

## Smart Robotic Arm

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### Abstract

*This is a research study on a smart robotic arm which provides technical information and introduction about it. The robotic arm is an issue which is being researched due to problems being faced in day to day life. Nowadays there are a variety of robotic arms available in the market. This research was done to overcome the real-time problems. This study includes the work of robotic arm and in which field it can be used. Now this arm can be used to overcome some of the real-time problems we face in our daily life.*

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### INTRODUCTION

As the technology is advancing day by day, robots are replacing humans to perform the repetitive tasks. Mainly, this is the invention in which more than two fields such as mechanical engineering, electrical engineering, and computer science engineering are combined to perform different tasks by a single machine. It can be fixed or movable, depending upon the purpose of use.

Now days, in this fast growing industrial age every company needs speed in manufacturing to meet the customer's requirements. The basic objective of our project is to develop a versatile and low cost robotic arm. The arms can be autonomous or controlled manually in number of applications by changing the program of controller; and the structure is designed in such a way that it is capable to perform variety of tasks with great accuracy in kitchen such as cutting, chopping, gripping etc. Our robotic manipulator would be used mainly for industrial and home applications. Here we propose to build a robotic arm which can do work of human arm, i.e., the motors used in making of our arm work on three Degree of Freedom (DOF).

In this new invention, the robotic arm is designed to perform various tasks. And this

arm is built for the kitchen purpose, i.e., it can cut and chop the vegetables, fruits etc. This reduces the time consumed in doing kitchen work. It can be used in more purposes. The robotic arm can be fixed or mobile (i.e. wheeled) and can be designed for industrial and home applications. It will work on DC motor that will acquire half of horsepower. This idea of the arm is proposed to overcome the problems such as reducing human effort, and to have accuracy [1].

### PREVIOUS WORKS

Kamatsu Ltd. previously worked on this issue in 1986 and made an arm which was usable for an industrial robot which was able to improve the reconfigurability of the robot to distinctive angles and portions of the workshops where work was done. After some years in 2006, Rodriguez *et al.* adapted this to another level by using infrared sensors to control its movements; and by using Visual Basic, they developed to have a graphic interface. But there was a flaw in this that it can only be controlled in limited range [2, 3].

### THE ROBOTIC ARM

Figure 1 shows the overall setup of the robotic arm which can be controlled by a personal computer by installing Arduino software in it or it can be controlled at a large distance with

the assistance of an app wirelessly (Figure 1). It can also be controlled by a person manually with help of arduino boards and personal computer [4].

These arms are built to overcome the problems we face in our daily life in kitchen, like cutting, chopping, mixing etc. These arms are able to do work of kitchen with accuracy and can lift weight up to 2 kg. These are made in a way so they can be fixed easily with minimum cost and require very less amount of maintenance [5].

This robotic arm consists of two servo motors, four DC motors, and a pair of gears which help this arm to move freely in any direction without any obstruction. This robotic arm works on three Degrees of Freedom (DOF) which is great thing according to do work in kitchen and this arm can also be used in hotel industry for saving time in kitchen work. This arm is controlled by arduino board using arduino software installed in personal computer systems [6].

## EQUIPMENT USED

- **Arduino**

It is an open-source electronic prototyping platform enabling users to create interactive electronic objects.

- **Servo Motors**

A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or servomotor is not widely used in industrial motion control, but it forms the basis of the simple and cheap servos used for radio-controlled models.

- **L298n Motor**

The LN298 is a high voltage, high current, dual full-bridge motor driver designed to accept standard TTL logic levels and drive inductive loads.

- **Gear Box**

The gear box is the second element of the power train in an automobile. It is used to change the speed and torque of vehicle according to variety of road and load condition.

- **Side Shaft Geared Motor**

Side shaft DC gear motor is suitable for large robots/automation systems. It has sturdy

construction with gear box built to handle stall torque produced by the motor [7].

This arm is made at a very low cost as it can be made on large scale because the material we have used is easily available but needs some labor to make it. We can use this arm in hotel industry which is beneficial for this industry as it is one time investment and takes very low amount on maintenance. This will help them doing their work faster and with great accuracy without any hassle.

## WORKING

As we said robotic arm can be operated through an app. It has a GUI which helps a user to use this app efficiently and conveniently. It allows user to choose whether he/she has to cut fruits or vegetable; if fruits, then which type of fruits; if vegetable, then which type of vegetable and how it should be cut. If user wants to chop something, there are further more options available in this app which are communicable through far away.

This arm is able to cut all types of fruits and vegetables. In future, with the help of Artificial Intelligence and Machine Learning, we can also improve this efficiency by using it with image detection algorithms to do this work more accurately and at a good rate [6, 8].



**Fig. 1: Robotic Arm.**

### Elements Used in Working

There are few elements which are used to make this arm working:

#### DC Motors

DC motors were used to rotate the elbow of the arm to a certain angle to which a normal cannot move his/her arm easily which allows this arm to do things in a better way (Figure 2).

#### Servo Motors

Servo motors are used to in the wrists of these arms to rotate the wrists at 360° which we cannot do. So it is also a new feature which will help us to work in our kitchen or in hotel industry (Figure 3).

#### L298n

It is also a motor which allows the hands and arms to lift the load so that gripper could hold it tight to make a cut properly (Figure 4).

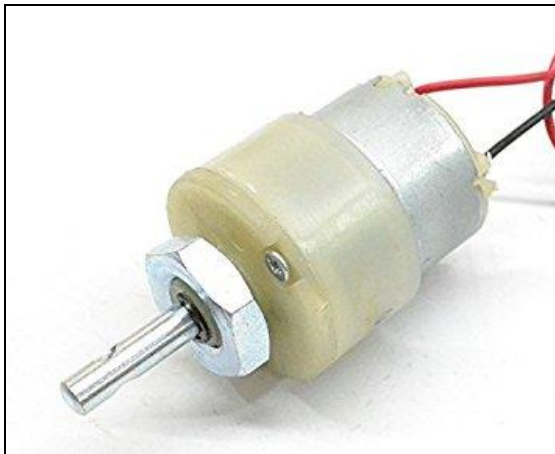


Fig. 2: DC Motors.



Fig. 3: Servi Motors.

#### Arduino Board

It allows us to program the arm easily and in a very nice so that it improves the function of arms and makes it work. This board helps us to convey our messages to arms to do what and after how much time (Figure 5).

#### Gears

These gears help arms to move freely even with a loaded gripper which provides us accurate cutting with a good rate of speed which saves time.

#### Arduino Software

This software is installed in the personal computer systems through which we give commands to the robotic arm on which fruit to cut or which vegetable to cut. To give commands to arduino boards we have to make a program in arduino software (Figure 6).

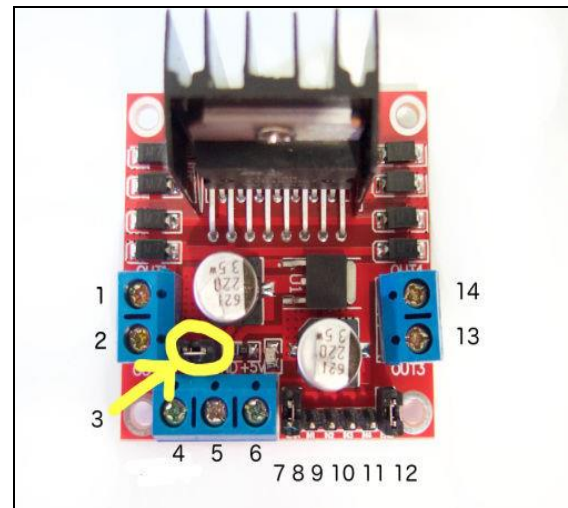


Fig. 4: L298n.



Fig. 5: Arduino Board.



Fig. 6: Arduino Software [4, 6, 8, 9].

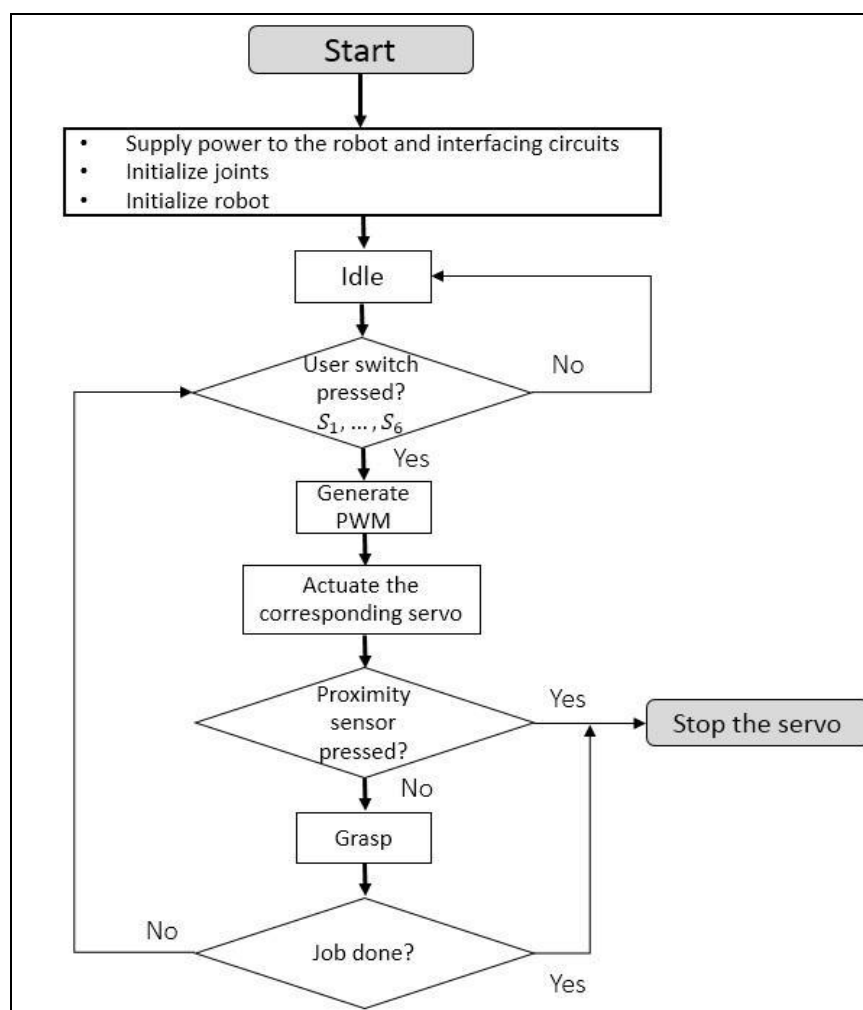


Fig. 7: Flowchart of Robotic Arm.

Figure 7 is a flow chart of this robotic arm through which it is easy to understand how the whole process works. As the proximity sensor is used to sense the objects in front of arm. It activates when some job is given to the arm. It makes sure that if there is any human body part coming in between the cutting and chopping task, then it will sense human being in between, so it will be automatically stopped until human being is not replaced [1, 8–10].

So, this make sure that it will not harm any human being in between its task but when we work in the kitchen, sometime we get a cut while cutting things; so like these are some common injuries we get in our home but while working with this arm, there is no chance of having these types of injuries.

## RESULTS

This arm is designed to be used in kitchen and hotel industry and it is able to cut and chop fruit and vegetables with accuracy and speed, without harming anybody.

## CONCLUSION

This robotic arm is a successful development as we are moving to wireless from wired which is much easier way of controlling/communication with less hassle. The App was invented to provide a facility to the user of having wireless feature with which we are having a great GUI as it is important for the user to communicate with the system. Last but not the least this app helps the user to choose which fruit/vegetable has to be cut and in which manner and also helps in controlling movement of the robotic arm.

As the technology is growing day by day, in future we can enhance this wireless system with the help of Artificial Intelligence and Machine learning. The algorithms can find many things to enhance like image-detection, object-detection, train data etc.

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