



# The Design of IOT based Robotic arm with Rover and Camera

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**Abstract.** In recent days, automating the things is increasing dramatically with improving humans necessity works. The technology was already increased with the support of machines and robots that are created in appropriate manner to meet current requirements. Robotic arms work with the pre-installed command by the designer with a certain degree of freedom. In this paper, a design of a robotic arm with a rover has been implemented with desirable features. The design also includes a camera module to view images of objects. This paper simply focuses on the huge development of a device by combining new technology with adding a camera and Google Assistant. A Robotic arm and Rover help in the pickup and placing operations in dangerous environments. Node MCU act as the main system of a device and the whole system is regulated using a Smartphone.

**Keywords:** Rover, Camera module, Node MCU, Blynk app, Motor Driver (L293D).

## 1. Introduction:

Over the past twenty years, automation was developed hugely everywhere in the earth which aims to rise of mechanized robots. Every huge shop where mechanism place is now working with robotic arm and rover to perform different tasks in positions of people. Universal robots can be separated in different section with industrialism and helping robots. [1] Many tiny and compatible machines are robotic arms which are completely work in different sectors and fields of applications like office, hospital operations, and industries object lifting and placing agriculture fields and hazardous environments. [2] The process of developing in different fields and technologies like artificial intelligence and radio frequency transmission these robotic arms are controlled by long distance with help of humans. These robotic arms with rover and camera are currently used in many other applications. Nowadays, some of the tasks are difficult or dangerous for humans to pick and place, like picking up the chemicals placed somewhere and anywhere over the "world" this robotic arm with rover and camera is very helpful in dangerous situations to handle. Node MCU act as the main device to the whole part of the arm and the rover is controlled via our smart "phones" Robotic arm also has its own importance for pick and place operations in all environments. On the other half of Google, assistant and rover have an independent significance to move in any direction. It is a connection of both hardware and software. Users can operate the Rover and Robotic arm using Smartphone to perform different operations from a long distance.

## 2. Project Overview:

The system is made up of Node MCU module which acts as a main system of the device. Our device used some freely available software like Arduino ide. The Micro controller has an ability to control using Wi-Fi. Every movement in rover has moved freely easily with the help of motors and also arm is controlled with the help of motors which are controlled by motor drivers. arm and Rover have a mechanism to raise the object between 300 to 400 grams and can do a picked and placed a task at a particular long distance. Our device is separated mainly in two different sections Robotic arm and rover. 12-volt DC battery is supplied to whole system including Node MCU and motor drivers. Every movement of robotic arm and rover is regulated using blynk app with the help of Smartphone. Robotic arm is rotatable in different angles easily using separate motor bases, including upper joint and curved joint

in Arm. To regulate the 3 motors 2 motor drivers are used here. One side of a motor driver pins is interconnected with motors and another side of input pins is interconnected with Node MCU.

Robotic arm and rover is connected to Node MCU using Wi-Fi hotspot of Smartphone.

### 3. Flow Chart:

Figure 1 suggests the flowchart of the proposed model. The steps of the flowchart have been mentioned below. Step1: The proposed model has the possibility of an initial check of the power supply at the beginning.

In case there is less power or no power available then the control moves to the start else if there is a power supply “available” then it activates the camera module to detect the object and to display the images.

Step2: After step 1 initiated, our proposed rover is move to a particular position to pick up the object

Step 3: At the third our proposed model has picked the object which receives command from user and move to particular place which is already located by the controller (user or humans) to placing the object.

Step 4: User can check and watch the step 1 to 4 entire processes by seeing camera while picking up and placing the objects and for several tasks.

Step 5: Now entire steps can be ended in a successful manner without any disturbances.

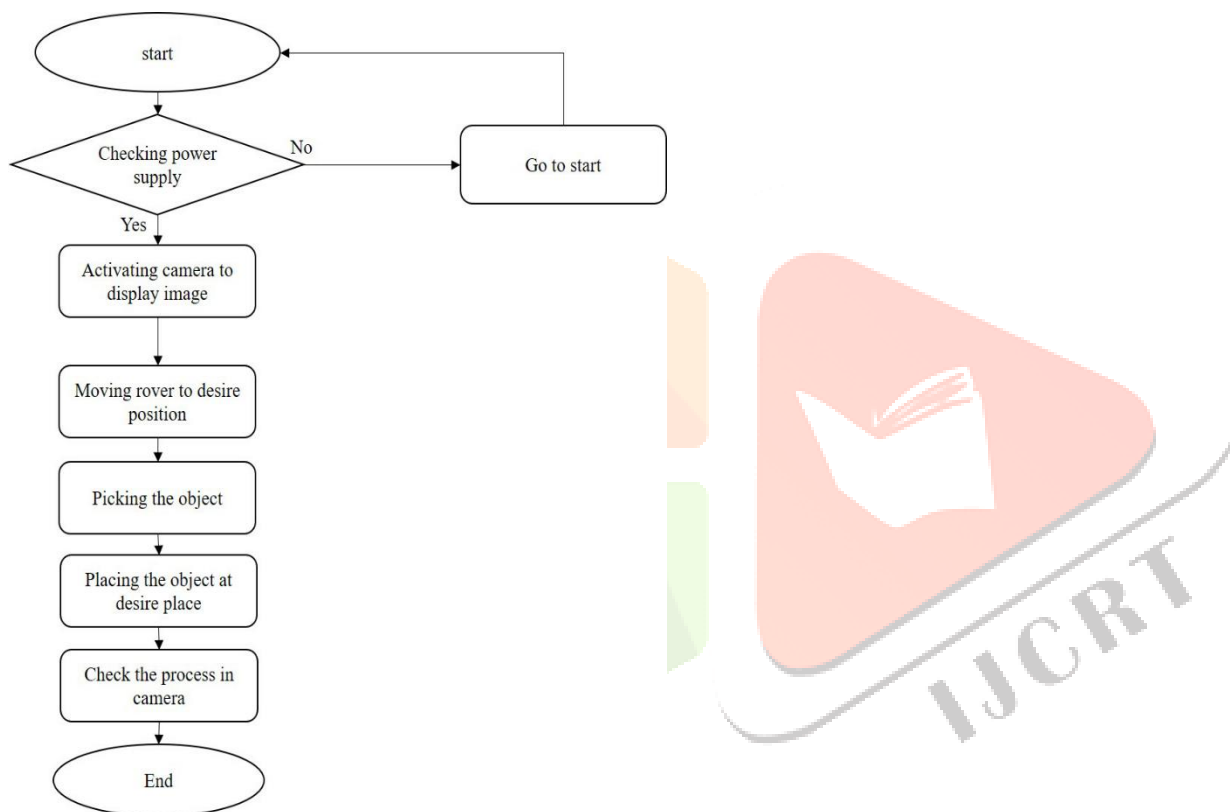


Figure 1 represents the flow chart of the proposed design.

### 4. Literature Review:

From many years back humans were interested toward constructing a new machine which executes different functions as human can perform. After that it is improved with particular architecture therefore industrialized government is formed in automated systems or robotic systems that are enough in development of robotic arm.[1] Now a day's all are getting update with things we are trying to connect things with IOT so there are some online iOS or android platforms or apps in general for example, users are using blynk app. Blynk app is a IoT platform which is used to control electronic devices remotely. It offers a friendly interface with the end user that can handle a graphical computing with various widgets. Blynk app will help to control using buttons. Blynk app is provided friendly interface to the hardware platforms like Arduino, Node MCU, Raspberry pi, Spark “fun” etc.[2]. Recent days users are using Node MCU in different places like controlling servo motors our device use servo motors in special locations like making computerized motion in wheel chairs and likewise utilized in domestic automation like robotic arm additionally[3]. In the past, so many researchers had done on iot control devices. Now, these iot base robots are increasing day by day in the world. Internet is becoming the main part of the iot device. The iot devices were build by using arduino, nide MCU etc. The robots does not require any training to perform any activities. This is the simple robotic arm.[4]. Internal control is a organization of objectives in operational effectness and efficiency. Internal control is a process to assist the achievement of operations. Warehouse is a process of storing goods.[5]. The warehouse automation is a new concept that requires warehouse products movements in a automatic

way. Many researchers and engineers have designed & developed automatic warehouse management pick and place robot operations over the past many decades. The concept of warehouse automation is discussed by Chuan.et.al.[6]. The entire work is isolated into vision processing, co-ordinate transformation, position calculation, orientation algorithm and guideline unravelling to robot. Boundary detection has huge applications in areas such as segmentation, contour grouping and symmetry detection. Image segmentation is based on colour, intensity and texture.[7]. The expeditiously growing internet has opened new horizons for development in various fields. The home automation industry has seen a brisk growth in the last few years. It has become a topic of interest of many people around the globe[8]. In recent days, we don't have any iot automated devices in the medical platform. Now healthcare system in iot field is increasing day by day. There are so many devices like air quality sensors, vital signs data capturing, Automated robots etc. In covid pandemic these iot automated devices are used to maintain social distance. These iot devices are very useful to the people in future.[9]

### 5. Working Principle:

The functioning of the Robotic arm and Rover is kept easy as feasible. Here DC 12 voltage power is supplied to Node MCU and Motors. Smart phone using blynk app which assists to regulate the robotic arm, motor drivers and motors which are used in different places. In blynk app user can design some keys commonly known as buttons which are used to make different movements in arm and rover.

Our desired system can be sub divided into three segments.

1. Input segment
2. Node MCU segment
3. The Output segment

Here receiving signals using blynk app and the received signals are subjected to Node MCU till this part comes under input segment. Then the received signals or commands are taken by Node MCU and send the commands to motor drives, comes to Node MCU segment. Finally, motors move accordingly to get movements in Robotic arm rover comes to Output segment.

Robotic arm consists of 2 motor drivers and 3 motors which are Base motor elbow motor and claw motor along with Node MCU. The rover part consists of L293d motor drivers, Node MCU and motors. The camera (ESP32) is also attached to the rover.

Arduino ide is used to code the Node MCU. Node MCU is connected to the laptop using data cable once the code is uploaded then user can remove the cable. These instructions will transfer the information to the node MCU to interact with the Smartphone and the L293D motor controller.

Node MCU act as the main controller of the device. Smartphone send instructions to Node MCU and assists the command the function of motor drivers(L293D) and entire part of the system.

Now the camera is attached to the rover for camera using ESP32 module it has the ability to capture the process and can be streamed in web browser which is available in our smartphones or laptop simply we get on Ip address of the cam once we enter the Ip address in search engines we get the video of the web cam. From this user can see the entire process.

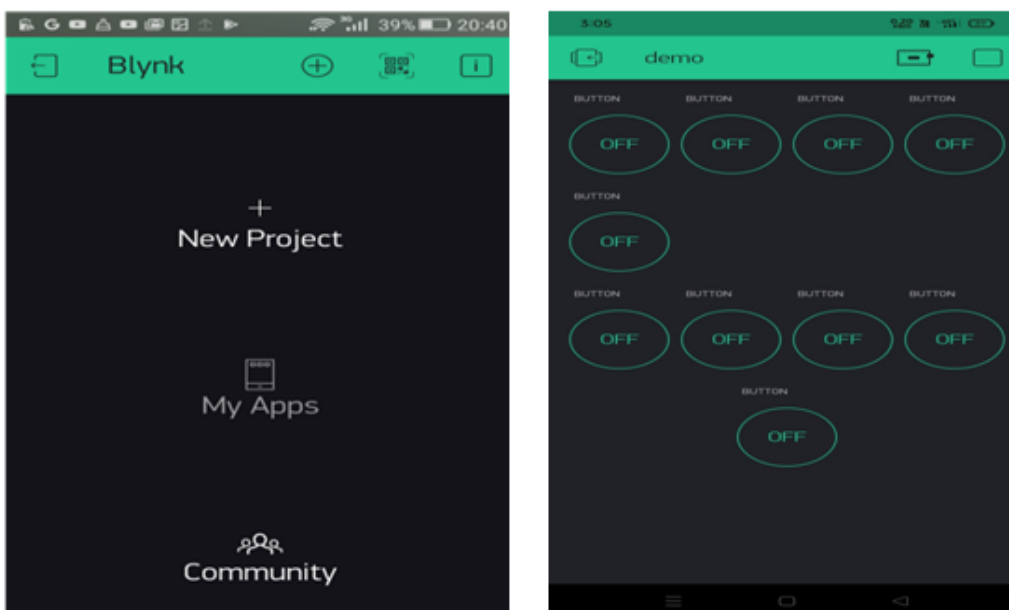


Figure 2 represents the blynk app interface of proposed design.

In the above figure2 we can see the two different blynk app interfaces first one is the one which user can see when anyone open the app for first time then second one is which is designed for the robotic arm and rover. In second picture user can see the different buttons to operate various activities like the first half in second one is for rover to move forward, backward, left and right each button will be subjected to each operation. The next half buttons are for arm to rotate left, right, up, down, pick and place.

## 6. Components

### 6.1. Hardware

#### 6.1.1. NODE MCU:

Node MCU is a very less cost, freely and easy usable IoT platform. Finally included software currently running on the Espressif Systems ESP8266 WIFI SoC and PCB that was well balanced on the Node MCU device. Recently added support for ESP32 32-bit MCU. The name "Knoten MCU" consists of "knot" and "MCU". Node MCU has the ability to accepts 3.3 voltage which can be supplied via data cable. Here analog(A0) pin is used to control the voltages between the range of 0-3.3 voltage. Node MCU is freely available to every user to connect objects and transfer data easily using WIFI protocol. Lua scripting language is used to firmware the device. 16 input-output gpio pins is used to connect any Iot devices. Node MCU is created by espressifsystems and it was launched on 2013. By this anyone can easily use this part in various places where it is needed.

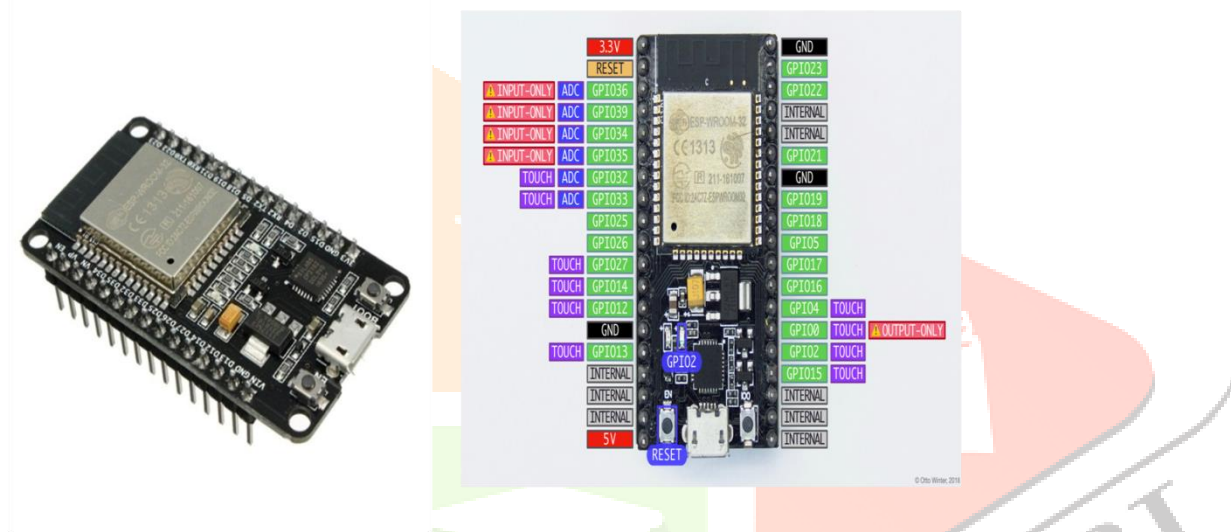


Figure 3 represents the node mcu of proposed design.

#### 6.1.2. Motor Driver L293D:

The L293D has a two H- Ground motors which gives permission to control several dc motors at a same time. It is H bridge module allows to operate the speed and direction of motors. To control speed of all motor drivers like turn on and turn off an enable line is used. L293DN driver is control everything independently likes two motors controlling is separately manner like one motor can be in rest state and at the same time second motor can be in motion state. Module can supply voltages between 5V to 35V with current 2A to motor drivers.

L293D driver consumed heavy voltage, current and dual bridge driver. It is created to undertake heavy several loads and standard TTL logic levels. Motor driver is mainly used to convert low current signal to high current signal which receives signal from controller circuit to run the motors.

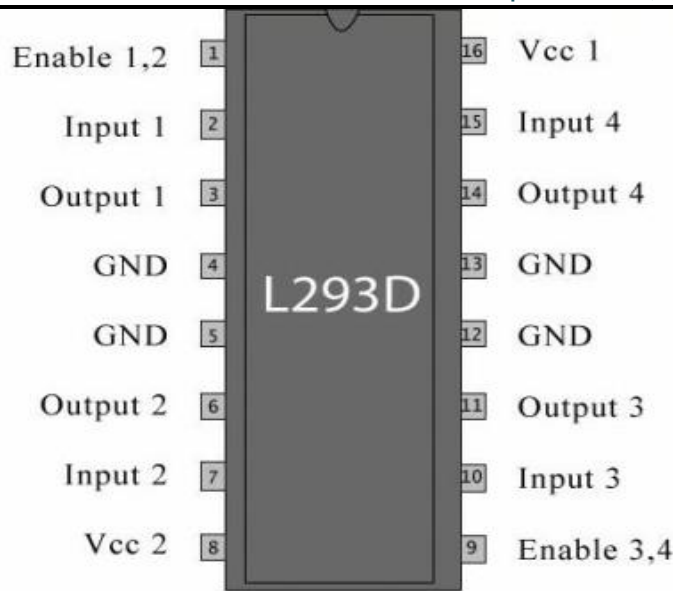


Figure 4 represents the motor driver(L293d) of proposed design.

**6.2. Software:**

**6.2.1. Blynk app/Arduino IDE**

It is created for Internet of things (IOT) devices. This software application has a capability that can perform several tasks to store the data easily. This application is available in both Android(play store) and iOS(apple store) to download it.

Blynk Application provides different ways to get easy interface to every controller to communicate with arm and development of this application is quite easy and possible.

Blynk Application It is quite easy and faster to communicate with our smartphone and our proposed device. User implemented with unique features to communicate easily and faster with the model.

**6.2.2. Arduino Software:**

Micro controller is used to regulate the entire system which is easy to communicate with the model. To execute several instructions c program language is used to our model. Micro controller is a part of Arduino board which stored the program data in eeprom with support of Arduino Ide software. Arduino software is used to burnt the code to microcontroller which is in Arduino board.

**7. Block Diagram of Rover:**

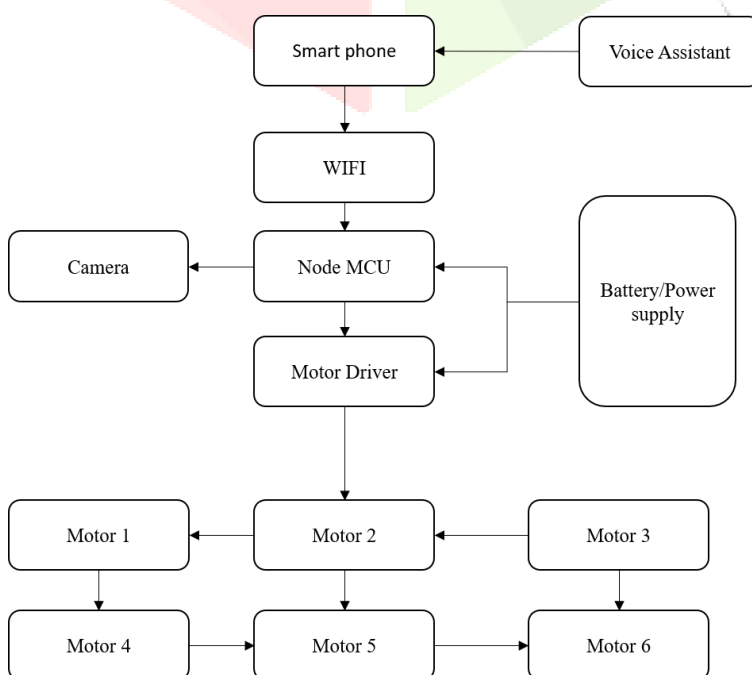


Figure 5 represents the block diagram of rover of proposed design.



## 7.1. Block Diagram of Robotic Arm:

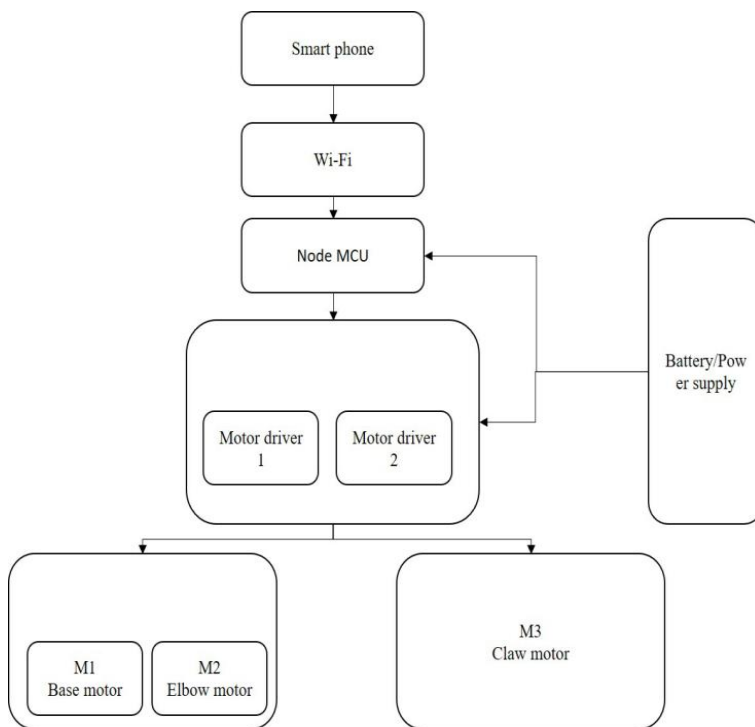


Figure 6 represents the block diagram of robotic arm of proposed design.

## 8. Result and Conclusion:

In this paper successfully implemented the robotic arm with rover and camera along with voice commands. The system has been tested in initial stage many times and arrange the things properly according to our requirements like base motor can rotate 360-degree Elbow motor can rotate 180 degrees to get horizontal movement in arm and claw motor 90 degree to do pick and place operations the entire process is checked in the camera which is attached to the rover which is used to transport the robotic arm.

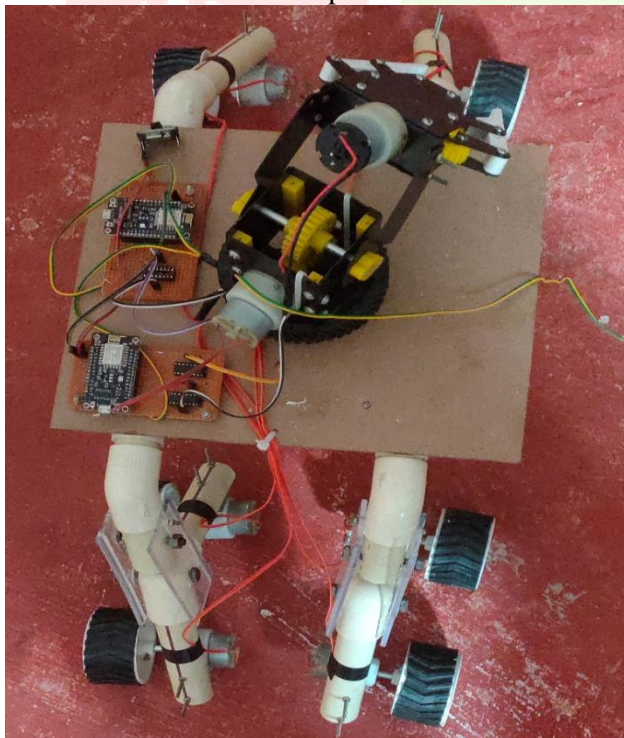


Figure 7 represents the project view of proposed design.

## Future Scope:

To perform several tasks like pick and place simple operations with certain degree of freedom basic arm structure is proposed in this paper. Here there is a lot of scope for different enhancements and advancement to increase the field of applications. Decreasing the smaller model of project for narrow area of several applications. Adding the night vision camera instead of ESP32 camera to see the image even in dark places.

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