Masterproef industriële ingenieurswetenschappen 2017-2018

Development of an educational exoskeleton for STEM education

Laurens Osstyn

Master IW elektronica-ICT

Simon Vercruysse

Master IW elektronica-ICT

Goal

Development of an educational exo-arm to interest youth in STEM. The target audience is the **third grade** of high school in Flanders. To reach this audience the exo-arm has to be incorporated into an **educational kit** which tackles multiple curriculum goals.

Most important **curriculum goals** of POV, VVKSO and GO!:

- Forces
- Velocity & acceleration
- Magnetism
- Derivative and integral

Manual

- Starts from the **problem** relating to users, context from survey.

  Mimicking: 4,33/5 Assistive: 4,18/5
  Rehabilitation: 3,39/5
- Modular
- Users build exo-arm step by step with guidance of a written manual

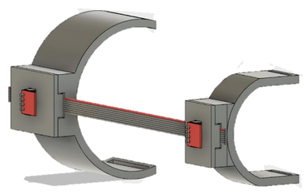
Future

- 2018-2019: pilot project in different schools in Flanders
- 2019-…: product available for all Flemish schools
- Possible extensions
  - Assistive arm
  - EMG-sensor
  - Extensions of the library
  - E-learning platform

EMG-sensor [5]

Exoskeleton arm

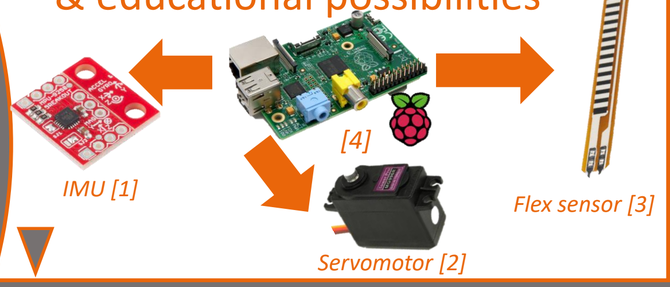
STEM – Education



Modelled cuffs to secure IMU's in mimicking case

Hardware

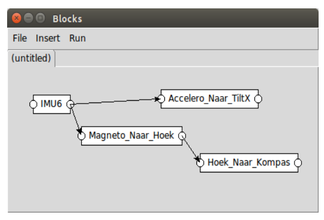
Choice based on functionality & educational possibilities

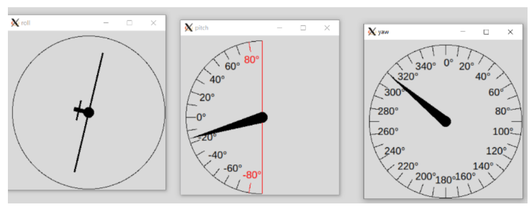


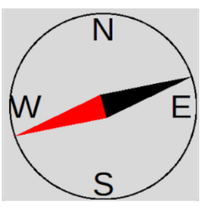
IMU [1] *[4]* *Servomotor [2]* *Flex sensor [3]*

Software

- Collaboration with Jasper Deflander (Computer sciences at KULeuven)
- Python Library
- GUI to give users the opportunity to **graphically** program the hardware components using a **flow chart**

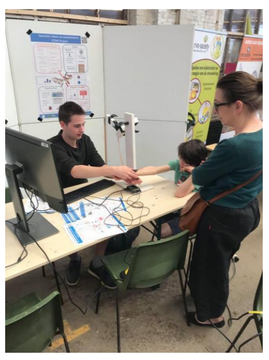






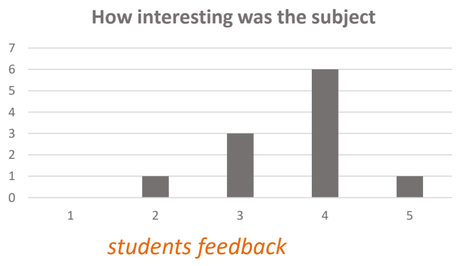
Testing

- 18 April: test session with students
- 25 April: test session with teachers
- 5 May: test session at the And&-festival



test session AND&-festival

Test session students



students feedback

References

[1] Sparkfun, ,,SparkFun IMU Breakout-MPU-9250-SEN-13762-SparkFun Electronics, " [Online]. Available: https://www.sparkfun.com/products/13762. [Accessed 20 October 2017].

[2] Tower Pro, ,,MG996R," [Online] Available: http://www.towerpro.com.tw/product/mg996r/. [Accessed 6 May 2018]

[3] Sparkfun, ,,Flex sensor 2,2 Inch," 2018. [Online]. Available: https://www.sparkfun.com/products/10264. [Accessed 25 February 2018]

[4] Raspberry Pi Foundation, ,,Raspberry Pi," [Online]. Available: https://www.raspberrypi.org/. [Accessed 6 May 2018]

[5] Sparkfun, ,,Myoware Muscle Sensor.," 2018. [Online] Available: https://www.sparkfun.com/products/13723. [accessed 15 May 2018]

Promotoren / Copromotoren: Prof. Dr. Ir. Nele Mentens

Dr. Ludo Cuypers