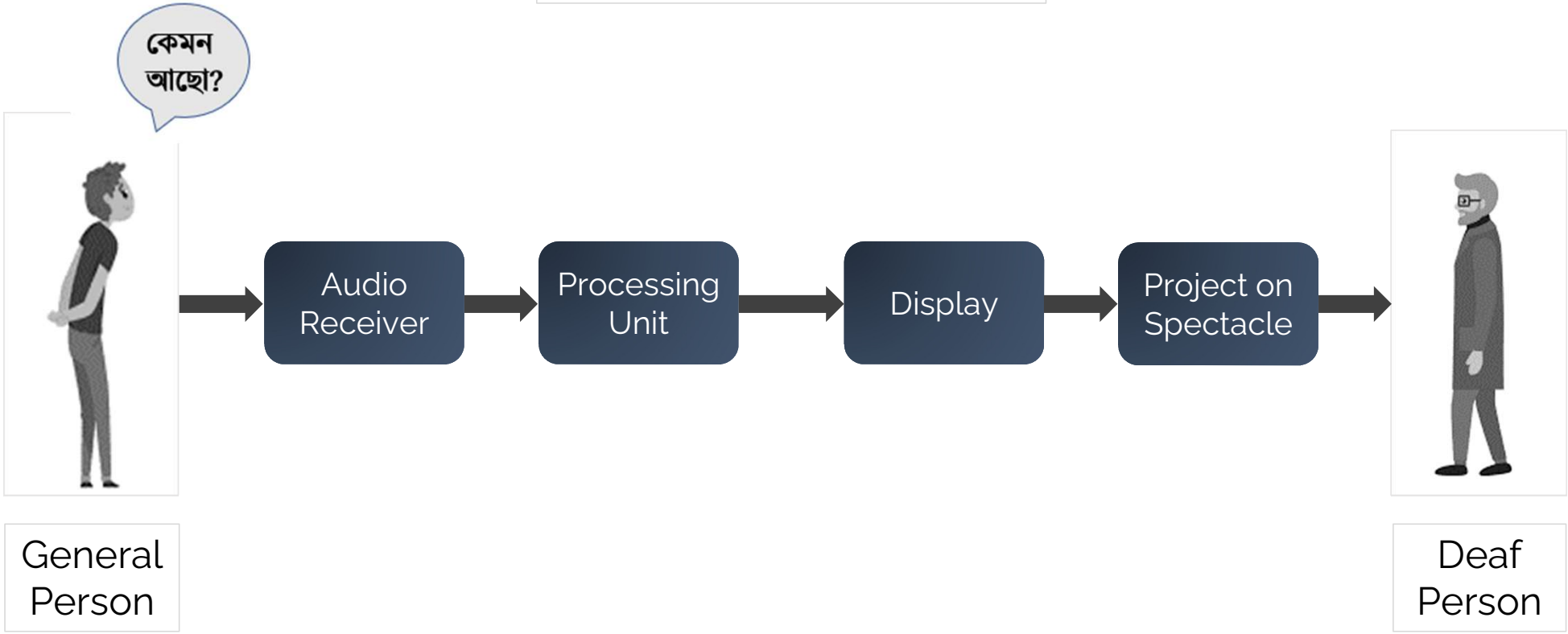
Voice To Text And Sign Language Converting Smart Spectacles for **Deaf People**

General Overview

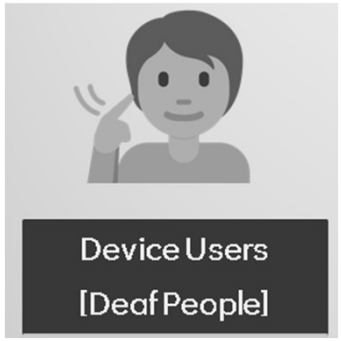
Motivation

- 2,27,424 people with hearing disabilities in Bangladesh.
- 85% of them are **unemployed**.
- Help the deaf community to communicate interactively.
- Creating opportunity for them to lead a normal life.
- Offer a vast working opportunity.

Concept


কেমন আছো?
Audio Receiver
Processing Unit
Display
Project on Spectacle
General Person
Deaf Person

Stakeholders



Both sign language and text

Attach with a spectacle

No internet connectivity

At least 3 hours of battery backup

Lightweight

Creative Aspects

Projecting text and Sign Language on **Spectacle**

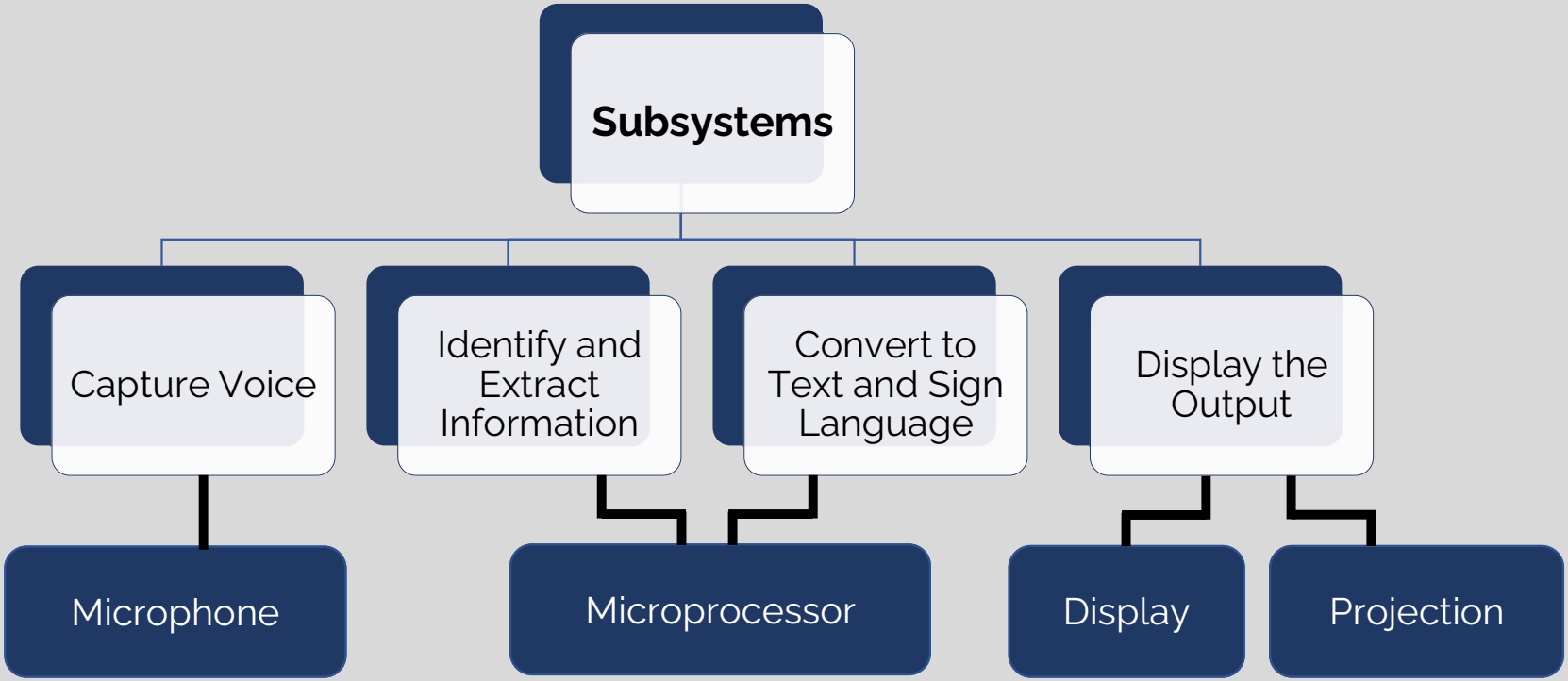
The language of text and sign will be **Bangla**

No **Internet** Connectivity.

First Device in **Bangladesh**

Technical Part

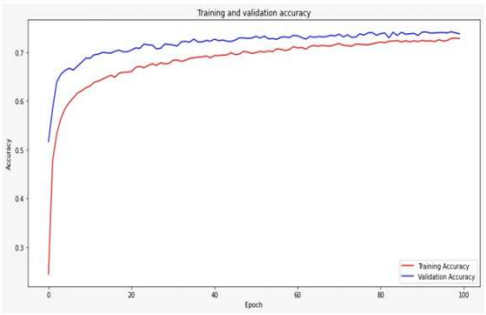
Subsystems

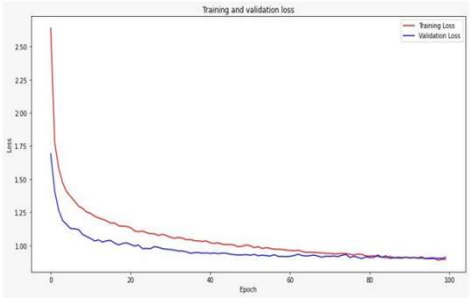

Subsystems
Capture Voice
Identify and Extract Information
Convert to Text and Sign Language
Display the Output
Microphone
Microprocessor
Display
Projection

Alternative Solution

Methods of **Speech Recognition**

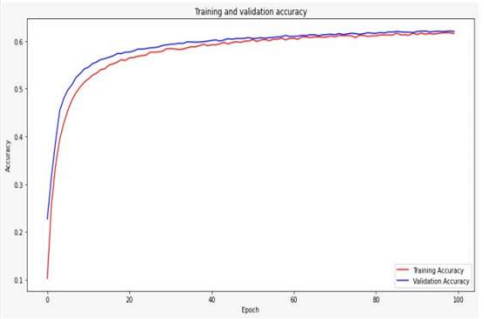
CNN

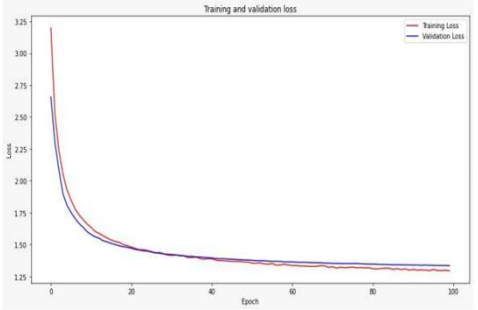





```
Epoch 100: val_accuracy did not improve from 0.74210
270/270 - 10s - loss: 0.8963 - accuracy: 0.7280 - val_loss: 0.9101 - val_accuracy: 0.7379 - 10s/epoch - 35ms/step
```

CNN combined with RNN

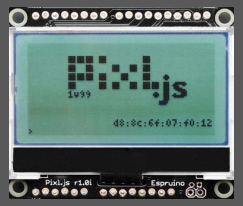





```
Epoch 100: val_accuracy did not improve from 0.62134
270/270 - 9s - loss: 1.2955 - accuracy: 0.6160 - val_loss: 1.3355 - val_accuracy: 0.6204 - 9s/epoch - 33ms/step
```

Alternative Solution

Display



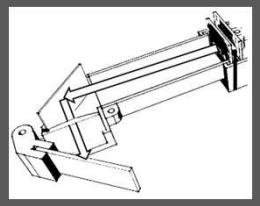
OLED

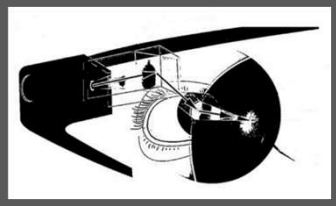
- Self-emissive
- Low power consumption
- Less Eye-strain

LCD

- Transmissive
- Comparatively higher power consumption
- Eye-Strain.

Projection Method





LENS-Mirror Technique

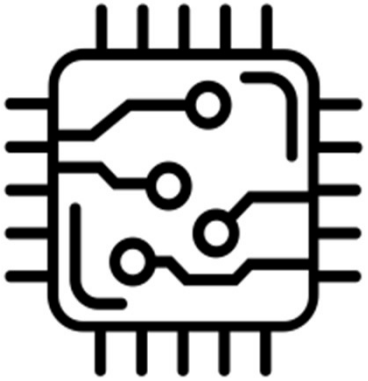
- Light weight

Prism Technique

- Heavy weight

Final Design

- Software Part



- Hardware Part

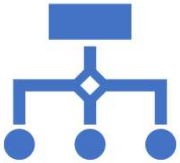
Software Part

Collect 25 voice-sets of 50 different words.

Use following platform to train the machine learning model:

Google Colaboratory

EDGE IMPULSE



Link the output with corresponding sign language.

Hardware Part

Raspberry PI Zero

- Compact size
- Lightweight
- Low Power Consumption

Battery

- 140mA current from a 5V supply.
- Required battery: 280mAh
- Backup: 2 hours

Case

- Body Frame
- Mirror and Lens
- Reflector
- Designed with: **Autodesk Fusion360**

OLED

- Compact size
- Lightweight
- Compatible with Raspberry PI Zero

Microphone

- USB microphone. Compatible with Raspberry PI Zero

Prototype Development

Raspberry PI 3B

- Higher processing speed
- Comparatively heavy weight
- Comparatively higher power Consumption

Power Source

- Maximum power consumption: 3.7 watts.
- For 2 hours backup 3.7 W * 2 hours = 7.4 Wh
- Required battery: 7.4Wh/5V = 1480 mAh.

Case

- Display, mirror and lens holder.

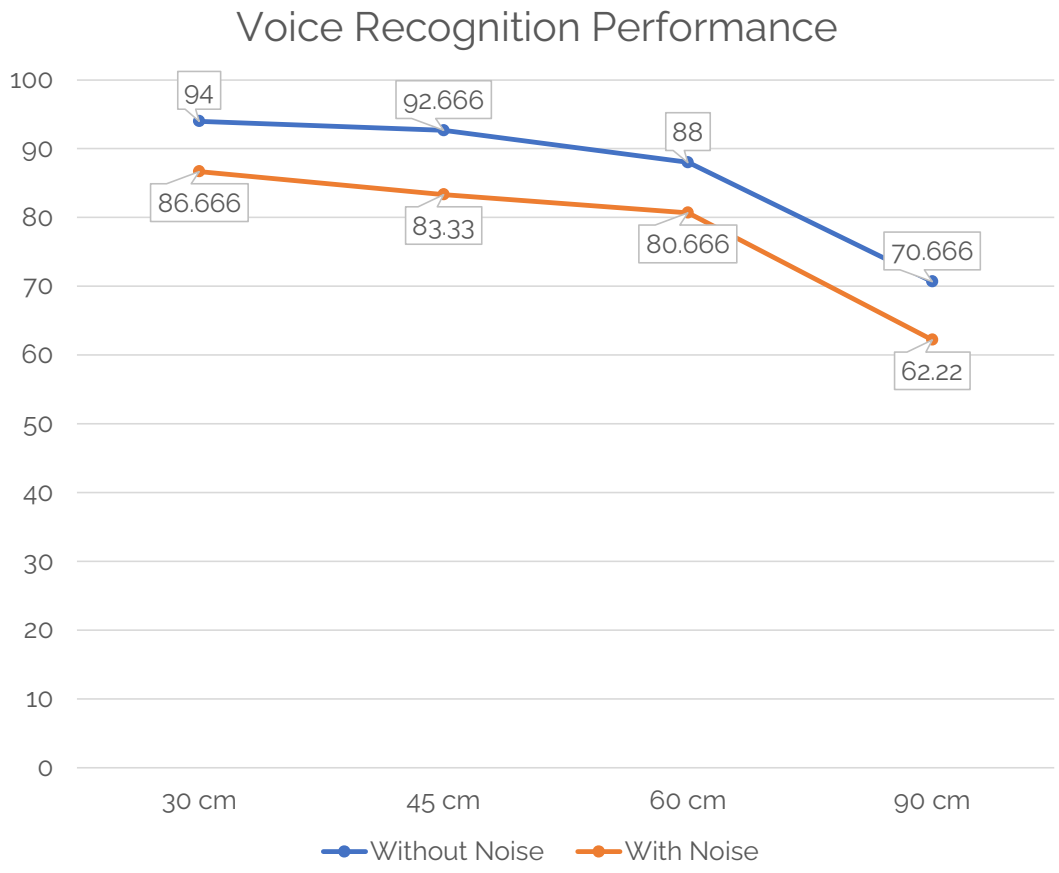
OLED

- Compact size
- Lightweight
- Compatible with Raspberry PI 3B

Microphone

- USB microphone. Compatible with Raspberry PI 3B

Performance Evaluation



Performance Evaluation

Requirements

- Better Battery Backup
- Lightweight

Temperature

Idly 40-42◦ Celsius After 30 min continuous use, 61-62◦ Celsius

Temperature Limit for Raspberry PI: 80-85◦ Celsius

Latency

2-3 second delay

Required real time processing

Battery Backup

90-95 Minutes for random use

Calculated Battery Backup:

114 Minutes

Weight

Weight of Spectacle with frame: 14-15 grams
Raspberry Pi : 45 grams

Weight limit: 40 grams

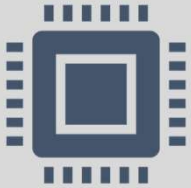
Design Refinement

Latency

Battery Backup

Weight Minimization

Wirelessly connect the raspberry pi and the display.

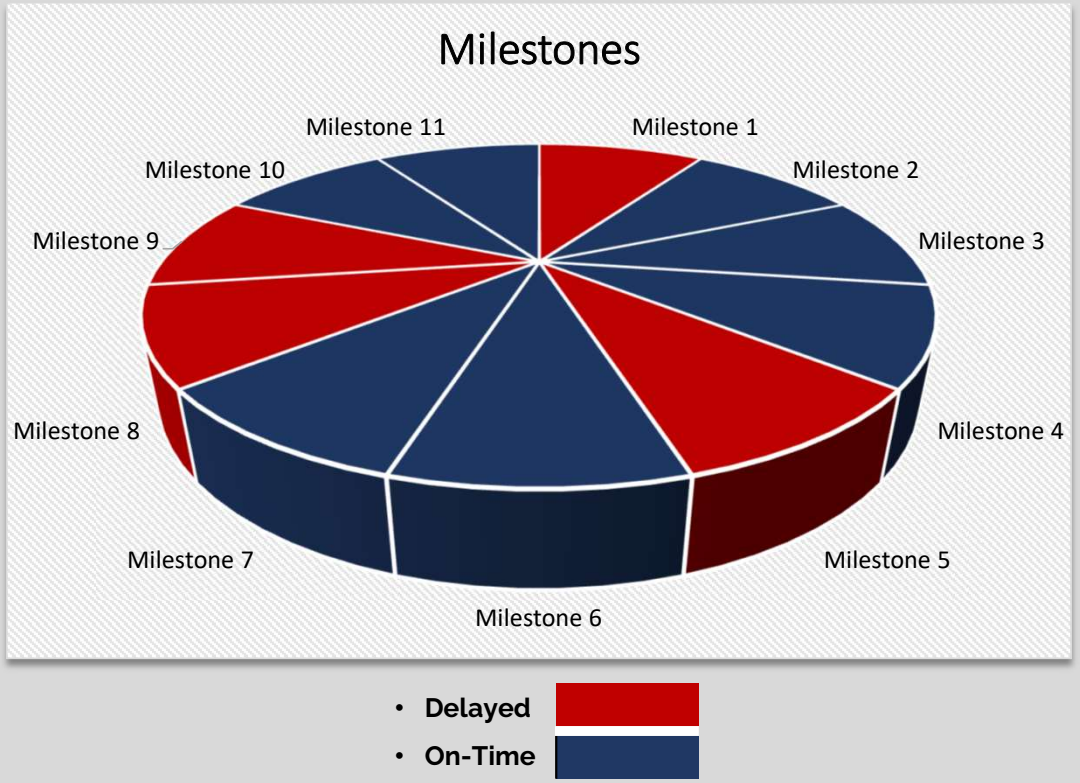


Using proposed design with Raspberry PI Zero.

Using Dedicated Embedded System.

Project Plan & Milestones Review

Course Segment	Start Time	End Time	Duration (Days)
400A	21.10.21	05.01.22	77
400B	06.02.22	06.05.22	90
400C	07.06.22	16.09.22	72
		Total	239



Economic Analysis

- Product Lifetime = **5 Years**
- Per Unit Production Cost = **2,328 Taka**
- Selling Price = **5,000 Taka**
- Production Per Year = **5000 Units**

Interest Rate, i = **5.3%**

Discount Rate, d = **9%**

- Simple Payback Period = **2 Years 5 months 8 Days**
- Internal Rate of Return (IRR) = **30%**
- Net Present Value (NPV) = **9,044,967 Taka**

✓ IRR > d
✓ NPV = (+ve)

- The Project is **Profitable**

Future Improvements

- Improving **IP Standards**
- More **Lightweight** in next Iteration
- Improving **Response Time**
- Optimizing **Noise cancellation**
- **Firmware** Upgradation
- More compact device

Thank You