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Project Report

Automatic Door Opening System Using ESP32

Introduction

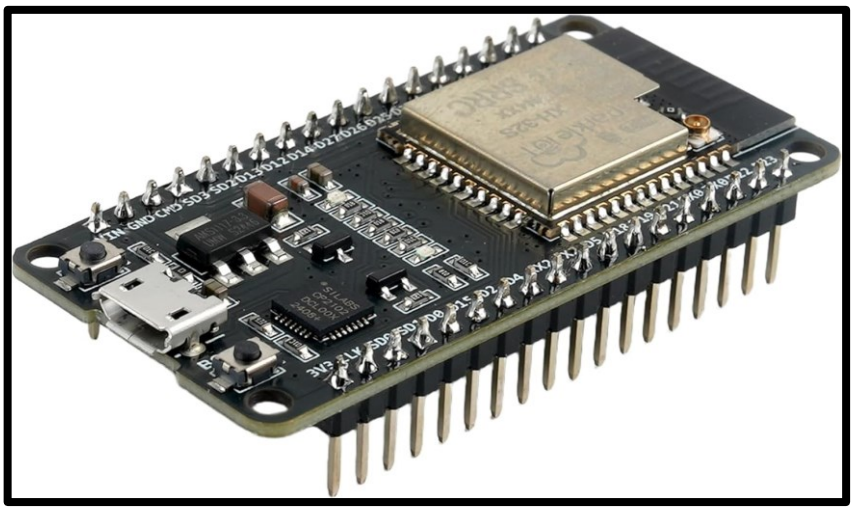
This project is an **Automatic Door Opening System** made using a small house model. The main aim of this project is to automatically open and close a door when a person comes near it. The system uses an **ESP32**, an ultrasonic sensor, and a servo motor. ESP32 acts as the brain of the system by takings inputs and making appropriate decision (opening and closing of door), sensor as input and servo motor acting as an output. We also sent our data like how often the door opened and closed to online cloud based database **Thingspeak** completing the layer of ICT in our project.

Objectives of the Project

- To design an automatic door system using basic electronic components.
- To learn how sensors work with a microcontroller.
- To understand automation and smart home concepts.
- To make a working model of a smart house door.

Components

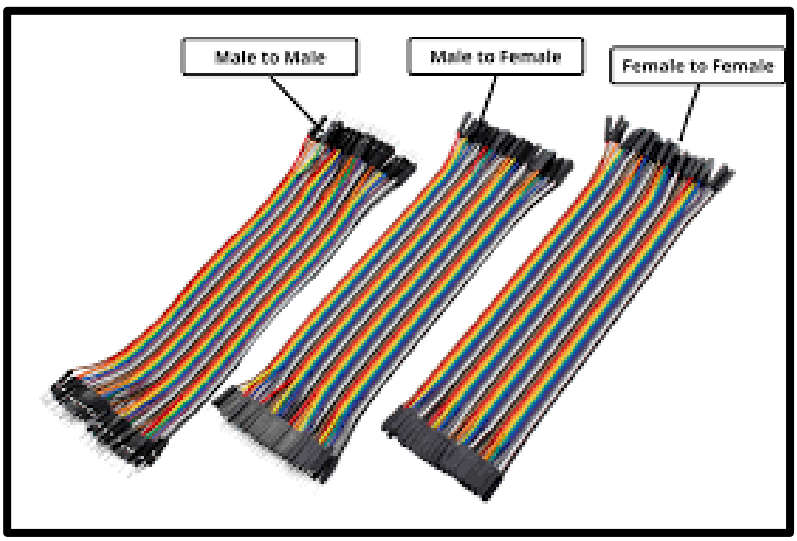
- **ESP32** – Controls the entire system and processes sensor data to operate the door automatically.



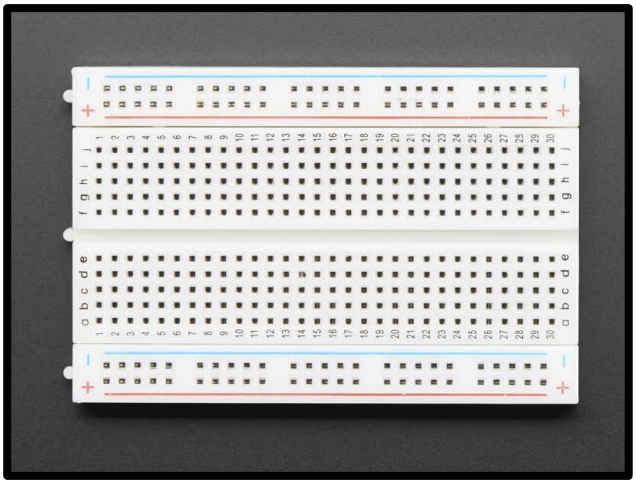
- **Ultrasonic Sensor (HC-SR04)** – Detects the presence of a person by measuring the distance in front of the door.

- **Servo Motor** – Rotates to open and close the door based on commands from the ESP32.

- **Jumper Wires** – Used to connect all electronic components together.



- **Breadboard** – Provides a temporary platform for assembling the circuit without soldering.



- **Power Supply / USB Cable** – Supplies power to the ESP32 and other components.
- **House Model (Cardboard/Wooden)** – Acts as the physical structure to demonstrate the automatic door system.

Working

The ultrasonic sensor sends ultrasonic waves. When a person comes in front of the door, the waves hit the object and return to the sensor. The sensor calculates the distance and sends this data to the ESP32. If the distance is less than a fixed value (for example, 20 cm), the ESP32 sends a signal to the servo motor. The servo motor then rotates and opens the door. When the person moves away, the door closes automatically.

Role of Ultrasonic Sensor (HC-SR04)

Ultrasonic Sensor (HC-SR04) is used to detect the presence of a person by measuring distance.
Pins and their roles:

- **VCC**: Supplies power to the ultrasonic sensor
- **GND**: Connected to ground
- **TRIG**: Sends ultrasonic waves when triggered by ESP32
- **ECHO**: Receives reflected waves and sends distance data to ESP32

When a person comes close, the sensor sends distance information to the ESP32.

Role of ESP32

ESP32 acts as the brain of the system. It processes the sensor data and controls the servo motor.
Pins and their roles (example):

- **5V / VIN**: Powers the ESP32 and other components
- **GND**: Common ground for all components
- **Digital Pin**: Pins for inputs and outputs

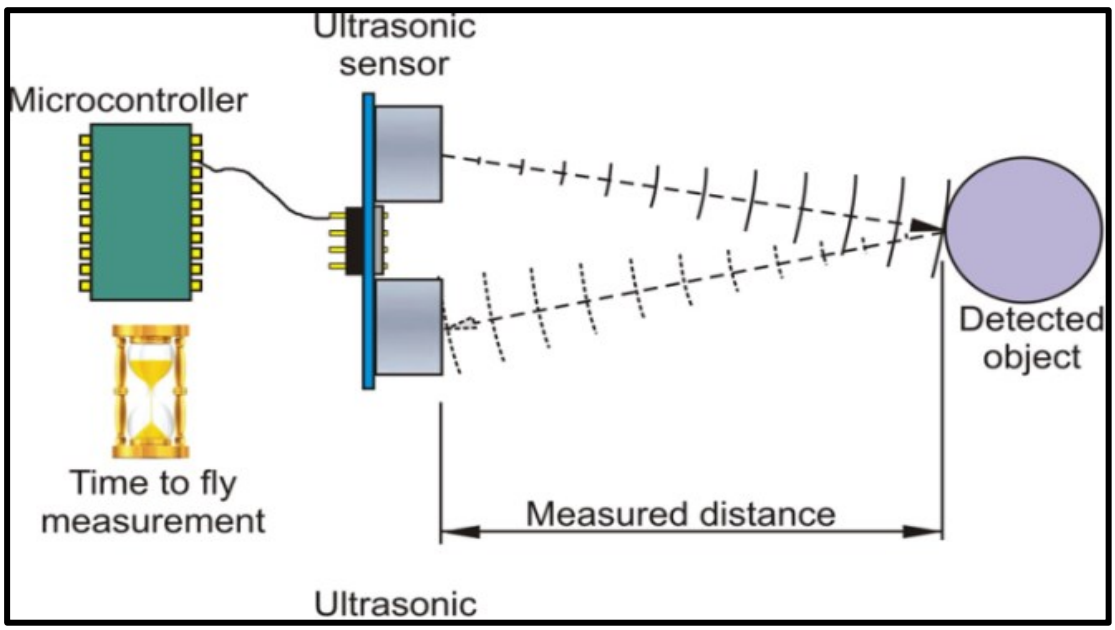
The ESP32 decides whether to open or close the door based on distance.

Role of Servo Motor

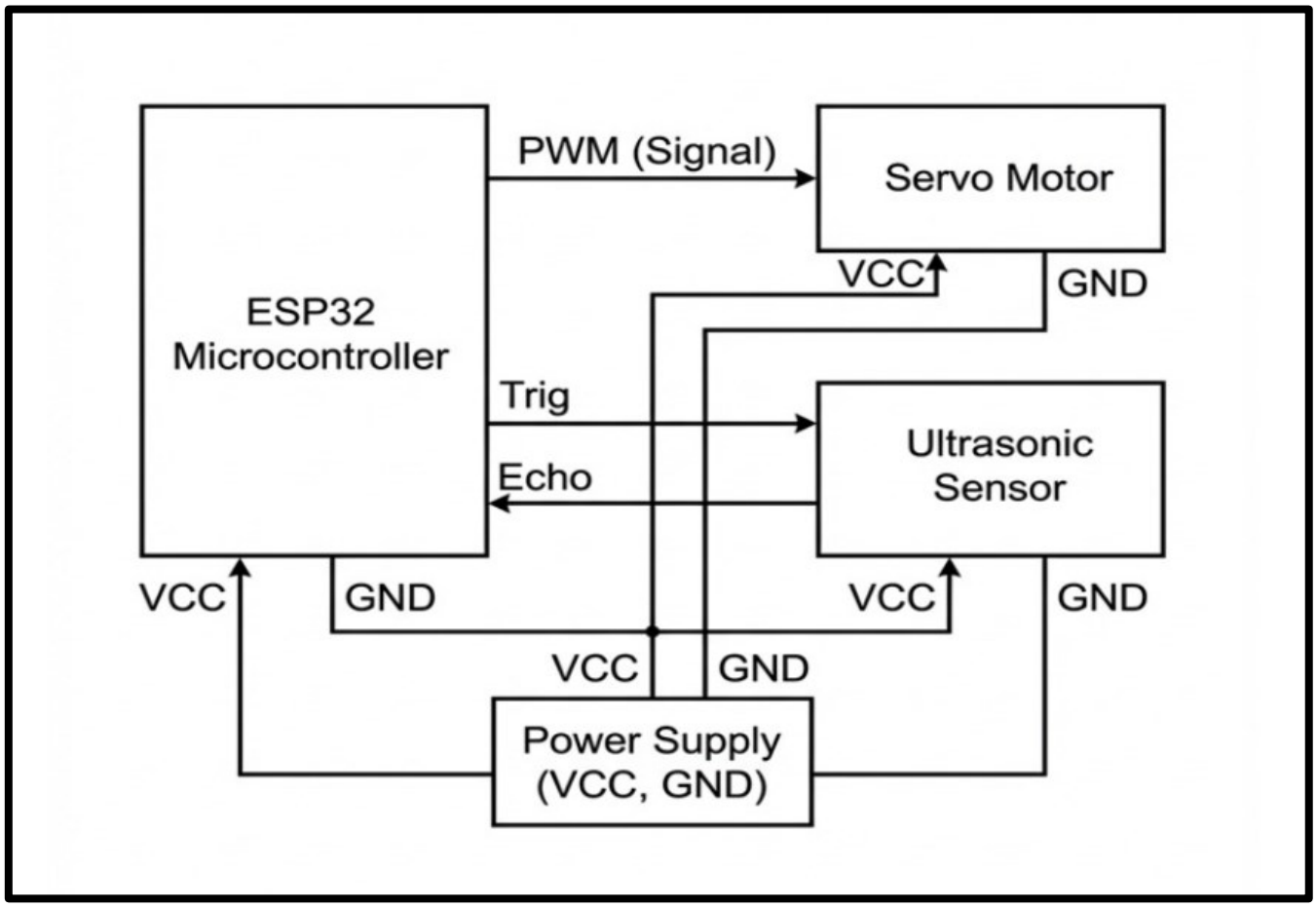
Servo Motor is responsible for opening and closing the door.
Pins and their roles:

- **VCC (Red wire)**: Supplies power to the servo motor
- **GND (Brown/Black wire)**: Connected to ground
- **Signal (Yellow/Orange wire)**: Receives control signal from ESP32

When the ESP32 sends a signal, the servo rotates to open or close the door.



Block diagram:



Advantages

- Saves human effort.
- Touch-free (hygienic).
- Easy to use and understand.
- Low cost and simple design.
- Useful for smart homes and offices.

Limitations

- Works only within a limited distance.
- Needs continuous power supply.
- Not suitable for heavy doors.
- Sensor accuracy can be affected by obstacles.

Applications

- Smart homes
- Automatic doors in offices
- Hospitals and shopping malls
- Contactless entry systems

Conclusion

This project successfully demonstrates an **Automatic Door Opening System** using ESP32, an ultrasonic sensor, and a servo motor. The system is able to detect a person and open the door automatically without any manual effort. Through this project, we learned how sensors interact with microcontrollers and how output devices perform physical actions. It also helped us understand basic concepts of automation, embedded systems, and smart home technology. This project improved our practical skills in circuit connections, programming, and problem-solving. It can be further enhanced by adding security features and wireless control, making it useful for real-world smart home applications.