SMART LIGHTING SYSTEM

A Report Submitted
as Requirements for the Mini Project 1B Course of
Semester IV, AY 2022-2023

Submitted by
Mayuri Kadam Roll No. 18
Sumith Kumar Roll No. 28
Rohit Mali Roll No. 32
Himanshu Jogi Roll No. 16

Supervised by
Prof.Freda Carvalho Prof. Jithin Issac
Department of Electronics and Telecommunication Engineering
Don Bosco Institute of Technology,Mumbai India

May 2023

Don Bosco Institute of Technology
(Affiliated to the University of Mumbai)
Premier Automobiles Road, Kurla, Mumbai - 400070

Certificate

This is to certify that the Mini project entitled
Smart Lighting System is a work of

Mayuri Kadam	**18**
Rohit Mali	**32**
Sumith Kumar	**28**
Himanshu Jogi	**16**

submitted as fulfilment of the requirement for the Mini Project1B of
"Semester IV" in **"Second Year of Engineering AY 2022-2023"**.

(**Prof. Freda Carvalho**)	(**Prof. Jithin Issac**)	(**Prof. Namita Agarwal**)
Project Guide	Project Guide	HOD, EXTC

Don Bosco Institute of Technology

(Affiliated to the University of Mumbai)
Premier Automobiles Road, Kurla, Mumbai - 400070

Mini Project 1B Report Approval

This Mini project report entitled **'Smart Lighting System'** by **Mayuri Kadam, Sumith Kumar, Rohit Mali, Himanshu Jogi** is approved for the completion of Mini Project 1B course **of Sem IV of AY 2022-2023 in Dept. of Electronics & Telecommunication Engineering.**

Examiners

1. _____

2. _____

Date :05 /05 /23

Place : **Kurla, Mumbai**

Contents

List of Tables

List of Figures

Abstract

In today's world many a times we see that people switch on the light but forget to switch it off. This leads to loss of electricity thereby, wasting the available resources. Therefore, to reduce power wastage, we have designed a 'Smart Lighting System' which when motion is detected will turn on the light, thereby saving electricity. Thus, contributing to a "Greener Earth" and sustainable energy.

Chapter 1

Introduction

1.1 Introduction:

In today's world many a times we see that people switch on the light but forget to switch it off. This leads to loss of electricity thereby, wasting the available resources. Deciding on a Motion Sensor Light of the many reasons for getting motion sensor lights, the three most significant considerations are energy conservation, theft or crime deterrent purposes, and convenience. You can save on energy costs light bulb usage and contribute to a more eco-friendly lifestyle by installing motion sensor lights. It's very easy to forget to turn off lights, for example, in a garage or basement, and you may leave the lights on all night.

If you use floodlighting to guard your house against intruders, keeping a light on all night may not alert you to a change in the perimeter, whereas a motion sensor light turning on might get your attention. Motion sensor lighting outside the house is also handy when taking out the trash, walking the dog at night, arriving home after dark, or leaving in the morning before sunrise.

Therefore, to reduce power wastage, we have designed a 'Smart

Light Switch' which when motion is detected will turn on the light, thereby saving electricity. Thus, contributing to a "Greener Earth" and sustainable energy.

1.1.1 Applications

- Reduction in use of electricity thus saving it.
- It helps us contribute to our environment and society by saving the efficient use of electricity.
- Motion detection eliminates light wastage especially late at night.
- It can be used as Intruder alarms.
- Automatic doors.
- It uses less power.
- The detection of motion is possible in the presence or absence of light approximately with equal reliability.
- They do not need contact with the object for detection

Design: This circuit is made with a hardware using components like Arduino UNO , PIR Sensor, Relay Module,LED , GB Board, bulb, some wires and power supply.

Chapter 2

Basic Idea and Working

2.1 Project Objective and Outcomes:

The main objective of this project is to design a low cost and user friendly Smart Light Switch, which will turn on the lights when motion is detected. In this fast growing country of ours, we need to save the light. Because the population in the growth in number of use of electricity is increasing exponentially day by day. As there is more construction so there is more use of electricity for this we need to use electricity in a proper way. To give you a sense of safety and security for your property. Having a sensor-activated light system installed on your property will let you be worry-free about stepping in the dark again.

2.2 Working of circuit

The block diagram of the project is as shown in Figure 2.1. Initially, when there is no human movement, the PIR Sensor doesn't detect any person and its OUT pin stays LOW. As the person enters the room, the change in infrared radiation in the

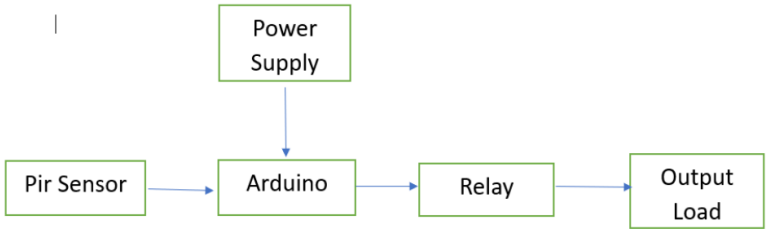


Figure 2.1: Block Diagram of smart lighting system

room is detected by the PIR Sensor.

As a result, the output of the PIR Sensor becomes HIGH. Since the Data OUT of the PIR Sensor is connected to Digital Pin 8 of Arduino, whenever it becomes HIGH, Arduino will activate the relay by making the relay pin LOW (as the relay module is an active LOW module).

This will turn the Light ON. The light stays turned ON as long as there is movement in front of the sensor.

If the person takes a nap or leaves the room, the IR Radiation will become stable (there will be no change) and hence, the Data OUT of the PIR Sensor will become LOW. This in turn will make the Arduino to turn OFF the relay (make the relay pin HIGH) and the room light will be turned OFF.

An active sensor sends out sound waves that bounce off people and objects in the room and then returns them to the switch. If the returning waves identify a change in the pattern of the objects in the room—because someone has entered or is moving in the room—the sensor triggers the switch that turns on the light.

Required Components for this Project:

1) Arduino UNO

2) PIR Sensor
3) Relay Module
4) LED
5) GB Board
6) Power Supply
7) Bulb
8) Connecting Wires

Chapter 3

Project Implementation

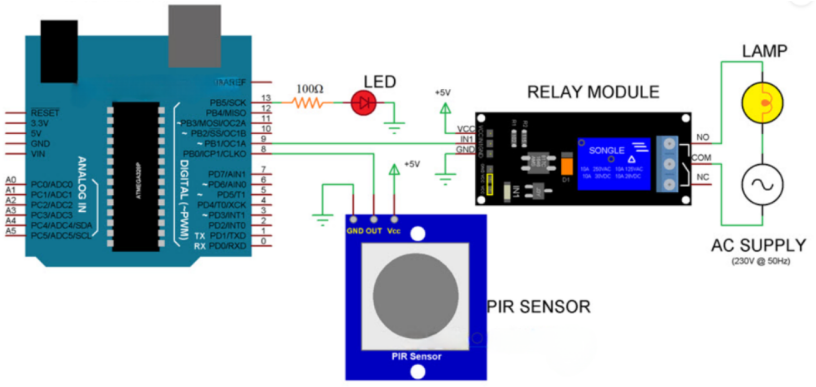


Figure 3.1: Ciruit Diagram of smart lighting system

PIR Sensor's Data OUT Pin is connected to Arduino's Digital I/O Pin 8. An LED is connected to pin 13 of Arduino to indicate whether the light is turned ON or OFF. The IN1 pin of the Relay Module is connected to Pin 9 of Arduino. A bulb is connected to mains supply through relay. One terminal of the bulb is connected to one wire of the mains supply. The other terminal of the bulb is connected to the NO (Normally Open) contact of the Relay Module. COM (Common) contact of the Relay is connected to the other wire of the mains supply. Be careful

when connecting this part of the project. When there is no human movement, the PIR Sensor doesn't detect any person and its OUT pin stays LOW. As the person enters the room, its OUT pin turns to HIGH.Data OUT of the PIR Sensor is connected to Digital Pin 8 of Arduino, whenever it becomes HIGH, Arduino will activate the relay by making the relay pin LOW (as the relay module is an active LOW module). This will turn the Light ON. The light stays turned ON as long as there is movement in front of the sensor.

3.1 List of Components

Table 3.1: List of Components

Name of module	Specifications	Price in Rs.
Ardiuno UNO	ATmega328P	350
PIR Senor	Supply Voltage 5v-20v	120
8-channel Relay Module	Rated voltage 5v DC	385
Bluetooth Module	Frequency 2.4GHz	250
Connecting Wires	Standard M/F Standard M/M	40

Chapter 4

Detail Description of Components:

4.1 Ardiuno UNO

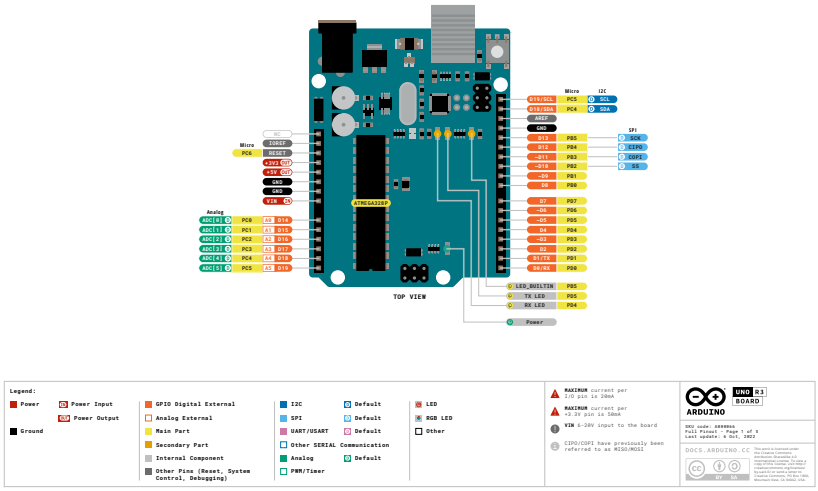


Figure 4.1: Ardiuno UNO

Arduino UNO is a microcontroller board based on the AT-

mega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. Arduino UNO is a low-cost, flexible, and easy-to-use programmable open-source microcontroller board that can be integrated into a variety of electronic projects. This board can be interfaced with other Arduino boards, Arduino shields, Raspberry Pi boards and can control relays, LEDs, servos, and motors as an output.

4.1.1 Specifications

Board Name - Arduino UNO R3
Microcontroller - ATmega328P
USB connector - USB-B
Pins - Built-in LED Pin (13) Digital I/O Pins (14) Analog input pins (6) PWM pins (6)
Communication - UART I2C SPI
Power - I/O Voltage - (5v) Input voltage(nominal) - (7-12V) DC Current per I/O Pin - (20 mA) Power Supply Connector - Barrel Plug
Clock speed - Main Processor (ATmega328P 16 MHz) USB-Serial Processor (ATmega16U2 16 MHz)
Memory - ATmega328P (2KB SRAM, 32KB FLASH, 1KB EEP-ROM)
Dimensions - Weight (25 g) Width (53.4 mm) Length (68.6 mm)

4.2 PIR SENSOR

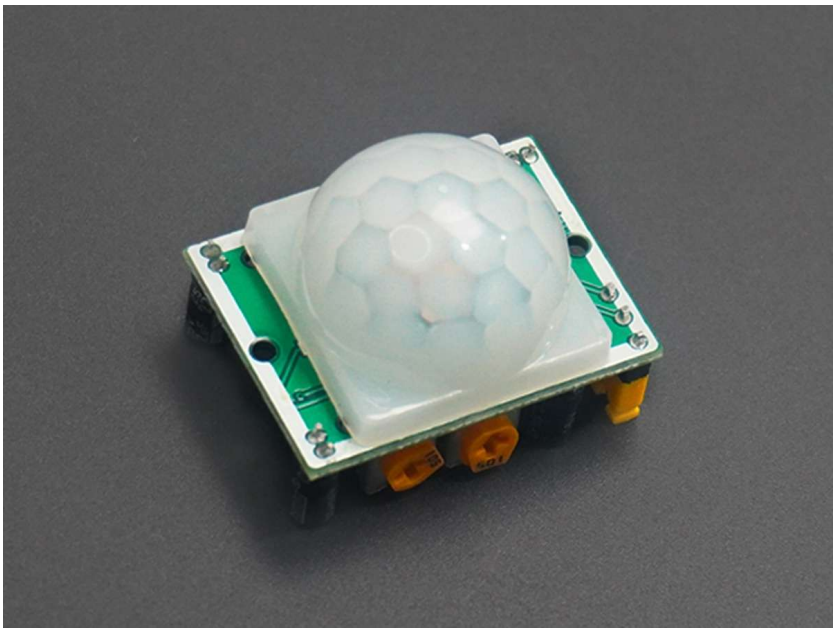


Figure 4.2: PIR Sensor

PIR (passive infrared) sensors utilise the detection of infrared that is radiated from all objects that emit heat.This type of emission is not visible to the human eye, but sensors that operate using infrared wavelengths can detect such activity. The IR sensors detect whether the light from the transmitter is emitted by an object or a person. Whereas, the PIR sensors detect changes in the levels of energy around the area. PIR sensor detects a human being moving around within approximately 10m from the sensor. This is an average value, as the actual detection range is between 5m and 12m. PIR are fundamentally made of a pyro electric sensor, which can detect levels of infrared radiation.

4.2.1 Specifications

GND - ground
Output
Supply voltage - 5v
Output Timing
Sensitivity
Reset
Auto Reset

4.3 Relay Module

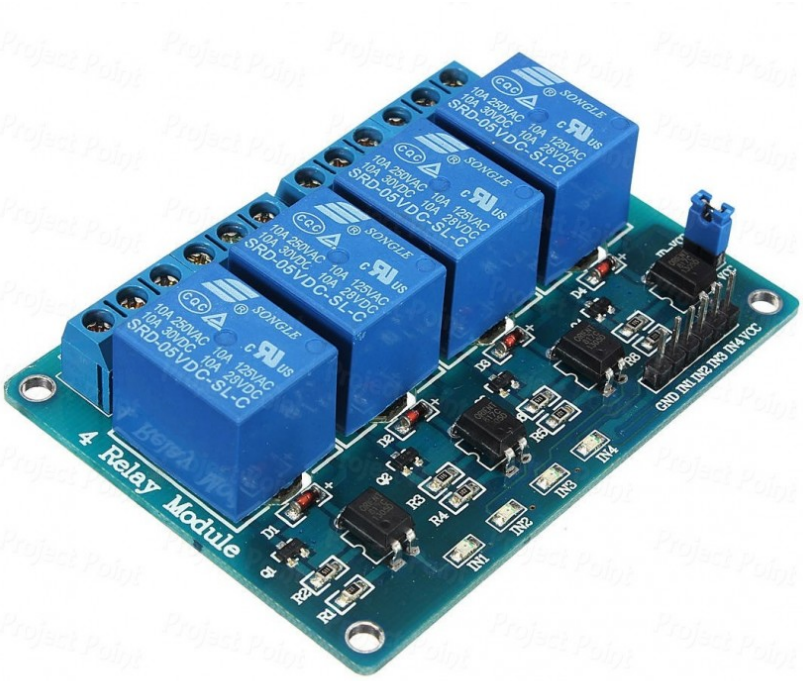


Figure 4.3: Relay Module

A power relay module is an electrical switch that is operated by an electromagnet. The electromagnet is activated by a separate low-power signal from a micro controller. When activated, the electromagnet pulls to either open or close an electrical ciruit. The relay module function is mainly to switch electrical devices and systems on or off. It also serves to isolate the control circuit from the device or system being controlled.

4.3.1 Specifications

Normal voltage: 5V DC.
Normal current: 70mA.
Maximum load current: 10A/250V AC, 10A/30V DC.
Maximum switch voltage: 250V AC, 30V DC.

4.4 Bluetooth Module

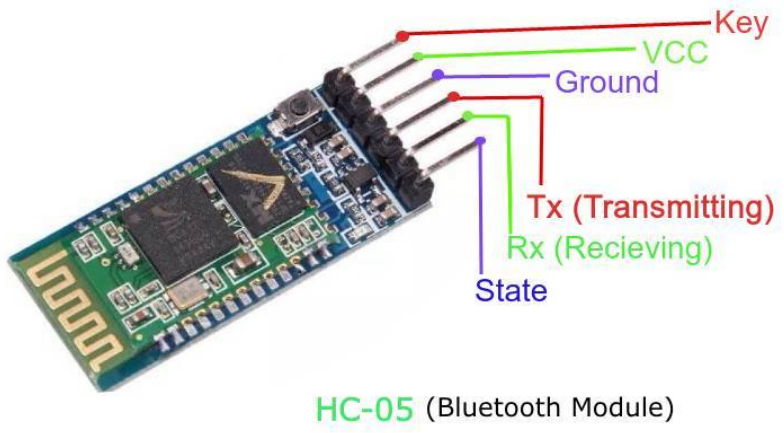


Figure 4.4: Bluetooth Module

Bluetooth module is a technology that acts as an interface that aids the wireless Bluetooth Low energy connection of any two devices and establishes a protocol for the communication of data between the devices. The HC05 bluetooth module is used as UART serial converter module and can easily transfer the UART data through the wireless bluetooth.

4.4.1 Specifications

Frequency: 2.4GHz
Wireless Serial Communication
VCC: Connect 5 V or 3.3 V to this Pin.
GND: Ground Pin of module.
TXD: Transmit Serial data
RXD: Receive data serially
State: It tells whether module is connected or not.

Chapter 5

Conclusion

Smart Lighting System for home provide the home-owners with greater control. This means you can make most of your automated home devices and appliances through improved functionality. The most remarkable benefit of using home automation switches is the cheaper electricity bills.
Putting it all together, smart system will only improve your lifestyle and will make job of a home-owner much easier and enjoyable.

In this project, the circuit detects motion and the light turns ON/OFF alternately. This systems helps in eco-friendly environment and sustainability by saving wastage of unnecessary electricity.

Bibliography

[1] P. Horowitz and H. Winfield, "The Art of Electronics (2nd ed.)", Cambridge University Press, Cambridge, pp. 61-78, 1989.

[2] A.I Menkiti, F.C Eze and O.E. Abumere, "Introduction to ELectronics", Spectrum Books Limited Ibadan, pp. 196-197, 1996.

[3] https://docs.arduino.cc/hardware/uno-rev3

[4] https://projecthub.arduino.cc/Shubhamkumar97/2fd190cc-51ca-47e0-afd7-c2e6dd56ff61

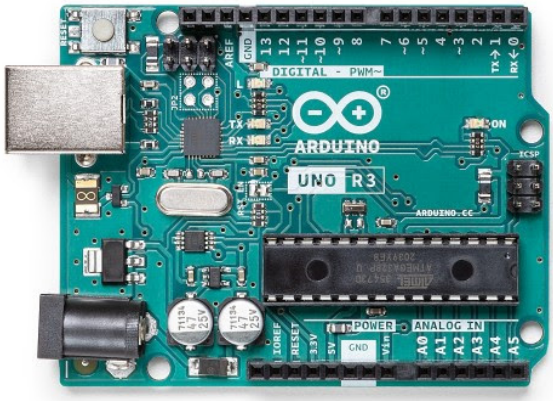
[5] https://www.electronicshub.org/automatic-room-lights-using-arduino-pir-sensor

[6] https://www.electronicwings.com/sensors-modules/bluetooth-module-hc-05-

Appendix A

Datasheets

Product Reference Manual
SKU: A000066



Description

The Arduino UNO R3 is the perfect board to get familiar with electronics and coding. This versatile microcontroller is equipped with the well-known ATmega328P and the ATMega 16U2 Processor.
This board will give you a great first experience within the world of Arduino.

Target areas:

Maker, introduction, industries

1 The Board

1.1 Application Examples

The UNO board is the flagship product of Arduino. Regardless if you are new to the world of electronics or will use the UNO as a tool for education purposes or industry-related tasks.

First entry to electronics: If this is your first project within coding and electronics, get started with our most used and documented board; Arduino UNO. It is equipped with the well-known ATmega328P processor, 14 digital input/output pins, 6 analog inputs, USB connections, ICSP header and reset button. This board includes everything you will need for a great first experience with Arduino.

Industry-standard development board: Using the Arduino UNO board in industries, there are a range of companies using the UNO board as the brain for their PLC's.

Education purposes: Although the UNO board has been with us for about ten years, it is still widely used for various education purposes and scientific projects. The board's high standard and top quality performance makes it a great resource to capture real time from sensors and to trigger complex laboratory equipment to mention a few examples.

1.2 Related Products

- Starter Kit
- Tinkerkit Braccio Robot
- Example

2 Ratings

2.1 Recommended Operating Conditions

Symbol	Description	Min	Max
	Conservative thermal limits for the whole board:	-40 °C (-40°F)	85 °C (185°F)

> **NOTE:** In extreme temperatures, EEPROM, voltage regulator, and the crystal oscillator, might not work as expected due to the extreme temperature conditions

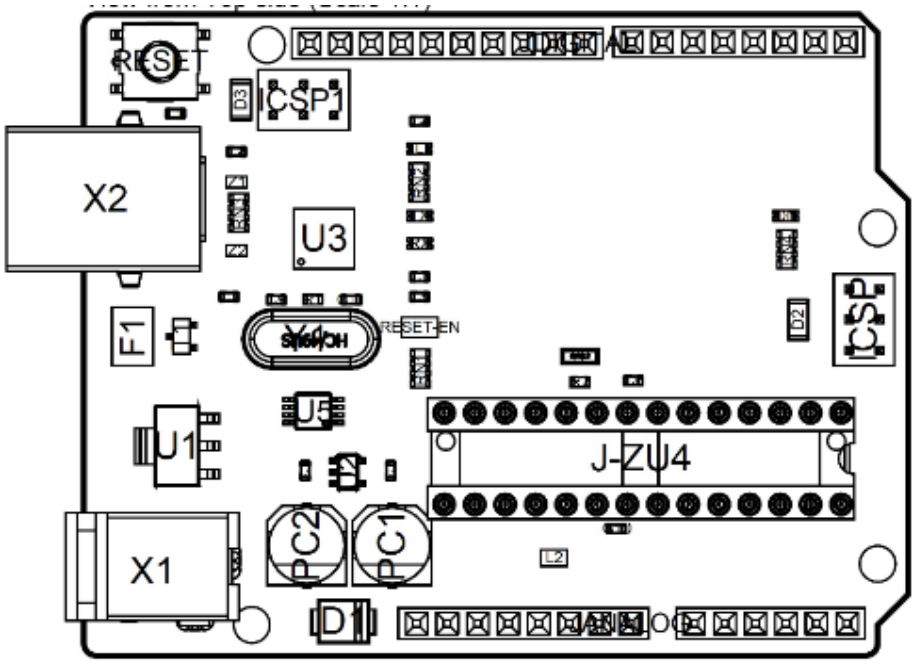
2.2 Power Consumption

Symbol	Description	Min	Typ	Max	Unit
VINMax	Maximum input voltage from VIN pad	6	-	20	V
VUSBMax	Maximum input voltage from USB connector		-	5.5	V
PMax	Maximum Power Consumption	-	-	xx	mA

3 Functional Overview

3.1 Board Topology

Top view



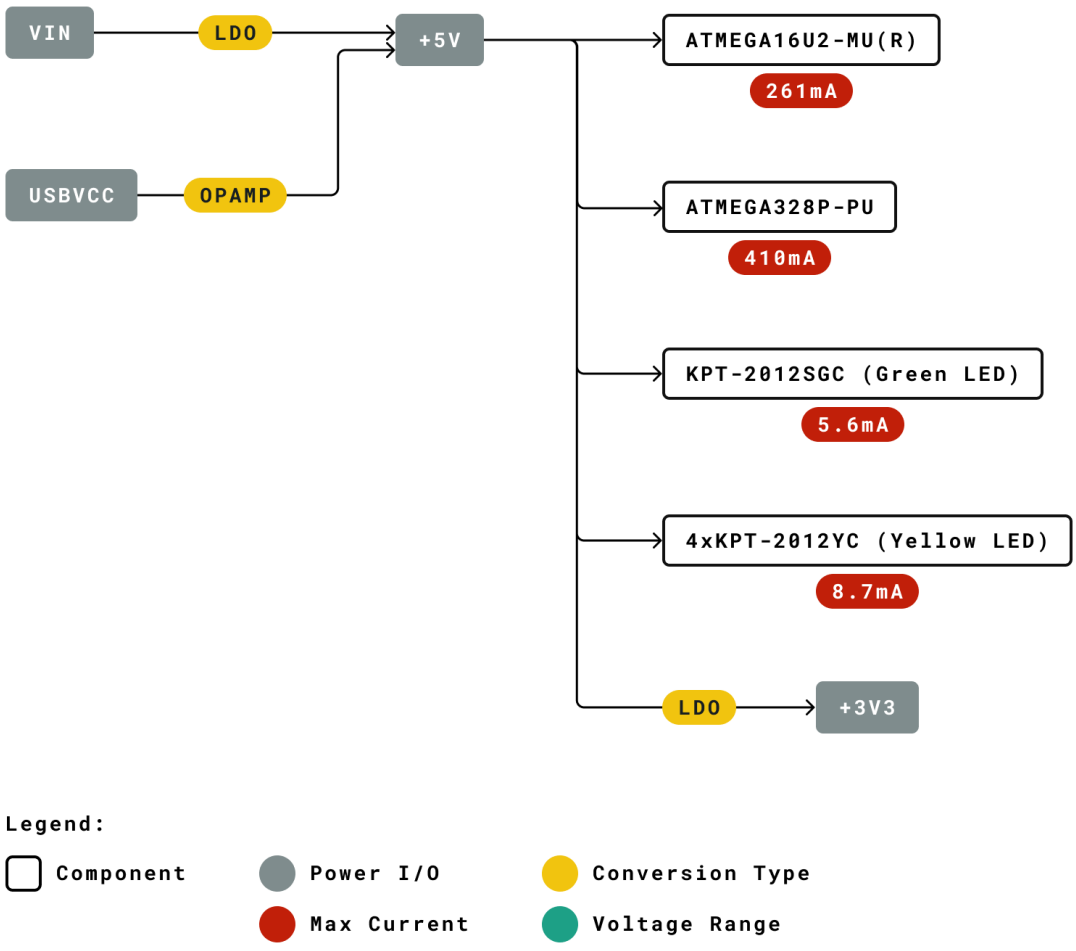
Board topology

Ref.	Description	Ref.	Description
X1	Power jack 2.1x5.5mm	U1	SPX1117M3-L-5 Regulator
X2	USB B Connector	U3	ATMEGA16U2 Module
PC1	EEE-1EA470WP 25V SMD Capacitor	U5	LMV358LIST-A.9 IC
PC2	EEE-1EA470WP 25V SMD Capacitor	F1	Chip Capacitor, High Density
D1	CGRA4007-G Rectifier	ICSP	Pin header connector (through hole 6)
J-ZU4	ATMEGA328P Module	ICSP1	Pin header connector (through hole 6)
Y1	ECS-160-20-4X-DU Oscillator		

3.2 Processor

The Main Processor is a ATmega328P running at up tp 20 MHz. Most of its pins are connected to the external headers, however some are reserved for internal communication with the USB Bridge coprocessor.

3.3 Power Tree



Power tree

4 Board Operation

4.1 Getting Started - IDE

If you want to program your Arduino UNO while offline you need to install the Arduino Desktop IDE [1] To connect the Arduino UNO to your computer, you'll need a Micro-B USB cable. This also provides power to the board, as indicated by the LED.

4.2 Getting Started - Arduino Web Editor

All Arduino boards, including this one, work out-of-the-box on the Arduino Web Editor [2], by just installing a simple plugin.

The Arduino Web Editor is hosted online, therefore it will always be up-to-date with the latest features and support for all boards. Follow **[3]** to start coding on the browser and upload your sketches onto your board.

4.3 Getting Started - Arduino IoT Cloud

All Arduino IoT enabled products are supported on Arduino IoT Cloud which allows you to Log, graph and analyze sensor data, trigger events, and automate your home or business.

4.4 Sample Sketches

Sample sketches for the Arduino XXX can be found either in the "Examples" menu in the Arduino IDE or in the "Documentation" section of the Arduino Pro website [4]

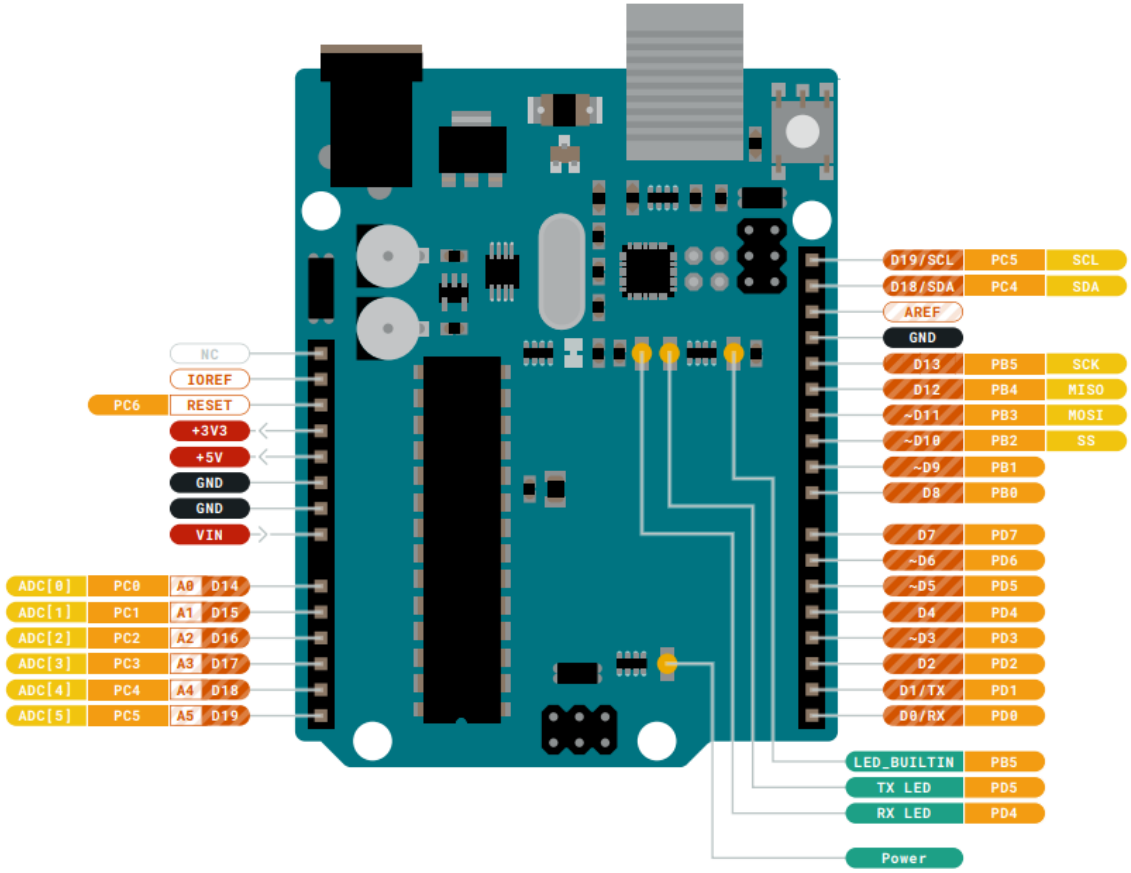
4.5 Online Resources

Now that you have gone through the basics of what you can do with the board you can explore the endless possibilities it provides by checking exciting projects on ProjectHub **[5]**, the Arduino Library Reference **[6]** and the online store **[7]** where you will be able to complement your board with sensors, actuators and more

4.6 Board Recovery

All Arduino boards have a built-in bootloader which allows flashing the board via USB. In case a sketch locks up the processor and the board is not reachable anymore via USB it is possible to enter bootloader mode by double-tapping the reset button right after power up.

5 Connector Pinouts



Pinout

5.1 JANALOG

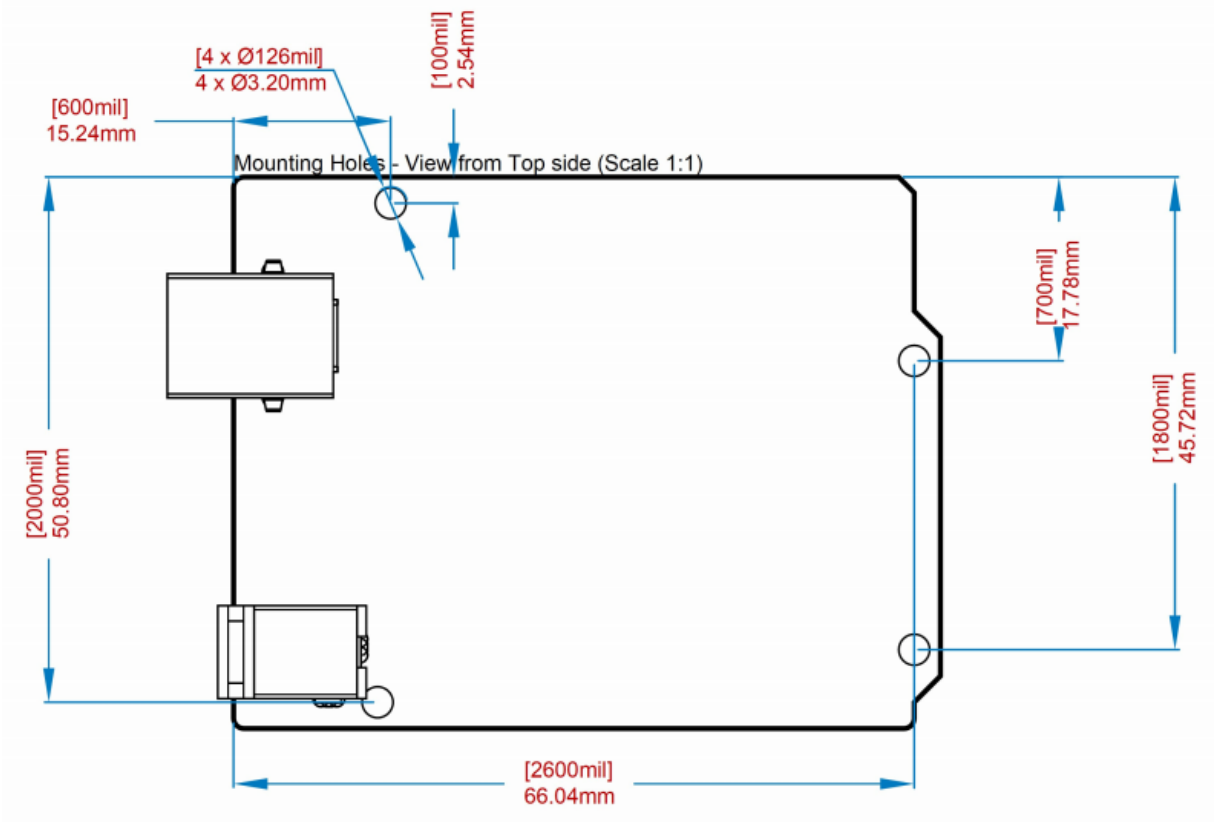
Pin	Function	Type	Description
1	NC	NC	Not connected
2	IOREF	IOREF	Reference for digital logic V - connected to 5V
3	Reset	Reset	Reset
4	+3V3	Power	+3V3 Power Rail
5	+5V	Power	+5V Power Rail
6	GND	Power	Ground
7	GND	Power	Ground
8	VIN	Power	Voltage Input
9	A0	Analog/GPIO	Analog input 0 /GPIO
10	A1	Analog/GPIO	Analog input 1 /GPIO
11	A2	Analog/GPIO	Analog input 2 /GPIO
12	A3	Analog/GPIO	Analog input 3 /GPIO
13	A4/SDA	Analog input/I2C	Analog input 4/I2C Data line
14	A5/SCL	Analog input/I2C	Analog input 5/I2C Clock line

5.2 JDIGITAL

Pin	Function	Type	Description
1	D0	Digital/GPIO	Digital pin 0/GPIO
2	D1	Digital/GPIO	Digital pin 1/GPIO
3	D2	Digital/GPIO	Digital pin 2/GPIO
4	D3	Digital/GPIO	Digital pin 3/GPIO
5	D4	Digital/GPIO	Digital pin 4/GPIO
6	D5	Digital/GPIO	Digital pin 5/GPIO
7	D6	Digital/GPIO	Digital pin 6/GPIO
8	D7	Digital/GPIO	Digital pin 7/GPIO
9	D8	Digital/GPIO	Digital pin 8/GPIO
10	D9	Digital/GPIO	Digital pin 9/GPIO
11	SS	Digital	SPI Chip Select
12	MOSI	Digital	SPI1 Main Out Secondary In
13	MISO	Digital	SPI Main In Secondary Out
14	SCK	Digital	SPI serial clock output
15	GND	Power	Ground
16	AREF	Digital	Analog reference voltage
17	A4/SD4	Digital	Analog input 4/I2C Data line (duplicated)
18	A5/SD5	Digital	Analog input 5/I2C Clock line (duplicated)

5.3 Mechanical Information

5.4 Board Outline & Mounting Holes



Board outline