

# An educational Android application – The SeeLife project

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## Overview & Introduction

Seelife Production is a project that introduces a new treatment for the anxiety of children ages 6-8. For those who experience difficulties when facing stressful circumstances, the effect of anxiety will cause poor self-esteem and social interaction failure. As a solution, Seelife provides a biofeedback therapy via introducing an engaging game. We provide a two-step design to achieve the goal. Firstly, we transplant the Seelife game demo from Windows to Android platform. We also change the control system of the game from the keyboard to Gyroscope. Then, we retrieve the heart rate data wirelessly by using BLE technology without a long delay. BLE technology is a relatively new technology that has the simplicity, low power, and compatibility advantages. The goal of this project is to successfully build a BLE connection between the heart rate sensor and the Android system.



### The SeeLife project

A serious game is a game designed for a primary purpose other than pure entertainment. Serious games use game environments and techniques to train or educate users or to promote a product or service in an engaging and entertaining way. The "serious" aspect of SeaLife comes from the fact that it enhances the ability to control anxiety and emotions of young children.



### Sensors & Measurements

#### Sensor data:

Analog: Raw EKG data from the Gravity Heart Rate Monitor Sensor

Digital: Digital data generated from the analog heart rate signal using an ADC.

#### Power Consumption:

According to the formula  
 $E = P*t$   
 $= V*I*t$

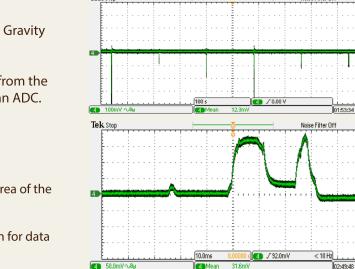
Refer to Origin's integration, the area of the spikes = 4.929015924617627E-4

The voltage here = 3.3V  
 Therefore the power consumption for data transmission = 18.73 E-4 J

= 1.873 mJ

#### Transmission Range

Range (ft.)	10 (3.05 m)	20 (6.10m)	30 (9.14m)	40 (12.2m)	50 (15.24m)	60 (18.29m)
Connecting condition	Response immediately (0 data point missed)	Response immediately (0 data point missed)	Response immediately (0 data point missed)	Slightly weakened (2 data points missed out of 10)	Weakened (5 data points missed out of 10)	Disconnect



### Software Design

The basic idea of this game is the player controlling a blue fish swimming in the sea, gathering coins as many as possible to score. During the game, there will be two obstacles: sea monster and fish hooks prevent the player to finish the level. Touching either of the two obstacles will cause the level to be lost, and the player has to replay from the beginning (Woodrum, Erika, 31). The obstacles appear randomly, and their frequency and speed are increasing as game levels going further. The final goal of the player is to reach the Golden Starfish at the end of each level to win the game.



Golden Starfish  
Completes current level, unlocks following level



Star Coin  
5 points



Bonus Coin  
15 points

### Hardware Setup

#### Serial

Including EasyPulse v1.1, Arduino Uno Rev3

1. Designed for testing purposes
2. Robust connection
3. Can sync data to computer for further analysis & researches



#### Bluetooth LE

Including Gravity Heart Rate Monitor, Adafruit nRF52 Feather

1. Compatible with devices with Bluetooth 4.0 features
2. Stable Connection up to 40ft
3. Low power consumption



The serial circuit will connect to devices via USB OTG cable.

The Bluetooth LE circuit will connect to devices via wireless Bluetooth port

### HRM readings



1. The BPM values are calculated using the digital signal from the sensor
2. The BPM values are calculated by measuring the time interval between peak-to-peak.
3. The machine monitors the first 10 peaks to determine whether the signal is valid or not.

### Conclusion

The game is aiming on introducing a new treatment for anxiety of children age 6-8. The final goal, making the game successfully working on Android devices with an accurate wireless heart rate sensor, is completed.

The game will be able to upload a dataset of heart rate to the mobile devices for parents and doctor to collect the information about children's performance under pressure.

### Reference

[1] "Seelife Production Book"Woodrum, Erika (2014).

[2] "PC-based heart rate monitor using Arduino and Easy Pulse sensor" Embedded Lab (2016).