TrackATool

....Don't Forget to Remember...

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ABSTRACT

TrackAtool is a wearable device which uses a cloud-based deep-learning framework to help human-memory to recall the location of their day-to-day objects. This tracks all objects around, providing a simple-yet-efficient mechanism to solve problem that is so prevalent in dementia people. This mechanism, unlike a tag-based object identification, is not limited to objects that have been specifically tagged. It is placed over the clothing, Captures images as user moves around and processes them to extract the objects within them.

INTRODUCTION

Dementia is a broad category of brain diseases that cause a long-term and often gradual decrease in the ability to think and remember that is great enough to affect a person's daily functioning.

Dementia at this time simply referred to anyone who had lost the ability to reason, and was applied equally to psychosis of mental illness, Dementia has been referred to in medical texts since antiquity. . Several countries have national plans or strategies. Many support networks are available to people with dementia and their families and caregivers.

Countries like India consider the care of people living with dementia a national priority and invest in resources and education to better inform health and social service workers, unpaid caregivers, relatives, and members of the wider community several charitable organisations aim to raise awareness and campaign for the rights of people living with dementia. There is also support and guidance on assessing testamentary capacity in people who have dementia.Recently Bill gates also invested 229 million dollars for research on dementia.

In today's world, dementia is a common ailment prevailing in developing countries like India. It starts with simple symptoms like forgetfulness, difficulty in pronunciation, confusion, etc., and worsens with time. Person who faces these symptoms is not the only victim to dementia. This set includes the family members and caretakers. It makes the whole family chaotic.

OBJECTIVE

We aim to make dementia people independent from others, while searching their belongings in day-to-day life. In India, there are no reliable existing products for keeping track of the objects. So, we would like to help such kind of people, by making a device which can store the location of their belongings .When asked for the location of particular object it informs the location.

Need Statement

A way to solve forgetfulness of daily belongings by dementia people to ease their daily life.

Mission Statement

Helping dementia people by assisting and helping them.

User study

Our team had visited, Jabalpur Hospital, Johri hospital, ..and consulted doctors and spoke to caretakers in a care centre . From the forms filled up by them as reply to our questionnaire, we analysed the data.

As forgetfulness is primary element in dementia people. We have asked, "What you are forgetting usually in your daily life?" and the response is as follows
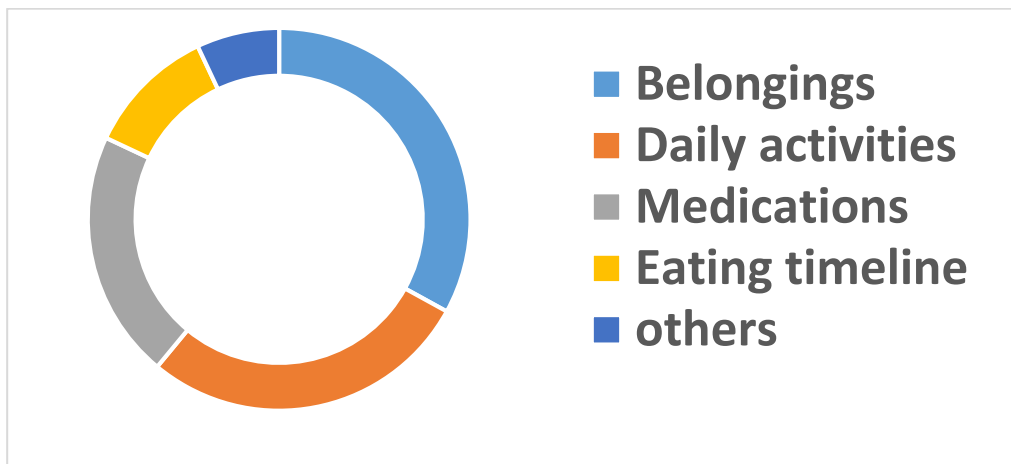
And we have asked for the places where they are going to spend their most of the time,

They are spending their most of time in either home or office.

Market survey

At present, TrackR is the only product which helps in locating the objects through GPS module. TrackR is a coin-shaped chip, which is attached to the objects which are used in daily life . When misplaced the object, a click in the phone app makes the chip attached to the corresponding object beeps.

But, each TrackR costs 3000/- , which makes it very costly and also not reliable.

Drawbacks

- o   Costly
- o   Not Reliable
- o   Limited to only few objects

Customer Needs

From our user study, we have derived the following customer needs

<u>Primary</u>: (must)

1. Objects that would be covered
   - Medicines, keys, spectacles, books, cards, wallet, etc.
2. Work places that need be covered
   - Home, office (for job holders), School (for students).
3. Range that would be covered is 2-3 m.
4. Can be used Independently

<u>Secondary</u>: (may/may not)

- A reminder for daily activities and medications.

Product Specifications

- Wearable Wireless device
- Portable and user-friendly
  - Weights around 120-140 grams
- Life span:- long lasting
- Power source – rechargeable battery
- Shock proof
- Water resistant
- Cost approximately ~ ₹3000 - ₹5000

QFD

In QFD, the bench mark product we have taken is the TrackR.

Strong positive ⊙   9 = Strong

Positive ⊖   3 = Moderate

Negative X   1 = Weak

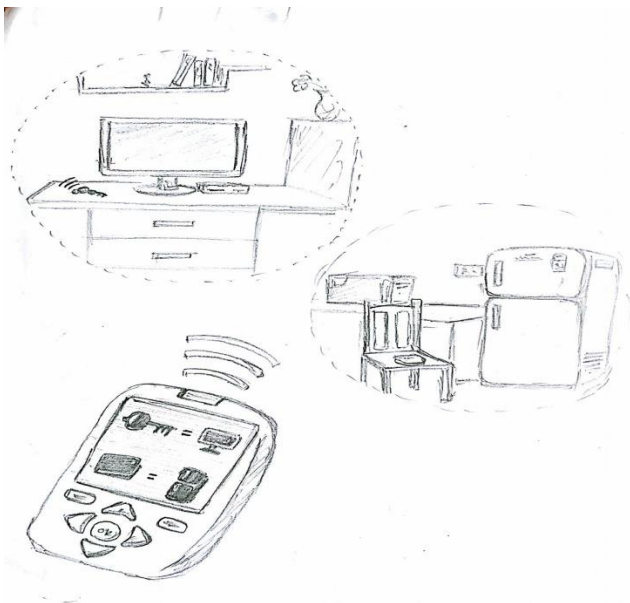| Requirements	wearable wireless device	portable user-friendly	weight ~ 120 - 140 grams	life span ~ long lasting	power source : Rechargable battery	shock proof	water resistent	Cost of manufacture	Customer Importance	TrackR	Planned device	Improvement ratio	Sales point	Improvement ratio	Relative Weight
Objects Covered: keys, medicines, wallet, spectacles.	3	3							5	3	5	1.67	1.5	12.5	0.17
Work places covered: Home, Office, School	9	9							4	5	5	1	1.3	5.2	0.44
1-3 m Range would be covered								9	2	4	4	1	1.3	2.6	0.022
Can be used Independently		9	9						5	3	5	1.67	1.5	12.5	0.107
Shock proof						9			5	1	3	3	1	15	0.129
Water resistance							9		5	1	4	4	1.3	26	0.224
New Features															
Remainders for daily actiivties and events		3							4	1	3	3	1	12	0.103
Cost				3	9	3			4	1	3	4	1.5	30	0.259
Absolute importance	1.026	1.68	0.963	0.777	2.331	1.938	2.016	0.198	11.929					115.8	1
Relative importance	0.086	0.1408	0.0807	0.065	0.195	0.162	0.168	0.0165							
TrackR	2.0	3.0		1.5	4.0			3.0							
Direction of movement	↑	↑	X	↑	S	X	X	↓							
Target Values	5.0	5.0		3.5	4.0			2.0							

Concept Generation

Concept 1:-
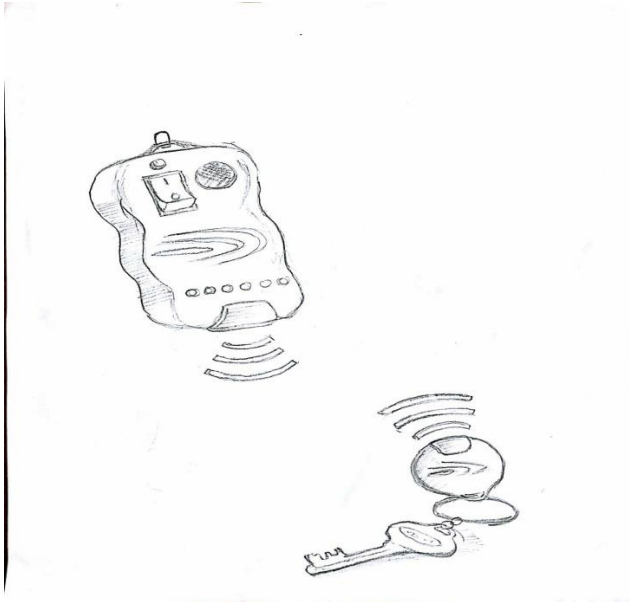
- Every object is attached with a chip.
- This chip emits a particular frequency.
- Device detects these particular frequency & helps to locate things
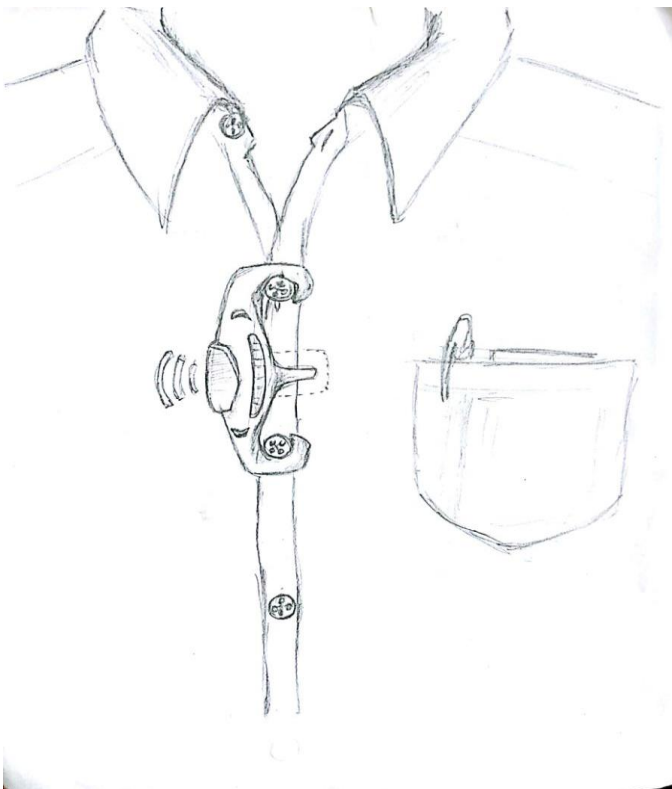
Concept 2:-

Concept 3:-

- Each and every object ,must be placed in a particular self or box
- Time table of the person is fed into this self or box
- The self/box notices about things before connecting event

- Like a broadcasting telephone a range can be created for a particular reference object.
- Every object which comes inside this range is identified automatically.

Concept 4:-

- The Cost of present TrackR is 3000/-
- Instead of using GPS sensor, we can use Bluetooth module which shows the distance and direction of objects.

Concept 5: -

- A wearable device keeps tracks of all the objects around us
- It stores the location of the corresponding object
- When asked for the object , it shows the location w.r.t reference object

Concept Evaluation

Concept Evaluation using Pugh's method:

Relative Ranking:

➢ Treating concept 1 as DATUM (reference)

Selection criteria	Concept 1	Concept 2	Concept 3	Concept 4	Concept 5
Engineering characteristics:	D				
Portable	A	+	−	+	+
Wearable device	T	−	−	+	+
Long lasting	U	0	0	0	0
Cost	M	−	+	−	0
Sum of +'s	0	+1	+1	+2	+2
Sum of 0's	0	0	0	0	0
Sum of −'s	0	−2	−2	−1	0
NET SCORE	0	−1	−1	+1	+2
RANK	3	4	4	2	1

As concept 5 ranked 1 now we treat concept 3 as DATUM

Selection criteria	Concept 1	Concept 2	Concept 3	Concept 4	Concept 5
Engineering characteristics:					D
Portable	0	0	−	0	A
Wearable device	−	−	−	0	T
Long lasting	0	0	0	0	U
Cost	0	−	−	−	M
Sum of +'s	0	0	0	0	0
Sum of −'s	−1	0	−3	−1	0
Sum of 0's	0	−2	0	0	0
NET SCORE	−1	−2	−3	−1	0
RANK	2	3	4	2	1

Absolute Ranking:

Selection criteria	Concept 1	Concept 2	Concept 3	Concept 4	Concept 5
Engineering characteristics:					
Portable	+1	+1	-1	+1	+1
Wearable device	0	0	-1	+1	+1
Long lasting	+1	+1	+1	0	0
Cost	0	-1	0	0	+1
Sum of +'s	+2	+2	+1	+2	+3
Sum of −'s	0	-1	-2	0	0
Sum of 0's	0	0	0	0	0
NET SCORE	+2	+1	-1	+2	+3
RANK	2	3	4	2	1

✓ From Pugh's method, Concept 3 is ranked first.

ABSTRACTION

a. <u>Block Diagram</u>
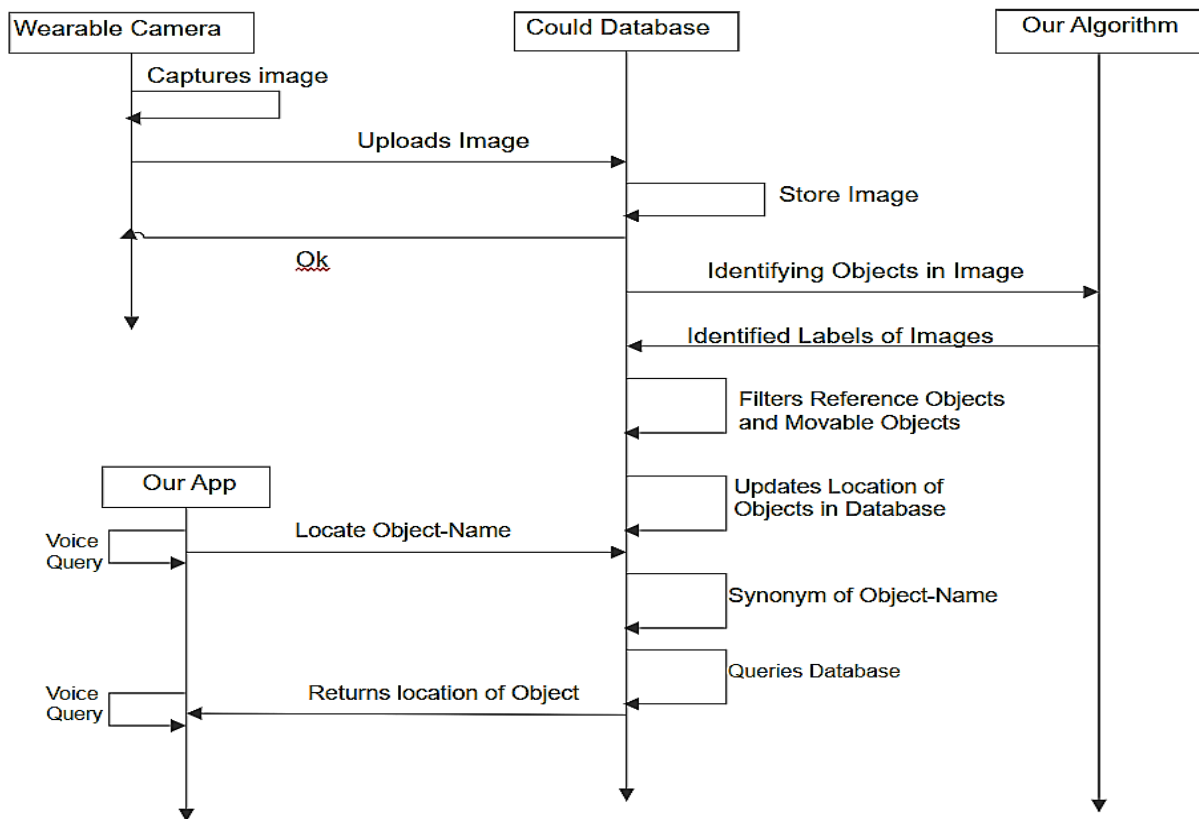
b. <u>work flow with example</u>

Let us suppose that keys are placed near television. Then the sequence of steps that are going to take place are:
   1) First device captures this image.
   2) Machine Learning algorithm detects the objects in image.
   3) Classifies these objects as keys (moving object) and Television (reference object)
   4) Updates location of keys as "Near Television".
   5) When asked "Locate keys" through App
   6) It returns "keys are near Television" in voice and text format.

c. Block Diagram with components

Block Diagram Describing Flow With Components
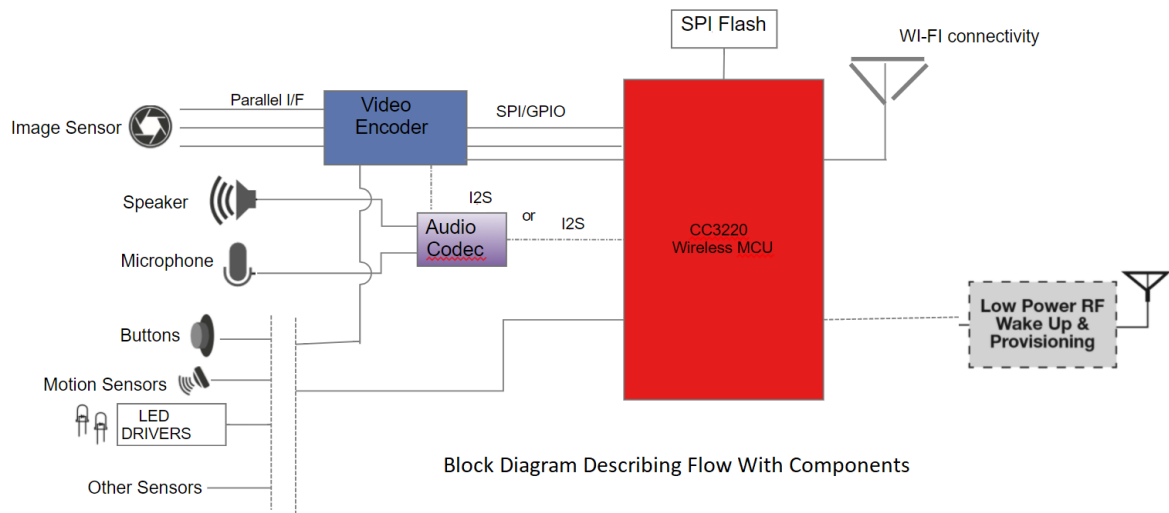
ALGORITHMS/COMPUTATIONAL IMPLEMENTATION

The algorithm contains 3 parts:

1. For Storing Input Images.

2. Reading and Processing Image

3. Identification of Images w.r.to stored images.

Pseudo code for part-1:

1) function [tr_set,test_set] = prepareInputFiles(dsObj)
2) image_location = fileparts(dsObj.Files{1});
3) imset = imageSet(strcat(image_location,'\..'),'recursive');
4) [tr_set,test_set] = imset.partition(700);
5) test_set = test_set.partition(200);
6) end

Pseudo code for part-2:

1) function Iout = readAndPreprocessImage(filename)
2) I = imread(filename);
3) if ismatrix(I)
   - I = cat(3,I,I,I);
4) end
5) end

Pseudo code for part-3:

1) title(sprintf('Best Guess: %s; Actual: %s',char(label),testSet.Labels(randNum)))
2) testFeatures = activations(convnet, testSet, featureLayer, 'MiniBatchSize',32);
3) predictedLabels = predict(classifier, testFeatures);
4) testLabels = testSet.Labels;
5) confMat = confusionmat(testLabels, predictedLabels);
6) confMat = bsxfun(@rdivide,confMat,sum(confMat,2));
7) mean(diag(confMat))
8) maxCount = size(testSet.Files,1);
9) randNum = randi(maxCount);
10) newImage = testSet.Files{randNum};
11) img = readAndPreprocessImage(newImage);
12) imageFeatures = activations(convnet, img, featureLayer);
13) label = predict(classifier, imageFeatures);
14) testSet.Labels(randNum)
15) imshow(newImage);
16) if strcmp(char(label),char(testSet.Labels(randNum)))
    i. titleColor = [0 0.8 0];
17) else
    i. titleColor = 'r';
18) end

# EMBODIMENT DESIGN

In this design , the dimensions of the outer body are 15*7*2 , which covers a large volume of 210 cc. From the above transperancy figure , it is observed that , after arranging the components a lot of space is still available . So the design is further changed for space optimisation
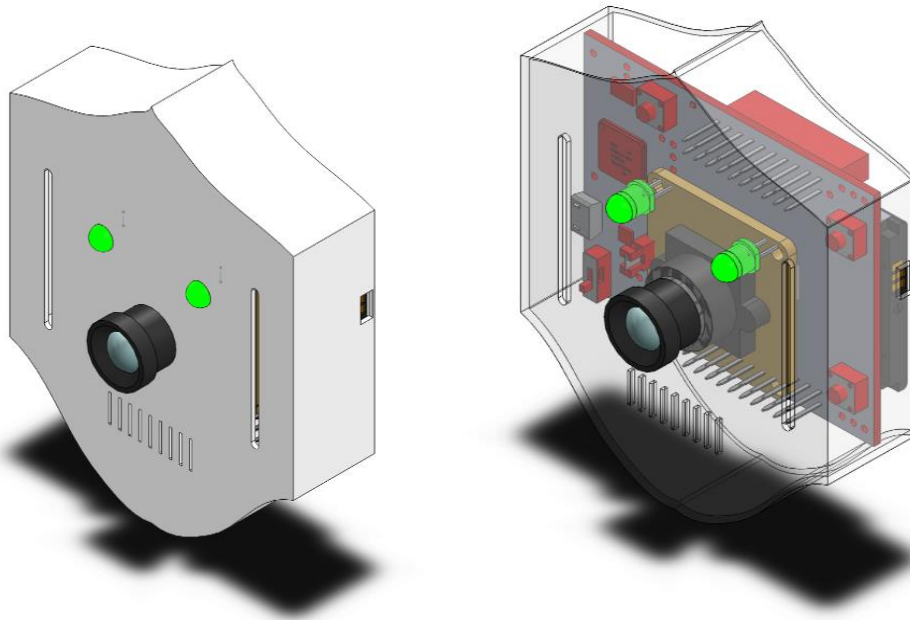
Design 2 :-

This time ,space optimisation is taken into consideration and designed. So , circular design is made as it occupies less volume when compared and to previous design . In this , all the components are arranged one above the other which makes the thickness larger . And also, diameter of the circle has to be increased to 8cm as the launchpad dimensions are 5cm*6cm .So , design 3 is made to fix this.
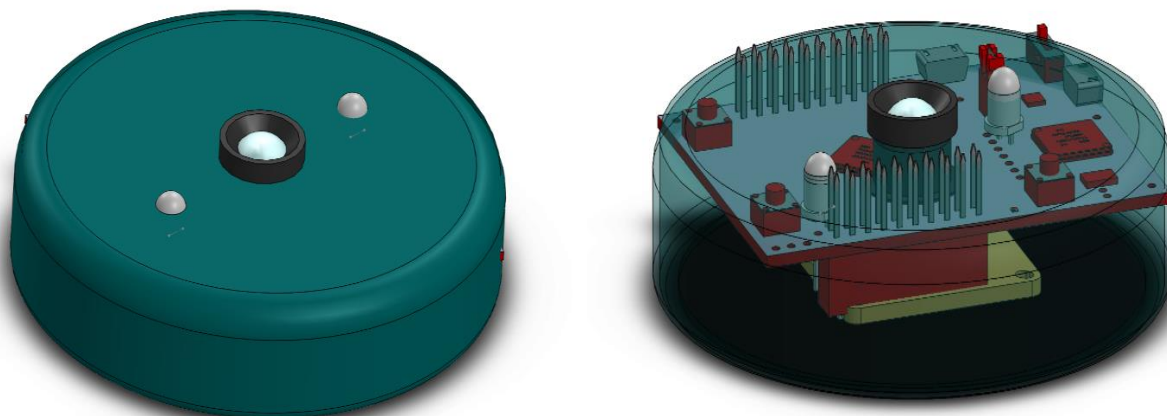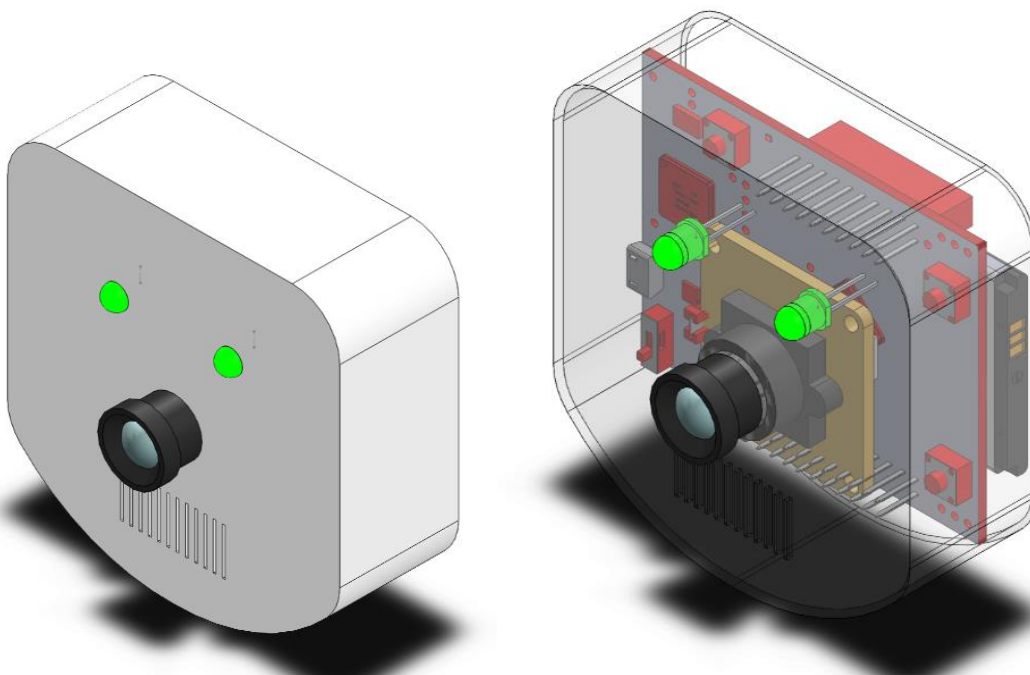
Design 3 :-

In this design , emphasis is made for good outlook and space optimisation . So, the design is made resembling a character . But still the space available in the design is not effectively used . So,final design is made by taking this design.
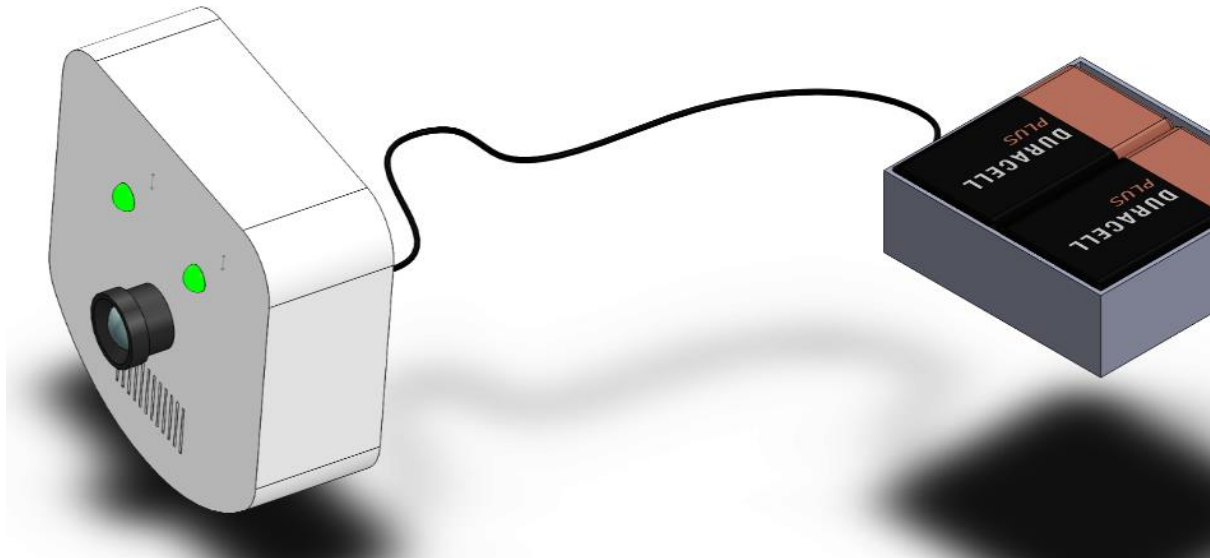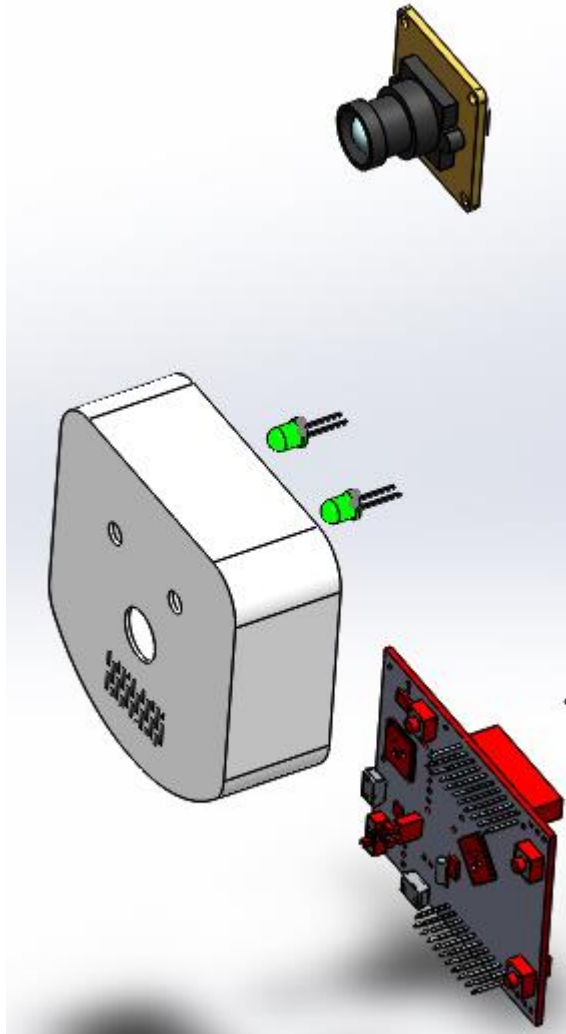

Design 4 :-

The above design is further processed to effectively implement all the components in the space available leading to a good outer part .
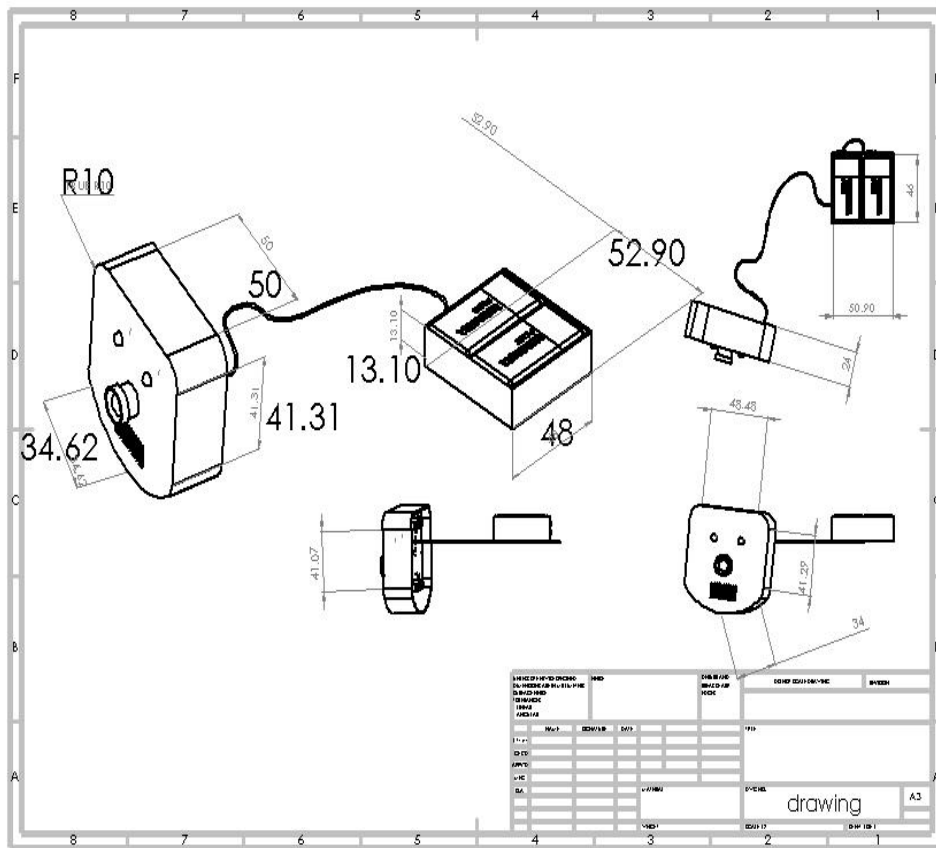
Looking the product from customers perpesctive , a battery module (just like a power bank) is made in times of charge crisis.
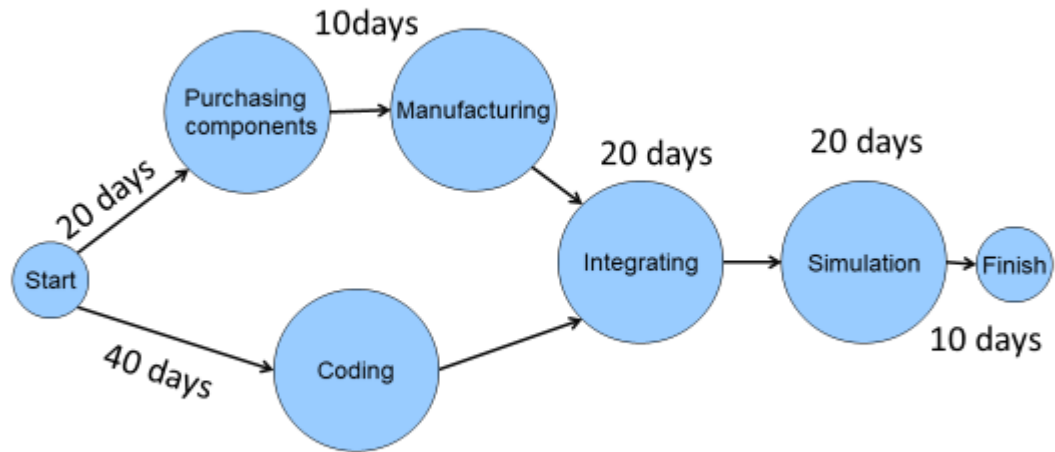
DETAIL DESIGN

The exploded view of the cad model showing all the components used in our device.

From the above sketch, the dimensions deduced approximately are:-

- o Height of the device is 55 mm
- o Depth is around 20 mm
- o length is 50 mm

TIME AND COST ESTIMATES

COMPONENTS	COST
Micro Controller Unit (1Ghz – 1.5Ghz)	3000 - 3500 ₹
Camera Module (5mp – 8mp)	1000 - 1300 ₹
Battery	600 - 900 ₹
Accelerometer	350 - 500 ₹
Device Manufacturing cost	300 - 500 ₹
Total cost	5250 -6600₹

MATERIAL SELECTION AND MANUFACTURING PROCESS

The outer body is only the part that has to be manufactured. Material cost, ease of manufacturing, toughness etc., are taken into consideration for selecting the material. Finally, the material Polystyrene is chosen, as it inexpensive (₹85/Kg) and it is known for its good manufacturability and high impact resistance.

Bill of material:-

s.no	Part that has to be manufactured	Material	Quantity	Cost
1	Outer body	High impact Polystyrene	500 grams	₹ 45

Generally, parts from plastic made up of injection moulding and casting for mass productions, we have opted for 3D-printing, which makes it a cost effective manufacturing process.
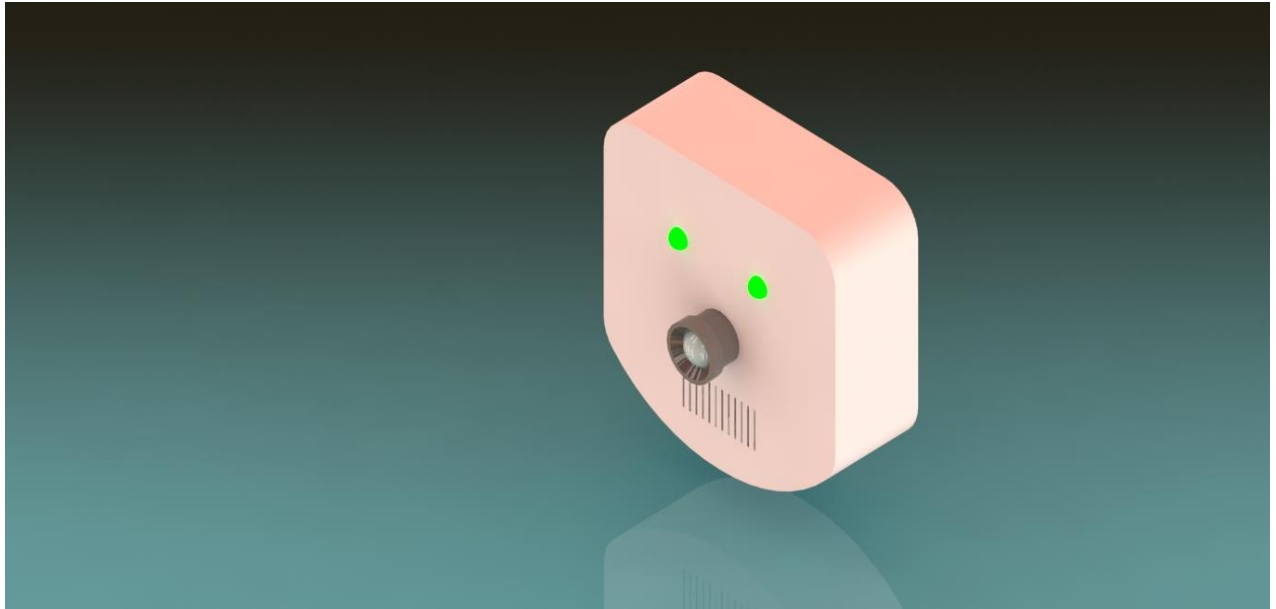
Material cost = ₹ 45
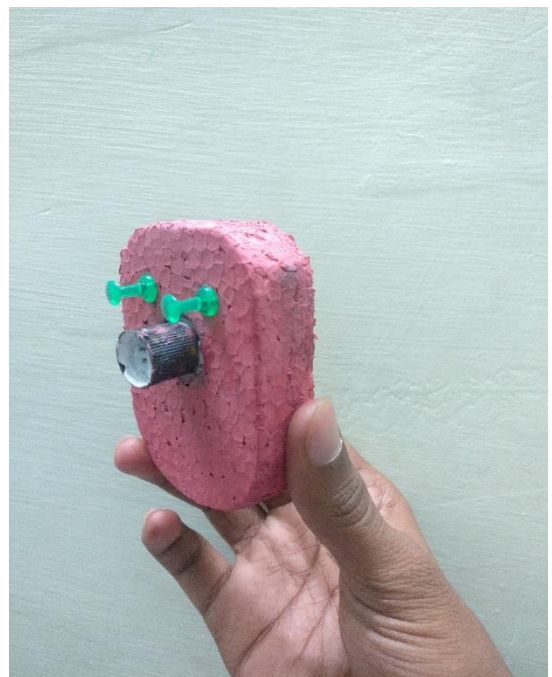
3D Printing cost = ₹ 400

Total cost of manufacturing = ₹ 445

PROTOTYPE

The detailed design of solid works model is converted into rendered view to visualize our product in real-world.

Physical prototype:

RESULT

We compiled our algorithm in octave software. From that we are able to identify the images which are given as input and recognized the images.

CONCLUDING REMARKS

Advantages

This device is intended for dementia people. It automatically identifies the object and stores the corresponding locations and displays the same when queried the app. It saves the quality time of caretakers and family members which was previously spent in the non-productive of searching the things for dementia people. our product would make the life of dementia person more independent and easy

Limitations:

Our product limits to the tracking capacity of 2-3 meters and the images captured in the dark are not analysed .so usage of this device only limits during day. When completely discharged without knowledge of the person, it stops working.

Unexpected aspects:-

This device also helps the common people through their forgetfulness.

Future work:-

Further, all components are purchased. Coding and manufacturing works are done in parallel. All the fabrication work will be done with in a time span of 90 days.

Appendices

Our Motivation:

Once, one of our teammates had misplaced his keys for which he searched a lot. By recalling, when he had last used the keys, from where he had taken and from where he had gone carrying those keys, he was able to track the keys in around 10 -15 minutes.

Then he had discussed this thing to his friend who is pursuing MBBS, in a casual chat. What she said was, "you are lucky! You are having the recalling power where as I met a person in my college who is not able to recall the incidents that happened recently." The reason is that the person is suffering from Dementia.

This is main motivation behind our idea of helping the dementia people to ease there day to day life.