GENERAL

avr atmega8 project list

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Introduction

In the world of embedded systems, the AVR ATmega8 microcontroller has long been a favorite among hobbyists, educators, and professional engineers alike. Its balance of low power consumption, ease of programming, and robust community support makes it an ideal platform for a wide range of projects. Whether you're just starting with microcontrollers or looking to expand your portfolio, exploring an **avr atmega8 project list**can spark creativity and deepen your technical understanding. This comprehensive guide presents a curated selection of ATmega8 projects, grouped by application domains, with practical details that will help you get started right away.

Why Choose the ATmega8?

The ATmega8 is a member of Atmel's (now Microchip) AVR family of 8 bit microcontrollers. It offers:

- 32 /kB of flash memory for program storage.
- 2 /kB of SRAM for data handling.
- 1 /kB of EEPROM for non volatile data.
- 16 general purpose I/O pins, including PWM, analog inputs, and serial interfaces.
- Low power sleep modes and a built in crystal oscillator.

Because of its generous memory and versatile peripherals, the ATmega8 can serve as the brain for simple sensors, motor controllers, communication modules, and even small robotic systems. It also runs on a 5 V supply, simplifying power management for battery powered designs.

Getting Started: Tools and Development Environment

Before diving into projects, you'll need a few essential items:

1. AVR Development Board – The ATmega8 can be soldered onto a custom PCB or purchased as part of a ready made board like the "ATmega8 Development Board" from various distributors.
2. AVR-GCC Toolchain – The GNU compiler for AVR allows you to write C code, compile, and flash the microcontroller.
3. AVRDUDE – A command line utility for programming the ATmega8 via USB or serial.
4. IDE (Optional) – Atmel Studio, Visual /Studio /Code with AVR extensions, or PlatformIO can streamline development.
5. Basic Electronics Toolkit – Breadboard, jumper wires, resistors, capacitors, LEDs, transistors, and a multimeter.

Once you have these tools, you can load sample code from the projects below and begin experimenting.

Project Categories

The ATmega8's versatility allows it to tackle projects across several domains. Below, we group projects into five major categories:

- Sensor Based Systems – Reading temperature, light, motion, and other environmental data.

- Actuator Control – Driving motors, servos, and relays.
- Communication Interfaces – UART, SPI, I²C, and wireless modules.
- Power Management – Battery monitoring, charging circuits, and energy harvesting.
- Robotics & Automation – Combining sensors and actuators for autonomous behavior.

Detailed AVR ATmega8 Project List

1. Temperature Logger with DS18B20

This project demonstrates how to interface the ATmega8 with a 1 Wire temperature sensor, log readings to an SD card, and display data on an LCD. It's perfect for learning serial communication, file I/O, and power saving techniques.

- Components: ATmega8 board, DS18B20 sensor, 4.7 /k:' VÆÂ W &W6—7F÷ , 16 bit SD card module, 16×2 LCD.
- Key Features: 1 Wire protocol, FAT16 file system, low power sleep mode.
- Learning Outcomes: Mastering the 1 Wire bus, SPI communication with SD cards, and LCD interfacing.

2. Light Sensitive LED Dimmer

Using a photoresistor (LDR) and PWM outputs, this project creates a dimming LED that automatically adjusts brightness based on ambient light. It's an excellent introduction to analog-to-digital conversion and PWM control.

- Components: ATmega8, LDR, 10 /k:' &W6—7F÷ , NPN transistor, LED.
- Key Features: ADC reading, PWM duty cycle adjustment, hysteresis to prevent flicker.
- Learning Outcomes: Understanding ADC resolution, PWM frequency tuning, and simple feedback loops.

3. Digital Dice with 7 Segment Display

Generate random numbers using the ATmega8's hardware RNG, then display the result on a 7 segment display. This classic exercise covers timer interrupts, random number generation, and multiplexing.

- Components: ATmega8, 7 segment display, current limiting resistors.
- Key Features: Timer0 interrupt every 1 /s, pseudo random number generator.
- Learning Outcomes: Timer configuration, interrupt service routines, and display multiplexing.

4. Home Automation: Smart Light Switch

Control a household light via a wireless remote using an RF module (433 MHz). The ATmega8 decodes the remote's signal and toggles a relay, enabling remote control of lights.

- Components: ATmega8, 433 /MHz RF receiver, relay module, optocoupler.
- Key Features: UART like protocol, debounce logic, safety isolation.
- Learning Outcomes: RF communication, interrupt based signal decoding, and safety considerations.

5. Servo Motor Controller for RC Car Steering

Drive a servo motor to control the steering of a small RC car. The ATmega8 reads input from an RC receiver and sends PWM signals to the servo, demonstrating real time control.

- Components: ATmega8, RC receiver, servo motor, power supply.
- Key Features: PWM generation with Timer1, RC signal parsing.
- Learning Outcomes: Real time signal processing, PWM resolution, and power management.

6. Wireless Weather Station with LoRa

Transmit temperature, humidity, and pressure data over long distances using a LoRa module. This project covers sensor interfacing, LoRa communication, and data aggregation.

- Components: ATmega8, DHT22 sensor, BMP180 barometer, SX1278 LoRa module.
- Key Features: Low power sleep, packet framing, error checking.
- Learning Outcomes: LoRa protocol basics, sensor fusion, and power efficient design.

7. Battery Powered Solar Charger

Design a small solar charger that monitors battery voltage, controls charging current, and protects against over charging. The ATmega8 manages the charge cycle and logs data.

- Components: ATmega8, solar panel, LM317 adjustable regulator, battery, voltage divider.
- Key Features: Current limiting, voltage monitoring, auto shutdown.
- Learning Outcomes: Power electronics, ADC monitoring, and safety circuits.

8. Infrared Remote Control Receiver

Build an IR receiver that can decode signals from a standard remote and trigger GPIO events. This project teaches low level timing and state machines.

- Components: ATmega8, IR receiver module (TSOP382), LED indicator.
- Key Features: 38 /kHz demodulation, state machine decoding.
- Learning Outcomes: Pulse width measurement, state machine design, and interrupt handling.

9. Digital Thermometer with OLED Display

Read a thermistor or digital temperature sensor and display the value on a small OLED. This project combines analog sensing with I²C communication.

- Components: ATmega8, TMP36 sensor, SSD1306 OLED, pull up resistors.
- Key Features: I²C master, temperature conversion formula.
- Learning Outcomes: I²C protocol, sensor calibration, and display graphics.

10. Autonomous Line Following Robot

Construct a small robot that follows a line on the floor using infrared sensors and differential drive. The ATmega8 processes sensor data and controls wheel motors.

- Components: ATmega8, two IR sensors, two DC motors with H bridge, chassis.
- Key Features: PID control, sensor calibration, real time decision making.
- Learning Outcomes: Sensor fusion, PID tuning, and motor driver interfacing.

11. Digital Clock with RTC Module

Create a real time clock that keeps accurate time using an DS3231 RTC module and displays it on an LCD.

- Components: ATmega8, DS3231, 16×2 LCD, push buttons.
- Key Features: I²C communication, time keeping, user interface.
- Learning Outcomes: RTC usage, button debouncing, and menu navigation.

12. Home Security System with PIR Sensor

Detect motion using a PIR sensor and trigger an alarm or send a notification via serial. This project is a good introduction to event driven programming.

- Components: ATmega8, PIR sensor, buzzer, serial terminal.
- Key Features: Interrupt on motion detection, debounce logic.
- Learning Outcomes: Event handling, interrupt configuration, and basic alarm systems.

13. Digital Thermostat with HVAC Control

Control an HVAC unit by reading temperature and adjusting fan speed. The ATmega8 interfaces with a temperature sensor and PWM controlled fan.

- Components: ATmega8, DHT11, PWM fan driver.
- Key Features: PID temperature control, fan speed regulation.
- Learning Outcomes: PID control, PWM resolution, and system integration.

14. Bluetooth Low Energy (BLE) Data Logger

Collect sensor data and transmit it wirelessly via a BLE module. The ATmega8 handles sensor acquisition and BLE communication.

- Components: ATmega8, BLE module (HM 10), sensor array.
- Key Features: UART communication, GATT services, power management.
- Learning Outcomes: BLE protocol basics, UART handling, and data serialization.

15. Simple Digital Synthesizer

Generate musical tones using PWM and a DAC or direct output. The ATmega8 can produce sine waves by controlling PWM duty cycle.

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