ECOLUTION

SENSITIZATION PAYS

# Designing a service based comprehensive solution for effective household waste segregation and real time monitoring

# PROBLEM IDENTIFICATION

## Household

- Lack of infrastructure
- Lack of motivation
- Waste collectors don't come regularly

## Waste collector

People do not segregate regularly

Manual tracking of waste quality from each house is difficult

## SWM community

- Lack of litter bins in city
- Long distance between community bins
- Irresponsible and uneducated workers

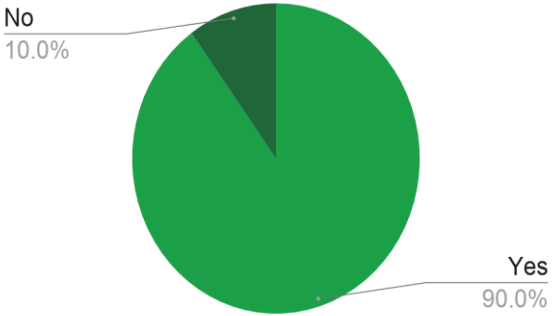
## Monitoring agency

- Lack of public awareness, motivation and education
- Contractors only work to maximize profits
- Many people involved so monitoring and imposing fines difficult

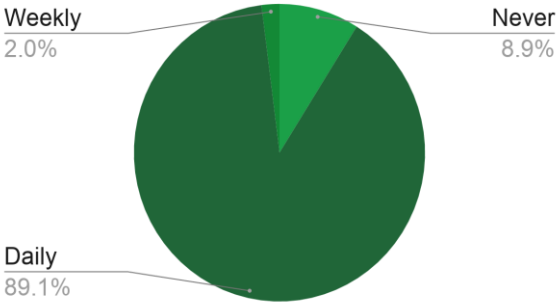
Source : Asnani 2004a

# PILOT STUDY SURVEY

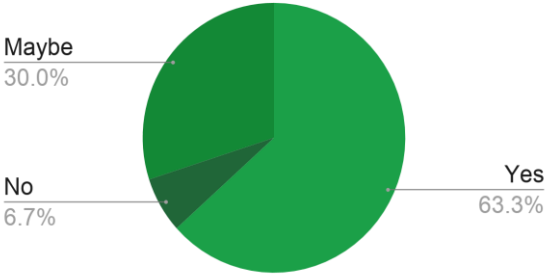
Do you know about waste segregation program in campus ?



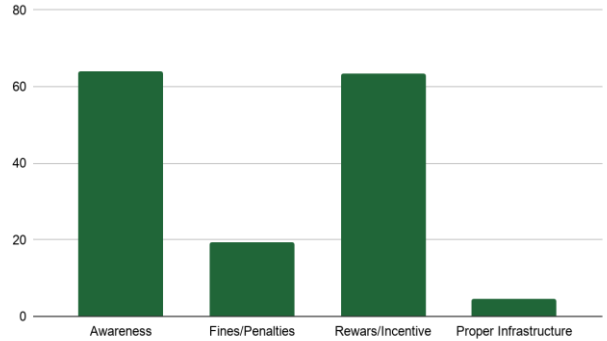

How often do you practice segregation ?




Would you be willing to segregate waste further if more dustbins are kept your doorsteps and on streets ?




What would motivate you to segregation on daily basis




Survey conducted on around 150 households at IIT Kanpur in December 2019

# INTRODUCTION

As mentioned in Solid Waste Management Rules, 2016 that every waste generator should segregate the waste at source and there will be spot fine imposed for littering and non-segregation of waste. But there is no system or procedure to check whether the waste generators are segregating the waste or not.

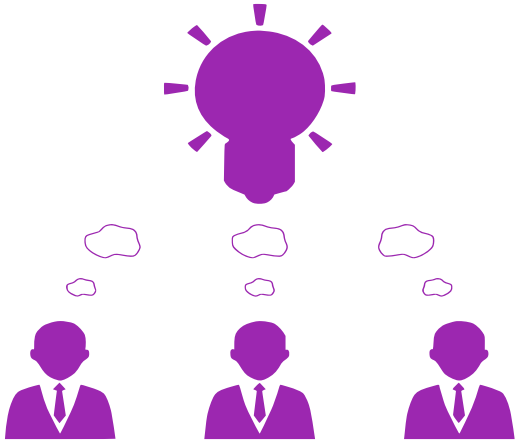
We aim to track the waste segregation from every house in the colony, mohalla and block and further notify the concerned authority, this way tracking can promote source segregation of waste.

**Our Objectives :**

- Promote source segregation of waste by determining segregation level of household waste
- Reduce the amount of waste that goes to waste dump yards.

# The Problem

Develop an autonomous system to detect waste segregation (dry and wet) at the source during collection, with real-time data transmission to the cloud via an inbuilt telemetry system.



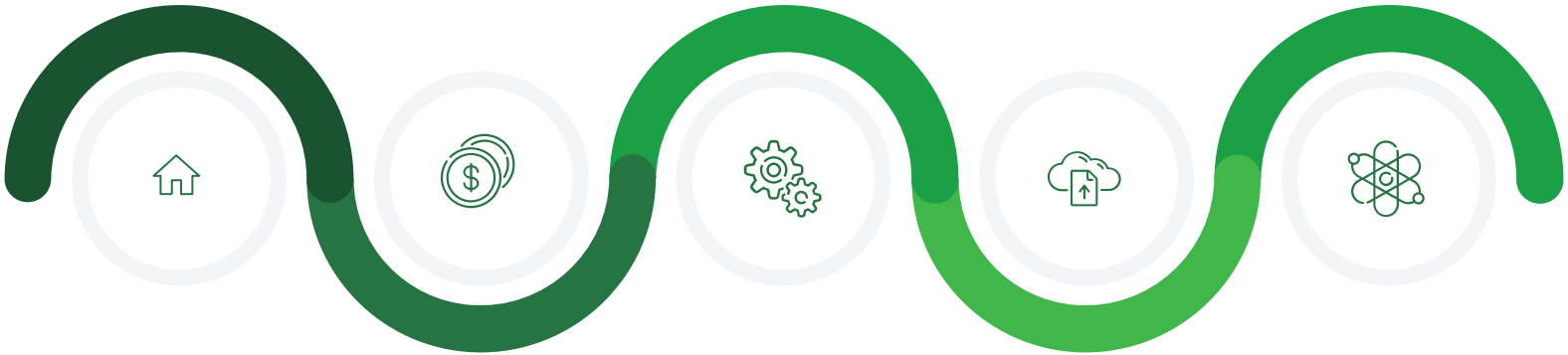
# SOLUTION

### Cost Effective Solution

Low cost efficient solution with low maintenance

### IoT Based

Cloud based Online, Real time monitoring



### Source Segregation

Promoting source segregation not only reduces waste transfer to landfills but also improves recycling and fertilizer production.

### Autonomous Functioning

Inbuilt sensing, estimation and telemetry devices & sensors

### Use of Spectroscopy

NIR based Material sensing for waste composition estimation

# The Product

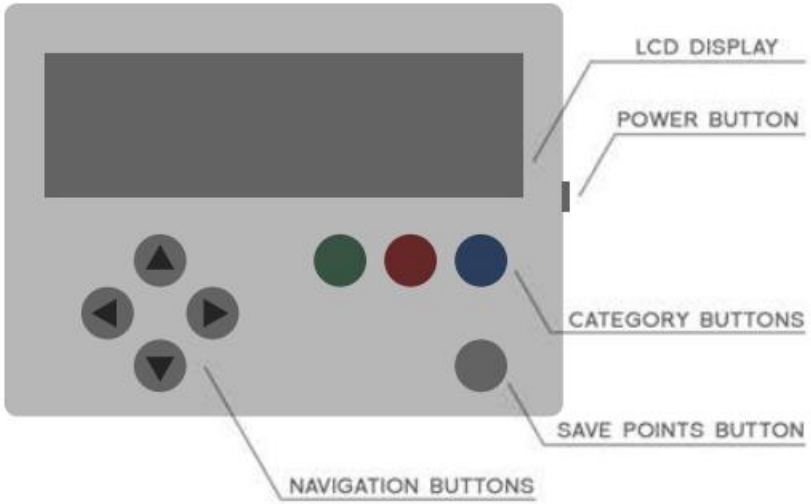
## Working Model of Manual Input Device


## Specifications

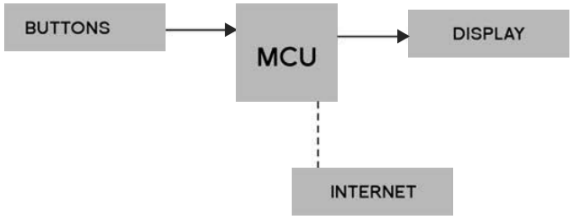
- IoT Enabled
- Using Cloud Storage
- Real Time Monitoring
- Easy to Operate
- Small size (handheld device)

*This device has been tested in IIT Kanpur campus*

# The Product




BLOCK DIAGRAM :



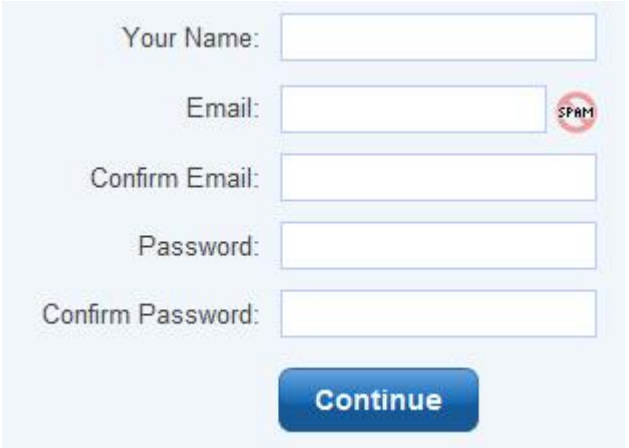
# The Product

How it works

purchase

Download App

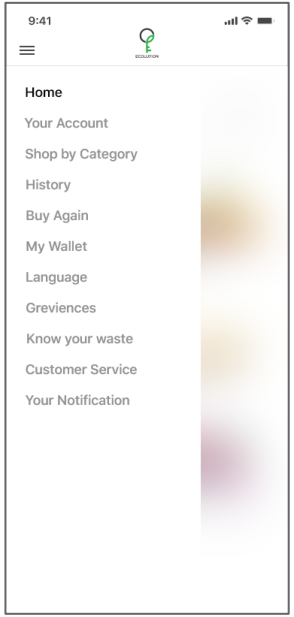
Sign up

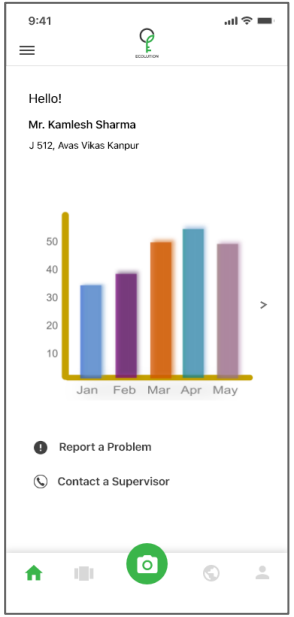


# MONITORING SERVICES LAYOUT

## Admin Dashboard


## Consumer Mobile App

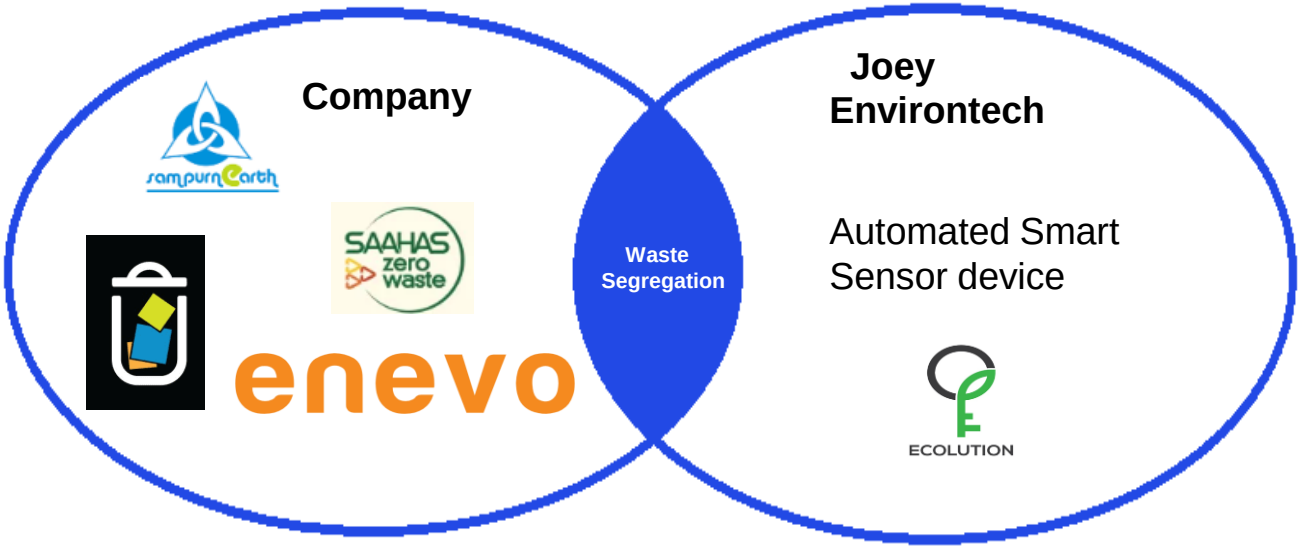


# Competition

Our product is unique and dosen’t have direct competitors

- Indirect Competitors



# Competitor & Clients

## Saahas Zero-Waste

- Their business model focuses onwaste segregation, recycling, and organic waste composting.
- Saahas Zero Waste facilitates waste management through composting units, recycling partnerships, and comprehensive training/support.
- They generate revenue through service contracts and aim to create a zero-waste future through sustainable practices and community engagement.
- They set up composting units at client locations, collaborate with recycling partners, and provide training and support for effective waste management.

## Clients


# Competition

Our sustainable competitive advantages

Source-Separation

Automated

Compatible

Smart Sensor

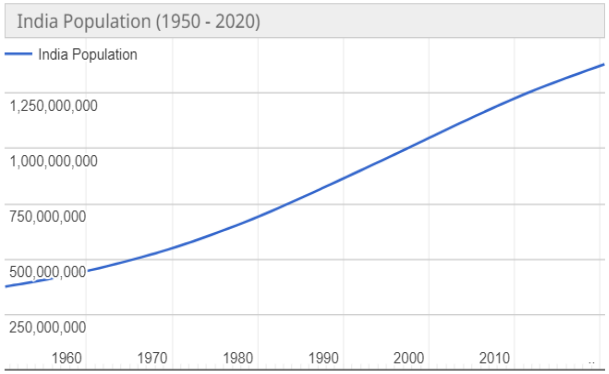
Scalable

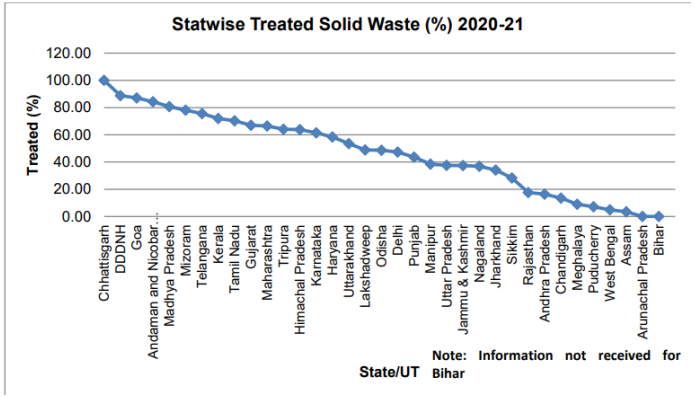
Cheap

# How will we make money ?

| Sell the product and/or the service | | | | |
|---|---|---|---|---|
| Municipal corporations | Housing societies | Corporate residencies | Educational institutes | Third party vendors for segregated waste |

# Market Potential and Growth Trends



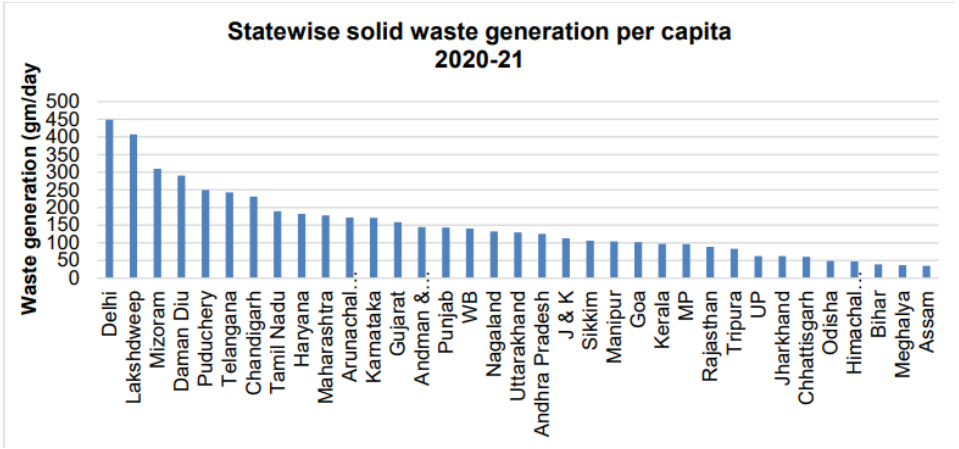

Increasing population

Growing Environmental Awareness

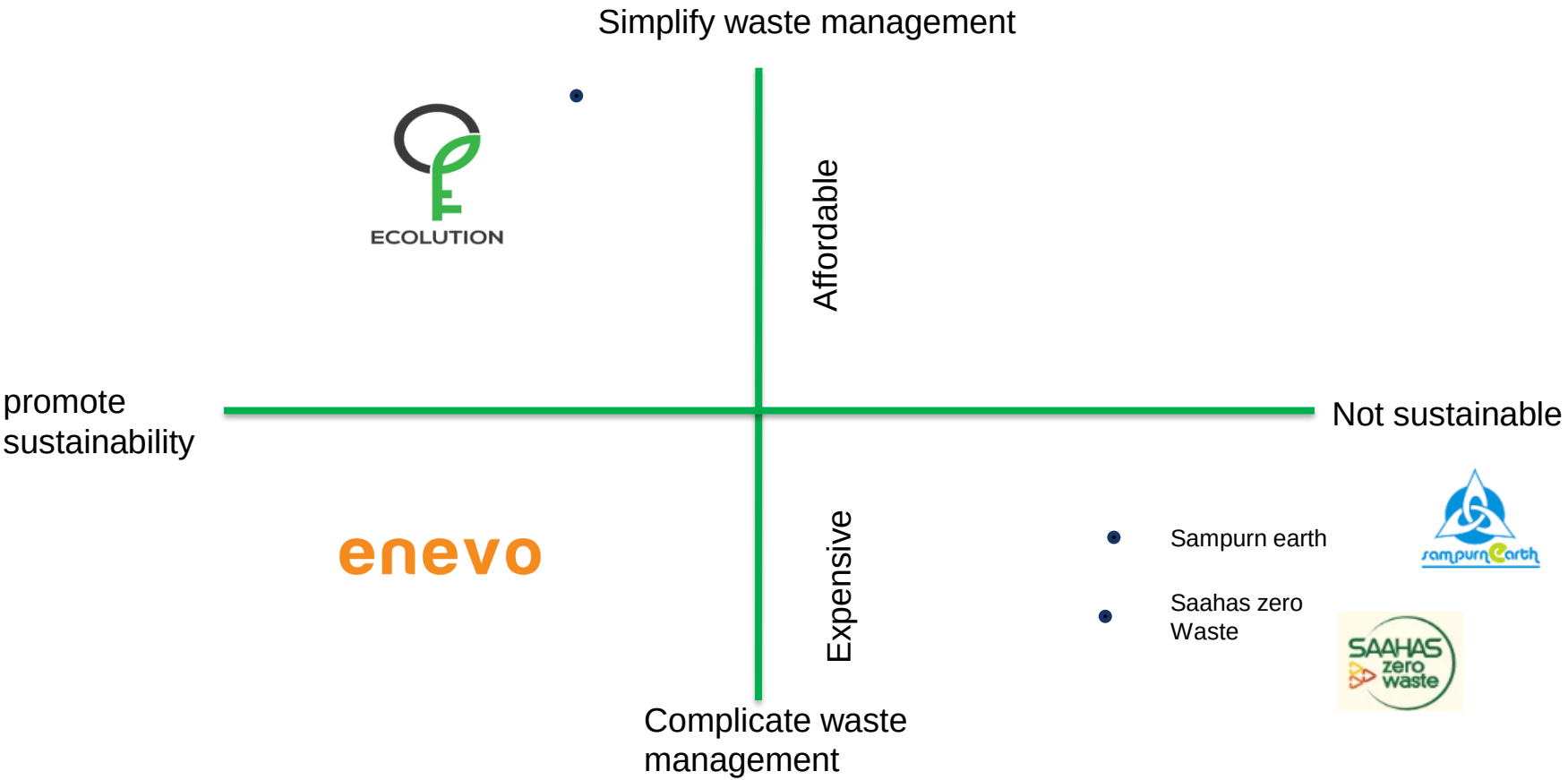
Urbanization

# Pricing and Business Models

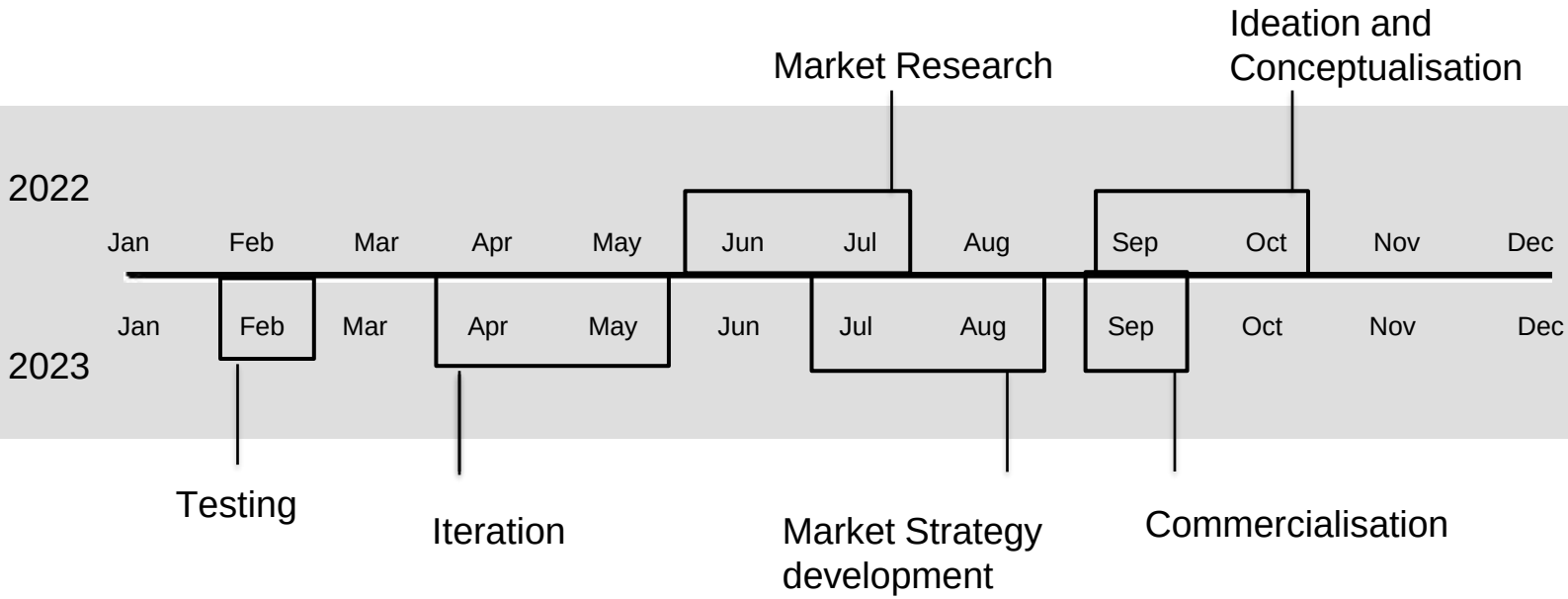
- Instrument cost 1.8k
- Setup in every house
- Kanpur city revenue generation:15lac
- UP revenue generation – 90000million
- Focusing on extracting the maximum value from materials.
- sort items based on their material composition, enabling efficient waste segregation and recycling.



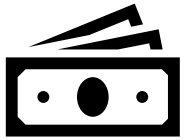
# Value Proposition



# Tentative Action Plan



# Device Generation Cost



Profit Margin per device = 836 INR

| Component | Part Name | Quantity req. | Specification | Price (INR) | Link | |
|---|---|---|---|---|---|---|
| | | | | | | |
| LCD | Nokia 5110 lcd | 1 | 84x84 Dot matrix | 170 | indiamart | |
| MCU/SoC module | ESP32-S2-WROOM | 1 | Wifi, more GPIOs | 150 | mouser | ESP32-WROVER-B |
| Keypad | | 1 | 4x4 | 60 | robu | |
| Battery | | 1 | 3.7v, 500mAh | 140 | robokits | |
| BMS | | 1 | 1S, 3.7v | 70 | robu | |
| RFID | | 1 | | 75 | robu | indiamart |
| RTC | | 1 | | 99 | robu | |

Manufacturing Cost = 170 + 150 + 60 + 140 + 70 + 75 + 99 +200 = 964 INR

Assuming Labour cost = 200 INR

Selling Price = 1800 INR

## TRACKING SOURCE SEGREGATION OF HOUSEHOLD WASTE

| Implementation Plan | Timeline | Description | Financial Support | Non-Financial Support |
|---|---|---|---|---|
| | | | | |
| Developing Proof of concept | 3 months | Devloping proof of concept on use of spectroscopy(NIR) in estimation of waste composition (on paper + in lab) | INR 50000 | IIT-K faculty mentor and lab support |
| Prototype Designing | 3 months | Designing a model with software and sensor integration to determine waste composition in real-life scenarios | INR 50000 | |
| Simulation | | Simulating the prototype design on software virtually to ensure/verify proper functioning<br>flow : Designing -> Simulation -> Redesigning | | |
| Prototype Manufacturing | 2 months | Manufacturing & assembling physical components and intergrating actual sensors to build the prototype | INR 1,00,000 | manufacturing and assembly support when testing in bulk |
| Prototype Testing | 2 months | Testing the prototype in real world and reiterating until desired accuracy is achieved | INR 50000 | Manpower, infrastructure like bins, transport vehicles,boarding and lodging while testing in kolhapur |
| | | | | |
| | 10 months | | INR 2,50,000 | |

# Income Statement

| Components | Expenses |
|---|---|
| **Research and Development Expenses** | 250,000 INR |
| Prototype Designing | 50,000 INR |
| Simulation: (Assume 10% of Prototype Designing cost) | 5,000 INR |
| Prototype Manufacturing | 100,000 INR |
| Prototype Testing | 50,000 INR |
| Manpower, Infrastructure, and Other Expenses | 2,000 INR |
| **Operating Expenses** | 27000INR |
| Marketing Expenses | 18,000 INR |
| Other Operating Expenses | 1,000 INR |
| EBITDA (Earnings Before Interest, Taxes, Depreciation, and Amortization) | |
| EBITDA = Revenue - (Research | |

## Success Metric

- Safety

Hazard Reduction
Improved Worker Safety
Controlled Emissions and Odor Management
Enhanced Handling Practices

- Profit Margin

Increase in profit margin due to reduction of human effort,land wastage and time consumption in waste segregation.

- Time saved

Average minutes saved per house
Due to adoption of this digital device

- User rating

Increase in the customer rating after an enhanced experience

## Possible Failure

- Inadequate Education and Awareness

If there is a lack of awareness or understanding about the importance and benefits of source segregation.

- Inaccurate waste classification

It hampers segregation efforts, leading to contamination and improper waste handling, undermining the effectiveness of the product.

- Lack of User Adoption:

Lack of user acceptance or convenience towards source segregation can impede widespread adoption and hinder the product's success.

## Future Scope and Improvements

- Use of solar batteries
- Smart Bin Segregator - It enables automatic segregation of dry and wet waste