

Introduction to eYFi-Mega Board Getting started with Input-Output Ports

e-Yantra Team

Embedded Real-Time Systems (ERTS) Lab
Indian Institute of Technology, Bombay

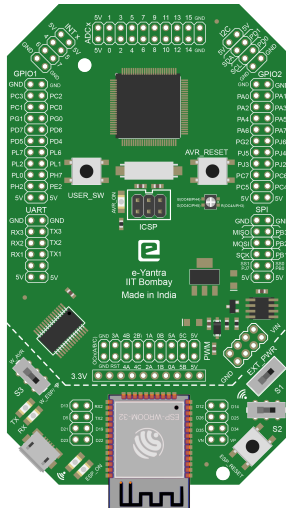
IIT Bombay
January 29, 2020



Overview of eYFi-Mega Board



Overview of eYFi-Mega Board



Features of eYFi-Mega Board



Features of eYFi-Mega Board

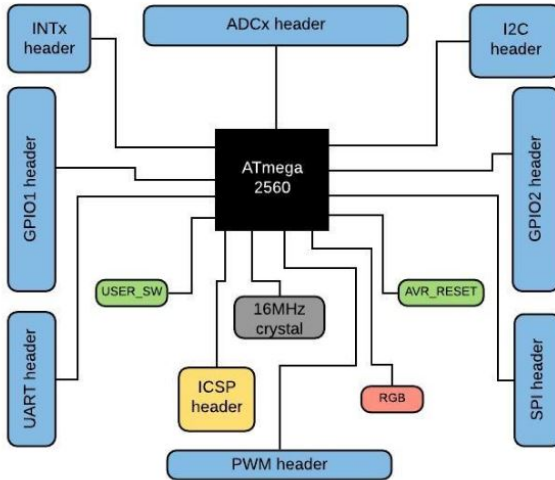
- **Dual Micro-controller Board:**
 - 8-bit ATmega 2560
 - 32-bit ESP32
- **High Output Power:** 12.5 W (5V, 2.5A)
- **Wi-Fi:**
 - Protocol: 802.11 b/g/n (802.11n up to 150 Mbps)
 - Frequency Range: 2.4 GHz ~ 2.5 GHz
- **Bluetooth Low Energy:**
 - Protocol: Bluetooth v4.2 BR / EDR and BLE specification
- **On-board File Storage:** 700 KB SPI-Flash File System
(expandable up to 3 MB)
- **Compatible with FreeRTOS:** Both micro-controllers are capable of running FreeRTOS
- **Arduino Programming Language:** Both micro-controllers can be programmed using Arduino API



Block Diagram (AVR):



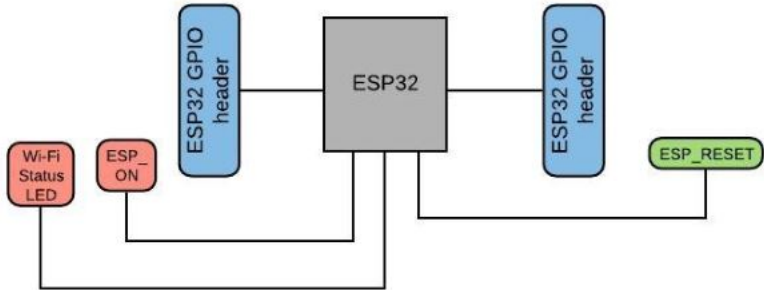
Block Diagram (AVR):



Block Diagram (ESP):



Block Diagram (ESP):



Getting started with ATmega 2560



Getting started with ATmega 2560

- AVR architecture based Microcontroller.
- Manufactured by Atmel.
- Uses 8-bit RISC architecture.
- Consists of 100 pins.
- Combines 256KB ISP flash memory, 8KB SRAM, 4KB EEPROM.
- Consists of 6 timers/counters, PWM, 4 UARTs, 16-channel 10 bit A/D converter and much more.



What are Ports?



What are Ports?

- Junctions where peripheral devices are connected.
- Out of 100 pins 86 pins are used as Input/Output pins.
- Pins are grouped together and are called as Port.



What are Ports?

- Junctions where peripheral devices are connected.
- Out of 100 pins 86 pins are used as Input/Output pins.
- Pins are grouped together and are called as Port.

① ATmega 2560 has ten 8-bit Ports

Port x; x = A to F and H, J, K, L



What are Ports?

- Junctions where peripheral devices are connected.
- Out of 100 pins 86 pins are used as Input/Output pins.
- Pins are grouped together and are called as Port.

① ATmega 2560 has ten 8-bit Ports

Port x; x = A to F and H, J, K, L

② ATmega 2560 has one 6-bit Port

Port G;



What are Ports?

- Junctions where peripheral devices are connected.
- Out of 100 pins 86 pins are used as Input/Output pins.
- Pins are grouped together and are called as Port.
 - ① ATmega 2560 has ten 8-bit Ports
Port x; $x = A \text{ to } F \text{ and } H, J, K, L$
 - ② ATmega 2560 has one 6-bit Port
Port G;
- All Port pins can be individually configured as Input/Output.



Accessing Ports



Accessing Ports

Each Ports has three associated registers with it:

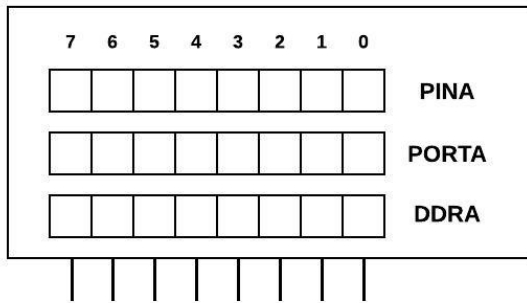
- 1 DDR_x x = A to H and J, K, L
- 2 PORT_x x = A to H and J, K, L
- 3 PIN_x x = A to H and J, K, L



Accessing Ports

Each Ports has three associated registers with it:

- 1 DDR_x x = A to H and J, K, L
- 2 PORT_x x = A to H and J, K, L
- 3 PIN_x x = A to H and J, K, L



Registers in detail



Registers in detail

- **DDRx**: To define Port pin as Input or Output.



Registers in detail

- **DDRx**: To define Port pin as Input or Output.
 - **DDRx bit = 1** → Portx pin is defined as Output.



Registers in detail

- **DDRx**: To define Port pin as Input or Output.
 - a DDRx bit = 1 → Portx pin is defined as Output.
 - b DDRx bit = 0 → Portx pin is defined as Input.



Registers in detail

- **DDRx**: To define Port pin as Input or Output.
 - **a** DDRx bit = 1 → Portx pin is defined as Output.
 - **b** DDRx bit = 0 → Portx pin is defined as Input.
- **PINx**: To read data present on Port x pins.



Registers in detail

- **DDRx**: To define Port pin as Input or Output.
 - **a** DDRx bit = 1 → Portx pin is defined as Output.
 - **b** DDRx bit = 0 → Portx pin is defined as Input.
- **PINx**: To read data present on Port x pins.
- **PORTx**: There are two cases:
 - Case 1: When Port is defines as Output: Send data on Port x pins.
 - Case 2: When Port is defined as Input: Activate/deactivate Pull-up resistor.



Registers in detail

- **DDRx**: To define Port pin as Input or Output.
 - **a** DDRx bit = 1 → Portx pin is defined as Output.
 - **b** DDRx bit = 0 → Portx pin is defined as Input.
- **PINx**: To read data present on Port x pins.
- **PORTx**: There are two cases:
 - Case 1: When Port is defines as Output: Send data on Port x pins.
 - Case 2: When Port is defined as Input: Activate/deactivate Pull-up resistor.
 - **a** PORTx bit = 1 → Pull up is activated on Portx pin.



Registers in detail

- **DDRx**: To define Port pin as Input or Output.
 - **a** DDRx bit = 1 → Portx pin is defined as Output.
 - **b** DDRx bit = 0 → Portx pin is defined as Input.
- **PINx**: To read data present on Port x pins.
- **PORTx**: There are two cases:
 - Case 1: When Port is defines as Output: Send data on Port x pins.
 - Case 2: When Port is defined as Input: Activate/deactivate Pull-up resistor.
 - **a** PORTx bit = 1 → Pull up is activated on Portx pin.
 - **b** PORTx bit = 0 → Pull up is deactivated on Portx pin.



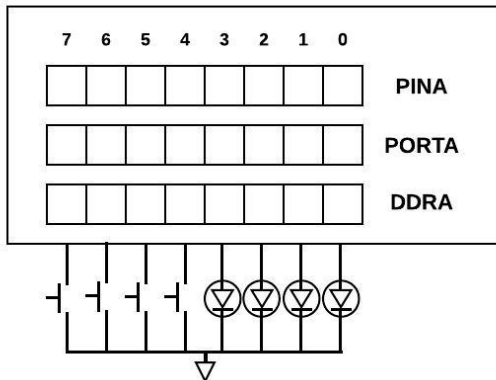
Examples

- Example: Connect LEDs to lower nibble and Switches to upper nibble of PortA. Turn ON alternate LEDs (0 and 2) and activate pull up for all Switches. Read data using PIN register. What will be the content of PINA register, if only Switch at pin 5 is pressed.



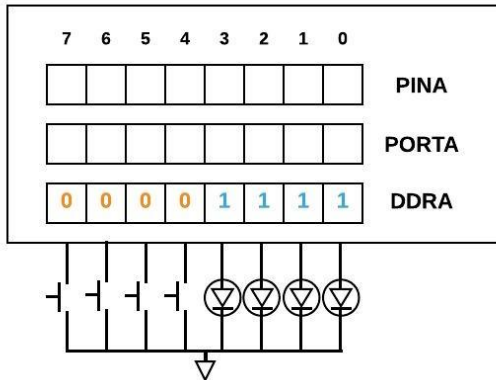
Examples

- Example: Connect LEDs to lower nibble and Switches to upper nibble of PortA. Turn ON alternate LEDs (0 and 2) and activate pull up for all Switches. Read data using PIN register. What will be the content of PINA register, if only Switch at pin 5 is pressed.



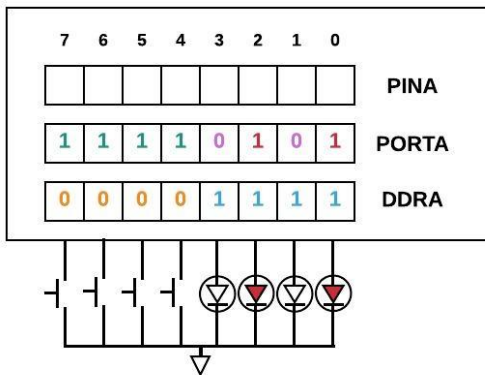
Examples

- Example: Connect LEDs to lower nibble and Switches to upper nibble of PortA. Turn ON alternate LEDs (0 and 2) and activate pull up for all Switches. Read data using PIN register. What will be the content of PINA register, if only Switch at pin 5 is pressed.



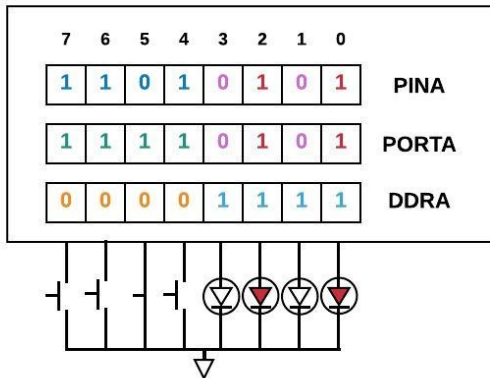
Examples

- Example: Connect LEDs to lower nibble and Switches to upper nibble of PortA. Turn ON alternate LEDs (0 and 2) and activate pull up for all Switches. Read data using PIN register. What will be the content of PINA register, if only Switch at pin 5 is pressed.



Examples

- Example: Connect LEDs to lower nibble and Switches to upper nibble of PortA. Turn ON alternate LEDs (0 and 2) and activate pull up for all Switches. Read data using PIN register. What will be the content of PINA register, if only Switch at pin 5 is pressed.



Thank You!

Post your queries on: helpdesk@e-yantra.org

