Implementation of Cloud-Connected IoT system using ESP32 Doit and Node-red

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*Abstract*—This report presents the implementation and evaluation of a cloud-connected Internet of things (IoT) system using Espressif ESP32 DoIT microcontroller, MQTT communication protocol, and the Node-Red platform for server-side processing and visualization. The major objective of this project is to visualize the data collected from sensor and control the multicolor led using the web-ui created by node-red.

Keywords— IoT, MQTT, Node-red, ESP32, cloud-connected.

# Introduction

This report explains the building, implementation and testing of cloud-connected IoT System using espressif ESP32 DoIT board, dht11 sensors, multicolour led and node-red along with MQTT protocol. With the help of this system user can monitor the real-time sensor data and control hardware components, such as multicolour LED, from a remote location. By using MQTT, a light weight messaging protocol, the system achieves the efficient data communication suitable for IoT environments with limited bandwidths. This project is divided into three parts: 1. Setting up the esp32 doit board and connecting it to local WiFi network, 2. Establishing cloud communication using MQTT for data transmission, 3. Building a dashboard with Node-Red for visualization and device control. This report is also attached with complete source code, github repository link and the work video link.

# Design of System Architecture

## Hardware Overview

The Hardware architecture of this IoT system is mainly depended on the Espressif ESP32 DoIT microcontroller, The ESP32, a cost-effective yet powerful microcontroller with built-in Wi-Fi and Bluetooth capabilities, serves as the core component of our system, enabling flexible and scalable deployment [1]. This microcontroller serves as the core processing unit, managing both the collection of data from the sensor and have the control of IoT System functionalities. It Supports various communication protocols which makes it well-suited for this project.

### Espressif ESP32 DoIT Devkit:

This microcontroller is used for connecting the local Wi-Fi network to do data exchange between the device and the cloud platform via the MQTT protocol. The microcontroller operates at 80 MHz and has 38 GPIO pins which are used to interface the sensor and the LED.

### Sensor:

This system uses DHT11 temperature and humidity sensor which continuously collects the environmental data. This sensor is connected to the microcontroller via GPIO pins and uses single-wire protocol. The major advantage of this sensor is the accuracy and the low power consumption.

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