**Assignment 2 – Computer Organization**

**Part A – System Architecture.**

**A:** ATMEGA4809 Micro-controller.

An integrated chip that houses all the core components of a basic computer system including a processor, RAM, flash storage and EEPROM for storing the basic program (IoT Guider, Para 2).

**B:** ISP Flash and USB Controller.

Contains ISP flash and a USB controller to enable interaction between the USB I/O and the Micro-controller (IoT Guider, Para 5).

**C:** I2C SMBus (System Management Bus)

Provides a bus that can be used to link one Arduino device as a master to one or many slave or other master devices. Controls the interaction between these devices and sends data between them (How To Mechatronics).

**D:** Capacitors??? \*\*\*\*

**E:** Power port.

Supplies 7V – 12V of power to the Arduino from an external power device. Either an AC to DC adapter or a battery (IoT Guider, Para 4).

**F:** Step-Down Converter.

Receives up to 21V of power and provides and output of 5V at 1.2A (MPS, Para 1) to be used by other Arduino components at the correct voltage for the system.

**G:** SMB Diode.

A diode for maintaining the flow of power through the device. Has a high resistance on one side, and low on the other to control the flow of electricity to only move in one direction.

**H:** RGB LED.

A programmable RGB LED light that can be controlled by the microcontroller (IoT Guider, Para 7).

**I:** RX/TX LED.

LED lights that flash when data is being transferred to or from the USB chip and a computer (IoT Guider, Para 9).

**J:** Voltage Regulator.

Regulates the power going into the Arduino unit to avoid damage to the system due to too much power ( > 12V ) (IoT Guider, Para 14).

**K:** IMU (Inertial Measurement Unit)

Can be used to measure external movement, temperature or orientation using an accelerometer and gyroscope (IoT Guider, Para 8).

**L:** Monostable Vibrator

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**M:** SMD Crystal Resonator.

Uses a quartz crystal and a piezoelectrical current to set the clock timing for the device (16MHz).

**N:** Master reset button.

Sends a pulse to the reset pin of the micro-controller to reset the Arduino unit to the start of the program (IoT Guider, Para 10).

**O:** Crypto Chip

An onboard crypto processor that handles encryption, tamper and intrusion detection, and key protection for the device (Semi Engineering, Para 1).

**P:** Small Outline Transistor.

A very small transistor used to correct the flow of current in the system. Increases the voltage when it drops below the required value necessary to the system.

**Q:** Digital Potentiometers.

Adjusts the level of the signal passing through it by using a “stepping ladder” architecture. Often used to control volume levels, speed of a motor, or brightness levels of external LED’s (Core Electronics, Para 1).

**R:**

1. USB Connector.
2. A computer for programming the Micro-controller, a power lead for powering the unit.
3. A USB type-B connector used as the main connection to a Computer for programming the Micro-controller using the boot loader (IoT Guider, para 3). Can also be connected to an external power device to supply power to the Arduino system. Provides 7 – 12 volts of power and 60MB/s bandwidth (Wikipedia).

**S:**

1. Digital I/O Pins
2. Connect to external devices e.g., motors, LED’s, sensors, switches, speakers etc.
3. The primary I/O ports for the Arduino device. A set of serial digital input/output ports that can be connected to a wide variety of external devices to provide data transmission or up to 40mA of power. Some plugs provide full digital output, and others simulate analog output. Send one bit worth of data at a time, for each plug, or more accurately, a constant stream of either high or low voltage that is read as one bit per hertz cycle (Arduino).

**T:**

1. ICSP Header Pins.
2. Connects to a computer.
3. Used to program the Arduino’s microcontroller without requiring the bootloader. Instructions can be sent directly to the microcontroller. Often used if the bootloader is damaged, or not present (IoT Guider, Para 15).

**U:**

1. Wi-Fi Module
2. Connects to Wi-Fi networks and Bluetooth enabled devices.
3. Uses a NINA-W10 Wi-Fi chip to connect to Wi-Fi networks and Bluetooth enabled devices. Maximum Wi-Fi throughput of the module is 25Mbit/s with a range of 400meters and it can maintain 8 Bluetooth connections (U-Blox, para 1).

**V:**

1. Analog Pins.
2. Connect to external devices e.g., motors, LED’s, sensors, switches, speakers etc.
3. Digital I/O pins that convert analogue input into a digital integer representation with 10-bit resolution (0 top 1023), or replicate analogue output using PWM (pulse width modulation). Though analogue pins are primarily useful for analogue I/O, they can be used as digital GPIO pins when required (Arduino, para 1).

**W:**

1. Power Pins.
2. Connect to external devices e.g., motors, LED’s, sensors, switches, speakers etc.
3. Used to power low voltage external devices. Made up of 5V, 3.3V, IOREF (pin with shield to select appropriate output voltage) and ground outputs. Also has a VIN pin to allow power from external sources if the other power mediums are not viable (IoT Guider, Para 13).

**References:**

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