

GPIO Pin Assignments

| GPIO | Function | Component | Notes |
|------|-------------|----------------|--------------------|
| 0 | XCLK/Boot | Camera | Boot mode when LOW |
| 1 | CHG_LED | FTDI | Serial transmit |
| 2 | UART_TX | TP4056 | Charge indicator |
| 3 | UART_RX | FTDI | Serial receive |
| 4 | Flash_LED | Camera | Built-in flash |
| 5 | LoRa_CS | SX1276 | SPI chip select |
| 12 | SD_CS | SD Card | SPI chip select |
| 13 | PIR_Input | PIR Sensor | Motion detection |
| 14 | LoRa_RST | SX1276 | Reset signal |
| 15 | SD_MOSI | SD Card | SPI data out |
| 16 | Vibration | SW-420 | Digital input |
| 18 | SPI_SCK | LoRa/SD | SPI clock |
| 19 | SPI_MISO | LoRa | SPI data in |
| 21 | I2C_SDA | BME280/ADXL345 | I2C data |
| 22 | I2C_SCL | BME280/ADXL345 | I2C clock |
| 23 | SPI_MOSI | LoRa | SPI data out |
| 26 | LoRa_DIO0 | SX1276 | Interrupt |
| 32 | Cam_PWDN | Camera | Power down |
| 33 | IR_LED | MOSFET | 12V LED control |
| 34 | Solar_ADC | Voltage Div | Solar monitoring |
| 35 | Battery_ADC | Voltage Div | Battery monitoring |

PIR Sensor

Motion Detection

GND
OUT → GPIO13
VCC (3.3V)

Range: 6-7m

BME280

Weather Sensor

SCL → GPIO22
SDA → GPIO21
I2C: 0x76
Pressure
Humidity
Temperature

ESP32 WILDLIFE CAMERA

Main Circuit Schematic

ADXL345

3-Axis Accel

Specifications:

Version: 1.0
Date: December 2024
MCU: ESP32 (AI-Thinker)
Power: 3.7V Li-ion + Solar
Storage: MicroSD (SPI)
Wireless: LoRa 915MHz
Sensors: PIR, BME280, ADXL345
Night Vision: 12V IR LEDs

Project Details:

- Solar-powered wildlife trail camera
- ESP32-CAM with OV2640 sensor
- LoRa mesh networking capability
- Multi-sensor environmental monitoring
- Low-power deep sleep operation
- 12V IR LED night vision system

SW-420

Vibration

GND
OUT → GPIO16
VCC (3.3V)

5V
Power Input
GND
Ground
GPIO0
XCLK/Boot
GPIO1
UART TX
GPIO3
UART RX
GPIO12
UART RX
GPIO13
SD_CS
GPIO14
PIR_IN
GPIO15
LoRa_RST/SD_CLK
GPIO16
SD_MOSI
GPIO17
VIBRATION
SW-420 vibration sensor

ESP32-CAM

AI-Thinker Module

ESP32

OV2640

Camera

SD Slot

3V3
3.3V Output
GPIO2
CHG_LED/SD_MISO
GPIO4
FLASH_LED
GPIO28
LORA_DIO0
GPIO29
I2C_SDA
GPIO27
I2C_SCL
GPIO34
SOLAR_ADC
GPIO35
BAT_ADC
GPIO32
CAM_PWDN
GPIO33
IR_LED_CTRL
12V IR LED control

FTDI FT232RL

USB-Serial

Programming

GND → ESP32 GND
5V → ESP32 5V
RX → GPIO1 (TX)
TX → GPIO3 (RX)

RESET

BOOT

10kΩ

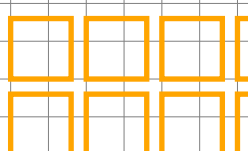
10kΩ

SD Card

Storage

MISO → GPIO19
CLK → GPIO14
MOSI → GPIO15
CS → GPIO12

Solar Panel

5V 2W
Polycrystalline
Weather ResistantCHG
FULL

TP4056

Li-ion Charger
1A Max Current

Protection Circuit

BAT+

BAT-

18650

Li-ion

3.7V Nominal
3000mAh
Protected

Component Specifications

ESP32-CAM: AI-Thinker, Dual-core 240MHz, 4MB Flash
OV2640: 2MP camera sensor, UXGA resolution
TP4056: 1A Li-ion charger with protection
18650: 3.7V 3000mAh Li-ion battery
AMS1117-5.0: 5V 1A linear regulator
MT3608: 3.7V to 12V boost converter
PIR: Passive infrared motion sensor
BME280: Temperature, humidity, pressure sensor
ADXL345: ±16g 3-axis accelerometer
SW-420: Vibration detection sensor
SX1276: 915MHz LoRa transceiver
IRE520N: N-channel MOSFET, 100V 9.2A
Solar Panel: 5V 2W polycrystalline
SD Card: SPI interface, FAT32 format

AMS1117-5.0

1A Output

C1

C2

MT3608

Boost Converter

3.7V → 12V

L1

C3

Design Notes

- I2C pull-up resistors: 4.7kΩ on SDA/SCL
- Voltage dividers sized for 3.3V ADC
- MOSFET gate pull-down: 10kΩ resistor
- Reset/Boot pull-ups: 10kΩ resistors
- LoRa antenna: 915MHz quarter-wave
- Solar panel: Schottky diode for reverse protection
- Battery protection: Built into TP4056
- Power consumption: <100µA sleep
- Operating temperature: -20°C to 60°C
- All connectors: IP65 rated for outdoor
- PCB: 4-layer with ground plane
- Enclosure: UV-resistant ABS plastic