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Abstract.
Mechatronic is used in a lot of activities, and our study intends to add supplementary components making the system more intelligent. A mobile robot which follows the path while avoiding obstacles and using the implementation of image processing on real worldThe economic aspect has become a major part of the investment in technology and needs to be taken into account. Project was of low cost, and there will be no impacts for not implementing this project in the future, considering little equipment added. Hoping the results of this work will be taken into consideration for further generations of mobile robots that can be improved and smarter, as nowadays, robots are used as waiters, nurses, taxi, delivery robots. Therefore, focus will be on measuring the object from the imagesprocessin in real time taken by the camera in order to create a code which will plan a new pathway and solve any situation with parallax camera mounted in front of mobile robot as car kit.

Keywords: Robot, intelligence, Image processing, Obstacles, measure, camera, objects, cost oriented

1   Introduction

In regard to human eyes intell infers distance from two images taken from different views, which is connected to image processing, especially in automation systems, this couldn't be possible without it. According on our experience also had instances of security camera installation and perhaps detecting some of its missing effects. There is a requirement to improve and update this field of activity. (Ahmed, M. F. 2006)

As a cost oriented idea there will be other way to reuse or use the existing applied techniques by just adding more details to the analysis. This is understood and justified in economic aspects.

During the working process will face four situations, where each of them should be solved. Also need to know some parameters before started working with smart car tolerance to overpass object, focal length of camera and its resolution, etc. Veven some parameters and guide to mount it is from producer company. (STEM 2019)

During this work when it is known thare is no calibration field and everything will be done in real time, it is known in advance that there should be a faster data transmission speed, finding the distance or point where to make decision to achieve more accuracy results.

As this project will only be based on one object as obstacle and must be regular object on shape, and its analysis must be in 2 dimensional a care should be taken that the environment does not interfere with other obstacles. When working with cameras that support HD technique and the resolution is higher, some little obstacles should be canceled or ignored through the filters or until creating code to do any condition like to measure just when it is closed shape.

The scope is mainly about mechatronic system that will include electronics, mechanical and programming components, that is, the mechatronics field includes equipment that will be completed with accessories and additional components. No specific circuit will be constructed, but their connection and its assignment of new tasks will be taken into consideration. Programming implemented to create a code that will be used on the existing programming language such as python by not having a need for creating a new code. The proposed measurement procedure is a three-phase process: object detection, segmentation, and distance calculations. (Tsung-Shiang Hsu and Ta-Chung Wang 2015)

The main goal is to make the robot car smarter, acting more independently, setting of certain rules (decisions) through programming obtained from image processing. Further objectives but with less importance to this project is to achieve and to create something which can be applied in practice as an alternative, by other words to adapt to it using just some parameters.

At the same time it is not to produce further equipment knowing the recommendations coming from WEEE or to create any trouble on the resource efficiency, but using of existing tasks and to expand their tasks.

2   Literature review

While researching the literature using various books, thesis, scientific publications, and other sources, found many conclusions and works of our nature, this will assist us to continue the specificity of our project.

Algorithm is implemented to enhance an image in different enhancement degree using the raspberry pi. The algorithm developed for the raspberry pi executes successfully and gives a very colorful image. Input images are multicolored while output may be either an image or a video frame or a set of characteristics or parameters related to the image and has taken or moved some effects, like gray image, Gaussian filtered image, contrast stretched enhanced Image, noise removal image etc. (K.S.Shilpashree, Lokesha.H, Hadimani Shivkumar, 2015).

Compared to our project, maybe the output part of the image presented by Gaussian filtering can work with some changes, as far as concerning other parts here, maybe because the purpose of our work is to present the output as a closed contour of the creation of effects to eliminate any interference and implications. But flow diagram

part has same principle, but mine will have more embedded system meaning with many parts like mechanical, electrical etc.

To summarize, it can be concluded that even making some comparison with what was found from the literature review, there are some similar works or logic. For sure our project will provide something new and improve some of the goals from literature review, the fact is, Using HD camera meaning an output, there will be more details from inputs, even for us sometimes there are problems to manipulate with filters, mounted camera in our project will be the difference on most part of project because they will be on horizontal line with objects as obstacle and the decision. Trying to make an optimal distance, so that the car doesn't stop, but somehow moving forward and analyzing at the same time, by other word this will be smarter.

Although in this work it has not been realized in 3D, but we believe that it helps the reconstruction from the base with 2D. (Yasir Salih and Aamir S. Malik (2012))

Most of industrial application required on 3D, but distance and size of the objects are measured by binocular stereo vision technology. (J H Yang and Q Zhao 2006)

3   Research Methodology

In order to achieve good results, various methods need to be used in order to achieve the objectives. Key methods in this project are inductive. In this project the inputs are the images, but the dealing is just an output, from obtaining data and not just taking a single picture, but in several consecutive patterns. More details are required and naturally it should be collected, and may arise by inductive methods.

Normally considering all those data, it is inevitable that there will be no need to use further methods and analysis techniques since the synthesis and its facts are opposed to each other. It would be definitely useful in both cases, as it provides the possibility to get a lot of information and get to know some of the phenomena that may have occurred during the process.

A comparison method may helpful in this research, because every measurement like distance, high dimension of object as obstacle, width, distance from left side and distance from right side, initially will be measured manually and will be considered like real, afterwards will be compared with respective measurement on real time.

During this work, it is needed to consider every possible situation which clinging to itself and it means that a unique case study is required, to complete and to cover this entire project that will be presented. In more expected situations and in this document various situations will be foreseen and solved in different aspects of study.

The data collected are presented in a tabular and graphical where all possible cases of their analysis are analyzed. Thus, by using statistical and graphical methods it will give a clearer understanding notice the differences in a better manner.

Normally the statistical methods are in some way in relation with mathematics, and in this project it is a must to use both.

In general, all the mentioned methods will be used to calculate details and to present them as clearly as possible, in a way to notice all data which has to be analyzed. (D.-J. Lee, P. Merrell, and Z. Wei. (2010))

4 Results and analyses

Knowing that such works definitely need to have results, as well as authors of this project will try to know that based on the results, is able to fulfill the accuracy of these data. Believing and convinced that through results will be able to describe and recognize the errors despite tests being made. As for closer calculations knowing exact examples and critical points as well as deviations in situations and objects have become better. Some conclusions should be provided, or it will help and guarantee us for the coefficients we have used in code on how effective are, and should intervene in the code again. Based on tests for each situation reports will follow that can explain even results achieved at each point, also while working have some results that do not comply with code but will be explained based on the file named report.log.

Maybe by analysing and calculation results will be significant for all what worked until now, but hoping that based on test and from window which appear during test, there is opportunity to achieve higher accuracy as average. Same time will analysis and all decision has made and to know limits which goes to wrong decision. In other words will define after making comparison of all results to calculate as well as critical sizes.

Figure 1. Assembled Smart Video Car Kit, with additional components
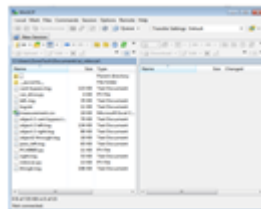

Figure 2. Flow diagram

Figure 3. Flow diagram for preparation

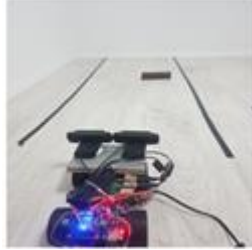**Figure 4. Right environment**

Figure 5. Vnc viewer

Figure 6. WinSCP

Figure 7. First situation Obstacle under 16 (mm)

Figure 8. Second situation Bypass left side

Figure 9. Third situation Bypass right side

Figure 10. Fourth situation Can't pass or bypass

Figure 11. Example from appearance on real time from bypassleft side

During test in order to make many measurements and various objects as an obstacle to arrive at a conclusion as accurate as possible. Whether it depends on size of the objects, distance of object, brightness, results were same with other cameras.. On this situation used to review two objects and have calculated and derived the accuracy for each measured parameter.

Selected objects beforehand to meet the conditions initially and did not go to critical point example 16 (mm) is specified in the code and for example object 158 (mm), but objects are much smaller in height as shown above, and finally based on this

measurement and accuracy we can come to a conclusion and the critical points where a wrong decision might be taken.

Situations 1 and 4 where car via code makes decision to move forward, it is very easy to achieve, problem was to create code and to make measurements, while in situations where the car has to turn left or right which is described above, the second situation and third situation has been more difficult because its first wheel have too much tolerance.

Thought to put the car in the middle of path and start measuring from one side. May first turn wheel and move forward based on the wheel spin, time and speed were manually measured until it is provided to left path bar, then turn it straight and move forward, even based on these measurements and right side it is same of course with opposite parameters.

Despite this trouble trying many way to get to the end, but during testing have noticed that servo motor compilers that are tasked to rotate in order to push the plastic rod to operate and to turn the wheel has slipped and never was the same split to create the right step that was needed. As to which of situations worked best, can freely say that in general it has a success in all situations, and what have thought and decided in the code that decisions have been made successfully.

the plastic rod to operate to turn the wheel has slipped and never was the same split to create the right step that I needed. As to which of situations worked best, I can freely say that I have had success iin all situations and what I have thought and decided in the code that decisions have been made successfully.

As for the results, can conclude that the goal has been achieved for all situations as well as the various facilities used.

After all calculations for object as obstacle 1 and 2, accuracy averacy for both objects is 94.95%.

5   Conclusion

Depending of dimension of object as obstacle, even results are fewer differences which means that object sizes play a role, especially when they are very large.

When working with a servo motor and you have to turn the wheels, set critical limit on code because it can easily damage the indentations.

Based on the application of this project, to continue and to solve fourth situation "cannot pass or bypass", example if it mounted like in real car can bypass and outside path besides on traffic rules. Or to have additional equipment to jump over it like modular robots.

Project although economically it may be more expensive and more complexity in math aspect, using four cameras would be more accurate cause you have four image from four angles.

On smart embedded system like in our work which is all in real time, must choose microcontroller with high speed rate to transfer data.

6 References

[1] D.-J. Lee, P. Merrell, and Z. Wei. (2010): Two-frame structure from motion using optical flow probability distributions for unmanned air vehicle obstacle avoidance," Machine Vision and Applications, vol. 21, no. 3, pp. 229-240, 2010.
Citation in text: (D.-J. Lee, P. Merrell, and Z. Wei. (2010))

[2] Ahmed, M. F. (2006):" Development of a Stereo Vision system for Outdoor Mobile Robots," M.S. thesis, University of Florida.
Citation in text: (Ahmed, M. F. 2006)

[3] Yasir Salih and Aamir S. Malik (2012): Depth and Geometry from a Single 2D Image using triangulation, 978-0-7695-4729-9/12, 2012 IEEE DOI 10.1109/ICMEW.2012.95, IEEE International Conference on Multimedia and Expo Workshops
Citation in text: (Yasir Salih and Aamir S. Malik (2012))

[4] Company focused on STEM (2019): Smart Car kit, Raspberry, Arduino and education. https://www.sunfounder.com
Last retrieved 10, 2019
Citation in text: (STEM 2019)

[5] Tsung-Shiang Hsu and Ta-Chung Wang (2015): An Improvement Stereo Vision Images Processing for Object Distance Measurement www.ausmt.org. 86. auSMT Vol. 5 No. 2 (2015), DOI: 10.5875/ausmt. v5i2.460.
Citation in text: (Tsung-Shiang Hsu and Ta-Chung Wang 2015)

[6] J H Yang and Q Zhao 2006 J. Phys.: Conf. Ser. 48 393 (2006): Studies on 3-Dimensional Measurement Using Multi-Images, Institute of Physics Publishing Journal of Physics: Conference Series 48 (2006) 393–397, doi:10.1088/1742-6596/48/1/074 International Symposium on Instrumentation Science and Technology
Citation in text: (J H Yang and Q Zhao 2006)

[7] International Journal of Advanced Research in Computer and Communication Engineering Vol. 4, Issue 5, May 2015 Copyright to IJARCCE DOI 10.17148/IJARCCE.2015.4545 199 Implementation of Image Processing on Raspberry Pi K.S .Shilpashree , Lokesha.H , Hadimani Shivkumar. DOI 10.17148/IJARCCE.2015.4545
Citation in the text: (K.S.Shilpashree , Lokesha.H , Hadimani Shivkumar, 2015).