

3x Practicum Ideas

Describe three valid practicum projects and indicate which one we have chosen.

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Projects

Chosen Option

Project Name: LED Cube (Alias - The Cube)

Description :

The first project is an acrylic cube containing addressable LEDs. The device turns on in response to a vertical and horizontal motion that increases the velocity above a threshold. It shuts down when static - (no motion detected) for 5 seconds. The appearance of the LED changes in response to the velocity and angle the user moves the cube. The central concept is building an entertainment device for consumers of all ages to use.

The sensor :

The LED Cube incorporates one sensor at the stage of the initial development. Further, it uses a gyroscope sensor to modulate the mode of operation for the LEDs. Gyroscope sensors are devices that can detect angular velocity. A sensor of this type can detect rotational motion and changes in orientation. The specific gyroscope sensor is listed below:

- MPU-6050

<https://www.digikey.com/product-detail/en/tdk-invensense/MPU-6050/1428-1007-1-ND/4038010>

The controller :

The LED Cube is using the ATmega328p microcontroller.

The high-performance Microchip 8-bit AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while-write capabilities. Besides, it has 1KB EEPROM, 2KB SRAM, 23 general-purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts.

(Source: <https://www.microchip.com/wwwproducts/en/ATmega328>)

What is more, the ATmega328p processor is in the Arduino board; therefore, prototyping and programming are faster and more accessible at the initial stage of the project.

The actuator:

The actuators in the project are addressable LEDs. The LEDs are individually programmable and change color based on different sets of inputs. The selected LEDs are:

- WS2812B1M60LB30

https://www.amazon.com/gp/product/B01CDTED80/ref=ppx_yo_dt_b_asin_title_o00_s00?ie=UTF8&psc=1

Option 2

Project Name: Digital Voltmeter

Description:

A digital voltmeter (DVM) is a device that measures an electrical signal and displays the signal on a digital screen. This objective of this project is to create a DVM using the analog to digital converter (ADC) in the ATmega328P microcontroller. A voltage divider configuration would be used at the input to avoid damaging the microcontroller in large voltage applications. A liquid crystal display outputs the signal to the user. Engineers and hobbyists use DVM to debug designs.

The sensor:

The device sensor is a set of wires that feed the ADC of the microcontroller. This device does not measure signals at high frequencies; therefore, the selection of wires can be arbitrary. A simple set of alligator clips is used to allow the user to probe the device under test quickly.

The Controller:

The project uses the ATmega328p. This microcontroller has ADC inputs and can communicate through I2C with an LCD. Prototyping for the DVM is accessible on an Arduino board, which uses the same controller. The functionality of the microcontroller and the ability to quickly prototype has made it a strong candidate.

The Actuator:

The Actuator for the Design is an LCD. The screen outputs the values of the voltage to the user. The specific LCD for the project is:

- KTM-S1201 LCD

https://www.amazon.com/KNACRO-Backlight-Arduino-MEGA2560-Letters/dp/B06X1F4PT5/ref=asc_df_B06X1F4PT5/?tag=hyprod-20&linkCode=df0&hvadid=241973970700&hvpos=1o3&hvn_etw=g&hvrand=17827159020780920623&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9032898&hvtargid=pla-556207392138&psc=1

Option 3

Project Name: Alarm Clock

Description:

This project focuses on creating an alarm clock using a quartz crystal and the timing capabilities of the ATmega328p. Through the use of multiple push buttons and an LCD, the user can choose a time for the alarm to activate. When the alarm activates, a row of LEDs turns on, and a buzzer creates a sound. The alarm deactivates when the user presses another push button. This project serves as an aesthetically pleasing alarm to remind people of their daily tasks.

Sensor:

The sensors for this project are a set of pushbuttons. The buttons feed the inputs of the microcontroller. Any push button would work fine for this application.

The Controller:

The project uses the ATmega328p microcontroller. This microcontroller has the necessary capabilities to complete to drive the LCD. The Arduino board uses the same microcontroller, making it easy to prototype the design.

The Actuator:

The actuators for this project are a buzzer and a strip of LEDs. The buzzer and LEDs notify the users when their alarm has activated. The specific parts for the project are listed below:

- WS2812B1M60LB30

https://www.amazon.com/gp/product/B01CDTED80/ref=ppx_yo_dt_b_asin_title_o00_s00?ie=UTF8&psc=1

- CPI-4333-85L127

<https://www.mouser.com/datasheet/2/670/cpi-4333-85l127-1627811.pdf>