# I-CEE INC.

## VIBRO-I

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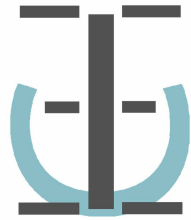**Ceren Hasançebi**

# Outline

- About Business Plan
- Initial Design Intended
- Evolution & Alterations
  - during Fall Term
  - during Spring Term
- Final Product
- Future Plans

# About Business Plan

revised values according to recent changes:

- Total Cost: $2,943,300
- Total Revenue: $2,968,000
- Total Profit: $24,700
- Variable Unit Cost: $340.6
- Estimated Selling Price: $371
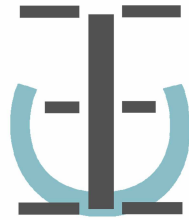
# Initial Design Intended

- As a company that values human most, we dreamed of a device to help the blind move independently

- We especially dreamed of vanishing the need for the cane to rehabilitate psychology of the visually impaired

Before VIBRO-I

With VIBRO-I

# Initial Design Intended

- beginning of the course (proposal of the project):
  - sensor implementation
    - Ultrasonic sensors to detect obstacles around and how far (resembling parking sensors' implementation principle) – input device
    - & tiny vibration motors (like the cellular phones') to inform the user of the obstacle – output device
    - Vibration motors to be placed on a wrist band & sensors to be placed on a waist belt.
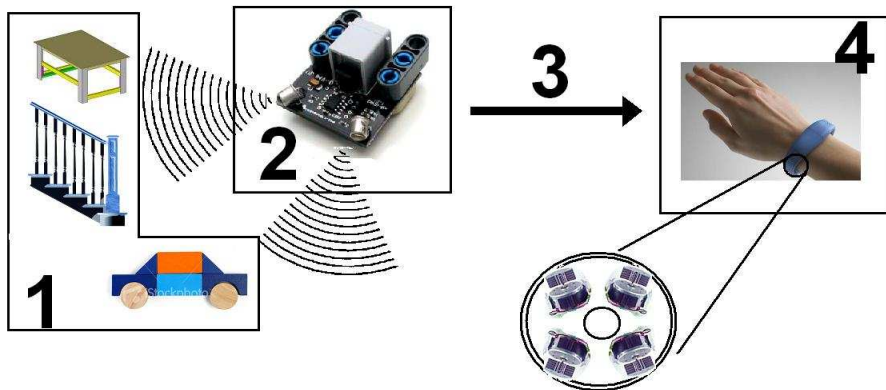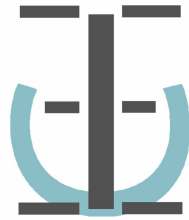
# Initial Design Intended

Implementation Principle has been roughly like this:

- Silent ultrasonic waves from the sensors bounce off objects sending back information about distance of objects.

- Sonar information is collected from the path ahead.

- Scanned objects normally produce multiple echoes, translated by the board into unique invariant pulses, which than translated to vibrations by the vibration devices according to the magnitude of the signal.

- The sound signatures vary according to how far away the person is from the object, thus indicating distance. The user senses these vibrations.

# Drawbacks of Initial Design

- Ergonomics issues:
  - how the belt would be worn (under or over the clothes)
  - cables between input & output units
- Mentors of the course proposed camera implementation in order to provide more precise information about the obstacles
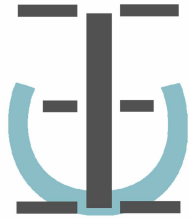
# Evolution & Alterations (Fall)

- Shift to camera implementation
- Design renewed:
  - Two wrist bands having vibration motors instead of one
  - One to interpret input from the camera & other to interpret input from sensors
  - Again sensors + a camera portable enough & having image processing capability
  - a processor board to process the image data received from the camera
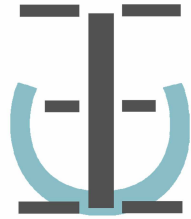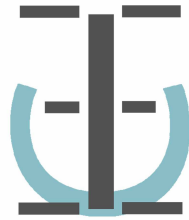
# Evolution & Alterations (Fall)

camera implementation (cont')

- Left-hand wrist band:
  - 3 vibration devices will be located:
  - One at the front
  - One at the right
  - One at the left (Each vibration device will vibrate according to the direction of the obstacle)
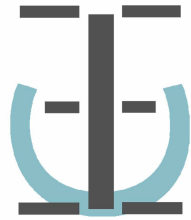
- Right-hand wrist band:
  - 4 vibration devices will be located:
  - One at the front
  - One at the back
  - One at the right
  - One at the left (Each vibration device will vibrate for each pre-defined object which planned to defined by third party object detection software)
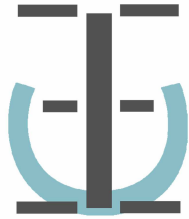
# Evolution & Alterations (Fall)
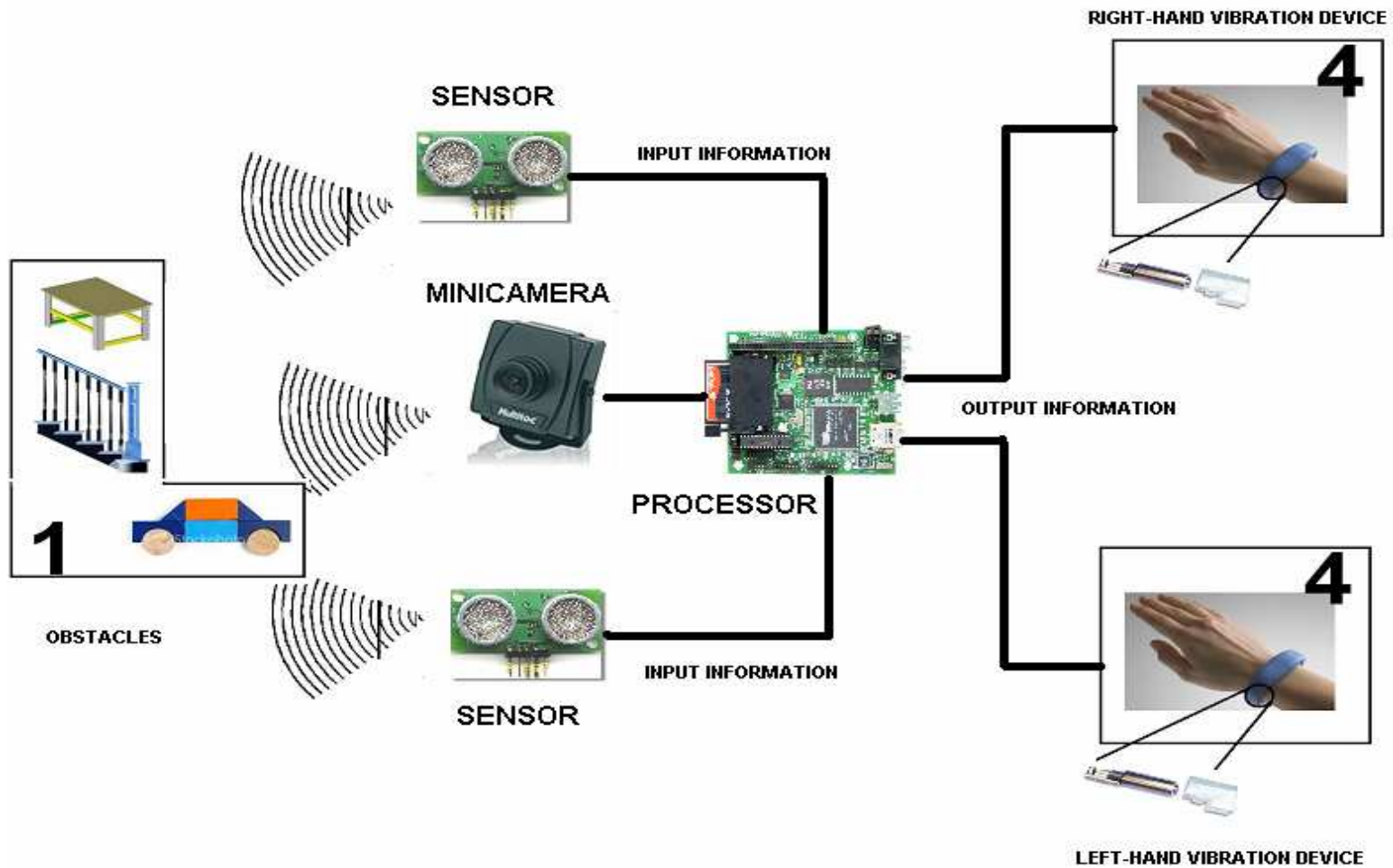
# Evolution & Alterations (Fall)

- The evolved design remained same except the ergonomics which lacked user comfort:
  - the heart of the product (the camera or the sensors serving as an eye) is decided to be manufactured inside a special coverage with an accessory allowing attachment over clothes
  - cables would still be tolerated
- at the end of Fall semester:
  - We had decided to first implement the sensor version of the product, than we would implement the camera version later when we decided on the image processing software for the camera

# Evolution & Alterations (Spring)

- We did not change the design of Fall semester:
  - Focused on the implementation (followed a step by step approach):

    - first implemented the sensor part of VIBRO-I (we showed as demo)
    - continued to work on the camera part
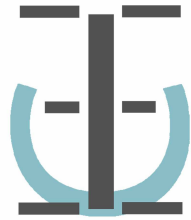
# Final Product

*Difficulties encountered during implementation of image processing as intended by the design of fall term*:

- Finding long-range sensors (2-3m long)
- Placing sensors on human body
- Bluetooth communication between input & output units
- Obejct detection using MATLAB
- Background filtering
- Detection of the object locations in each frame

# Final Product

*Because of the difficulties, some basic changes:*

- Shift to double camera implementation
- Both cameras capture frames synchronously
- Using object detection & background filtering for object recognition & distance information
- Third party object detection software
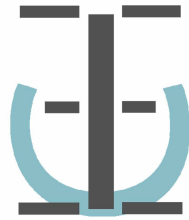
# Final Product

- sensor and camera implementation separately
- For camera implementation:
  - two cameras capture frames continuously & synchronously
  - using MATLAB, background filtering and finding location of objects (succeed)
  - with two separate cameras, finding the same objects on both frames (succeed)
  - using the frame matrix, calculating distance of the object (still working on it)
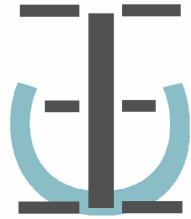
# Future Plans

- Wireless technology (instead of cables between processor board and wrist bands)

- Earphones as output device (instead of wrist bands including vibration devices)

- GPS map information via earphones with the arrival of GPS maps for Turkey
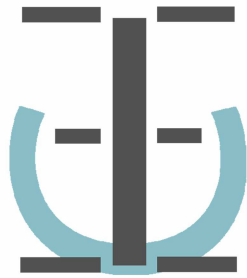
# THANKS FOR LISTENING
## QUESTIONS & COMMENTS