

Hedgehog vs Wallaby - Pros and Cons

Comparison of Hedgehog and Wallaby

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Abstract—We compared the Hedgehog and the Wallaby controller and in addition to this we came to the result that both of them are suitable for Botball and PRIA-Open. Mainly, we compared them in the categories technical specifications, practical usage and price.

Keywords— *Hedgehog; Wallaby; specifications; practical usage; price; educational robotics*

I. INTRODUCTION

In a few categories we compared the Wallaby [1] controller, which is still in use for Botball, and the new Hedgehog controller, which was developed by "Practical Robotics Institute Austria" [2]. Technical specifications, price and programming language are only a few categories where we took our rating from.

A. History of the Hedgehog

- The Hedgehog was developed by the Practical Robotics Institute Austria (PRIA).
- It was developed as a cheaper version of a bot controller.
- The first development steps began in July 2012.
- The latest version of the Hedgehog came out in 2017.

B. History of the Wallaby

- The Wallaby is the latest bot controller of the KISS Institute for Practical Robotics (KIPR).
- It is the successor of the Link controller.
- The link was displaced from the market in 2015 respectively 2016 by the Wallaby.
- It is the official controller for Botball.

II. TECHNICAL COMPARISON

A. Basic information

The Hedgehog controller is based on Raspberry PI and the Wallaby works with a processor based on the ARM architecture [3]. The newest Wallaby model was introduced in 2016. On the other hand, the development of the first and also the latest version of the Hedgehog was completed in early 2017. The Wallaby was especially developed for the Botball event by the KISS Institute for Practical Robotics and the Hedgehog was made for many project and also for the robotic events like Open ECER.

B. Operating system

Both controllers offer a Linux distribution as operating system. The Hedgehog allows you to install any operating system but the Wallaby is restricted to its preinstalled system [4]. The whole firmware of both controllers is open source. Everything is available on GitHub.

C. Programming

You can program both controllers with a Web-IDE. The Wallaby is ready for C programming and the Hedgehog can be programmed with Python 3 [5]. In the future, the Hedgehog is going to support much more programming languages. Right now, it is much easier for beginners to learn Python with the Hedgehog. For advanced programmers there is the possibility to work together on one program simultaneously but all clients must be in the same network. The Hedgehog has got one big advantage to the Wallaby, especially for beginners. The controller can be programmed in a visual programming language. In the Web-IDE of the Hedgehog you have the possibility to create single graphic program fragments and put them together in a working algorithm. Another useful feature is that you can display the source code behind this graphic fragments in order to understand the logic behind it. However the Wallaby does not support this feature. Therefore you are depending on open source libraries and online tutorials.

D. Battery pack

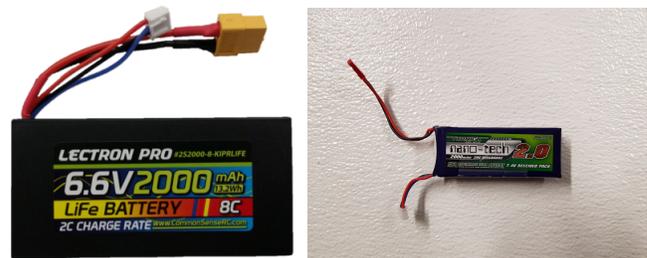


Fig. 1. Wallaby's battery (left) and Hedgehog's battery (right)

Although both controllers battery packs capacity are about 2000 mAh, the only difference is that the Wallaby's battery has a output of 6.6V and the Hedgehog's one 7.4V. We experienced a slightly lower battery performance from the Wallaby's

side. The reason for this is that the Wallaby consumes much more power than the Hedgehog because of its own integrated display, also the Wallaby batteries are older than the Hedgehog batteries. The Wallaby's battery operates for about 20 minutes before it runs out of power reserves and you have to charge it. On the other hand, the Hedgehog is capable of at least 30 minutes of usage.

The code below is a small part of the actual test code. The used code just repeated the functions shown in the pictures below over and over again.

The Hedgehog was tested with two motors, two servos and five analog sensors, while the Wallaby controlled the motors of the create, three servos, one external motor and one analog sensor.

We tested with the following code:

```
# telling the hedgehog to drive
# move() is a predefined function
# speed range: -1000 to 1000
hedgehog.move(0, 1000)
hedgehog.move(1, 1000)
sleep(2)

# set the servo to a certain position - (port, value)
hedgehog.set_servo(0, 0);           # minimum
hedgehog.set_servo(0, 2047);       # maximum

# drives till analog sensor measures too high values
while(hedgehog.get_analog(port) < 870)
    hedgehog.move(0, 1000)
    hedgehog.move(1, 1000)

# drives with a given speed until a digital sensor triggers
while(hedgehog.get_digital(port)!=0) {
    hedgehog.move(0, 1000)
    hedgehog.move(1, 1000)
}
```

Fig. 2. Hedgehog's test code

```
//bytecodes that tell the create to drive
//speed range: -1000 to 1000

create_write_byte(137);
create_write_byte(HIGH_BYTE(500)); //speed
create_write_byte(LOW_BYTE(500)); //speed
create_write_byte(HIGH_BYTE(32768));
create_write_byte(LOW_BYTE(32768));

// set the servo to a certain position - (port, value)
set_servo_position(0, 0); // minimum
set_servo_position(0, 2047); // maximum

// create drives till analog sensor measures too high values
while (analog10(port) < 870){
    create_drives(speed); //self defined function
}

// drives with a given speed until a digital sensor triggers
while(digital(port)!=0) {
    create_drives(speed);
}
}
```

Fig. 3. Wallaby's test code

E. Connection

In terms of connectivity, the Hedgehog and the Wallaby are pretty similar. You can connect both controllers wireless to networks. Other than described in the paper from the last year that compared both controllers [6], the Hedgehog as well as the Wallaby can connect to password protected networks. This can be done by configuring the Raspberry Pi of the Hedgehog for the appropriate network via SSH. A wired connection to the Wallaby is possible using USB. However, a patch cable must be used if a wired connection to the Hedgehog is required.

F. Advantages

Hedgehog	Wallaby
- Good battery performance	- Libraries available
- Open source	- Open source
- Easy handling	- Contains display
- visual Programming	- More versatile (C, Java)
- fast charging	- Connection via USB

G. Disadvantages

Hedgehog	Wallaby
- No libraries ¹	- Higher energy usage
- No display	- no visual programming
- Update of IDE makes problems	- Heavier and bigger
- limited by Python	
- long charge time	

H. Conclusion of the technical specifications

The specifications of both controllers are similar and also meet the technical conditions which are necessary for a Botball respectively PRIA-Open tournament. Both of them have their advantages and disadvantages but neither of them outplays the other one.

III. GENERAL AND PRACTICAL USAGE AND HANDLING

We worked with both controllers and noticed some differences in usage between the Hedgehog and the Wallaby. It is very easy to understand the hardware because of the well thought construction of the controllers. For this reason, getting started with the controllers is not very complicated. In the advanced usage, for example Botball or PRIA Open tournaments, we noticed that the display of the Wallaby is very helpful for testing and improving. On the other hand the live-team-programming feature of the Hedgehog is also very helpful and can make your work much faster.

¹Only one library available on the GitHub [7] page of the Hedgehog developer.

A. Experiences with the Hedgehog



Fig. 4. Hedgehog promotional image

When we started working with the Hedgehog we did not have it easy because there is not that much information about it on the internet. But when we read the Hedgehogs official documentation, which is written clearly, structured and professional, handling with the Hedgehog became more and more easier. It is clearly shown how things work, for example how to use servos, motors and sensors and how it is constructed. After a few beginning tests we were able to program the controller as we were familiar from other controllers. But our knowledge about the Python language helped us a lot. The compact size and live-team-programming are some advantages which are really helpful in practical usage. The holes at the bottom of the Hedgehog are useful to attach the controller at your bot construction. You can either use a patch cable for data transferring or you transfer via wifi.

B. Experiences with the Wallaby



Fig. 5. Wallaby promotional image

Getting started with the Wallaby was easier than getting started with the Hedgehog because there are more informations on the internet and we could talk with people who are familiar with the Wallaby. Our former controllers worked also with the programming language C and therefore it was not a change for us. For reading out values measured by the sensors the display of the Wallaby helps is very useful. At the beginning we looked forward to working with the Wallaby but later we noticed some difficulties, like the low battery life. This problem was caused due to the old age of the used Wallaby, though. In testing and practical usage the battery of the

Wallaby lasted between 25 minutes and 45 minutes. We tested the battery by running a program that included controlling motors and servos and reading out sensor values. The Wallaby needs a lot of electric energy by its battery among other things by its display.

C. Quick comparison of the features which help you a lot in practical usage

Hedgehog	Wallaby
- Live-team-programming	- Display
- Wifi	- Wifi
- Compact size	- Easier modularization
- Connections	- Connections
- Web IDE	- Web IDE
- Structured design	Versatile (C, Java, Python)
- Mobile controlling	fast charging
- Good battery life	

D. Conclusion

In conclusion you can say that after a few hours of working and learning the behaviour of the controllers you will be able to program them pretty easily. We are convinced that it is fun and productive with both controllers and also in practical use you cannot say which is the better one. It depends on so many factors which is the better one for you, like your previous experiences with programming languages and your budget. There are different use cases for both controllers. When you want a compact, reliable and a cheap bot then the Hedgehog is the better choice. But when you want a multifunctional, complex and adaptable bot then you should choose the Wallaby. You should find a middle way between this factors so that you have combined all good characteristics which are important for your bot. We chose the Hedgehog as main bot, because of its small form factor and the convenient features. For beginners it is very easy to learn how to control the Wallaby (provided you are good in programming). This also applies to the Hedgehog. After all our research and tests we came to the conclusion that both controllers are valuable and useful in the programming of robots.

IV. PRICE

Both controllers have a very high price point, so they are made for robotics teams who participate in tournaments. Although neither of them are suitable for every robotics tournament. As described below, the Hedgehog is way cheaper but is almost as versatile as the Wallaby. Therefore, the Hedgehog's price to performance ratio is better then the Wallaby's and the better choice for teams with a low budget, like PRIA Open Teams.

A. Wallabys price

The Wallaby can be bought on the official website of KIPR. Currently (02/13/2018) the controller is only available for purchase in a bundle with a small camera, a battery pack and the Wallaby itself. The Wallaby's price point lies at 425.00 Dollars. The high price level is justified by the display and the

versatility of the Wallaby. Mainly the Wallaby was developed for Botball and that is another reason why the Wallaby's price point is on its level. But for the reason that mainly schools, universities and bigger organizations take part on the Botball tournament, the price level is relatively low. And considering what the Wallaby's package contains, the price gets more and more justified.

B. Hedgehogs price

The Hedgehog is the cheaper alternative to the Wallaby because it was designed as a low cost controller. Right now (02/13/2018) the price point of the Hedgehog lies at around 250.00 Dollars. For that price you get a cheap but reliable controller which can easily be programmed by Python and Scratch, but without a display or any additionally equipment. Mainly the Hedgehog was developed from PRIA for PRIA Open and for robotics beginners. So 250.00 Dollars is a fair price and it is affordable for the most people who are interested in robotics. In consideration of the compact size, its good battery pack and the visual programming feature of the controller, the price is totally justified.

V. FINAL COMPARISON

We compared the controllers in the categories mentioned above and got the results, which are based on our tests. We tried to make it as objective as possible in order to make it an useful rating.

A. Technical specifications

0% - insufficient — 50% - satisfactory — 75% - good — 100% - excellent

Operating system	
Hedgehog	Wallaby
100%	75%

The Hedgehog is a bit more versatile due to its changeable OS.

Programming	
Hedgehog	Wallaby
75%	100%

The Wallaby supports more programming languages including C, C++, Python and Java. The Hedgehog can only be programmed by Python.

Battery pack	
Hedgehog	Wallaby
100%	75%

The power output of the Hedgehog's battery pack is slightly higher than the Wallaby's, but both have the same capacity.

Connection	
Hedgehog	Wallaby
75%	100%

Although the controllers are very similar in this category, a wired connection to the Hedgehog using USB is not possible.

Technical specifications	
Hedgehog	Wallaby
100%	100%

The average values of the rating in OS, programming and battery pack.

B. Practical usage

Simplicity	
Hedgehog	Wallaby
100%	75%

Depends strongly on your previous experiences with programming languages. The Hedgehog scores better because of the easier Syntax of Python and the visual programming feature.

Features	
Hedgehog	Wallaby
75%	100%

The Hedgehog doesn't have a display and supports only one programming language, but comes with visual programming. It's the other way around with the Wallaby.

Practical usage	
Hedgehog	Wallaby
100%	100%

It's probably easier to handle the Wallaby because of the display and more support and information on the internet.

C. Price

Price	
Hedgehog	Wallaby
100%	75%

The Hedgehog is much cheaper than the Wallaby, but it also comes with less features. On the other hand, its battery is more compact and the performance is a bit higher.

D. Support

Support	
Hedgehog	Wallaby
75%	75%

There are a few libraries available for both controllers. There are plenty of explanations how to control motors and servos, but for beginners it is very difficult to handle with this information.

E. Total

Total	
Hedgehog	Wallaby
100%	100%

The final percentage is the average of all the previous rating.

VI. CONCLUSION

We used both controllers and dealt with the features of the Hedgehog and the features of the Wallaby. Everyone who is interested in robotics, programming or technique can try both controllers. We, as a robotics team, found that it depends very much on your own opinion and on your own attitude. Both controllers are very reliable and both of them can be programmed pretty easily. Choosing between the Hedgehog and the Wallaby should mainly depend on the programming language, on the libraries you may want to use and on your budget. You have to keep in mind that both controllers have been developed for robotics tournaments and for that they fulfil their purpose. It is possible that both controllers are going to get a hardware upgrade and probably a software update. The Hedgehog will probably be improved in the future so that it can be programmed with multiple languages. According to the current status we recommend each controller for robotics tournaments or other purposes, like workshops and hobbyists.

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