IFERP connecting engineers... developing research

ISSN (Online) 2394-6849

International Journal of Engineering Research in Electronics and Communication Engineering (IJERECE)
Vol 3, Issue 11, November 2016

Mechanical Robotic Automation with Raspberry PI utilizing Image Processing

[1] Greeshma K [2] Yoga Ramya B [3] V.Laxmi Meghana [4]Abdul Lateef Haroon P.S
[1][2][3] 5th Sem [4] Assistant Professor
[1][2] Ballari Institute of Technology and Management, Ballari

***Abstract:* -- The point of this paper is to display a framework fueled by a Raspberry PI and a modern automated arm, which can execute various errand in a production line. The utilized mechanical arm and imaging gadgets are modern sort, however the control framework it's a straightforward improvement microchip board. The mechanical arm it's the SCORBOT-ER III and the envisioning gadgets are IP cameras. The objective it's to exhibit that even intricate modern frameworks can be keep running with unassuming and little card-measure stash figuring gadgets. Last extension is to demonstrate, that with one and only microchip, brilliant self-sufficient automated frameworks, can be made.**

Watchwords actuator; mechanization; camera; end effectors; picture preparing; mechanical control; Raspberry PI; automated arm.

I. INTRODUCTION

In the business a major measure of mechanical robotization is required because of the way that the items are extremely distinctive, as a result of numerous setup alternatives [1]. The elements of the modern line has developed in the past year, along these lines numerous creation lines must be reused and reconfigured [2]. It requires o parcel of investment and push to do this physically and to reconfigure mechanical arms to the new procedure. In the event that a video framework is utilized mechanical arms can reconfigure themselves for the new generation lines, along these lines it will be no issue when changes are included in the mechanical procedure [3].

The objective is to incorporate as much computerization a conceivable in the creation line, with a figuring framework with the most minimal conceivable assets and still have no trade off in the outcomes. The creation line is a modern creation line with mechanical automated arms and modern IP cameras [4]. The main basic framework is the control figuring gadget which in the long run has a tendency to be coordinated on a solitary chip outline [5]. The creation line it's produced using a SCORBOTER III instructive/modern automated arm and the control cameras are modern IP cameras. The undertaking is to pick with the assistance of the automated arm objects with arbitrary shape, shading, size or position in space. These objects than must be put in an arbitrary place, where the beneficiary is set. The mechanical arm takes after the objects, regardless of the possibility that it's moved from its position and makes the sorting in the particular beneficiary regardless of the possibility that the beneficiary it's moved.

This is entirely new in a generation line, in light of the fact that the measure, shape, shading and place of the articles are indicated before and the beneficiary where it's set its preset [6]. In a generation line if a minor change is made, or the framework dispatches because of various reiterations, the entirety line must be reconstructed. The camera controlled generation line reconstructs continuously amid execution [7]. At every execution the position of the joints are reinvented keeping in mind the end goal to achieve the objective position are exact as could be expected under the circumstances [12]. The control is made with stereo cameras so as to have the capacity to measure removes too with stereo triangulation [13]. The entire framework is made in a route that as a human would be set up of the creation line. In the event that the place of the question is changed, the human can readapt and be ready to pick it and place it effectively in the beneficiary [14]. The eye framework (the two cameras) are place in the side of the generation line (the automated arm it's seen from the side) and not at the gripper of the mechanical arm, in light of the fact that the eyes of the human administrator are not at his fingers, the hand it's seen by the side, the eyes are in the head [15].

The human body it's the ideal framework, which has to be a model for the robots. The human body needs to be dependably a motivation to the robot manufacturers. The rate of the likeness of the automated framework with the human body will gauge the rate of how adaptable is the mechanical framework.

II. PROBLEM FORMULATION

The objective of the framework is to make a little mechanical environment, where an automated arm can be controlled just in light of the information got from the cameras. This information is handled and the automated arm can move in like manner. The framework must be executed in a circle, so no human mediation is permitted. This implies the mechanical arm can readapt to the progressions of the environment and to the progressions of the items shape, size, shading and position in space. The mechanical arm can auto just itself and repay its balance with a specific end goal to move constantly exact and exact. The entire control gadget of the framework it's a little Raspberry PI. This figuring framework it's utilized due to the reality to demonstrate that the entire modern framework can be robotized just with a card measure registering framework on the other hand a microchip.

III. SYSTEM IMPLEMENTATION

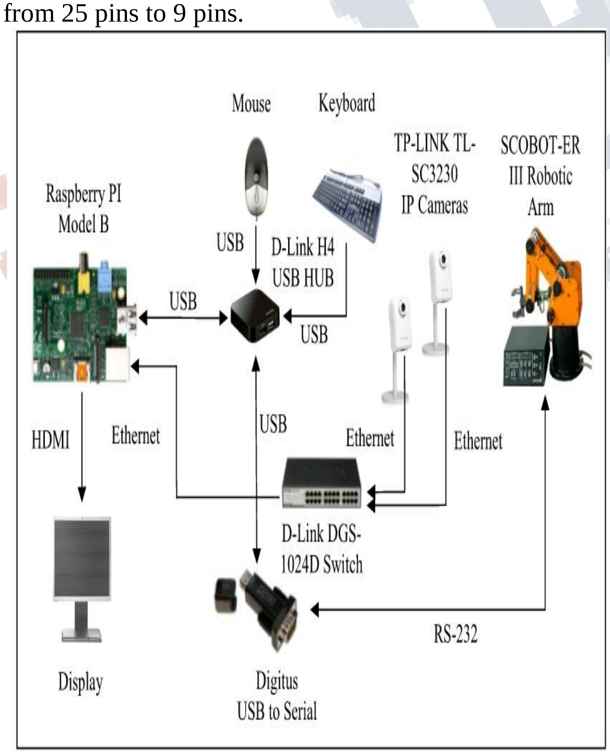
A. Hardware setup

The utilized mechanical arm it's the SCORBOT-ER III. The video framework which it's utilized is the TP-LINK TL-SC3230 sort IP camera.
The SCORBOT-ER III mechanical arm can be controlled utilizing SCPI charges on the RS-232 serial port. There is required a change from 25 stick to 9 stick serial link, however no other adjustment is required, due to the way that the utilized convention it's the standard RS-232 convention. It can be utilized a USB to serial converter as well on the off chance that the control PC has no serial port, which is the instance of the Raspberry PI. The Digitus USB to serial converter it's a decent and tried gadget. It's perceived by the Raspberry PI; along these lines n driver establishment is required. For further upgrades Bluetooth correspondence can be utilized as well, and the additional hardware is not all that perplexing, because of the way that there it's no need to change the transmission convention.

On Fig. 1 there is the square graph of the test setup. There is the Raspberry PI display B board, however the Raspberry PI V2 board can be utilized as well. The second board would be better because of the way that it has more USB ports and a superior CPU, 900 MHz quad core ARM Cortex-A7and it has 1 GB RAM. The reality that it's utilized the old Raspberry PI this is on the grounds that at the time of the execution the Raspberry PI V2 load up was not accessible. The use of the old Raspberry PI, with the 700 MHz single-centre ARM1176JZF-S CPU what's more, 512 MB RAM, it's a decent confirmation that even on this framework, with unobtrusive assets, the control of the mechanical arm, with picture preparing, it's conceivable. To the Raspberry PI it's associated a show on HDMI interface. This can be any sort of show, if it's computerized what's more, hasn't got HDMI input a straightforward HDMI to DVI convertor can be utilized. In the event that the show is analogical and has just VGA contribution, there is likewise conceivable to utilize them with a dynamic HDMI to VGA convertor, one like this it's the Pi-View. To the Raspberry PI it should be associated a mouse and a console, which can be any kind of fringe gadget on USB port. The Raspberry PI display B has just two USB ports, so for more fringe gadgets a USB HUB must be utilized, one great tried USB HUB it's the D-Link H4, however the fundamental thought is to have a remotely controlled USB HUB, because of the way that enough current is depleted by the Raspberry PI and there is not a smart thought to control as well numerous gadgets on the USB ports. The Raspberry PI V2 has 4 USB ports, so the use of a USB Hub it's discretionary. One of the principle gadgets would be the Digitus USB to serial converter, which is one of the best arrangements because of the way that this converter is perfect with numerous working frameworks and for the Raspbian Linux utilized by the Raspberry PI there is no need to introduce any drivers, the converter it's perceived on the fly. With other USB to serial converters there were a few issues, yet this one works exceptionally well. The Raspberry PI has additionally UART correspondence on the GPIO pins. Those are not really easy to use, because of the way that they require level shifters, in light of the fact that the rationale levels are on 3.3 V, so if level shifters are not utilized, the GPIO pins can be harmed if utilized on 5 V TTL level.

The TP-LINK TL-SC3230 IP cameras are associated by means of a D-Link DGS-1024D Ethernet switch to the Ethernet port of the Raspberry PI. For this association any Ethernet switch can be utilized and if a PC is the control registering framework, than a arrangement with more system cards it's suitable as well.

The last and primary component of the setup it's the SCORBOT-ER III instructive/mechanical automated arm which it's associated with the Digitus USB to serial converter through the RS-232 converter from 25 pins to 9 pins.



B. *Theoretical background*

The difference between vectors we calculate the following way.

$$V_x = X_2 - X_0$$

$$V_y = Y_2 - Y_1$$

The vector length we calculate with the following formula.

$$\|l\| = \sqrt{X^2 + Y^2}$$

We can compute the orthogonal vector in the following way.

$$Temporary = X$$

$$X_0 = Y$$

$$Y_0 = -temporary$$

$$X_4 = V_{xox} - 2 \cdot V_{xox} + X_2$$

$$Y_4 = V_{xoy} - 2 \cdot V_{xoy} + Y_2$$

$$X_5 = V_{yox} - 2 \cdot V_{yox} + X_2$$

$$Y_5 = V_{yoy} - 2 \cdot V_{yoy} + Y_2$$

After this only the parallelogram computation is needed.

C. *Software implementation*

On Fig. 2 there is the usage of the SCORBOT-ER III automated arm control apparatus made in Python and running on a Raspberry PI. The working framework is the Raspbian 7.0 "Wheezy". The picture preparing calculations are made with the utilization of the Open CV libraries.

The principal picture is the ongoing acquisitioned picture, with the overlays of the circles and lines, which are rules for registering edges and separations for framework to know the amount to move the automated arm in the objective position. The second picture is the HSV (Tone, Saturation, and Value) sifting. The following four pictures are the shading separating windows for every jug plug stuck to the mechanical arm's joints. There is the blue container plug stuck to the base, there is the yellow container plug stuck to the elbow, there is the red container plug stuck to the gripper and there is the green container plug at the objective question. The shading separating windows are made for setting the HSV insignificant and maximal qualities, this will channel the particular hued bottle plug. These qualities need to be aligned for each lighting condition. On the off chance that histogram levelling channels are utilized, than the HSV values have to be designed just once, after this these qualities can be utilized as a part of different lighting conditions. The alignment must be done just once, when the framework it's set up.

On Fig. 3 there is the zoomed picture of the underlying automated arm picture with the line a hover overlay for figuring the development separation of the mechanical arm.

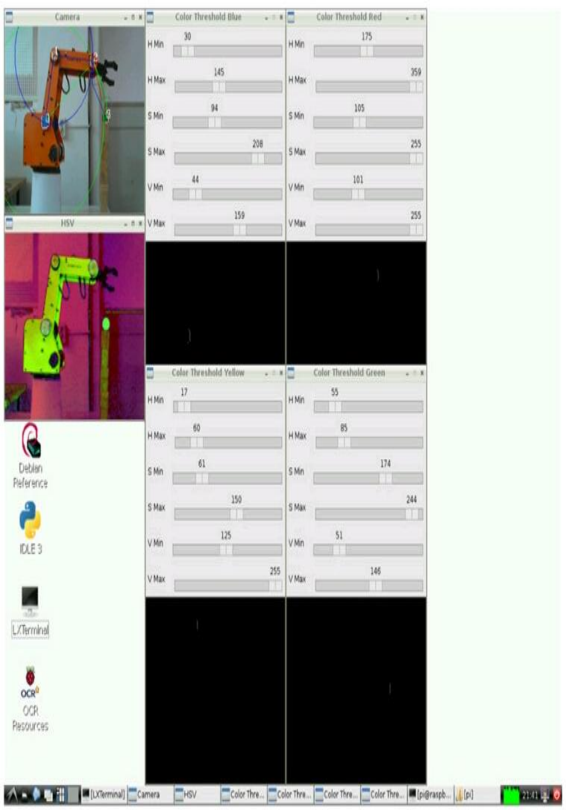


Figure 2. SCORBOT-ER III automated arm control GUI made in Python and running on a Raspberry PI.

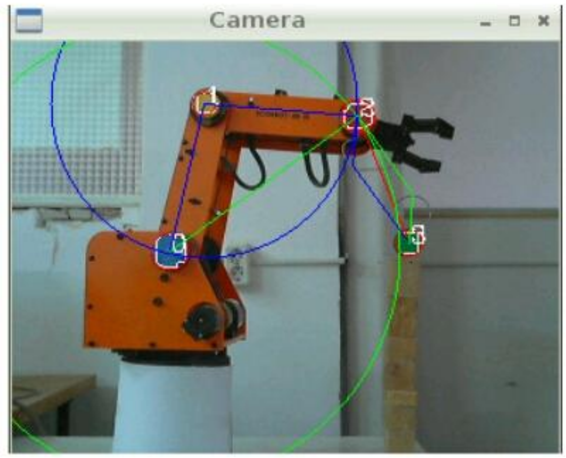


Figure 3. Zoomed picture of the SCORBOT-ER III automated arm with the overlays on the picture after discovery of the joints.

IV. CONCLUSION

As it was displayed, a mechanical automated arm control framework was made, utilizing the SCORBOT-ER III instructive/mechanical automated arm and modern IP cameras. The control framework it's a straightforward Raspberry PI, which is the entire control framework for this mechanized environment. The mechanical arm can snare the protest set apart with the green container plug and place it in the right beneficiary, paying little mind to its position. After tests it was demonstrated that the Raspberry PI V2 it's more reasonable for multi camera control frameworks, in view of the expanded centre number and recurrence of its CPU, while the Raspberry PI display B it's reasonable for the most part for one camera frameworks and 2D control, due to its unassuming CPU. Despite the fact that it was demonstrated that such a basic framework can control and mechanical environment furthermore, make a full computerization. Assist improvement is port the framework on FPGA sheets like the Zed Board of ZYBO, which can have a Ubuntu Linux working framework, along these lines the porting of the framework it's straight forward. The porting on the FPGA sheets it's only an delegate step frame the last objective, to make an ASIC frame the framework, so the confused robotized mechanical control can be pressed clamour a solitary chip. With this apparatus chain, any device can be ported, on a solitary chip.

REFERENCES

[1] W. G. Hao, Y. Y. Leck, L. C. Hun, "6-DOF PC-Based Automated Arm (PC-ROBOARM) with effective direction arranging and speed control," fourth International Conference On Mechatronics, Kuala Lumpur, 2011, pp. 1–7.

[2] W. Yang, J. H. Bae, Y. Gracious, N. Y. Chong, B. J. You, S. R. Gracious,"CPG based self-adjusting multi-DOF mechanical arm control," Worldwide Conference on Intelligent Robots and Systems, Taipei, 2010, pp. 4236–4243.

[3] E. Oyama, T. Maeda, J. Q. Gan, E. M. Rosales, K. F. MacDorman, S. Tachi, A. Agah, "Backwards kinematics learning for mechanical arms with less degrees of opportunity by measured neural system frameworks," International Conference on Smart Robots and Systems, 2005, pp. 1791–1798.

[4] N. Ahuja, U. S. Banerjee, V. A. Darbhe, T. N. Mapara, A. D. Matkar, R.K. Nirmal, S. Balagopalan, "PC controlled automated arm," sixteenth IEEE Symposium on Computer-Based Therapeutic Systems, New York, 2003, pp. 361–-366.

[5] M. H. Liyanage, N. Krouglicof, R. Gosine, "Outline and control of a superior SCARA sort automated arm with revolving water powered actuators," Canadian Conference on Electrical and Computer Engineering, St. John's, CA, 2009, pp. 827–832.

[6] M. Mariappan, T. Ganesan, M. Iftikhar, V. Ramu, B. Khoo, "An outline system of an adaptable automated arm vision framework for OTOROB," International Conference on Mechanical and Electrical Technology, Singapore, 2010, pp. 161–164.

[7] H. Guo-Shing, C. Xi-Sheng, C. Chung-Liang, "Improvement of double automated arm framework in light of binocular vision," Global Automatic Control Conference, Nantou, 2013, pp. 97–102.

[8] R. Szabó, A. Gontean, "Controlling a Robotic Arm in the 3D Space with Stereo Vision," 21th Telecommunications Forum, Belgrade, 2013, pp. 916–919.

[9] R. Szabó, A. Gontean, "Automated arm control in 3D space utilizing stereo separation count," International Conference on Development and Application Systems, Suceava, 2014, pp. 50–56.

[10] R. Szabó, A. Gontean, "Remotely Commanding the Lynxmotion AL5 Type Robotic Arms," 21th Media communications Forum, Belgrade, 2013, pp. 889–892.

[11] R. Szabó, A. Gontean, "Making a Programming Language for the AL5 Type Robotic Arms," 36th International Meeting on Telecommunications and Signal Processing, Rome, 2013, pp. 62–65.

[12] M. Seelinger, E. Gonzalez-Galvan, M. Robinson, S. Skaar, "Towards a mechanical plasma splashing operation utilizing vision," IEEE Robotics and Automation Magazine, vol. 5, issue 4, 1998, pp. 33–38, 49.

[13] R. Kelly, R. Carelli, O. Nasisi, B. Kuchen, F. Reyes, "Stable visual servoing of camera close by mechanical frameworks," IEEE/ASME Transactions on Mechatronics, vol. 5, issue 1, 2000, pp. 39–48.

[14] V. Lippiello, F. Ruggiero, B. Siciliano, L. Villani, "Visual Get a handle on Planning for Unknown Objects Using a Multifingered Mechanical Hand", IEEE/ASME Transactions on Mechatronics, vol. 18, issue 3, 2013, pp. 1050–1059.

[15] M. Kazemi, K. K. Gupta, M. Mehrandezh, "Randomized Kinodynamic Planning for Robust Visual Servoing", IEEE Exchanges on Robotics, vol. 29, issue 5, 2013, pp. 1197– 1211.

[16] R. T. Fomena, O. Tahri, F. Chaumette, "Remove Based and Introduction Based Visual Servoing From Three Points", IEEE Exchanges on Robotics, vol. 27, issue 2, 2011, pp. 256–267.

[17] N. C. Orger, T. B. Karyot, "A symmetrical mechanical arm plan approach with stereo-vision capacity for CubeSats," sixth Worldwide Conference on Recent Advances in Space Innovations, Istanbul, 2013, pp. 961–965.

[18] F. Medina, B. Nono, H. Banda, A. Rosales, "Order of Strong Objects with Defined Shapes Using Stereoscopic Vision also, a Robotic Arm," Andean Region International Meeting, Cuenca, 2012, pp. 226.

[19] M. Puheim, M. Bundzel, L. Madarasz, "Forward control of mechanical arm utilizing the data from stereo-vision following framework," fourteenth International Symposium on Computational Insight and Informatics, Budapest, 2013, pp. 57–62.

[20] T. P. Cabre, M. T. Cairol, D. F. Calafell, M. T. Ribes, J. P. Roca, "Extend Based Learning Example: Controlling an Instructive Robotic Arm With Computer Vision," IEEE Revista Iberoamericana de Tecnologias del Aprendizaje, vol.8, issue 3, 2013, pp. 135–142.

[21] G. S. Gupta, S. C. Mukhopadhyay, M. Finnie, "WiFi-based control of a mechanical arm with remote vision," Instrumentation what's more, Measurement Technology Conference, Singapore, 2009, pp. 557–562.

[22] L. Haoting, W. Wei, G. Feng, L. Zhaoyang, S. Yuan, L. Zhenlin, "Advancement of Space Photographic Robotic Arm in light of binocular vision servo," Sixth International Meeting on Advanced Computational Intelligence, Hangzhou, 2013, pp. 345–349.