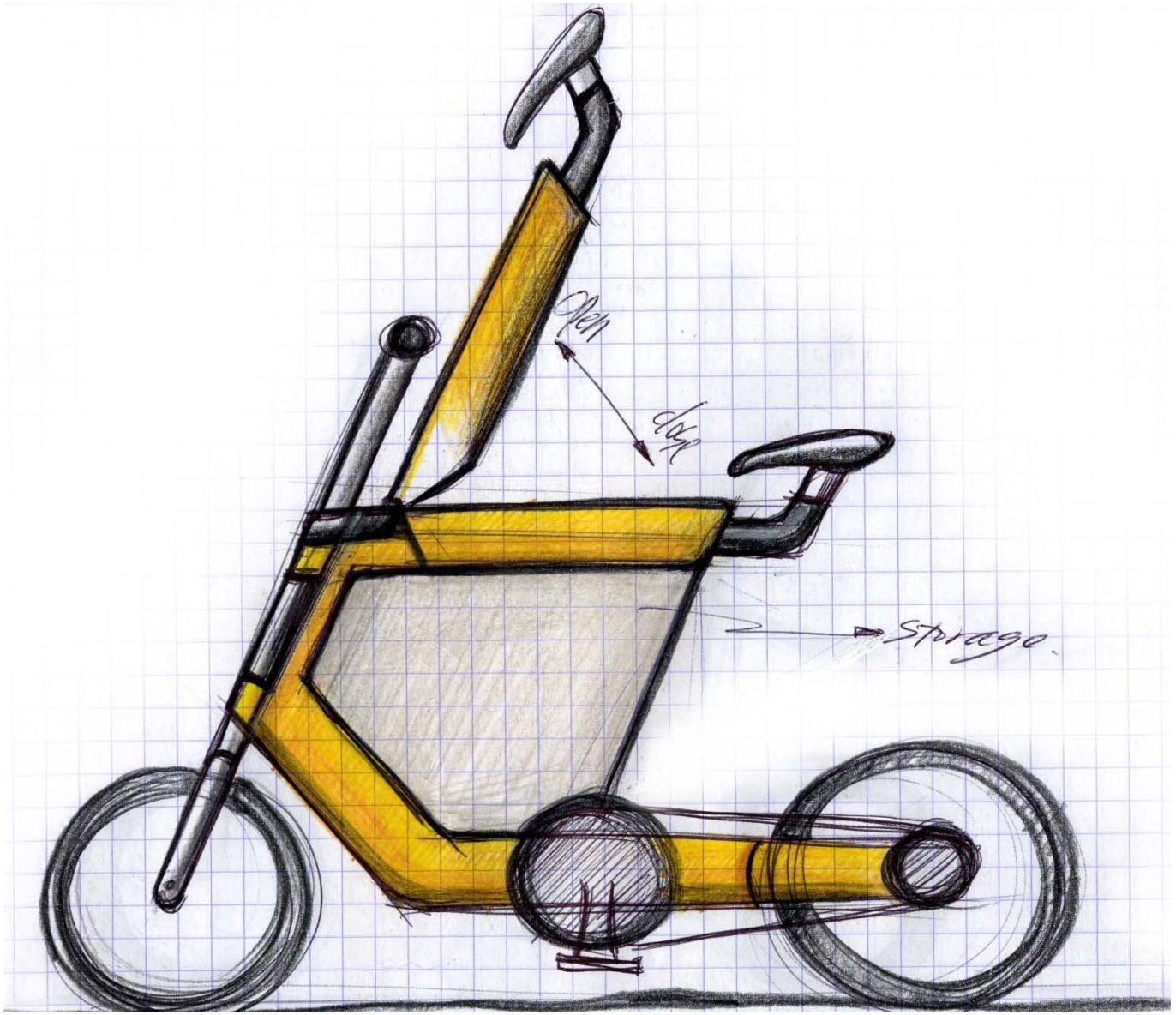
DESIGN PROCESS
Concept Development

Phase: Ideation 1



DESIGN PROCESS
Concept Development

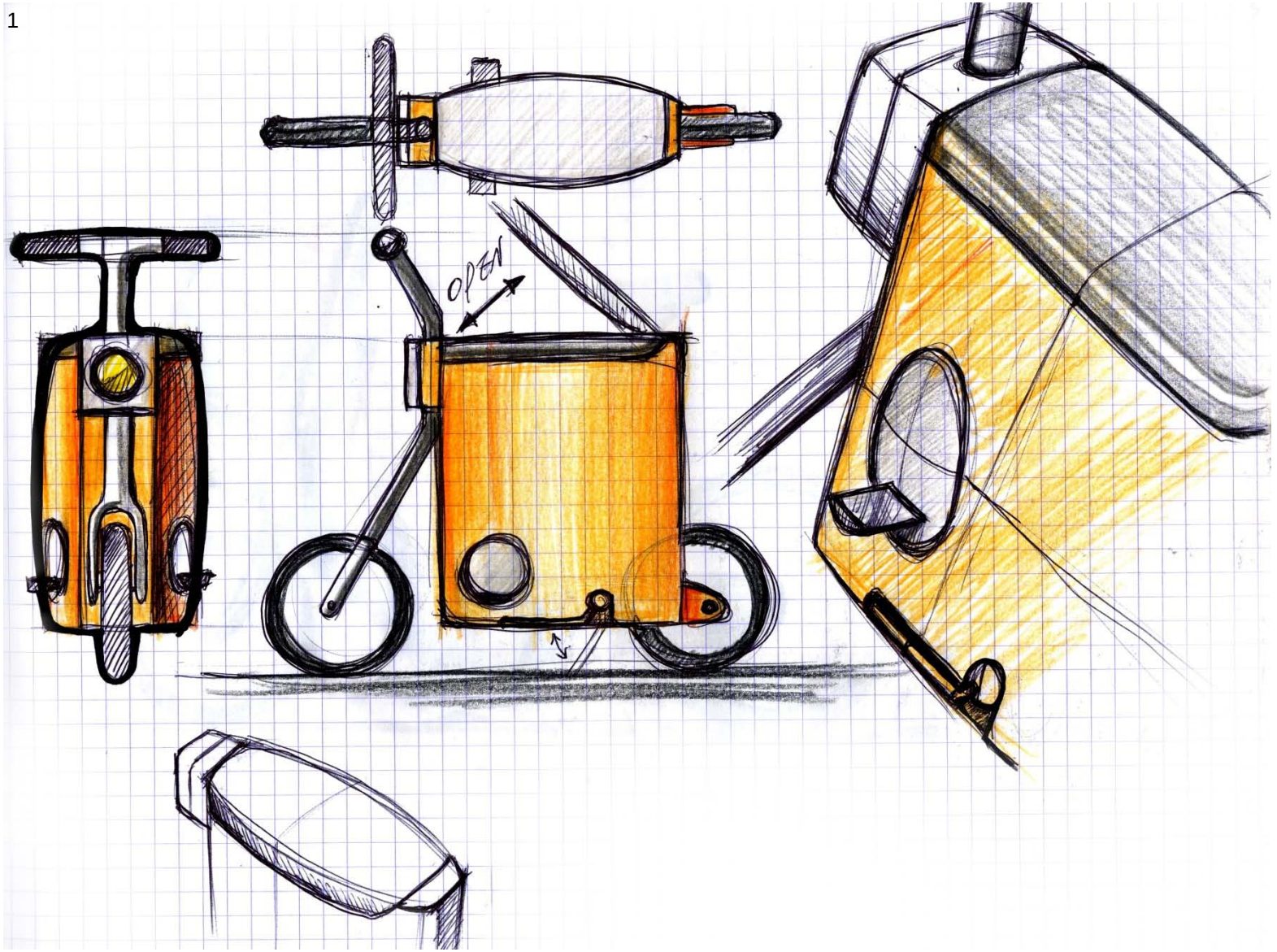
Phase: Ideation 1



DESIGN PROCESS

Concept Development

Phase: Ideation 1

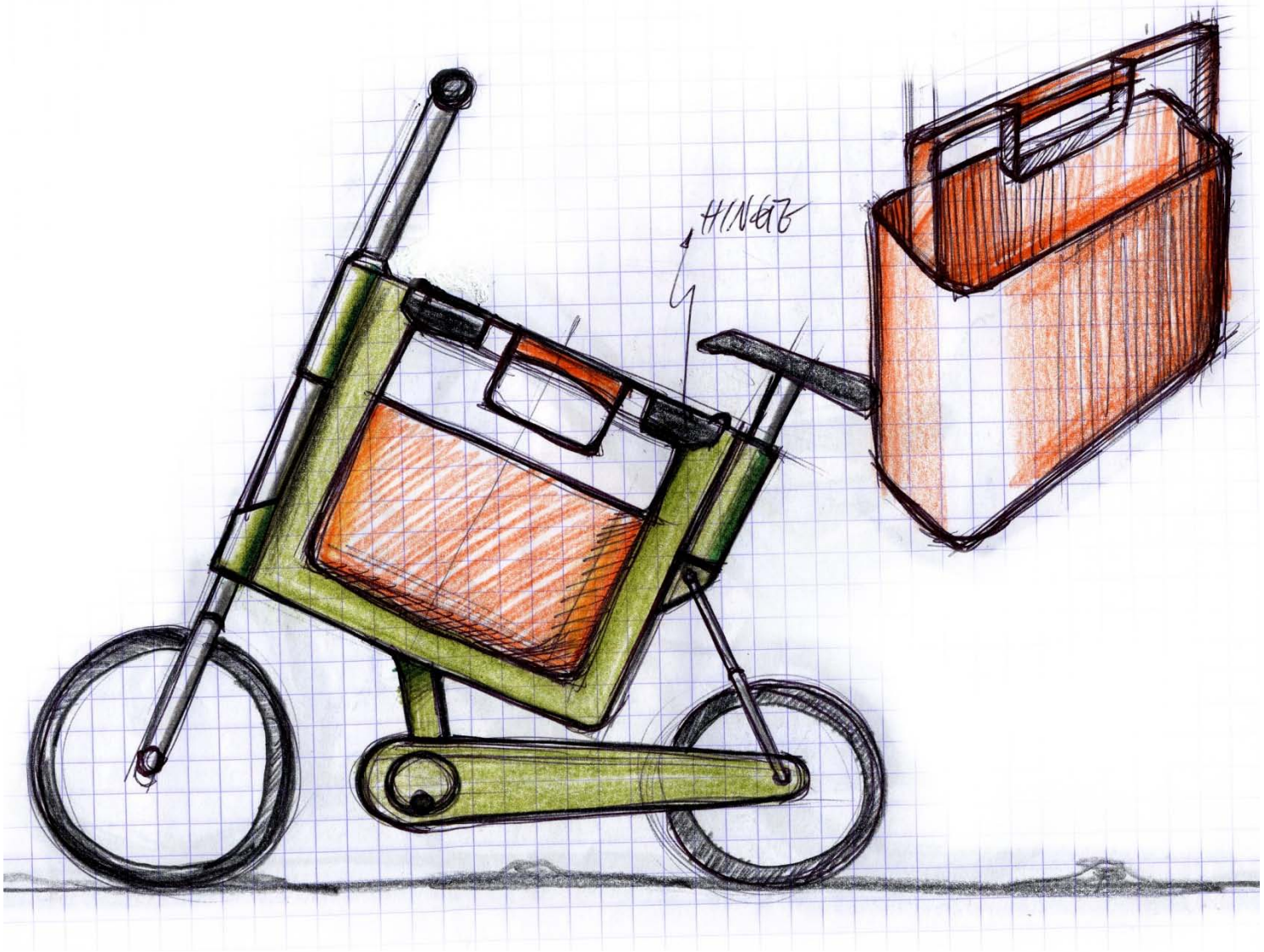


DESIGN PROCESS
Concept Development

Phase: Ideation 1

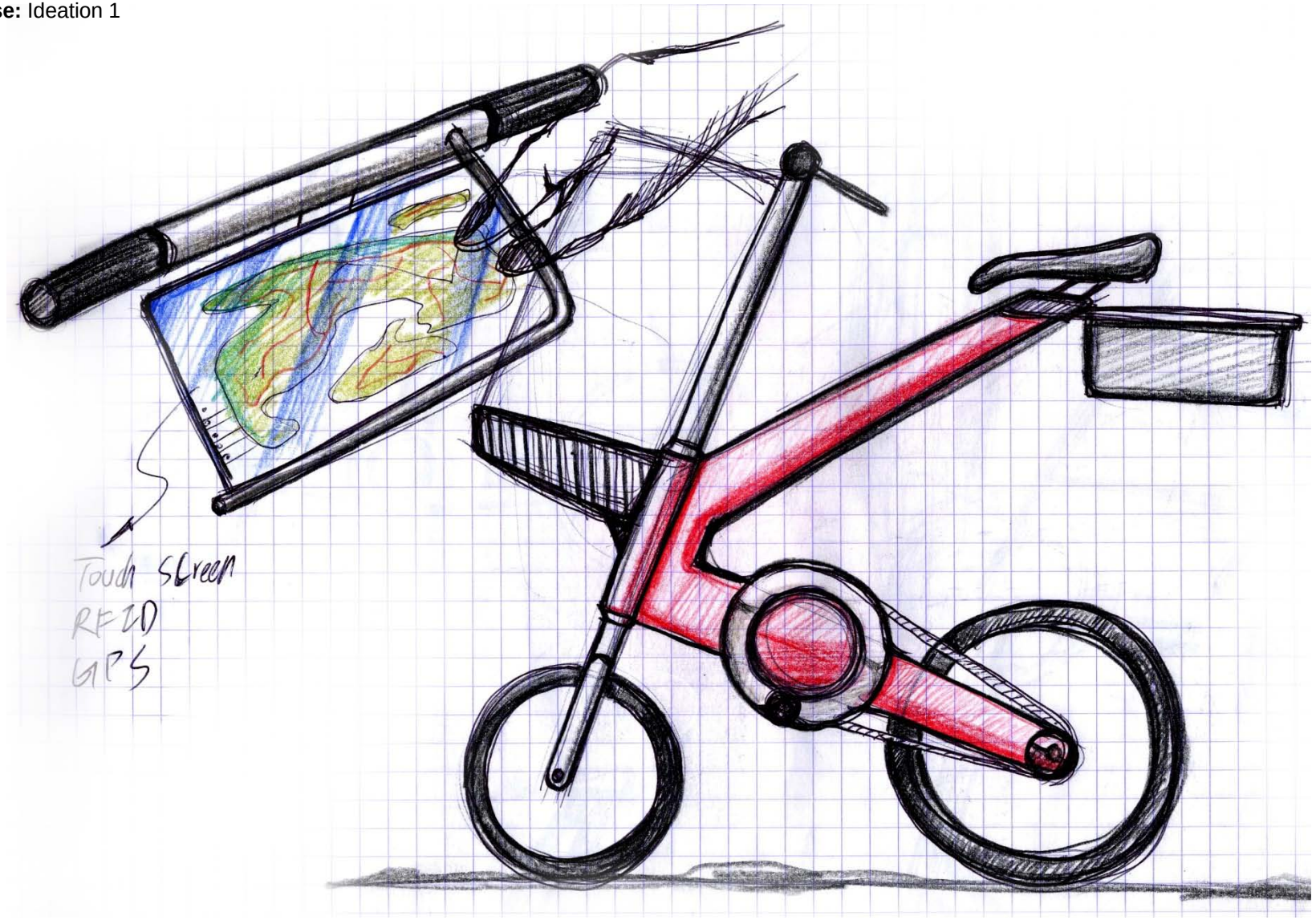
DESIGN PROCESS
Concept Development

Phase: Ideation 1



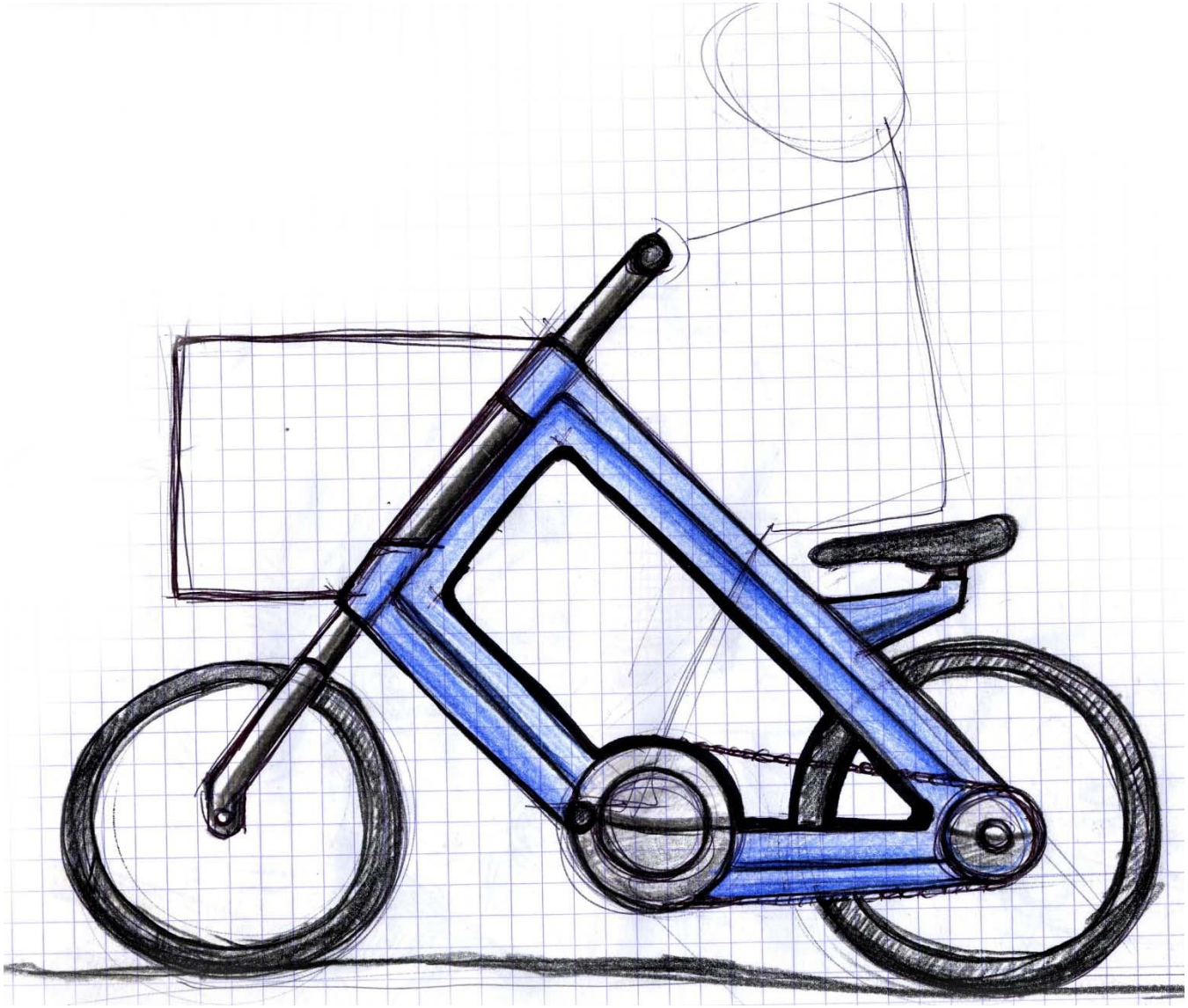
DESIGN PROCESS
Concept Development

Phase: Ideation 1



DESIGN PROCESS
Concept Development

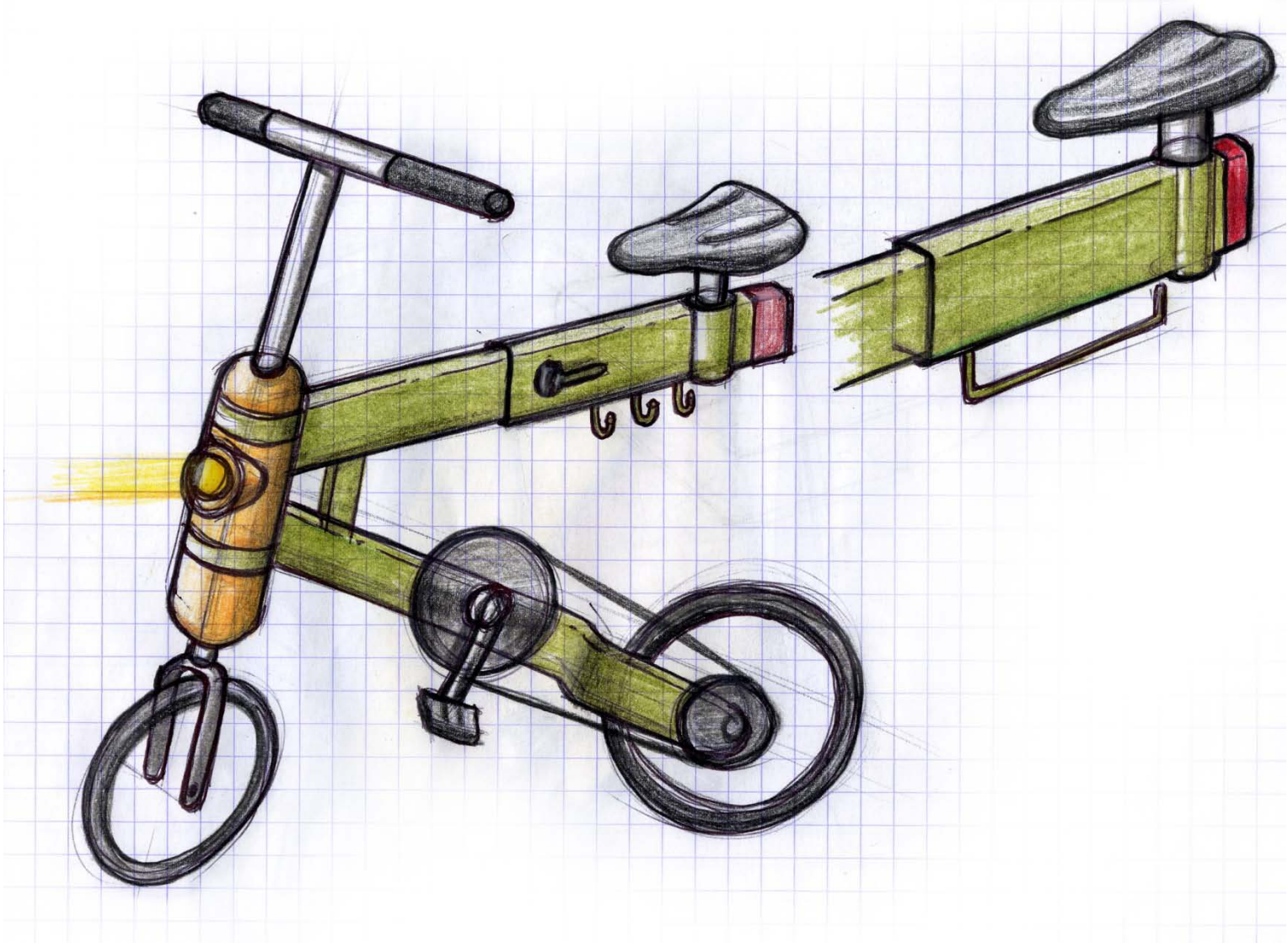
Phase: Ideation 1



DESIGN PROCESS

Concept Development

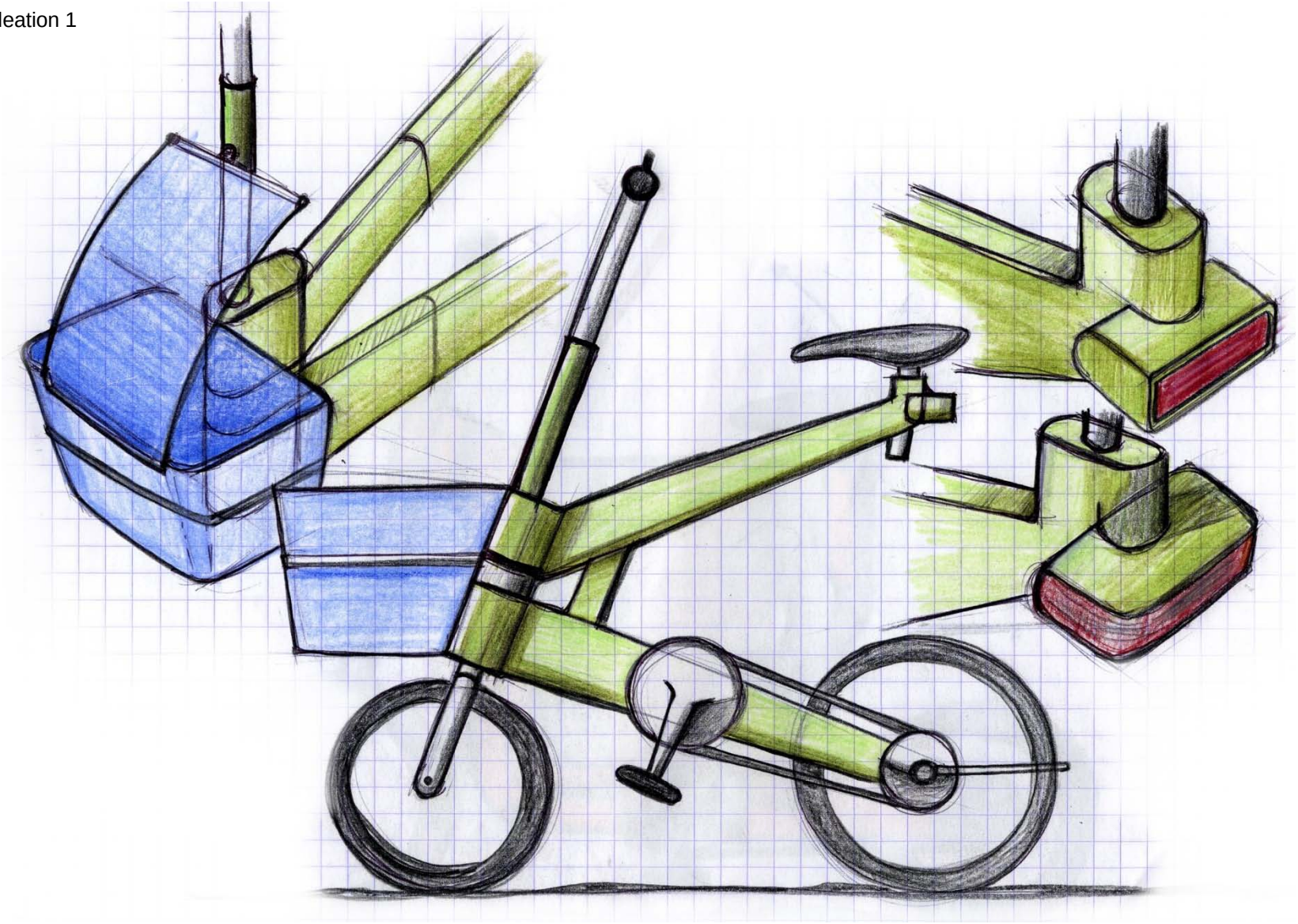
Phase: Ideation 1



DESIGN PROCESS

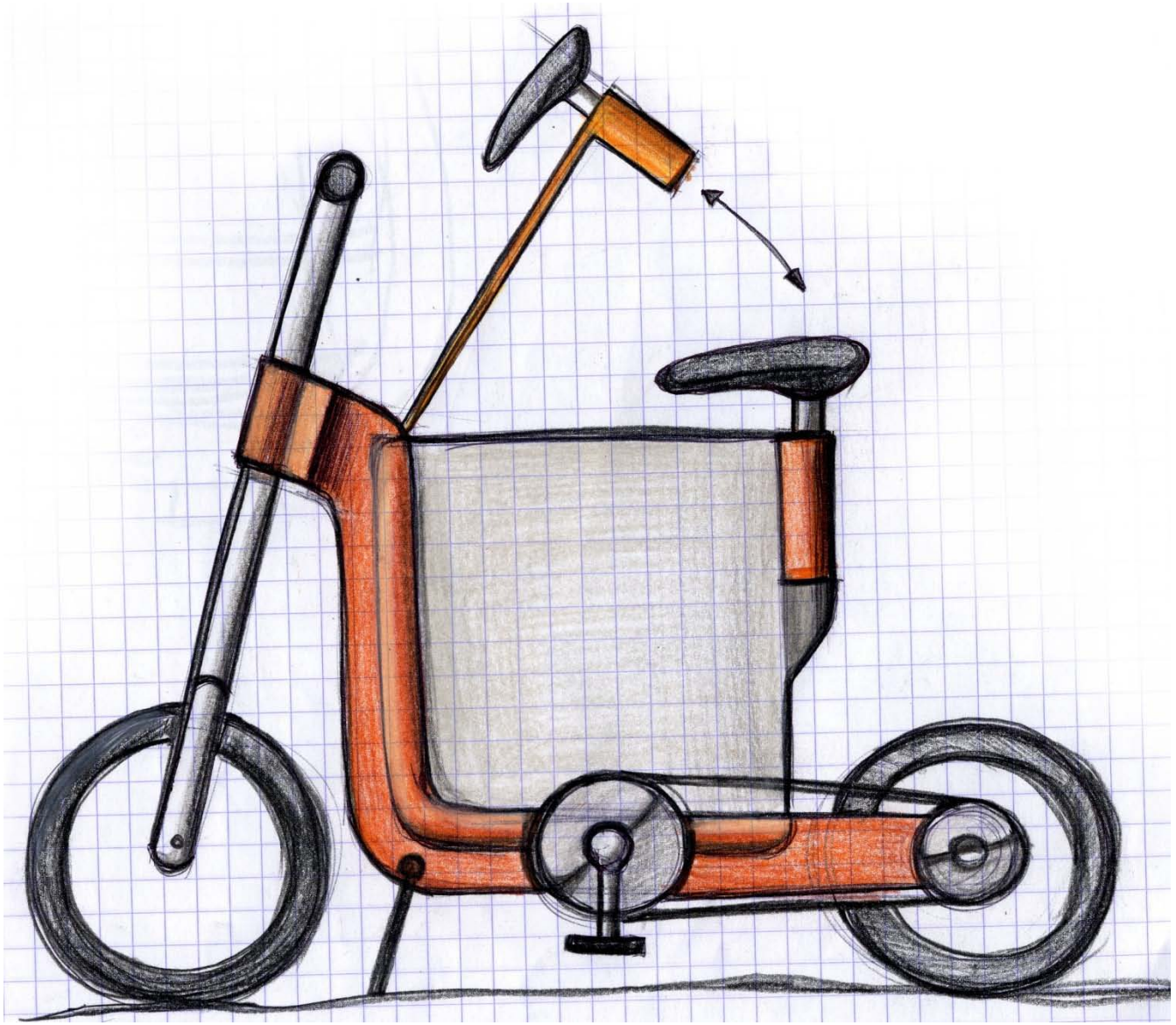
Concept Development

Phase: Ideation 1



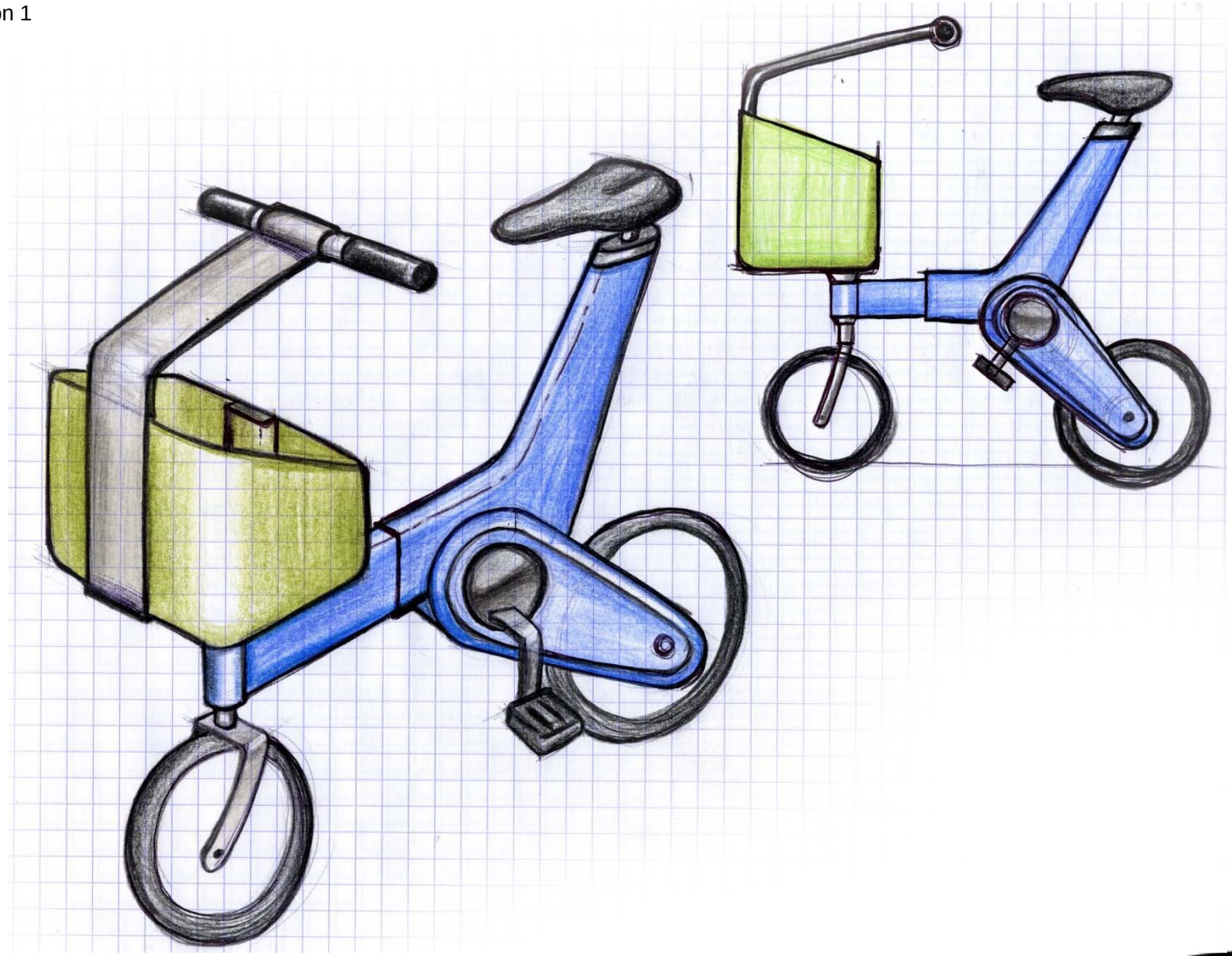
DESIGN PROCESS
Concept Development

Phase: Ideation 1



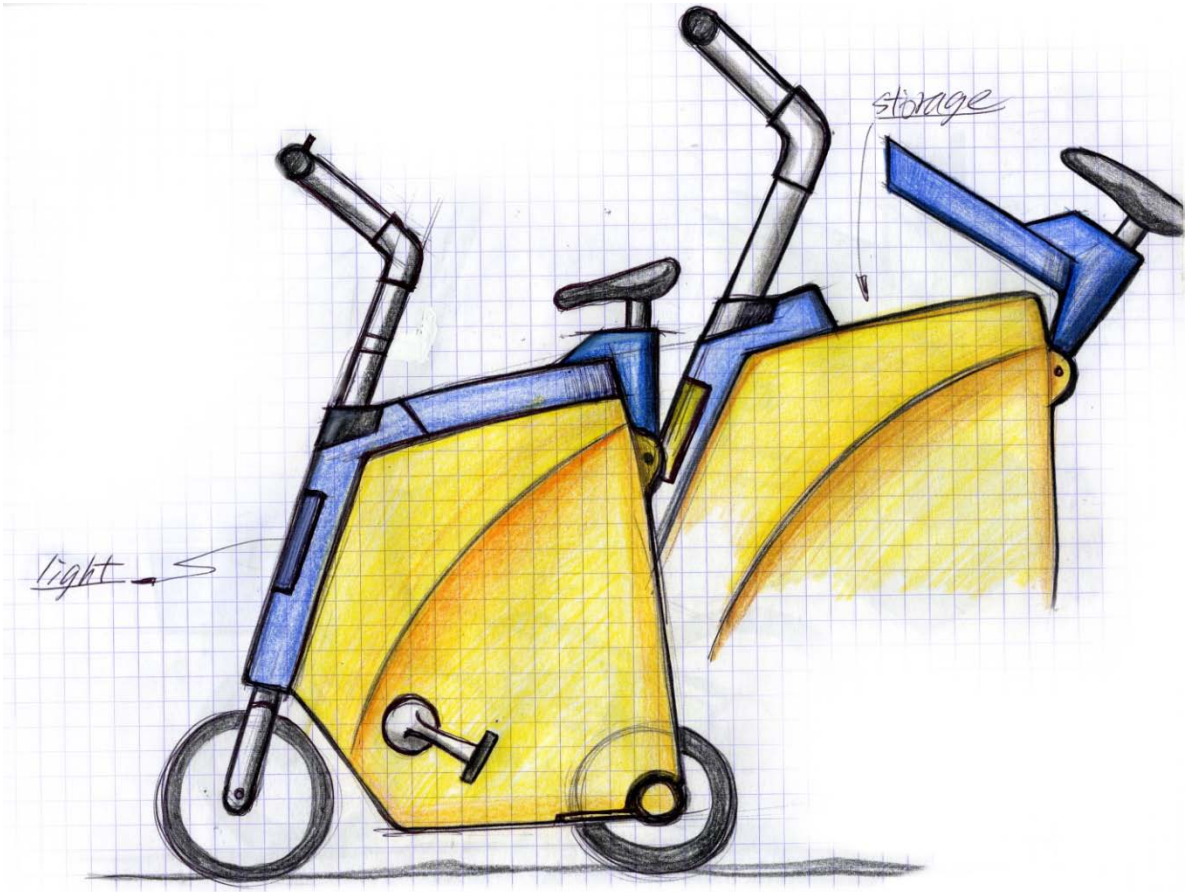
DESIGN PROCESS
Concept Development

Phase: Ideation 1



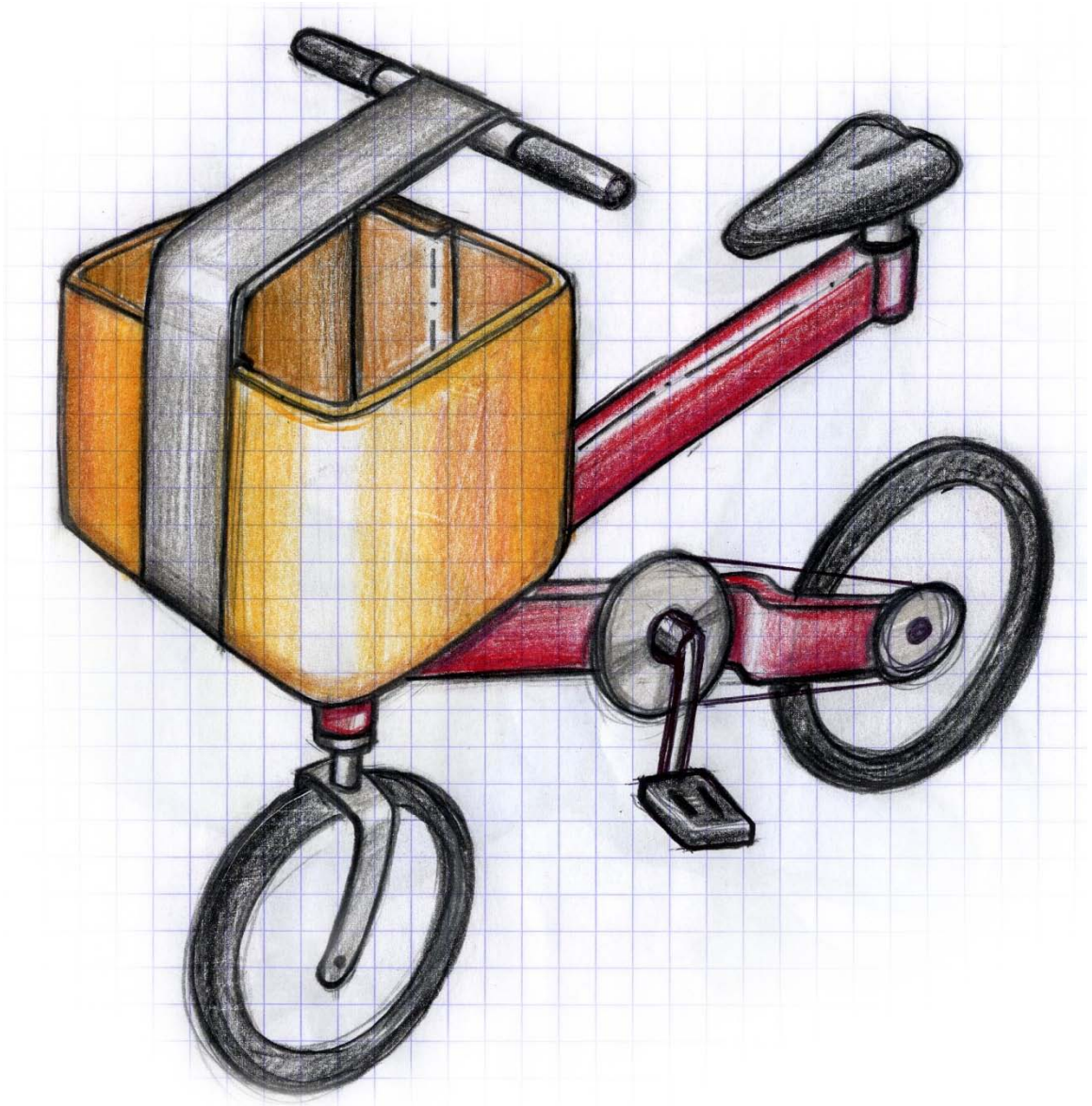
DESIGN PROCESS
Concept Development

Phase: Ideation 1



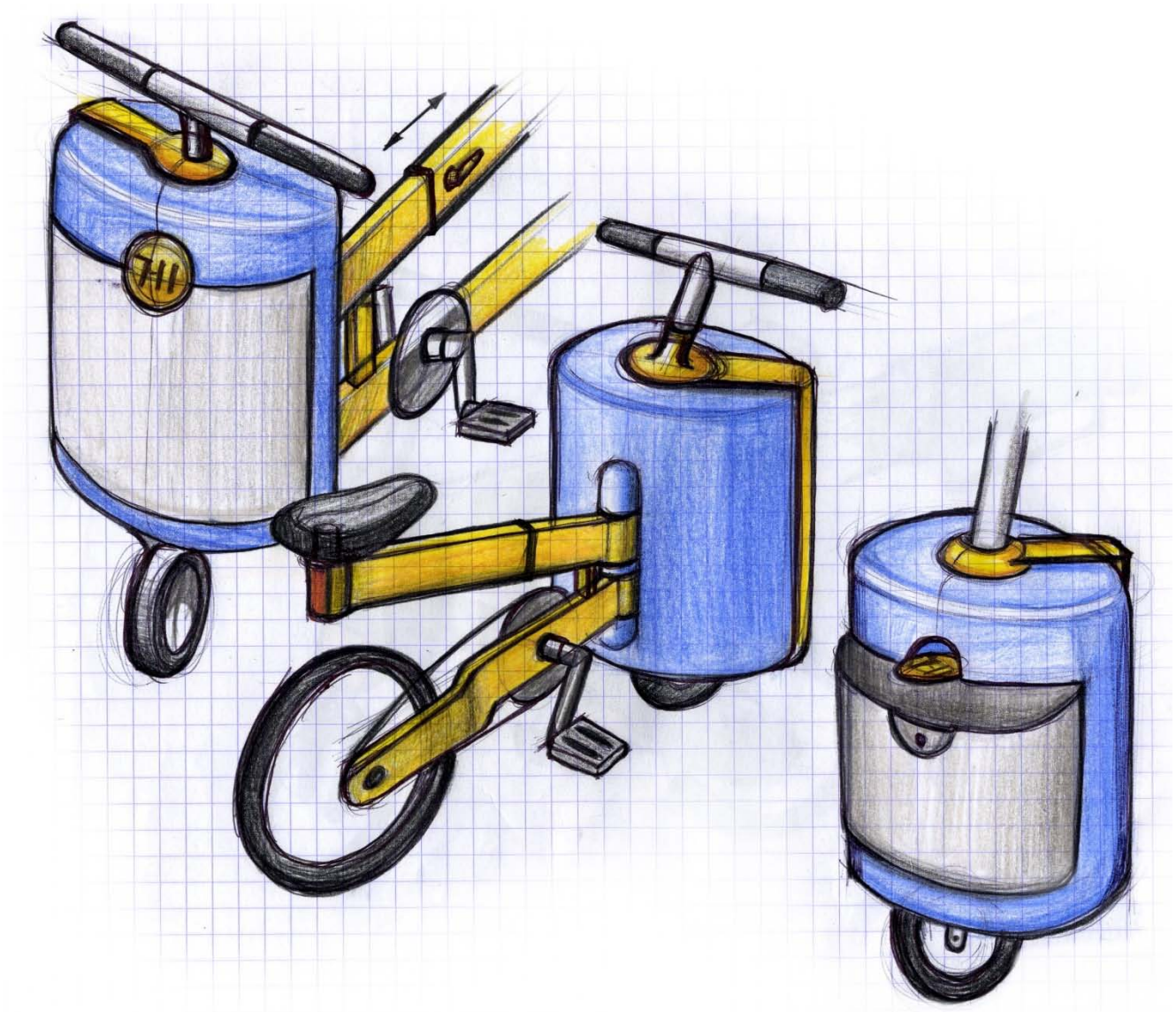
DESIGN PROCESS
Concept Development

Phase: Ideation 1



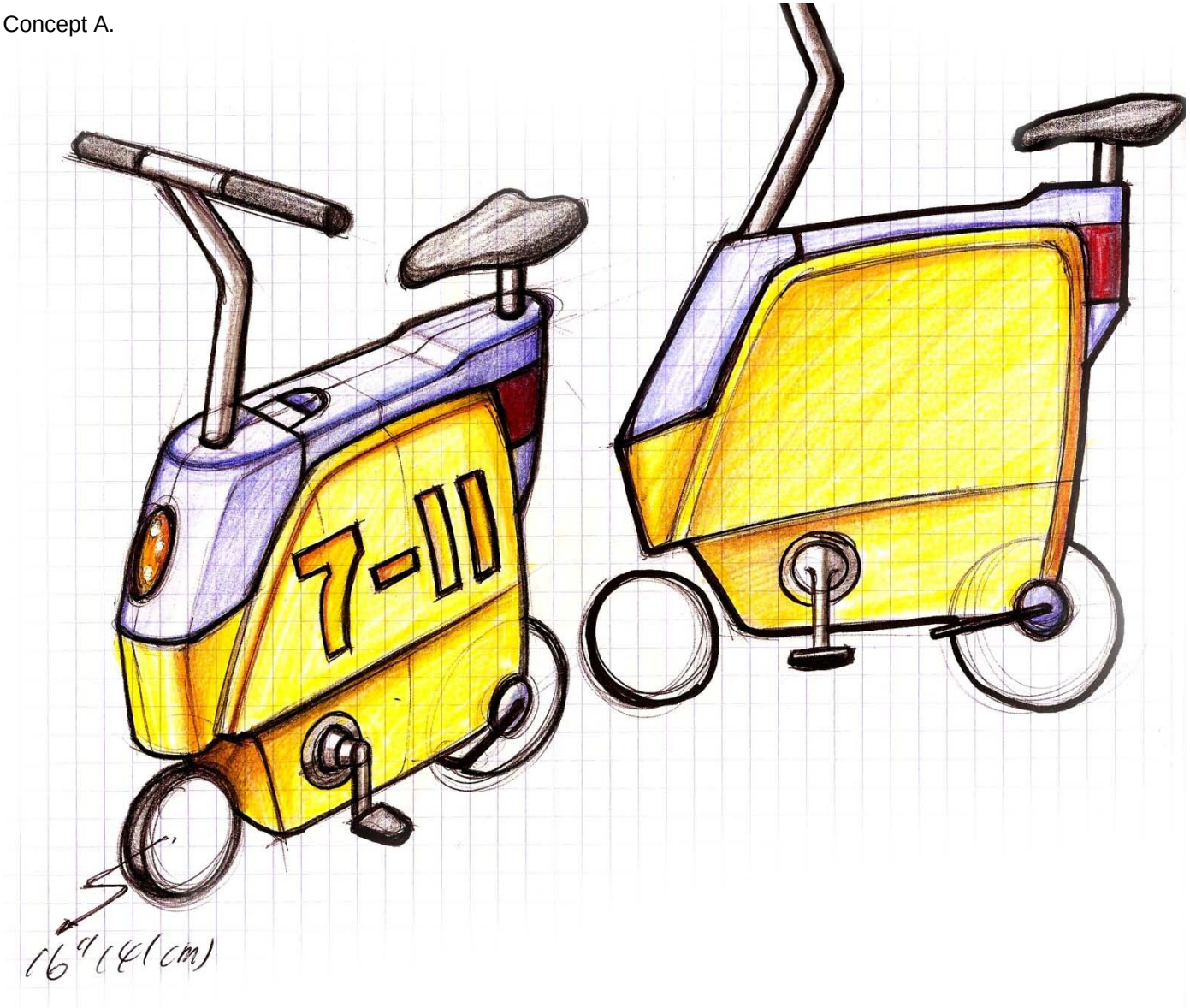
DESIGN PROCESS
Concept Development

Phase: Ideation 1



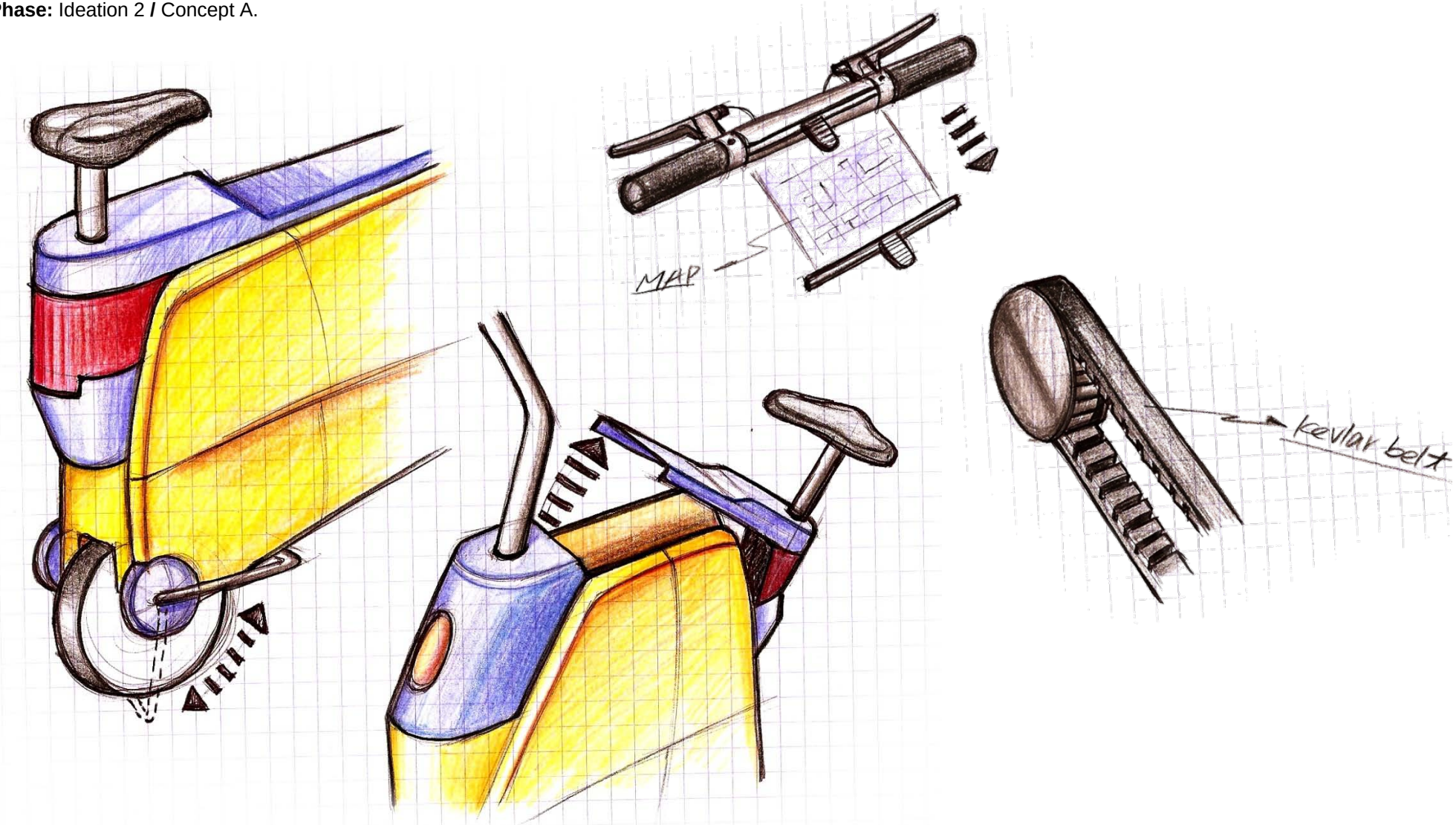
DESIGN PROCESS
Concept Development

Phase: Ideation 2 / Concept A.



DESIGN PROCESS
Concept Development

Phase: Ideation 2 **/** Concept A.



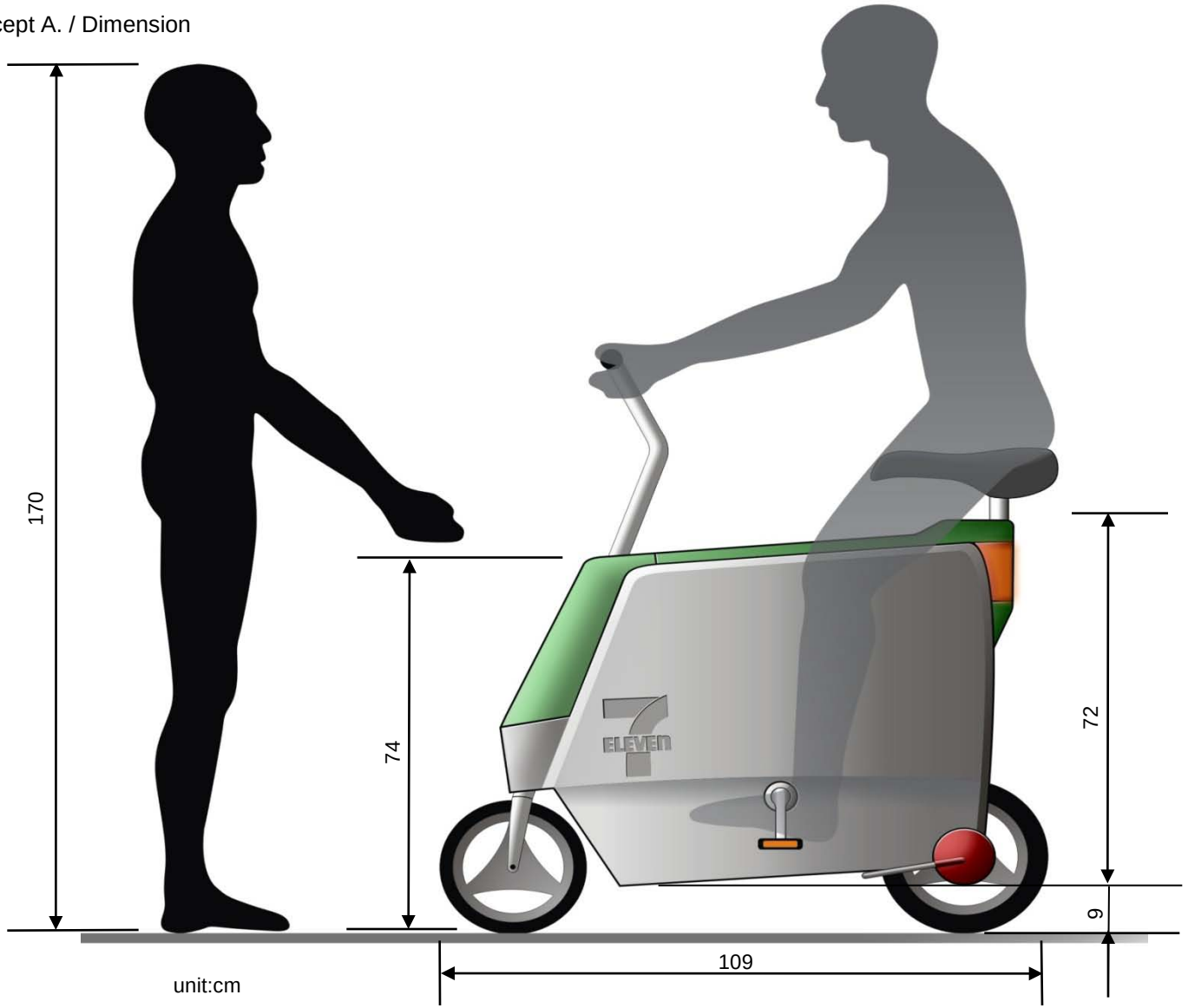
DESIGN PROCESS
Concept Development

Phase: Ideation 2 **/** Concept A. / 2D Drawing

Design Feature: 1. Create 58 x 38 x 20 (cm) room for storage.
2. Give the users a secure feeling of carrying important belongings.
3. Smaller than current bikes on the market for convenience parking.
4. Most Parts will be made out of recycled plastic to reduce weight and efficiency of energy transition generated from human power.
5. Minimum fasteners for fast assembly and disassembly of the bike.

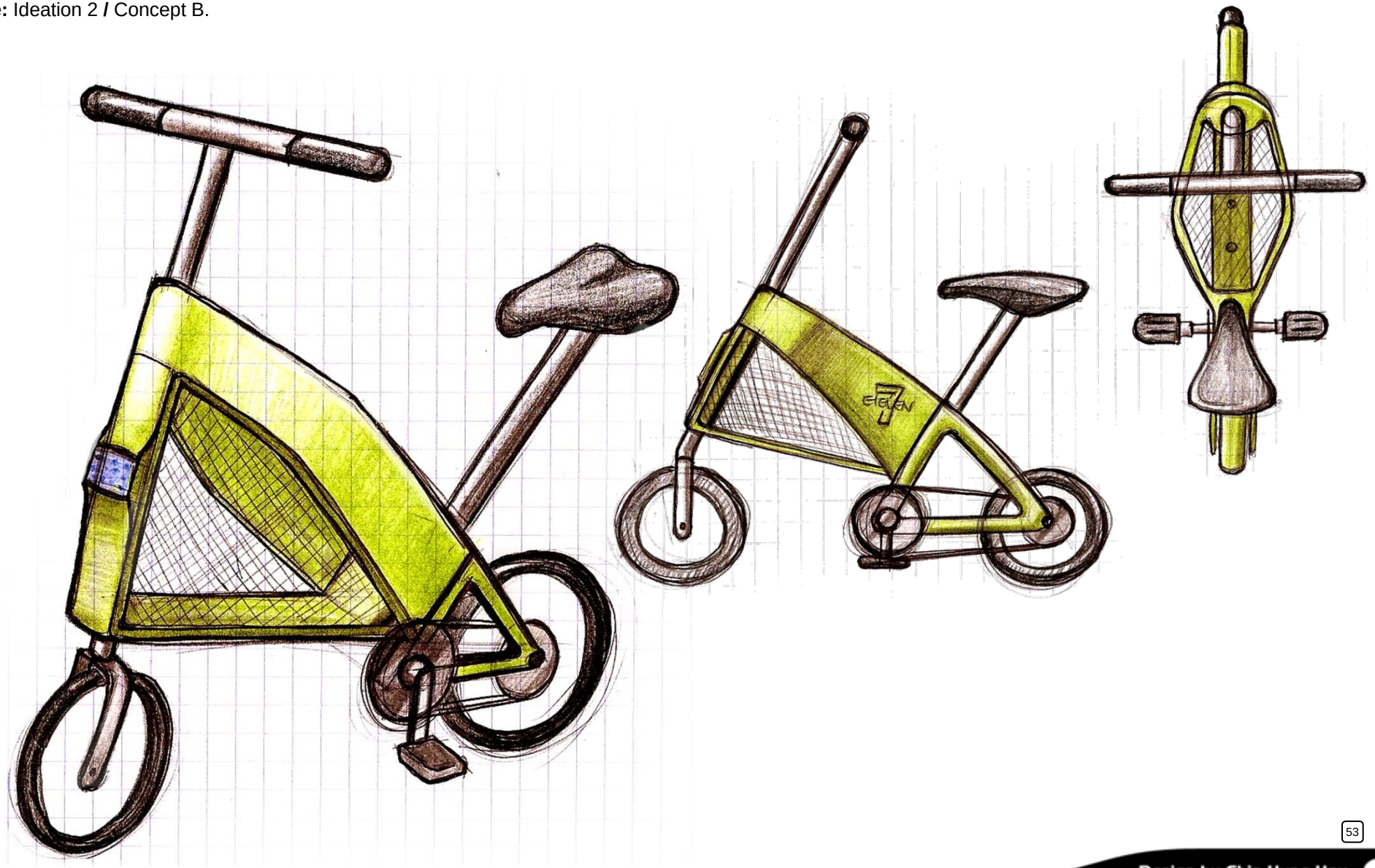
DESIGN PROCESS
Concept Development

Phase: Ideation 2 **/** Concept A. / Dimension



DESIGN PROCESS
Concept Development

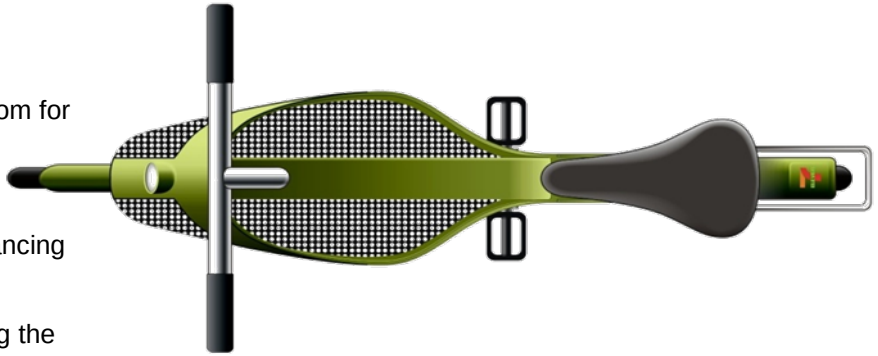
Phase: Ideation 2 **/** Concept B.

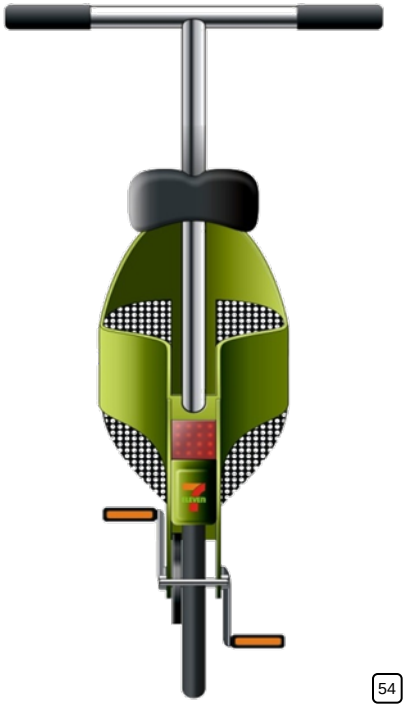


DESIGN PROCESS
Concept Development

Phase: Ideation 2 **/** Concept B. / 2D Drawing

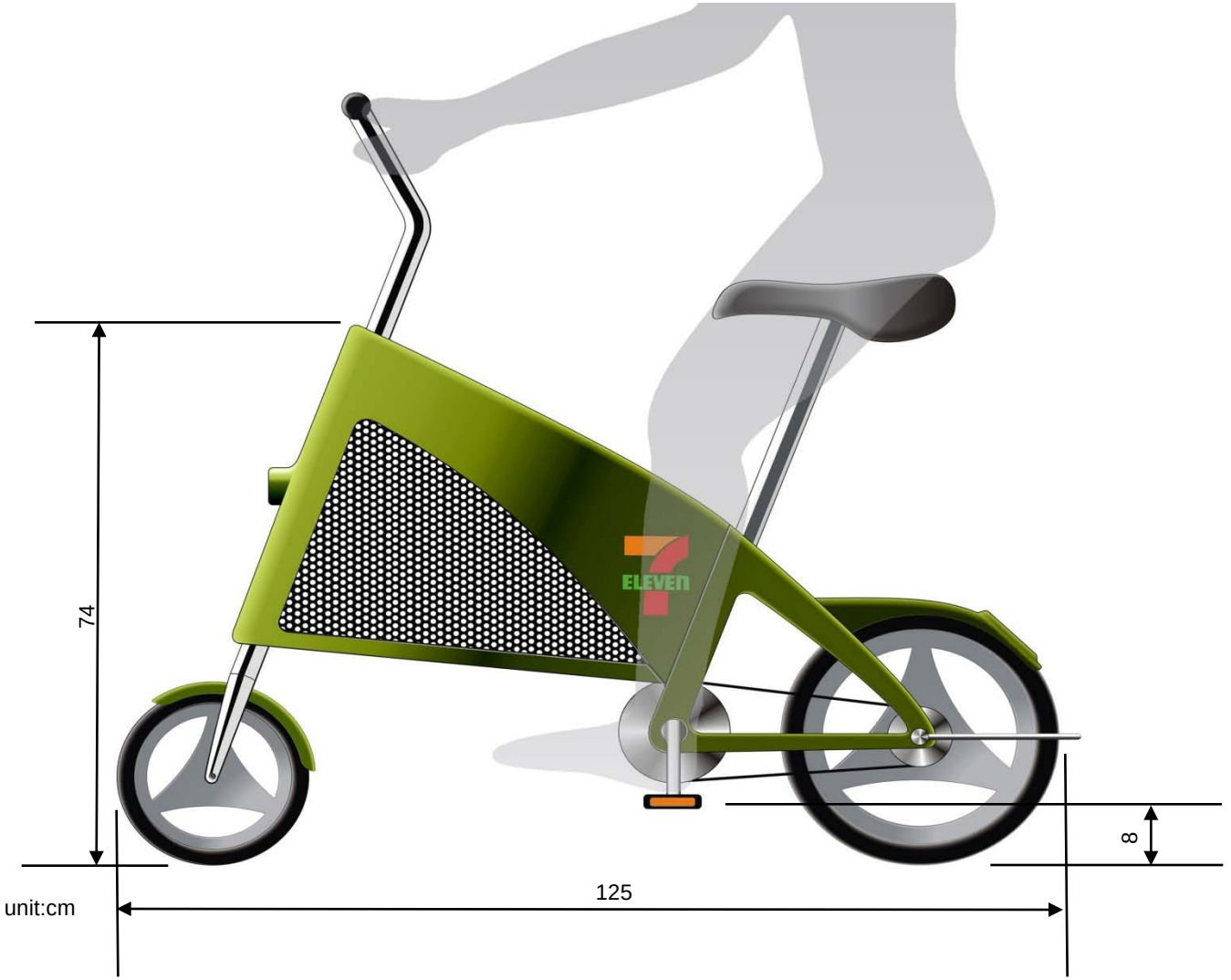
Design Feature: 1. Create over 50 x 40 x 25 (cm) room for storage.
2. Design with a neutral look.
3. The parts will be module for enhancing the efficiency of production and transportation, as well as lowering the consumption of energy.
4. Eliminate welding so as to make replacement and recycling of parts easy.





DESIGN PROCESS
Concept Development

Phase: Ideation 2 **/** Concept B. / Dimension



DESIGN PROCESS
Concept Development

Phase: Human Factor Testing

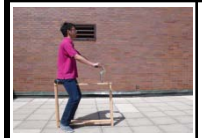
After carefully evaluating concept A and B, to achieve a sustainable design goal, concept B seems to have more possibilities and approach than Concept A.

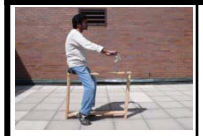
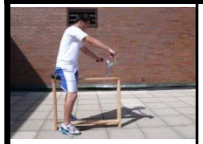
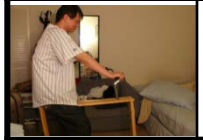
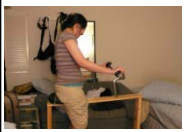
In other to find out the amount of space needed for storage in concept B, I built a model (image 19) to conduct a test comprising of sixteen Asians. In this experiment the handle bar is designed to adjust to the consumer satisfaction. Measurements were taken throughout this experiment.

Image 19. Human Factors Testing Model

DESIGN PROCESS
Concept Development

Phase: Human Factors Testing

HUMAN FACTORS TESTING	Tester	Height (cm)	position(cm)
	PAM	162.5	58
	PETROS	180	63
	MARK	171.5	58
	ELI	167	60.5
	KI	173	60.5
	HAO	180	63
	WEIJAY	174	55.5

HUMAN FACTORS TESTING	Tester	Height (cm)	position(cm)
	RISHI	169	58
	JASON	172.5	63
	YOON	165	55.5
	MATT	186	63
	CASPER	175	63
	GLORIA	160	53
	LIN	163	58

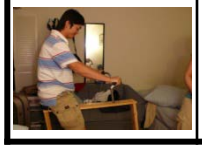
HUMAN FACTORS TESTING	Tester	Height (cm)	position(cm)
	ICE	163	55.5
	JOSH	181	55.5

Image 20. Human Factors Testing chart

Tester: 12 males, 4 females

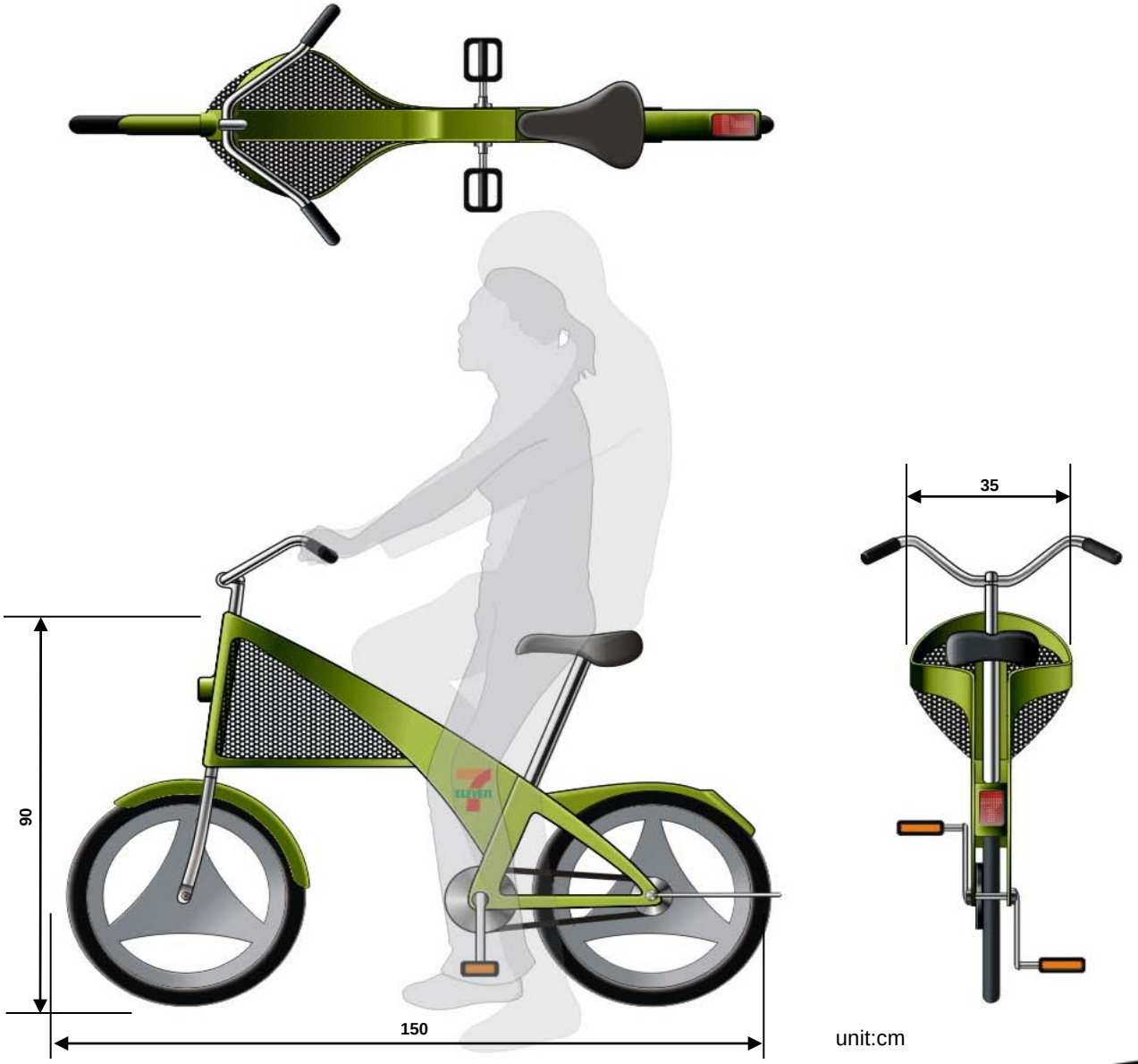
Race: Asian

Test range: 73-43(cm)

Measurement result: the average result of the measurement range from 53 to 63 (cm). This means the length of the storage will be limited to the seating pivot. As long as I stay within this range I can guarantee the riders comfort.

DESIGN PROCESS
Concept Development

Phase: Ideation 3 / 2D Drawing



unit:cm

DESIGN PROCESS
Concept Development

Phase: Ideation 3 / Prototype Testing

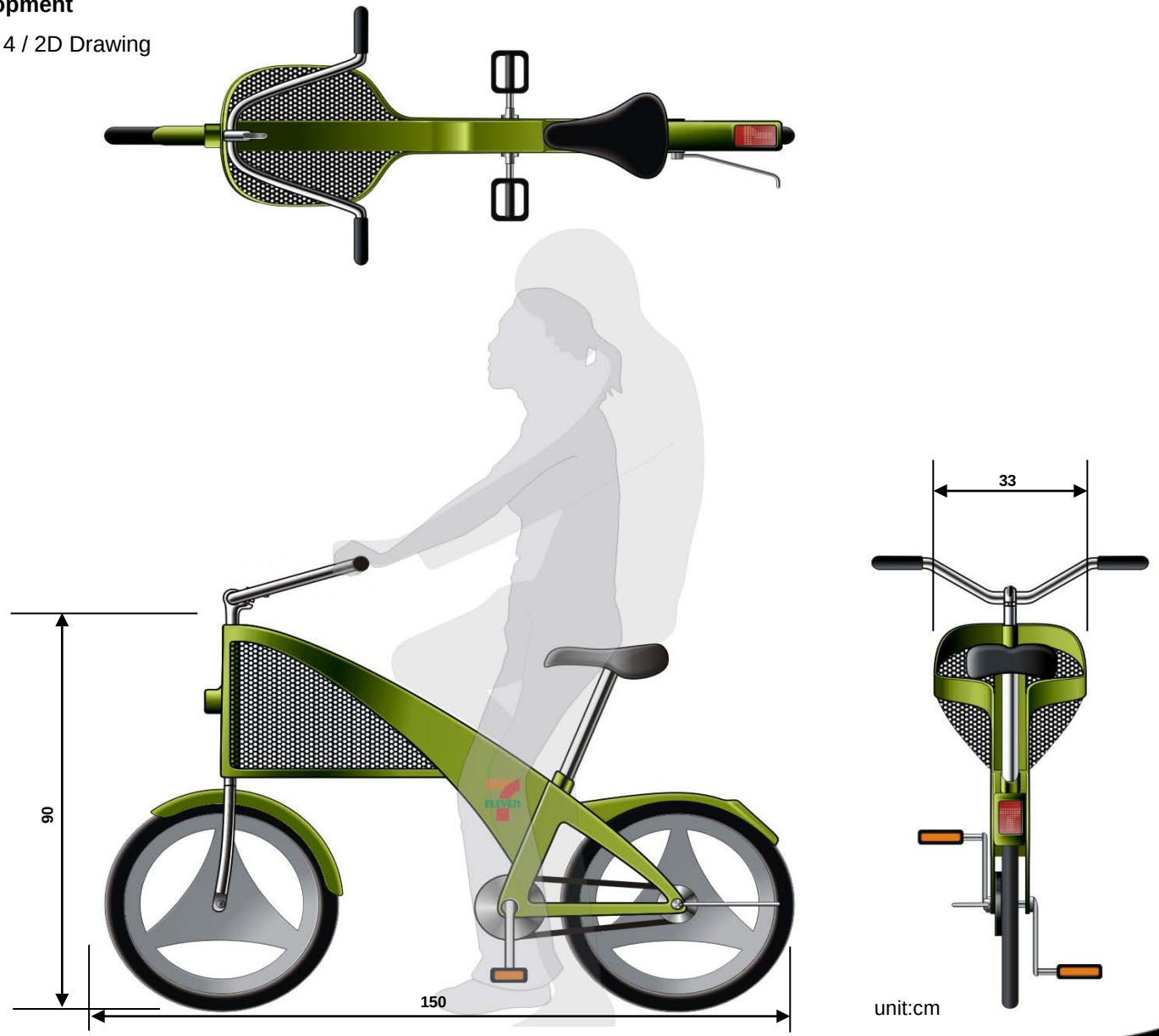
Problem: Based on my 2d drawing in ideation 3 there was suppose to be enough room for the consumer. After constructing a prototype for testing. It became obvious that there isn't enough knee room for the users. This obstruction can hinder their comfort level and make riding difficult.

Image 20.

DESIGN PROCESS

Concept Development

Phase: Ideation 4 / 2D Drawing



unit:cm

DESIGN PROCESS
Concept Development

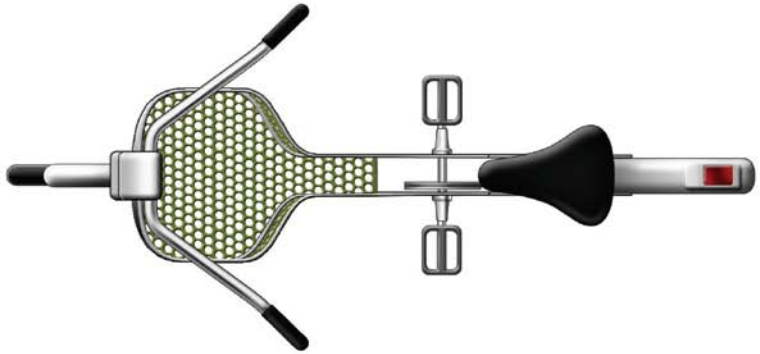
Phase: Ideation 4 / Prototype Testing

Problem: in ideation 4, I adjusted the angle of the fork and gained an extra distance to enlarge the space of the storage. The handle bar however was far to reach when in natural riding posture.

Image 21.

DESIGN PROCESS
Final Design

2D Drawing



DESIGN PROCESS
Final Design

Prototype

Image 22. Final Model Testing

DESIGN PROCESS
Final Design

3D Computer Model

Image 23. Computerized 3D Model

DESIGN PROCESS
Final Design

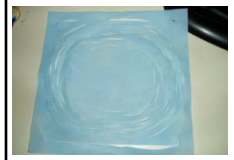
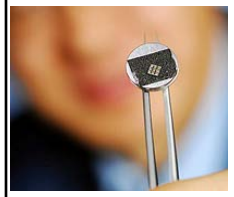
Material Call-out

Image 24.

DESIGN PROCESS

Final Design

Material Call-Out

	PART	MATERIAL	DISCRIPTION
1	Bike Frame		**Radio Frequency Identification (RFID)** technology is going to be well-developed and thrive in the market. It works by having a microchip on the object you wish to identify and a reader. The reader sends a wireless signal which energizes the chip, the chip then sends back a unique identification number to the reader. This is the same technology used with the well known "EZ-Pass" toll tags. This technology is attractive because it doesn't require the bicycle to be placed in a precise location. The chip needs to broadcast within a certain range.
2	Basket		**PET** can be semi-rigid to rigid, depending on its thickness, it is lightweight. While all thermoplastics are technically recyclable. PET bottles on the other hand, can be decomposed to “recovered fiber” which can be further manufactured into products like cloths, carpets and the interior of transportations. It can also be reused consistently.
3	Grip, Seat		The patented **Active Protection System (APS)** is a unique protective material that instantly becomes rigid upon impact, but remains flexible and breathable when protection is not required. The System consists of a three-dimensional spacer fabric treated with a silicone coating. Versatile, durable and lightweight, it can be incorporated directly into a wide range of products to provide unprecedented levels of safety.
4	Head Light , Rear Light		**Energy-Scavenging (Energy-Harvesting) Technique**, aims at collecting ambient energy to help power a system, possibly storing energy when it isn’t required- typically in batteries, capacitors, or springs. According to the book Green Design, Energy-Scavenging Technique. can transform everyday things like the vibrations caused by person walking (pressure, force, vibration) across the room to ambient heat and light into electrical charges.

DESIGN PROCESS
Final Design

Material Call-Out

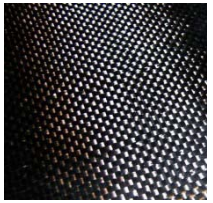
	PART	MATERIAL	DISCRIPTION
5	Chain		**Kevlar** is an innovative technology from DuPont that combines high strength with light weight to help dramatically improve the performance of a variety of consumer and industrial products. Because of its high strength-to-weight ratio, it is well known for "5 times stronger than steel on an equal weight basis". In Sports goods world, it presents part of a composite material. It is used as an inner lining for some bicycle tires to prevent punctures, due to its excellent heat resistance.
6	Frame		**Carbon fiber** has many different woven patterns which can be combined with a plastic resin and wound or molded to form composite materials such as carbon fiber reinforced plastic to provide a high strength-to-weight ratio material. Besides, it features in light-weight, bending resistance, well absorbency for impact and easy to shape, those advantages make it popular in industrial applicant ions.

Image 25. Material Application Analysis Chart

DESIGN PROCESS

Rental System Design

Strategy

Taiwan has the largest concentration of 7-11 stores in the world. There are currently about 4,179 stores located in the cities, suburbs, and countryside of Taiwan. For that reason Taiwanese seem to have some sort of a close bond with these stores. The stores are opened 24/7 for business. These locations will be perfect and handy for the implementations of the city bike program.

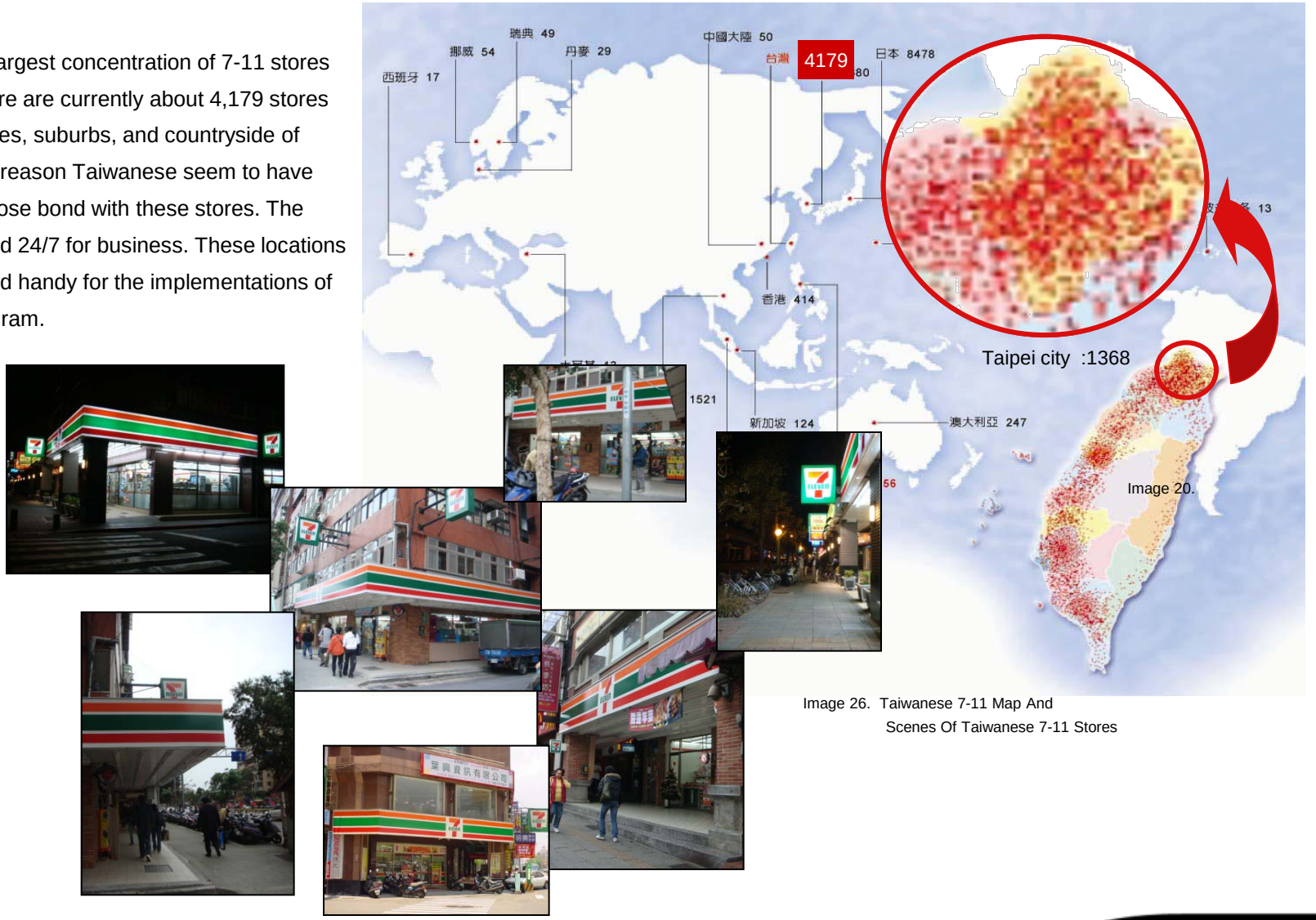


Image 26. Taiwanese 7-11 Map And Scenes Of Taiwanese 7-11 Stores

DESIGN PROCESS

Rental System Design

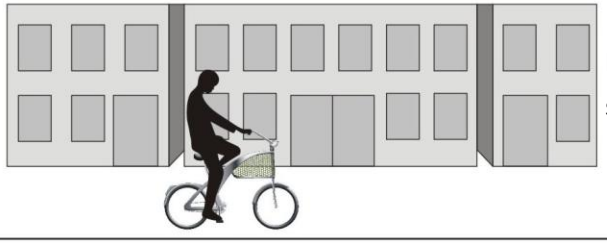
Strategy

Pick up a bike by credit card or metro card

By 7-11 logistics and RFID technology, every bike will be placed to its original store

The goal of this strategy is to encourage people to use bikes more frequently in their daily lives. By implementing this program, we could help to reduce if not eliminate theft, parking issues and reduce the ill environment impact. Offering insurance service for users will encourage and enhance the quality of cycling. In addition to that, we will hope to institute the idea of “sharing is better than having” in the minds of the people.

Ride to the destination

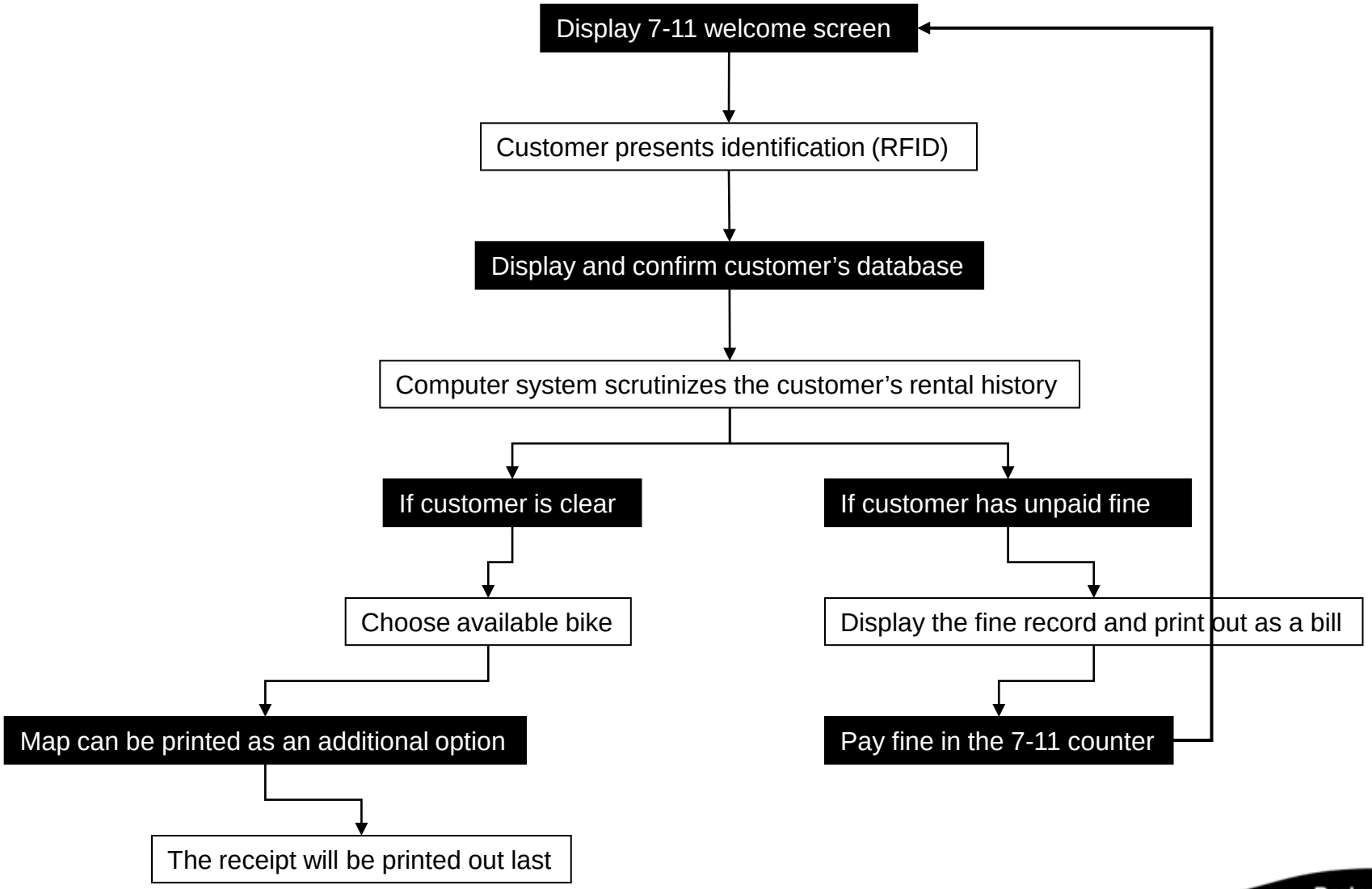


Return a bike to any 7-11 stores close by the destination

Image 27. City Bike Program Strategy Explanation

Rental System Design

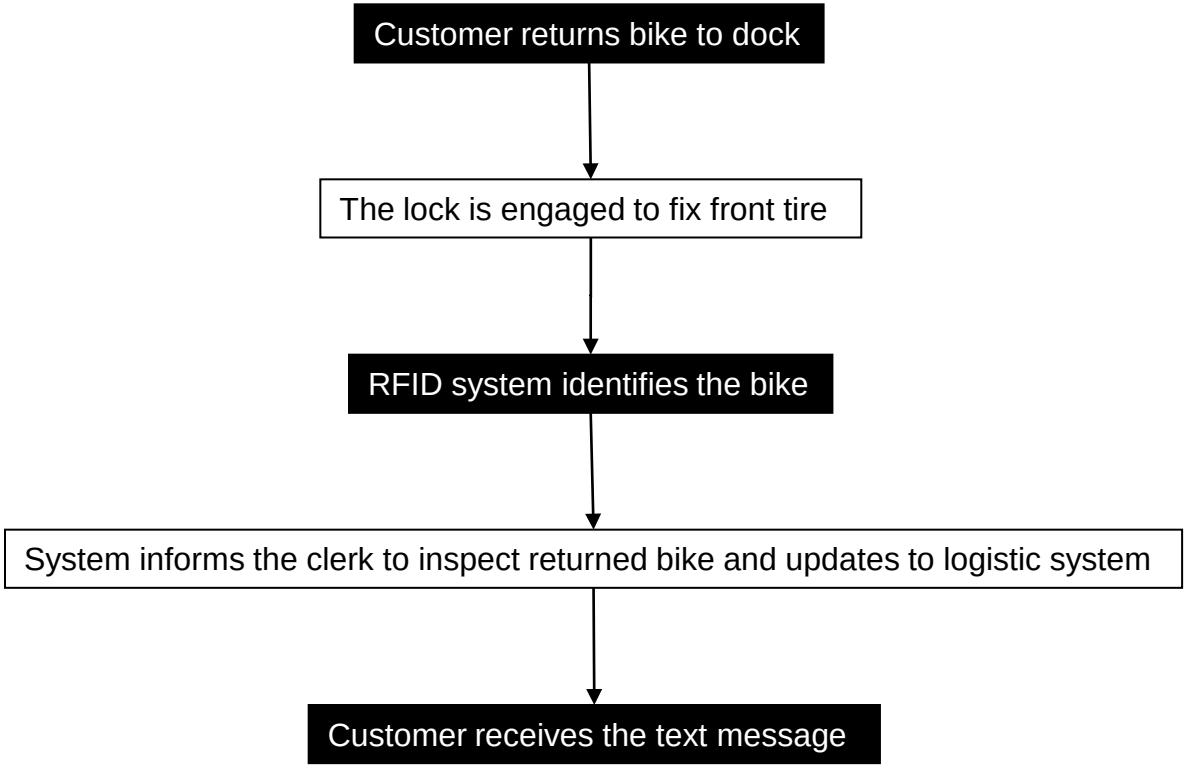
City Bike Check Out Flowchart



DESIGN PROCESS

Rental System Design

City Bike Return In Flowchart



Taiwan should develop and popularize the city bike program because of its unique geographical location and dense population. In Taiwan, such as the capital, Taipei would be environmentally sound if cycling was the main mode of transportation. However, only 2 percent of Taiwanese residents patronize the use of cycling in their daily lives compared to 34% of bike riders in Copenhagen. I agree we have a long way to go.

In regards to the improvement of the city bike program a level of involvement from the Taiwanese government through rigorous enforcement will be needed. However, to avoid direct legislation of the government and disputes at the provincial level which could sometimes drag scheduling of construction, it will be ideal if this program was privatized to enhance efficiency and competency but with backing from the central government.

The integration of 7-11 Corporations and the city bike program can set a good example for running other types of city bike program with a different vision in other counties. The Integration will spray a culture of cyclist from all walks who might not wait for offerings to develop their infrastructures or the annual budget by the government. The city bike program can easily be localized and setup following a new store opening. It will also help to boost customer base to the stores thereby increasing profit for this business.

I truly believe Taiwan could be a model country for cycling on the Asian continent. Developing a city bike program does not require complicated science or techniques to succeed. As long as the government can put in place initiative efforts as well as provide security to its citizens through campaigning, educating and enacting new traffic rules that can be easily understood and visually legible.

I am certain it will not only increase the moral of the people to participate. It will equally benefit bicycle-related corporations such as Giant to sponsor and support the program. I hope someday soon, Taiwan will become another cycling heaven like Amsterdam and Copenhagen.

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