COLOR DETECTOR FOR VISUALLY IMPAIRED PEOPLE

COE 485 Senior Project

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1. Introduction

Blindness is the condition of poor visual perception, an estimation from World Health Organization [1] state that 285 million people are visually impaired worldwide, 39 million are blind and 246 million have low vision.

A Blind person with proper training can function like any person with perfect vision, but there are the small things that can improve the quality of a blind person life, like color detection which is the focus of this project.

Being able to detect color can help in many ways, like identifying colors of clothes or even identifying uniquely colored objects (e.g. paper money) and appreciating art.

The project will help overcome challenges that visually impaired people face in daily basis, by creating a way to detect colors and providing unique biofeedback for each color.

2. Problem Statement

The problem that the project focuses on is the inability to detect or distinguish between colors. This project conducted to help solve the problem by providing an alternative way to detect colors to help visually impaired person in his daily life.

2.1 Positive Impacts:

The tool provided by this project can increase the opportunity for visually impaired person in his life style or career. This will improve the society by increasing Workforce and quality of life, this will lead to better economy and stronger society.

2.2 Possible negative impacts:

A possible negative impact, is wearing the glove for a long period can cause allergies.

[1] World Health Organization, http://www.who.int/mediacentre/factsheets/fs282/en/

3 Project Specifications

1) Customer: The visually impaired people
2) User requirements: the system should be reliable and able to detect colors of different intensities and ranges. Also it should be able to translate colors to vibrations that are perceived by the visually impaired as fast as they are scanned, instant comprehension.
3) Technical specifications: the system consists of two gloves containing in total:
   a) 10 Color detector chips: "Flora" color detector. The range of which is around 5mm or touching range to detect a color.
   b) 30 Vibration devices; variable voltages between 2 and 3 volts to indicate the different color intensities. On each finger along the length of it, there will be three vibrators. Each set of vibrators working together indicates a different color to cover all color ranges.
   c) 2 Arduino boards; one on each hand tied around the wriest. Each board will translate the colors feed by the Flora chips to volts for the specified vibrators to indicate color and its intensity.

4 System Design

4.1 Architecture

The system consists of two main parts:

1) Wearable glove and contains:
   a) Color detectors
      i) Its function is to read the color it's pointed at and feed back the processing unit.
   b) Vibration motors
      i) Its function is to feed back the user with a specific vibration rhythm for each color so the user will recognize the color he is pointing at.
2) Processing unit, its program will consist of two main methods:
   a) Translator method.
      i) Its function is to translate the readings from the sensor to a specific integer or a code for the vibration generator method.

b) Vibration generator method.
   i) Its function is to translate the code received from the translator method to the appropriate vibration rhythm.

4.2 Component Design and Implementation

The off shelf components we will use in our system are the following:

1) Processing unit. We choose Arduino processors because it's efficient for the assigned tasks for the processing unit.
2) Color detectors. For many good reasons we choose flora color detectors to work with. For instance, it is Arduino compatible and has the required size.
3) Vibration motors, we choose a vibration motor model number 310-101, it meets the project requirements such as the appropriate size and vibration strength range.

The costumed hardware we need is:

An appropriate glove we can use to implement the device on. Attaching the vibration motors and the color detectors will require customizing the glove for it.

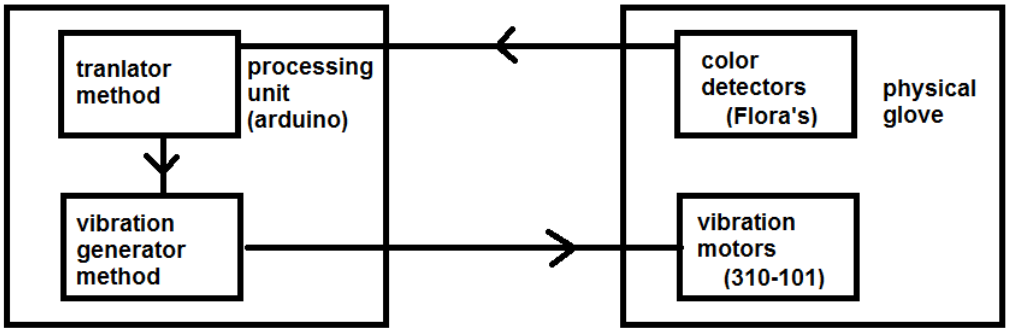

Fig.1 Main Components of the System

4.3 System Integration

Flora detectors are Arduino compatible, it will be connected to the Arduino analog ports directly. After processing the data in the Arduino, instructions will be generated to the vibration motors pins. This will drive the vibrators to act accordingly.

4.4 Design Decisions

Part required	**Targeted Criteria**	**Option1**	**Option2**	**Option 3**	**Preferred one**	**Main reasons**
processor	Ability to handle data and generates appropriate signal after processing for the output	Arduino processor	AT mega8	ATmega328	Arduino	Provides boot loader, easy to program (in C) , efficient in meeting the needs.
Color Sensor	Size limited by the average finger size, ability to recognize the colors immediately and uses RGB module.	Flora color Sensor s	Color Sensor/TCS3200D/RGB Module	TCS3200 Color Sensor RGB Module	Flora Color Sensor	It meets the targeted criteria perfectly. Others are not arduino compatible
Vibration motors	Smaller than a finger tip and has a vibration intensity range.	Grove vibration motor	Aslong A1234 Flat Vibration Motor	vibration motor module 310-101	vibration motor module 310-101	Perfectly meets the targeted criteria and easier to purchase.
Programming language	A language that works with our processor and efficient for the processing task	C	java	python	C	Arduino's language, easier to use by the team members than python.

Table.1 List of Options and comparison of each of the main Components

5 Progress

5.1 Task Schedule

Task	Owner	Description	Time span	Status
Project plan	All team	-	-	done
Design document	All team	-	-	done
Design presentation	All team	-	-	Not yet started
Final report	All team	-	Throughout the semester	In progress
Final presentation	All team	-	-	Not yet started
Final demonstration	All team	-	-	Not yet started
identify the engineering and marketing requirements	All team	Research for tools to be used	3 weeks	done
identify different solutions and choose one	All team + advisors	Meeting and discussion with advisors	1 meeting (in week 2)	done
Identify hardware and software needed	All team	Discussion after identifying requirements	1 meeting (in week 2)	done
Identify the engineering tools needed	All team	Discussion after identifying requirements	1 meeting (in week 2)	done
Purchasing needed parts	All team	-	1 week (during week 3 and 4)	done
programming the system	All team	Mapping the detected colors to the vibratos using the Arduino boards	7 weeks (during weeks 5 - 11)	In progress
Physical integration	All team	Wiring the Arduino boards to the vibrators on the glove	5 weeks(during weeks 7-11)	In progress
System analysis and output measurements	All team	Testing the color detector and varying the volts feed to the vibrators	7 weeks (during weeks 5 - 11)	In progress
System Final tests and solve any issues	All team		Final 3 weeks	Not yet started

Table.2 List of Tasks with Status and time

5.2 Completed Tasks

Identify different solutions and choose one: after meeting with the advisors and discussing some of the presented solutions an agreement was made to choose the gloves being the most practical choice.

Identify the engineering and marketing requirements and tools needed: after meeting with team members each one did research on the tools needed to implement a proto type of the project. An agreement was made to choose some parts over others due to different prices and specifications.

Purchasing parts : some difficulties at the beginning for there was no clear way to deliver the tools needed in the universities name for some purchases were taking place online, difficulties were overcome with the help of advisor Dr.Yahya.

Testing Components: Testing each component (sensors, vibrators…etc.) and writing test programs to learn how to use it and how it works and documenting useful information.