RUTVIJ PATHAK

INDUSTRIAL DESIGN PORTFOLIO 2020

Hi ,

My name is Rutvij Pathak.

I am an Indian by birth. I am also an engineer specializing in electronics. I have great passion towards product designing, robotics, painting and Yoga. I am currently working at Vigyan Ashram in Pabal, India. Vigyan Ashram is a multi-faceted entity focusing on rural and sustainable development and seed invests in agricultural and rural enterprises.
This is place where I got the opportunity to develop products and solutions for the rural environment. I love to paint watercolour sketches. I am a student of the world-renowned Ramamani Iyengar Memorial Yoga Institute (RIMYI) which is the epicentre for Iyengar Yoga. It is also an integral part of my life. My creativity is heavily influenced by two legendary visionaries: Dieter Rams and Jonathan Ive.
I describe myself as “An artist whose primary medium is Silicon”.

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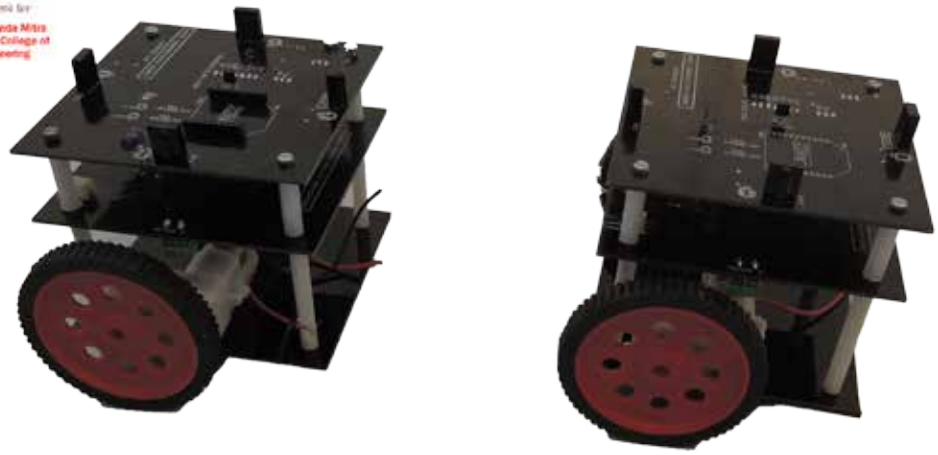
SURPRISE

This Portfolio is AR enabled. It contains extra goodies that can be viewed through APP that is created using Vuforia and Unity Player with Android Support. I have been following the AR though the fixed QR code tracker and CV days. I started experimenting with Vuforia as it can literally drag and drop elements thus, making the process of creating the app simple. The app can be downloaded using the given by scanning the QR code. Cheers !

Look out for this tag “ AR “

POINT YOUR CAMERA TOWARDS
THIS QR CODE TO DONWLOAD

MBOT - A LOW COST SWARM PLATFORM



MBOT- FINAL ROBOTS WHICH WERE MADE

In nature we observe that many insects like bees and ants work in unison. Their efficiency is observed to be higher than any single individual. Swarm robotics is an emerging indisciplinary branch. It covers area such as mechatronics, communication and Artificial Intelligence. Swarm of robots is efficient than a single robot, due to less hardware and small size, hence the term “swarm”. In our project, we planned collective action of robot to accomplish small tasks. Swarm uses a decentralized approach that creates high efficiency in the system, due to its added redundancy.

This was by Bachelor Thesis Project. We decided to make a low-cost swarm robotics platform. Swarm robotics is an emerging branch which is interdisciplinary. It covers area such as mechatronics, communication and artificial intelligence. Swarm of robots is efficient than a single robot, due to less hardware and small size, hence we prefer swarm. In our project we planed collective action of robot to accomplish small tasks. Swarm uses a decentralized approach. The 3 basic tasks are implemented ; **follow the leader** in which agents follow the behavior of a designated agent, **cluster formation** in which all agents form a **predefined shape** or pattern. Out of these tasks we were able to complete the two way - communication and line formation. This was my final year thesis project titled “Swarm Robotics and its Applications”

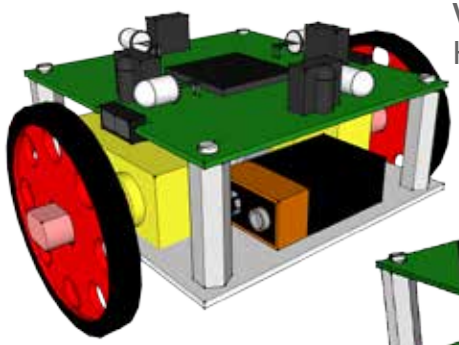
My role In this project was to design the entire hardware and mechatronic design for the robot. I chose to use Atmega 328p as due to wide availability and relatively cheap and it allowed us to use Arduino Libraries and work relatively hassle free.
The PCB design was optimized by going through multiple iterations of boards and also going back and forth with the code to change the use of multifunctional pins. After testing 3 configurations we were able to finalize the design. After that I decided to have the PCB professionally made by Chinese PCB house called “Elecrow” .

REVIEW / INSPIRATION

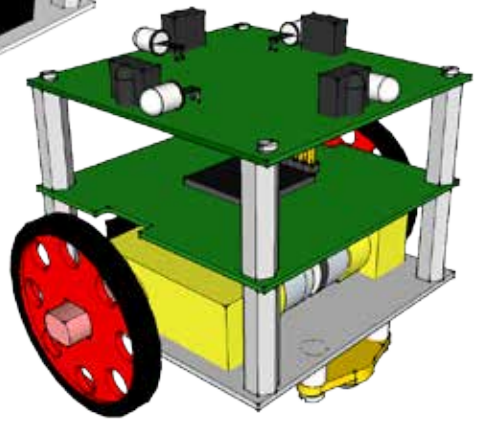
LESS COMPLEX DESIGN

COMPLEX DESIGN

As you can see from the above grid that the benchmark swarm platforms are divided from the simple to implement and complex to implement . This excercised allowed us to pick and choose things such as mode of transmission , locomotion type , microprocessor used etc .



VER1- REJECTED DUE TO HIGHER PCB COMPLEXITY

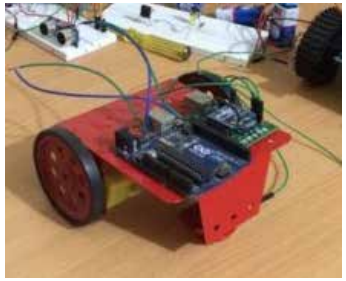


VER2- ACCEPTED DUE TO APPROPRIATE DESIGN

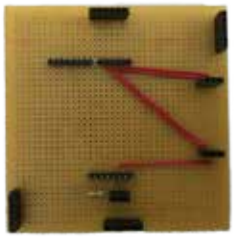
3D MODELS OF THE AGENTS CREATED USING SKETCHUP 2016

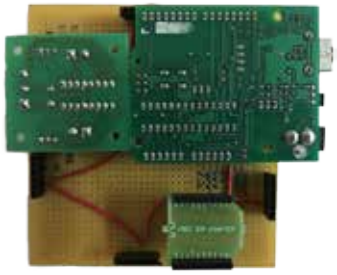
The following the images are of the agents that were designed after reviewing the all the benchmark swarm projects in the category . Notice the 2 layer design which was borrowed from all the projects to simplify the PCB debugging and design issues . It simplified various issues of interferences and the PCB paths interfering with each other .

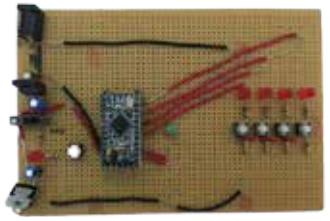
TESTING AND HARDWARE DESIGN

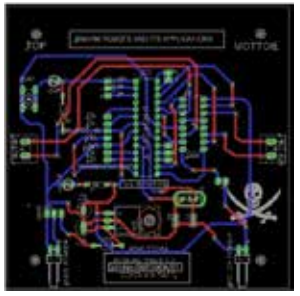


Initial prototype of the robot

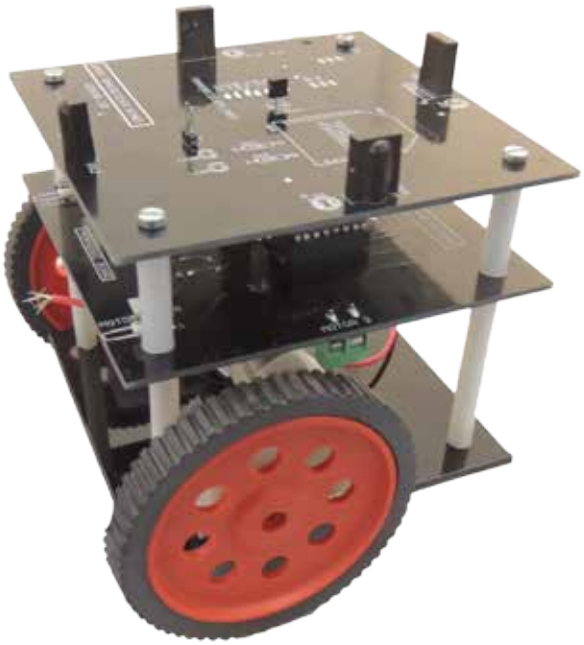








PCB Prototypes



Final Agent Construction

These are the initial zero PCB designs that were implemented for testing . This is the image of the eagle file which was the final board which was produced .

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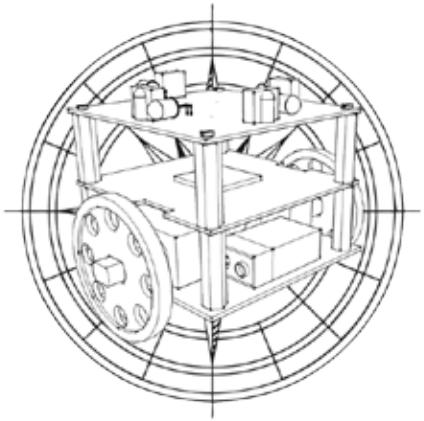
CHALLENGES FACED AND SOLUTIONS IMPLEMENTED:

1. Software integration into the hardware needed some changes in the PCB and vice versa. Various things such as improper track placement , 2 or more tracks shorting together.
2.Hardware designs and sizes shown on the screen and the actual designs were different which led to errors and needs for glitches and errors in the board functioning.
3. Final bot assembly consumed current than anticipated thus the current capacity of the battery pack had to be increased.



ASTRA 2015 - AN ALL TERRAIN VEHICLE

2015 Abhedya's Car : ASTRA (WEAPON)

2015 Abhedya's Car : ASTRA (WEAPON)

Being part of a motorsport was always a part of dream for me since childhood. When the opportunity presented itself, I applied to be part of my college's BAJA team . It is competition where students build their own All Terrain Vehicle . I was selected in team from a participant pool of 200 students. I was the only electronics engineer on the team.

BRIEF:

To build the best BAJA Car possible to best of our abilities and our limited budget.

TARGET ENVIRONMENT:

Outdoor, Full of dirt, Oil, Grease, High Vibrations.

TARGETS:

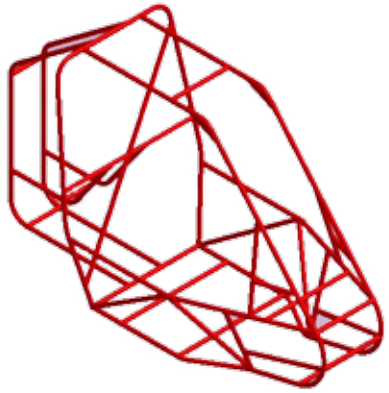
Ruggedness, Modularity of the entire car.

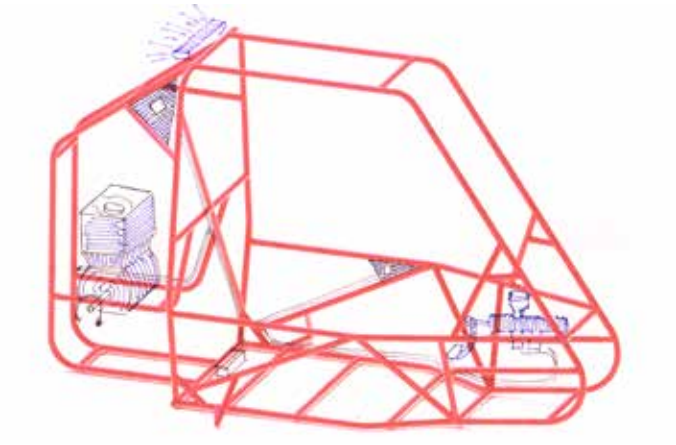
PROCESS:

I examined the circuit beforehand and took into consideration, all the possible failure cases. For e.g: Malfunctioning of switches, lights, and horns. Contingency plans were also put into place in case of a crash and/or shorting.

I designed the wire harness to be modular and be easily replaceable in the field. I used cable tags and cable spirals at places to de-clutter and better organize the wires. The wire harness was modular in nature to quickly replace any faulty components.

IDEATION





Wiring Harness Sketch

3D model of ASTRA 2015

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In the above Images you can the see the frame of the car . I designed the wire harness of the car by sketching the critical components of the electrical systerm and then joining them efficiently .

I laid out the circuit of the previous years car on the ground and studied for failure and shortcomings. Took into consideration all the possible failure cases. For e.g.: switches, lights, and horns. In case of a crash and shorting.

I designed the wire harness to be modular and be easily replaceable in the field i.e during the endurance race. I used cable tags and cable spirals at places to de-clutter and better organize the wires.
The wire harness was modular in nature to quickly replace any faulty components.

I aslo worked on helping the mechanical engineers on team design better components by making use of real time data of an accelerometer which was interfaced with a Arduino Uno.This work culminated into a research paper that I wrote along with a team mate .The paper is titled **“Accelerometer based g -force measurement on various dynamic components of an automobile wireless sensor network”**
and can be found at

“http://www.ijiert.org/vol_iss.php?id=22” .

Over the course of the year I learned mechanical manufacturing techniques and practices.,which greatly help me to this day.

Accelerometer placed on the wheel hub

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Images show various critical points on the electrical harness of the car.

“BAJA SAEINDIA“AUTOCAR COVER 2015

ID CARD

IYENGAR PROPS - Future proofing Yoga

Yoga is an ancient Indian practice for holistic health. Iyengar Yoga, as it is commercially known these days was popularized and taken mainstream by Guruji B.K.S Iyengar. Iyengar Yoga focuses on the technicality and symmetry of movements. Iyengar is also known specifically for use of props i.e. specifically designed wooden blocks and boxes to help and improve the postures.
Iyengar Institute has been an important part of my life for the past six years. I am also a volunteer for various events and functions conducted by the institute, which is an influential part of my life.
There was discussion amongst the core members about the standardization and documentation of all the props that Guruji devised. I took up this project as I have experience in 3D modelling.
One of my hobbies is to watch Japanese documentaries on the net. My interest in Japanese Culture had already introduced me to Sashimono type of Furniture i.e. no Glue and No Nail Approach to design, which is ideal for Yoga.
Problems with existing Props was due to improper construction and hacky craftsmanship. This led to the fear of stability of the Props during certain advanced poses.

HalasanBox being used in practice , to relieve stress on the spine.

image source : "https://featheredpipe.com/therapeutic-yoga/ "

HalasanBox created by Mr.B.K.S Iyengar

HalasanBox modelled using Fusion 360

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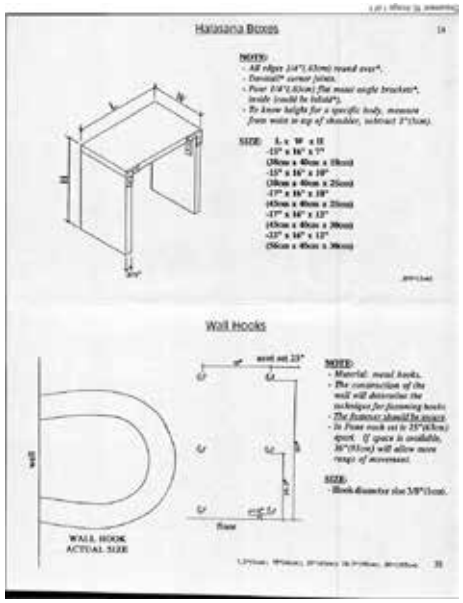
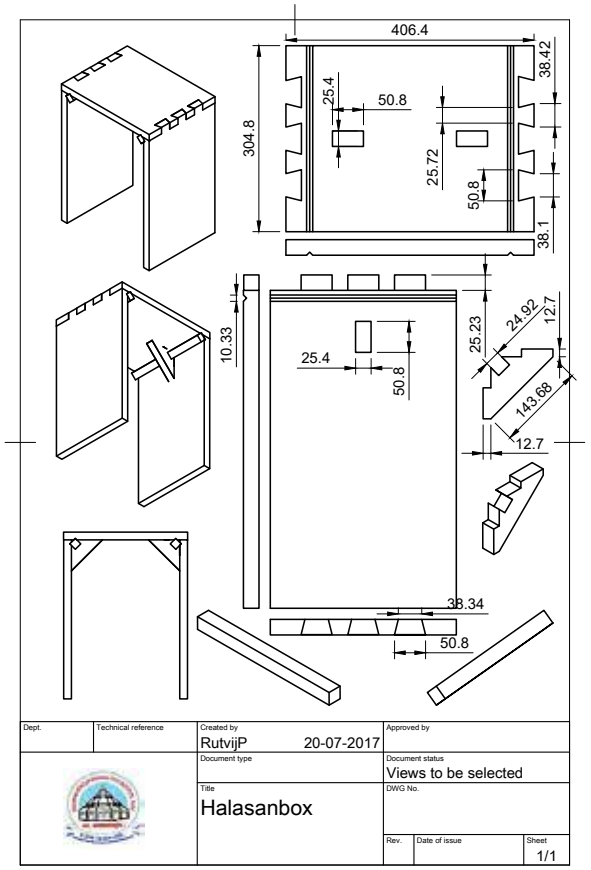
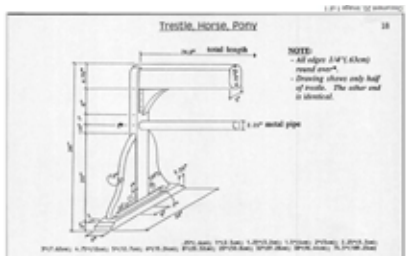


The current props book was made by Francois Lozier in January of 1994. Existing book which is being used as a standard .It contains error and is not comprehensive as it only illustrates the shape and size of the prop . The designs are not suitable for manufacturing.



The page of working Props booklet named Halasan Box.

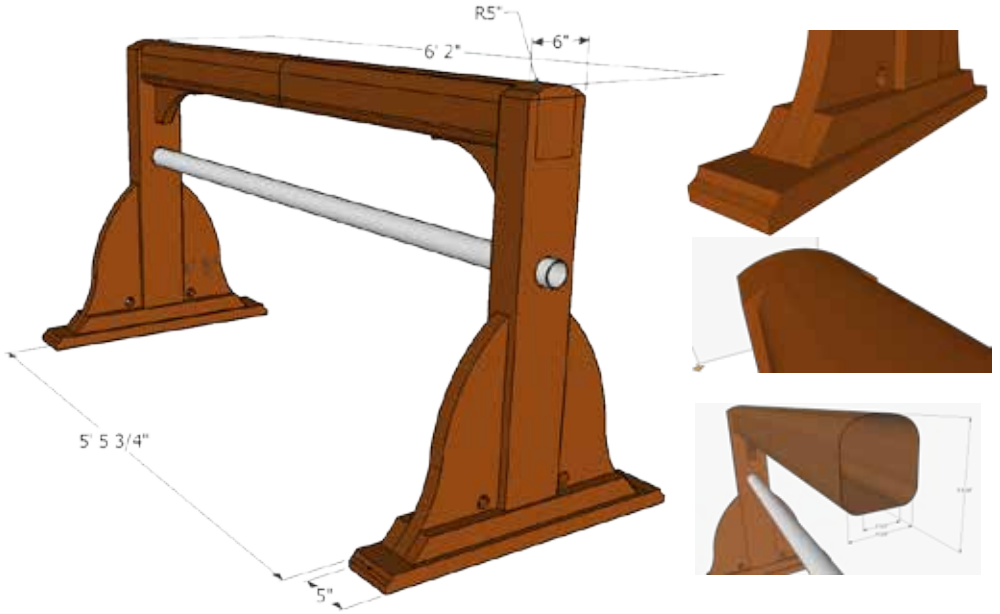
The second part was designing of the actual PDF. As Iyengar Yoga is spread across the world, it only made sense to use English as the main language. The IKEA instruction manual was used as inspiration for the PDF as IKEA instructions are mostly conveyed linguistically and pictorially thus surpassing the language barrier.
The entire PDF layout was kept clean so as to convey the dimensions and the instructions clearly and the reader doesn't have to rely on the language guide.



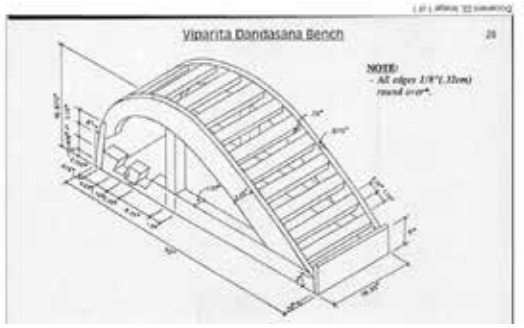
Existing page of the props booklet detailing the tressler

This props is one of the big-gest wooden props which is used in Iyengar Yoga . It is called a Tressler , This is used mostly for standing poses .
The following props are modelled in SketchUp2016.

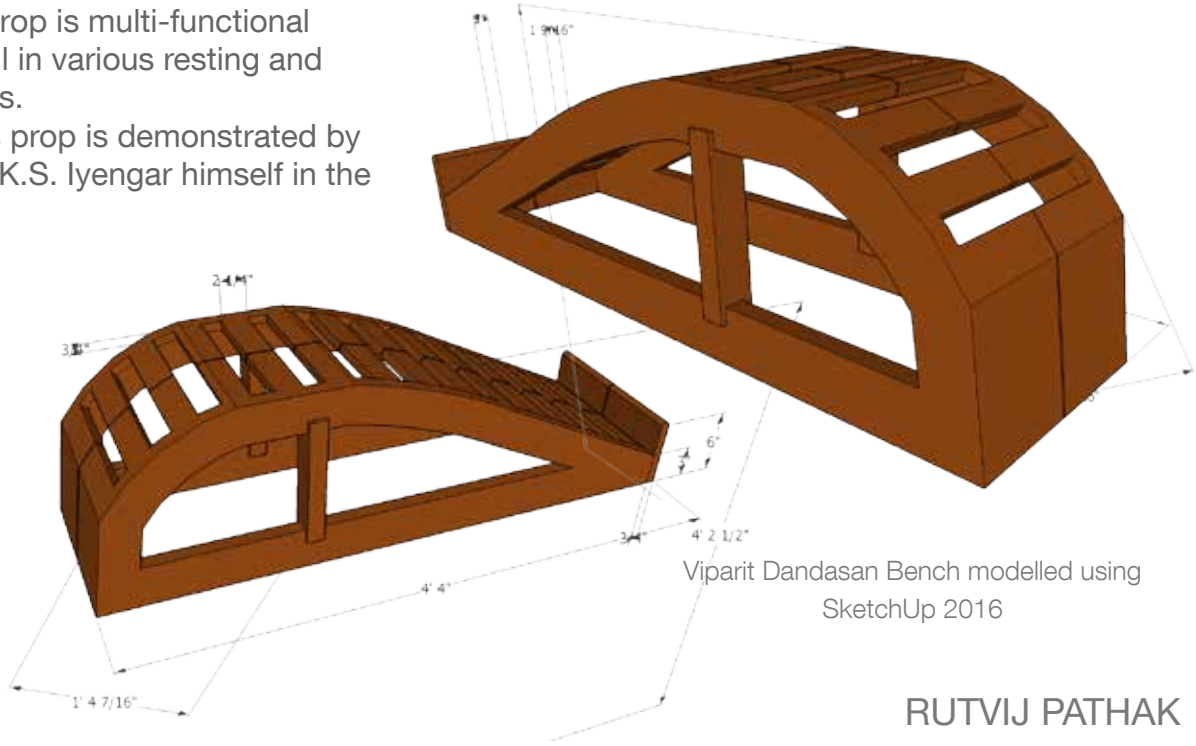
tressler in use



Tressler modelled using SketchUp 2016



This prop is called **Viparit dandasan Bench** . This prop is multi-functional which is usefull in various resting and inversion poses.
The use of this prop is demonstrated by Yogacharya B.K.S. Iyengar himself in the image below.



Viparit Dandasan Bench modelled using SketchUp 2016

VIGYAN ASHRAM - AN INTRODUCTION

Vigyan Ashram is a center of Indian Institute Of Education (IIE) Pune. A scientist turned educationalist Late Dr.S.S.Kalbag started Vigyan Ashram in 1983 to find out solution to the problems in education.

For us “Vigyan” means ‘Search of Truth’ and “Ashram” symbolises ‘Simple living and High thinking for us, a organization where all are equal, it’s a modern version of old Gurukul system’

To increase the pace and quality of our education delivery system, ashram adopted new information technology. Many Govt and Private organization and individual donor supported the programs of ashram.

Vigyan Ashram is located in village Pabal approx 70 kms from Pune. Its situated on Rajgurunagar - Shirur Road. Population of Pabal is @ 10000. There are several small hamlets attached to Pabal which make Pabal central market place.

Pabal is drought prone and its truly representative Indian village. Idea of establishing Vigyan Ashram at Pabal is whatever we do at Ashram can be replicated in any part of the country.

Vigyan Ashram is working on the above philosophy named as ‘Rural Development through Education System (RDES)’ initiated and practised by its founder Dr.S.S Kalbag. Various appropriate Technologies innovations developed are disseminated through education program.

Students learn by ‘Learning while doing’ methodology and while doing so they provide services to community at modest cost. This gives students experience and confidence to start their own enterprises. Appropriate technologies are disseminated through these rural enterprises.

Premises of Vigyan Ashram

Education based on ‘Learning while doing’ philosophy gives meaningful education to students and helps to develop scientific temper and work culture in them. VA tried to integrate technology in the concept of ‘work centered education’.

It is also demonstrated new areas and ways of providing community services. VA believes, for education for 21st century, we need to change our education system from ‘Book centric’ to ‘Work centric’ education.

Therefore VA set its self vision of ‘To become a national resource centre for research, development and training for transformation towards work based education system and related social policies’.

GREY WATER SANITATION

CONTEXT :

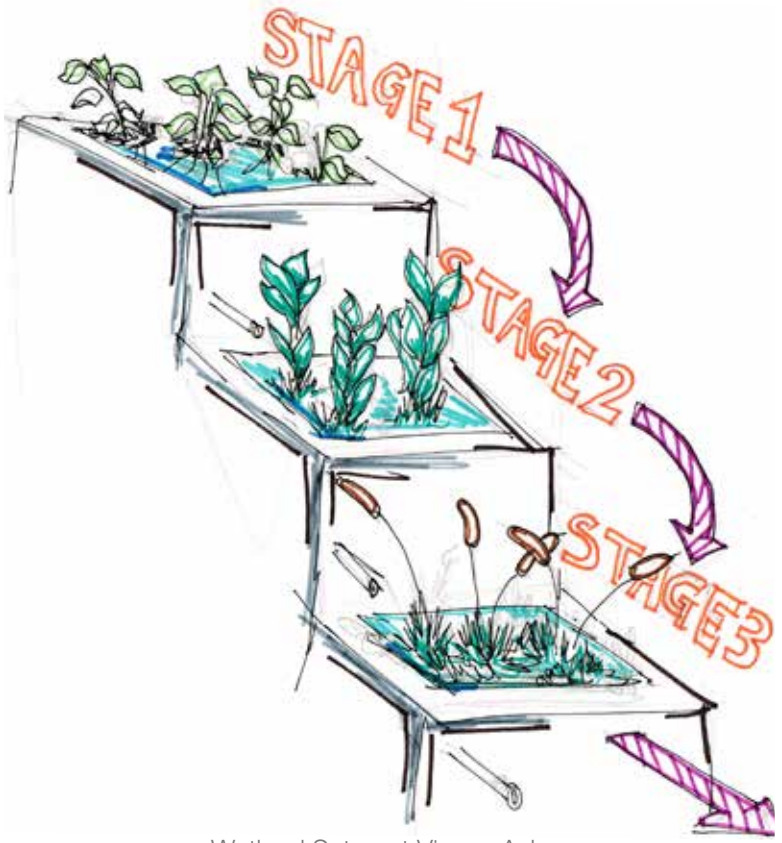
Pabal, located in Pune district, is situated in a drought-prone area, so water in Vidyan Ashram is of utmost importance. Vidyan Ashram has a small vernacular school consisting of 50 students. Amongst them, only the boys' hostel bathing utility uses grey water. This grey water is filtered using a constructed wetland technique.

CHALLENGE :

The challenge is to recycle the grey water and introduce into the daily use. i.e. back into the cycle.

WORK:

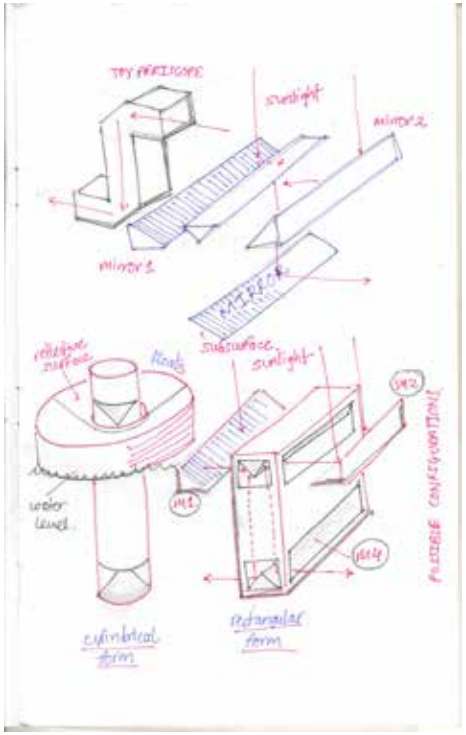
The brief of the problem was to remove the "smell "of the water. The smell of the water was attributed to presence of phosphates in the water .so algae was introduced in the system to consume the leftover nutrients in the water. Later algae will be removed from the water and will be fed to the grass carp which is being raised on the premises for a high density fish farming project.
Algae became the common factor which was prioritized as it was the cheapest and the easiest way to remove these nutrients in the water. The plan is to stimulate the algae in the subsurface level of the grey water to quickly consume and reduce the holding time of the grey water in the system. The plan is to stimulate sub-surface growth by inducing additional lighting in the tank. The issues are that surface penetration of the light is 10 CMS for water but lower for water with additional dissolved and suspended solids. Thus, we cannot use the sunlight even though its abundance.



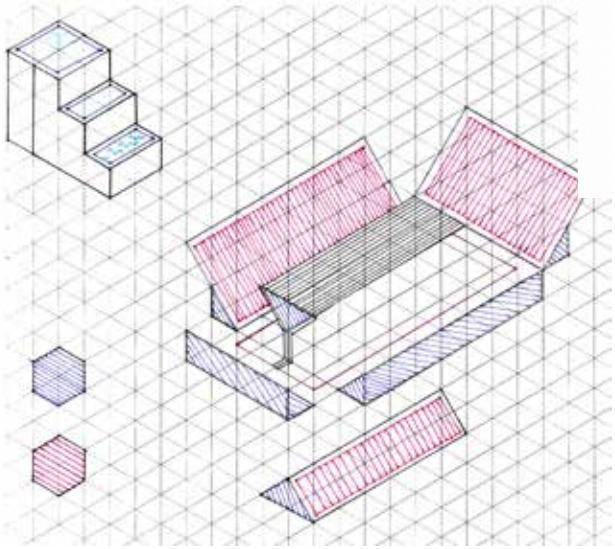
Wetland Setup at Vigyan Ashram


" USE " cycle of water

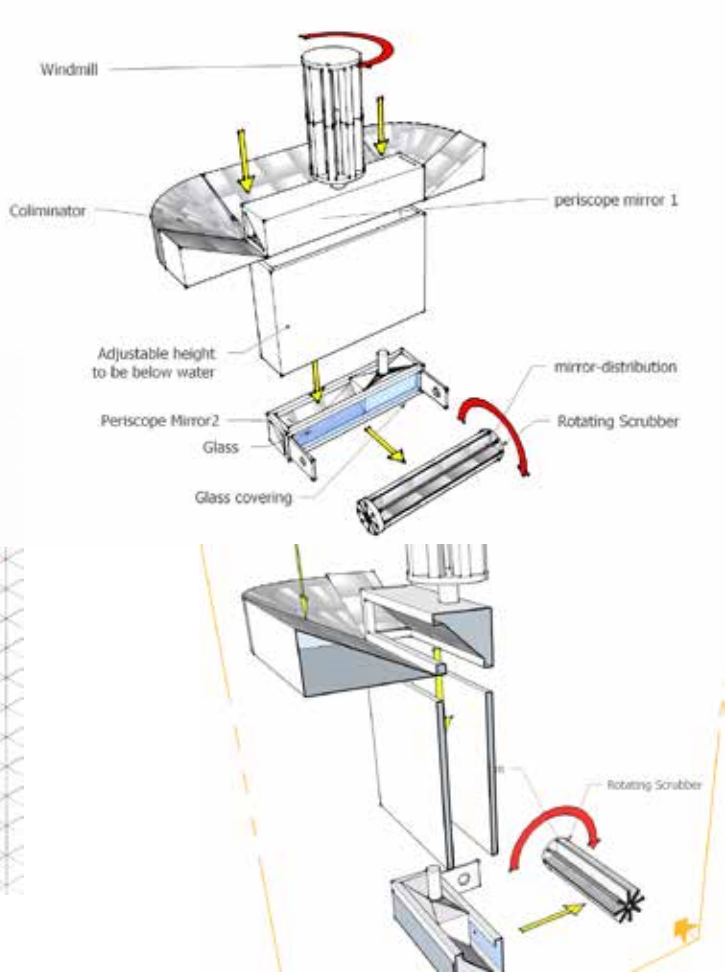
IDEATION



Ideation Sketches for the periscope



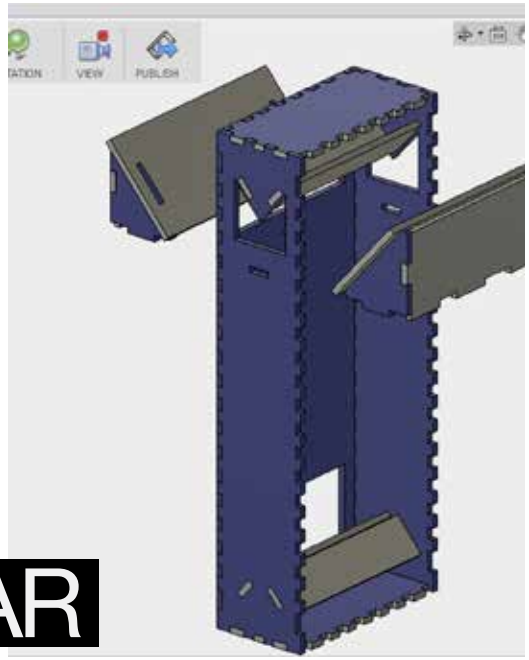
REFINEMENT



Low fidelity CAD model using Sketchup 2016

The subsurface pentration of water is very low i.e only 30 cms . I designed a solution to introduce sunlight in the subsurface layers to increase the area which the algae can grow thus speeding up the process.
The solution I came up with was designing a periscope like structure to increase sunlight penetration in subsurface region of the water. There is already a Solar Scheffler at the Vidyan Ashram and I was inspired by the toy periscopes I used to make as a child. Thus, this combination of periscope and Scheffler was made. Its advantages are the simplicity of operation. and hassle-free installation.
Various variations of the periscope were envisioned i.e. floating in water body or attached to the side of the tank.

FINAL DESIGN :



Periscope modelled using Fusion 360

Periscope with reflective mirrors inside .

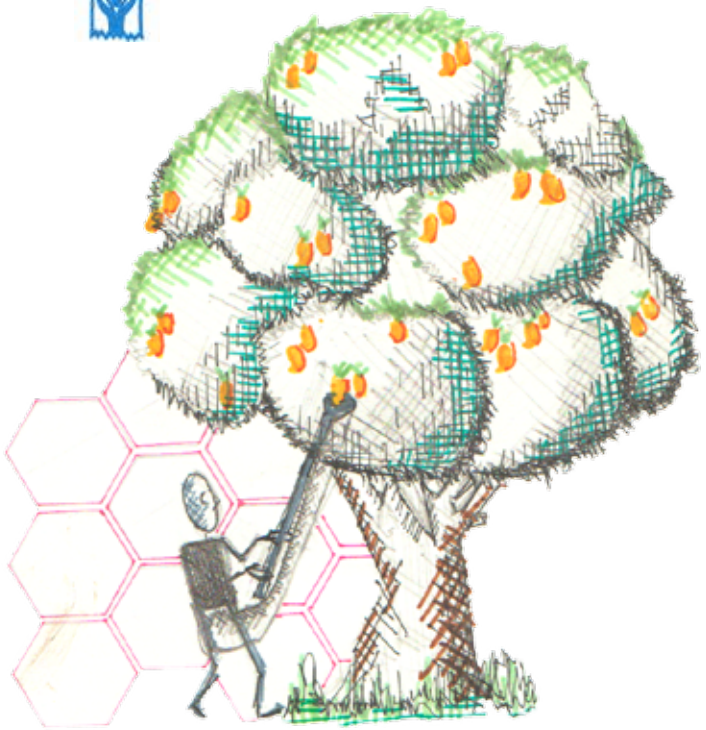
Periscope which was lasercut using Fusion 360

This is the combination of the entire design which is a mixture of the toy periscope along with the bioreactor made inset . I was designed in Fusion 360 and cut on a laser cutter ,
The periscope is giving promising results as the dissolved oxygen has increased by over 17 % and the chemical oxygen demand of the water has dropped.

This periscope solution is also cheap as it uses sunlight . Thus making it cheaper and more hassel free to implement . Operation of the system is almost free and is also maintenance free.
This periscope system can be deployed at the side of water tank or can be deployed inside a tank with floats .

Actual Place of deployment

MORDERNISED MANGO(FRUIT) PICKER



Ideation sketches and user research sketches on the mango picker

A. PROBLEM STATEMENT :

"60% of export quality mangoes in Maharashtra go to waste due to improper handling there needs to a tool designed to better harvest the produce so that this percentage can be lowered This will directly increase the profits for the farmers"

B. RESEARCH

a. Existing Problems of the Current Product :

i. Low – Availability of Labour as harvesting doesn't play that handsomely.

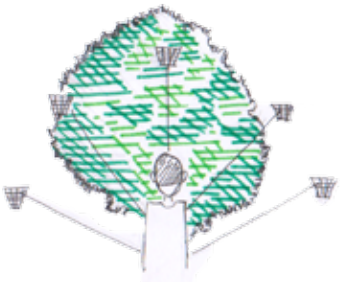
ii. Use of the same crude tools and harvesting practices

iii. Mangoes harvested before being ripened i.e. colour change in the man go when it is ripe. Then only It needs to be picked mangoes picked before that will not ripen thus leading to wasted fruit

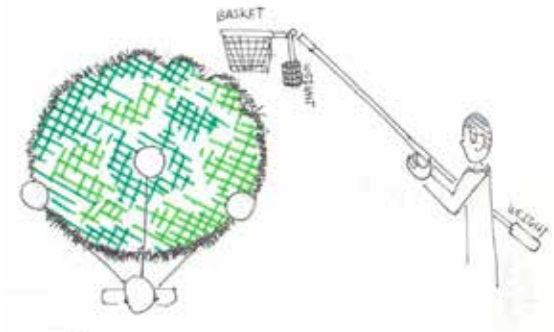
iv. Harvesting is cumbersome due to the old tool.

v. Stem Acid of the fruit damages the skin of the fruit .Blackening it which reduces the market value drastically.

vi. Mangoes which bruise also darken which leads to rejection of the fruit for export.

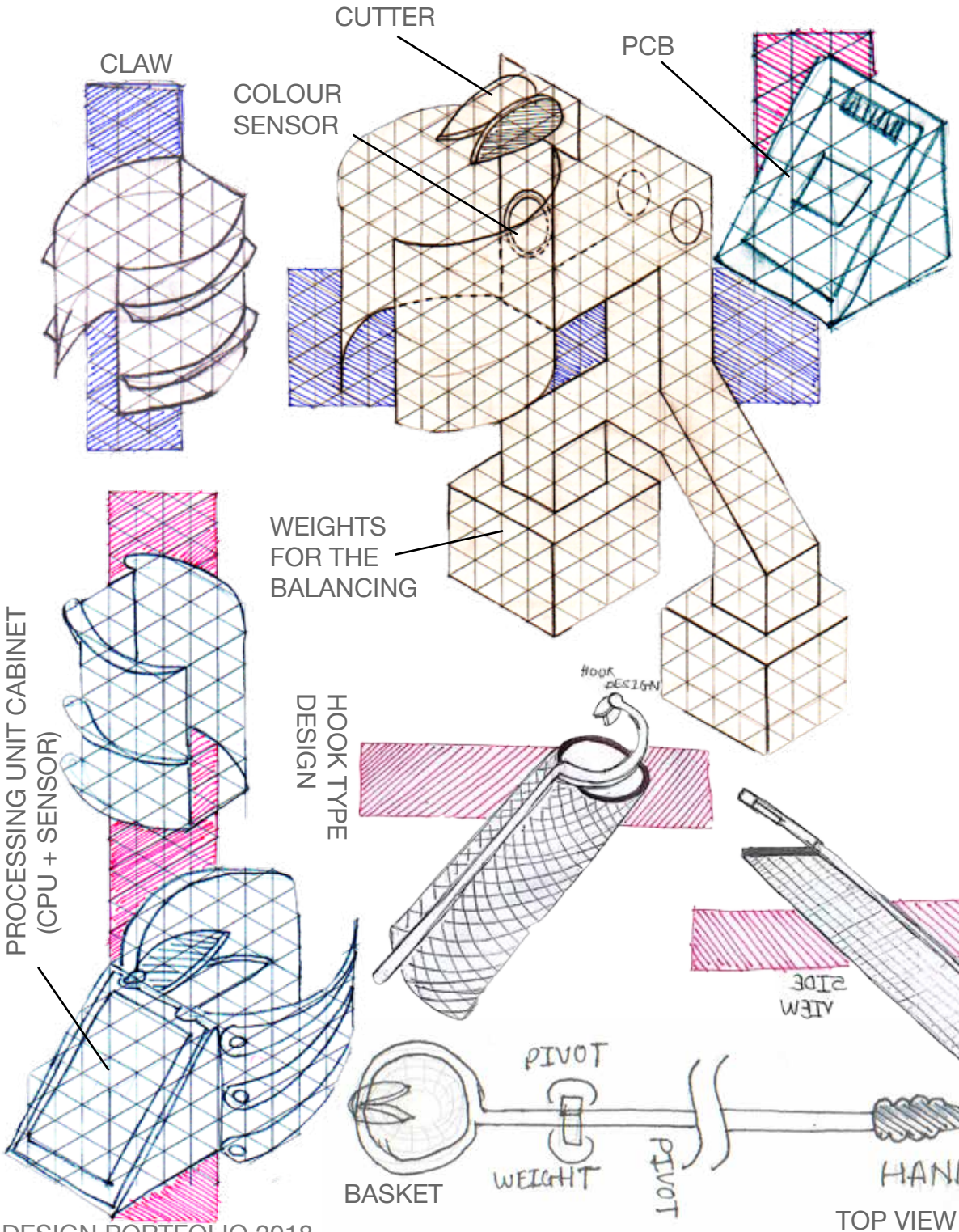


Front View (Axis 1)



Top View (Axis 2)

EXISTING SOLUTIONS FOR THE PROBLEMS



B. PROBLEMS ON THE SIDE OF THE USER (HUMAN INTERACTION):

i. Too much load of the entire shaft on the shoulder and arms of the user.

ii. Fixed basket makes it hard for moving the tool to the fruit and needs constant adjustment of poisition.

iii. After being cut the fruit directly falls to the ground, after which it is extremely likely to get bruised.

C. POSSIBLE SOLUTIONS:

i. Auto levelling basket to increase the usability of the product to make sure the basket is always level to the ground and the cutter always aligned to cut the stem of the fruit.

ii. Colour Sensor to give the binary decision on whether the mango is to be picked or not.

iii. A net channel to be designed below the basket to guide the fruit into the basket without damaging it.

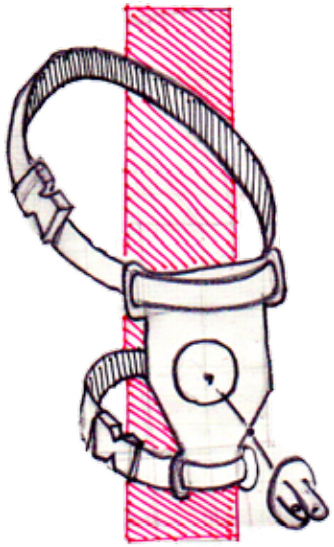
iv. Counter Balance provided to reduce the stress on hands and shoulders of the users.

v. Counter Balance hangs around the HIP so that the entire weight is on the hip and not entirely on the hands. (existing problem – use fatigue)

INSPIRATION

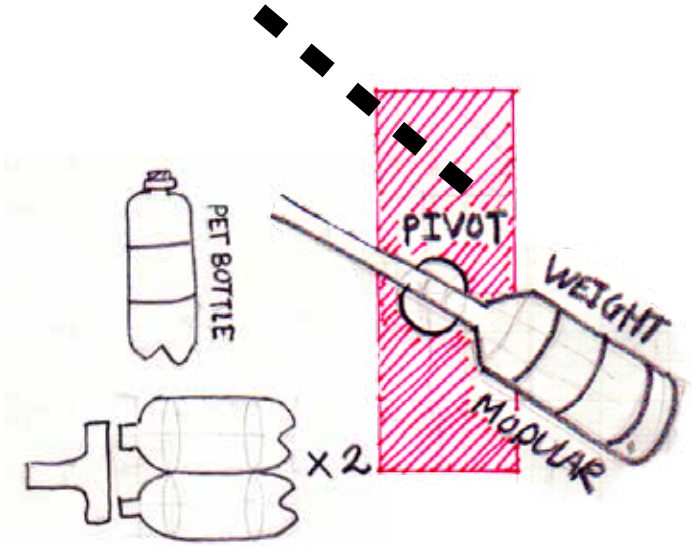
“STEADICAM” - FOR CAMERAS

“FORTIS”- LOCKHEED MARTING EXOSKELETON



PISTOL STYLE HOLSTER

HARNESS DESIGN SKETCHES



MODULAR WEIGHTS BY PET BOTTLES DUE TO THEIR WIDELY AVAILABILITY

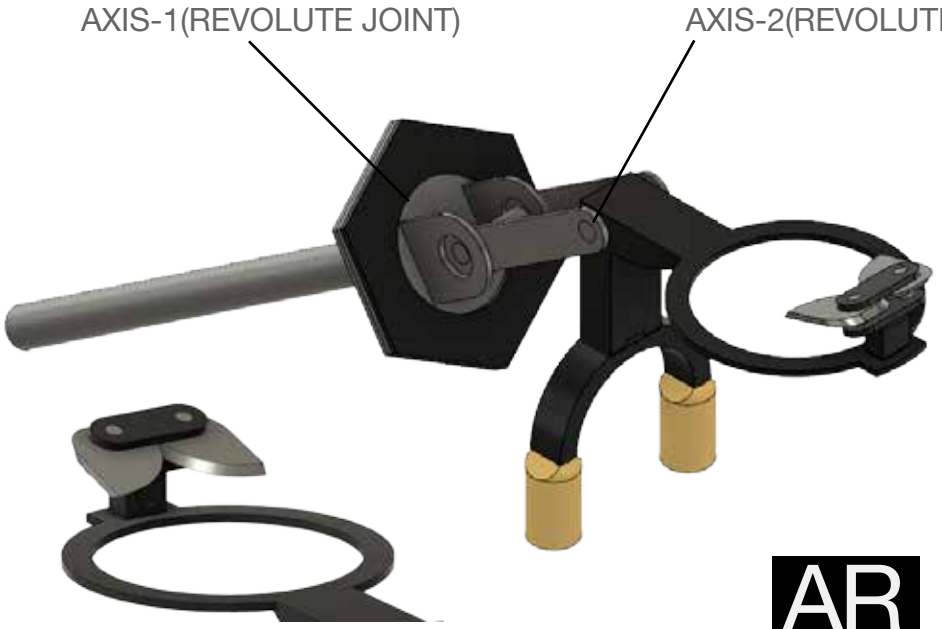
MODULAR WEIGHT SYSTEM WITH THE PIVOT

IDEATION

A common complaint of the users using traditional tools.Prolonged resulted in fatigue in hands and shoulders . The video production industry has been strugling with this issue of heavy cameras . That is why companies like “Steadicam “ developed various harness with arm which comes springs which can be tensioned to essentially to male the camera weightless.

Recently companies like “Lockheed Martin “ have comeup with exoskeltons for their workers on assembly plants to make their 50 lbs tools weightles .

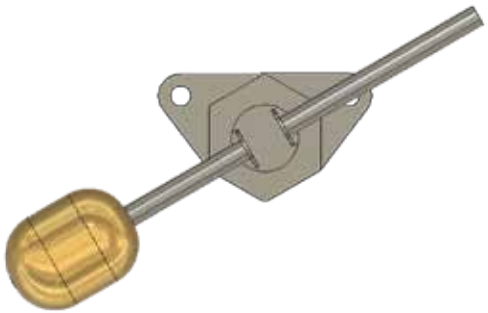
This is main direction I have choosen to work on . The product will use a small pivot and a counter-balance system to make the rod and the basket weightless. As the product will be used in rural context . I have designed the weight of the system to have large PET bottles filled with water of sand to be used as weight which will provide , flexibility of caliberating the balance .



Above images are of the top end of the assembly with the curved cutting blades to deliver better cutting peroformance

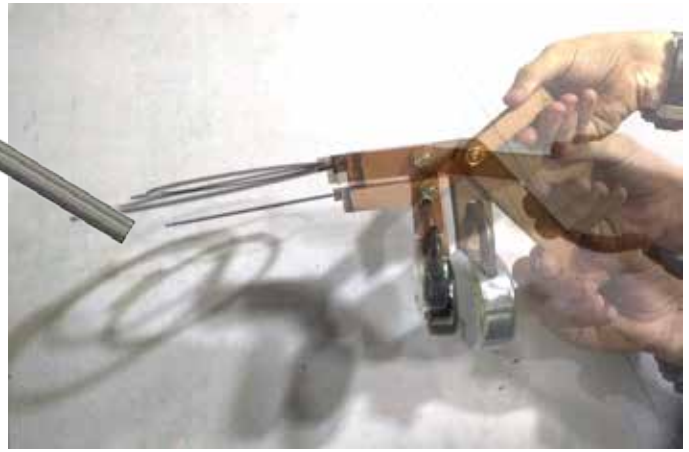
The test Rig is designed out of MDF to test the Gimbal operation . It was successfully tested

AR



WEIGHT AROUND THE HIP

Above images are the CAD model I made of the basket and the counter weight situated on the waist of the used which will fastened to a harness



LOW FI PROTOTYPE

As you can see from the image I tested the Gimbal using a test rig by using a weight attached to the assembly to test the stabiliy of the basket.

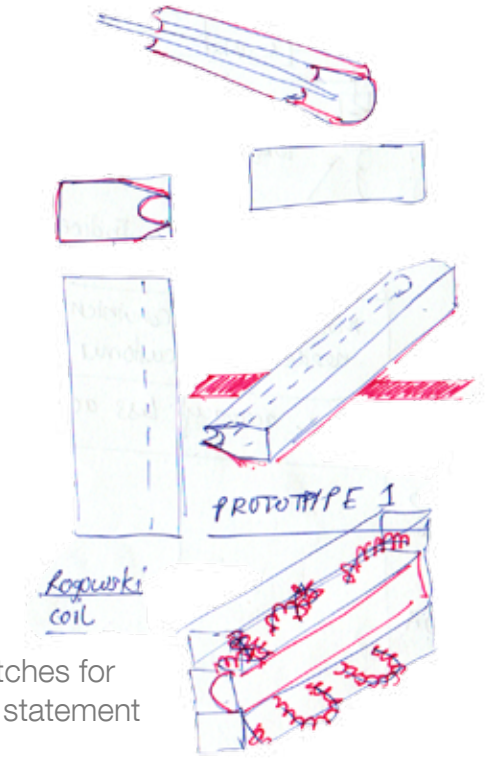
S.T.E.A.M SCHOOL :

ENERGY MONITORING: MAINTAINING CLEAN ENERGY EQUIPMENT

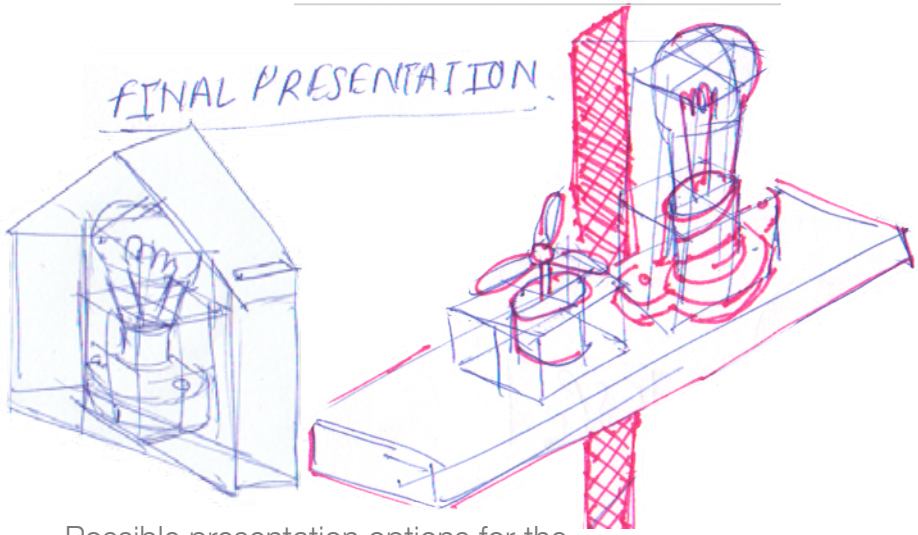
S.T.E.A.M SCHOOL

An initiative to encourage hands-on education and problem-solving, based on the United Nations Sustainable Development Goals. Held under the umbrella of Bonjour India 2017-18, this Indo-French partnership programme will bring together 100 participants from India & France. Projects will be designed and built and viable projects will receive incubation support. The challenges are based on the United Nations Sustainable Development Goals and the final projects will be showcased at the TECH2017 Conference, by UNESCO & MGIEP, in Visakhapatnam on 16-18 December 2017. The hackathon was suplemented by various talks about gamification , Paper prototyping , gamification , and also the aspect of Behaviour design etc . I choose to work on :

Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all Our everyday lives depend on reliable and affordable energy services to function smoothly and to develop equitably. A well-established energy system supports all sectors: from businesses, medicine and education to agriculture, infrastructure, communications and high-technology. Conversely, lack of access to energy supplies and transformation systems is a constraint to human and economic development.



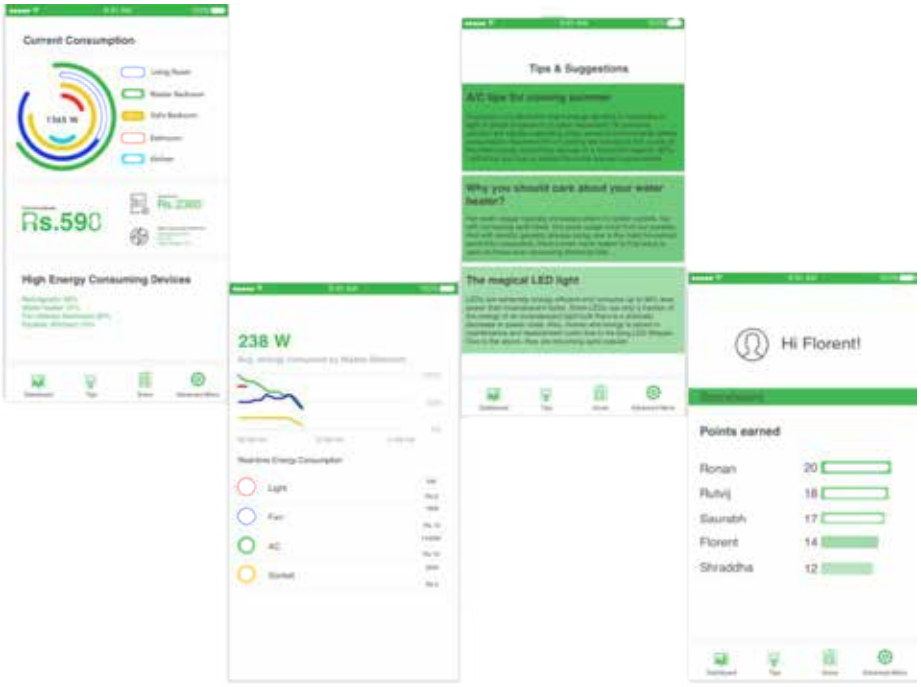
Ideation sketches for the problem statement



Possible presentation options for the final presentation.

Paper prototyping of the concept

Final prototype presentation



Screen Captures of the Prototype App that we made to notify the user of his energy consumption.

I was responsible for the actual tech implementation of the product and making the case while my teammates worked on the user reseach , gamification and behaviour design aspect of the project.

REVISED PROBLEM STATEMENT:

How might we help the consumer be more conscious regarding his/her energy consumption

CURRENT SCENARIO:

According to NSSO, total household consumption in 2008 = 151.86TWh . 5-10% of household energy consumption is due to wastage. The consumer is not aware of this and neither is he/she bothered to cut down on his consumption.

PROPOSED SOLUTION:

In order to keep a track of each and every device and the energy it consumes, install our product for each room and download the app.The app is connected to the device through WiFi, it will monitor consumption pattern and will produce real-time updates.
We have assigned a separate page that will guide the user towards reducing wastage of energy.
The entire plan will be set up on a community level and a reward scheme for users is planned for the same.(Gamification aspect)

FUTURE ROADMAP:

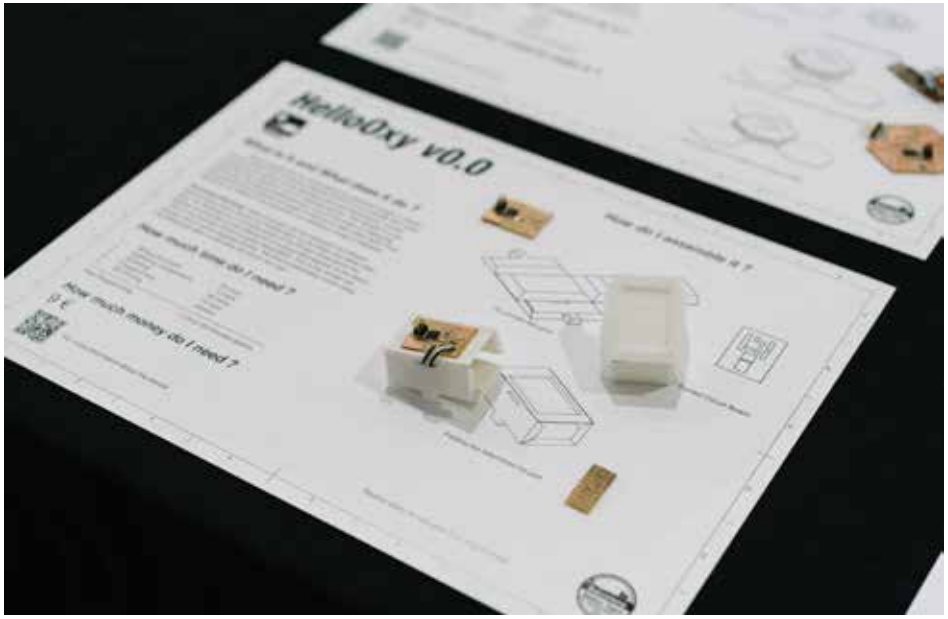
Collaborate with local vendors such that the points earned can be redeemed for tangible utilities.Collaborate with energy providers so that the points can be used to get better tariffs.Monitor the health of devices and update users when needed replacement.

HelloHealth , a modular and accessible family of healthcare devices

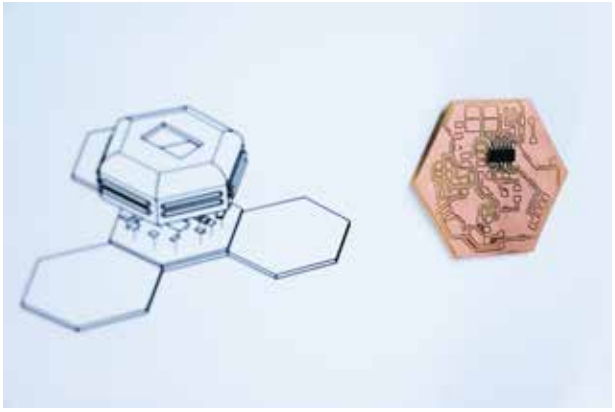
Today the paradigm for medical devices is like the smartwatch: for it to work you need a cellphone, a mobile network an internet connection in some cases, more so now with the future of ioT. Instead, we wanted to create medical

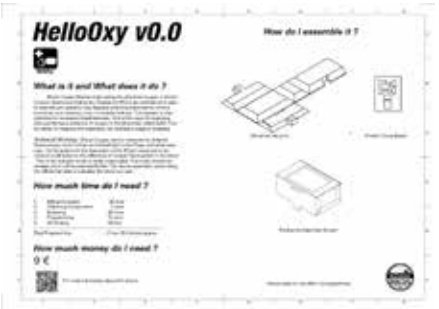
devices that can be self-sufficient, meaning they have

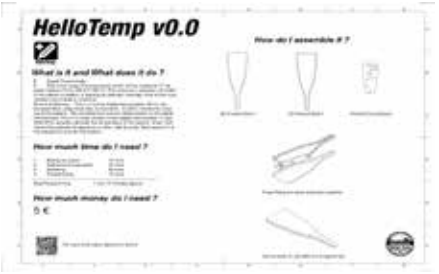
their own power supply, and work
without a cellphone grid or internet connection.
Medical devices don't work well or don't work at all once you take them out of their environment, (e.g. the hospital), but when we are providing healthcare services in the farthest reaches of the world, you need medical devices that work in those circumstances and at a cost which makes it possible for them to reach who need them the most.



Project exibited at MakerFaire Barcelona 2019







More information available at : https://wikifactory.com/+hellohealth

MISC. SKETCHES