Alphabot

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1 C++ Alphabot API for the Raspberry PI

C++ class to control the basic functionality of the Alphabot (https://www.waveshare.com/wiki/ \leftarrow AlphaBot) with a Raspberry PI:

- · PWM motor control
- Distance sensor readings (digital and analogue)
- · Battery voltage
- Wheel speed encoders (rotating flags)
- IR sensor readings
- 10Hz sampling rate with callback

```
Prerequisites
pigpio
The Raspberry PI hardware is accessed via the pigpio library. Install its package:
apt-get install libpigpio-dev
Timer library
Install the timer library from: https://github.com/berndporr/cppTimer
ncurses
The demo programs below display the sensor readings with the neurses library. Install it with
apt-get install libncurses-dev
Building
The built system is cmake. Just type:
cmake .
make
Usage
The online documentation is here: https://berndporr.github.io/alphabot/
Start/stop
Start the communication with the robot:
start()
Stop the communication:
stop()
Motor speed
Setting the speeds of the left/right wheels:
setLeftWheelSpeed(float speed);
setRightWheelSpeed(float speed);
where speed is between -1 and +1.
```

Get Collision sensor readings

The digital functions are boolean values which are true if the distance sensor threshold (set with the potentiometer) has been reached:

```
bool getCollisionLeft();
bool getCollisionRight();
```

The analogue readings from the sensors from 0..1 can be read with:

```
float getLeftDistance()
float getRightDistance()
```

Battery voltage

The function getBatteryLevel () provides the voltage of the battery in volt.

Speed encoders

These are terrible encoders and really only reliable to detect if the wheel is spinning at all or not. Updates every 1/2 sec.

```
bool getLeftWheelSpinning();
bool getRightWheelSpinning();
```

Infrared channels / general purpose ADC channels 0-4

```
float (&getIR())[nIR]
```

returns a reference to the whole array of IR sensor readings normalised between 0..1.

Callback

Whenever a new set of analogue readings is available the callback step in StepCallback is called. It contains the reference to the Alphabot class itself so that one can read the different ADC values.

Demo programs

testIO is a simple test program which displays the different senor readings and you can test the motors. It also shows how the callback is used to display the sensor readings.

testMotor ramps up the motor speed and back again.

obstacleAvoid.cpp implements a Braitenberg vehicle and it has an emergency stop if the digital readings from the collision sensors are triggered. This is an instructional example and needs to be tweaked. The fun begins here!:)

2 Hierarchical Index

2.1 Class Hierarchy

This inheritance list is sorted roughly, but not completely, alphabetically:

CppTimer

AlphaBot 4

AlphaBot::StepCallback 9

3 Class Index

3.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

AlphaBot 4

AlphaBot::StepCallback 9

4 Class Documentation

4.1 AlphaBot Class Reference

#include <alphabot.h>

Inheritance diagram for AlphaBot:



Classes

class StepCallback

Public Member Functions

- void start (long _samplingInterval=100)
- void stop ()
- ∼AlphaBot ()
- void registerStepCallback (StepCallback *_stepcallback)
- void setLeftWheelSpeed (float speed)
- void setRightWheelSpeed (float speed)
- bool getLeftWheelSpinning ()
- bool getRightWheelSpinning ()
- float getBatteryLevel ()
- bool getCollisionLeft ()
- bool getCollisionRight ()
- float getLeftDistance ()
- float getRightDistance ()
- const float(& getIR ())[nIR]

Static Public Attributes

static const unsigned nIR = 5

4.1.1 Detailed Description

Alphabot class which communicates with the Alphabot hardware

4.1.2 Constructor & Destructor Documentation

```
4.1.2.1 ∼AlphaBot()
```

```
AlphaBot::~AlphaBot ( ) [inline]
```

Destroys the Alpha Bot object and stops any communcation

4.1.3 Member Function Documentation

4.1.3.1 getBatteryLevel()

```
float AlphaBot::getBatteryLevel ( ) [inline]
```

Get the Battery Level

Returns

float Battery level in Volt

```
4.1.3.2 getCollisionLeft()
bool AlphaBot::getCollisionLeft ( )
Get the Collision Left (digital signal from the distance sensor)
Returns
     true Obstacle detected
     false No Obstacle
4.1.3.3 getCollisionRight()
bool AlphaBot::getCollisionRight ( )
Get the Collision Right (digital signal from the distance sensor)
Returns
     true Obstacle detected
     false No Obstacle
4.1.3.4 getIR()
const float(& AlphaBot::getIR ( ))[nIR] [inline]
Returns the IR channels as a reference to an array with length nIR. This allows using C+11 style loops.
Returns
     Reference to a const array with the 5 IR readings (0..1)
4.1.3.5 getLeftDistance()
float AlphaBot::getLeftDistance ( ) [inline]
Get the Left Distance
```

Returns

float Value between 0 and 1 as relative distance.

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4.1.3.6 getLeftWheelSpinning()

```
bool AlphaBot::getLeftWheelSpinning ( ) [inline]
```

Info if the left wheel is spinning.

Returns

true Wheel is spinning false While is not spinning

4.1.3.7 getRightDistance()

```
float AlphaBot::getRightDistance ( ) [inline]
```

Get the Right Distance

Returns

float Value between 0 and 1 as relative distance.

4.1.3.8 getRightWheelSpinning()

```
bool AlphaBot::getRightWheelSpinning ( ) [inline]
```

Info if the right wheel is spinning.

Returns

true Wheel is spinning false While is not spinning

4.1.3.9 registerStepCallback()

registers callback which signals new data

Parameters

_stepcallback	A pointer to the callback interface
---------------	-------------------------------------

4.1.3.10 setLeftWheelSpeed()

```
void AlphaBot::setLeftWheelSpeed ( {\tt float} \ \ speed \ )
```

Set the Left Wheel Speed

Parameters

```
speed between -1 and +1
```

4.1.3.11 setRightWheelSpeed()

```
void AlphaBot::setRightWheelSpeed ( {\tt float} \ speed \ )
```

Set the Right Wheel Speed

Parameters

```
speed between -1 and +1
```

4.1.3.12 start()

Starts the communication with the robot.

Parameters

```
_samplingInterval | Sampling interval in ms for the ADC data
```

4.1.3.13 stop()

```
void AlphaBot::stop ( )
```

Stops the communication with the Alphabot

4.1.4 Member Data Documentation

4.1.4.1 nIR

```
const unsigned AlphaBot::nIR = 5 [static]
```

Number of IR channels or anagloue input channels at the rear of the robot.

The documentation for this class was generated from the following file:

· alphabot.h

4.2 AlphaBot::StepCallback Class Reference

```
#include <alphabot.h>
```

Public Member Functions

• virtual void step (AlphaBot &)=0

4.2.1 Detailed Description

Callback interface which is called at the specified sampling rate. The method step needs to be implemented.

4.2.2 Member Function Documentation

4.2.2.1 step()

Called at the specified sampling rate with a reference to the Alphabot instance which has all the getters for the data and setters for the motor control.

The documentation for this class was generated from the following file:

· alphabot.h

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