

# Modeling and Development of Multi-Arm Robot Using CATIA for Pick and Place Operation to Adapt Ease in Work

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**Abstract** - In General, now days, robots are used in many industries. In this paper, Multi Arm Robotic System (MARS) is developed and manufactured. Only one person controls this MARS system so reduction of work force is achieved. Arm modeling is carried out by using CATIA V5. The different electronic components like Arduino, Bluetooth module HC05, etc. are used to obtain the automatic working of the designed robot. Different arms are used for the pick and place operation, drilling operation and tapping operation. The program used for Arduino consists of use of Arduino IDE. Here modeling of multi arm robot in CATIA is given. Part making CATIA file is converted for the CNC laser cutter machine file hence making the different small parts. Assembly of all parts combined. This project has more number of beneficiaries. It reduces the human efforts. In addition, main major benefits that only one person can control more number of robots at a time. It can be operated from place far away from the controller.

intelligent manufacturing technology. The current paper presents a research conducted by the author in order to develop an effective tool is voice controlled four arm multipurpose robot. Each of those research domains is its own challenge, solved and unsolved problems there for they are usually dealt separately. Human and machine voice communication has been the subject of the research for many years.

Robotic arm developed using 6 degrees of freedom a predefined trajectory with much better accuracy and precision value. In this the movement of the robot is controlled using speech commands. i.e. the movement i) robot body, ii) the pick and place arm, iii) the voice controlled drilling arm with maximum different five to six tools, iv) the voice controlled tapping arm using five to six tools depends upon the voice commands.

**Key Words:** Multi-arm robot, CATIA, pick and place, Arduino

## 1. INTRODUCTION

Industrial robot is some typical mechanical equipment, which plays an important role in industrial production and social development in a practical. Due to some industrial sector development in an infrastructure, today we need to get some amount of input or resources for industrial sector. As we know, many industries are coming forward to developing the urbanization of their systems. As a demand of these companies, there is a need to develop new innovative techniques. which content prototype of a voice controlled robotic arm to reduce the human efforts for continuous demonstration to give services. In this arm are less amount of input we get a very precise amount of work with accuracy, Palletizing, handling, drilling and tapping purpose. Industrial robot application positioning and accuracy in a critical performance index recently with the development of automation and

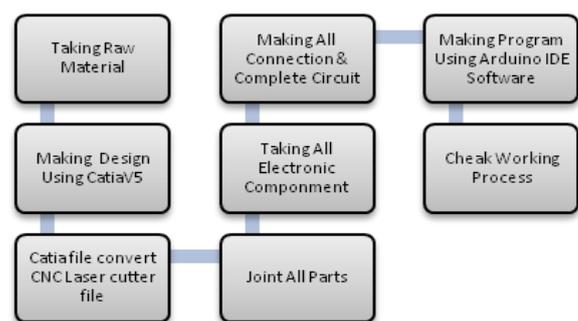


Fig.01: Block Diagram of All Process

## 2. CONSTRUCTION

In this model to the robotic arm, have the two-robotic arm, a one drilling arm, and one tapping arm. In this pick and place arm this is take object from maximum 30 to 35 cm distance long. Both pick and place arm has been six degree of freedom. Due to this arm takes the any side to take the object or jobs. Another is a drilling arm. This arm is drilled to the object at given depth this is controlled to the

Bluetooth voice command. Then another arm is tapping and boring arm. This arm is activated to the third arm picked object to the place the front of the last arm then this arm is activated. Create the given function like as tapping, boring.[1][2]This arm has the uses the directly to the industry .the drilling arm is automated adjusted this is adjusted to the sensor .the this all of the is adjusted to the and controlled to the

- Arduino mega2560
- Arduino shield
- Bluetooth module hc05
- Servo motors
- L7905cc

In this to using the different drilling tool like 5mm drill, 5.5 mm drill, 6mm drill, 6.5 mm drill,7mm drill,7.5mm drill and another he tapping tool is this to the 2mm bigger [4]. Also used the boring tool .this is a combined all in one.



Fig. 02: Pick and Place Arm

### 3. Arduino mega2560:

Arduino is a control card, which is developed as open sources, with the Atmel AVR microcontroller as a process and additionally with various peripheral units. there has been huge increase is use in recent year due to reason such as being open sources, having easy to use libraries , and having to a many resources for a programming , processing written language and Arduino IDE media are used.

The Arduino mega 2560 R3 card is a micro master based controller card. There are 54 pins to be used as input/output on the card. 14 pins of the them can be used as a PWM output (Pulse Amplitude modulation), 16 pins are the analog input, 4 of them as UART (Universal crushing receiver / transmitter) serial commutation. The Arduino mega 2560 R3 card features such as a 16 MHz crystal oscillator, 256 kb

flash memory. Eight KB SRAM, four KB EEPROM, figure shows Arduino mega 2560 R3 card.

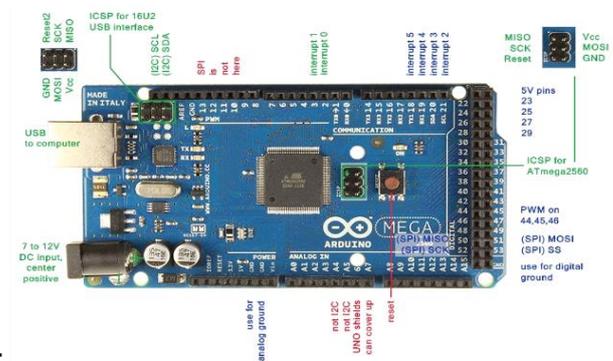


Fig. 03: Arduino Mega 2560

### 4. Arduino IDE:

The Arduino IDE is a both code editor and compiler the code can be compiled and loaded to Arduino card. The IDE, which is, can work on a different platform such as windows and Linux, was developed in a java language. Figure shows to the Arduino IDE editor.

The toolbar in the upper part is designed as standard, similar to other compiler programs. It is possible to reach the example made in the Example section under the file tab. pressing the check LAN button on the main screen. The program is compiled. After the completion in the section “Completion Complete” is written and if there are errors in the lower part of black region in writing errors. If there is no error because of the completion. Press the button named r Download l in the upper part of the code.

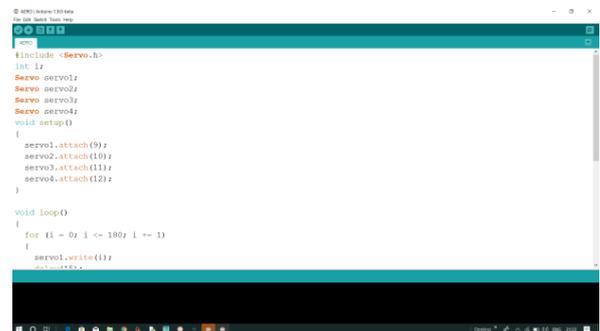


Fig. 04: Arduino IDE Software

### 5. Hc-05 Bluetooth Sensor:

Bluetooth technology eliminates cable ties with the help of the radio frequency (RF) short distance in 1994,

such as mobile phone, PDAs, Headphone, etc. To communicate and exchange data between mobile devices by Ericson it has been developed. The Bluetooth technology used in the 802.15 standard operates in the 2.4 GHz frequency band. Voice and Data transmission between Bluetooth powered which range between above 10 and 100 meter them [7]. The hc-05 Bluetooth sensor is a sensor that allows wireless communication between devices using Bluetooth technology. The HC-05 Bluetooth sensor support Bluetooth 2.0 operates in the 2.4 GHz frequency band and operates at a communication distance of about 10 meters. Scopes are used in both hobby and project studies. There is 26 MHz crystal oscillator. REF Antenna, 8 MB flash memory, 6 interactive pins (Status, IX, GNDF, VCC, and EN) figure shows example connection between the HC-05 sensor and Arduino Mega [9].

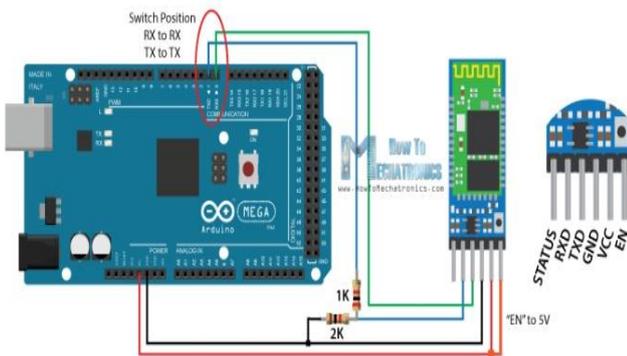


Fig. 5: Modeling (Courtesy: How to Mechatronics)

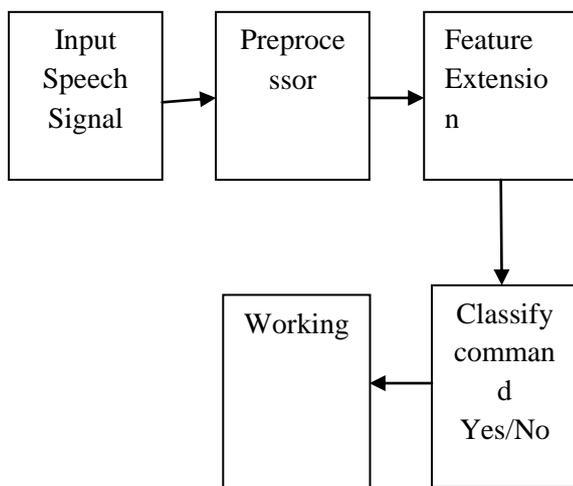


Fig.06: Block Diagram for Voice Command

In this modeling CATIA v5 software to use making a design. CATIA means computer added three-dimensional interactive application. This software is multi plate form software suite computer aided design (CAD), computer aided manufacturing (CAM), and computer aided engineering (CAE), PLM and 3D developed by dassaults Systems Company. CATIA is started as 1977. CATIA can be applied to a wide variety of industries.

CATIA used to reason is this CATIA tool is in the design of the various object as arm, end effector, chuck, base, and many part etc. much as other CAD systems, this tool perform many function such as basic volume. This is also used as the perform a mesh analysis give to any load. It is also used as the numerical control for a drilling machine, tapping machine, and milling machine. In this CATIA following toolbar are used 1) start, mechanical design, part design 2) sketcher 3) sketch based features 4) view 5) product structure tool 6) view and different tools are use the complete design is show In Fig.

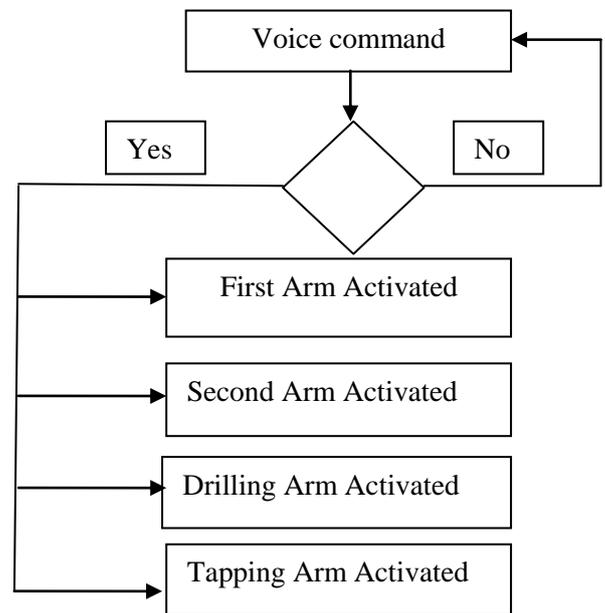
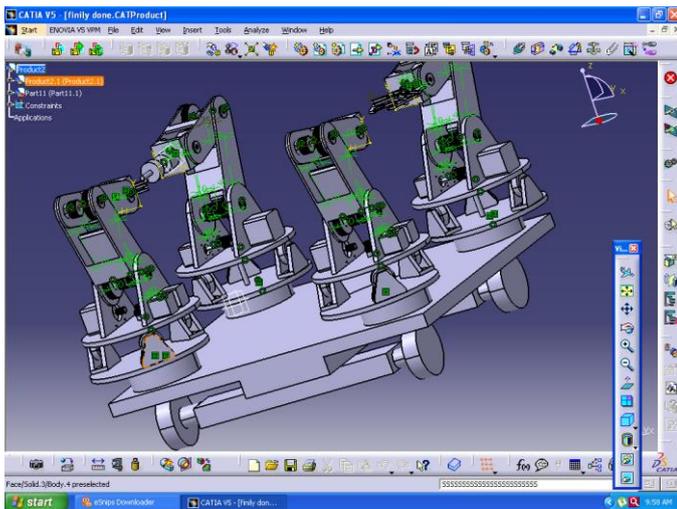
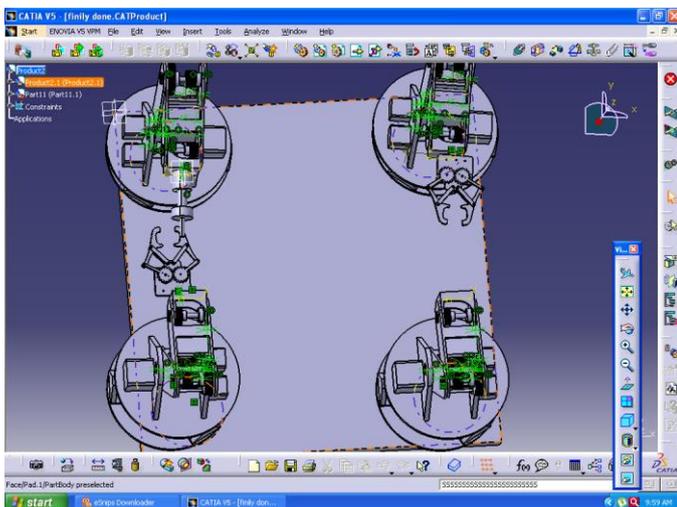


Fig.07: Flow chart Of Process of voice command



**Fig. 08: Modeling-Using CATIA**



**Fig. 09: Arm Design**

**6. Manufacturing process of each component -**

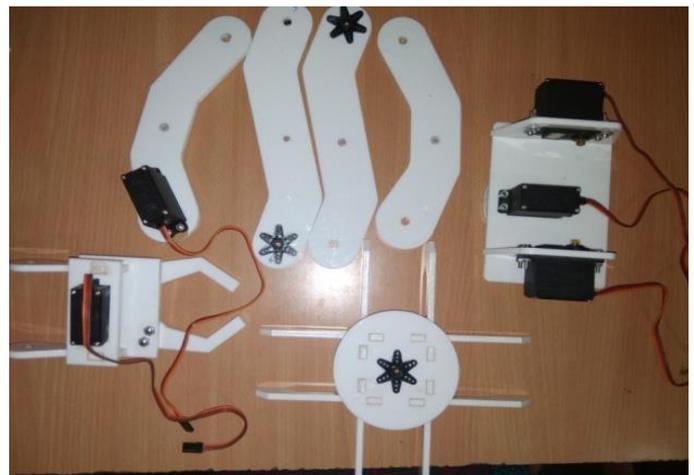
In this process, the CATIA design is converted into laser cutting design file and then cut the material. In this laser cutting machine materials are involved a motion of control systems to follow a CNC or g-code of the pattern to be a cut onto the material. The focused laser is directly in the material, which is then either melts, burns, vaporizes away or is blown away by the jet of gas leaving an edge with a high quality surface finish. The industrial laser cutter is used to cut flat sheet material as well as the structural or piping materials.

The laser cutting a mainly a three types CO2 laser, neodymium and neodymium yttrium aluminum garnet (ND:YAG). The laser cutting have a

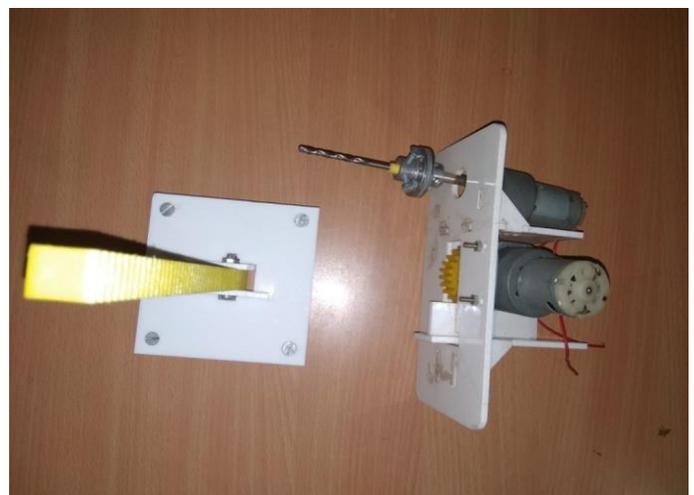
different method 1) Vaporization cutting 2) Melt and blow 3) Thermal stress cracking 4) Stealth dicing of silicon wafers 5) Reactive cutting. The laser cutting machine figure is below.



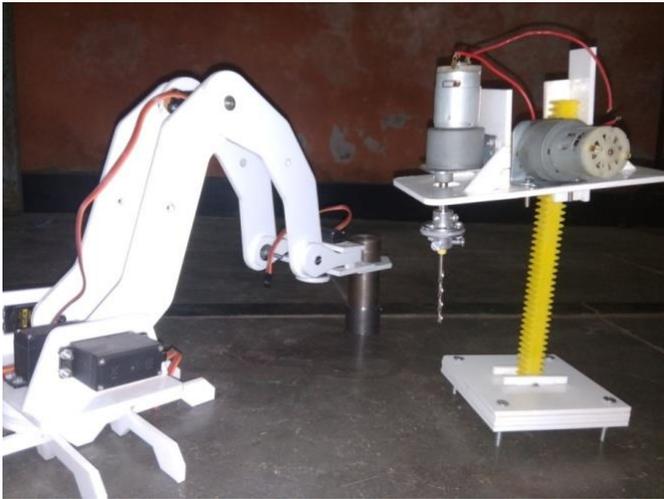
**Fig. 10: Laser Cutting Machine**



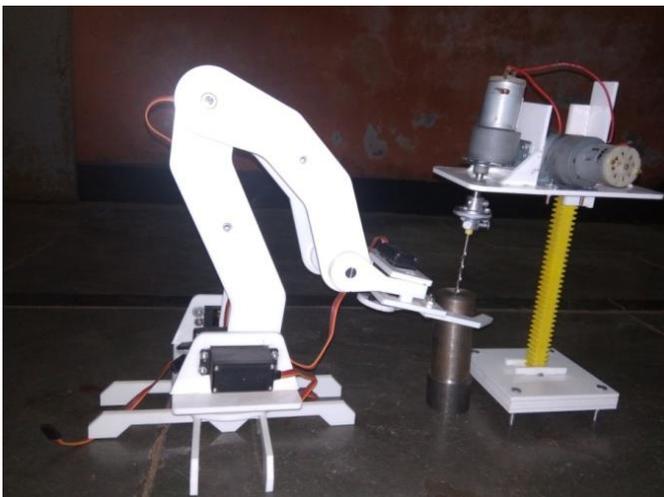
**Fig. 11: Manufactured Parts of Model**



**Fig. 12: Manufactures Model**



**Fig. 13: Motion-1 Pick the Material**



**Fig. 14: Motion-2 Drilling the Material**

The above figure shows that the motion 1 is the pick the material or job at citron distance and put at the front of drilling arm. Then motion two indicates that at a citron time this drilling arm drill to the material .And then also similar that the motion 3 and four. This motion to at a drilling material pick the arm place the tapping arm then this is tap the material and then job is ready. In this drilling arm we can use the at one time five different drilled at the any time. In addition, use at the VMC machine.

## 7. Conclusion:

- Multi Arm Robotic System is extensively used in most of the industries.
- Modeling of a multi arm robot is done by using CATIA V5.

- Acrylic material used to develop to multi arm robot.
- Laser cutting technique is highly efficient for manufacturing for this robot.
- Arduino IDE is used for the programming purpose, which gives better results.
- Bluetooth HC05, Arduino mega 2560, servomotor are important component required for smooth or proper functioning of multi arm robot.
- These robots are useful for multitasking operations also it reduces human efforts and human power.

## 8. Future Scope

The above model can developed by implementing Raspberry Pi with this through voice command can be given to robot for its functioning. It increases the communication range.

## 9. References-

1. Meng Fei , Zhang Haiou , Wang Guilan “Application of industrial robot in rapid prototype manufacturing technology”, **2nd International Conference on Industrial Mechatronics and Automation**, 2010, pp-228-220.
2. Yichen ZHANG , Zhiguo LU , Changhui Liu , Yunong WANG “Voice control dual arm robot robot Based on ROS system” , **Proceedings of the 2018 IEEE International Conference on Intelligence and safety for Robotics Shenyang ,China**, August 24-27,2018, pp-232-237
3. Xiaoling Lv Minglu Zhang , Hui Li , “Robot Control Based On Voice Command” , , **Proceedings of the IEEE International Conference on Automation and logistics Qingdao** , China , September 2008,pp-2490-2494.
4. Fariha Musharrat Haque , Asif Shahriyar Sushmit , M.A.Rashid Sarkar , “Design of a Voice Controlled Robotics Gripper Arm using Neural Networks”, **International Conference on Energy, Communication, Data Analytics and soft Computing**, 2017, pp-94-97 .
5. Bojan Kulji, Simon Janos and Szakall Tibor, “Mobile Robot Controlled By Voice” , **International Symposium on Intelligent system And info frmatics**,2007, pp-189-192
6. Peter X , Liu , A.D.Chan ,R. Chen , K. Wing , Y.Zhu, “Voice Based Robot Control ” , **International Conference on Information Acquisition**, 2005, pp-543-547.

7. Bo Cui, Tongze Xue , “Design and Realization of an Intelligent Access Control System Based on Voice Recognition”, **International Colloquium on Computing, Communication, Control And Mangement**, 2009, pp-229-232.
8. S.Azargoshab, A.H. Korayem, Sh. Tabibian , “A Voice Command Detection system For controlling Movement of SCOUT Robot” , **International Conference on Robotics And Mechatronics** , October 23-25,2018, pp-326-330.
9. <https://howtomechatronics.com/tutorials/arduino/arduino-and-hc05-bluetooth-module-tutorial>

## BIOGRAPHIES



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