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Applications of a Robotic Arm (A Dobot)

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***Abstract*- Today, a robotic arm may be utilized for a wide range of tasks, such as pick-and-place operations, medical procedures, industrial automation, and many other things. The robotic arm moves and completes the work based on the hand motions of humans. This device imitates the movements of human hands. The arm is incredibly versatile and may be utilized in fields like making fireworks and bomb disposal when the atmosphere is dangerous for people to be in. The robotic arm may be controlled in a variety of ways. The Dobot Studio programme is used in this study to discuss the Dobot's applications as a robotic arm.**

Keywords*- *Dobot (Robotic arm), pick and place, colour sorting, stacking, 3D printing, laser engraving, writing and drawing.

INTRODUCTION

Reserve room for robotics in all disciplines, including engineering, medicine, and space science, among others, because it has had a significant influence on our civilization in the current day. Robots can be utilized in emergency scenarios like bomb disposal where human life is at risk. An artificial mechanical arm known as a robotic arm may be programmed and has functions that are similar to those of a human arm. The arm could be the whole device or it might be a part of a more complex robot. A robotic arm can be used to perform a wide range of activities starting from small scale household use to a larger scale industrial purpose. In this article, I have tried to scale down a few applications that I have performed on a dobot magician as shown in figure1. I have used an application namely Dobot Studio linking it with my robot arm.

A. Pick and Place

Pick and place robots give businesses the ability to employ automated methods for moving goods from one spot to another. Lifting or transferring goods from one spot to another does not need much consideration when it comes to simple activities. Lifting or moving goods is a simple action that doesn't take much thought. Consequently, hiring human labour for these jobs might be inefficient because the workforce could be better utilized for tasks requiring higher cognitive capacities. The pick-and-place robots are in charge of these repetitious chores. These robots frequently have vision and sensing systems that allow them to take items off of a moving conveyor belt.

[1]Pick and place robots come in a variety of designs depending on the particular task they are utilized for. The majority of these designs have a similar fundamental idea. These robots often have a long arm that can reach their whole working area and are mounted on a sturdy pedestal. For the kind of thing the robot wishes to move, the end of the arm attachment is tailored. These robots can move objects from a moving surface to a moving surface, from a moving surface to a stationary surface, and from a stationary surface to a moving surface (such as between two conveyor belts).

My robotic arm had 4-axis. However, there are also 5-axis and 6-axis robotic arms in use that can twist the items to rotate their orientation. Different end-effectors can be used such as a gripper or a suction cup. Coding can be done in blockly and python.

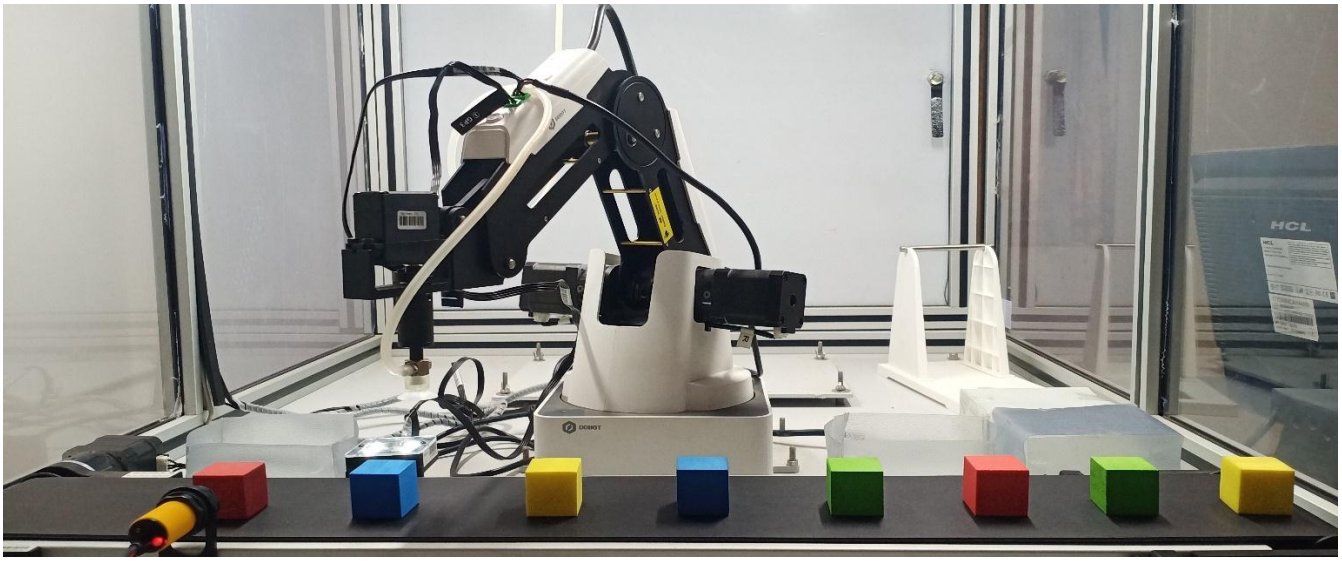

Figure 1. Proposed robotic arm (a dobot)

B. Colour Sorting

As seen in figure 2, the colour sensor is utilized to determine an object's colour. It determines the RGB color's light intensity and outputs a result in accordance. It includes an inbuilt IR blocking filter that accurately detects colour. The colour sensor has four analogue to digital converters.

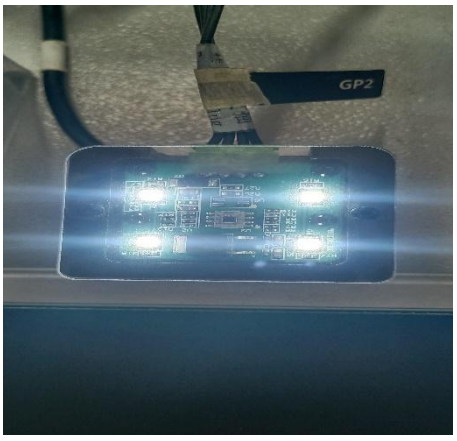

Figure 2. A colour sensor

The system uses colour as its sorting criterion, hence a photodiode serves as its colour sensor. [2]The RGB colour model, which encompasses a large variety of colours, forms the foundation for the sensor's colour recognition. The microcontroller is a crucial component that manages the other building blocks in the unit. The microprocessor analyses the intensities and regulates the operations of the other building elements of the system using the photo sensor's output as input. detects the object's colour and then grasps it with a gripper. Controlling the gripper motor is necessary for this. The gripper motor is once again commanded to drop the object once the controller has moved the arm to the dropping area. Since the o/p voltage of the microcontroller unit is substantially lower than that needed to operate the motors, motor drivers are utilised to connect motors with the microcontroller unit. Three servo motors and one stepper motor power the entire system.

[4]The colour sensor picks up the RGB primary colours and then searches for reflected colour intensities, which are then translated into 8-bit values for each primary colour. As with the GREEN and BLUE colours, the RED colour item reflects the RED colour with strong intensity. The additional colours are made by combining the RGB's three primary colours. Knowing the preset primary colour values makes it simple to identify the colour of the tested object. Since each colour has a specific value and the matching light intensity is reflected on the sensor, the sensor will generate the output.

Three servos and one stepper motor are used to control the pick-and-place control action. PWM pulses are used to drive a servo motor and change and maintain position. The arm is rotated at a particular angle using a stepper motor. The mechanical part's arm and gripper are built of compressed 2 mm aluminium sheet, which will assist make the model lighter. The object is chosen by the sensor using a gripper once it recognises the colour of the thing. Controlling the gripper motor is necessary for this. The gripper motor is now directed to drop the thing once more as the controller now moves the arm to that point.

A. *Stacking*

Figure 3. Stacking blocks using a robot arm [5]

Figure 3 shows a robot arm stacking the blocks one above another and forming a pyramid. Stacking is the process which does not require a lot of thinking and therefore it is pointless to appoint a human being to perform that job when machines can do it tirelessly. A robot arm is the best possible choice for it. It can carry heavy loads as well and at times can be very flexible as well. Different end effectors can be used and that too of different sizes as per the requirement. A gripper and the suction cup are among them.

Stacking is mainly done at industries for packaging purpose. It can also be very useful at the warehouses and also in arranging the transportable containers.

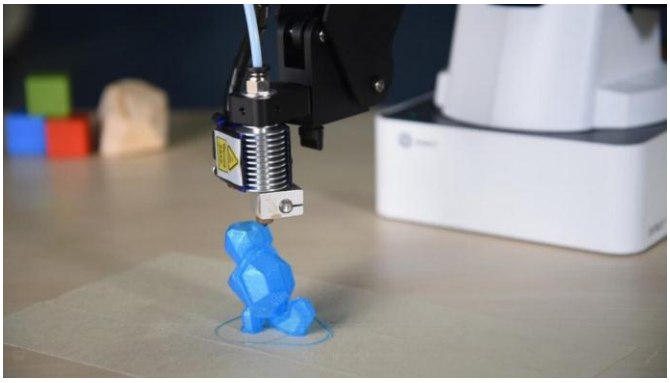

Figure 4. Cool 3D printing robotic arm [7]

B. *3-Dimentional printing*

The method of creating three-dimensional items by the printing or addition of incredibly thin layers of material is known as additive manufacturing, or 3D printing. It is extensively utilised in quick manufacturing, rapid prototyping, healthcare, dentistry, orthopaedics, jewellery, and architecture, and its application in additional fields is constantly expanding. [8]Digitally produced 3D items can be designed or constructed using computer-aided design software, scanned using 3D digitising equipment, or created by taking pictures of the object's exterior. The format is translated into extremely thin horizontal slices and consecutively printed one atop the other to generate the finished product. The digital form elements that hold the essential data direct the three-dimensional printer, which guides the format. Figure 4 shows a dobot building a 3-dimentional model.

To create the required shape and the appropriate item, processes including modification, moulding, alignment, and combination are used. [7]The dobot Magician is similar to many other 3D printers on the market and is accurate enough to produce things with fine details. Dobot can also print in multiple colours because to its twin extruders. Furthermore, it works with well-known open-source 3D printing programmes like Repetier Host and Pronterface.

C. *Writing and Drawing*

Figure 5. Robot arm Writing and Drawing using a pen [7]

Because of its exceptional precision and stability, the Dobot Magician can draw smooth lines. Customized artwork may be sent into Dobot's software to be translated to code and then drawn on paper by the arm. Similar settings can also be used for custom text. It may be a great ally for creatives. A robot arm can also be used for calligraphy, portraits, and much more.

I used Dobot Studio application for writing and drawing. It is very easy to use. Just select the text or the drawing and place it properly between the coordinates. Then, adjust all the three axis properly as per the sheet placed beneath the pen and it's all set. PCB designs can also be created on a copper plate for project purpose.

D. *Laser Engraving*

[7] Dobot Magician can engrave not only lines but also shaded sketches of pictures by simply swapping the pen with a laser end-effector. Harder materials like leather and wood may be engraved with its strong laser head. It's a fantastic tool for creating artwork and unique gifts.

Figure 6 shows a dobot engraving my department logo on a wooden plank. [9] Drawing and laser engraving both use the same graphical user interface. Adjust the zero point and direct the laser beam towards the desired material while laser engraving for the first time. Zero point adjustment refers to aligning the laser nozzle's end effector with the surface of the work item being engraved. In essence, the zero point does not have zero value since it makes sure the laser nozzle only contacts the target surface.

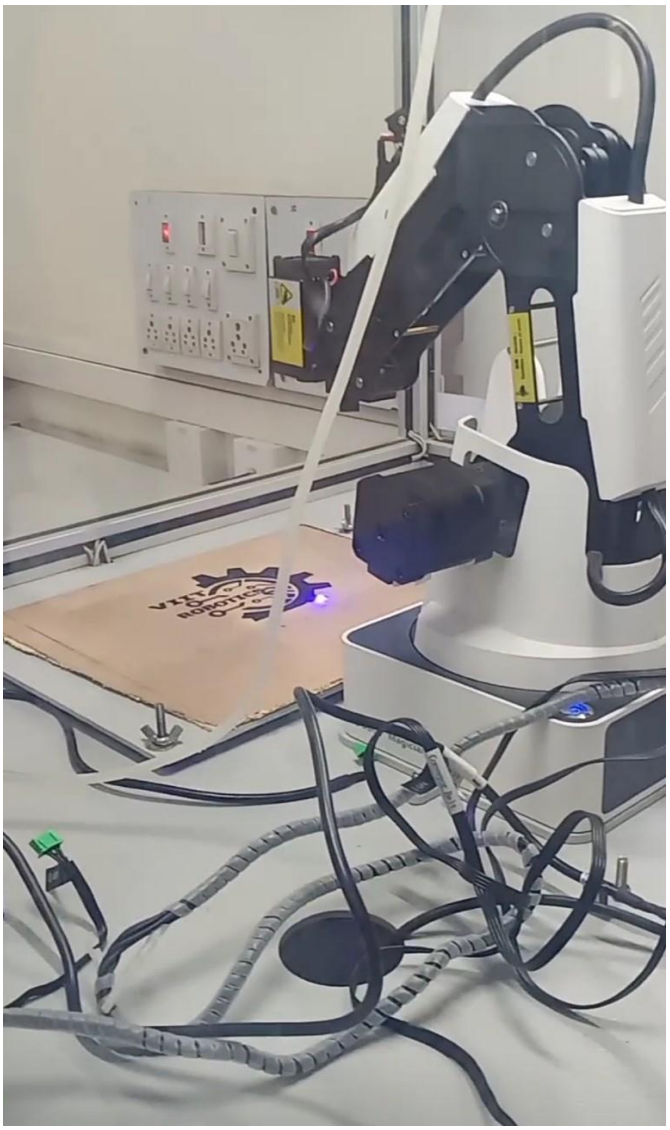

Figure 6. Laser engraving on wooden plank

CONCLUSION

For a better understanding of the applications of the robotic arm, I have successfully read a number of research articles written by various writers. Robotic arms are useful for a variety of industrial and manufacturing processes that call for quickness, accuracy, and repeatability. [11]Today, robotic arms are employed in many different industries and sectors to increase production and yield a quicker return on investment. It offers a high level of accuracy and removes people from risky operations. In addition to everything else, they are now considerably more affordable and frequently marketed with various attachments for specific tasks.

From this article, one can conclude that robotic arm is very useful and is just like a human arm. In this competitive and growing world, where robots will be the future, a lot more research and advancements will be made in the similar fields. Working on a dobot magician robotic arm and experiencing it was like a great accomplishment for me.

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