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# IOT Based Robotic Arm

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**Abstract***: In response to the escalating threats proposed by explosive devices in various environments, the development of advanced technologies for effective bomb detection and diffusion has become imperative. This paper introduces state-of-the-art features of the robot include a robust mechanical structure with a manipulator arm equipped with specialized tools for safe handling and defusing of explosive devices. Wireless communication capabilities facilitate seamless interaction between the robot and its operators, allowing for real-time control and monitoring. Safety is paramount, and the robot is equipped with IP built-in security measures, including emergency shutdown mechanisms and protective systems to mitigate risks during explosive diffusion operations. The integration of low-power modes enhances the robot's endurance in prolonged missions. A six degree of freedom robotic arm is the most widely used mechanical device in the field of robotics. It can work in the various complex environment and has the accuracy and precision that the human arm cannot achieve. Generally, the motion of a robotic arm needs to be controlled by a wired teach pendant or computer control. However, in some complex environments, it is impossible to achieve short- distance control wireless control. Real-time remote data transmission is also the key to achieve precise control of the robotic arm, and if the control terminal can be realized anytime and anywhere, the robotic arm can be controlled remotely. Internet of Things (IoT) and web applications can solve these problems of near real-time data transmission as well as multi-platform realization at the control end. In this paper we present a design and implementation of a web-based control of the robotic arm using on MQTT (Message Queuing Telemetry Transport) communication protocol and ESP32 (a network data transmission module).*

**Keywords:** ESP32, Internet of Things(IOT), Message Queuing Telemetry Transport (MQTT)

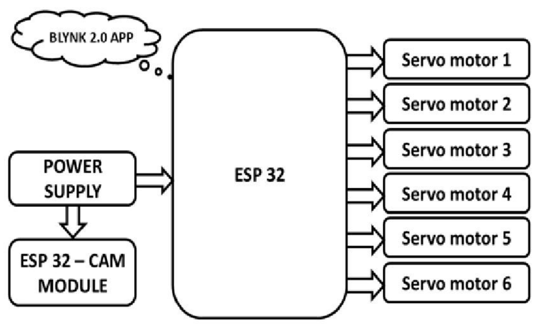
## I. INTRODUCTION

Usage of robots in industries are common now a days. Remote control is a challenging aspect and it is not addressed by the researchers. This paper proposes to design a robot which is controlled through Wi-Fi using the Blynk IoT App with widgets like Joystick and Sliders so that the operation and control of robots can be done from anywhere. The robot's Internet of things-controlled arm will help the doctors and nurses monitor and care for the patients remotely during pandemics like Covid-19. The Internet of Things (IoT) is embedded with sensors, software and other technologies to connect and exchange data with other devices and systems over the Internet. Because of this IoT technology, many industries have worked remotely using Wi-fi Internet. Industry 4.0 has been implemented in almost every industry. Therefore, this IoT-controlled Robotic Arm can also make hospitals smarter and fast for the lifesaving of the people.

## II. LITERATURE SURVEY

S.-R have published Intelligent Robots and Systems (IROS), IEEEit introduces a low-cost yet highly capable anthropomorphic robotic hand, emphasizing design and control techniques that enhance dexterity and functionality in the year 2011 Its low-cost approach demonstrates the potential for accessible, advanced robotic hands in applications like prosthetics and serrobots.R. Marín, P. J. Sanz, P. Nebot, and R. Wir have published IEEE Transactions on Industrial Electronics, which includes multimodal interface for web-based control of robotic arms, illustrating how remote programming can be used in industry in year 2005Z. Kuijing, C. Pei, and M. Haixia have published Chinese Control Conference (CCC), IEEE, *which includes* a control algorithm for a 5-DOF robotic arm tailored to table tennis applications. This research contributes to real-time control systems, especially useful in dynamic, interactive settings requiring quick responses, such as robotics in sports in year 1997. M. Nakashima, K. Yano, Y. Maruyama, and H. Yakabe have published the book entitlled Intelligent Robots Systems, IEEE, that discusses about a robotic system designed for power line maintenance, with a focus on developing effective human-robot interfaces (HRI) in year 2009

## III. SYSTEM METHODOLOGY




**ESP32 Microcontroller:** The ESP32 microcontroller is the main processing unit in this robotic arm system. It is a powerful and versatile microcontroller with built-in Wi-Fi and Bluetooth capabilities, making it ideal for IoT applications. **Controlling Servo Motors**: The ESP32 generates PWM (Pulse Width Modulation) signals to control each of the six servo motors.

**Servo Motor:** A servo consists of a Motor (DC or AC), potentiometer, gear assembly, and a controlling circuit. First of all, we use gear assembly to reduce RPM and to increase torque of the motor. Say at initial position of servo motor shaft, the position of the potentiometer knob is such that there is no electrical signal generated at the output port of the potentiometer. Now an electrical signal is given to another input terminal of the error detector amplifier. Now the difference between these two signals, one comes from the potentiometer and another comes from other sources, will be processed in a feedback mechanism and output will be provided in terms of error signal

**ESP 32-CAM:** The ESP32-CAM module has fewer I/O pins than the previous ESP-32 module we looked at. Many of the GPIO pins are used internally for the camera and the microSD card port.Another thing missing from the ESP32-CAM module is a USB port. In order to program this device you'll need to make use of an FTDI adapter. This will be described further on in this article.Using the ESP32-CAM is similar to using the ESP32 modules we looked at previously, with one major difference. The ESP32-CAM board has no USB port, so you can't just connect it up to your computer and start loading programs.Instead you will need to add an external FTDI adapter. This is the same adapter you would use programming an Arduino Pro Mini, so if you've worked with the Pro Mini then you probably already have one of these.

**4.Blynk 2.0 App:** The Blynk application is a versatile IoT platform that provides a user-friendly interface for remotely controlling and monitoring hardware devices like robotic arms. It enables seamless interaction with hardware through a smartphone or tablet, using various widgets (e.g., sliders, buttons) to control actuators or receive sensor data. This makes it especially convenient for developers working with microcontroller units (MCUs) such as ESP32. Blynk's cloud-based system supports real-time control, data logging, and visualization, offering an effective solution for both prototyping and deployment. In this project, the Blynk app's slider widget is used to control the robotic arm, sending commands to the ESP32 module.

## IV. WORKING PROCESS

When the ESP32 boots up, it attempts to connect to the specified **Wi-Fi network** using the credentials (ssid and pass) defined in the code.Once the ESP32 is connected to Wi-Fi, it is ready to communicate with the Blynk2.0

The ESP32 establishes a connection with the Blynk cloud using an Auth Token that was generated when you created the project in the Blynk app.This Auth Token is crucial for ensuring that the ESP32 can receive commands from the Blynk app securely.
The Blynk slider widget on the app is configured with a range from 0 to 180. This range corresponds to the servo's angle.**0** = 0° (the servo starts in one position, typically 0°).180 = 180° (the servo moves to the maximum position, typically 180°).As the user moves the slider in the Blynk app, it sends a value between 0 and 180 to the ESP32.The ESP32 is listening for data sent by the slider through Virtual Pin V0 (configured in the Blynk app).The BLYNK_WRITE(V0) function is triggered whenever the slider's position changes. This function reads the slider value using param.asInt(), which gives an integer between 0 and 180, representing the desired angle of the servo.The ESP32 processes the slider value and passes it to the Servo library using the myservo.write(slider Value) function.As the servo moves, the ESP32 may print feedback to the serial monitor (e.g., Slider Value: 90), allowing the user to see the position value of the slider in real-time.The servo physically rotates based on the slider's position, and you can observe the changes as you adjust the slider.The ESP32 continually listens for changes from the Blynk app through the Blynk.run() function.Whenever the slider position is adjusted, the Blynk app sends an updated value to the ESP32, which processes this value and moves the servo accordingly.

## V. CONCLUSION

Thus, we have efficiently developed a mini controller arm which picks and places things as desired. The paper discusses three degrees of freedom on robotic arm. The robotic arm had been constructed of readily available low-cost materials. The robotic arm model was developed, and the functionality was tested. Using the module restricts the robotic arm's remote access to a few meters. Future work may include using a ZigBee module to monitor the robotic arm from a remoter position. The robotic arm can be operated over the internet through Ethernet connectivity and a visual feedback camera.
When it comes to the future of Iot and Robotics, we first need to break down what both are in order to better grasp the potential developments in these spaces.

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