ARDUINO CLONE

OBJECTIVE

The objective of designing an Arduino clone PCB is to create a custom, cost-effective version of the Arduino platform with full compatibility with the Arduino IDE and libraries. This clone replicates essential functionality while allowing for specific modifications, like additional I/O pins or a different form factor, tailored to project needs. It also offers a hands-on opportunity to learn PCB design, component selection, and embedded systems, making it ideal for education, prototyping, and experimentation.

Literature Review

Existing Work and Alternatives

Review existing Arduino clones and their purposes, highlighting differences in design and cost-effectiveness compared to the original Arduino boards. Mention other microcontroller options that offer similar features (e.g., ESP32, STM32) and how they compare to Arduino in terms of community support, ease of use, and adaptability.

Key Components and Functionality

Describe the essential components used in Arduino boards, such as the ATmega328P, USB interface, voltage regulators, capacitors, and LEDs. Explain the role of each in the Arduino architecture.

Methodology

Selection of Arduino Version

Justify the choice of Arduino Uno as the base model for the clone, considering its popularity and compatibility with most shields and accessories.

Component Selection

Outline the parts used in the clone, focusing on the main components like the microcontroller, voltage regulator, USB-to-serial converter, and other peripherals.

Circuit Design

Using KiCad or Eagle, recreate the Arduino Uno circuit design, ensuring all essential connections are included. This includes the microcontroller, power regulation, input/output pins, reset button, LEDs, and USB interface.

PCB Layout and Design Considerations

Layout Requirements: Describe considerations for trace routing, spacing, and ground planes.

Component Placement: Explain the placement strategy to ensure signal integrity and ease of soldering**.**

Design Rules and Constraints: Discuss specific PCB design rules followed, such as trace width, via size, and pad spacing.

Software and Tools Used

Briefly introduce the software tools, such as KiCad for PCB layout and design rule checking (DRC), to prevent design flaws before prototyping.

Design Implementation

Schematic Capture

Show the schematic diagram, illustrating the connections between components, and discuss key points such as decoupling capacitors and crystal oscillator placement.

PCB Layout

Present the PCB layout, showing how components are positioned and how traces are routed. Include images of top and bottom layers and explain the routing strategy for power, ground, and signal traces.

Prototype Production

Describe the process of creating Gerber files and sending them to a PCB manufacturer. Mention any requirements for the board thickness, copper weight, and solder mask color.

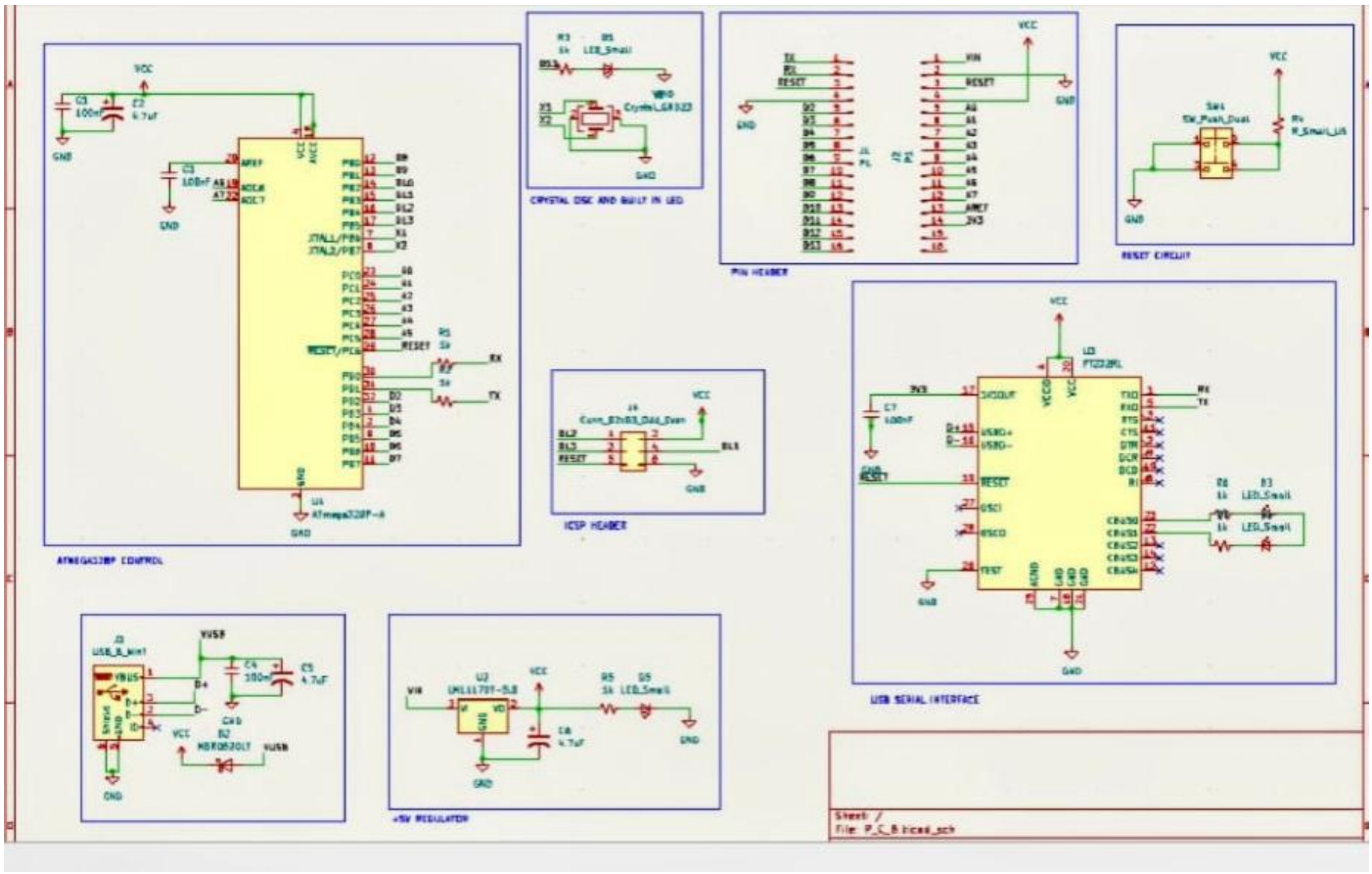
Component Soldering and Assembly

Provide an overview of the soldering process and any difficulties faced in assembling the components on the PCB.

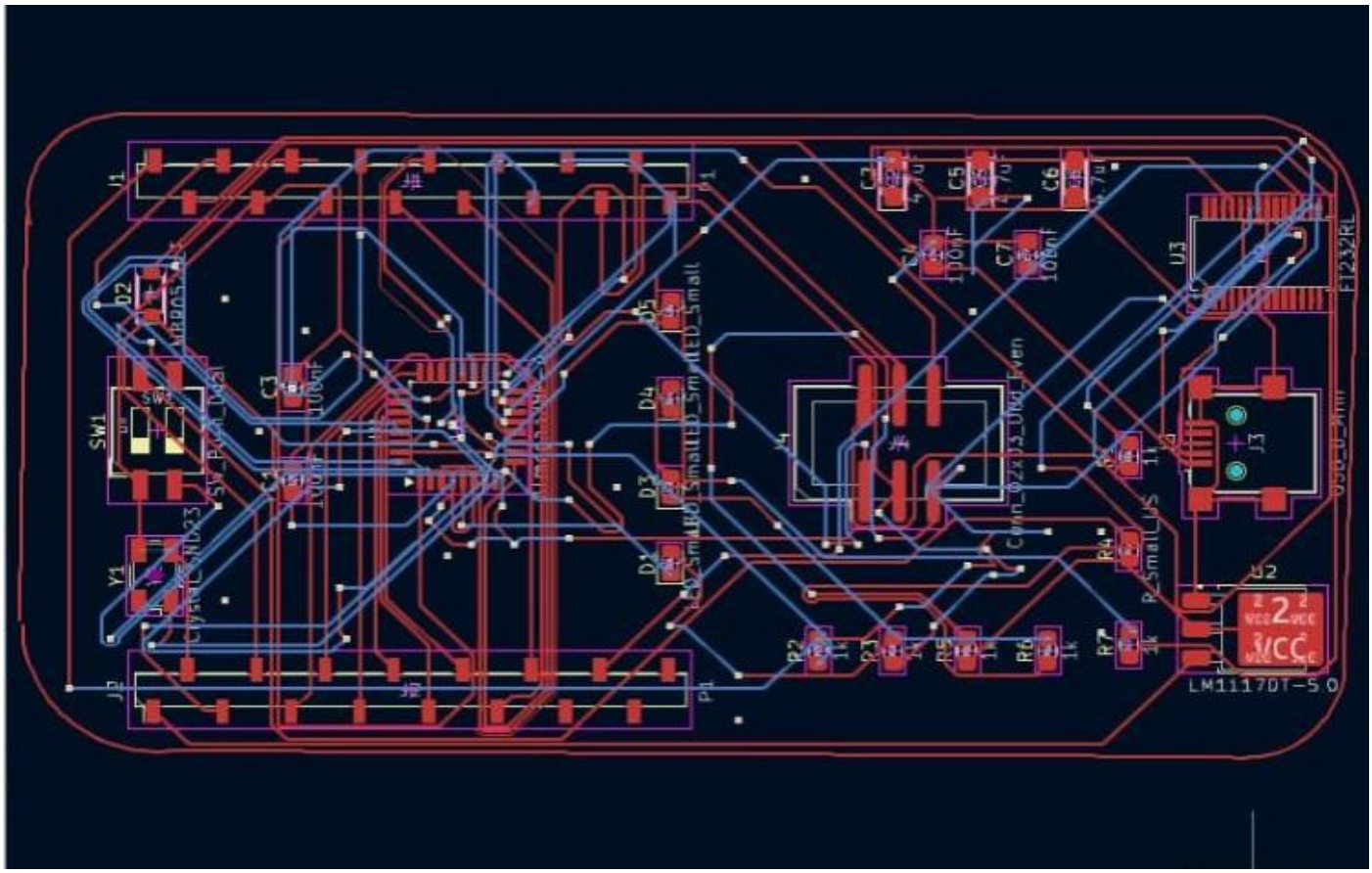
Bootloader Programming

Explain the process of burning the Arduino bootloader onto the ATmega328P microcontroller, which enables compatibility with the Arduino IDE.

SCHEMATIC DIAGRAM:



PCB LAYOUT: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C3
100nF
D5
D4
D3
D1
Y1
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P1
C4
100nF
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C6
C7
100nF
U3
J3
J4
R2
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R6
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R7
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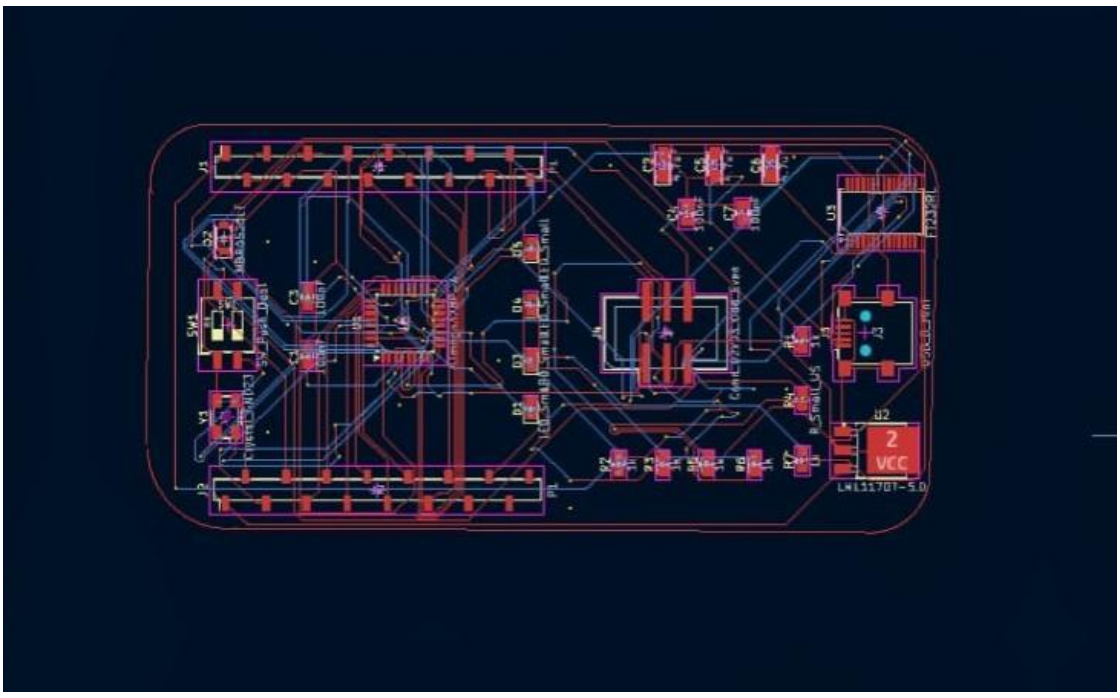
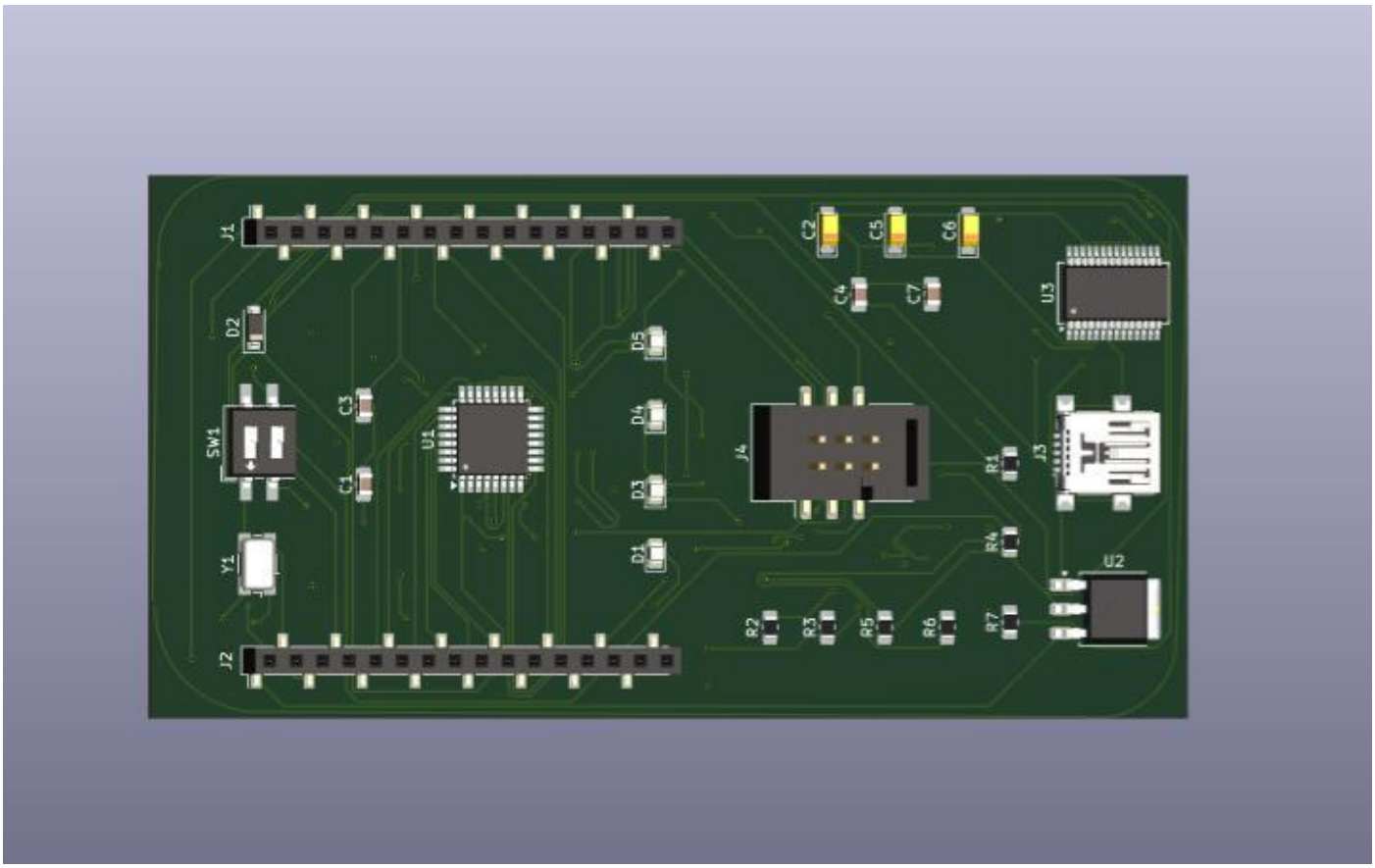
R4
U2
VCC
LM1117DT-5.0



3D VIEW: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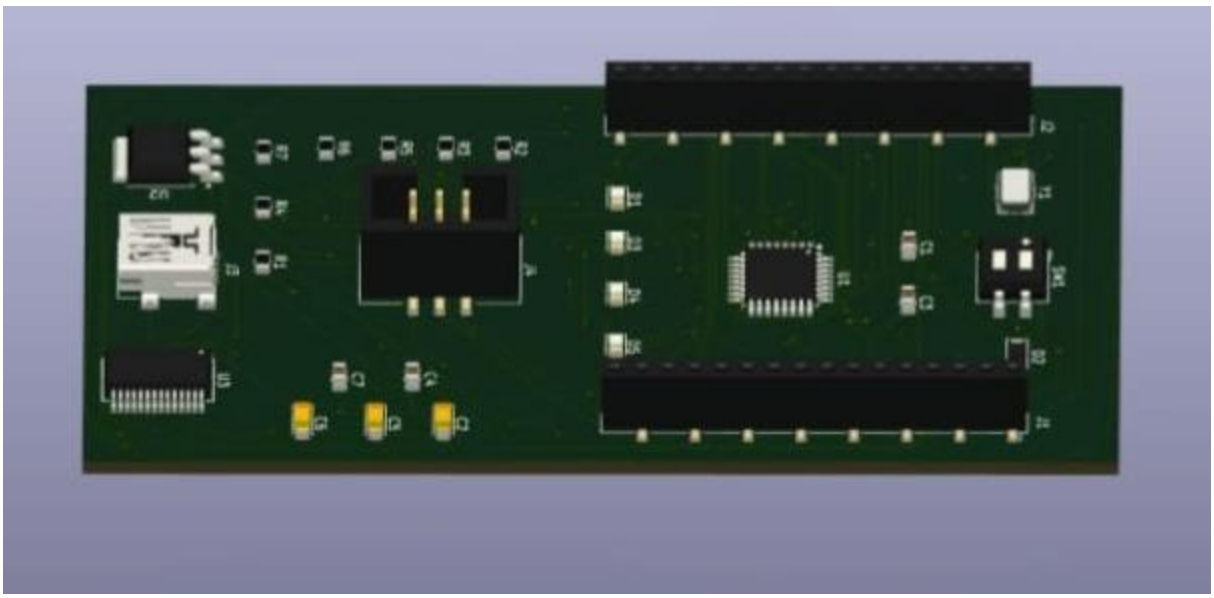

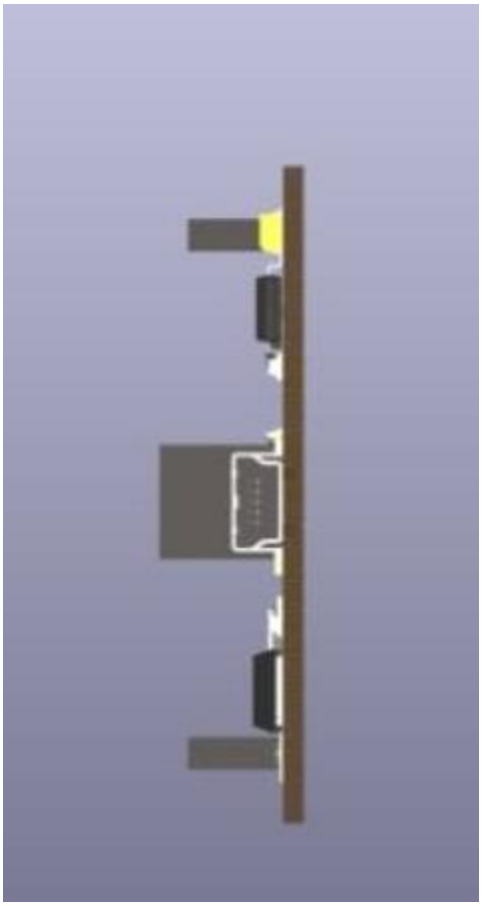

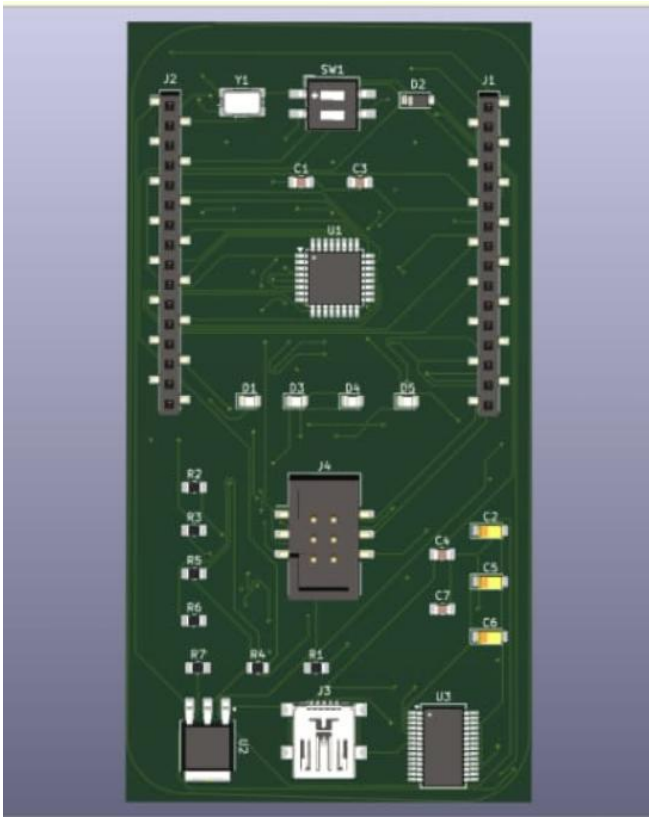
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D2
J1
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C3
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D1
D3
D4
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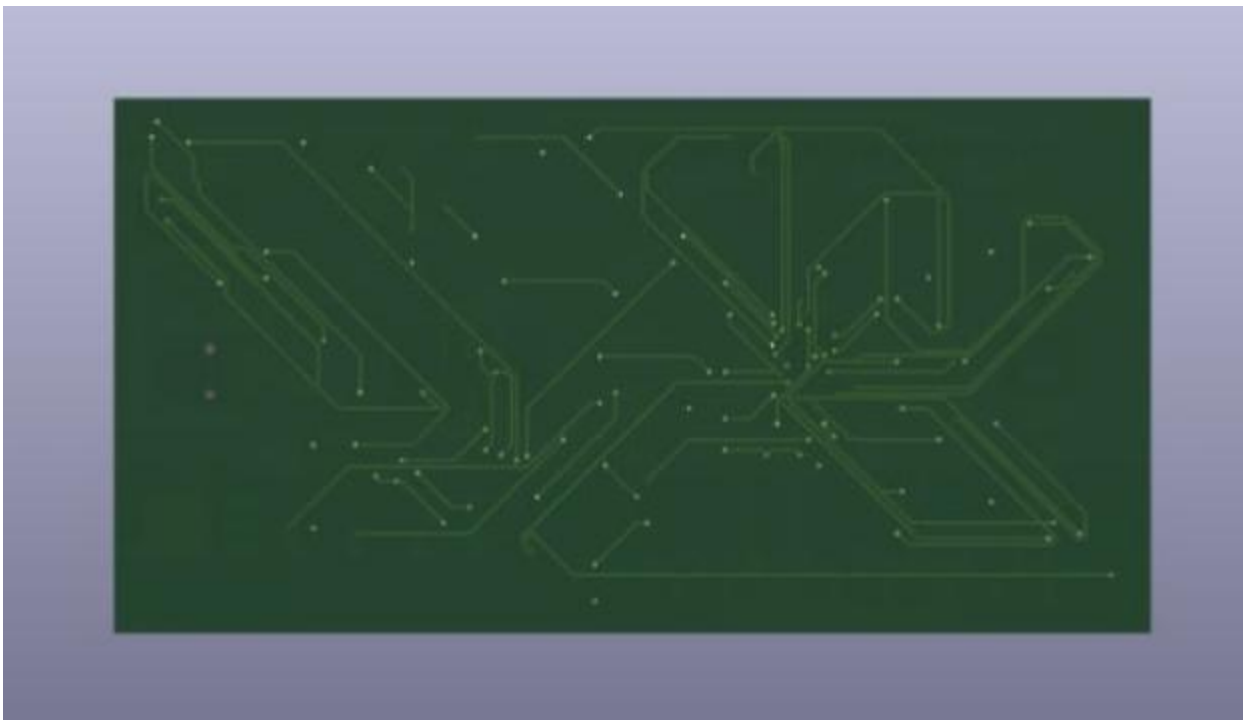
C4
C5
C7
C6
J3
U3
C8



FOOT PRINTS:

1	C1 -	100nF	Capacitor_SMD:C_0805_2012Metric_Pad1.18x1.45mm_HandSolder
2	C2 -	4.7uF	Capacitor_Tantalum_SMD:CP_EIA-3216-18_Kemet-A_Pad1.58x1.35mm_HandSolder
3	C3 -	100nF	Capacitor_SMD:C_0805_2012Metric_Pad1.18x1.45mm_HandSolder
4	C4 -	100nF	Capacitor_SMD:C_0805_2012Metric_Pad1.18x1.45mm_HandSolder
5	C5 -	4.7uF	Capacitor_Tantalum_SMD:CP_EIA-3216-18_Kemet-A_Pad1.58x1.35mm_HandSolder
6	C6 -	4.7uF	Capacitor_Tantalum_SMD:CP_EIA-3216-18_Kemet-A_Pad1.58x1.35mm_HandSolder
7	C7 -	100nF	Capacitor_SMD:C_0805_2012Metric_Pad1.18x1.45mm_HandSolder
8	D1 -	LED_Small	LED_SMD:LED_0805_2012Metric
9	D2 -	MBR0520LT	Diode_SMD:D_SOD-123
10	D3 -	LED_Small	LED_SMD:LED_0805_2012Metric
11	D4 -	LED_Small	LED_SMD:LED_0805_2012Metric
12	D5 -	LED_Small	LED_SMD:LED_0805_2012Metric
13	J1 -	P1	Connector_PinSocket_2.54mm:PinSocket_1x16_P2.54mm_Vertical_SMD_Pin1Right
14	J2 -	P1	Connector_PinSocket_2.54mm:PinSocket_1x16_P2.54mm_Vertical_SMD_Pin1Left
15	J3 -	USB_B_Mini	Connector_USB:USB_Mini-B_Lumberg_2486_01_Horizontal
16	J4 -	Conn_02x03_Odd_Even	Connector_IDC:IDC-Header_2x03_P2.54mm_Vertical_SMD
17	R1 -	1k	Resistor_SMD:R_0805_2012Metric_Pad1.20x1.40mm_HandSolder
18	R2 -	1k	Resistor_SMD:R_0805_2012Metric_Pad1.20x1.40mm_HandSolder
19	R3 -	1k	Resistor_SMD:R_0805_2012Metric_Pad1.20x1.40mm_HandSolder
20	R4 -	R_Small_US	Resistor_SMD:R_0805_2012Metric
21	R5 -	1k	Resistor_SMD:R_0805_2012Metric_Pad1.20x1.40mm_HandSolder
22	R6 -	1k	Resistor_SMD:R_0805_2012Metric_Pad1.20x1.40mm_HandSolder
23	R7 -	1k	Resistor_SMD:R_0805_2012Metric_Pad1.20x1.40mm_HandSolder
24	SW1 -	SW_Push_Dual	Button_Switch_SMD:SW_DIP_SPSTx02_Slide_6.7x6.64mm_W8.61mm_P2.54mm_LowProfile
25	U1 -	ATmega328P-A	Package_QFP:TQFP-32_7x7mm_P0.8mm
26	U2 -	LM1117DT-5.0	Package_TO_SOT_SMD:TO-252-3_TabPin2
27	U3 -	FT232RL	Package_SO:SSOP-28_5.3x10.2mm_P0.65mm

tered by Library: 13995 matching footprints

Conclusion

Summarize the project outcomes, emphasizing the clone PCB's ability to replicate Arduino functionality and its potential applications for prototyping, educational use, and project-specific customization.

Discuss the practical knowledge gained in PCB design, component selection, and microcontroller programming.

Suggest future improvements, such as adding new features or optimizing the PCB layout for a smaller form factor.