

Autonomous Robotic Arm for Pick and Drop

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Abstract—In today's world, industry and daily routine tasks are increasingly attracted to and implemented through robotic automation. The goal is to alter how people think about remote controllers for manually driven robotic arms. Pick and place robots are a type of technology used in the industrial industry to execute pick and place tasks. The system is constructed in such a way that it reduces human error and intervention, resulting in more exact work. The system is designed with a simple, flexible, and minimum control technique in mind. There are numerous domains in which human intervention is problematic, yet the process in question must be operated and regulated, which leads to the application of robots. The aim of this project is to design and implement a robotic arm that can pick and drop object by adding voice commands, gesture commands and also by colour and shape detection.

Keywords— Robotics; robotic arm; yolo; open cv; python

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I. INTRODUCTION

The most special form of automation employed today is robotic systems, A robotic system may use numerous sensors including temperature, infrared, colour, mass, etc. A robotic arm is a type of mechanical arm, usually programmable, with similar functions to a human arm robotic arms are implemented in different sizes and forms to accomplish tasks the usage and spread of robotic systems in commercial and non-commercial environments resulted in increased productivity, efficiency, and higher quality of life. Many researchers have developed systems that improve many aspects of people's lives, based on robotics. The aim is to design and implement a robotic arm that can pick and drop object by adding voice commands, gesture commands and also by colour and shape detection. Voice interaction and gesture is crucial because it consists of a user-friendly communication to the robotic system. The purpose of this functionality is initially to successfully recognize voice and gesture commands the shape and colour object detection function was chosen to detect the three basic colours red, green and blue and as far as shape is concerned the square, rectangle, triangle, pentagon and circle were detected. When instructions are given as input(voice and gesture), the preprogrammed controller will give the desired output (pick and place) by using robotic arm this system aims to further improve people's quality of life, and more specifically people with physical and mobility impairments

II. RELATED WORK

Today, various robotic hands are employed in robotics research, each with its own set of capabilities and design requirements. This section provides a summary of several recent extensively utilized and/or influential robotic arms. Several research initiatives in the field of robotics have been aimed toward recognizing human gestures, voice interaction etc.

A. Gesture Recognition Based on Vision

It basically worked in the field of Service Robotics, and the researchers eventually created a cleaning robot. They created a hand gesture-based interface for controlling a mobile robot with a manipulator. A camera will be used to follow a person and identify arm motion motions. A quick, adaptive tracking algorithm allows the robot to easily track and follow a human through changing illumination conditions in office surroundings. It will clean and utilize a camera to track its progress.

B. Voice control of a powered wheelchair

Several researchers have described voice control mechanisms for a power wheelchair, but voice control has yet to become a commercially viable control alternative we utilize voice control in combination with the navigation

assistance provided by "Smart wheelchairs," which use sensors to identify and avoid obstacles in the wheelchair's path. This paper describes an experiment that compares the performance of able-bodied subjects using voice control to operate a power wheelchair both with and without navigation assistance.

III. LITERATURE REVIEW

Color Object Detection Based Image Retrieval Using ROI Segmentation with Multi-Feature Method[2] has been proposed with combination of all three features i.e. texture, color, and shape. The experiment performed on the two standard databases and achieved better precision results. Image Acquisition First step of the new algorithm is to consider query image and stored image .

Pre Processing: In this step, resized the query image and stored image with 192x128 sizes, *ROI Segmentation:* In the present work for segmentation of region of interest different edge detector method are used like Sobel and Canny, *Feature Extraction :* The HSV color space is progressively appropriate for human eye recognition. The human eye can't recognize an expansive number of hues in the meantime; shading quantization is utilized in this strategy.

Design and Implementation of a Robotic Arm Assistant with Voice Interaction[1] presents a voice-controlled robotic arm, capable of detecting and delivering objects to the user. Here the shape, color object detection and voice interaction are used. The shape and color object detection function was chosen to detect the three basic colors red, green and blue and as far as shape is concerned the square, rectangle, triangle, pentagon and circle were detected. The implementation of the voice recognition system was based on the Speech Recognition library. The user is continuously informed with voice messages when the system is ready to execute commands and at the start and finish of each action performed by the system. *Algorithm:* YOLO algorithm employs convolutional neural networks (CNN) to detect objects in real time. YOLO is a predictive technique that provides accurate results with minimal background errors.

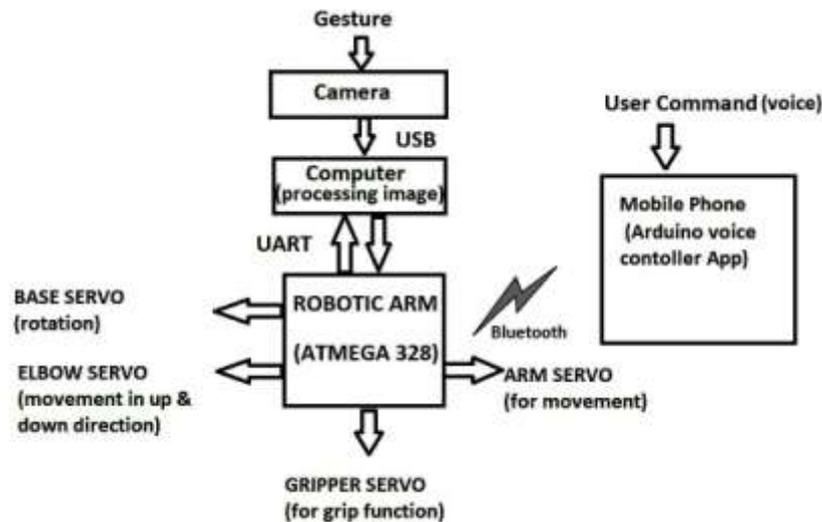
Industrial Robot Control by Means of Gestures and Voice Commands in Off-Line and On-Line Mode[3] is a method of controlling an industrial robot with the use of gestures and voice commands. It uses Kinect v2 module to control the robot. A number of tests were carried out to verify the correctness of the robot's reaction to gestures and voice commands. Tests were conducted using a digital twin and a real robot. Both single movements and complex tasks (e.g., pick and place) were tested.

IV. METHODOLOGY

Voice interaction and Gesture is crucial because it consists of a user-friendly communication to the robotic system. The purpose of this functionality is initially to successfully recognize voice and gesture commands. The shape and color object detection function was chosen to detect the three basic colors red, green and blue and as far as shape is concerned the square, rectangle, triangle, pentagon and circle were detected. When instructions are given as input (voice and gesture), the preprogrammed controller will give the desired output (pick and place) by using robotic arm

There are 3 inputs. First, for the color identification, a camera is placed. It captures the picture and offers the pics to the processor. The processor we use here usage is laptop. Here the inputs are transformed into string formats and end results are given to the Arduino through UART (serial communication). The code for every color is fed in the Arduino and this makes the servo to move accordingly and places the item in accurate location.

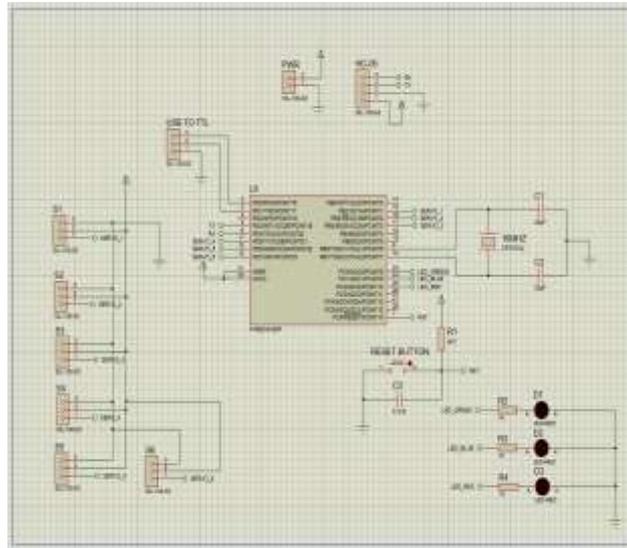
If we use gesture as inputs, it works through counting the finger. If one finger is raised up, a corresponding color given to that gesture. Likewise, each color is assigned. This is fed in the Arduino and the servo rotates and places the item in correct location. A Bluetooth module is attached to the Arduino. This is attached by using of UART protocol. The voice we supply reaches the Arduino in string format. The data are already fed in the Arduino. Those data are compared with our voice input. If this voice input suits with the data's found in Arduino the servos are rotated accordingly. If this doesn't suit, the output may be given as invalid data command



A. CIRCUIT DESCRIPTIONS

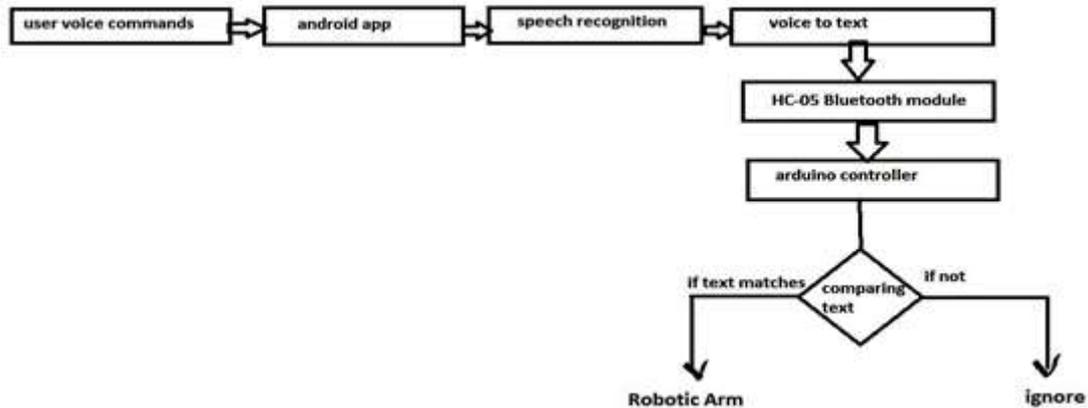
The main controller used on the Arduino uno is the at mega 328A default reset button is present in the Arduino board. A pull up button is pulled from the reset button and a resistor is connected (4k7). A capacitor is used for filtering. The body can be made reset by pressing the button. Power supply used is 12v. Servo motors, Bluetooth module used here is of 5v. So, we need to convert the 12v to 5v. Therefore, we use a buck converter. This drops the voltage to 5v.

In this process we first captured the frame in live. Then converted the RGB frame into gray scale image. Then after preprocessing method of noise reduction, by using Gaussian blurring the frame were converted to binary image. Contour drawing is done thereafter. Once the above process completed, the hull and defect are found out by using the function cv2 in OpenCV. Based on the number of defects the gesture can be find.



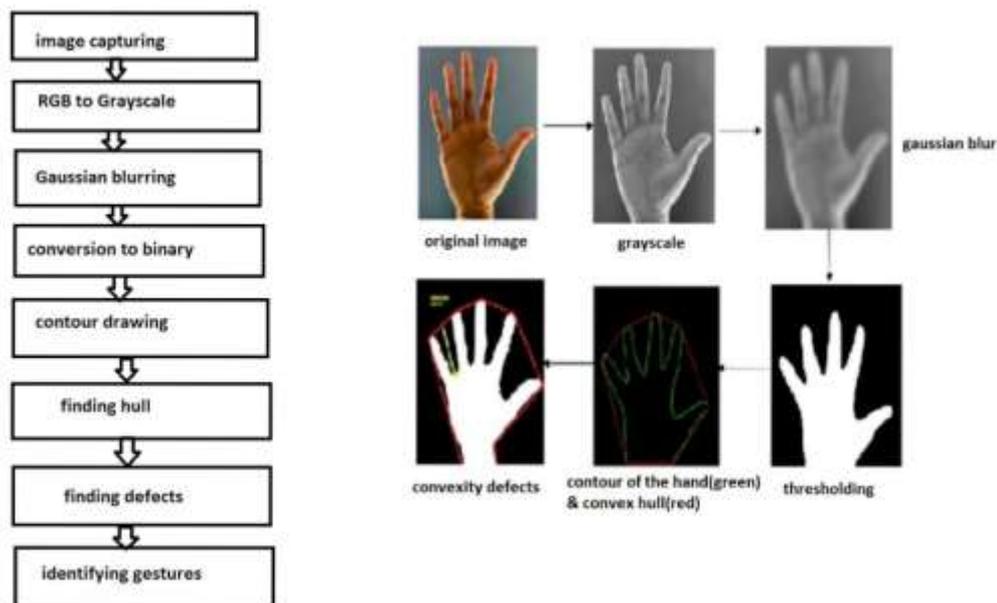
B. VOICE INTERACTION

To realize this project, we bring many contributions. One of our inputs is voice. Enter the voice command provided to the Bluetooth module and the Arduino voice control app in the phone acts as an interface. For this, we give our voice commands. The speech recognizer takes input voice commands and converts them to text format and it is fed to the arduino in string format. Here it will parse the string format and check if the given input is present in the built-in library. Finally, it was inserted into the robot arm



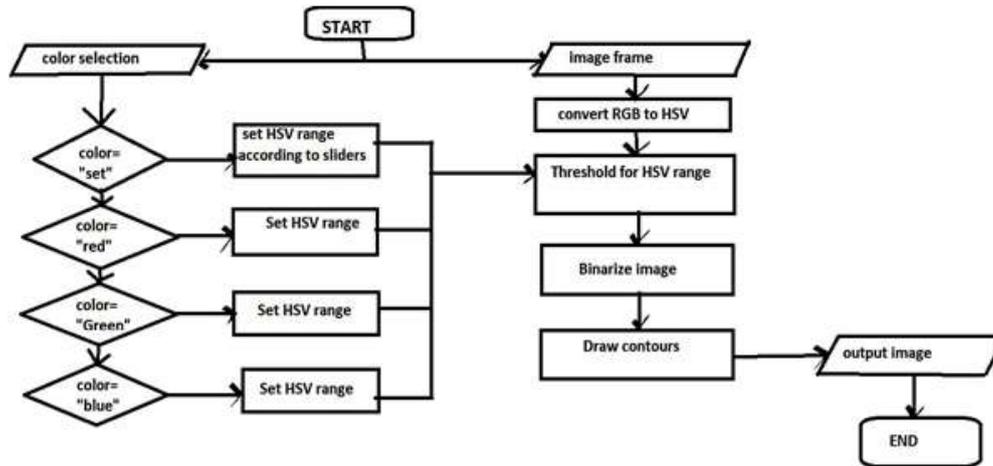
C. GESTURE CONTROL

For the gesture control, we take the live photo first. For shooting we use camera. Here RGB image format is converted to grayscale image. In RGB format the noise is higher, so we convert it to grayscale. But in the gray scale, there is Gaussian noise. This is eliminated by Gaussian blur. Next, we will convert it to a binary image. Here we provide zeros for main and one for background. Then contour drawing is done. The lines are drawn through the fingertips and we find the defects. The space between the fingers is identified and these are called the defects. This is meant by finding the defects. Finally, the output is displayed based on the defects



D. COLOUR SORTING

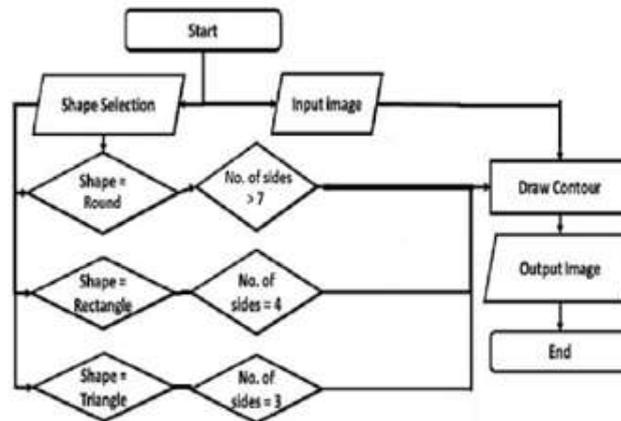
For color sorting, the input can be voice or gesture. If specified as a language, the input will be through the Arduino voice controller. Otherwise, it will be input in real time through the camera. The input image is divided into frames. Second, RGB is converted to HSV because RGB contains only the details of the primary colors, while HSV has a wide range of colors also the HSV space allows for more precise color selection. The three-color thresholds are already predefined and the thresholds are checked. The one with the highest threshold color is detected as the input color. The image is then converted to a binary value. This transformation makes it easy to separate the object from the background. Next, to avoid the external environment the contours are drawn. Then it identifies the exact color and gives the output



E. SHAPE SORTING

First, the input image is given. Then contours are drawn.

Depending on the number of sides, corresponding shapes are detected.



V. RESULTS AND DISCUSSIONS

This section discusses the system designed for this project; it shows the results acquired by testing the system; analyze the results to contextualize them. The completed system consists of the robotic arm, the user interface, and the frame, consisting of the camera mount and the workspace for the robotic arm there is the video feed which displays the objects that the robotic arm targets. At the bottom of the interface, we see the parameter selection tab, which includes three drop down menus for color, shape, There are the color sliders that are used to manually set HSV value for the object to be sorted to the right of that. To evaluate the robotic arm prototype, we performed several experiments using different objects. A special area was set up to meet the requirements of the workspace, lighting, and background color of the objects. Objects capable of being detected by the available recognition functions were placed in the surrounding area of the arm, the object detected by the input of voice and gesture , sorting of object by its colour and their shapes



VI. CONCLUSION

This paper presents a design and implementation of a robotic arm operated using voice-control and Gesture control, this allows users to determine their desired object, which is then picked up and placed by a robotic arm into the target location, the three parameters used for object selection are three of the primary features based on which sorting is based on the industry, for example the system may use in the food industry for sorting of grains , fruit , and vegetable, in essence , the system may be used in any location were sorting pick and place operation is required capable of detecting and delivering objects to the user. The application allows users to determine their desired object, which is then picked up and placed by a robotic arm into the target location. The three parameters used for object selection are three of the primary features based on which sorting is done in the industry. For example, the system may be used on a dock to sort freights or in an airport for luggage picking. Further applications include usage in the food industry for sorting of grains, fruit, and vegetables. In essence, the system may be used in any location where sorting and pick and place operation is required. The robotic arm assistant is powered by machine vision and voice recognition software. This application allows users to determine their desired object, which will be picked up and placed by a robotic arm into the target location. The application allows users to filter objects based on colour and shape.

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