P2 Report

“Designing A Tool Bag For Doorstep Bicycle Repair Executive”

By

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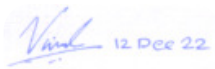
Approval Form

This is to certify that the Industrial Design Project entitled " Designing A Tool Bag For Doorstep Bicycle Repair Executive " by Uppili Nithin Soorya B, Roll no 216130016, is approved for partial fulfillment for the Master of Design degree in Industrial Design.

Prof. Avinash Shende (Project Guide) 

Signature of the Chair Person: 

Signature of the Internal Examiner: 

Signature of the External Examiner: 

Date : 12.12.2022

Declaration Form

I, declare that this written report represents my ideas in my own words, and where other's ideas or words have been included I have adequately cited and referenced the original sources.

I also declare that I have adhered to all principles of academic honesty and integrity and have not falsified, misinterpreted or fabricated any idea, data, facts or source in my submission.

I understand that any violation of the above will be caused for disciplinary action by the Institute and can also evoke penal action from the source, from which proper permission has not been taken or improperly been cited.

Signature : 

Name : Uppili Nithin Soorya B

Roll No : 216130016

Date : 12.12.2022

Acknowledgement

I would like to sincerely thank my guide Prof. Avinash Shende for his invaluable guidance at every stage of the project and for supporting the project in every way possible. I also extend my gratitude to all the faculty, workshop assistants and students of IDC (Industrial Design Centre) for their kind help, opinions and suggestions for the betterment of the project. My special thanks to my batchmates from Industrial Design, for brainstorming sessions and their feedback at various times during the duration of project.

Abstract

Everybody would have used a bicycle at some point in their lives. It is also regarded as the best form of transportation on the planet that doesn't hurt the environment, and it's not only about the environment—it also keeps our bodies in shape and makes us feel healthy. However, the demand for bicycles surged significantly after the effect of COVID, and people began to purchase bicycles to maintain their health and fitness.

Therefore, just as any product in the world need routine maintenance to prolong its life, the same holds true for bicycles. But people with their hectic work schedules, some people find it difficult to maintain their bicycles. Being unable to transport their bicycle to a nearby shop. Keeping this in mind, a few doorstep bicycle repair service startups launched the business where customers must schedule an appointment to service their bicycle, and then the technician with his tools goes to the customer's home and repairs the bicycle. Observing the issues faced by the technicians while repairing the cycle, I tried to offer solutions to the technician through designing them a portable tool bag which enables them to increase the efficiency, to reduce the strain created in their back and to reduce the mess that happens with the existing tool box/bag. This tool bag will be helpful for people who will be travelling in locals while going to their customer houses.

Contents

Contents

1. Introduction

1.1 What Is A Bike Service ?

Performing maintenance on a bicycle is known as a "bike service." There are a variety of service options. Some of them might be fundamental, while others might be more in-depth and include updating components or making changes.

Most common bike repairs

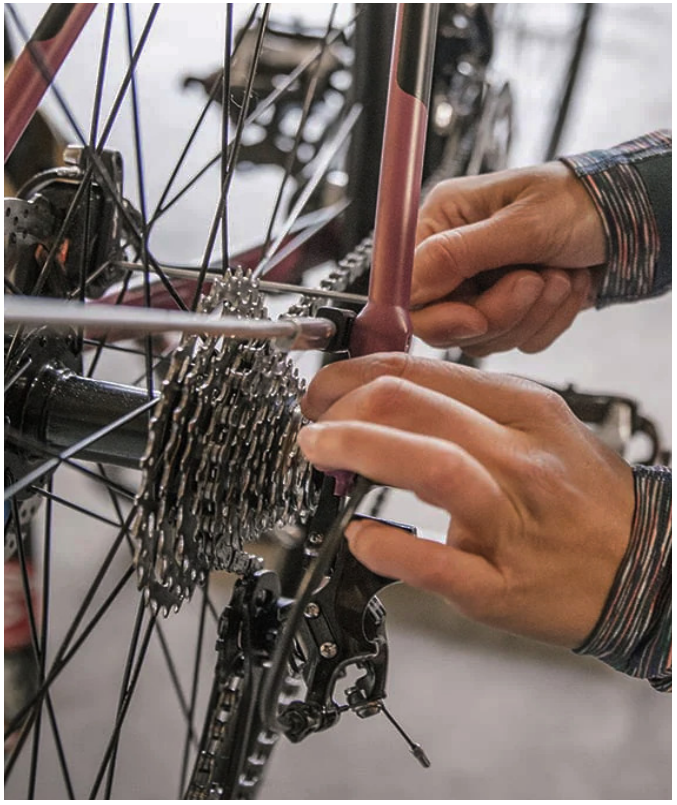
Fix a Flat, Reattach a Slipped Chain, Tighten Up Loose Bolts, Loosen a Stuck Seat, Wrap Drop Handlebars.

Types of operations carried out while repairing

Wear on tyres and brake pads, Tensioning of cables, Wear of working parts, Reindexing of gear, General damage check

1.2 What Is A Doorstep Bicycle Service ?

Doorstep bicycle service brings the convenience of professional bike maintenance and repairs to your home. Skilled technicians travel to your location, offering a range of services, including tune-ups, brake adjustments, tire replacements, and more. This hassle-free service saves time and ensures your bicycle remains in top condition without the need to visit a physical bike shop.



Post Pandemic

People started purchasing bicycles for themselves and their families after the pandemic as a way to maintain their health and to change their lifestyle.

Maintenance

A bicycle needs to be maintained properly because it is made of metal and has moving parts that will eventually wear out.

Service

Servicing can be done by taking the bicycle to a nearby local repair shop, which is difficult for the user to take the broken cycle to.

Time saving

Booking a doorstep repair appointment to service the bicycle saves the consumer time from taking the bicycle to a nearby shop.

1.2.1 Doorstep Service Companies

These businesses offer door-to-door services. Each business has its own method for servicing bicycles, and it offers customers a variety of service packages to pick from depending on their requirements and the condition of the bicycle. Following the effects of COVID-19, these mobile bicycle repair services were introduced, coming to the clients' homes to service their bicycles.

Companies like Fix My Cycle and a select few others offer customers the choice of pick-up and drop services as well. These companies will pick up the customer's bicycle from their residence, transport it to their service centre, perform any necessary repairs, and then return the bicycle to the customer.

These new companies are situated in cities such as Chennai, Bangalore, Mumbai, Delhi, etc.

Fig. 1 Startup companies

1.2.2 Packages And Services Offered By Companies

Different companies each have their unique processes for servicing bicycles. There are different packages available for the customers to choose from based on their bicycle condition, which includes basic adjustments and ripping off the bicycle for complete repairing of the bicycle.

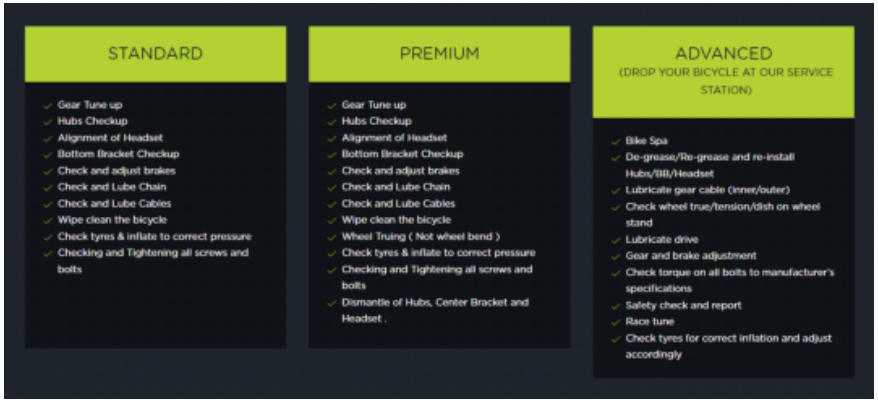


Fig. 2 Service package

Bronze package

- Front & Rear Brake Adjustment
- Front & Rear Derailleur Adjustment
- Lube Chain
- Proper Tire Inflation

Silver package

- Front & Rear Brake Adjustment
- Front & Rear Derailleur Adjustment
- Lube Chain
- Proper Tire Inflation
- Wheel True & Tension
- Hub & Headset bearing Adjustment

Gold package

- Front & Rear Brake Adjustment
- Front & Rear Derailleur Adjustment
- Lube Chain
- Proper Tire Inflation
- Wheel True & Tension
- Hub & Headset bearing Adjustment
- Replace all cables & Housing
- Remove & Clean Drivetrain

1.3 Cycle Sales in India

Cycle sales in India doubles in last 5 months amid pandemic. A total of 41,80,945 bicycles have been sold in the country in the five months from May to September 2020, according to the All India Bicycle Manufacturers Association.

Sales of bicycles have gone up by over 100 per cent in these five months. In many places people have to wait for their favourite cycle, booking has to be done.

In May, the number of bicycles sold was 4,56,818. This number almost doubled to 8,51,060 in June, while in September, the country sold 11,21,544 cycles in a month. In total, 41,80,945 cycles have been sold in the last five months, as per the AICMA data.

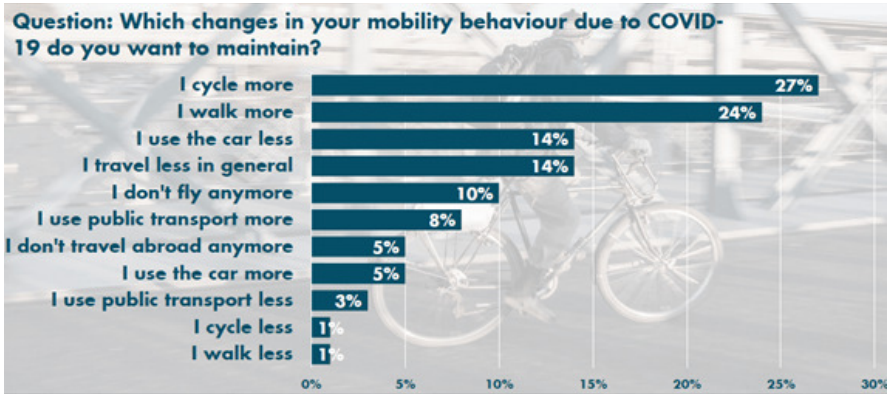


Fig. 3 Mobility behaviour

1.3.1 Production of Bicycle In India

Table 2: Production of the bicycle in India.

Year	Production (in Lakh)
1950-51	0.99
1960-61	10.71
1970-71	20.42
1980-81	44.89
1990-91	61.63
2000-01	140
2020-21	200

Based on the above table cycle production in India increases every year [18].

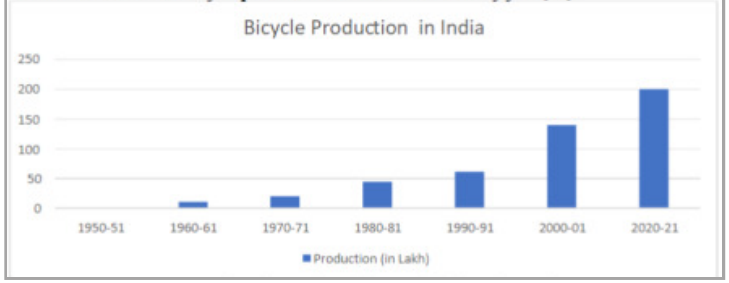


Fig. 4 Production of bicycle in India

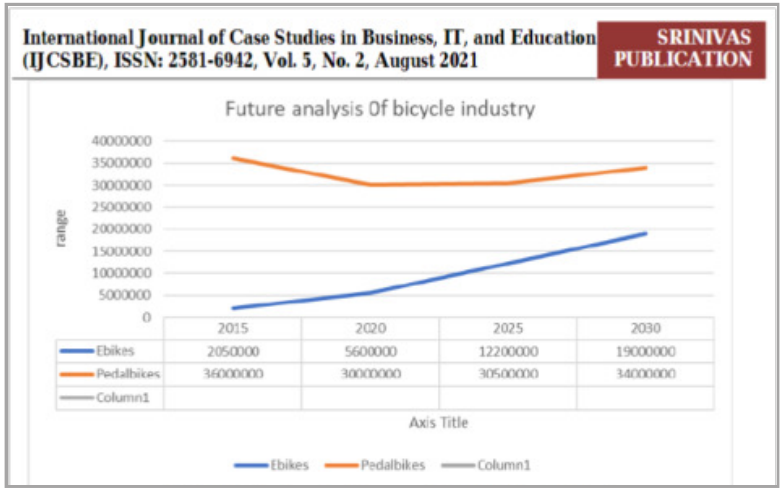


Fig. 5 Future analysis of the bicycle in India

1.4 Types of Cycle

In India, various types of cycles are available to cater to different needs and preferences. These include road bikes, designed for speed and endurance on paved surfaces; mountain bikes, built for off-road trails and rugged terrains; hybrid bikes, offering a combination of road and mountain bike features for versatile usage; city/commuter bikes, ideal for urban commuting with features like fenders and racks; folding bikes, compact and portable for easy storage and transportation; and electric bikes, equipped with electric motors for assisted pedaling. Each type of cycle serves a specific purpose and provides options for individuals to choose based on their intended use and riding preferences.

Breakup by Type:

- Road Bicycle
- Mountain Bicycle
- Hybrid Bicycle

Breakup by Technology:

- Electric
- Conventional

Breakup by Price:

- Premium
- Mid-Range
- Low-Range

Breakup by End User:

- Men
- Women
- Kids

Fig. 6 Bicycle types

1.4.1 Parts of Cycle

A bicycle consists of various essential parts that work together to enable its functionality. The frame serves as the main structure, providing support and stability. The wheels comprise rims, spokes, and tires, responsible for traction and smooth movement. The drivetrain consists of the chain, crankset, and cassette or freewheel, allowing power transfer from the rider to the wheels. Brakes, such as rim brakes or disc brakes, enable controlled stopping. The handlebars provide steering control, while the saddle offers a comfortable seating position. Additional components include pedals, gears, derailleurs, and various smaller parts like grips, bearings, and cables. Each part plays a crucial role in the overall performance and operation of a bicycle.

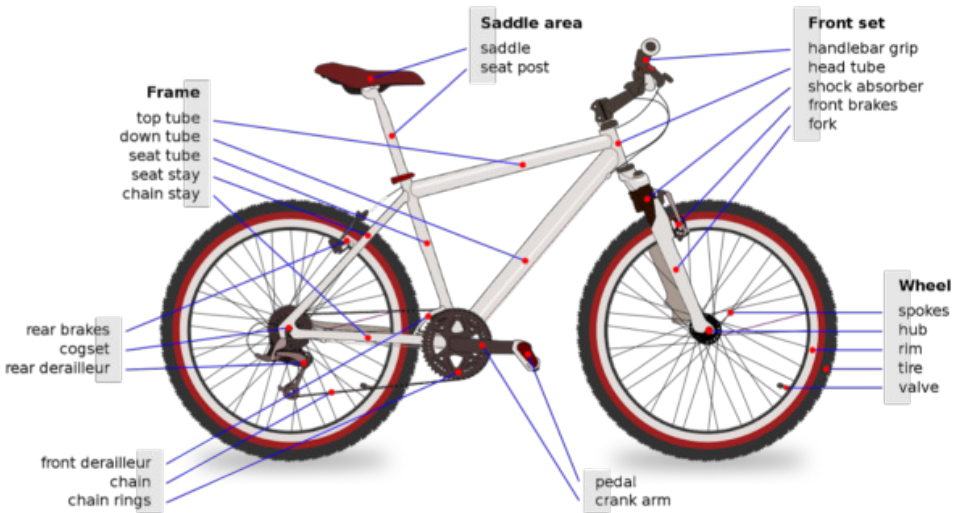


Fig. 7 Bicycle types

2. Primary Research

2.1 User Interview 01

Local bicycle repair shop

Name : xyz
Age : 46
Years of experience : 11
Total working hour : 10 to 12
No of cycle attended per day : 15 to20

Position at which bicycle is kept and being serviced

Tools used commonly.

Cart used to keep all tools in one place and also as an storage box.

Getting assisitance from the owner of the cycle to hold bicycle straight.

2.2 User Interview 02

Local bicycle repair shop

Name : xyz
Age : 51
Years of experience : 14
Total working hour : 8 hours
No of cycle attended per day : 6 to 8

Cycle is mounted on the repair stand so that servicing can begin.

The shop owner built his own bicycle repair stand so he could work comfortably while mounting and servicing a bicycle on it.

2.3 User Interview 03

Decathlon service department

Name : xyz
Age : 42
Years of experience : 8
Total working hour : 10 to 12
No of cycle attended per day : 6 to 8

Observations :

Tool Holder and tools used

Cycle being mounted on the stand

Tools kept at accessible height

2.4 User Interview 04

Velodoctor technician interview

Name : xyz
Age : 30
Years of experience : 5
Total working hour : 10
No of cycle attended per day : 1 to 3

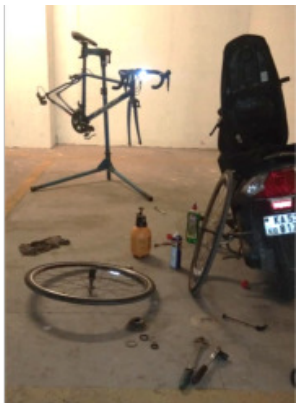
Technician carries bike repair stand with him while going for doorstep service in which he feels burdensome to carry but at the same time he tells it making it bit easy for him and comfortable while repairing the bike

2.4.1 Observations

Aim: Observing the setting in which mechanics will be working on bicycles in various locations and environments, as well as how the bike and repair tools are set up, is essential.

Tools has be kept on the ground ner to the bicycle for easy access and scattered.

Cycle being mounting on the repair stand to start servicing the bicycle.



2.4.2 Scripting The Process

Aim: To understand the mechanic's actions while repairing the bicycle and their interactions with the customer.

Technician : Inspects the bicycle's condition

Technician : Requesting two large buckets of regular water

Customer : Customer provides the required facility

Technician : - Explaining the cycle's servicing procedures and timing.
- Suggest that the cycle be serviced every six months, which would include ripping it apart and performing other tasks.
- Stating that regular servicing every two months is necessary.

Technician : Mounts the bike on the tripod support.

Technician : Rip Off all the bicycle parts

Technician : Degreases all the parts and Jet washes to remove dirt and greases

Technician : Dries away all the parts

Technician : Yet again mounts the bike frame to the support and begins to put all of the parts together.

Technician : Test ride and examine the bicycle.

2.5 Problem Identification

- Unorganized tools setup
- Technician has to bends body often to pick tools from ground.
- Repetitive movement of technician while picking tools and inability to maintain closer proximity with the tools.

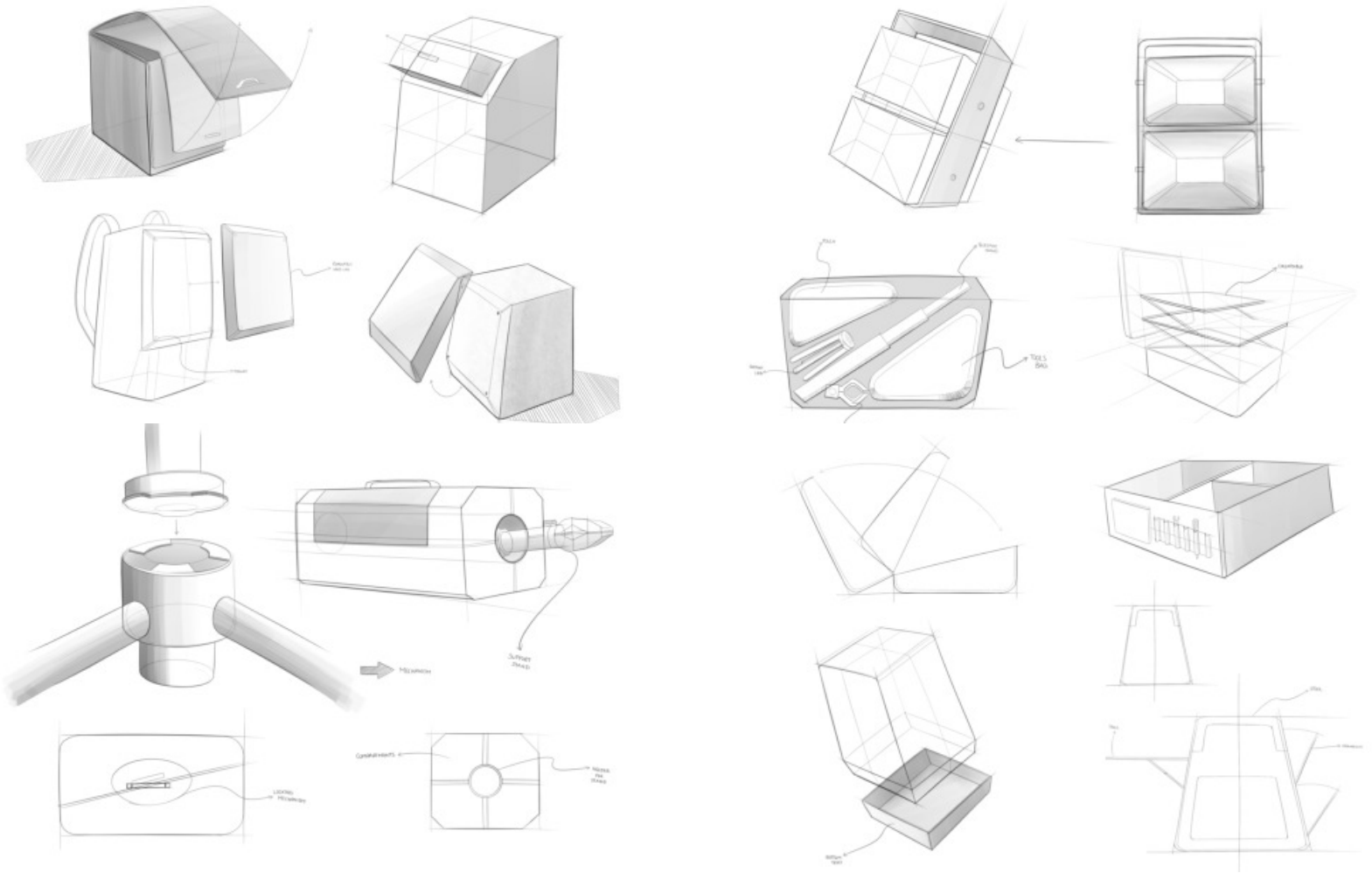
3. Initial Design Brief

"To design a compact portable service station for doorstep bicycle repair executive"

Must have

- Stand
- Organizer
- Tray to clean tools
- Pump

4. Initial Ideations



5. Testing Different Toolboxes and Bags

From the interactions with the technician while interviewing them i came to know about there own way of carrying the tools along with them to the customers place to service the cycle. So i did task analysis with products like tool storage box, carrying case and backpack which has not been specifically designed for door step service technicians and to find the problems faced while using these products.

Tool Storage Box

Carring Case

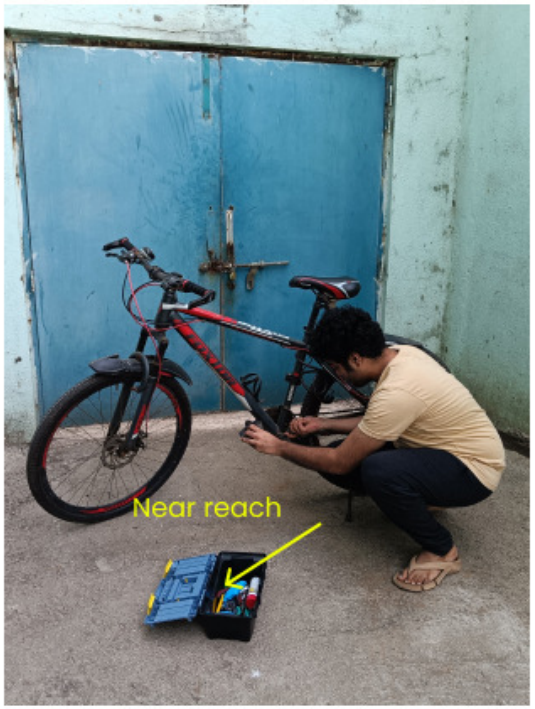
Backpack

5.1 Role Play 01

Aim: To understand the user experience with the tools and bicycle while servicing the cycle and to find the problems while performing the task.

Tools not organised

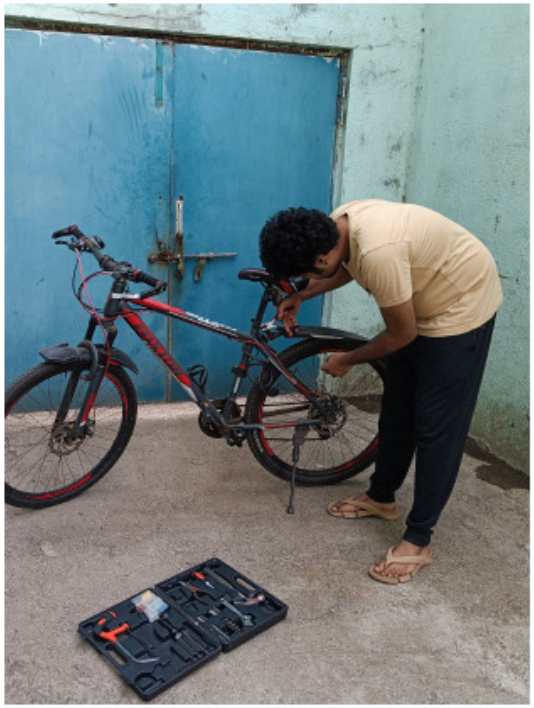
No clear visibility of tools



5.2 Role Play 02

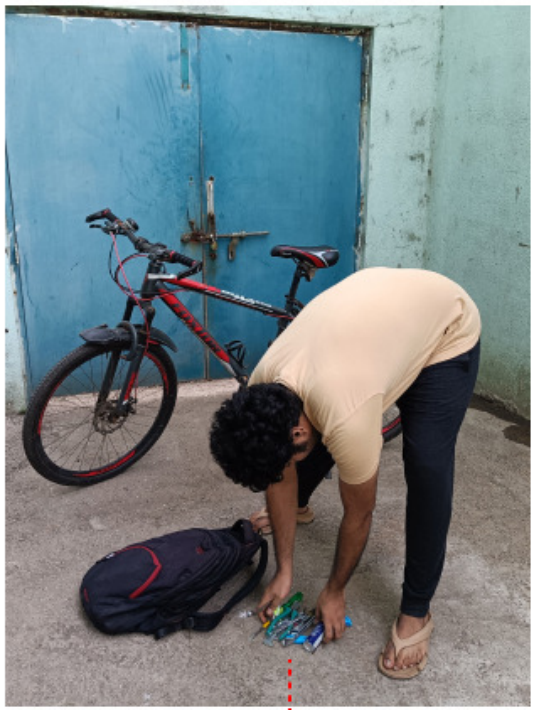
Opens flat to the ground

Need to constantly bend to pick up the necessary tool



5.3 Role Play 03

Taking all the tools out



Putting tools on the ground

Going back and forth to pick the tool

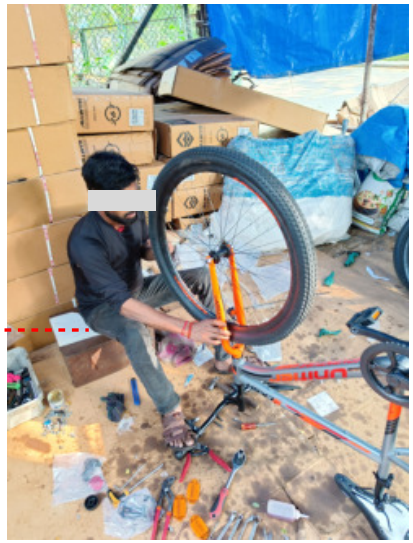
6. Contextual Study

Assembly of bicycle

A technician who assembles three to four cycles each day was interviewed, and observations were made of his assembly technique, tools, body postures, and tool storage arrangements.

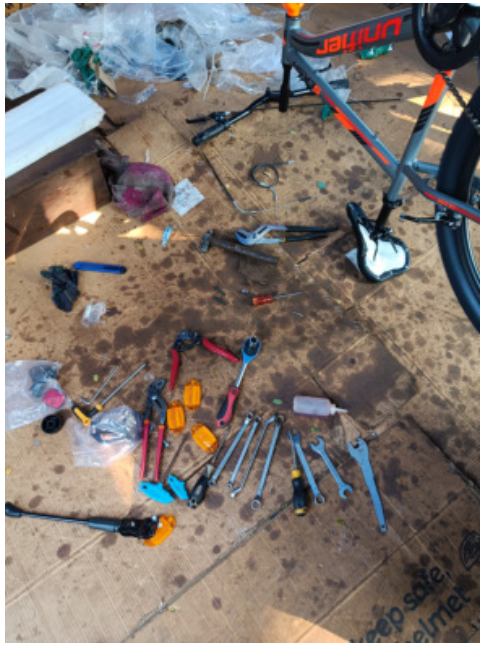
Bicycle kept upside down while assembling wheels, pedal and chain

Technician prefers sitting while aligning the spokes wheel rim

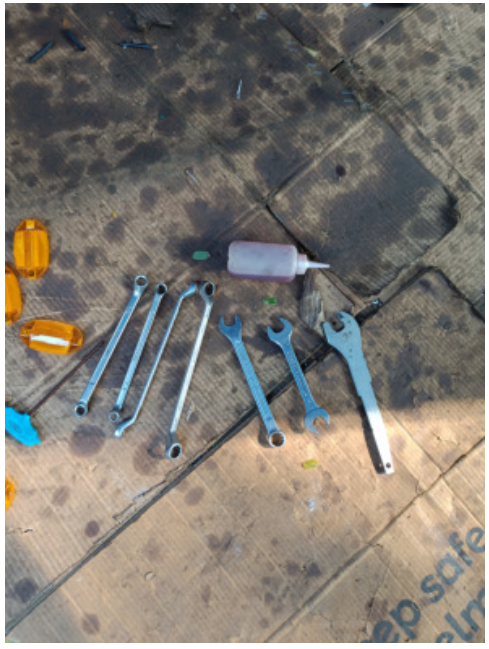


6.1 Observations

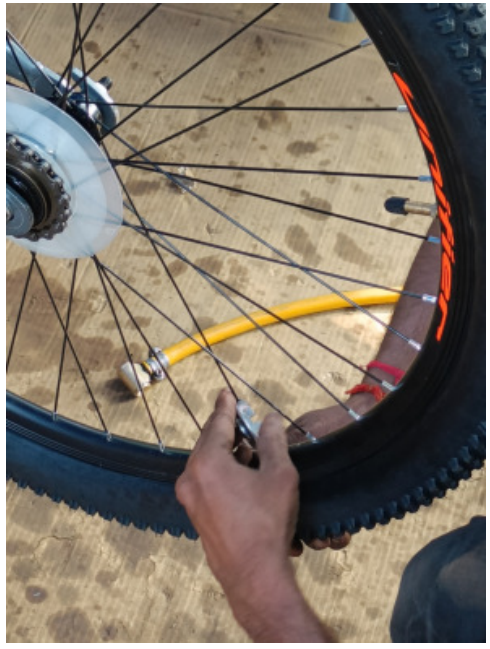
Observation made on tools used, workspace and process carried out while assembling the bike.



Tools that has been used for bicycle assembly



Wrenches with different size



Spoke wrench being used to adjust the spokes

7. Different Bicycle Parts And Its Function

As a result of the numerous moving parts that keep a bicycle in motion and being prone to wear and tear, it requires maintenance. When it comes to maintenance, particular pieces must be removed, necessitating the use of particular equipment to disassemble it. These components will be attached to the bike using a variety of tools of varied sizes.

Parts name	Parts image	Tools used to dismantle	Function
Cogset		Lock ring nut remover	Provide a range of gearing options for your chain to run on.
Rear Derailleur		Allen key, Screwdriver	Changes gears by moving the chain from one sprocket to another.
Front Derailleur		Allen key	Shifts your chain from chainring to chainring.
Brake Caliper		Allen key	Allowing the arms to auto-centre on the rim.

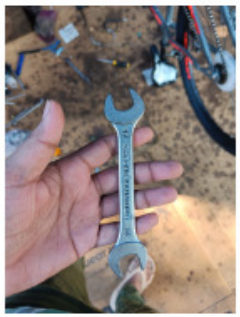
7.1 Different Bicycle Parts And It Function

Gear Shifter		Screwdriver	Operates the derailleurs via cables
Frame		Wrench	Holds the entire bike up and together and allows you to sit on and steer.
Crank		Socket Wrench	Convert the power produced by your legs into rotational motion that drives the bicycle forward.
Disc Brake		Allen key	Stop the bike by squeezing a brake pad against a rotor mounted around the hub.
Brake Handle		Screwdriver	By means of pulling a cable to bring bicycle to a halt.

Bolt & Nuts		Open ended wrench, Allen key	To fasten multiple parts together.
Wheel		Open ended wrench	The wheel itself, which includes the hub, spokes and rim.
Transmission Chain		Nose plier	Transfers power from the pedals to the drive-wheel of a bicycle, thus propelling it.
Bearings		_	Reduce friction and make rotation more smooth.

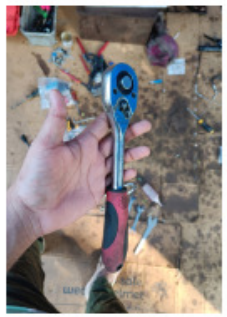
8. Tools Used

After discussing with the technician, the necessary equipment for fixing the bicycle have been selected for further design ideation.


Open End Wrench


Closed End Wrench


T-Handle Allen Key


Socket Wrench


Screw Driver


Cable Cutter


T-Handle Allen Key


Spokes Wrench

9. Mapping of Tools

The tools in use are mapped to their respective interactions with the cycle's various components.

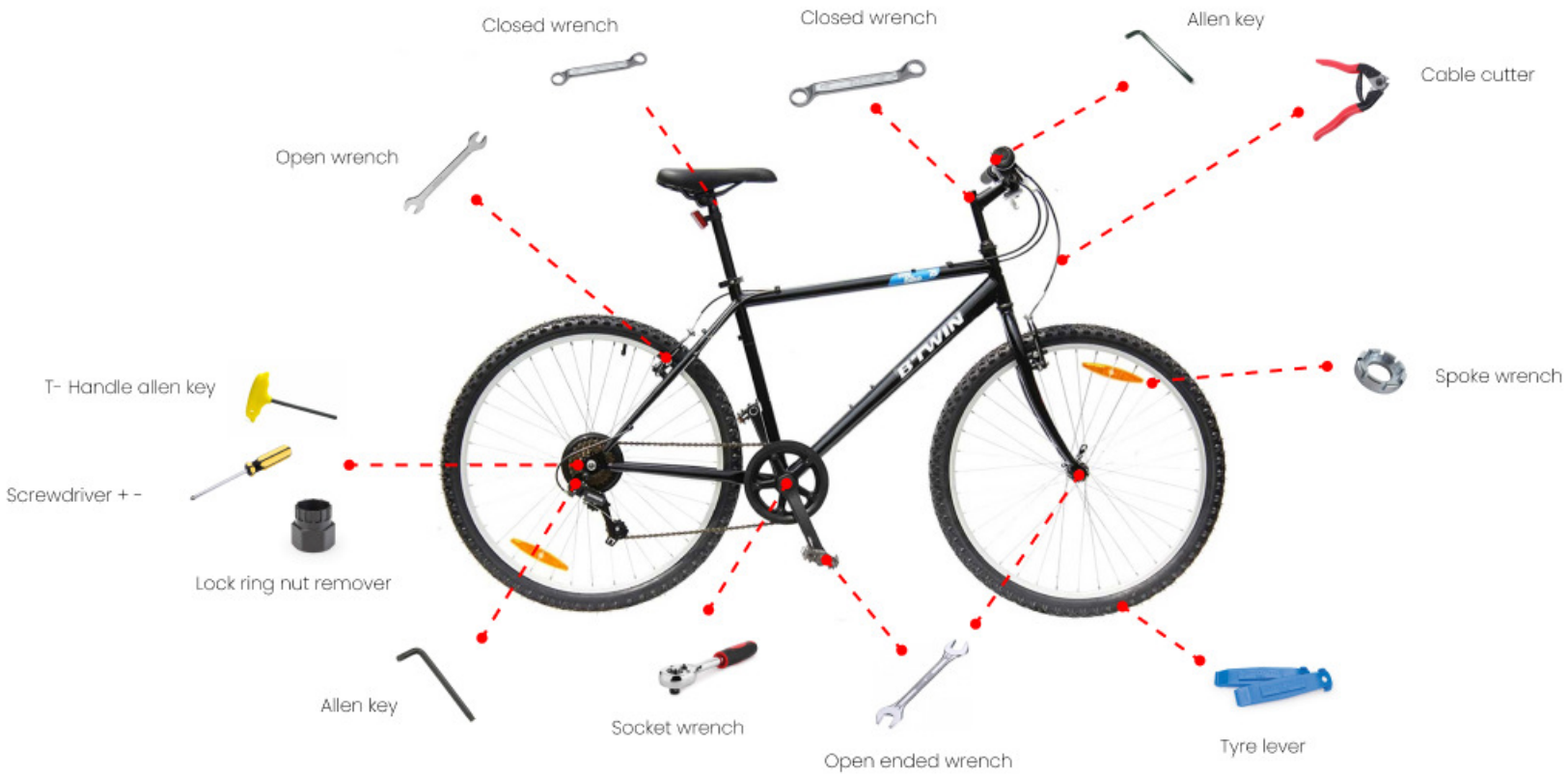


Fig. 8 Mapping of tools used

10. Operation And Tools Used

The basic operation that had been performed while servicing the bicycle are adjusting, puncture, greasing while requires a set of tools which is found in all of the technician tool box which has been taken into consideration, which is mandatory for a person who repair a bike.

So these tools has been taken into consideration to design a tool bag for bicycle repair technician.

Operations	Tools Used			
Adjusting				
				
Puncture			—	—
Greasing		—	—	—

11. Initial Design Brief

"To design a tool bag for door step bicycle service executive"

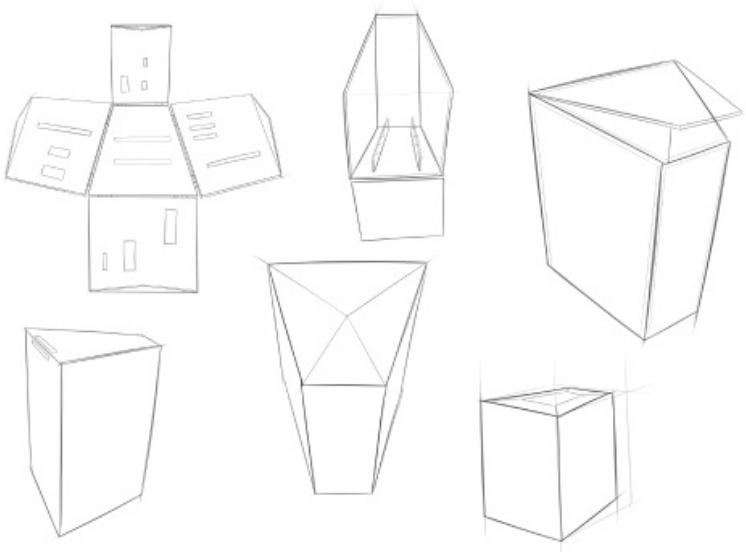
Objectives

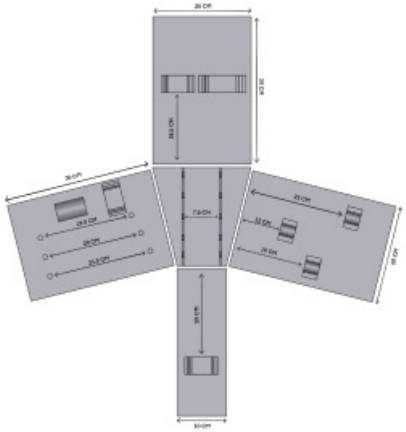
- Portable
- Moveableness.
- Light weight
- Easy accessibility of tool
- Cost effective
- Foldability

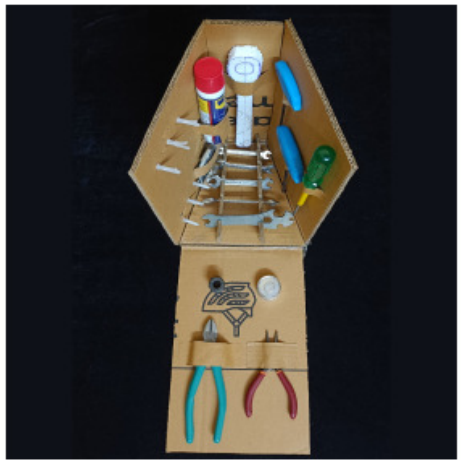
User

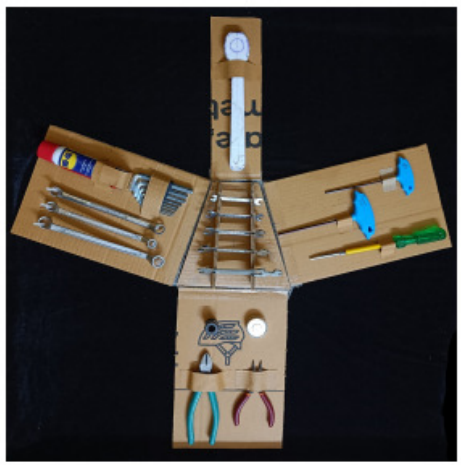
Bicycle repair technician

12. Concept 01



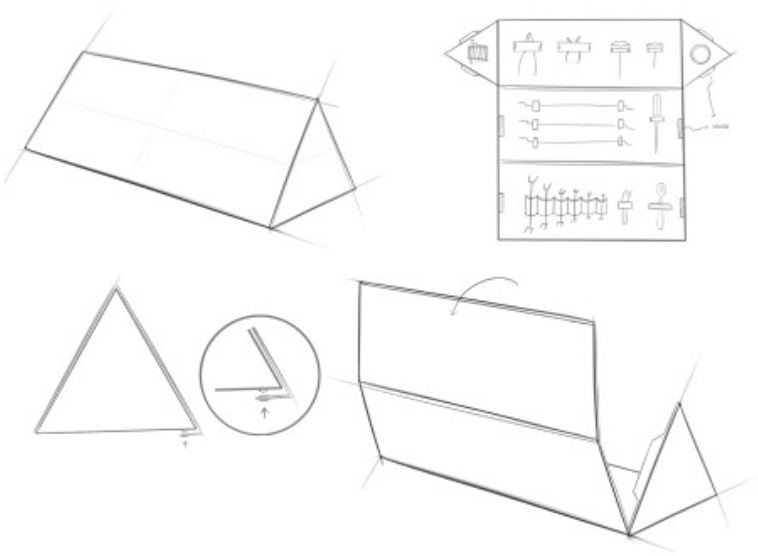


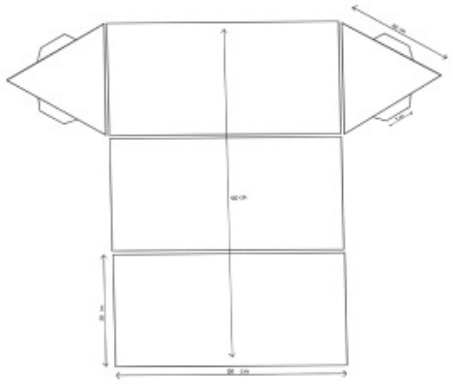


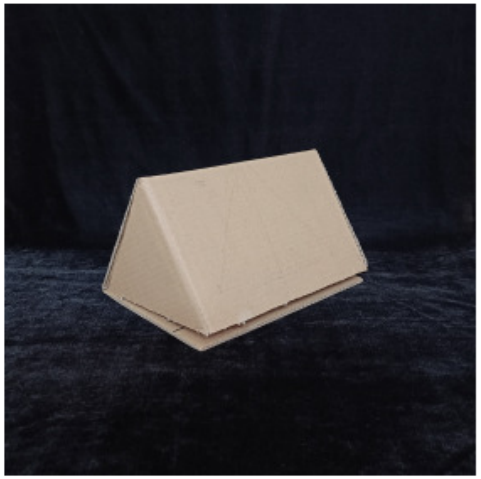


Concept based on carrying tool box which can be flattened for the easy access of tools and easy to carry it on the bike

12.1 Concept 02



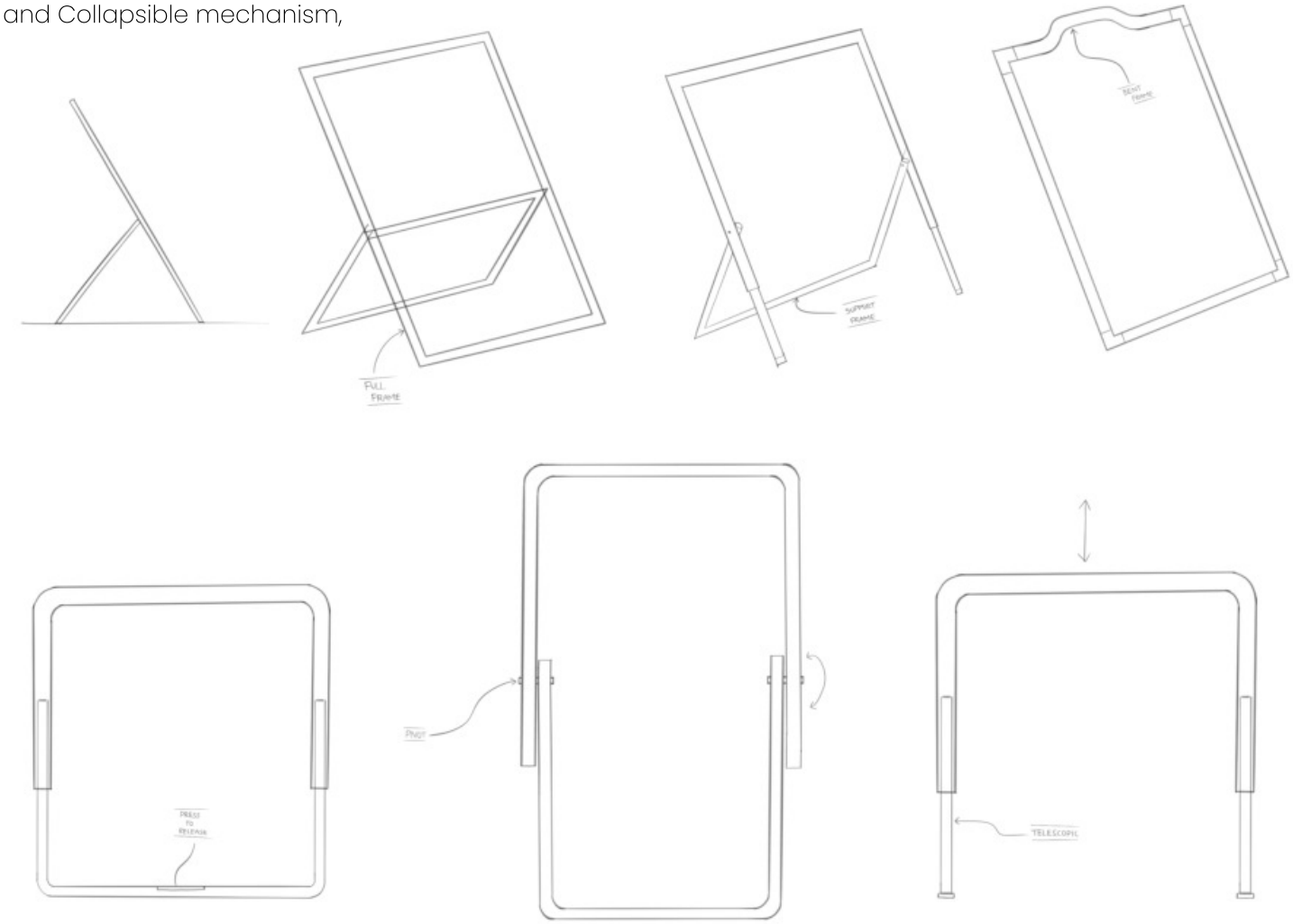




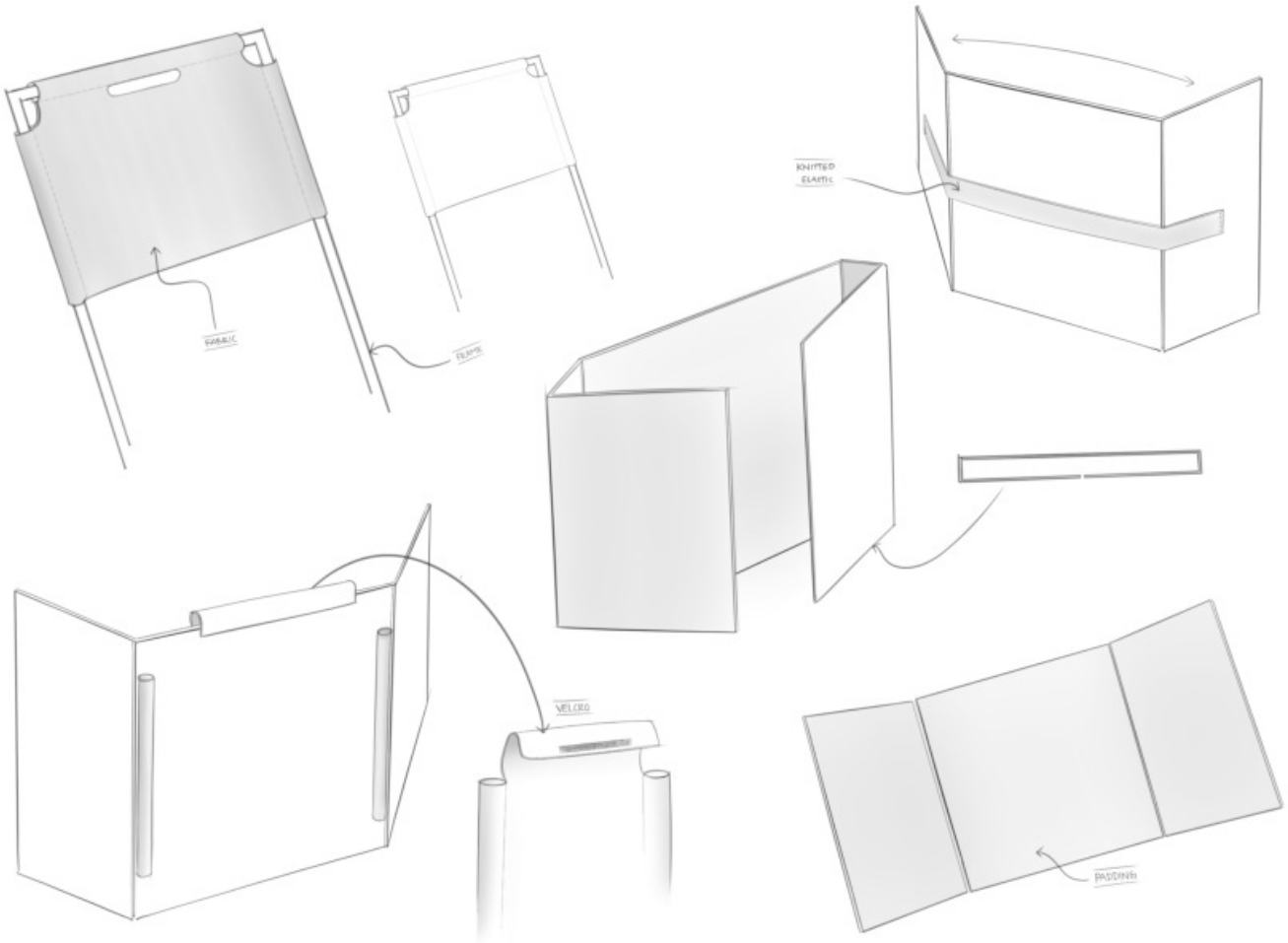
Compact triangle carrying case which when unfolds provides access to tools

13. Ideations

Frame, Hinge and Collapsible mechanism,



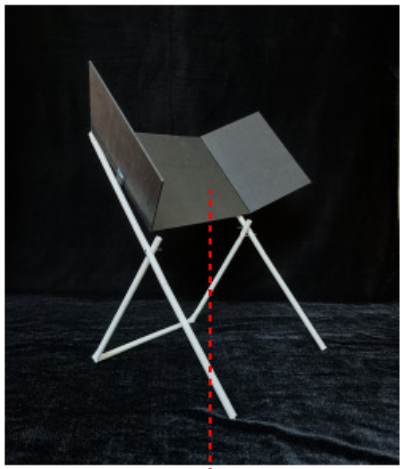
13.1 Ideations



13.1.1 Mockup 01

To validate the stability, manufacturability, and visualization.

Metal stand with telescopic leg

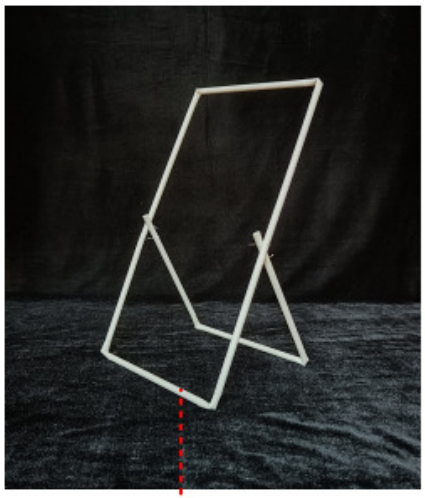


Canvas to keep tools

Support stand

Concept based on carrying tool box which can be flattened for the easy access of tools and easy to carry it on the bike

13.1.2 Mockup 02

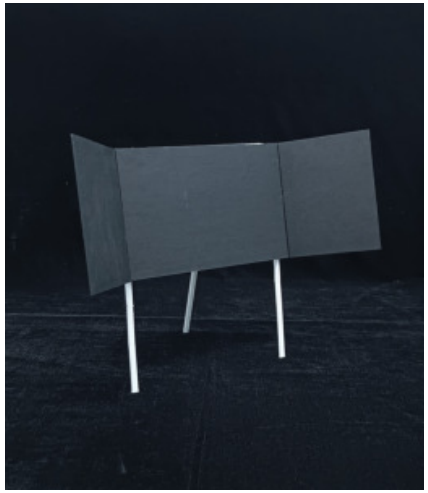


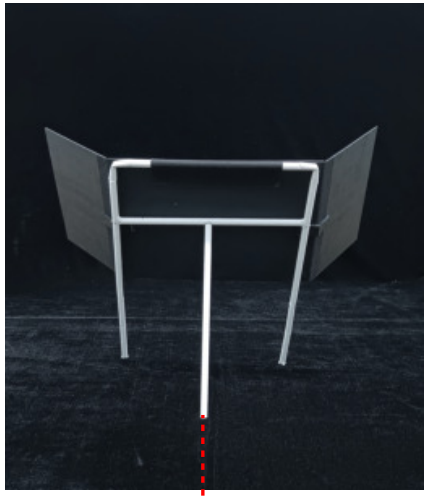
Flat leg support

Pivot for the rear support

13.1.3 Mockup 03

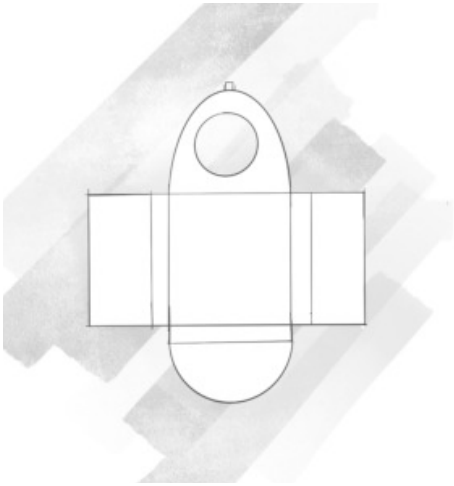
Tripod legs





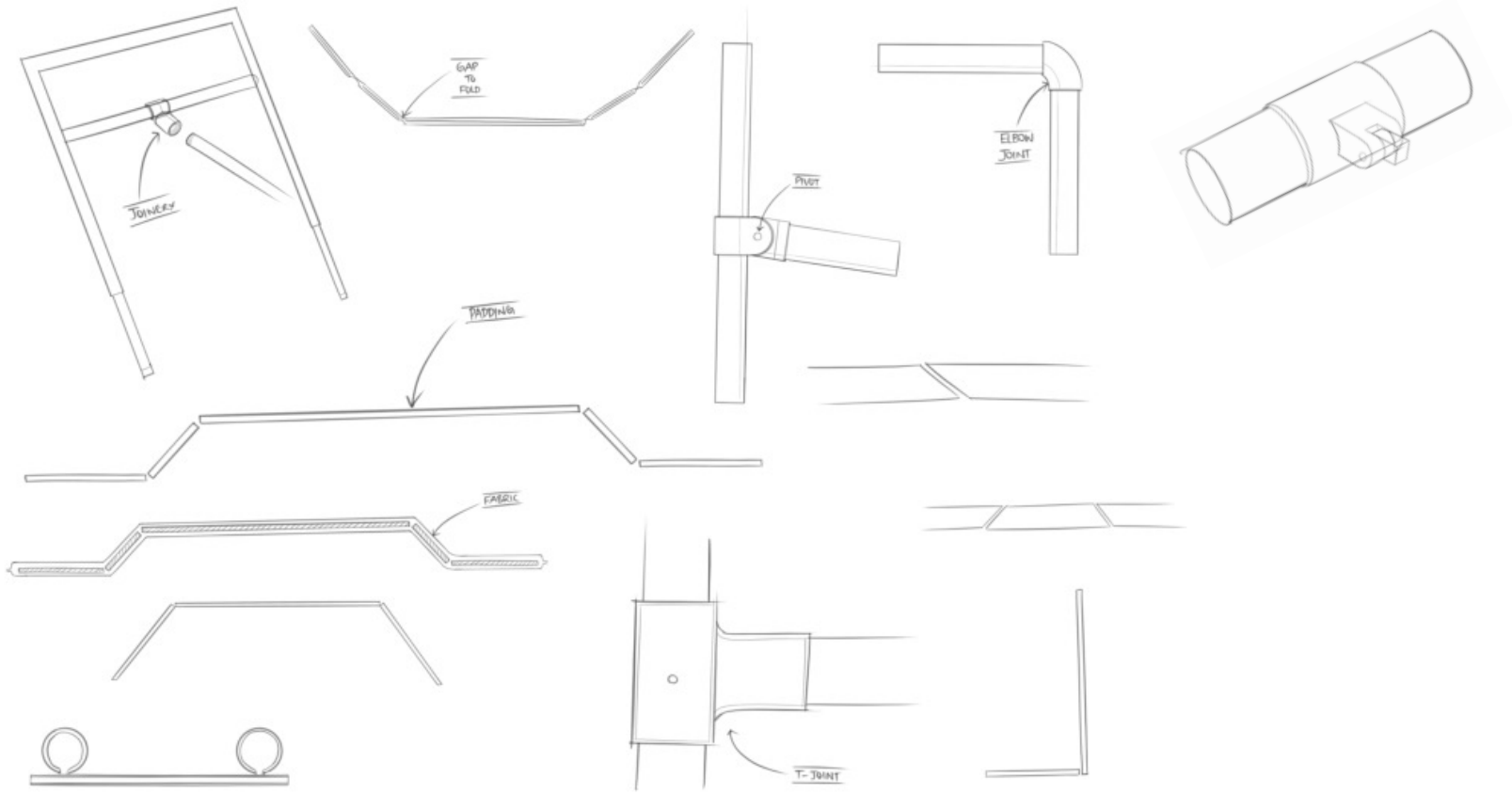
Rear support will be adjustable

13.2 Ideations



13.2.1 Detailing Ideations

The joineries detailing and the flap folding method.



14. Choosing Layouts

After finilazing the tools and canvas different layout options are tried to fit the tools in right place so that it will be easy to the techician to remove and eep the tools back and it shoild also follow the work pattern while servicing the bike

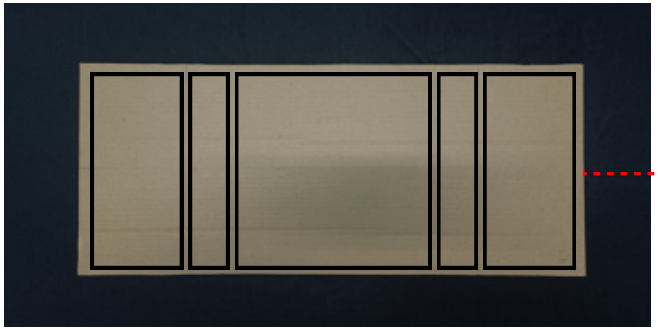
Option 01

Factors to be considered

-Tasks

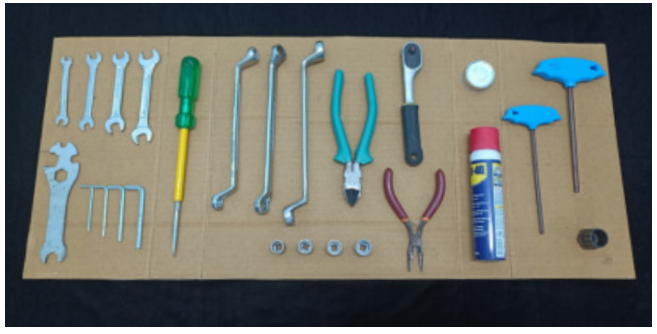
-Balancing the weight

-Ease of accessibility and visibility



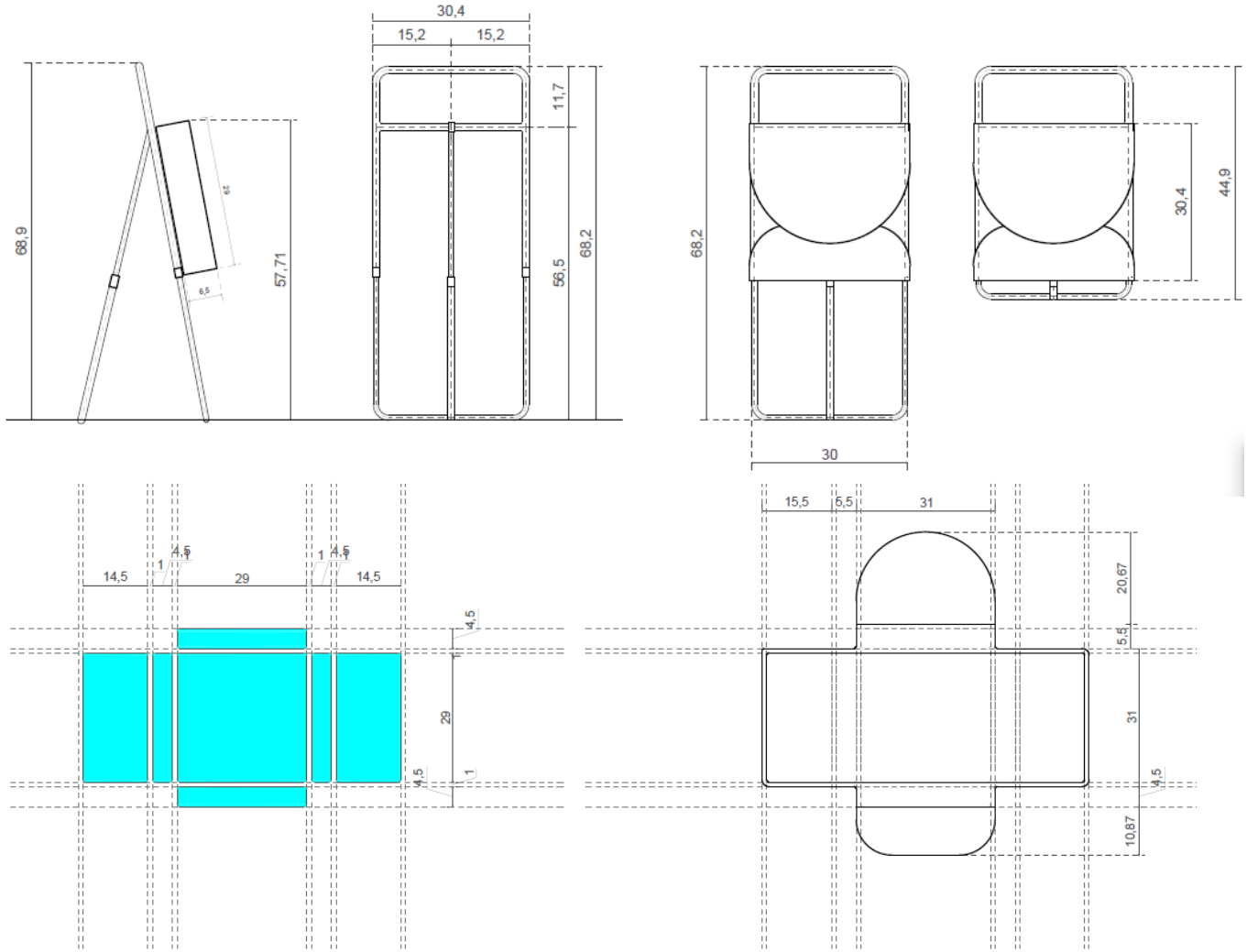
Divided into five sections

Canvas

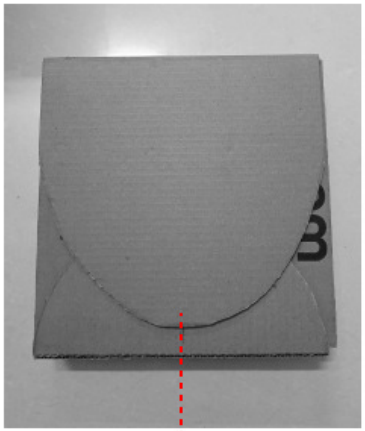


Option 02

15. Dimensions

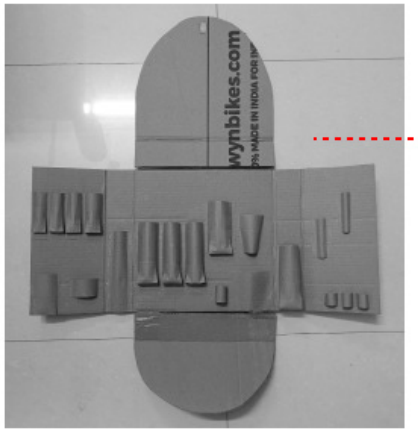


16. Prototype



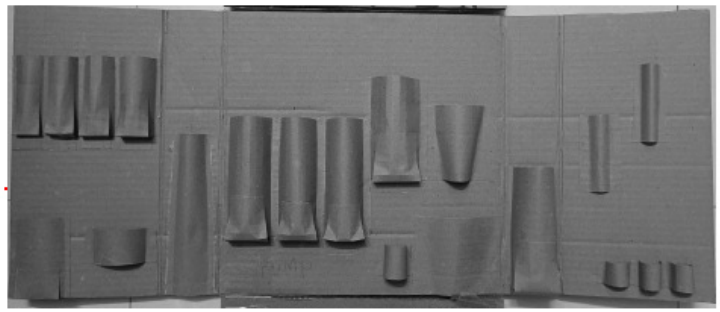
Corrugated board mockup model

Velcro



Actual dimension prototype

Flaps with pockets to hold the tools



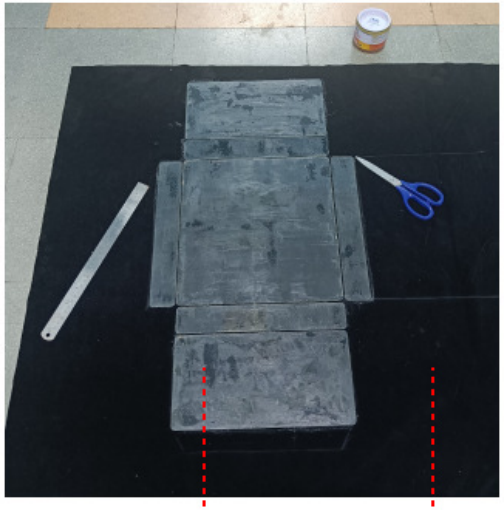
17. User Testing

Name : Sunil
Age : 70
Years of experience : 20
Total working hour : 2hr
No of cycle attended per day : 1 to 2

Tested the working rig with the technician who works at choose my bicycle who does door step service.

- Process carried:
- Washing the bicycle
- Ripping off the bicycle
- Assembling and
- Tweaking

18. Fabrication of Final Model



Fabric Cutout

Collapsible frame

19. Final Model

Tool bag final model made out of fabric with acrylic padding inside to hold tools firmly.

Handle to hold the bag while travelling

With collapsible leg

Tool bag when closed

Open position

Final Model

Rear support leg

Final Model

Rear view

20. Reference

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