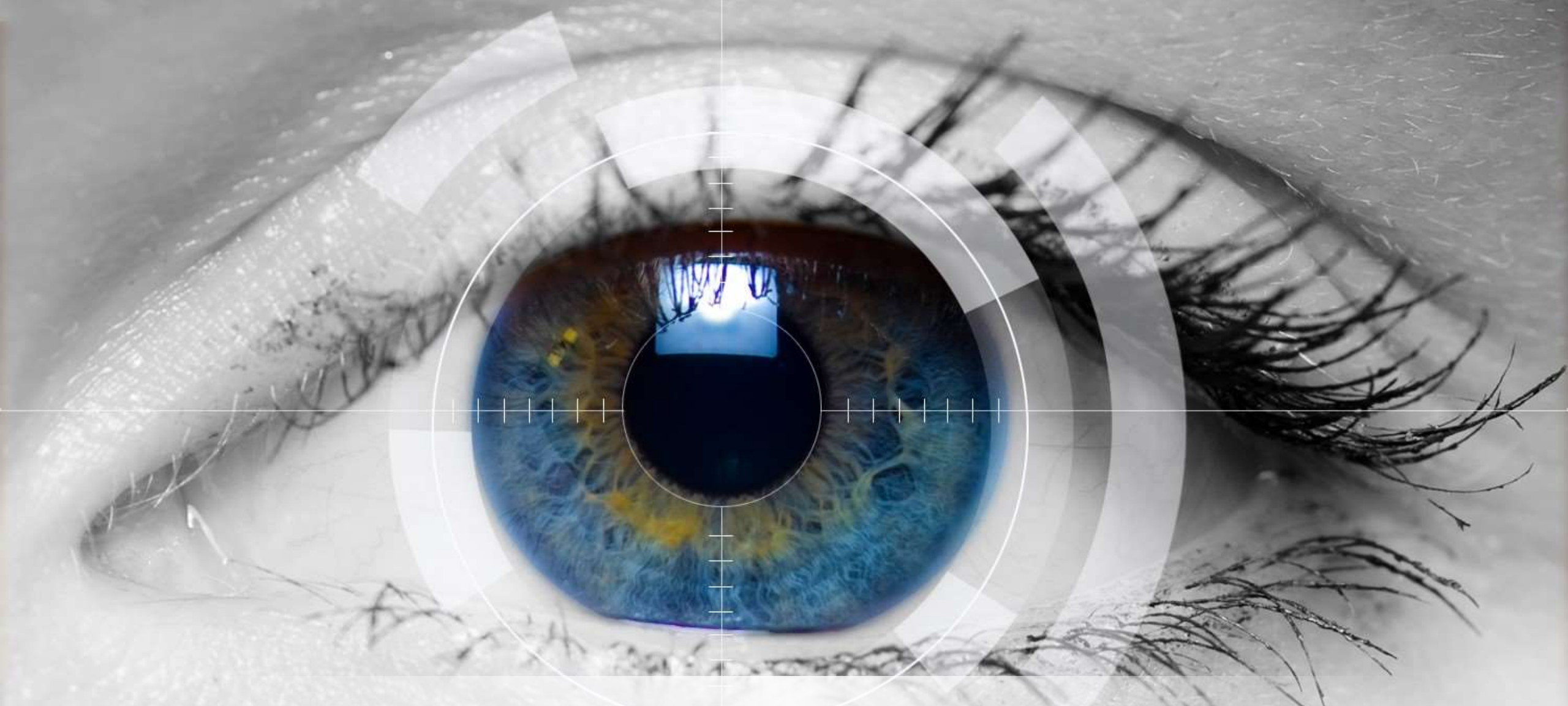




ELEKTRA

Making Living Easy With Eye's Closed...

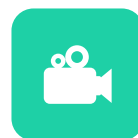
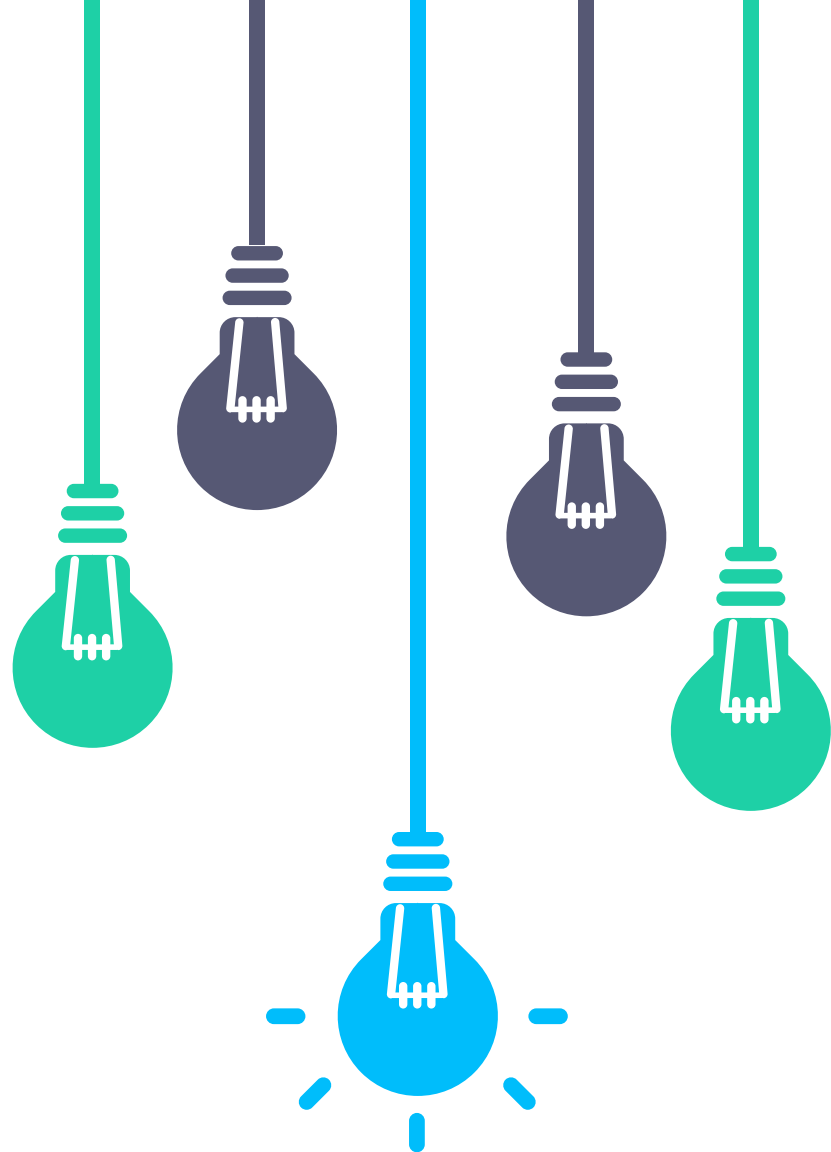


ELEKTRA

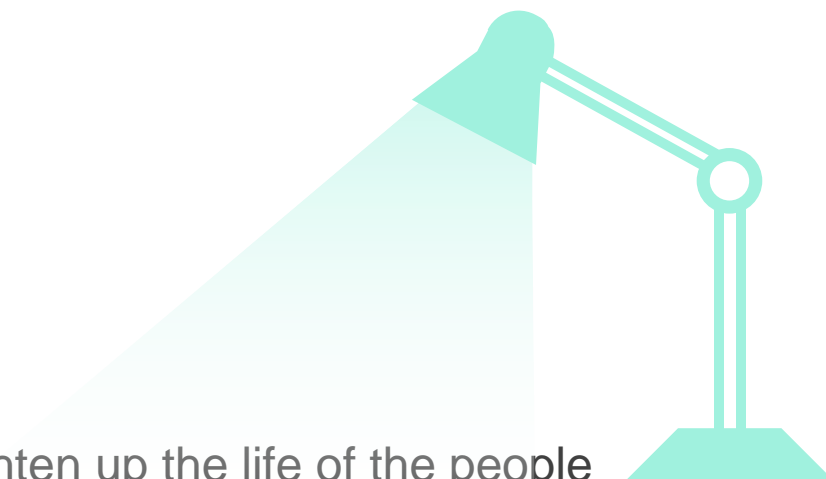
Making Living Easy With Eye's Closed...

Gaurav Chand Singh

Agenda !



To somehow brighten up the life of the people who are not as gifted as a normal person



What is Elektra ?



Elektra is a smart embedded device and its objective is to assist the blind people

- ~ by support them in their navigation and
- ~ helps them in the controlling of the digital devices remotely.





What does it basically do?



1

Human Detection

2

Controlling of **embedded electronic appliances** over voice commands

3

Proximity Calculation from any obstacle

4

Vehicle Detection



Motivation !!



There are over 284 million people who are visually impaired and there are over 39 million people who are totally blind .



The lack of visual capabilities has limited these individuals from completely perceiving their immediate surroundings which has potential safety concerns and also lowers their quality of life.



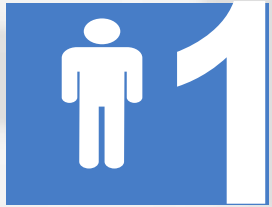
A good solution will be a device that is portable and is able to provide directions to new locations and alert the user of obstacles in their path when the user is walking.





Modules !!

Technology can be the remedy of every problem if used wisely



Face Detection

With the help of Machine Learning's HAAR CASCADE algorithm we are detecting the faces.



Digital Appliances Control using IOT

Controlling of Digital Appliances over Voice commands using IOT.



Proximity Calculation

Distance calculation from any obstacle is done by using Ultrasonic Sonic Sensors.



Vehicle Detection

Using Machine Learning's HAAR CASCADE algorithm we are detecting the faces.



Face Detection



Algorithm Used

Viola Jones Haar Cascade based feature extraction.



Hardware & Software Used

1. Raspberry Pi 3B+ board
2. Display screen
3. HDMI cable
4. Camera
5. Headphones
6. Micro SD Card
7. Active Internet

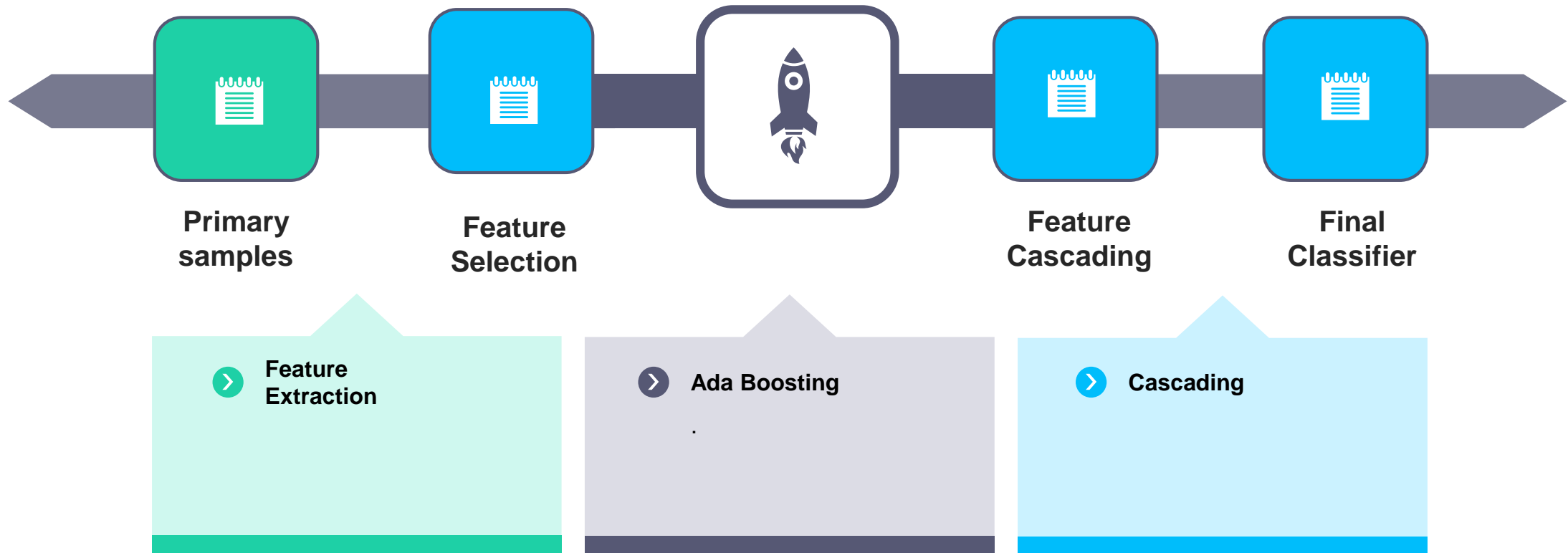


Face Detection

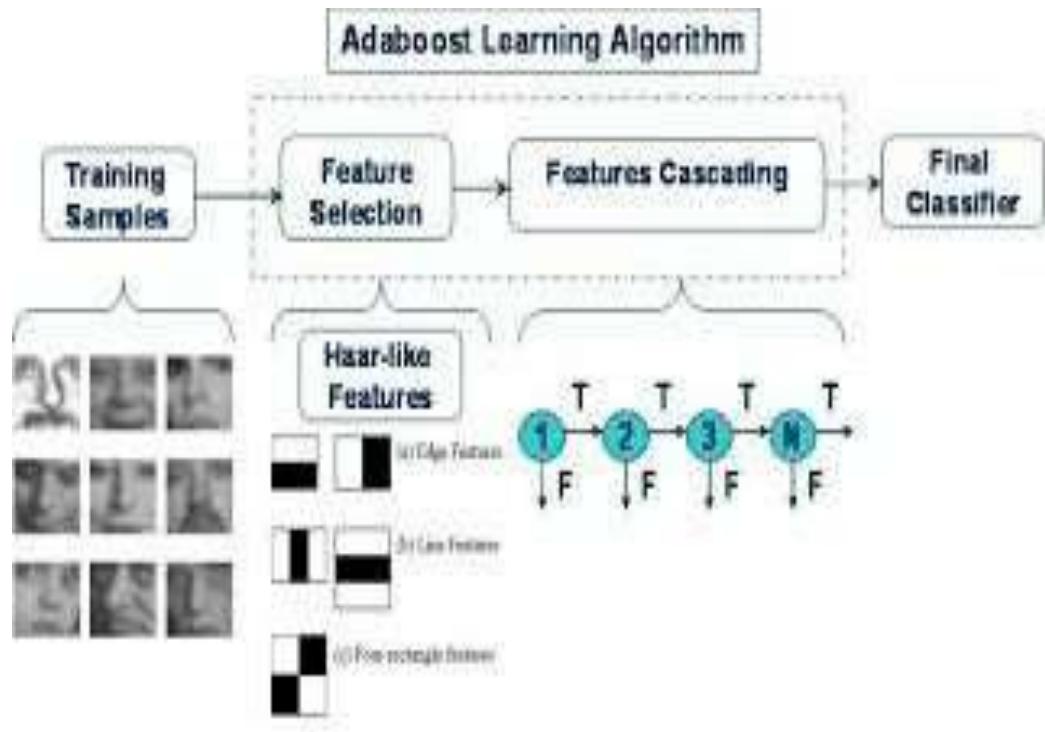


Understanding Haar Cascade

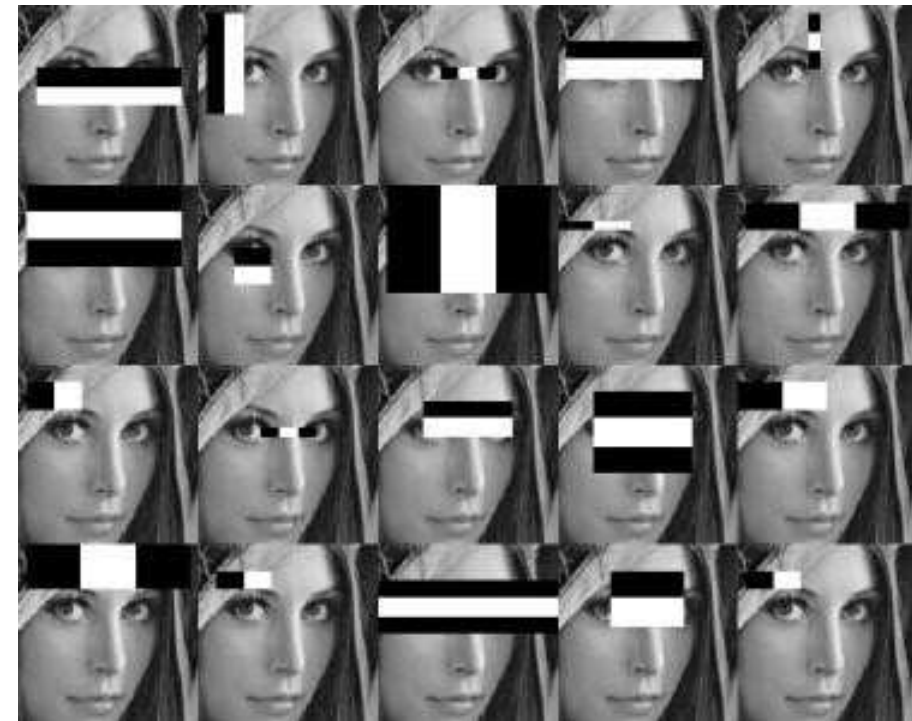
A facial identification system is a technology capable of identifying a face of a person from a digital image or a video frame from a video source.



Face Detection



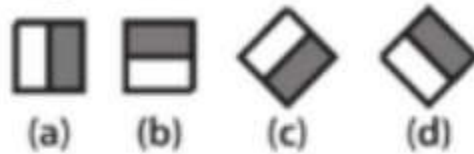
Architecture for the Face Detection



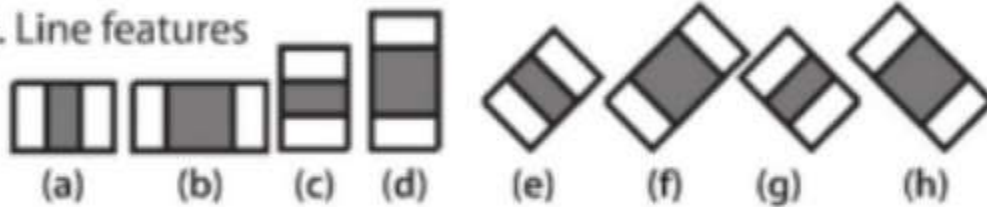
Haar Features

Face Detection

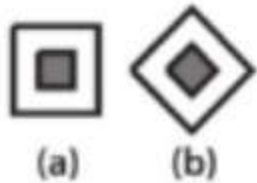
1. Edge features



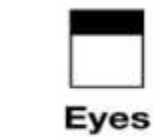
2. Line features



3. Center-surround features



Features



**A Theoretical
Face Model**

content

content

content

content

content

content

content

content

Haar

Feature

Extraction

Face Detection

Ada Boosting

Ada Boost is used to remove redundant features and choose only relevant features.

Formulae Used:

Strong classifier = linear sum of weak classifiers

$$F(x) = \sum (\alpha_i * f_i(x))$$

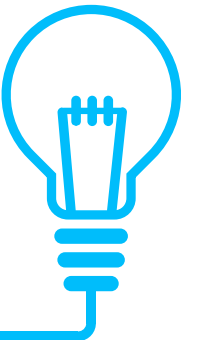
01



02

Cascading

Given a input image we need to move our 24*24 window all over the image and compute 2,500 features for every window and take a linear combination of all outputs and see if it exceeds a certain threshold or not.



IOT Module



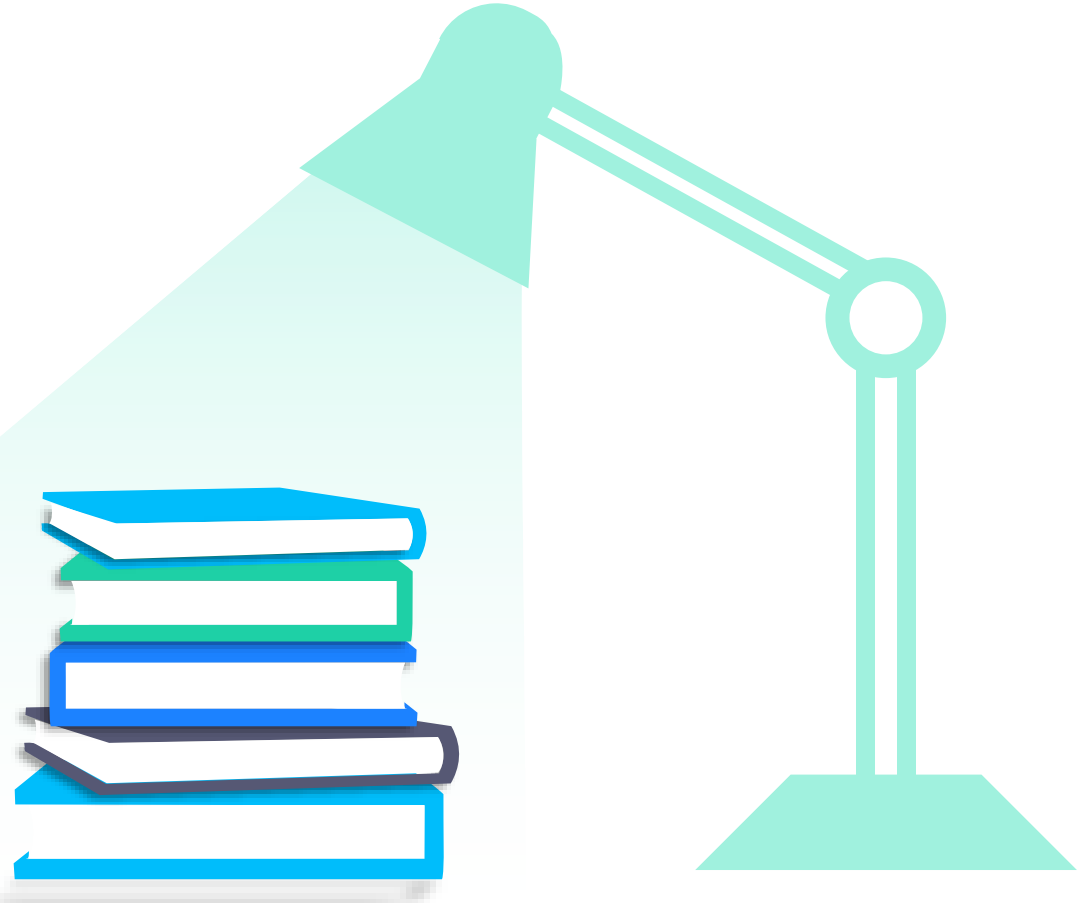
Module Agenda

To provide the user capabilities to control the smart embedded electronic devices in his/her home or workplace.



Hardware & Software Used

1. Arduino Nano
2. HDMI Cable
3. Bluetooth HC05
4. Relay Drivers
5. Power Supply
6. Bulbs, Plywood & Connection Wires
7. Raspberry PI
8. Microphone



What is IOT ?



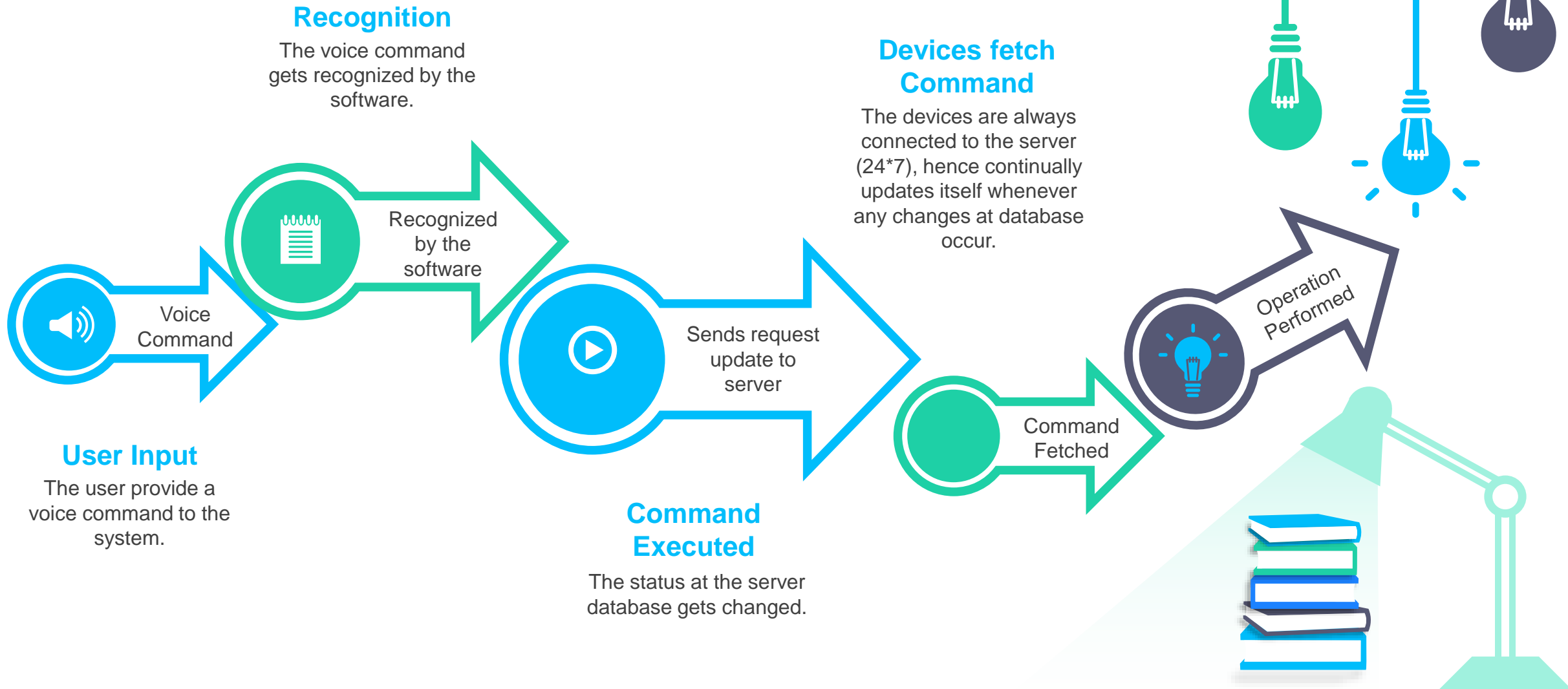
“The Internet of Things (IoT) is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.”

- **Python Modules Used:**

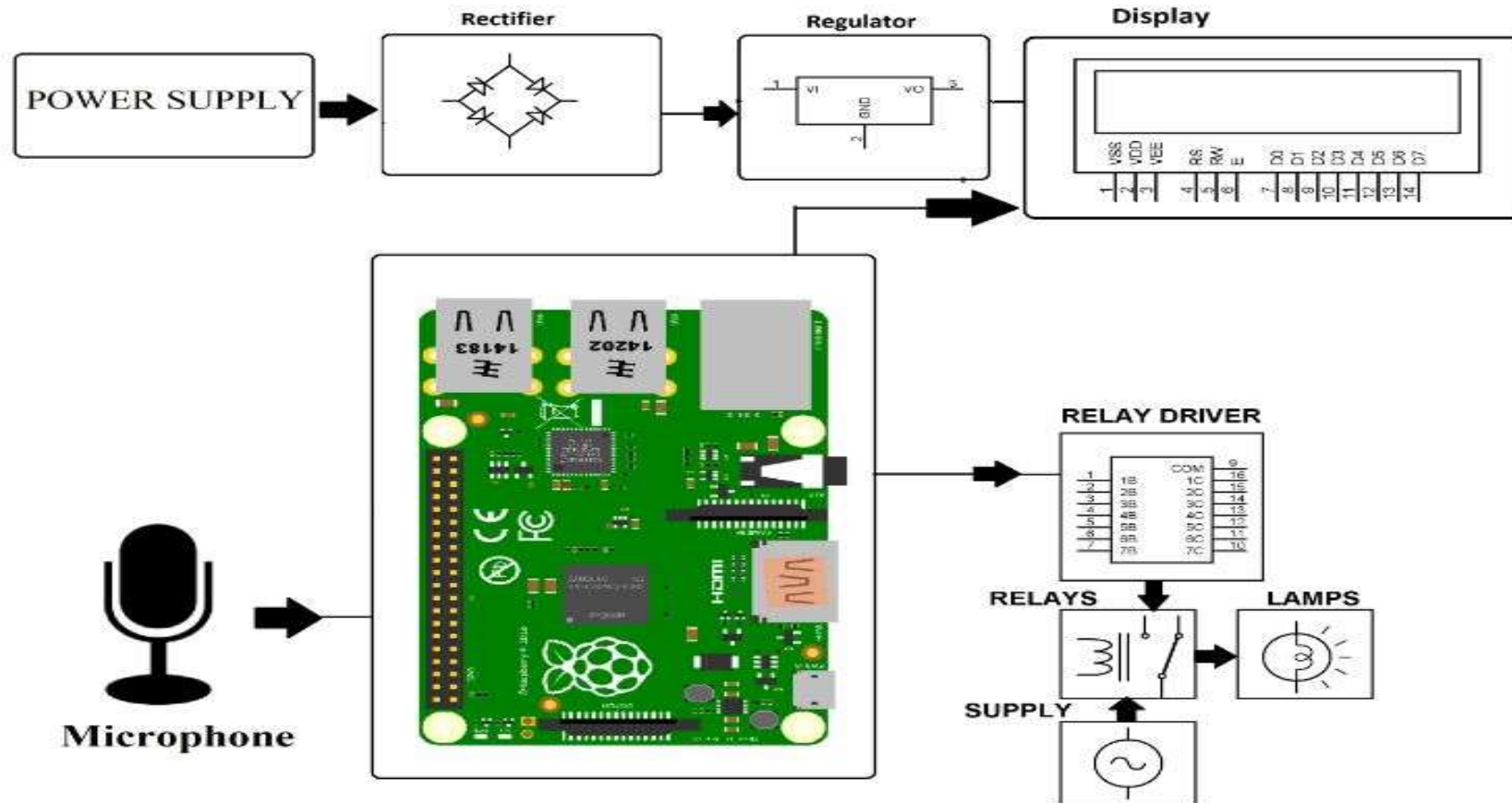
- 1. Speech recognition 2. pyttsx3 3. urllib3



IOT Module

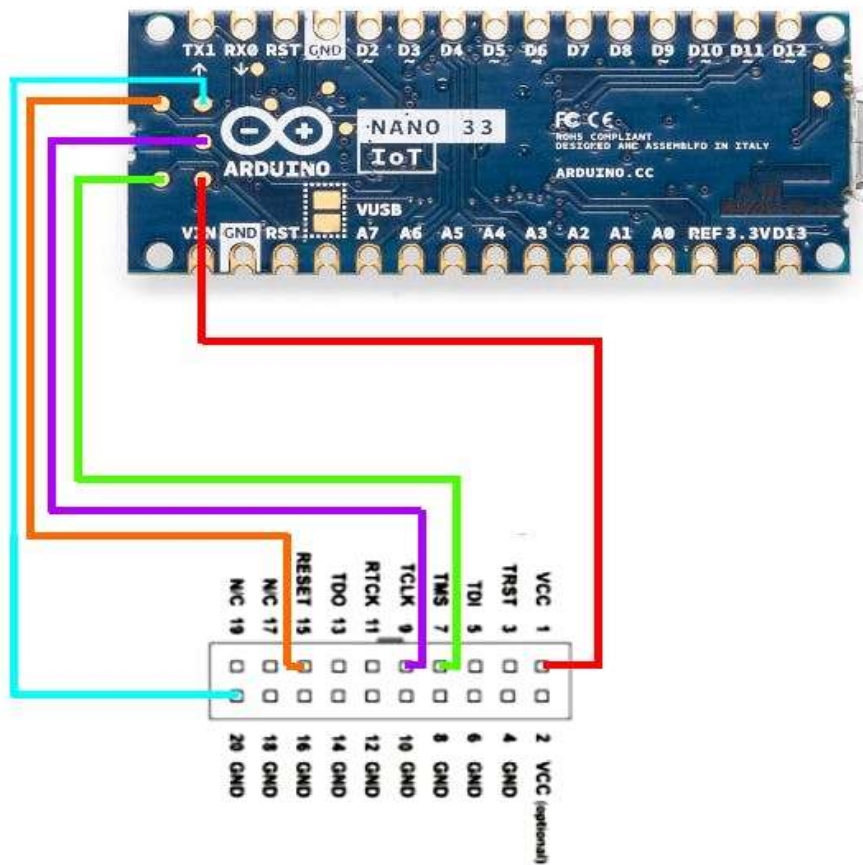


IOT Module

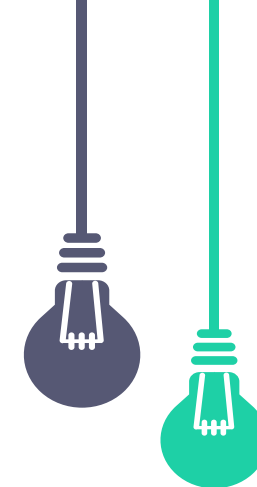
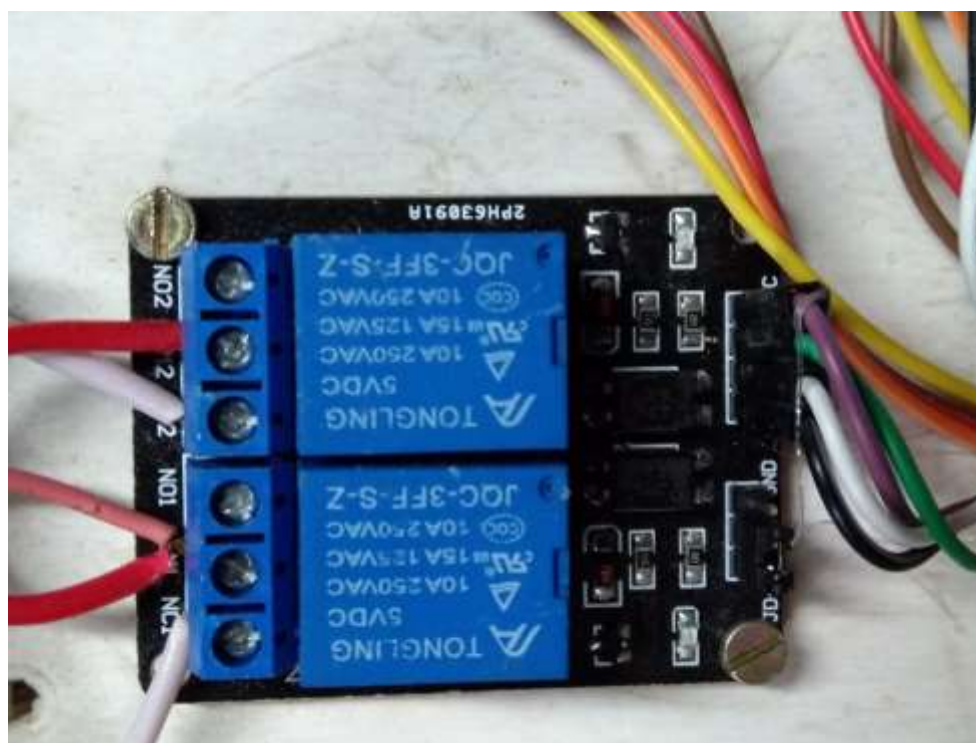




Arduino Nano



Relay Switch



IOT Module



Vehicle Detection



Algorithm Used

Viola Jones Haar Cascade based feature extraction.



Hardware & Software Used

1. Raspberry Pi 3B+ board
2. Display screen
3. HDMI cable
4. Camera
5. Headphones
6. Micro SD Card
7. Active Internet

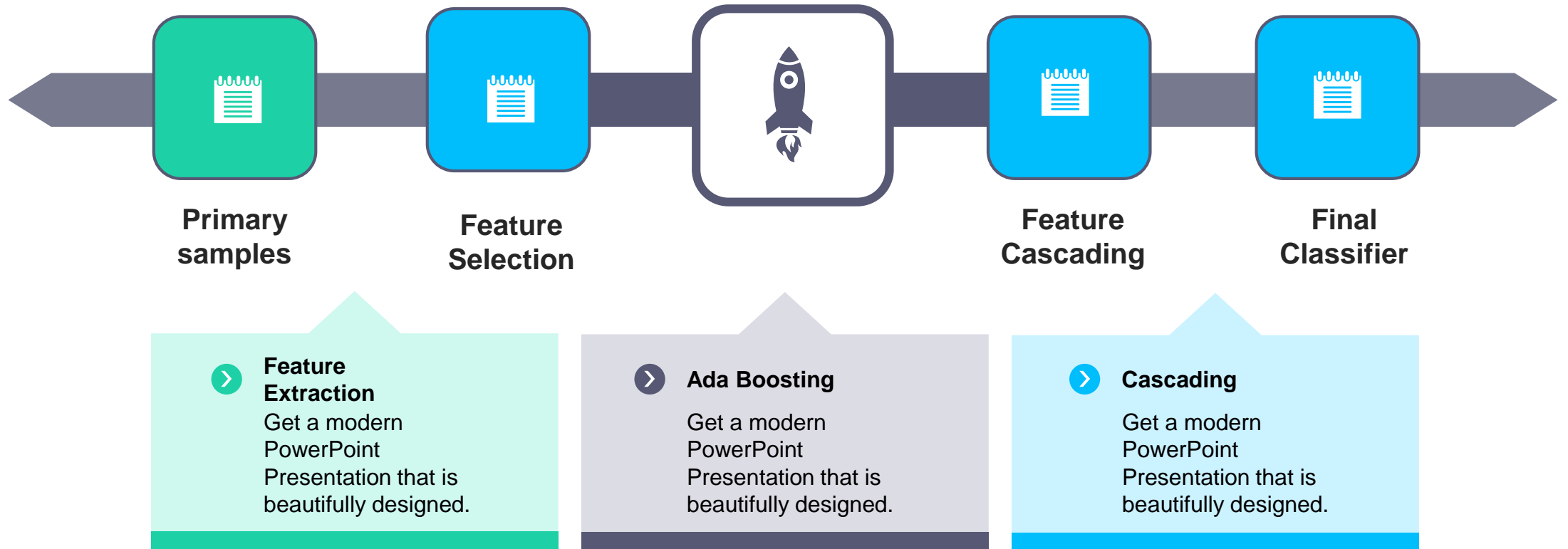


Vehicle Detection

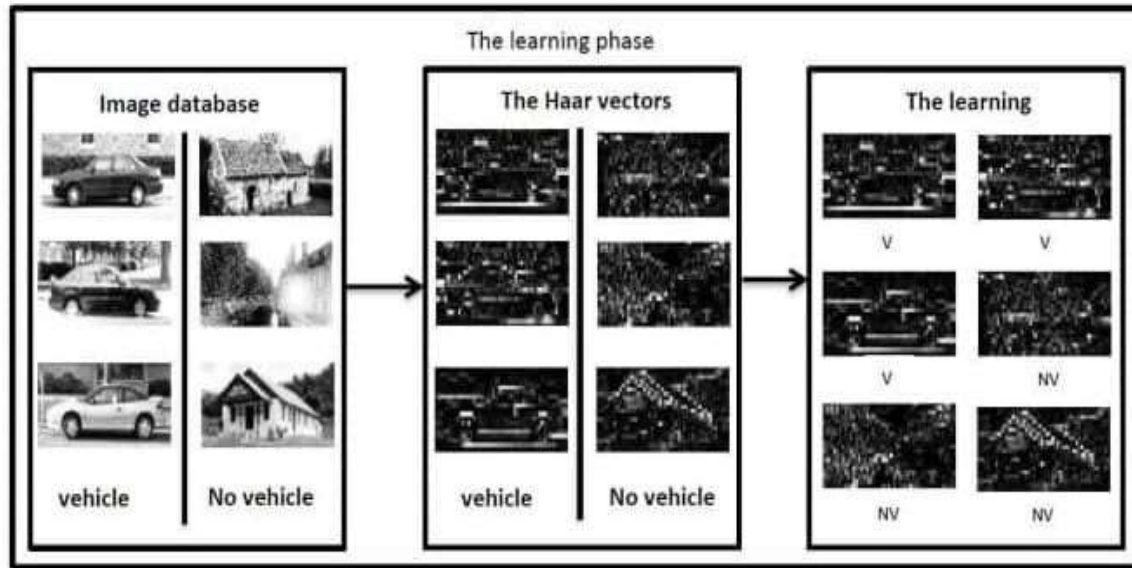


Understanding Haar Cascade

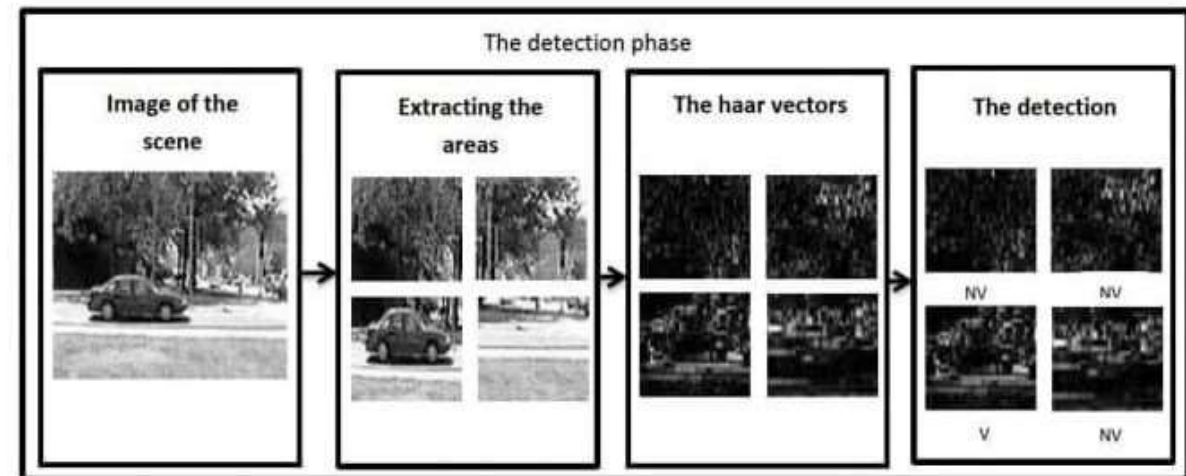
A vehicle identification system is a technology capable of identifying a vehicle from a digital image or a video frame from a video source.



Vehicle Detection



Learning Phase



Detection Phase

Vehicle Detection



Haar

Feature

Extraction

Vehicle Detection

Ada Boosting

Ada Boost is used to remove redundant features and choose only relevant features.

Formulae Used:

Strong classifier = linear sum of weak classifiers

$$F(x) = \sum (\alpha_i * f_i(x))$$

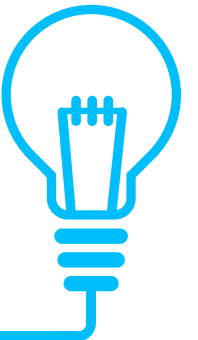
01



02

Cascading

Given a input image we need to move our 24*24 window all over the image and compute 2,500 features for every window and take a linear combination of all outputs and see if it exceeds a certain threshold or not.



4. Proximity Calculation



Module Agenda

The Proximity Calculation module calculates the distance between the blind person and the hindrance coming in his path while walking.



Hardware & Software Used

This module is implemented through **ultrasonic sensor**.

The sensor has two main components:

1. Echo

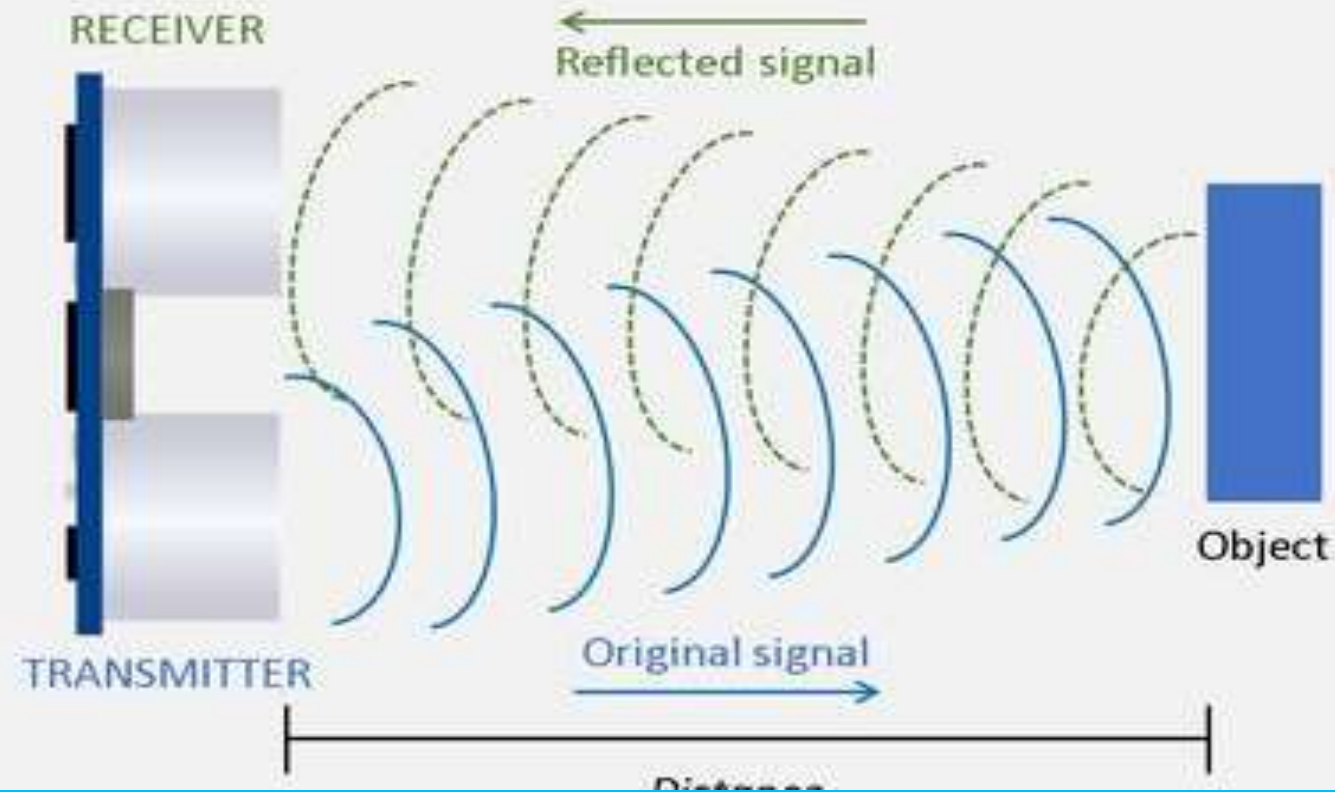
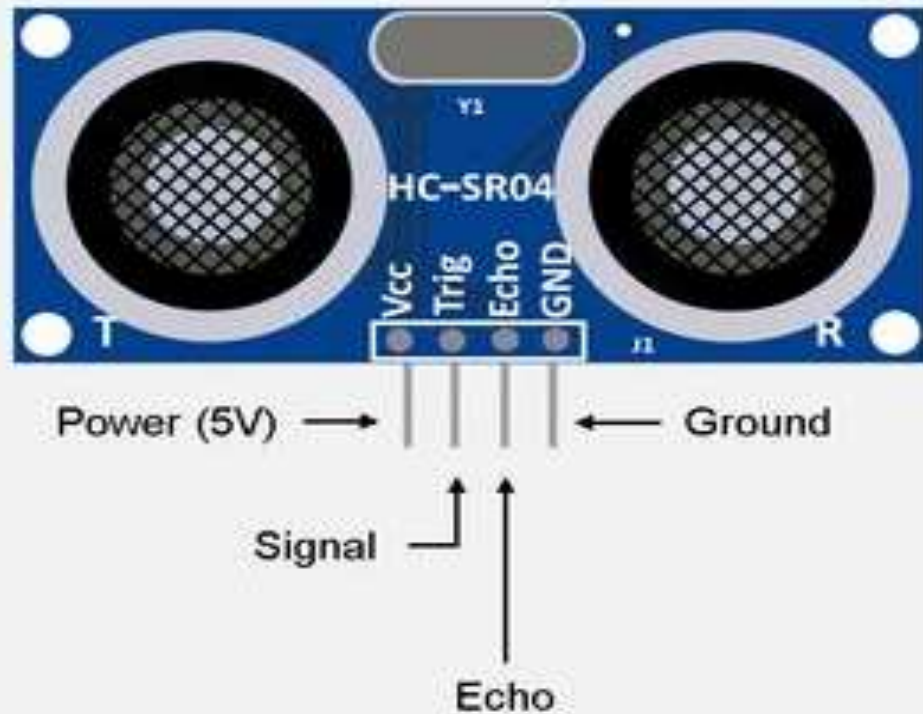
2. Receiver

There are four pins in this sensor:

1. Vcc
2. GND
3. TRIG
4. ECHO



Proximity Calculation



Ultrasonic sensor (HC-SR04)

1. **HC-SR04** is an ultrasonic sensor mainly used to determine the distance of the target object.
2. It measures accurate distance using a **non-contact technology**.
3. Formulae Used :

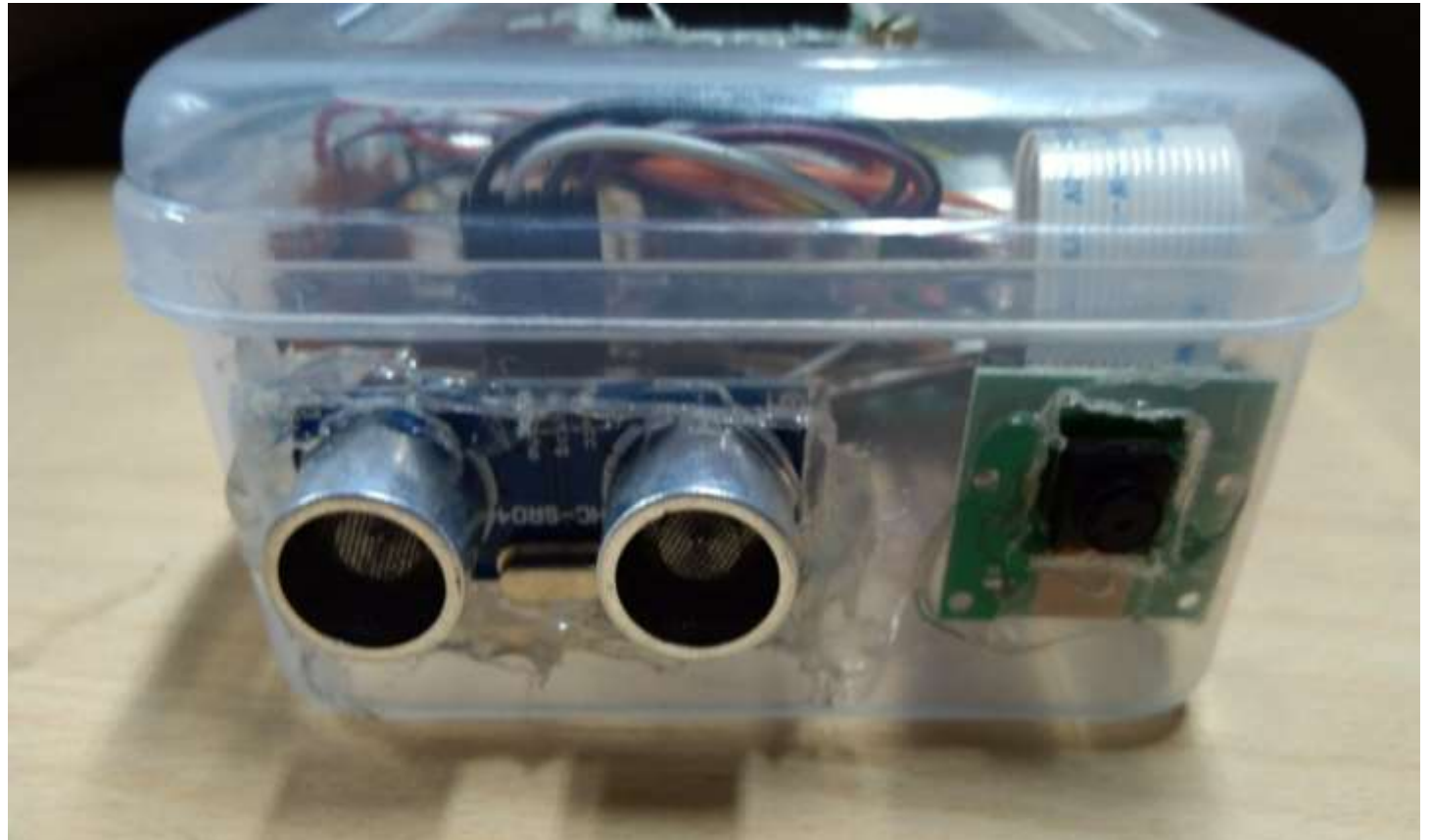
$$\text{Distance} = (\text{Time} * \text{Speed of Sound}) / 2$$



Proximity Calculation

HC-SR04 Sensor Features

- Operating voltage: +5V
- Theoretical Measuring Distance: 2cm to 450cm
- Practical Measuring Distance: 2cm to 80cm
- Accuracy: 3mm
- Measuring angle covered: $<15^\circ$
- Operating Current: $<15\text{mA}$
- Operating Frequency: 40Hz







Results and Output

The project that our team developed that is ELEKTRA basically answers and provide solutions to the following three queries:

1

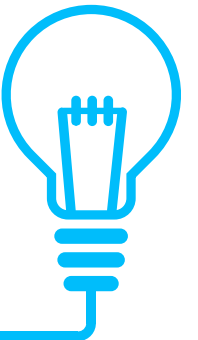
Recognition of
object without
touching.

2

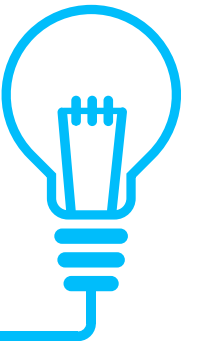
Controlling of
embedded smart
electronic devices
over voice
commands.

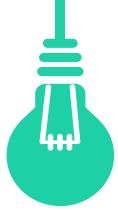
3

Makes navigation a
little bit easier by
telling the distance
from obstacles.



Results and Output





Future Enhancement

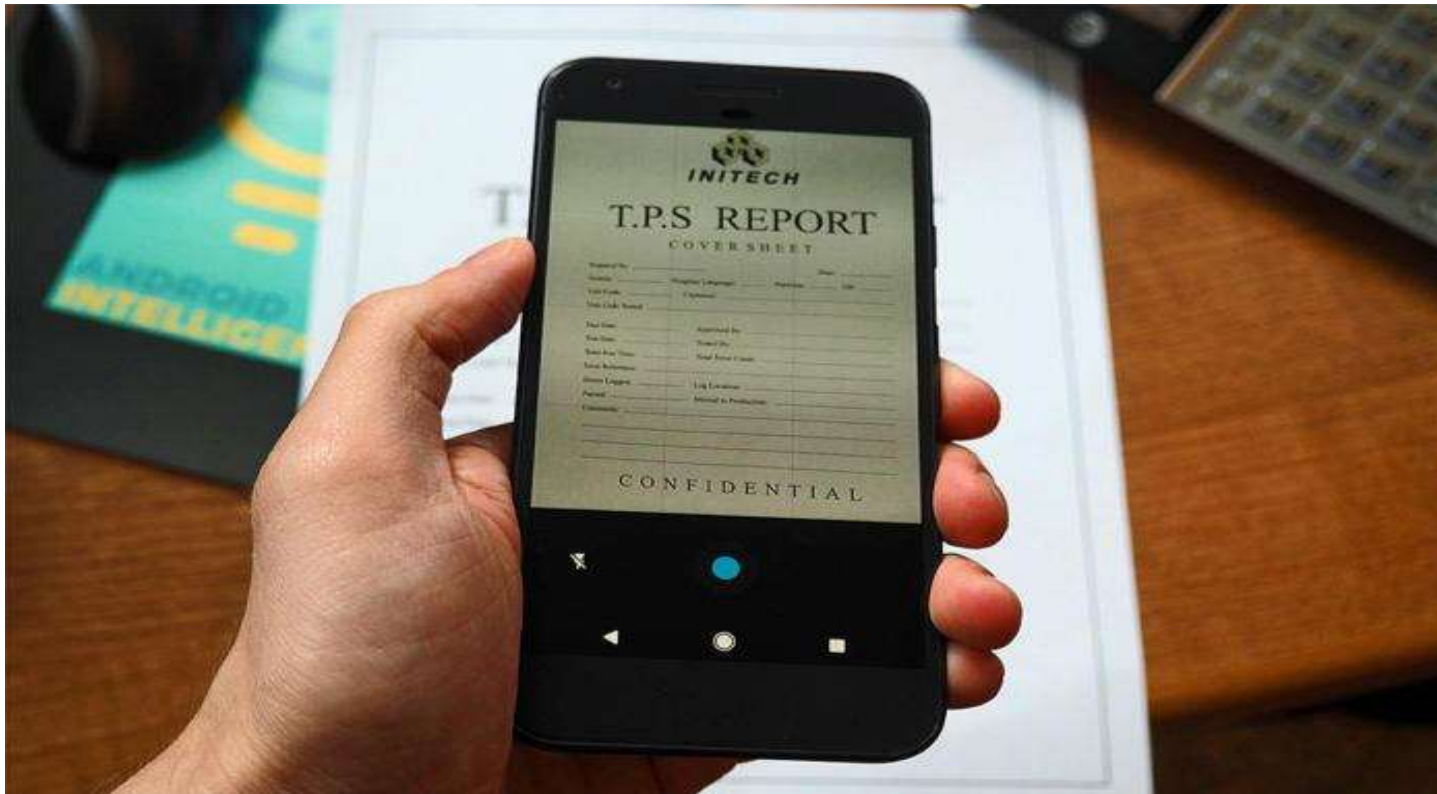


1. We are trying to incorporate the whole system and its working into a mobile app in place of Raspberry Pi by using java, android studio and some machine learning algorithms



Future Enhancement

2. One of the most important enhancement on which we will be working upon is to make the device capable of scanning the texts written in English, understanding it and then converting it into the audio for the user.

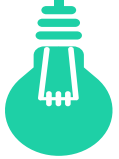


Future Enhancement

3. We will be doing face recognition along with face detection with the help of convolutional neural network.



References



1. <https://thepihut.com/blogs/raspberry-pi-tutorials/hc-sr04-ultrasonic-range-sensor-on-the-raspberry-pi>

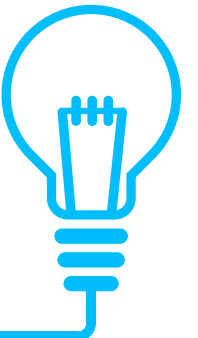
2. <https://medium.com/@krsatyam1996/haar-cascade-face-identification-aa4b8bc79478>

3. Paul Viola, Michael Jones (2001). Rapid Object Detection using a Boosted Cascade of Simple Features. In Conference on Computer Vision and Pattern Recognition 2001.

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Thank you

Vision