XX. Fiatal Műszakiak Tudományos Ülésszaka, 2015. Kolozsvár, 111–114. *DOI: 10.33895/mtk-2015.03.20*
http://hdl.handle.net/10598/28604

A ROBOTINO OKTATÓI ROBOT KAMERAKÉP FELDOLGOZÁSÁNAK ÉS SZÍNFELISMERÉSÉNEK ELEMZÉSE

THE ROBOTINO EDUCATION ROBOT'S CAMERA PICTURE PROCESSING AND COLOUR RECOGNITION PROCESS

Henrique Venga Cardoso[1], Lucas Mesquita Diniz[2], Tolnai András[3]

[1]Universidade Federal de Lavras – UFLA – Campus Universitário, Zip Code: 37200-000, Lavras-MG, Brazil
Óbudai Egyetem, Bánki Donát Gépész és Biztonságtechnikai Mérnöki Kar, 1081 Budapest, Népszínház u. 8, , henriqueveca@gmail.com

[2]Universidade Federal de São João del-Rei – UFSJ – Campus Alto Paraopeba - C.A.P- Ouro Branco - MG Zip Code: 36420-000
Óbudai Egyetem, Bánki Donát Gépész és Biztonságtechnikai Mérnöki Kar, 1081 Budapest, Népszínház u. 8, lucasmdiniz@live.com

[3]Óbudai Egyetem, Bánki Donát Gépész és Biztonságtechnikai Mérnöki Kar, Mechatronikai és Autótechnikai Intézet, 1081 Budapest, Népszínház u. 8, tolnai.andras@bgk.uni-obuda.hu

Abstract

This paper is part of a project work which uses a didactic robot platform to simulate, train and do some automation works that in the future can be applied in the industrial area. The robot used in this project is the Robotino® from Festo Didactic. Its hardware consists of didactically suitable industrial components such as sensors (bumper, infrared), drives, webcam, optical wheel encoders and multiple digital and analog inputs/outputs.

The task is, to find in the environment the subject with given color, and mark the target as a target position. The task is based on the camera-picture processing and automation. It uses a Robotino View software that makes possible to program the robot. It shows how the webcam can recognize the color spectrums and how the robot will move according with the specific order that was preset.

***Keywords**: Robotino, camera picture processing, color recognition.*

Összefoglalás

Jelen értekezés egy nagyobb projekt részét képezi, melyben egy oktató robottal szimulálhatjuk, vizsgálhatjuk a mobilrobotok működését, előrevetítve különböző, jövőbeli ipari alkalmazásokat. A projectben -és így a jelen munkában használt eszköz egy Robotino®, fantázianevű mobilrobot, mely a Festo Didactic cég terméke. Az eszköz el van látva mindazon hardver elemekkel, melyek megtalálhatók az ipari termékekben is. Ilyenek -a szenzorok tekintetében az ütközőkapcsolók, vagy az infraérzékelők. További fontos részek: a hajtáslánc, optikai kerékelfordulás érzékelő, többfunkciós, digitális és analóg ki- és bemenetek.

A célul kitűzött feladat szerint a robot, egy adott környezetben, egy előre megadott szín alapján felismer egy céltárgyat. Ezek után a robot, ennek a céltárgynak meghatározza a térbeli pozícióját. A feladat egy kamerakép feldolgozó program segítségével lett megvalósítva. A felhasznált alkalmazás a

Robotino ”Látó” szoftvere, mellyel a robot mozgásának programozására is lehetőség nyílik . Az értekezésben bemutatásra kerül továbbá az is, hogy hogyan határozható meg a webkamera képből egy fényspektrum és ennek alapján hogyan alakul ki a robot mozgása egy meghatározott program szerint.

Kulcsszavak: *Robotino, kamerakép feldolgozás, színkeresés.*

1. Introduction about Robotino

Made by Festo Didatic and used for research, education and training, the Robotino is a robot which can be programmed in RobotinoView, C, C++, Java, NET, Matlab, Simulink, Labview and Microsoft Robotics Developer Studio.

It has an omnidirectional drive (Omni drive), which permits the Robotino to travel in all directions and also rotate around itself, a high performance controller, different sensors and a VGA camera. All this devices make the Robotino autonomous and give it the necessary “intelligence”.

The connection between the Robotino and the PC can be made via wireless LAN, through this connection the controller can access and program multiple tasks.

Besides the original sensors of the Robotino, additional sensors and actuators can also be connected via an I/O interface.

With the Robotino and its versatility is possible for the students to improve different skills and see what happens outside the theory.

2. Project Work

The basic task of this project is that the Robotino has to look for a coloured disc (puck), and go to the disc, and take it to the inicial or target position.

Behind this task there are many elements to be considered: sensors, tasks, programming and the most important, how the Robotino’s webcam can recognise the colour spectrum.

The Robotino robot is totally automated and connected to the PC via wireless. This connection allows the Robotino to do multiple tasks according to what it is the main idea of the project.

2.1. Project Development

In this project, it was used a software called Robotino View. Although the Robotino accepts many programming languages, the Robotino View is the main and simplest software that can be used. It uses a block interface function that makes it quite interactive.

These blocks are predetermined and each one has its own proposal. Because of it, it is easy to control, configure and set the further actions of all devices that belong to the Robotino.

As the main target of this task is to show how the webcam can recognize the color spectrum, which is quite a large task, it will be split into three main function blocks: Camera, Color Range Finder and Segment tracker.

Thenceforth, the next step is to program once the robot will do when it recognizes the correct color.

3. Main Function Blocks

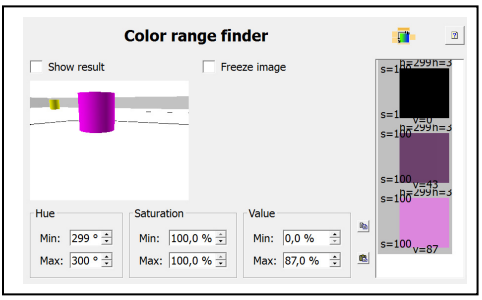
3.1. Camera

This is the simplest but not least important function block in this task. It has a single objective: set the live image or the last image that was seen by the webcam as output.

Using the software the user can see online the webcam image.

3.2. Color Range Finder

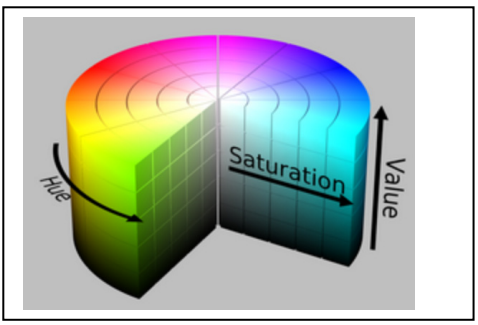
This is the most important function block in this project. The Color Range Finder will take the image of the camera and with this image the user will be able to choose which color will be the desired one.



1. figure. *Selecting the desired color*

The figure above shows the Color Range Finder window. A simulation software was used in order to generate a site, which is shown on the window. By clicking or dragging with the mouse on the desired color, the function block sets all the configurations automatically.

These configurations are calculated by the HSV color space. The 2.figure below shows how the HSV works.



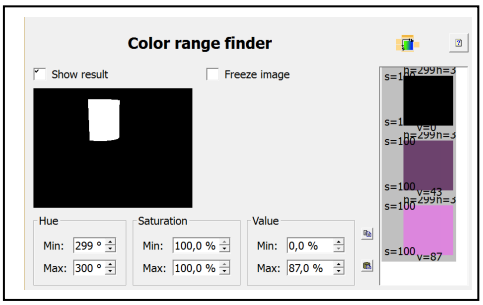
2. figure. *HSV color space*

The bases are the hue, saturation and value.

- Hue is an angle. H=0°=red., H=120°=green and H=240°=blue.
- Saturation denoted by S is given in percent. 0%=grey. 100%=pure color.
- Value (V) is given in percent. 0% means no brightness and 100% means full brightness.

These parameters are the three boxes at the bottom of the 1. figure.

After the color set, if the "Show result" box on the 1. figure is ticked a grey scale image will be shown, where the white points are the desired color. This image is the output of this function block.



3. figure. *Grey scale image*

3.3. Segment Tracker

The segment tracker is the most complex function block in this task. It receives a grey scale image, which comes from the filter, as its input and tracks the white point on the image.

Even though this block has 7 outputs, it will only be needed 2 of them. The first one is the X-coordinate, which is where the white point is with respect to the x-axis; and the second one is the sixth output port, which gives a 0 if there are no white points on the image and 1 if one or more white points were found.

4. Conclusion

This project work was created with the basic idea of make some robot looking for a colored disc, but this paper shows that what is behind this basic idea is not that simple. Using the Robotino and the intelligent laboratory of the Bánki Donát Faculty (iSpace/iRoom), it was possible to discover how a camera can process the image, recognize colors and make it a useful data [4].

Despite it was in a lab scale, where everything was small, know how to do this kind of task can be very useful in an

industrial scale. There the robots are bigger but they have the same sensors, drives and programming functions that the Robotino has.

5. Acknowledgements

This paper was developed during the exchange program Science Without Borders, supported by the Brazilian government institutions: CAPES and the Ministry of Education.

This work was also sponsored by the Hungarian National Scientific Fund (OTKA 105846). The project was realized through the assistance of the European Union, with the co-financing of the European Social Fund, TÁMOP-4.1.1.C-12/1/KONV-2012-0002.

6. References

[1] Robotino Manual - http://www.festo-didactic.com/ov3/media/customers/1100/544305_robotino_deen2.pdf , pages 60-61. Festo Didatic

[2] http://www.festo-didactic.com/int-en/services/robotino/hardware/interface/?fbid=aW50LmVuLjU1Ny4xNy4zNC4xNDQw

[3] Robotino View Software Help Library – Image Processing – Color Range Tracker

[4] A.R.Várkonyi-Kóczy, I. Nagy, I. Langer, E. Tóth-Laufer: *Intelligent Space: New Challenges in Research and Education*, in Proc. of INES2013, 17th International Conference on Intelligent Engineering Systems, Costa Rica, 2013, PP.: 357-364.