NITTE EDUCATION TRUST | NMAM INSTITUTE OF TECHNOLOGY

INTERNET OF THINGS LAB

Report

Radar Controlled By ESP32

Project Report submitted by

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In partial fulfillment of the requirements for the award of

the Degree of Bachelor of Engineering in Information Science and Engineering from

Visvesvaraya Technological University, Belagavi

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(An Autonomous Institution affiliated to VTU, Belagavi)

NOVEMBER 2023

CERTIFICATE

Certified that the project work entitled

Radar Controlled By ESP32

is a bonafide work carried out by

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in partial fulfilment of the requirements for the award of

Bachelor of Engineering Degree in Information Science and

Engineering prescribed by Visvesvaraya Technological University,

Belagavi

during the year 2023-2024.

It is certified that all corrections/suggestions indicated for Internal Assessment have been

incorporated in the report deposited in the departmental library.

The project report has been approved as it satisfies the academic requirements in respect of

the project work prescribed for the Bachelor of Engineering Degree.

Signature of the Guide　　Signature of the HOD　　Signature of the Principal

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Abstract

This mini project focuses on the development of a radar control system using the ESP32 microcontroller, incorporating an ultrasonic sensor and a servo motor. The Internet of Things (IoT) paradigm is leveraged to create a smart and remotely accessible radar system. The ESP32 serves as the central processing unit, facilitating seamless communication and control.

The ultrasonic sensor is employed to capture distance information, enabling the radar to detect objects within a specified range. The ESP32 processes the sensor data and commands the servo motor to adjust the radar's position accordingly. This dynamic movement enhances the system's ability to monitor its surroundings efficiently.

Key components of this project include the ESP32 microcontroller, known for its versatility and wireless capabilities, the ultrasonic sensor for distance measurement, and the servo motor for controlled movement. The integration of these components results in a compact and cost-effective radar system with potential applications in security, surveillance, and automation.

The project emphasizes the utilization of open-source technologies and IoT principles, making it accessible for enthusiasts and learners interested in exploring the intersection of IoT and radar systems. Additionally, the remote accessibility aspect allows users to monitor and control the radar system through web-based interfaces, expanding its usability and practicality.

This mini project serves as an educational and hands-on exploration of IoT concepts, embedded systems, and sensor integration, providing valuable insights into the development of smart and connected devices.

Introduction

In the era of the Internet of Things (IoT), the fusion of embedded systems and connectivity has paved the way for innovative and smart applications across various domains. This mini project delves into the realm of IoT with a focus on developing a radar control system utilizing the powerful ESP32 microcontroller. Complemented by an ultrasonic sensor and a servo motor, this system demonstrates the potential of interconnected devices to enhance real-world applications.The ESP32, renowned for its versatility and robust wireless capabilities, takes center stage as the brain of the radar control system. Leveraging the IoT paradigm, this project aims to create a compact and remotely accessible radar system capable of dynamic monitoring. The integration of an ultrasonic sensor facilitates precise distance measurement, empowering the radar to detect objects within a predefined range.

The inclusion of a servo motor adds a dynamic element to the system, enabling the radar to adjust its position based on the data acquired from the ultrasonic sensor. This feature enhances the system's ability to efficiently scan and monitor its surroundings, showcasing the potential applications in security, surveillance, and automation.This project not only focuses on the technical aspects of radar control but also embraces open-source technologies, making it accessible to enthusiasts and learners interested in exploring the intersection of IoT and embedded systems. The emphasis on remote accessibility allows users to interact with and control the radar system through web-based interfaces, demonstrating the practicality and versatility of IoT solutions.

As we embark on this journey, the integration of the ESP32, ultrasonic sensor, and servo motor serves as a foundation for hands-on exploration into IoT principles, embedded systems, and sensor integration. This mini project stands as a testament to the exciting possibilities that arise when technology, connectivity, and creativity converge in the pursuit of smarter and more connected devices.

Components required

- ESP32 or NodeMCU
- Ultrasonic sensor
- Servo motor

Circuit Diagram

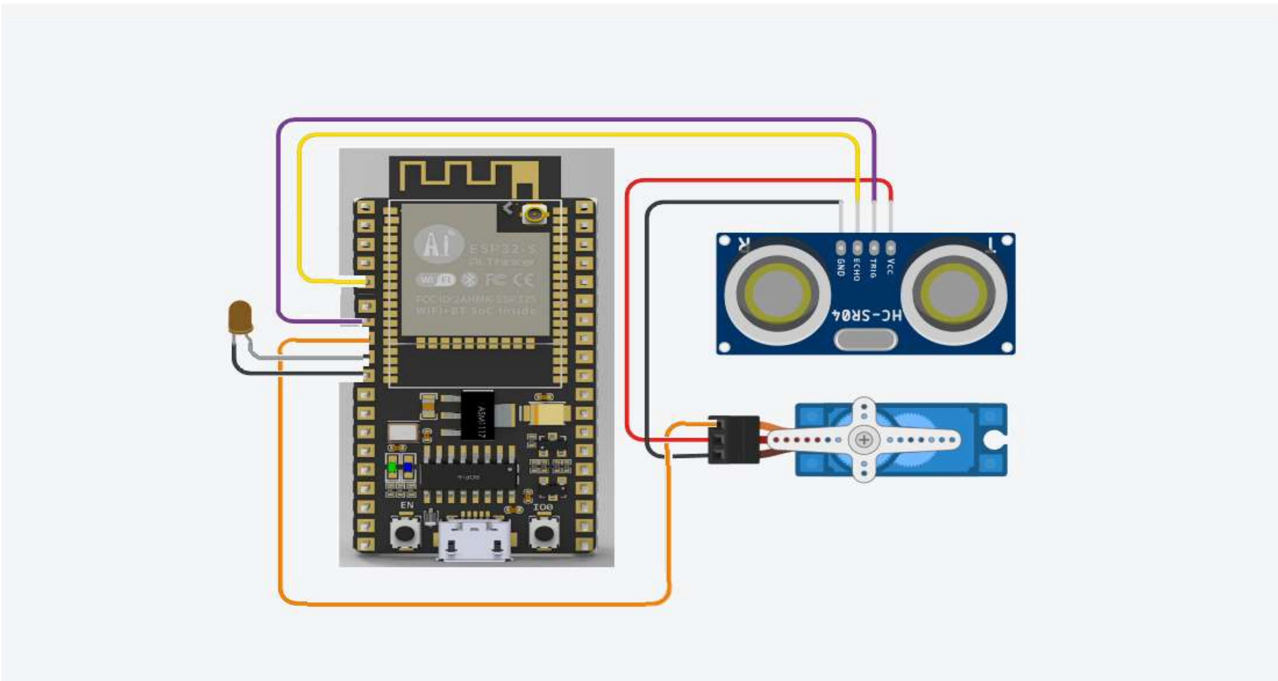


Fig 1: circuit diagram

In the NodeMCU circuit, the MQ-2 Gas sensor analog output is connected with the GPIO A0. And the Rain detector module's digital output is connected with the D1 (GPIO5). The Indicator LEDs are connected with GPIO D5 & D7. If required you can also connect the buzzer across GPIO D7 and GND instead of the red LED. The ESP32 board LED connected with GPIO D0 is used as the Wi-Fi indicator.

Code

```
/* Comment this out to disable prints and save space */
#define CORE_0 0
#define CORE_1 1

TaskHandle_t taskSendSensor, taskSpin;

#define BLYNK_PRINT Serial
#define LED_PIN 19

/* Fill in information from Blynk Device Info here */
#define BLYNK_TEMPLATE_ID           "TMPxxxxxx"
#define BLYNK_TEMPLATE_NAME         "ESP32"
#define BLYNK_AUTH_TOKEN            "HqRnzwSxTvgkD-eVrh1tT0gZAHvOCkBs"

#include <WiFi.h>
#include <WiFiClient.h>
#include <BlynkSimpleEsp32.h>

#include <Servo_ESP32.h>

#define trig 4 // Replace with the correct GPIO pin number for the trigger pin
#define echo 2 // Replace with the correct GPIO pin number for the echo pin
```

```
long duration;
int distance;

static const int servoPin = 18; //printed G14 on the board

Servo_ESP32 servo1;

int angle =0;
int angleStep = 4;

int angleMin =0;
int angleMax = 180;

char auth[] = "HqRnzwSxTvgkD-eVrh1tT0gZAHvOCkBs"; // Use the BLYNK_AUTH_TOKEN you defined

// Your WiFi credentials.
// Set the password to "" for open networks.
char ssid[] = "Amshu GT 2";
char pass[] = "Amshu@399";

BlynkTimer timer;

WidgetLCD lcd(V1);

void setup()
{
```

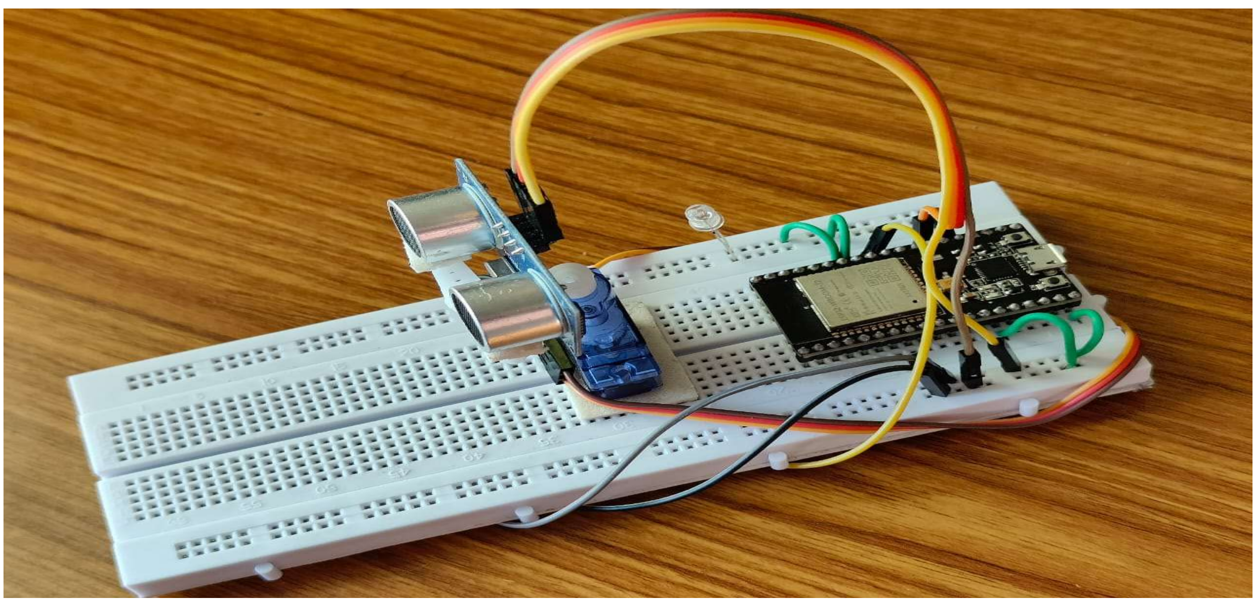
```
  pinMode(trig, OUTPUT);  // Sets the trigPin as an Output
  pinMode(echo, INPUT);
  pinMode(LED_PIN, OUTPUT);  // Sets the echoPin as an Input
  Serial.begin(9600);

  servo1.attach(servoPin);

  Blynk.begin(auth, ssid, pass,IPAddress(117,236,190,213),8080); // Change the IP address to "blynk-cloud.com" and remove IPAdress



   xTaskCreatePinnedToCore(
    sendSensor,      // Function to execute
    "TaskSendSensor",// Name of the task
    10000,           // Stack size (bytes)
    NULL,            // Parameters to pass to the function
    1,               // Priority of the task
    &taskSendSensor, // Task handle
    CORE_0);         // Core to run the task (CORE_0 or CORE_1)

  xTaskCreatePinnedToCore(
    spin,            // Function to execute
    "TaskSpin",      // Name of the task
    10000,           // Stack size (bytes)
    NULL,            // Parameters to pass to the function
    1,               // Priority of the task
    &taskSpin,       // Task handle
```

```
    CORE_1);        // Core to run the task (CORE_0 or CORE_1)

}

void loop()
{
  Blynk.run();
  timer.run();
  delay(1000);
}
void sendSensor(void *pvParameters) {
  while (true) {
    // Code for the sendSensor function

    digitalWrite(trig, LOW);
    delayMicroseconds(2);
    digitalWrite(trig, HIGH);
    delayMicroseconds(10);
    digitalWrite(trig, LOW);
    duration = pulseIn(echo, HIGH);
    distance = duration * 0.034 / 2;

    Serial.print("Distance = ");
    Serial.println(distance);

    Blynk.virtualWrite(V0, distance);
```

```
    if (distance < 30) {
    digitalWrite(LED_PIN, HIGH); // Turn ON the LED

  } else {
    digitalWrite(LED_PIN, LOW); // Turn OFF the LED

  }

    lcd.print(0, 0, "Distance: " + String(distance) + "cm ");

    vTaskDelay(100 / portTICK_PERIOD_MS); // Adjust delay based on your requirements
  }
}

void spin(void *pvParameters) {
  while (true) {
    // Code for the spin function

    for (int angle = 0; angle <= angleMax; angle += angleStep) {
      servo1.write(angle);
      delay(40);
    }

    for (int angle = 180; angle >= angleMin; angle -= angleStep) {
      servo1.write(angle);
      delay(40);
    }
```

```
    vTaskDelay(300 / portTICK_PERIOD_MS); // Adjust delay based on your requirements
  }
}
```

Snapshot of the project



Conclusion

In conclusion, the development and implementation of the ESP32-based radar control system with an ultrasonic sensor and servo motor integration showcase the potential of Internet of Things (IoT) technologies in creating intelligent and responsive devices. This mini project has provided a practical avenue for enthusiasts and learners to explore the intricacies of embedded systems, sensor integration, and IoT principles.The ESP32 microcontroller, acting as the central processing unit, has demonstrated its prowess in managing complex tasks while maintaining wireless connectivity. The utilization of an ultrasonic sensor has empowered the radar system to gather precise distance data, enabling it to detect and monitor objects within a specified range. The dynamic movement afforded by the servo motor enhances the system's adaptability and responsiveness.

Moreover, the incorporation of open-source technologies ensures accessibility and affordability, encouraging a wider audience to engage with and contribute to the evolving landscape of IoT. The remote accessibility feature not only enhances user convenience but also underscores the practicality of deploying such systems in real-world scenarios.As we reflect on this mini project, it becomes evident that the intersection of IoT and radar systems opens doors to diverse applications, from security and surveillance to automated monitoring. The hands-on experience gained through the development process fosters a deeper understanding of the challenges and opportunities presented by smart and connected devices.

In the ever-expanding realm of technology, this project stands as a testament to the creative possibilities that arise when innovative hardware, open-source software, and connectivity converge. The knowledge and insights gained from this endeavor serve as a valuable foundation for those seeking to explore, experiment, and contribute to the exciting field of IoT and embedded systems. As technology continues to advance, projects like these pave the way for a future where intelligent, connected systems play a pivotal role in shaping the world around us.