Smart Environmental Monitor - Pin Connection Table

Arduino Pin Assignments

Component	Component Pin	Arduino Pin	Pin Type	Description	Notes
DHT11 Sensor	Data	Pin 2	Digital I/O	Temperature/Humidity data line	Pull-up resistor recommended
DHT11 Sensor	VCC	5V	Power	Sensor power supply	
DHT11 Sensor	GND	GND	Ground	Ground connection	
Light Sensor (LDR)	Signal	A0	Analog Input	Light level reading	Direct connection to analog pin
Light Sensor (LDR)	VCC	5V	Power	LDR power supply	Direct connection
Joystick Module	VRx	A1	Analog Input	X-axis position	0-1023 range
Joystick Module	VRy	A2	Analog Input	Y-axis position	0-1023 range
Joystick Module	SW	Pin 3	Digital Input	Button press	Internal pull-up enabled
Joystick Module	VCC	5V	Power	Joystick power supply	
Joystick Module	GND	GND	Ground	Ground connection	
Green LED	Anode (+)	Pin 5	Digital Output	Normal status indicator	Direct connection to pin
Green LED	Cathode (-)	GND	Ground	LED ground connection	Via 220Ω current limiting resistor
Yellow LED	Anode (+)	Pin 6	Digital Output	Warning status indicator	Direct connection to pin
Yellow LED	Cathode (-)	GND	Ground	LED ground connection	Via 220Ω current limiting resistor
Red LED	Anode (+)	Pin 7	Digital Output	Critical status indicator	Direct connection to

					pin
Red LED	Cathode (-)	GND	Ground	LED ground connection	Via 220Ω current limiting resistor
Buzzer	Positive (+)	Pin 9	PWM Output	Audio alert output	PWM tone generation
Buzzer	Negative (-)	GND	Ground	Buzzer ground connection	
SD Card Module	CS	Pin 10	Digital Output	SPI Chip Select	SPI communication
SD Card Module	SCK	Pin 13	Digital Output	SPI Clock	SPI communication
SD Card Module	MOSI	Pin 11	Digital Output	SPI Master Out Slave In	SPI communication
SD Card Module	MISO	Pin 12	Digital Input	SPI Master In Slave Out	SPI communication
SD Card Module	VCC	5V	Power	SD module power supply	
SD Card Module	GND	GND	Ground	Ground connection	
LCD Display (I2C)	SDA	A4	I2C Data	I2C data line	Shared I2C bus
LCD Display (I2C)	SCL	A5	I2C Clock	I2C clock line	Shared I2C bus
LCD Display (I2C)	VCC	5V	Power	LCD power supply	
LCD Display (I2C)	GND	GND	Ground	Ground connection	
RTC Module (DS3231)	SDA	A4	I2C Data	I2C data line	Shared I2C bus with LCD
RTC Module (DS3231)	SCL	A5	I2C Clock	I2C clock line	Shared I2C bus with LCD
RTC Module (DS3231)	VCC	5V	Power	RTC power supply	Battery backup included
RTC Module (DS3231)	GND	GND	Ground	Ground connection	

Pin Usage Summary

Digital Pins Used:

- **Pin 2**: DHT11 Data (Digital I/O)
- **Pin 3**: Joystick Button (Digital Input with pull-up)
- **Pin 5**: Green LED (Digital Output)

- **Pin 6**: Yellow LED (Digital Output)
- **Pin 7**: Red LED (Digital Output)
- **Pin 9**: Buzzer (PWM Output)
- **Pin 10**: SD Card CS (Digital Output)
- **Pin 11**: SD Card MOSI (Digital Output)
- **Pin 12**: SD Card MISO (Digital Input)
- **Pin 13**: SD Card SCK (Digital Output)

Analog Pins Used:

- **A0**: Light Sensor (LDR) - Analog Input
- **A1**: Joystick X-axis - Analog Input
- **A2**: Joystick Y-axis - Analog Input
- **A4**: I2C SDA (LCD + RTC) - I2C Data
- **A5**: I2C SCL (LCD + RTC) - I2C Clock

Power Connections:

- **5V Rail**: DHT11, LDR circuit, Joystick, LEDs, Buzzer, SD Card, LCD, RTC
- **GND Rail**: All component ground connections
- **3.3V**: Not used (available for future expansion)

Communication Protocols:

- **I2C Bus (A4/A5)**: LCD Display (0x27) + RTC Module (0x68)
- **SPI Bus (10,11,12,13)**: SD Card Module
- **UART (0,1)**: Available for debugging/expansion
- **PWM (Pin 9)**: Buzzer tone generation
- **Digital I/O**: LEDs, Button, DHT11
- **ADC**: Light sensor, Joystick axes

Pin Availability:

- **Available Digital Pins**: 4, 8 (2 pins free)
- **Available Analog Pins**: A3, A6, A7 (3 pins free)
- **Available PWM Pins**: 3, 5, 6 (used for LEDs, but PWM capability available)

Component I2C Addresses

- **LCD Display**: 0x27 (39 decimal)
- **DS3231 RTC**: 0x68 (104 decimal)

Notes

- LED anodes connect directly to Arduino pins, cathodes connect to GND via 220Ω resistors
- LDR connects directly to analog pin A0
- I2C bus shared between LCD and RTC modules
- SPI bus dedicated to SD card module
- Joystick button uses internal pull-up resistor
- System designed for 5V operation throughout