AI4U: Modular Framework for AI Application Design

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July 2022

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Motivation

➢ The written paper presents the concept of a universal, modular tool that will enable rapid development of artificial intelligence (AI) applications

➢ The concept of the proposed tool using the Sens4U approach will improve the construction process, testability and reliability of the application

➢ AI has been applied in many scenarios, from intelligent assistants to advanced real-time vision systems

➢ This approach can also be used to transfer one application from one scenario to another one, like a consumer solution to become a space solution, without re-implementing the application from scratch

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Related work

:::ROS.org

Software can be written in such programming languages as Python, C++, Lisp

Robot Operating System (ROS) is open source software which allows the community to create new solutions

The stable version work on Unix systems, but there are also experimental versions for Windows 10 system

Software can be written in only C language

CubeSystem

CubeSystem in combination with RobLib allows you to customise and combine sets of libraries that are tailored to your specific application

CubeSytem is a collection of hardware and programmable components that enable rapid prototyping of robots

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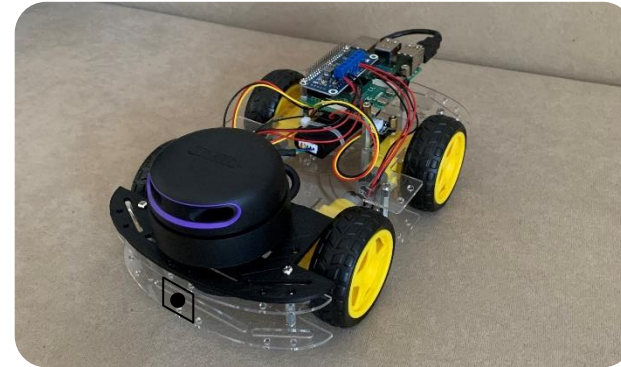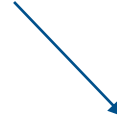
Proposed approach

- OpenCV library was implemented on Raspberry

- Intel Neural Compute Stick 2 was used on the Raspberry.

- One camera is used to detect the object

- Two servo motors and camera are used to track the object

- For low computing power devices, functionality to support AI accelerators can be implemented in the proposed conceptual tool
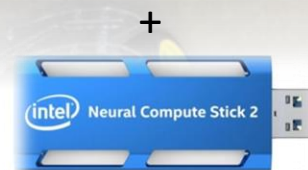
2x USB Cameras

2x Servo motors

QBO ONE

Arduino Board

+

Raspberry Pi4

(intel) Neural Compute Stick 2

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Proposed approach

> The second prototype is a mobile robot whose task was to detect objects and follow them.

> An accelerator to detect objects in the image in real time was added.

> The stationary robot had servos that control the camera direction, and the mobile robot have DC motors to move it
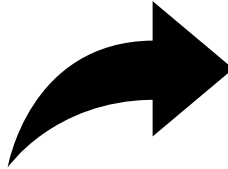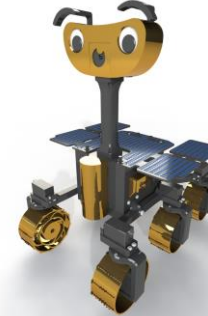
PI Camera

4x DC motors

+

(intel) Neural Compute Stick 2

Raspberry Pi4

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Proposed approach

Earth Solutions

Space Solutions

Proposed approach

Stationary robot

```
class SnRobot:
    def __init__():
        .
    def moveLeft():
        .
    def moveRight():
        .
    def moveUp():
        .
    def moveDown():

class DetectObject:
    def __init__():
        .
        .
    def loadVideo():
        .
        .
    def showPrediction():
```

Mobile robot

```
class MbRobot:
    def __init__():
        .
    def turnLeft():
        .
    def turnRight():
        .
    def driveForward():
        .
    def driveBackward():

class DetectObject:
    def __init__():
        .
        .
    def loadVideo():
        .
        .
    def showPrediction():
```

The same code for object detection

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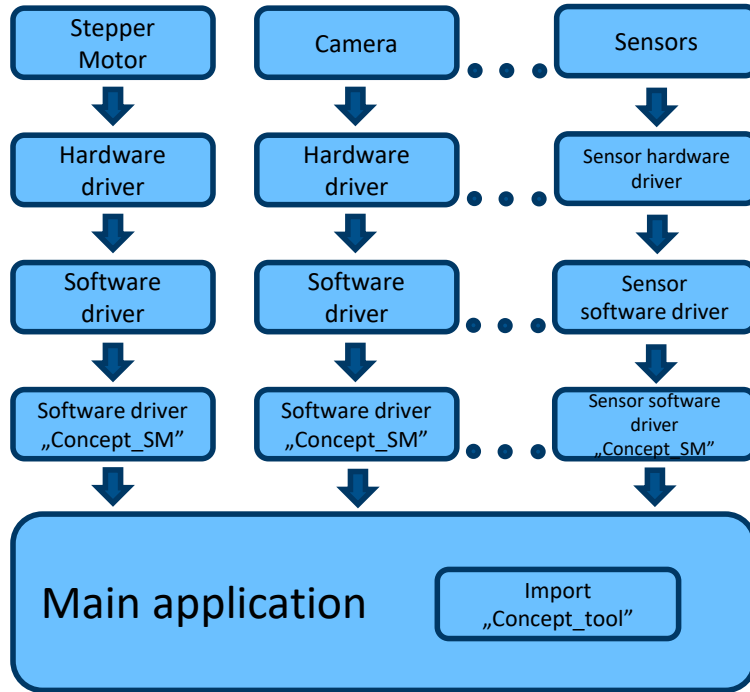Europejski Fundusz
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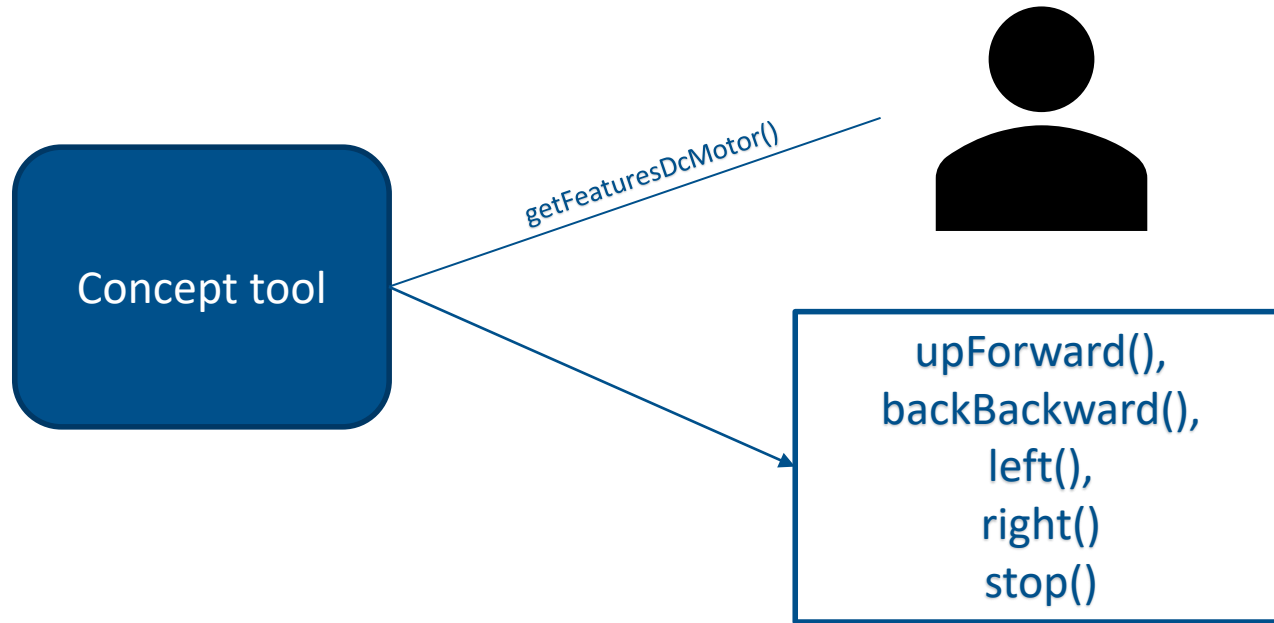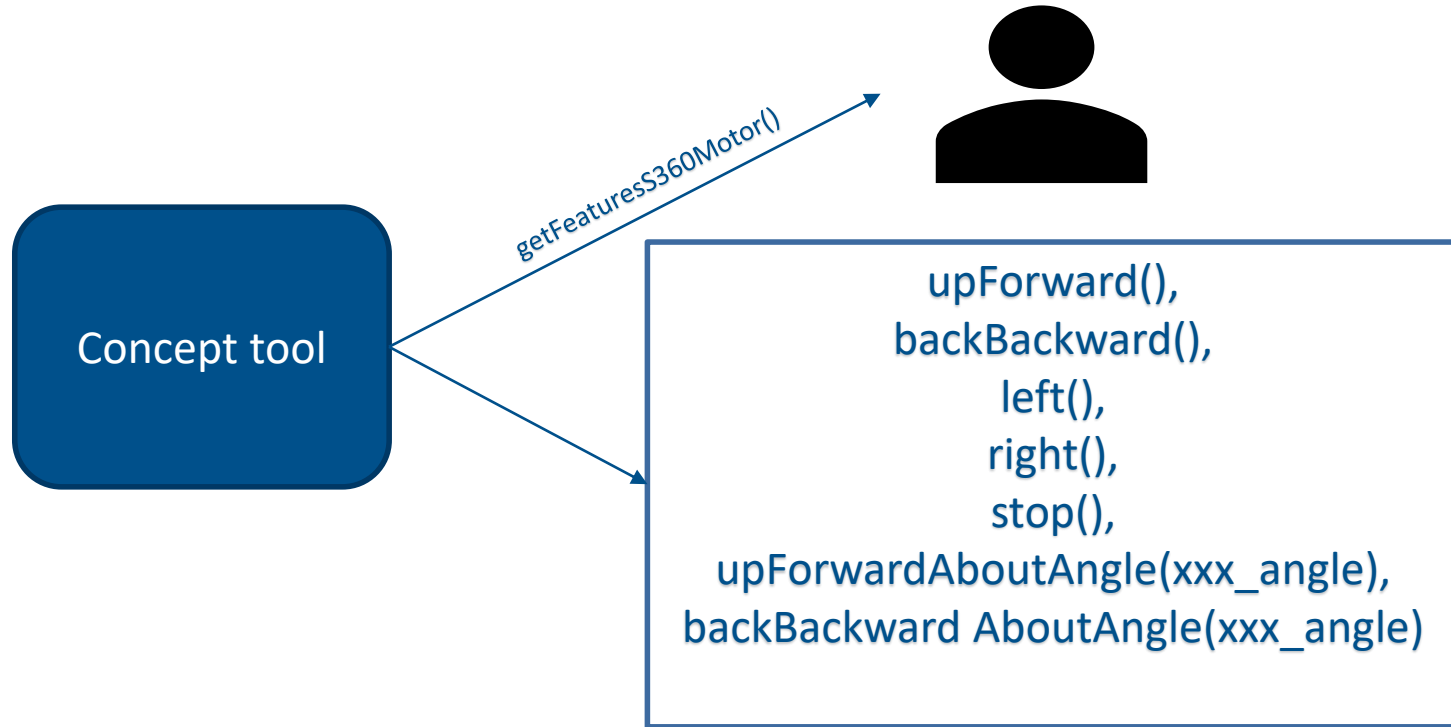
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Proposed approach

> The aim of the proposed tool is to create software, which will be a set of dedicated libraries, but the introduced modification in the conception tool will allow to perform the same action on different sensors

> The application should use generic application programming interface (API) to use the functionalities of the devices and for instance adapt to the physical features the devices provide (video resolution of a camera module or the resolution of a motor turn).

Concept tool

getFeaturesS360Motor()

upForward(),
backBackward(),
left(),
right(),
stop(),
upForwardAboutAngle(xxx_angle),
backBackward AboutAngle(xxx_angle)

Conclusions and further work

Concept tool

▷ The main goal of the proposed conceptual tool is to simplify the construction of artificial intelligence applications
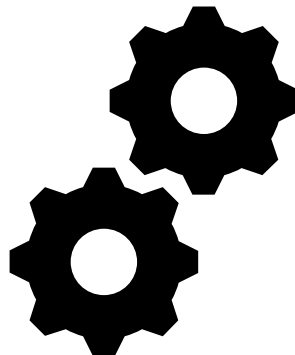
▷ The concept of the tool, which is still under development and may change during implementation

▷ Based on the developed scenarios, the capabilities and requirements of the proposed tool will be adjusted

▷ An analysis of the application for modification when scenarios change will be performed

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Thank you for your attention!

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