

Micro-Controller Project Proposal

at

*Cornell University*

for

**ECE476, Spring 2002**

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Date: March 27, 2002

## **Project name: Sound Targeting**

### **1. PROJECT DEFINITION**

#### **1.1 What is it?**

This project will use an Atmel processor to determine the two-dimensional position (direction relative to the processor) of a simple, predetermined audio signal by sampling the outputs of two microphones. Once the signal is located, the system will then control a mechanical system which will respond to this signal as defined below.

#### **1.2 How will it operate?**

Micro-processor:

§ The processor will receive real-time audio samples of the environment through multiple microphones connected to up to eight (8) A/D ports (we will use 2 microphones). If the reference signal is sensed, it will determine the direction of the signal by calculating the delay of this signal from the multiple sources.

Mechanical:

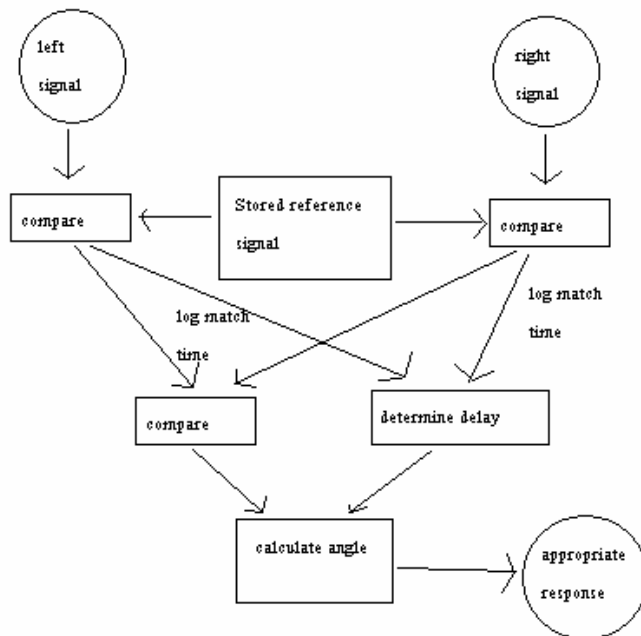
§ This part is yet to be determined. The initial idea is to control a motor which will rotate a pointing device (or, indeed, the entire sensor setup) towards the direction of the received signal or turn the pointing device off if no signal is detected. There are many possible extensions listed at the end of the proposal.

### **2. PROJECT FEATURES**

#### **2.1 Self contained audio positioning system.**

### 3. TECHNICAL SPECIFICATIONS

#### 3.1 Block diagram



#### 3.2 Inputs:

- \$ Output of multiple microphones positioned accordingly.
- \$ Start and stop button.
- \$ Power

#### 3.3 Output:

- \$ Pointer light aimed towards the source of the matched signal. (Or if time permits, a walking dog which walks towards the source of the matched signal)

- 3.4 The sample rate is to be determined, but it may be a rate of roughly 4kHz (a sample roughly every 2000 clock cycles assuming 8MHz clock). This will allow for a signal about 2kHz to be sensed.

### 4. ELECTRICAL DESIGN

#### 4.1 Power:

**Micro:** ideally 3 or 4 AA cells. (May require two separate supplies for the micro and A/D converter supply).

**Motor:** Appropriate power supply.

- 4.2 Microphones: TBD.
- 4.3 Microphone hardware: Pre-amps may be required depending on the microphones. Also, hardware gain control (to normalize signal) may be required if it is not done in software.
- 4.4 A/D: Simple RC filtering to avoid aliasing (might be accomplished by choosing the appropriate band limited microphones).
- 4.5 Op-Amps or transistors to control power to motor(s).

## 5. MECHANICAL DESIGN

Note: All of the below is contingent on successful location ability of the electrical design. Thus the basic detection criterion must be satisfied before any of the below is attempted.

- 5.1 Primary goal is to build a system to swivel the sensors to point towards the direction of the signal, once the system has ascertained the correct direction.
- 5.2 Secondary goal is to mount the system upon an autonomous unit (a robot dog) to move towards the signal source.
- 5.3 Tertiary goal is to mount the signal source upon a remote-controlled robot.

## 6. PRODUCT SCALABILITY

- 6.1 Increase processor speed for higher freq signals
- 6.2 More microphones can be added for higher precision in the location detection (assuming enough computational power).

## 7. FUTURE ENHANCEMENTS

- 7.1 Make dogs chase each other. (See 5.2)