VOICE CONTROLLED ROBOTIC ARM FOR KITCHEN APPLICATION

[1]N Dhana Lakshmi, [2]P M Sainath Rao
[1]Assistant Professor, [2]Student
[1] Electronics and Communication Engineering Department
[1]Chaitanya Bharathi Institute of Technology, Hyderabad, India

Abstract : A robotic arm is a programmable mechanical arm that is comprised of segments connected by rotary and linear joints. These joints allow for controlled movement. Initially the use of robotic arms was primarily confined to industrial applications like assembling cars in automobile industry. But now with the advancements that have been made in the field of robotics their use for domestic needs is also gaining momentum. One such proposition is to build a fully automated kitchen powered by robotic arm. This project tries to contribute to that very idea by acting as one of the stepping stones. This work is intended to help mothers in particular and amateur cooks who mainly follow recipes in general. In this a robotic arm is proposed to be designed and implemented to assist a cook by readily providing her/him with various ingredient containers from shelves on just a voice command. Here the Arduino is going to control servo motors which drive the joints of the robotic arm. The cook's voice commands are given to the Arduino via a Smartphone over a Bluetooth network. The cook just needs to utter the names of the ingredients specified in the recipe in order and subsequently the arm picks up the respective ingredient container and places it infront of her/him.

***IndexTerms* - Robotic arm, Ardunio UNO**

I. Introduction

A robotic arm is a type of mechanical arm , usually programmable, with similar functions to a human arm; the arm may be the sum total of the mechanism or may be part of a more complex robot. The links of such a manipulator are connected by joints allowing either rotational motion or translational (linear) displacement. The links of the manipulator can be considered to form a kinematic chain. The terminus of the kinematic chain of the manipulator is called the end effector and it is analogous to the human hand.

The end effector, or robotic hand, can be designed to perform any desired task such as welding, gripping, spinning etc., depending on the application.

II. Literature Review

A project done by C. W. Chen *et* al [1] presents a design of controlled robotic arm with myo electric and body action signals. The implementation uses the sensed signals, via the signal processing of ARDUINO UNO R3 development board and NUC140VE3CN development board (ARM processor), to control the robotic arm wirelessly. The proposed design can be used in the dangerous operation environment. The users can contact less control the robotic arm safely. And it can operate specified action repeatedly and accurately for factory manufacture. The rotative angle of robotic arm controlled by Servomotor is decided by pulse width modulation signal obtained from microcontroller via Bluetooth 4.0 wireless technology. The pulse width modulation signal obtained from microcontroller is decided by the sensors located on the human's arm or sensor glove.

A project done by McMorran, Darren *et* al [2] represents a Flexible automation systems which provide the needed adaptability to serve shorter-term projects and specialty applications in biochemical analysis. A low-cost selective compliant articulated robotic arm designed for liquid spillage avoidance is developed here. In the vertical-plane robotic arm movement test, the signals from an inertial measurement unit (IMU) and accelerometer were able to sense collisions. In the horizontal movement test, however, only the signals from the IMU enabled collision to be detected. Using a calculation method developed, it was possible to chart the regions where the obstacle was likely to be located when a collision occurred. The low cost of the IMU and its easy incorporation into the robotic arm offer the potential to meet the pressures of lowering operating costs, apply laboratory automation in resource-limited venues, and obviate human intervention in response to sudden disease outbreaks.

III. Methodology

Fig 1 shows the block diagram corresponds to controlling circuitry that controls the rotation of motors positioned at different places of a Robotic Arm. Motors are used to control the movement of Arm, one for shoulder, one for elbow and two motors are used to hold the object.

The Arduino is going to control servo motors which drive the joints of the robotic arm. The cook's voice commands are given to the Arduino via a Smartphone over a Bluetooth network. The cook just needs to utter the names of the ingredients specified in the recipe in order and subsequently the arm picks up the respective ingredient container and places it infront of her/him.

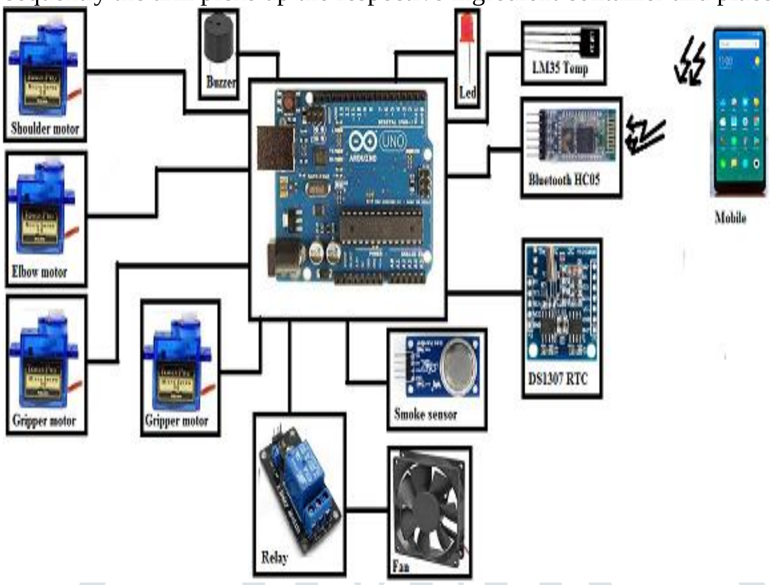

Fig. 1 Block diagram of voice controlled robotic arm

As a safety measure a LPG sensor will be included in order to alert the cook in case of any fuel leakages. A temperature sensor is provided to control exhausting fan in kitchen. A real time clock is provided for remainder shown in Fig 2. This will thus greatly mitigate the task of our mothers in particular and amateur cooks in general by cutting down their efforts. This concept can further be enhanced to expand its application to restaurants.

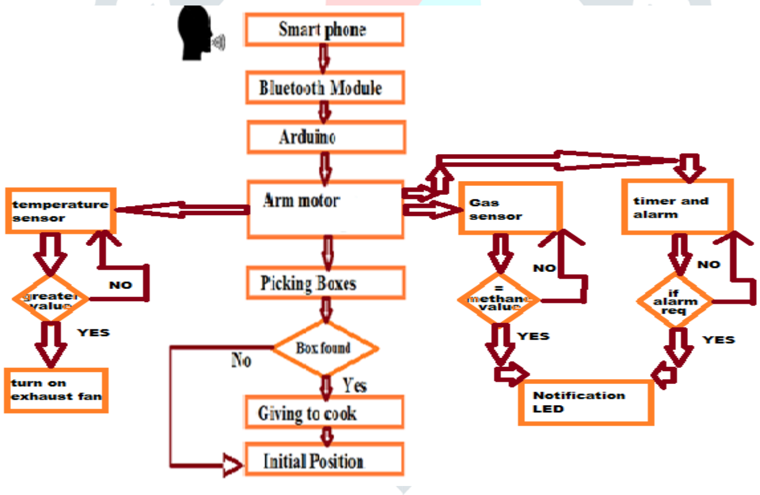

Fig. 2 Working of voice controlled robotic arm

IV. EXPERIMENTAL RESULTS

Motors of the arm are controlled by using three switches (i.e, SW Blue, SW Green, and SW Yellow). In programming for each switch we assigning different angles so that motors can rotate in that angles and pick corresponding ingredient boxes. When the ingredient box is picked from shelf it gives to cook and motors comes to its corresponding position.

Fig 3 shows the usage of Bluetooth module (i.e, HC-05) which connected at Arduino UNO. We are using smart phone application to control the motors via Bluetooth communication. In this chart, we are giving three commands Blue, Green, and Yellow. Here a baud rate of 9600 is used which is default rate for communication. For each command we are giving different angles to motors to pick an ingredient. If ingredient is picked then it gives to cook and motors come to their initial positions.

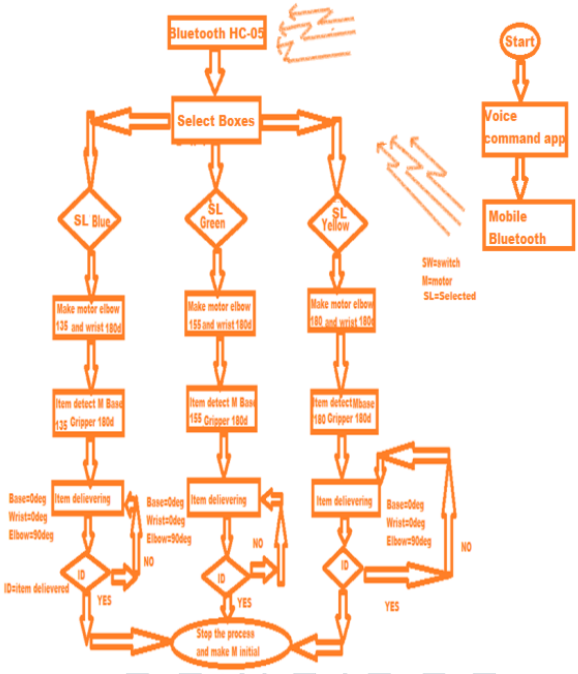

Fig. 3 Flowchart using Bluetooth module

Fig 4 and 5 shows the results using yellow and blue switch in Proteus. The Arduino UNO Rev3 is for controlling the motors by using switches. When we close the Blue switch then Blue selected LED will ON and then the motors will move according to programming angles specified by controller. Similarly when we close Yellow switch then Yellow selected LED ON and then the motors will move according to programming angles. Whenever item or ingredient received then item received LED will ON. When we open corresponding switch then motors go to initial positions.

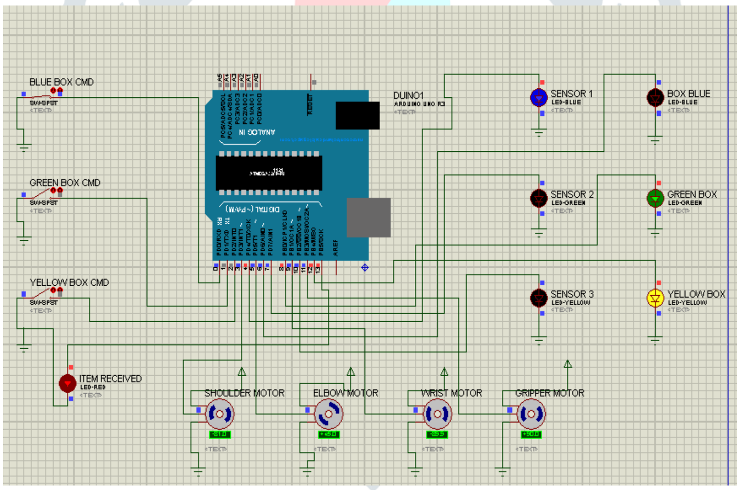

Fig. 4 Schematic diagram showing yellow switch

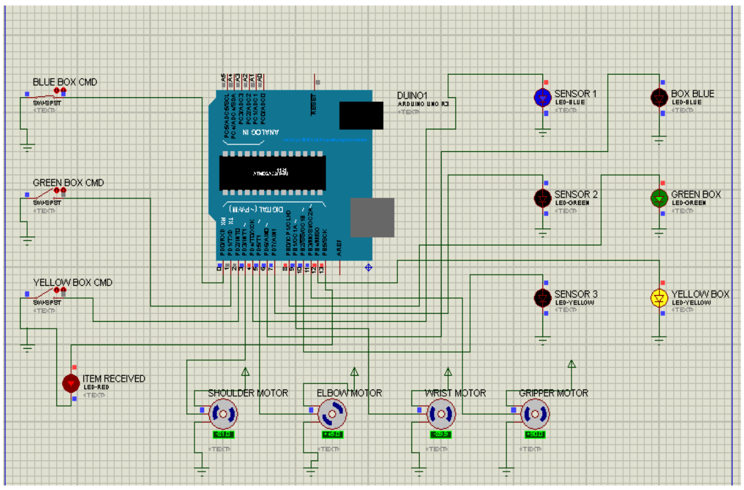

Fig. 5 Schematic diagram showing Blue switch

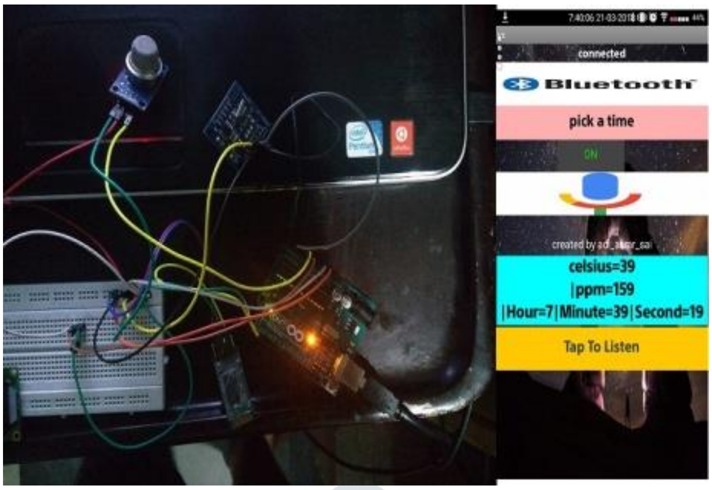

Fig. 6 Sensor combined results on Android App

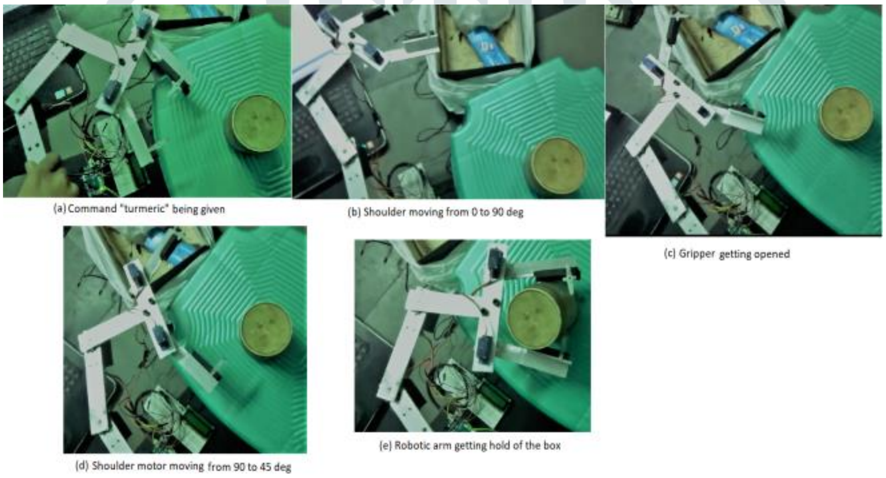

Fig. 7 Picking up the Box

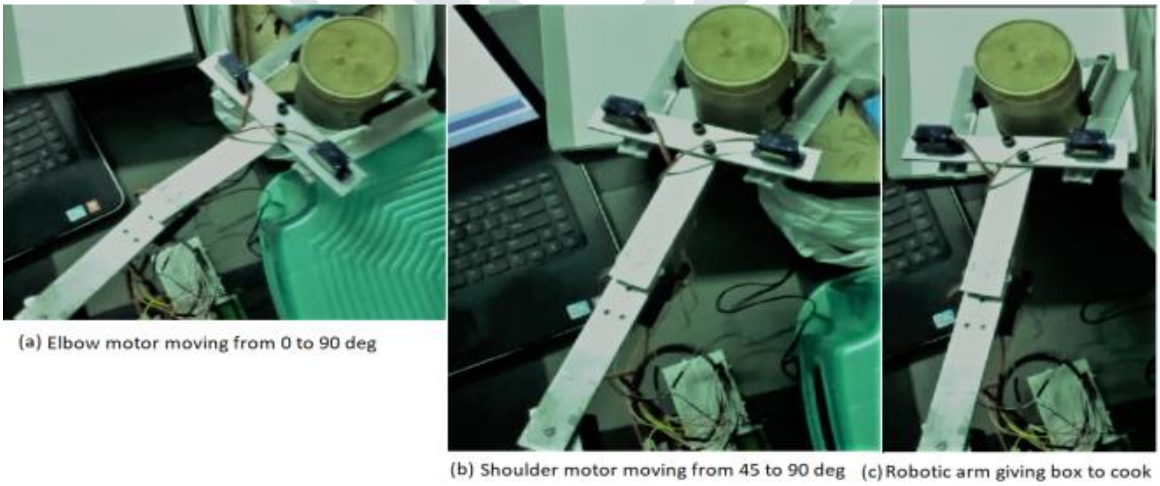

Fig. 8 Delivering the Box

Fig 6 and 7 shows the basic robotic arm. Here we are using the aluminum as a metal for our robotic arm. Two motorsare MG995 which is using at base and elbow for high torque and other two motors are SG90 which are connected to gripper. Whenever we give the voice commands to robotic arm it gives the ingredient boxes to cook in kitchen.

IV. CONCLUSION

The design and control of "Robotic Arm for kitchen applications" is successfully designed, tested and a demo unit is fabricated. Since it is a demonstration unit, a small and low power unit is built which can be able to pick up various low weights ingredient containers on just a voice command. But the number of containers that can be picked is quite limited. In this we tried to keep things as simple as possible by building an application from where everything can be done and controlled. As it is a demo unit the LCD screen to set remainders is implemented virtually via the above mentioned application. The design done in Proteus applies to a more powerful practical unit also. Thus we were successfully able to build a prototype model which could fulfil our aim and objectives of mitigating the task of mothers and amateur cooks.

The arm may be made mobile to improve its range. Fixed position pick up can be replaced by Colour code or barcode pick up for enhancing capability.

REFERENCES

[1] C. W. Chen, R. M. Hong and H. Y. Wang,"Design of a Controlled Robotic Arm," 2016 3rd International Conference on Green Technology and Sustainable Development,(GTSD)Kaohsiung, 2016 ,pp. 22-23.doi: 10.1109/ GTSD. 2016.15.

[2] McMorran, Darren; Chung, Dwayne Chung Kim; Li, Jonathan; Muradoglu, Murat; Liew, OiWah; Ng, TuckWah (2016-02-16). "Adapting a Low-Cost Selective Compliant Articulated Robotic Arm for Spillage Avoidance"doi:10.1177/2211068216630742.ISSN 2211-0682.PMID 26882923.