

IoT-Based Smart Parking System

An Intelligent Real-Time Parking Management Solution

Meet the Team



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Introduction

What is a Smart Parking System?

An IoT-enabled solution that automates parking management through real-time monitoring and intelligent slot detection.

Traditional Parking Limitations

- Manual monitoring requires constant human presence
- No visibility into available spaces
- Inefficient space utilization
- Poor user experience



Real-time automation eliminates guesswork and reduces congestion significantly.

Problem Statement

Parking Congestion

Drivers circle endlessly searching for available spots, creating traffic and frustration.

Manual Monitoring Issues

Human attendants cannot efficiently track real-time occupancy across large facilities.

Time Wasted

Average 15-20 minutes lost per visit finding free parking slots.

No Digital Records

Lack of proper data tracking prevents analysis and optimization of parking usage.



Project Objectives

01

Real-Time Vehicle Detection

Instant identification of vehicles entering and exiting parking spaces using ultrasonic sensors.

02

Live Slot Status Display

Visual dashboard showing available and occupied spots with color-coded indicators.

03

Reduce Human Effort

Eliminate need for manual monitoring and attendant-based slot management.

04

Increase Accuracy

Achieve 99%+ accuracy in occupancy detection through automated sensor systems.

05

Improve User Experience

Enable drivers to quickly locate available parking through intuitive digital interface.

Project Overview

System Components

Our solution integrates **ESP32 microcontrollers** with **ultrasonic sensors** to detect vehicle presence in real-time.

Data flows seamlessly to cloud infrastructure, powering a responsive web dashboard with live car icons.



Hardware Layer

ESP32 + Ultrasonic Sensors



Cloud Infrastructure

Real-time data processing



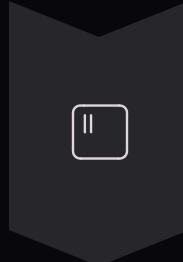
User Interface

Web dashboard with live updates



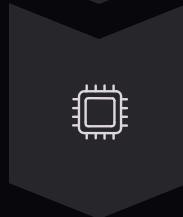
System Architecture

Data flows seamlessly from physical sensors through cloud processing to user-facing displays.



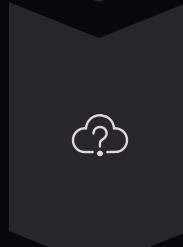
Sensors

Ultrasonic sensors detect vehicle presence in each parking slot



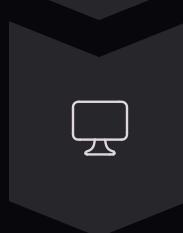
ESP32

Microcontroller processes sensor data and transmits to cloud



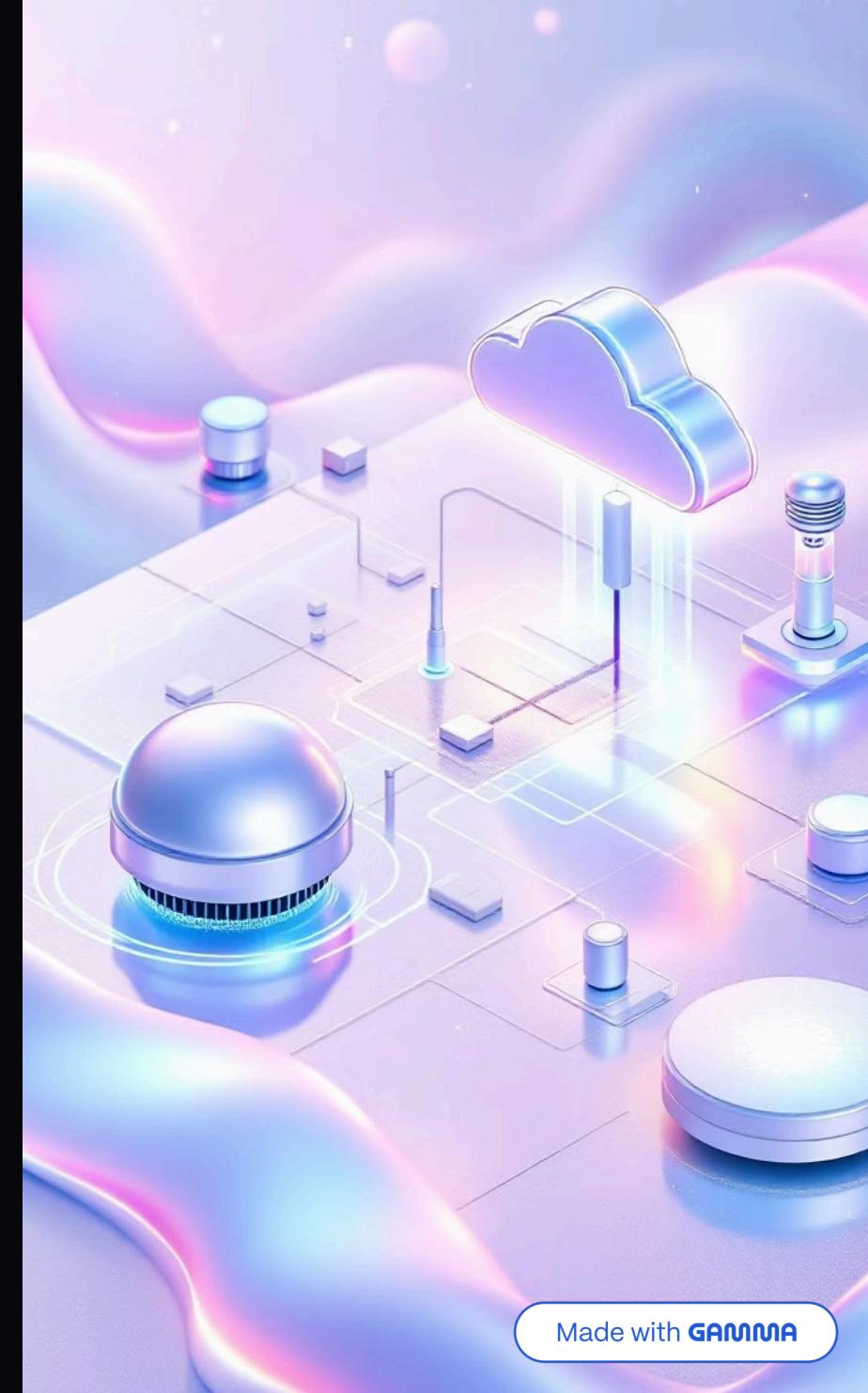
Cloud/Server

Firebase or Node.js backend stores and manages real-time data



Web UI

Dashboard displays live parking status with visual indicators



Hardware Components

ESP32/NodeMCU

Powerful microcontroller with built-in WiFi for cloud connectivity and sensor management.

Ultrasonic Sensors

Accurate distance measurement devices detecting vehicle presence in parking slots.

LEDs/Indicators

Visual status indicators showing slot availability through color-coded lights.

Power Supply

Reliable power source ensuring continuous system operation.

- **Optional Enhancement:** RFID module or automated gate control system for advanced access management.

Software Components



ESP32 Firmware

Developed in Arduino IDE for sensor reading, data processing, and WiFi communication.



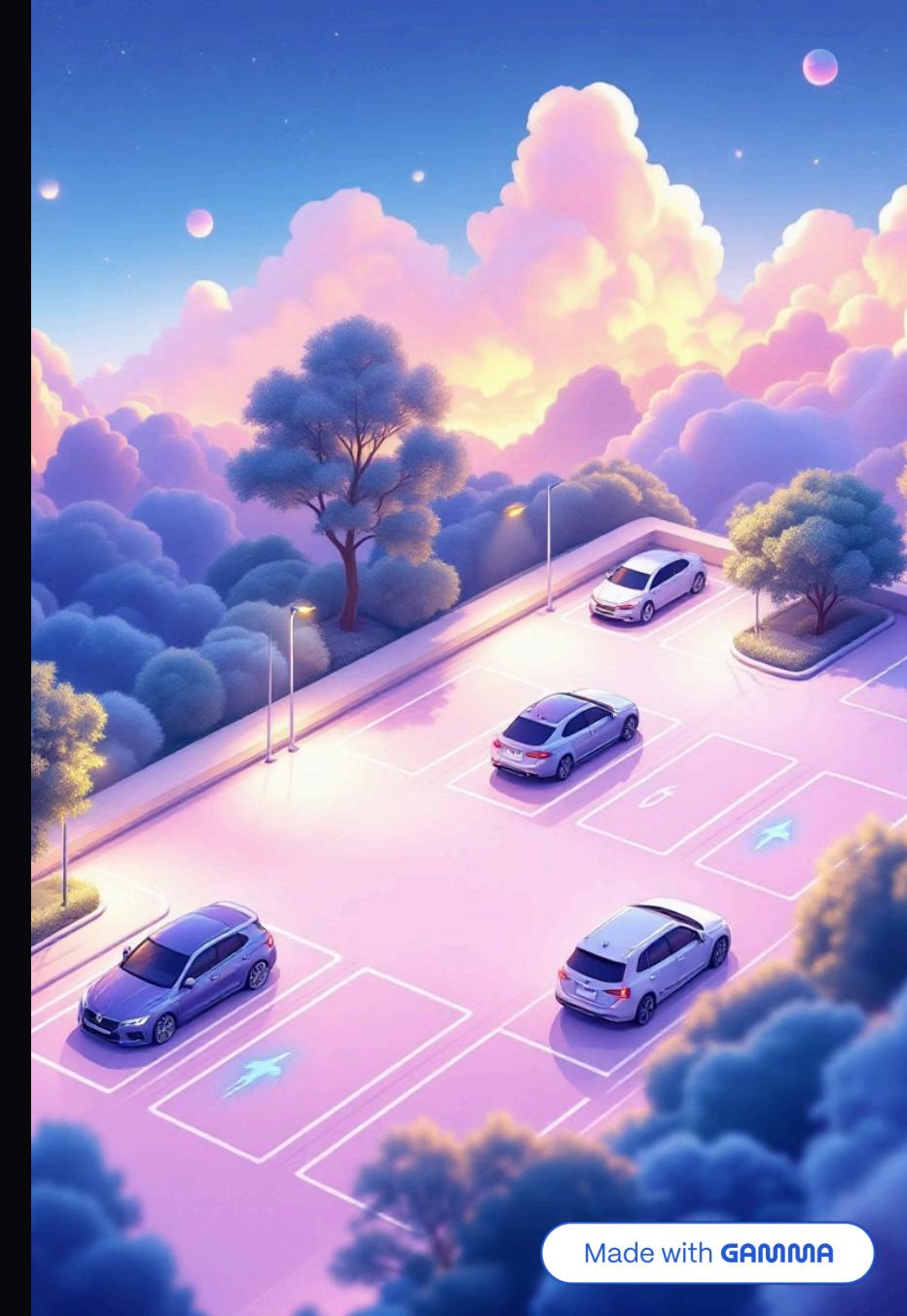
Cloud/Server Backend

Firebase, ThingSpeak, or Node.js handling real-time data storage and API endpoints.

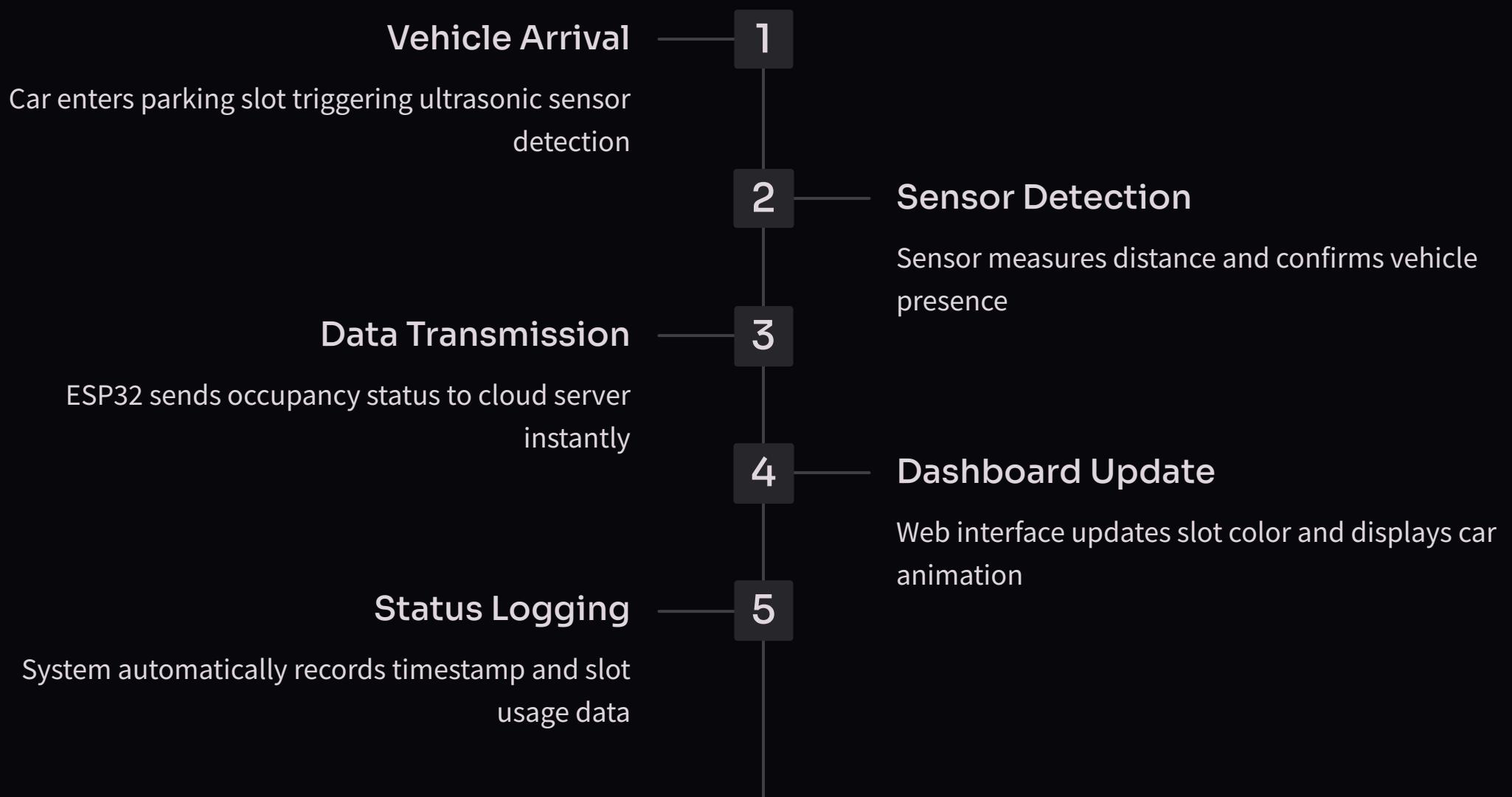


Web Dashboard

Built with HTML, CSS, and JavaScript for responsive real-time parking visualization.



Working Process



Visual Feedback

- **Green**: Slot available
- **Red**: Slot occupied
- Animated car icons for intuitive understanding

