FIT540057 - Advanced Mobile Systems S2 2016

"Music of Colors"

Mobile Application Project Report

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i. Initial Design Purpose

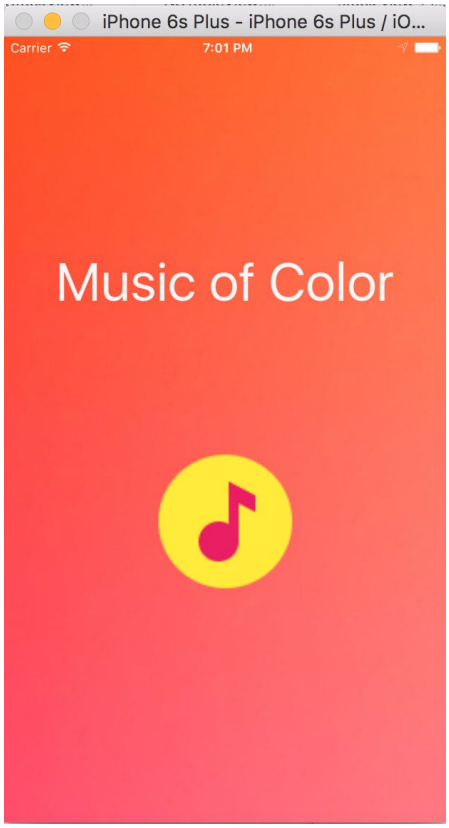
"Music of Colors" is an app targeted for blind people to help them recognise different colours by playing different music notes. With this app, a user can play with gesture and color sensor, as well as voice recognition.

Color sensor is used to read some color value, which is converted to a music note. The speed of consecutive notes is controlled by leap motion gesture.

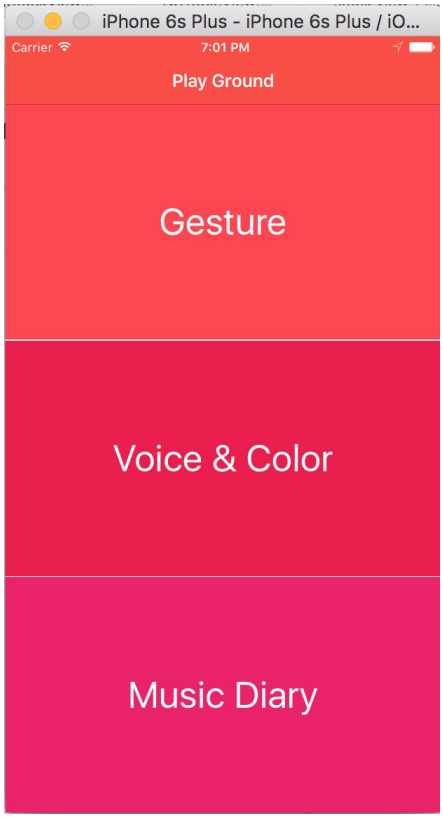
Voice recognition will be used to start recording or to stop and start playing the record.
Gesture playground will enable user to move hands in different velocity and produce different notes according to the gesture velocity.

ii . UI Design

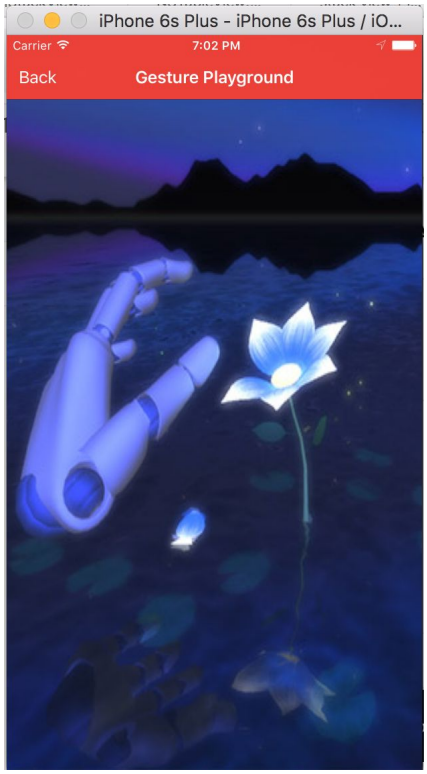
(1) Entry Screen



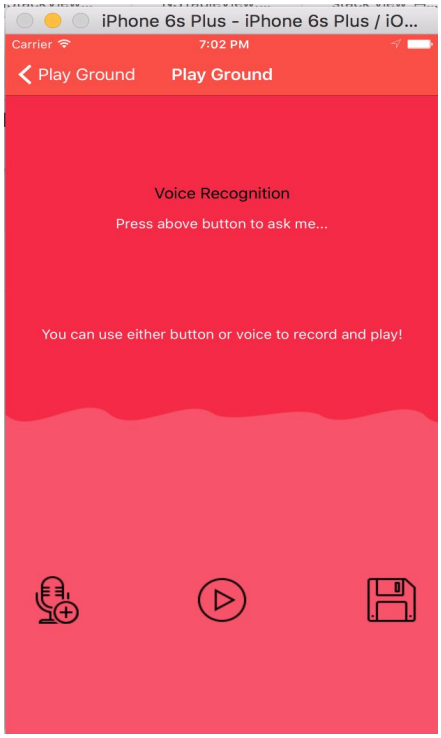
(2) Main Menu Screen



(3) Gesture playground Screen



(3) Record Play and Save Music Screen



iii. Architecture Design

3.1. Devices overview

On server side, there are two Raspberry PI and we select color data from each sensor and combine them. The leap motion is remotely connected to the Raspberry PI. All the data is in format of JSON and is transferred through HTTP.

The figure below explain how the devices are connected:

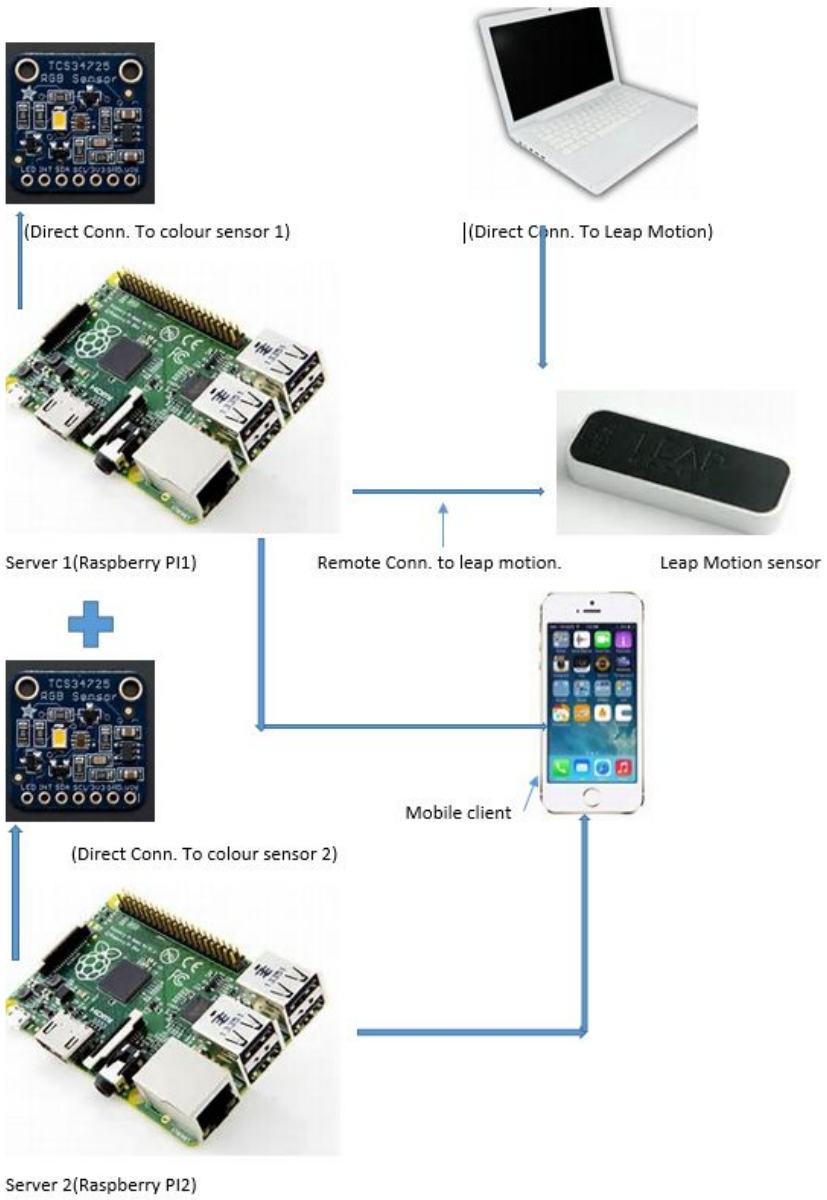


fig: Client-Server Architecture

3.2. Main functions overview

There are three main functions of our project:

3.2.1. Mapping color to music (combining 2 Raspberry PI)

Values from color sensors are read as JSON from both servers. The JSON values are combined together to create a single JSON.

A mapping algorithm is used to map color values to music.

There are 15 wav files to represent different music notes. The file format is "xy.wav". The mapping algorithm is explained as following:

(1) Fetch maximum value from red, green or blue and mapping x as
: Max(Red/Gren/Blue) (x) => 1 / 2 /3
(2) Divide colour value 255 into 5 colour and mapping y as :
levels (y) => 1/2/3/4/5
(3) Then, xy.mp3 will give us file name.
So 11.mp3 means Red value is dominating with Red value lying within first level.

The speed of corresponding music notes will be controlled by y-axis position of palm, recognised by gesture sensor. If the palm position goes from higher to lower, there will be more interval between two consecutive tones and vice versa.
ColorViewController implements the logic for the above discussed feature.

3.2.2. Playing music by gestures (leap motion)

The leap motion gesture sensor is remotely connected to Raspberry PI. It provides two functions:

(1) A user can swipe their hand vertically to change the speed of playing a single notes. When the hand position (Y axis) is increasing, it will speed up and vice versa.

(2) A user can swipe their hand horizontally to play the multiple notes. The music of different pitch will be played according to hand velocity (X axis).

Libraries used:

(1) Server side
- cylon.js
  Cylon.js is used for connecting robotics, physical computing system such as leap motion. It makes it easier to command devices.

(2) Client side:
- SwiftyJson
  It is used for parsing JSON data at client side.
Retrieved from: https://github.com/Swiftyjson/Swiftyjson

- Wave class
  It is used for displaying the change of voice wave on screen.
Retrieved from: https://github.com/zhangxigithub/Wave

3.2.3. Speech to Text

The user can simply speak "start to record" and "stop and play" to make it record and play.

Libraries used:

- Nuance SpeechKit 2 API
  It is used for invoke voice Recognition service from remote server with appToken and specified URL.
    - Official documentation URL:
      https://developer.nuance.com/public/Help/DragonMobileSDKReference_iOS/index.html

3.2.4 Save recorded music tones
The recorded tones can be saved in database and can be listened later on.

iv. Individual contributions

Rashmi
1. Integrating color and music, combining two raspberry pis,
2. UI
3. Documentation

Kaiwei Lin
1. Leap motion (sending and receiving data)
2. Voice recognition
3. Documentation

Youbing Song
1. APIs design & implementation & documentation: record, play, tone-modifying.
2. UI
3. Support local data persistence

Yifan
1. UI
2. Storing recorded music to database
3. Mapping real-time gesture data to music file