

STEM Education for a Sustainable World

Sharing Inspiration 2021 – April 22

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Rover, a Sm@rt Wheelchair

Electric wheelchair steering control through head movements

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Rover, a Sm@rt Wheelchair

This project consists in developing a robotic prototype for controlling the movement of an electric wheelchair, only with head movements. This is especially relevant for people who can only move their head in a controlled way, due to a tetraplegia or similar condition.

In: Rover, a Sm@rt Wheelchair, T3 Europe Portal



CONTENTS

1

Technical/pedagogical aspects

2

Prototype demonstration

3

Connection to SDG's

Technical/pedagogical aspects

Learning outcomes

1

(1) conceptualize simple computer algorithms;

(2) operationalize simple computer algorithms in coded programs;

(3) identify and mathematically manipulate physic variables evaluated by sensors;

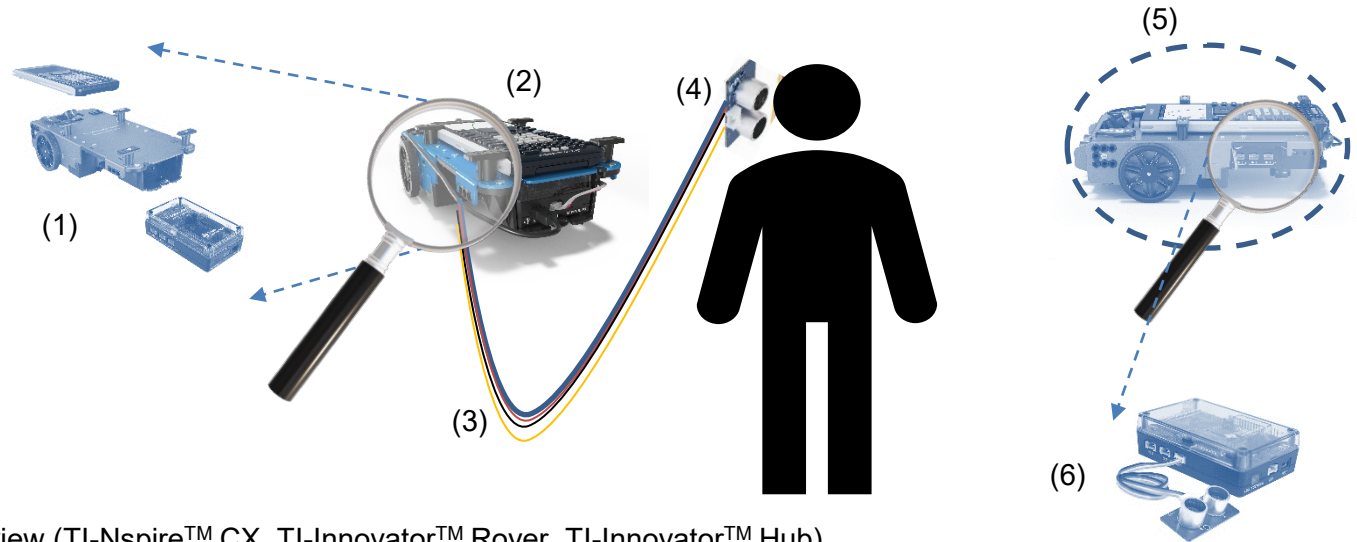
(4) design and create a functional simulator of an electric wheelchair, driven from head movements;

(5) judge and compare the advantages and disadvantages of technological development.

Technical/pedagogical aspects

1

System General Layout



(1) – Rover setup, components view (TI-Nspire™ CX, TI-Innovator™ Rover, TI-Innovator™ Hub).

(2) – Rover setup, perspective view.

(3) – 3-meter electric wire,

(4) – Ranger Sensor

(5) - Rover setup, lateral view

(6) - TI-Innovator™ Hub, detailed Ranger connection view

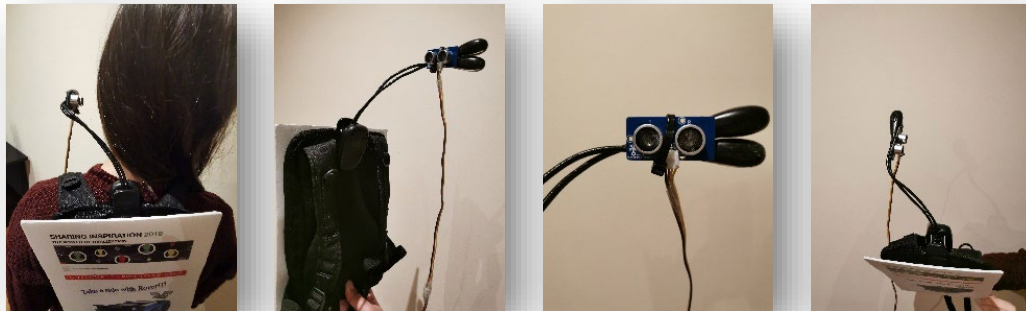
Technical/pedagogical aspects

1

System General Layout



(general view)



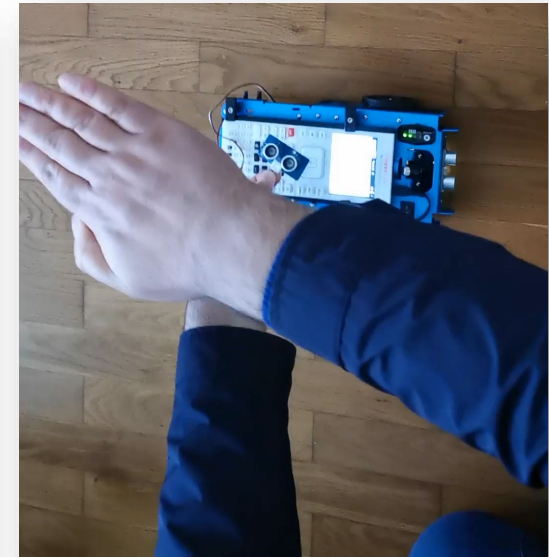
(detailed ranger sensor view)

Technical/pedagogical aspects

1

Simplified code

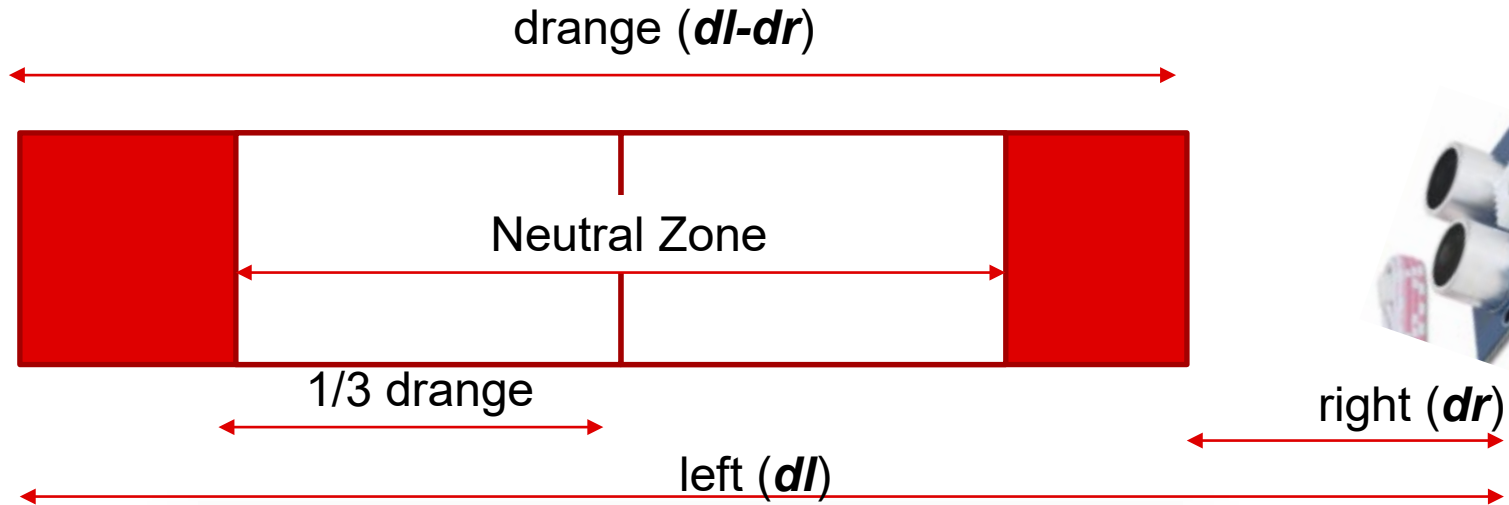
```
* rover_stem 15/20
For i,1,100
  Send "RV FORWARD TIME 120"
  Send "READ RANGER 1"
  Get d
  If d<0.5 Then
    Send "RV STOP "
    Send "RV RIGHT 30"
    Cycle
  EndIf
  If d>0.7 Then
    Send "RV STOP "
    Send "RV LEFT 30"
    Cycle
  EndIf
EndFor
Send "RV STOP "
Send "DISCONNECT RV"
```



Technical/pedagogical aspects

Head movement amplitude: *calibration*

1

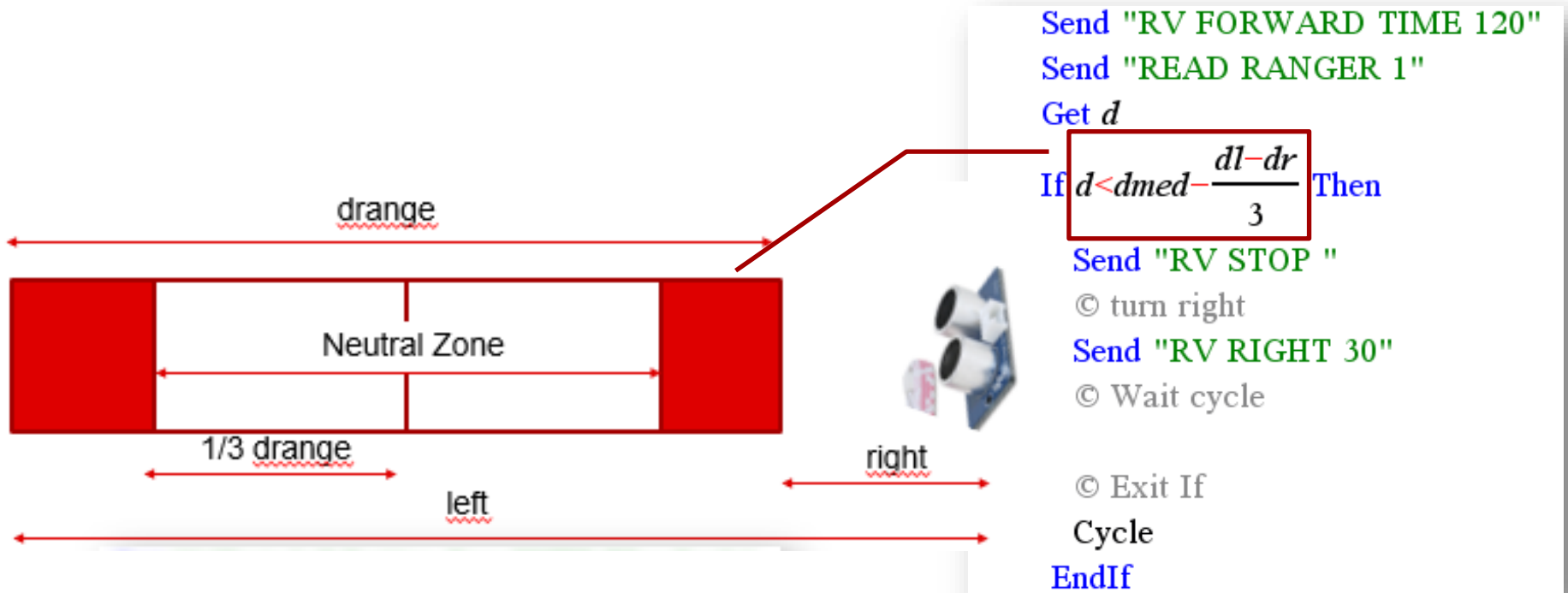


```
Text "Calibrate Left Position: Press ENTER When Ready"  
Send "READ RANGER 1"  
Get  $dl$   
Text "Calibrate Right Position: Press ENTER When Ready"  
Send "READ RANGER 1"  
Get  $dr$   
 $dmed := \frac{dl+dr}{2}$ 
```

Technical/pedagogical aspects

Head movement amplitude: *calibration*

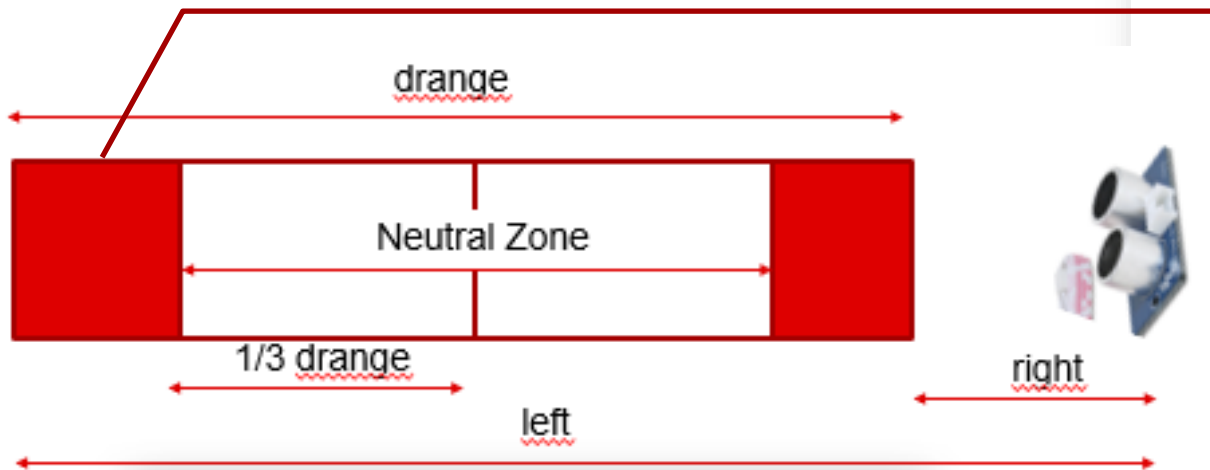
1



Technical/pedagogical aspects

Head movement amplitude: *calibration*

1

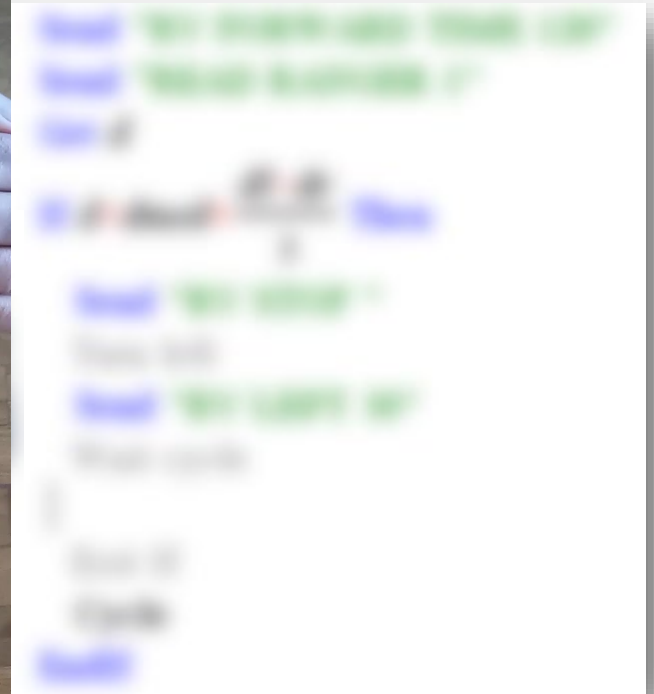


```
Send "RV FORWARD TIME 120"  
Send "READ RANGER 1"  
Get d  
If  $d > d_{med} + \frac{d_l - d_r}{3}$  Then  
Send "RV STOP "  
Turn left  
Send "RV LEFT 30"  
Wait cycle  
Exit If  
Cycle  
EndIf
```

Technical/pedagogical aspects

Head movement amplitude: Calibration

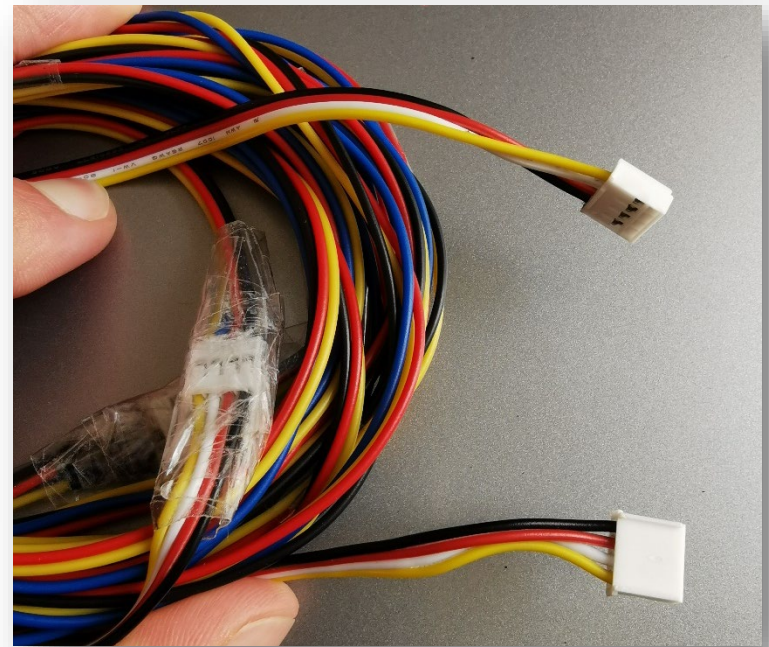
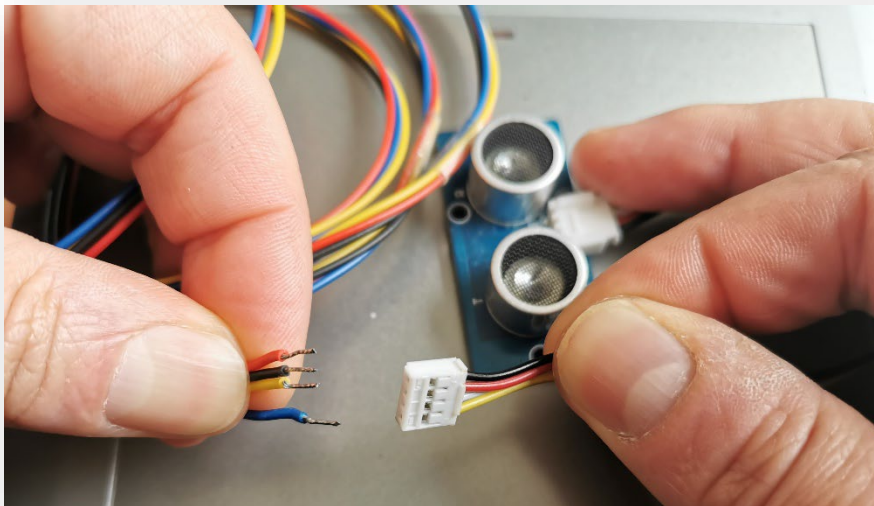
1



Technical/pedagogical aspects

1

Extending the connection cables



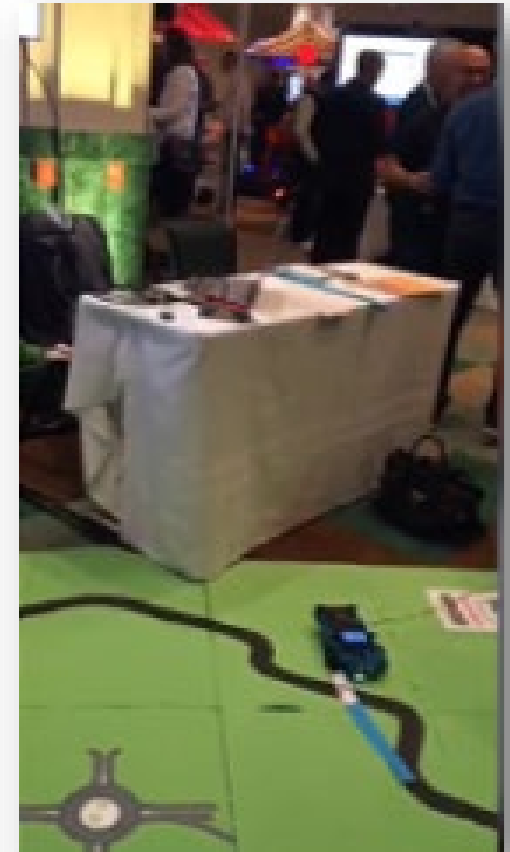
Technical/pedagogical aspects

1

Project Gamification



```
← 1.1 1.2 ▶ RoverSI2019 RAD [Battery Icon] [Close Icon]
rovergame 26/351
© Options menu
Disp "1. Calibrate Sensor|"
Disp "2. Select Game Level"
Disp "3. Start Game"
Disp "4. Just drive me!"
Disp "5. Leave me alone!"
Disp "6. Exit"
Disp "Choose Option "
```



Sharing Inspiration 2019



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Prototype demonstration



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Rover, a Sm@rt Wheelchair

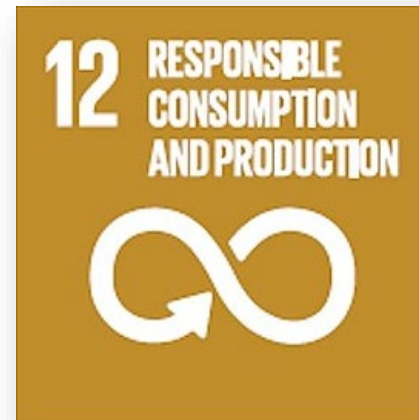
Electric wheelchair steering control through head movements

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2

Connection to SDG's



Connection to SDG's



Goals

3

Ensure healthy lives and promote well-being for all at all ages

← Prev

Next →



Connection to SDG's



Topics under discussion



Physiologic causes for human paralysis;

How different is the life of someone who is paralytic?

What could be done to promote the well-being for someone who is paralyzed?

Which technical solutions to control an electric wheelchair;

3

Connection to SDG's



Goals

12

Ensure sustainable consumption and production patterns

← Prev

Next →



3

Connection to SDG's



Topics under discussion



What are the impacts of the mining activities?

What countries can profit from such inventions like the Rover-wheelchair?

Well-being vs. environmental costs

3

Connection to SDG's



Topics under discussion



With all these inputs and considerations, we will reach a point where it becomes clear that the over-consumption of a minority of the population world wide is driving the majority of people more and more into poverty. It is to be feared that the UN's noble goals of sustainability will benefit above all the societies that are already favored today, and that the costs will be shouldered by the countries that are already disadvantaged.

One question arises quite fundamentally:

how long can modern societies become even more modern with the current climate goals in the current situation?

3

2020, Christine Bürki, Biologist, Expert for sustainable development



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Thank you for your attention



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