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Design and Development of 3-DOF Robotic Arm With Vision Assistance

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Abstract

In modern time, use of smart applications for automation and guiding mechanical structures is on peak. The use of Python, Internet of things and Java based applications are prominently used in industry 4.0 for advanced resolution. Robotics is an emerging field for being processed with accumulation of image processing for his automation process and applications. In this paper Arduino and LabVIEW is used to design a 3 DOF robotic arm for identification of an object and then sending Pulse width modulations to Servomotors for exact calculation of object in the image. The accuracy of model is only 68% due to resolution problems and a greater number of temporary joints in the electronic setup.

Keywords: LabVIEW, Arduino, Vision Assistance

Introduction

In our day to day life, we are doing every work accurately with our eyes. Eyes are the most crucial part of human body for doing any or every work[1]. In this modern time, the technology is too fast that with the help of smart sensors are mathematical processing, any kind of information has been assessed from the image or any kind of acquired signal [2]. A single image contains lot of information regarding the seen captured from a camera. The image processing is a best tool to extract information and region of interest from a given image. Few decades back, many processors were introduced for doing image processing [3,4]. The main problem with those processors were the processing timing and computation complexes. But now with advancement in VLSI methods, the processing becomes too fast and the cost of these high-end

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processors become too low as compared to other methods. From previous time, textual programing is used for building innovative applications but now graphical programming is now also being popular in professional such as technical as well as non-technical experts for compliance of concepts in to dedicated applications [5,6]. LabVIEW is such a application for performing such kind of task. LabVIEW is a graphical programming which contains lot of modules such as image processing, vision development module, signal processing module, and other supportive options. LabVIEW is supported with various third-party firmware for communications [7,8,9]. This is one of the major supports provided by the company to use the services which are designed by third party with open fare trade. Maker hub is a third party who designed the firmware to attach Arduino and other boards for setting up data transfer modes for data acquisition and control modes. The robot is mostly used for pick and place tasks. The robot has various technical aspects taken in to consideration. The main specification on which robot has been dependent the most is his degree of freedom and workspace. It has been observed in a layman that a greater number of joints in a robot contains a greater number of degrees of freedom and more count of complexities. In this paper a three degree of freedom robotic arm has been prepared who will get the counts of coordinates from a camera and then pick the object accordingly [10].

Methodology and components

To make this project various components are required such as LabVIEW 2015, USB Camera, Arduino UNO board, A three degree of freedom robotic arm made by acrylic sheets and LM2951 driver for running servomotors, three 4km/Cm high resolution servomotors. The control logic has been designed in LabVIEW and then decision has been given to servomotors by précised Pulse Width Modulated waves [11]. The Block Diagram of application is given in Figure 1.

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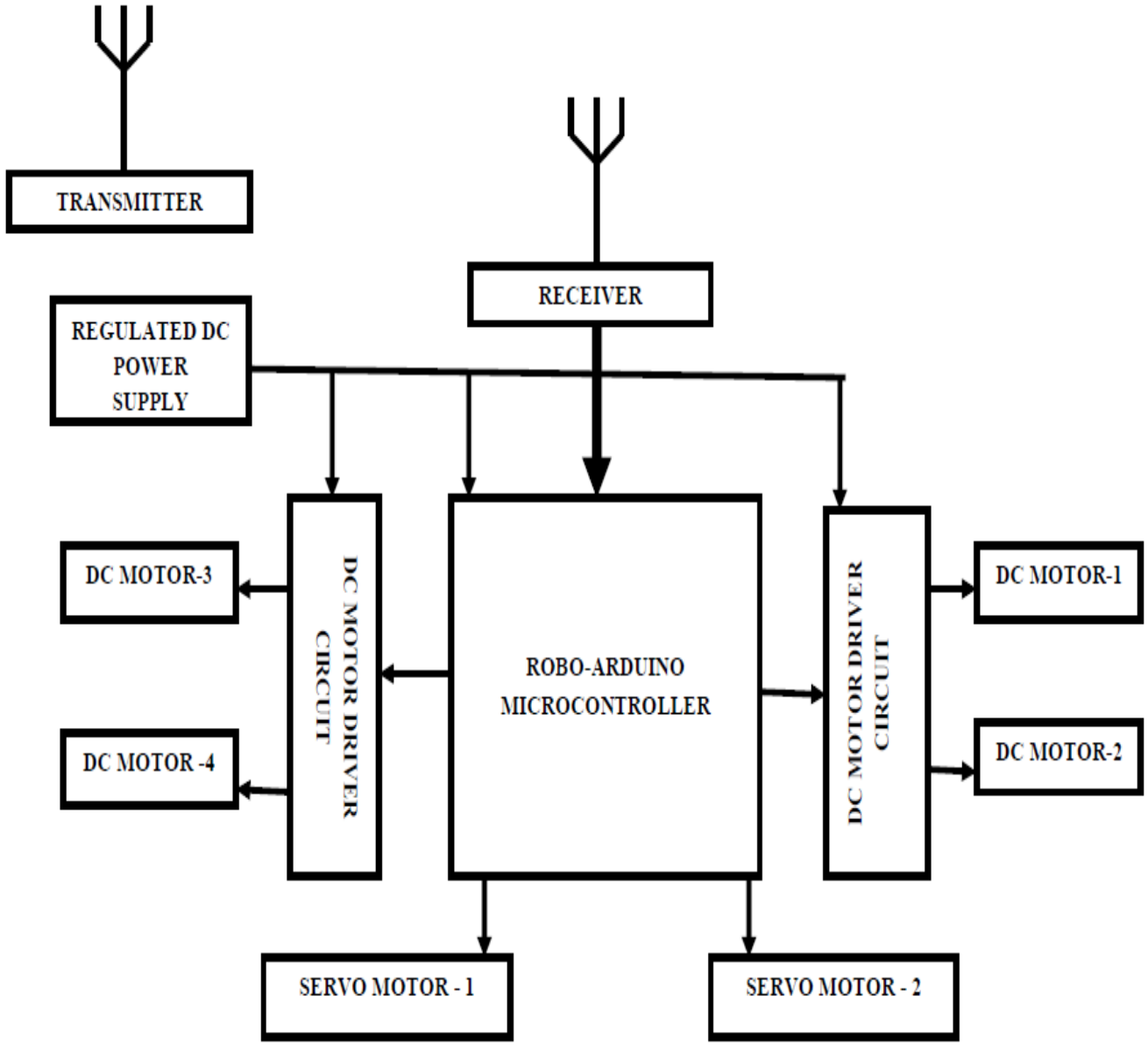

Figure 1: Block Diagram of Project

Results and Discussion

To accomplish the task the project has been approached in steps. First of all, the robotic arm was assembled to make a flexible structure for attachment with board. The set up is shown in Figure 2.

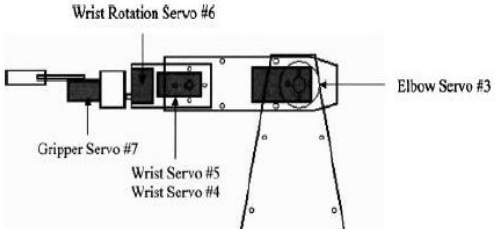

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Figure 2: Mechanical Structure of Robotic arm having three degree of freedom

After installation of robotic structure, the schematic of this project was prepared in National Instruments Multisim for circuit troubleshooting's and testing's. The diagrams given in Figure 3.

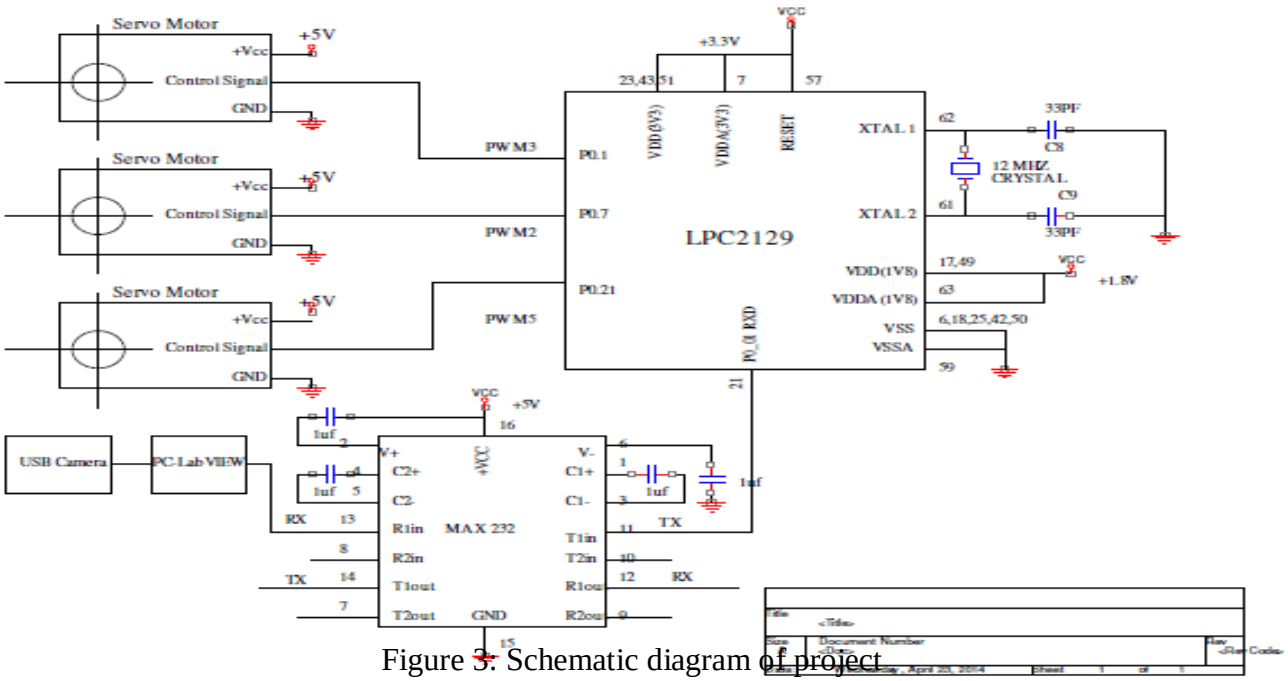

Figure 3: Schematic diagram of project

In LabVIEW, the logic was prepared using While loop for maintenance ofsynchronization. The delay loops are used to maintain perfect relation with Arduino board Baud rates.

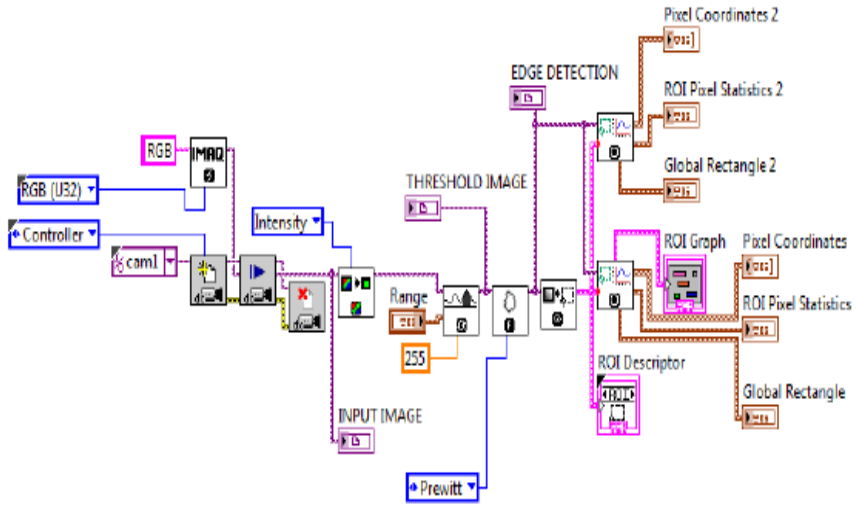

Figure 4: Control and communication logic in LabVIEW 2015

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The edge detection with prewet filter is used for x and y coordinates calculation using reverse kinematics calculations. The convolution method is prefund here for servo PWM calculations with respect to joint movements in a perfect stage.

Conclusion:

The project is very helpful to set up a demonstration for pick and place tasks. The palletization is further improved version of this project which will come in to existence with the help of encoders.

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