Blockly for bitalino

Lessons

EMG with Hugo the Dinosaur

What is EMG?

Electromyography (EMG) is the electrical signal in your muscles. An EMG biosignal allows us to acquire, measure and visualise any changes in muscle movement (such as if your arm has been moved up or down). In this lesson, we use an EMG signal to measure muscle movement in the arms, and interact with a game utilising these signals.

Lesson Aims:

Topic:	Electromyography (EMG); biosignal processing
Class:	Year 8-9
Prior Learning:	It is assumed that children have been introduced to the fundamentals of what a biosignal is and how they work, but this is not crucial as the lesson builds on these ideas
Resources required	Sensor Documentation (linked via the interface) Getting Started Guide 'Hugo the Dinosaur' activity sheet 'Hugo the Dinosaur' extra challenges sheet

Learning Objectives:

- Become familiar with biosignals in general, what EMG is, what happens if the arm is tensed etc.
- Use Blockly to implement EMG monitoring
- Use Blockly to understand thresholding (activities only happen if you exceed EMG force threshold)
- Learn how to interpret basic EMG data

Link to KS3 teaching aims:

This lesson is related to the following National Curriculum teaching aims at Key Stage 3, and can also facilitate multidisciplinary learning across different subjects in the curriculum such as computing or psychology.

- **Biology:** biomechanics (interaction between skeleton and muscles including measurement of force exerted by different muscles)
- **Chemistry:** Energy changes dependant on the state of the body

- o this will be covered assuming students experiment with the blocks
- **Physics:** forces and motion

Format of lesson:

Part 1: Introduction (10 mins)

- Introduce the idea of biosignals in general
- Introduce the BITalino device and explain how it will be used in the lesson
- Introduce the interface and how to "drag and drop" blocks

Part 2: Programming the game activity (35mins)

- Pair up students into groups of two. Each student takes on the role of 'player' or 'observer' and take turns either monitoring the data or playing the game with the electrodes etc. (note that to re-start the game, one player will have to click).
    - o Allow students to become familiar with the basic game output, but then turn their focus to the blocks that are powering it

- After around 10 mins (or earlier if appropriate), hand out the *activity sheets* to allow students to interact with the core blocks, and experiment with other features of the game.
    - o There should be a focus to the activity, but some freedom should be offered as well.
    - o The focus of the activity should be on the interaction (or rules of the game) e.g. If the muscle is tensed, then do something
- Allow time to play the game they have created, and to see what data is generated from their gameplay
    - o If time, some simple interpretation of the data could be facilitated. Or, the data could be exported into an external file for use in another lesson (e.g. Biology)

Part 3: Challenges (15 mins)

- If students have completed the tutorial with relative ease, encourage them to progress to the *extra 'challenges'* exercise, which provides more complex code for advanced features exploring the ideas behind EMG. This exercise has additional scope and experimentation to really make students games their own.

- Hand out the *challenge sheet*, or alternatively some quiz questions that can be answered by playing the game about EMG/biosignals
    - o This will reinforce learning