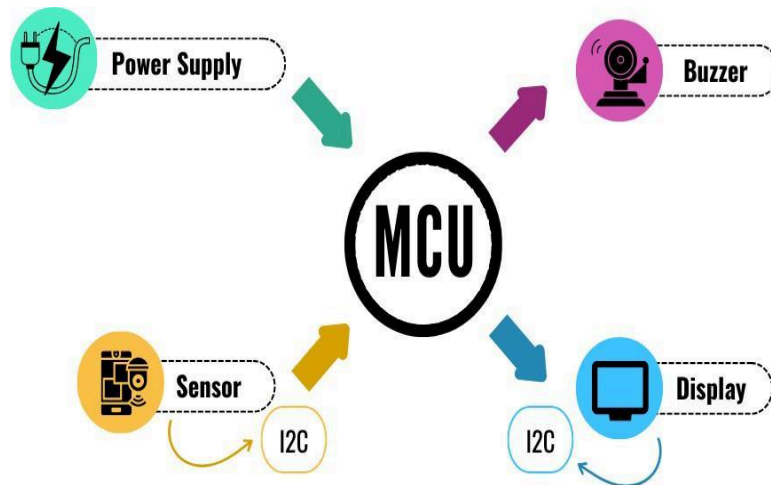# 1. Block diagram

The specifications for the heart rate monitoring system created by our team require certain requirements to be met as follows. First, it is imperative that the system be able to accurately measure heart rate. Additionally, each measurement must begin with activation of the system's buzzer, which provides an audible indication. Furthermore, heart rate measurement results should be displayed on the OLED screen, ensuring easy access to information. Communication between the OLED panel and the heart rate sensor, as well as the microcontroller (MCU), is supported through the use of the I2C protocol. Consequently, the block diagram of our setup reflects this interconnectedness in figure below.
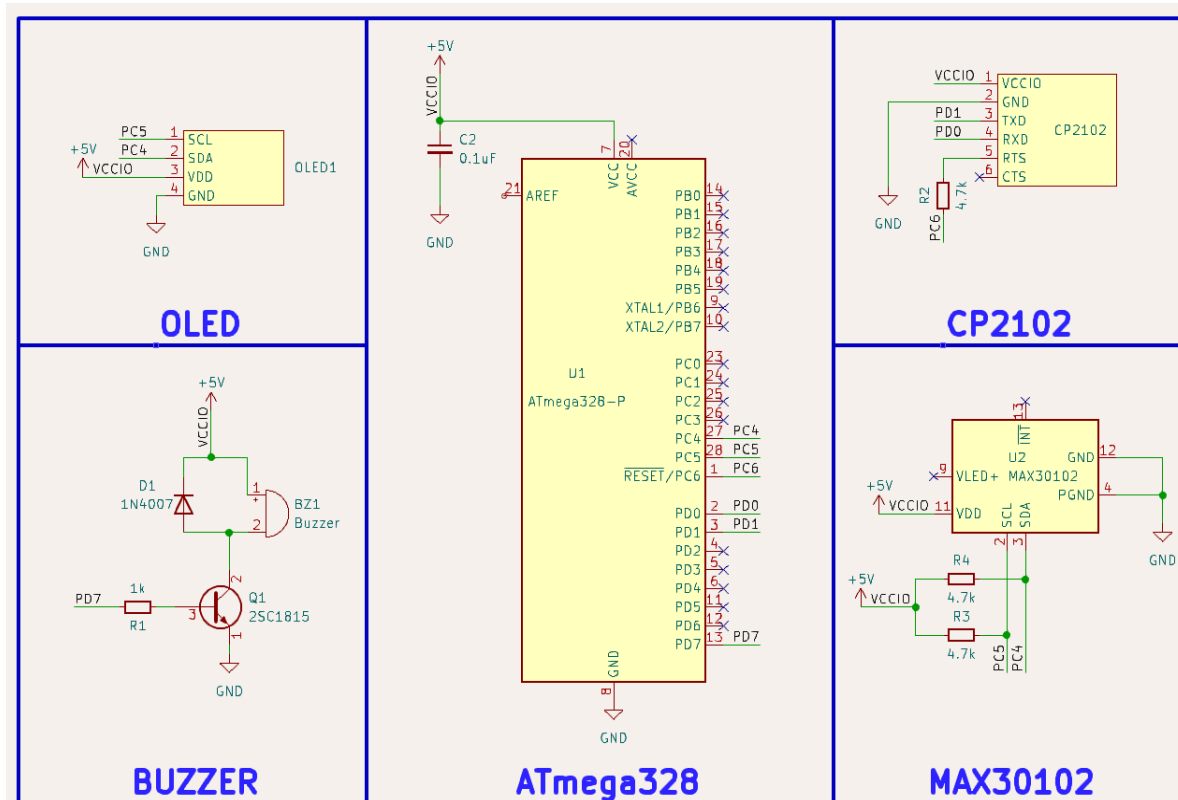

2. Schematic

Block	Component's name	Reason
MCU	ATMEGA328P	- In the academic curriculum of the "Embedded Systems" course, instruction in the programming of the ATMEGA328P AVR microcontroller is included. -The ATMEGA328P is equipped with Serial Clock (SCL) and Serial Data (SDA) ports, enabling the Inter-Integrated Circuit (I2C) interface with the MAX30102 sensor within the sensor block, and the SSD1306 display within the Display block. -Additionally, the ATMEGA328P features Receive Data (RXD) and Transmit Data (TXD)

		ports, facilitating a Universal Asynchronous Receiver-Transmitter (UART) interface with the CP2102 module.
		-The microcontroller also incorporates Input/Output (I/O) ports designed specifically to activate the HS000305 component of the buzzer block.
		-Due to its affordability and wide availability, the ATMEGA328P represents a viable acquisition for educational purposes, offering both accessibility and cost-effectiveness.
Sensor	Heartbeat sensor MAX30102	-The MAX30102 sensor is equipped with Serial Clock (SCL) and Serial Data (SDA) ports, facilitating an Inter-Integrated Circuit (I2C) communication interface with the ATMEGA328P microcontroller.
		-The procurement of the MAX30102 sensor is characterized by its economic feasibility, given its affordability and broad availability in the market.
Display	SSD1306	-The SSD1306 display module is equipped with Serial Clock (SCL) and Serial Data (SDA) ports, enabling an Inter-Integrated Circuit (I2C) communication interface with the ATMEGA328P microcontroller.
		-The acquisition of the SSD1306 display module is facilitated by its economic accessibility and widespread availability, ensuring its affordability for a wide range of applications.
Power supply	CP2102 USB UART Board	-The CP2102 module serves as a conduit for uploading C-based code from Microchip Studio to the ATMEGA328P microcontroller, illustrating its utility in the programming process.
		-Due to its design, the CP2102 can act as the power supply for the system, leveraging the voltage derived directly from the USB port of a connected laptop, thereby providing an integrated power solution.
		-Additionally, the CP2102 is equipped with Receive Data (RXD) and Transmit Data (TXD) ports, facilitating a Universal Asynchronous Receiver-Transmitter (UART) communication

		interface with the ATMEGA328P microcontroller. -The procurement of the CP2102 module is characterized by its affordability and wide availability, making it an economically viable option for a broad spectrum of applications.
Buzzer	HS000305	- The acquisition of the HS000305 component is facilitated by its economic accessibility and widespread market availability, ensuring its affordability for a diverse range of applications

Therefore, our group obtain the schematic of the system designed by Kicad software:

In the schematic design, a small capacitor of 0.1 µF is connected between the 5 V power supply (V_CC) and ground. This helps to stop any unwanted noise or sudden voltage changes from affecting the system. Pull-up resistors of 4.7 kΩ are added to the SCL and SDA ports of the I2C interfaces to keep these ports stable. Similarly, the RESET port of the ATMEGA328P is connected to a 4.7 kΩ pull-up resistor for the same reason. Lastly, a special setup with a BJT and diode is placed between the HS000305 buzzer and the ATMEGA328P's I/O port. This protects the I/O port from any extra current generated by the buzzer's coil.