Traffic Signal Control System with Cloud

Overview

This project demonstrates a traffic signal control system using Arduino Mega, ESP32, and ultrasonic sensors. The system is designed to control traffic signals based on the presence of vehicles detected by ultrasonic sensors. The data from the sensors are sent to a cloud service for further analytics.

Why Arduino Mega 2560?

The Arduino Mega 2560 is chosen for its extensive digital pins, allowing for the connection of multiple ultrasonic sensors and traffic signal LEDs. The increased pin count addresses the specific requirements of the project.

Handling Low Lane Values

The system monitors four lanes for vehicle presence. If the distance covered by a lane is less than a threshold (t), the system initiates traffic signal control. Different scenarios are addressed:

1. All Lanes < t (Different):

   - The system prioritizes the lane with the lowest distance value.

   - Traffic signal for that lane turns green, and other lanes remain red.

2. One Lane < t, Others > t:

   - The system prioritizes the lane with the lowest distance value.

   - Traffic signal for that lane turns green, and other lanes remain red.

Code Explanation

The Arduino Mega code utilizes the TimerOne library for time-controlled interruptions. Ultrasonic sensors measure the distance covered by each lane, and traffic signals are controlled based on vehicle presence. The ESP01 module is repurposed for offline data collection, and the Python script simulates data transmission to the ThingsBoard cloud platform.

Components

- Arduino Mega
- Ultrasonic Sensors
- LEDs for Traffic Signals

Setup

Arduino Mega

1. Ultrasonic Sensors:
   - Connect the ultrasonic sensors to the following pins on the Arduino Mega:
     - Sensor 1: Trigger - 11, Echo - 10
     - Sensor 2: Trigger - 7, Echo - 6
     - Sensor 3: Trigger - 5, Echo - 4
     - Sensor 4: Trigger - 3, Echo - 2
2. LEDs for Traffic Signals:
   - Connect the LEDs for traffic signals to the following pins on the Arduino Mega:
     - Signal 1: Red - 23, Yellow - 25, Green - 27
     - Signal 2: Red - 29, Yellow - 31, Green - 33
     - Signal 3: Red - 35, Yellow - 37, Green - 39
     - Signal 4: Red - 41, Yellow - 43, Green - 45

ThingsBoard Cloud Platform

1.Choose ThingsBoard for Analytics:
   - Utilize the ThingsBoard platform for cloud analytics.

2. Configure ThingsBoard Credentials:
   - Set up an account on ThingsBoard and obtain device credentials.
   - Update the Python script with the ThingsBoard server URL, device ID, and access token.

Programming

1. Upload Arduino Mega code for traffic signal control.

2. Python script simulates data transmission to the ThingsBoard cloud platform for offline-collected data.

Running the System

1. Power up the Arduino Mega.

2. Ultrasonic sensors detect vehicle presence, and traffic signals are controlled accordingly.

3. Data is collected offline, and the Python script simulates data transmission to the ThingsBoard cloud platform for analysis.