

# P32 Goblin Full - Complete Visual Build Guide

## What You're Building

A mood-driven animatronic goblin head with:

- **3 Animated Displays** (2 eyes + 1 mouth)
- **Distance Sensing** (proximity detection)
- **Audio Output** (sounds and speech)
- **9 Emotional States** (automatic mood changes)

## Complete Wiring Diagram

Complete Wiring Diagram

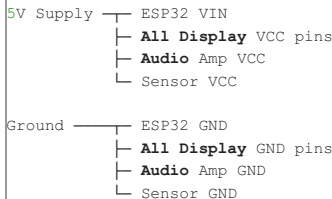
### GPIO Pin Assignments Quick Reference

GPIO Component Function Wire Color

4	Audio Amp I2S BCLK	Red
5	Audio Amp I2S WS	Black
6	Audio Amp I2S DATA	White
9	HC-SR04 TRIG	Gray
10	HC-SR04 ECHO	Pink
12	All Displays SPI MISO	Blue
13	All Displays SPI MOSI	Green
14	All Displays SPI CLK	Yellow
15	Left Eye CS	Orange
16	Right Eye CS	Purple
17	Mouth CS	Brown

## Power Distribution System

Power Rail Architecture:

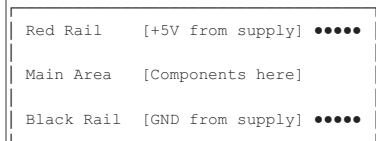


**Critical:** All components share common 5V and Ground rails

## Assembly Order (Follow This Sequence!)

### 1 Power Setup First

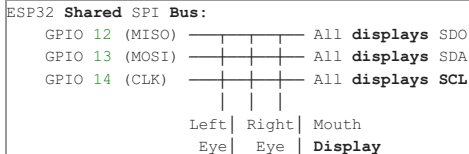
Breadboard Setup:



### 2 ESP32 Connection

- VIN → Red power rail
- GND → Black power rail
- **Test:** Verify 5V with multimeter before proceeding

### 3 SPI Bus Wiring (Shared Lines)



### 4 Individual Chip Selects

- GPIO 15 → Left eye CS (Orange wire)
- GPIO 16 → Right eye CS (Purple wire)

- GPIO 17 → Mouth CS (Brown wire)

### 5 Audio System

I2S Digital Audio:

ESP32 GPIO 4

MAX98357A BCLK

ESP32 GPIO 5

MAX98357A LRCK

ESP32 GPIO 6

MAX98357A DIN

MAX98357A +

Speaker +

MAX98357A -

Speaker -

### 6 Distance Sensor

HC-SR04 Connections:

ESP32 GPIO 9

TRIG pin

ESP32 GPIO 10

ECHO pin

5V power rail

VCC pin

Ground rail

GND pin

## 🔧 Testing Checklist

#### Power Verification (Use Multimeter)

- ☐ 5V present on ESP32 VIN
- ☐ 5V present on all display VCC pins
- ☐ 5V present on audio amp VCC
- ☐ 5V present on sensor VCC
- ☐ Continuity on all GND connections

#### Software Upload

- ☐ PlatformIO project opens without errors
- ☐ ENABLE\_GOBLIN\_COMPONENTS defined in config
- ☐ Build completes (~5.8% RAM, ~51.7% Flash)
- ☐ Upload successful to COM port
- ☐ Serial monitor shows loop messages

#### Component Function Tests

- ☐ All 3 displays show content
- ☐ Eye displays animate (blink cycle)
- ☐ Mouth display changes colors
- ☐ Speaker produces clear audio
- ☐ Distance sensor readings change with proximity
- ☐ Mood system cycles through emotions

## 🧙 Mood System Overview

Your goblin automatically cycles through 9 emotions:

Emotion	Visual Effect	Trigger Condition
😨 FEAR	Pale colors, rapid blinks	Sudden proximity
😡 ANGER	Red colors, intense stare	Sustained proximity
😠 IRRITATION	Orange tints, narrow eyes	Repeated interaction
😊 HAPPINESS	Bright colors, wide eyes	Positive interaction
😌 CONTENTMENT	Soft blue, relaxed	Extended calm period
🍲 HUNGER	Green tints, searching	Time-based cycle
👁️ CURIOSITY	Blue tints, alert look	Motion detection
💕 AFFECTION	Pink tints, gentle gaze	Gentle interaction
🥳 EXCITEMENT	Rapid color changes	High activity

## 🔧 Troubleshooting Guide

#### No Display Output

**Symptoms:** Black screens on all displays

**Check:**

- 5V power on display VCC pins
- SPI wiring (GPIO 12,13,14 connections)
- Individual CS pin connections (GPIO 15,16,17)

#### Build/Upload Errors

**Symptoms:** Compilation fails

**Check:**

- p32\_component\_config.h contains #define ENABLE\_GOBLIN\_COMPONENTS
- USB-C cable connected to ESP32
- Correct COM port detected

## No Audio

**Symptoms:** Silent speaker

**Check:**

- I2S connections (GPIO 4,5,6)
- 5V power to audio amplifier
- Speaker polarity (+ and - terminals)

## Sensor Not Working

**Symptoms:** Fixed distance readings

**Check:**

- HC-SR04 requires full 5V (not 3.3V)
- GPIO 9,10 connections
- No obstructions in front of sensor



## Component Specifications

### ESP32-S3-DevKitC-1

- **MCU:** Dual-core 240MHz
- **RAM:** 512KB SRAM
- **Flash:** 8MB
- **WiFi/Bluetooth:** Built-in
- **GPIO:** 45 pins (11 used, 34+ available)

### GC9A01 Round Displays (×3)

- **Size:** 1.28" diameter
- **Resolution:** 240×240 pixels
- **Interface:** SPI (7-pin)
- **Colors:** 65,536 (RGB565)
- **Voltage:** 3.3V logic, 5V power

### MAX98357A Audio Amplifier

- **Interface:** I2S digital input
- **Output:** 3W @ 4Ω
- **SNR:** 92dB
- **Voltage:** 5V power

### HC-SR04 Distance Sensor

- **Range:** 2cm to 400cm
- **Accuracy:** ±3mm
- **Interface:** Digital trigger/echo
- **Voltage:** 5V required



## Expansion Ideas

With 34+ unused GPIO pins, add:

- **Servo neck movement** (PWM control)
- **LED accent lighting** (WS2812B strips)
- **Camera module** (ESP32-CAM integration)
- **Microphone input** (I2S or ADC)
- **Wheeled mobility base** (motor controllers)
- **Additional displays** (expand face features)



## Support Resources

- **GitHub Repository:** [p32-animatronic-bot \(https://github.com/reussered/p32-animatronic-bot\)](https://github.com/reussered/p32-animatronic-bot)
- **Documentation:** See /docs folder for technical specs
- **Hardware Datasheets:** Component manufacturer websites
- **ESP32 Resources:** Espressif official documentation



**Congratulations! You've built a complete mood-driven animatronic system!**

*Print this guide in color for best results. The SVG diagram will scale perfectly on any printer.*