Robotics & Automation Engineering Journal
ISSN: 2577-2899

Juniper Publishers
key to the Researchers

Research Article
Volume 2 Issue 3 - March 2018
DOI: 10.19080/RAEJ.2018.02.555590

Robot Autom Eng J

Image Processing Technique using Google Cloud API and Sighthound for Lego Mindstorms EV3 Robot

Zuraini Othman*, Nor Azim Abdullah, Chin Kon Yee, Fareen Farina Waida Shahrin, Sharifah Sakinah Syed Ahmad and Fauziah Kasmin

Department of Intelligent Computing and Analytics, Faculty of Information & Communication Technology, University Teknikal Malaysia Melaka, Malaysia

Submission: January 17, 2017; **Published:** March 21, 2018

***Corresponding author:** Zuraini Othman, Department of Intelligent Computing and Analytics, Faculty of Information & Communication Technology, Universiti Teknikal Malaysia Melaka, Hang Tuah Jaya, 76100 Durian Tunggal, Melaka, Malaysia, Tel: +6063316611, Email: zuraini@utem.edu.my

Abstract

The world today faces major garbage crisis that are due to the product of rapid economic growth, overcrowding, poor urban planning, corrosive corruption and political dysfunction. Presently, many have tried and tested methods of garbage collection but the current methods are proven to be ineffective. In this era of higher technology, humanoid robots are found to be the trends in most of the applications. Humanoid robots can support people in everyday life. The industry is moving towards the current side of automation to increase productivity and to deliver uniform quality. Thus, Trash Collecting Robot (TCR) is proposed to help in providing automatic control to collect the garbage. TCR is built by using Lego Mindstorm EV3 robot and it can differentiates between the static and dynamic obstacles and moves accordingly as it programmed. Basically, TCR consists of sensors at different levels to detect the dynamic obstacles and it implements image processing techniques where it can identify the type of waste material that has been collected. In image processing part, cloud services via Google Cloud API and Sighthound are used to identify the trash type whether plastic, can or paper. The result shows that Sighthound outperforms the Google Cloud by getting almost 100% accurate on classifying the trash type.

Keywords : Image processing; Lego mindstorm EV3 robot; Google Cloud API; Sighthound

Introduction

The robots are human like machines capable of doing duty they are programmed to do. They have shown significance in decreasing human work, especially in industries. In manufacturing tasks, speed and efficiency have long been improved by robotic systems. A robot has replaced humans in many industries especially in repeated or dangerous situations. A line follower robot is mostly a robot model for tracking and follows a pre-defined black line or path on a white surface [1]. The importance in the robotics field has been realized by researcher since the beginning of the development of machine vision because it provides a useful tool for the environment detection and decision making during the automation process. The drawbacks of robotic operations are extra hours needed for programming the operations and they are limited to certain predefines operation that will cause rigid automation. One of the solution to improve the adaptability of the system is by integrating image processing system to robotic system and make it open to other potential application for example work done by [2] aims to imitate the human behavior in sketching human facial portraits.

There are 10 types of new robotic trends which are bioinspired robots, micro-nano-femtorobots, walking machines, toy robots, ubiquitous robots, household robots, cloud robots, flying robots, autonomous driving vehicles and modular self-reconfiguring robots. Cloud robots are said to be exciting possibilities in the near future because of its reduced requirements for on-board processing and this can increase efficiency in performing complex tasks [3]. A Google researcher claims that cloud computing could make robots smaller, cheaper, and smarter by calling this approach as cloud robotics and it allows the robot to off load compute-intensive task like image processing. Thus cloud robotics could make that possible by expanding a robot's knowledge beyond its physical body [4].

This paper proposed thrash collecting robot which can classify the thrash type and insert it into the corresponding bins. Here, a comparison between two cloud services for image processing which are Google Cloud API [5] and Sighthound [6] will be executed.

Thrash Collecting Robot (TCR)

The proposed robot will do image processing to recognize the type of recyclable trash and allocate them into a different type of recycling bin. For the image processing part, cloud services are used to understand the content of the captured image. Figure 1 shows the flow of TCR 's task, Figure 2 presents the TCR robot from different views and Figure 3 shows example of thrash images have been used.

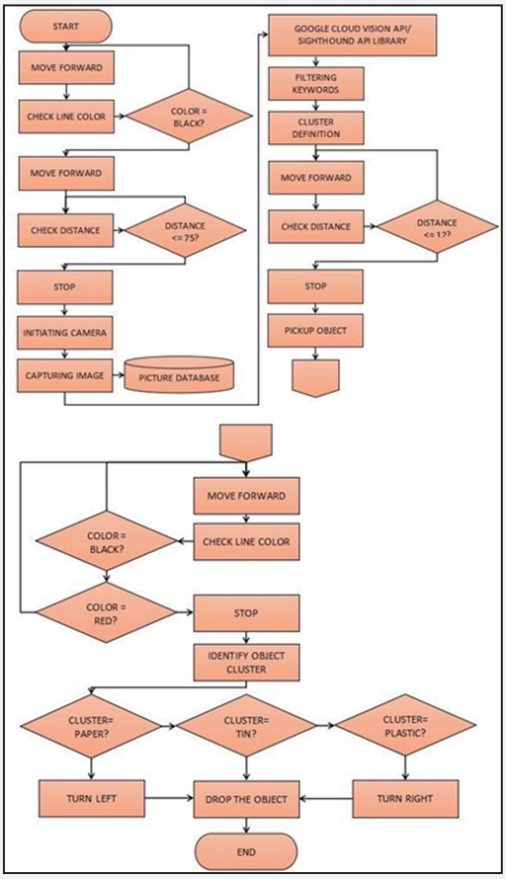

Figure 1: Flowchart for TCR's task.

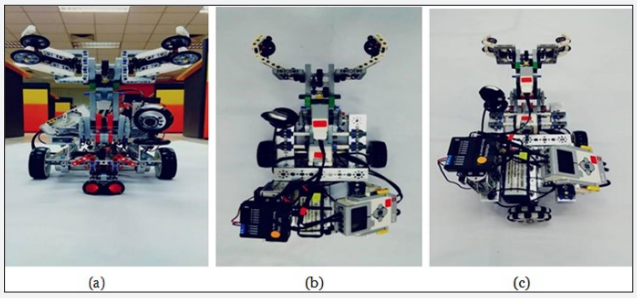

Figure 2: (a) Front (b) upper and (c) behind view of the TCR robot.

Figure 3: Example of thrash images (a) bottle (b) can and (c) paper.

Experiment and Results

TCR can move on a smooth track. LEGO Mindstorms EV3 is used as the brain for processing all the commands and TETRIX set is used as the brawn to support the architecture. TCR also can pick-up the objects once they sense their presence and take a picture of them using the wireless camera to distinguish its type and class via Google Cloud Vision API and Sighthound. After TCR is able to identify what type of the objects that it has collected, it will separate them into a different place with a different colour. Table 1 & 2 present the accuracy of identifying the type waste material based on the captured image using Google API Cloud Vision and Sighthound respectively (Figure 4).

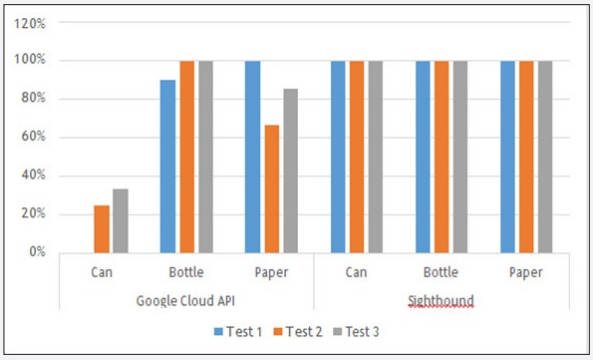

Figure 4: Bar graph obtained from image processing results.

Table 1: Accuracy on identifying the type of waste material based on the captured image Using Google API Cloud Vision.

NO	Type	Test 1	Test 2	Test 3
1	Can	0%	25%	33.33%
2	Bottle	90%	100%	100%
3	Paper	100%	66.67%	85.71%

Table 2: Accuracy on identifying the type of waste material based on the captured image using Sighthound.

NO	Type	Test 1	Test 2	Test 3
1	Can	100%	100%	100%
2	Bottle	100%	100%	100%
3	Paper	100%	100%	100%

Conclusion

In summary, robotics and automation significantly advance the life sciences. TCR that is based on Lego Mindstorm EV3 robot have been built to help in providing automatic control to collect the garbage. Image processing system have been integrated into TCR and a comparison between Google Cloud Vision API and Sighthound have been made. From the experiments, it is found that Sighthound can identify type of waste material efficiently compared to Google Cloud Vision API. In the future, we proposed that large scale processing works such as image processing need to be done in an environment with better processing power. To achieve that, the robot should be

How to cite this article: Zuraini O, Nor A A, Chin K Y, Fareen F W S, Sharifah S S A, Fauziah K. Image Processing Technique using Google Cloud API and Sighthound for Lego Mindstorms EV3 Robot. Robot Autom Eng J. 2018; 2(3): 555590. DOI: 10.19080/RAEJ.2018.02.555590.

equipped with a wireless camera and a network card. Wireless camera will capture an image of an object and the metadata of the image will be sent to the server for image processing task. All the heavy processing work will be done at the server and eventually results will be returned, and the robot will be able to identify the type of trash.

References

1. Nadirah MK, Sakinah SA, Samad SA (2017) Improved fuzzy PID controller in following complicated path for LEGO Mindstorms NXT. In: Proceedings of Mechanical Engineering Day, pp. 474-475.
2. Mohammed A, Wang L, Gao RX (2013) Integrated image processing and path planning for robotic sketching. Procedia CIRP 12: 199-204.
3. Kopacek P (2016) Development Trends in Robotics. IFAC-PapersOnLine 49(29): 36-41.
4. Guizzo (2011) Robots with their heads in the clouds. IEEE Spectr 48(3): 17–18.
5. Google Cloud Platform.
6. Sighthound.

DOI: 10.19080/RAEJ.2018.02.555590

How to cite this article: Zuraini O, Nor A A, Chin K Y, Fareen F W S, Sharifah S S A, Fauziah K. Image Processing Technique using Google Cloud API and Sighthound for Lego Mindstorms EV3 Robot. Robot Autom Eng J. 2018; 2(3): 555590. DOI: 10.19080/RAEJ.2018.02.555590.