K.J. Somaiya College of Engineering
(A Constituent College of Somaiya Vidyavihar University)
Department of Electronics Engineering

Mini Project
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Automatic Door Lock With Mask Detection

Year /Div : TY/A
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Examiner 1

Examiner 1

0.1 Abstract

The COVID 19 pandemic is devastating mankind irrespective of caste, creed, gender, and religion. Until a vaccine is discovered, we should do our bit to constrain the expanse of the coronavirus. Using a face mask can undoubtedly help in managing the spread of the virus. COVID 19 face mask detector uses or owns Facemasknet, deep learning techniques to successfully test whether a person is with wearing a face mask or not. The manuscript presents three class classification namely person is wearing a mask, or improperly worn masks or no mask detected. Using our deep learning method called Facemasknet, we got an accuracy of 98.6

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Nomenclature

OPEN CV open course computer vision library

IOT Internet of Things

CNN Convolution Neural Network

DD FT deep Dense Face Detector

AI Artificial Intelligence

SVM Support vector machine

GAN generative advisory network

ICSC in circuit serial programmimg

Chapter 1

Introduction

This chapter presents a brief introduction of the project.It included background, motivation,scope and the brief description of the project and also the overall organization of the report

The new coronavirus is believed to have originated from bats in Wuhan, China, on November 17, 2019, and spread from one country to another in a very short time. The deadly coronavirus has previously caused respiratory infections, especially severe acute respiratory syndrome (SARS) and Middle Eastern respiratory syndrome (MERS). The main symptoms of COVID 19 are fever, malaise, dry cough, anosmia, sore throat, and headache. Its arrival stopped the world because of its severity and its negative impact on humans. It takes two weeks for a person with mild symptoms to recover. The recovery time for patients with severe symptoms depends on their severity. People infected with the coronavirus are advised to remain quarantined or self-quarantined. Reverse transcriptase-polymerase chain reaction (RTPCR) is the standard method currently implemented to detect the presence of viruses in the human body. Wearing a face mask can limit the spread of the virus. Often, the coronavirus is also asymptomatic. As the saying goes, prevention is better than treatment when it comes to wearing a face mask when in contact with a person. In this way, one helps ensure one's own safety, the safety of others, and thus limits the spread of the disease. The World Health Organization (WHO) and the US Centers for Disease Control and Prevention (CDC) have proposed the use of face masks to control the spread of the virus. This project focuses on detection of face masks as it has become a necessity to wear masks. Individuals wearing face masks only will be allowed to move on the other side of the door.

1.1 Motivation

As we all know that Covid19 is about sanitizing, wearing masks and maintaining social distance. This idea motivated us to make a project that followes all the covid guidelines and also helps the society. This project will detect face and the individuals will only be

allowed to move into the door if they are wearing masks. It detects only 2 faces at a time which also promotes social distancing.

1.2 Objective

To detect faces and open or close the door on basis of the detection. If a person is wearing a face mask then door will be opened. If the person is not wearing a face mask then the door will not be opened.The main objective of this project is to assure the safety of the crowd through Covid 19.

1.3 Scope of the Project

It can be used anywhere and everywhere where safety is required. We can make use of it in almost all the public places. For example: Malls, Restaurants, Offices, Schools, Colleges, Hospitals, Banks, Residential Areas and many more. As it has become mandatory for us to wear masks and maintain social distancing, in this crucial time this project will help us and keep us safe as well as others. If another covid wave happens to come in the near or far future then this project can be used.

1.4 Brief Description

As the name suggests "Lock System" it is assumable that the project consists of a locking mechanism. In the earlier times we used to have lock and key mechanism.As the times have changed our project consists of an advanced locking system. As we have recently come across the Covid Pandemic, we have realised that it has become important for us to wear masks and maintain social distancing. Hence this project has an advanced locking system wearing masks will act as the key to the lock. An individual wearing a mask and maintaining social distance will be allowed to move through the other side of the door. An individual not wearing a mask will not be allowed to move through the other side of the door.

1.5 Organization of the Report

The project is designed with a low cost and all level users can have one for security reasons.This project therefore seeks to continuously use for surveillance by face detection.The rest of the paper is organized as follows.Related work is explained as follows; Literature Survey is explained in chapter 2. Chapter 3 explains the project design.Chapter 4 explains

us the coding and interfacing of the components and Chapter5 shows us the implementation of the project followed by testing and execution in chapter 6,7 respectively.The report is concluded in chapter 8

Chapter 2

Literature survey

This chapter presents the literature reviews of various authors and from various research papers provided references and its bibtex citation in Bibliography

almufti *et al.* [1] have designed Many face detection models have been designed using different algorithms and techniques. The proposed approach in this paper developed to avoid mask-less people from entering to a desired places (i.e. Mall, University, Office, ... etc.) by detecting face mask using deep learning, TensorFlow, Keras, and OpenCV and sending a signal to Arduino device that connected to the gate to be open. it detect a face in a real-time and identifies whether the person wear mask or not. The method attains accuracy up to 97.80 percent. The dataset provided in this paper, was collected from various sources.

sharath *et al.* [2]Robots work in strictly defined path and there is no or very little change in such systems in order to overcome this we are using a vision based control system to make the system dynamic in nature the images are picked by using a USB camera processed images of the object is transmitted via serial communication to the Arduino Mega 2560 microcontroller and processed using pythons open source computer vision (Open CV) image to process the image captured by the USB camera to find the exact colour and to pick the object and sort it.

hussain *et al.* [3] have proposed an IoT-based Smart Screening and Disinfection Walkthrough Gate (SSDWG) for all public places entrance. The SSDWG is designed to do rapid screening, including temperature measuring using a contact-free sensor and storing the record of the suspected individual for further control and monitoring. Our proposed IoT-based screening system also implemented real-time deep learning models for face mask detection and classification. This module classified individuals who wear the face mask properly, improperly, and without a face mask using VGG-16, MobileNetV2, Inception v3, ResNet-50, and CNN using a transfer learning approach. We achieved the highest accuracy of 99.81 percent while using VGG-16 and the second highest accuracy of 99.6 percent using MobileNetV2 in the mask detection and classification module. We also implemented classification to classify the types of face masks worn by the individuals,

either N-95 or surgical masks. We also compared the results of our proposed system with state-of-the-art methods, and we highly suggested that our system could be used to prevent the spread of local transmission and reduce the chances of human carriers of COVID-19.

gupta *et al.* [4]The proposed model is developed using MobileNetV2 which is a deep learning algorithm. The architecture takes the image as input, assigns weights to various objects in the image, differentiates one from another and the neural network output which tells us whether there is a mask or not, and the result is given to the Arduino module by using PY serial software. This model gives an accuracy of 99.9 percent, and it is connected to the servo-motor which is attached to the Arduino and acts as an automatic sensor door present at various public places. The door will be opened or remains closed based on the output value given to Arduino by the mask detection model designed in proposed study. The door opens only when a person is wearing a mask; otherwise, it remains closed.

sasikala *et al.* [5] have designed contactless attendance tracking and screening is an essential part in all the organizations. This will be solved by building a technology which will do multiple functions like detecting faces of people with their masks on and reading their body temperature involving various techniques computer vision and deep learning using Python, OpenCV, and TensorFlow/Keras and also some sensors like Infrared Temperature Sensor. The output values of these modules will be uploaded in cloud storage and can be viewed remotely. It is highly possible to reduce the spread of the virus and promote social distancing as per the government norms by using such technology driven solutions.

karthik *et al.* [6]In this paper, the dataset is utilized to create a COVID-19 face mask detector with CV utilizing Open CV, Python, Tensor Flow, and other tools. The mail aim of the work is to find whether the being on the image/cinematic rivulet is exhausting a face mask or not through the aid of deep learning and computer revelation. By using this face mask detection, we are going to make a gateway system. This system allows people in only if they wear a face mask. We use Raspberry pi to make this system and an a4899 driver module to control the stepper motor. The gateway is controlled by the motor which is connected to the driver module.

Militante *et al.* [7] In this paper, deep learning techniques have been used in distinguishing facial recognition and recognize if the person is wearing a facemask or not. The dataset collected contains 25,000 images using 224x224 pixel resolution and achieved an accuracy rate of 96 percent as to the performance of the trained model. The system develops a Raspberry Pi-based real-time facemask recognition that alarms and captures the facial image if the person detected is not wearing a facemask. This study is beneficial in combating the spread of the virus and avoiding contact with the virus.

Meivel *et al.* [8] mask detection using Matlab is used when complex images are present in the dataset. Matlab specified the Faster R-CNN algorithm and Dataset allotment for mask detection. This paper manages complex pictures using facial recognition packages. The Faster R-CNN methodology used in the security system and the medical

system. The proposed work balanced face restriction, color changes, brightness changes, and contrast changes. Segmentation and feature extraction used in face restriction of the person image. We chose RCNN, Fast RCNN, and Faster RCNN algorithm for detecting Mask detection and Social distance. Regions with Convolutional neural network Based on Mixing pictures, pixel prediction, and specific enhancements. The main objective was to solving multiple and multitask picture detection problems with speed rates. The Methodology used for face detection and detection of Unmask person in a dataset of face database.

saputra *et al.* [9]have proposed a smart and real-time door lock system for an elderly user based on local binary pattern histogram as a face recognition algorithm with modular system architecture design. The novelty in our proposed system design, it does not require any additional device, it does not use any user interface, and the least user participation by automating the processes. All the user needs to do just walk toward the door and stand in front of it and the door will automatically unlock and locked back after the user enters the house and close the door. The system resulted in an accuracy of 98 percent, with an average processing time is 1.449 seconds for the entire process. Additional advantages, the system is designed with a modular approach that makes it flexible and scalable for further development.

ahmed *et al.* [10]have proposed an IoT based smart home security and automation system named 'Facebook messenger Chatbot' which is made using Raspberry PI as the central processor. It will enable its users to use it free of cost as Facebook messenger app is free in Bangladesh. People can use it from home or any remote location and can control digital home appliances like fans, lights etc. Smart door locking system, face recognition, gas leakage detection, temperature detection and control, humidity detection, fire detection, which has been done through collecting data from different sensors and passing them to Raspberry PI and then PI passes these to the BOT through a REST API, are the additional features that make our security system safer, effective and easier to use compared to other existing approaches.

Chapter 3

Python

This chapter includes the Steps to Perform Image Processing ,Python script to train a face mask detector on our dataset using Keras and TensorFlow, 0pen CV.

3.1 Steps to Perform Image Processing

- Load images using Python or any other programming you are working on.
- Convert images into array.
- And finally apply some algorithm on that array.

3.2 Python script to train a face mask detector on our dataset using Keras and TensorFlow.

TensorFlow is an open-source platform for machine learning and a symbolic math library that is used for machine learning applications.Tensor flow has the advantage that it does support and uses many backend software like GUI and ASIC. When it comes to community support tensor flow has the best.Tensor flow also helps in debugging the sub-part of the graphs.Tensor flow has shown a better performance when compared with other platforms.Easy to extend as it gives freedom to add custom blocks to build on new ideas. Keras It is an Open Source Neural Network library that runs on top of Theano or Tensorflow. It is designed to be fast and easy for the user to use. It is a useful library to construct any deep learning algorithm of whatever choice we want.Keras is used for low-performance models.In Keras framework, there is only minimal requirement for debugging the simple networks.

OpenCV (Open Source Computer Vision Library) acts as a toolkit for computer vision . It contains built-in classes and methods that can be used for image and video processing and analyses. You can also do machine learning in OpenCV. Most of its built-in machine learning algorithms are built for its primary purpose which is computer vision. It has C++, C, Python, Java and MATLAB interfaces.Both TensorFlow and OpenCV are used together to have the optimal implementation for object detection. Object detected using only OpenCV is not optimal and using TensorFlow as a framework gives you more options to explore like networks, algorithms. TensorFlow is optimal at training part i.e. at data handling(tensors) and OpenCV is optimal in accessing and manipulating data (resize, crop, webcams etc.,). Thus, both are used together for object detection.

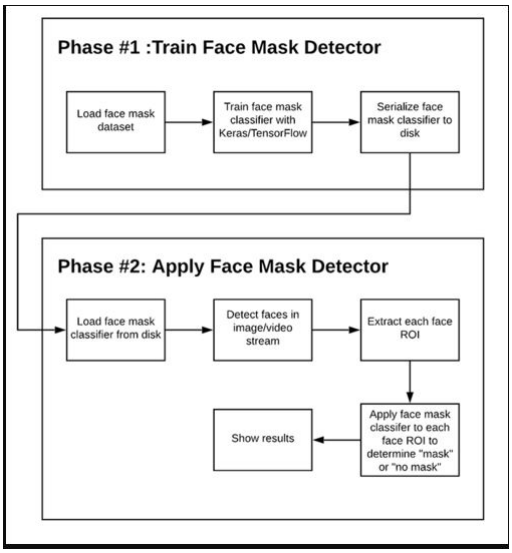

Figure 3.1: Phases and individual steps for building a COVID-19 face mask detector with computer vision and deep learning using Python, OpenCV, and TensorFlow/Keras.

3.3 Methodology

Phases and individual steps for building a COVID-19 face mask detector with computer vision and deep learning using Python, OpenCV, and TensorFlow/Keras.In order to train a custom face mask detector, we need to break our project into two distinct phases, each with its own respective sub-steps: Training: Here well focus on loading our face mask detection dataset from disk, training a model (using Keras/TensorFlow) on this dataset, and then serializing the face mask detector to disk. Deployment: Once the face mask detector is trained, we can then move on to loading the mask detector, performing face detection, and then classifying each face as with$_maskorwithout_maskCOVID-19facemaskdetectiondataset$

3.4 Testing using OpenCV

Capture the video through webcam or any saved video testing file. Pass each frame of video or captured frame from webcam through the model.Get the boxes, scores and classes obtained as output and draw the boxes on the frame accordingly (colour depending on the class of each box).Display a total number of boxes of both classes at the bottom of the screen and record them in a variable. Training the model:Without mask Our model gave 98 percent accuracy for Face Mask Detection after training via tensorflow-gpu==2.5.0. We used our own images to verify the working of the custom deep learning model to detect whether a person is or is not wearing a face mask without mask with mask

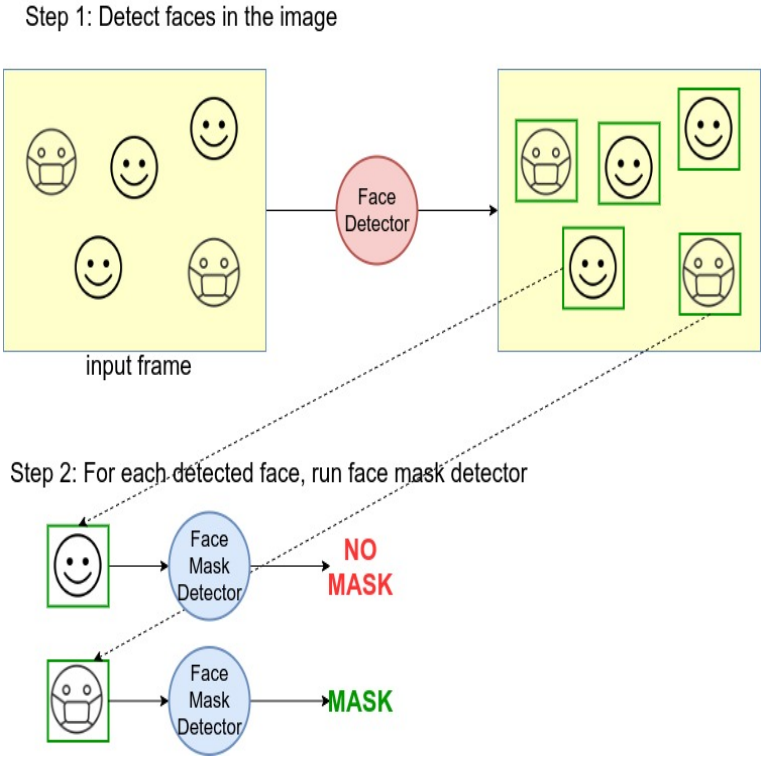

Figure 3.2: Face Detector

Chapter 4

Pyfirmata

This chapter presents the description of Pyfirmata and how it has helped us to get the respective results.

PyFirmata is basically a prebuilt library package of python program which can be installed in Arduino to allow serial communication between a python script on any computer and an Arduino. This python package can give access to read and write any pin on the Arduino

4.1 Steps to control Arduino with Python and Pyfirmata (directly from your computer)

- Run Standard Firmata on your Arduino board.
- Setup pyFirmata on computer
- Control your Arduino with pyFirmata enditemize
  - Push button – LEDs interaction with pyFirmata

4.2 Why to use Pyfirmata

Arduino is an open-source platform composed of hardware and software that allows for the rapid development of interactive electronics projects.Arduino uses its own programming language, which is similar to C++. However, it's possible to use Arduino with Python or another high-level programming language. In fact, platforms like Arduino work well with Python, especially for applications that require

integration with sensors and other physical devices. Firmata is an intermediate protocol that connects an embedded system to a host computer, and the protocol channel uses a serial port by default. The Arduino platform is the standard reference implementation for Firmata. The Arduino IDE comes with the support for Firmata. pyFirmata makes it easy for you to write complete Arduino applications in Python.It's great because you don't have to have 2 programs, you can just write everything in one program, while pyFirmata takes care of the rest.

Chapter 5

Designing Of project and Implementation

This chapter presents the hardware implementation of the project which involves the Arduino, servo motor and actual connection between the servo motor and the Arduino.

5.1 Components Used

5.1.1 Arduino

Figure 5.1: Arduino

The Arduino UNO is a standard board of Arduino.Arduino UNO is based on an ATmega328P microcontroller. It is easy to use compared to other boards, such as the Arduino Mega board, etc. The board consists of digital and analog Input/Output pins (I/O), shields, and other circuits.The Arduino UNO includes 6 analog pin inputs, 14 digital pins, a USB connector, a power jack, and an ICSP (In-Circuit Serial Programming) header. It is programmed based on IDE, which stands for Integrated Development Environment. It can run on both online and offline platforms.

Figure 5.2: Servo motor

5.1.2 Servo Motor

A servo motor is a rotary actuator that allows for precise control of angular position. It consists of a motor coupled to a sensor for position feedback. It also requires a servo drive to complete the system. The drive uses the feedback sensor to precisely control the rotary position of the motor.

5.1.3 Jumper

Figure 5.3: Jumper

A jump wire (also known as jumper, jumper wire, DuPont wire) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.

Individual jump wires are fitted by inserting their "end connectors" into the slots provided in a breadboard, the header connector of a circuit board, or a piece of test equipment.

5.1.4 Led's

Figure 5.4: Led's

A light-emitting diode (LED) is a semiconductor device that emits light when an electric current flows through it. When current passes through an LED, the electrons recombine with holes emitting light in the process. LEDs allow the current to flow in the forward direction and blocks the current in the reverse direction.Light-emitting diodes are heavily doped p-n junctions. Based on the semiconductor material used and the amount of doping, an LED will emit a coloured light at a particular spectral wavelength when forward biased. As shown in the figure, an LED is encapsulated with a transparent cover so that emitted light can come out.

5.1.5 USB Cable

Figure 5.5: Usb Cable

This cable features a standard Type-A USB connector on one end and a standard Type-B connector on the other. For example, you can plug the Type-A connector into your computer, then plug the Type-B connector into a device with a Type-B port. Printers and servers often have Type-B ports.

5.2 Hardware Implementation

Components that we have used are Arduino Uno, servo,Led's,Jumpers.

5.2.1 Interfacing of Arduino Uno with Servo Motor

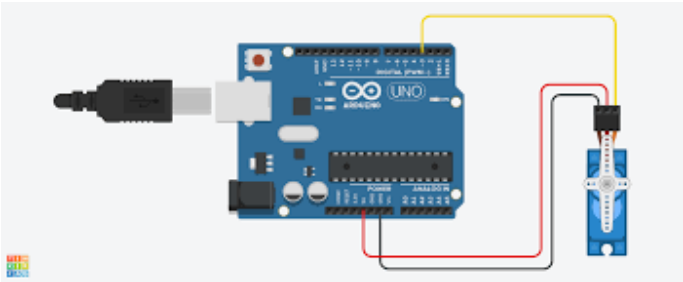

Figure 5.6: Interfacing of Arduino Uno with Servo Motor

To interfaced Arduino Uno with motor we have used a Servomotor SG-90 and Arduino Uno microcontroller.SG90 Micro Servo Motor runs on 4.8-6VDC (5V Typical) and can rotate approximately 180 degrees (90 in each direction). It consumes around 10mA at idle and 100mA to 250mA when moving, so we can power it up through 5-volt output on the Arduino.we have onnect the Red wire to the 5V on Arduino and Black/Brown wire to ground. And finally have connect the Orange wire to the PWM enabled pin 9.

5.2.2 Interfacing of Arduino Uno with Led

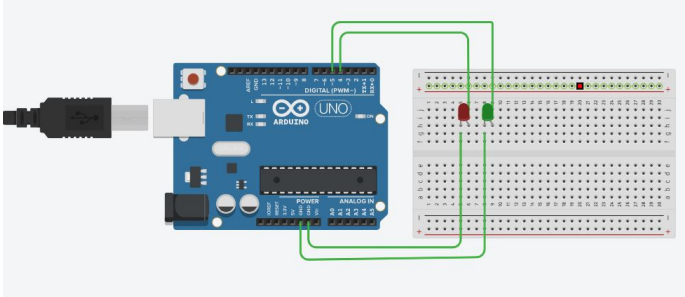

Figure 5.7: Interfacing of Arduino Uno with Led

So we have use this interfacing to know the status of the door. In this we have connect the 2 LED's to Arduino Uno.In which 1st led is connected to pin no 4 and 2nd led is connected to pin no 5 of the Arduino uno.And cathode of the led is given to the GND pins of the Arduino Uno. If the green led turns on , it indicates that the door is open .If the red led turns on, it indicates that the door is closed

5.3 Working of the project

We are taking input of real time image captured by webcam then we are training and testing our data in order to develop face detector pyfirmata is used to control our arduino board with python. Then the PWM signal is given from the Arduino to Control the servo Motor. if the face mask is detected then green led will turn on and motor will start. if face mask is not defected then red led will turn on and door will be locked

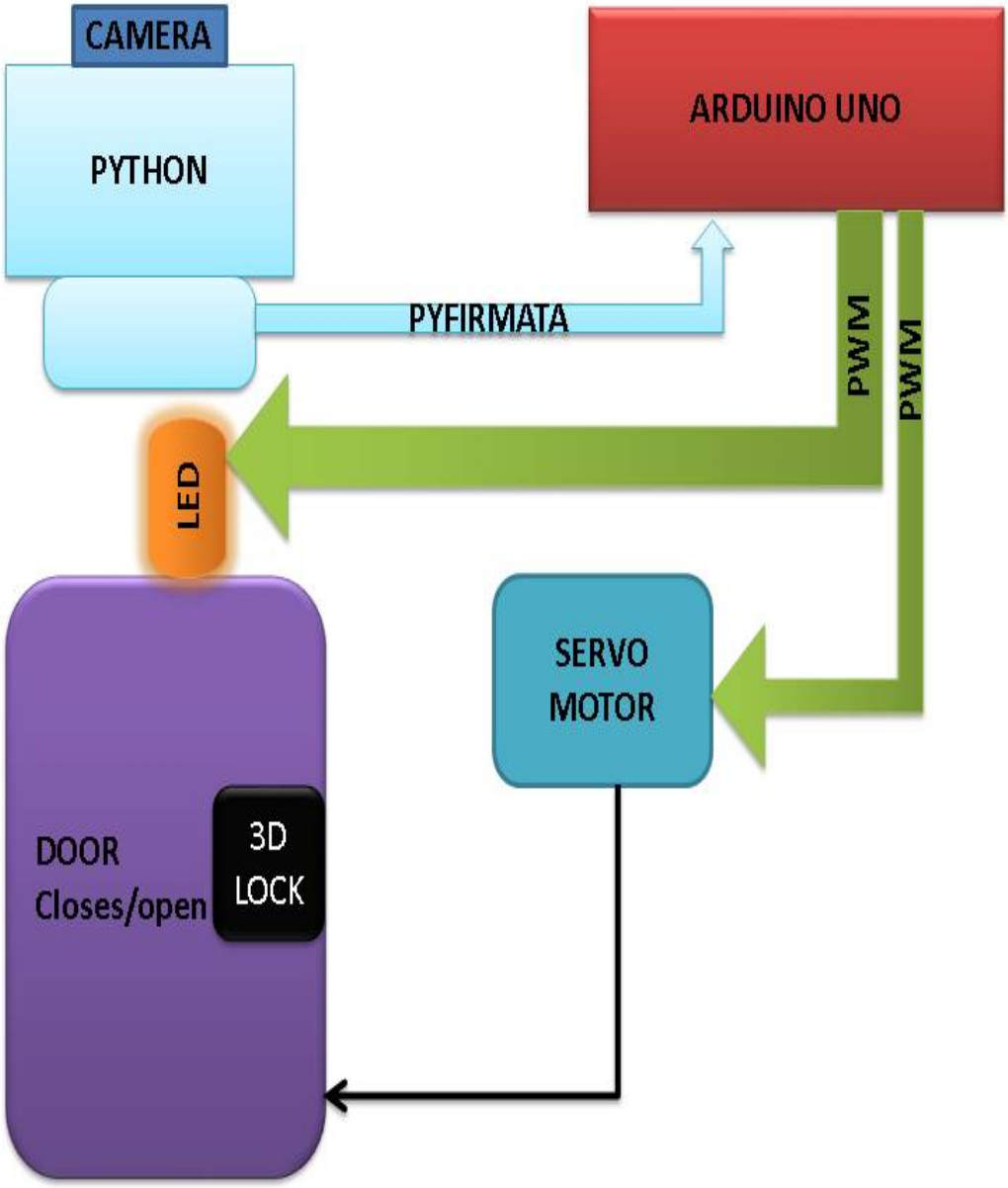

Figure 5.8: Block Diagram Of the Project

Chapter 6

3D Door Lock

This chapter presents the use of FDM 3D printer which we used in our project to print the lock mechanism. Thre are many software tools availabele from which we used tinkercad to design our 3D lock.

6.1 FDM 3D Printer

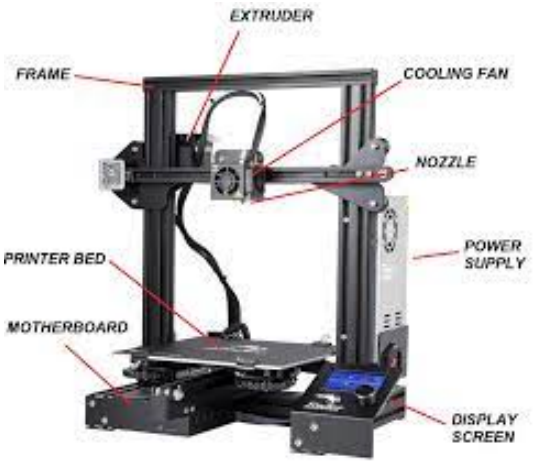

Figure 6.1: FDM Printer

Refer Fig no 6.1 An FDM 3D printer works by depositing melted filament material over a build platform layer by layer until you have a completed part. FDM uses digital design files that are uploaded to the machine itself and translates them into physical dimensions. Materials for FDM include polymers such as ABS, PLA, PETG and PEI, which the machine feeds as threads through a heated nozzle. This extrusion head is attached to a three-axis system that allows it to move across the X, Y and Z axes. The printer extrudes melted material in thin strands and deposits them layer by layer along a path determined by the design. Once deposited, the material cools and solidifies. You can attach fans to the extrusion head to accelerate cooling in some cases.

To fill an area, multiple passes are required, similar to coloring in a shape with a marker. When the printer finishes a layer, the build platform descends and the machine begins work on the next layer. In some machine setups, the extrusion head moves up. This process repeats until the part is finished

To operate an FDM machine, you first load a spool of this thermoplastic filament into the printer. Once the nozzle hits the desired temperature, the printer feeds the filament through an extrusion head and nozzle.

6.2 3D Software

3D Software There are many different software tools available. From industrial grade to open source. We've created an overview on our 3D software page.

We often recommend beginners to start with Tinkercad. Tinkercad is free and works in your browser, you don't have to install it on your computer. Tinkercad offers beginner lessons and has a built-in feature to export your model as a printable file e.g .STL or .OBJ.

Now that you have a printable file, the next step is to prepare it for your 3D printer. This is called slicing.

- Slicing: From printable file to 3D Printer Slicing basically means slicing up a 3D model into hundreds or thousands of layers and is done with slicing software.

  When your file is sliced, it's ready for your 3D printer. Feeding the file to your printer can be done via USB, SD or Wi-Fi. Your sliced file is now ready to be 3D printed layer by layer.

6.3 3D Gear Lock Design(It's objects)

1)Gear 2) Gear2 3)Holder 4)Lock 5)Lock2

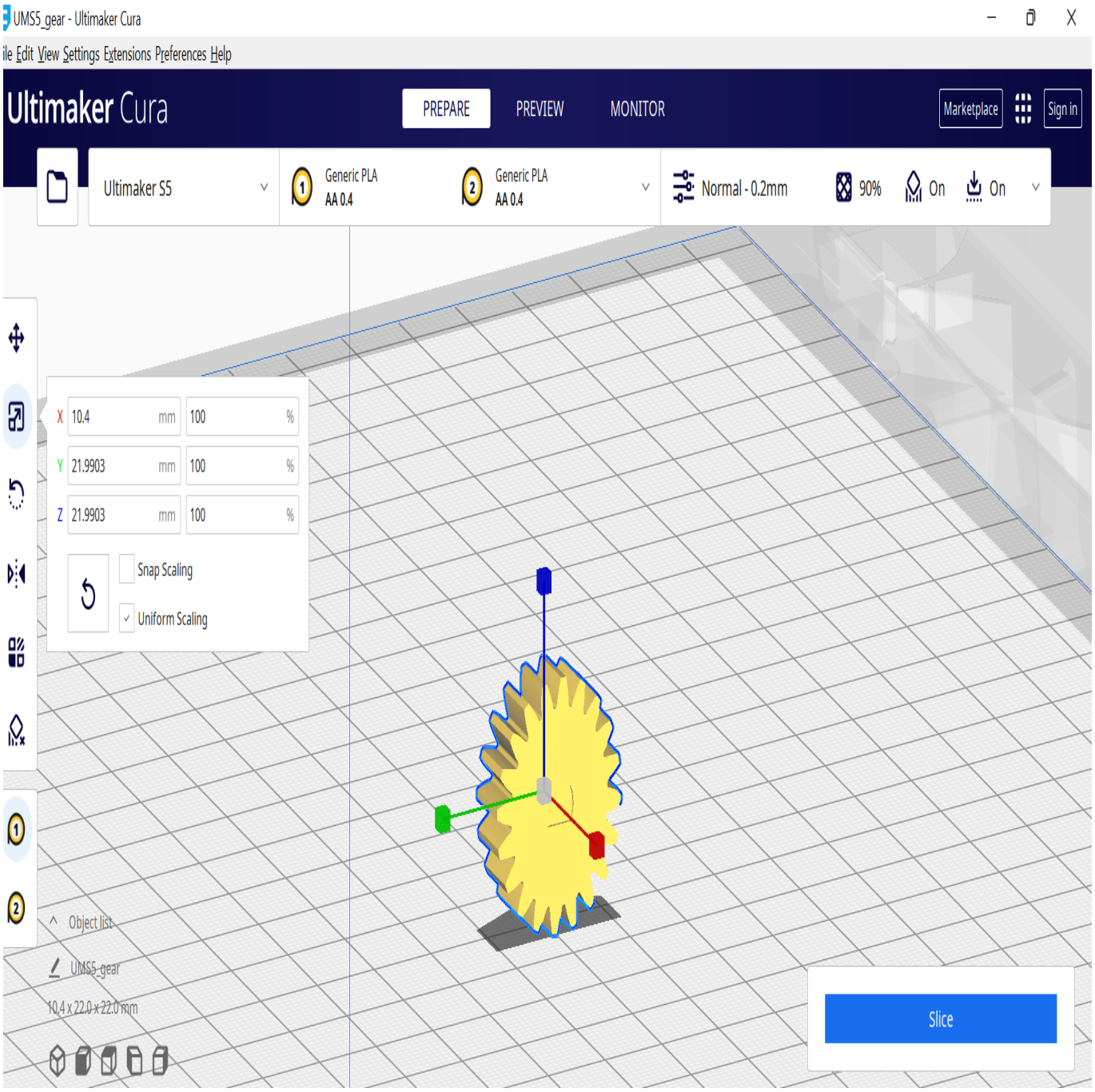

Figure 6.2: Gear

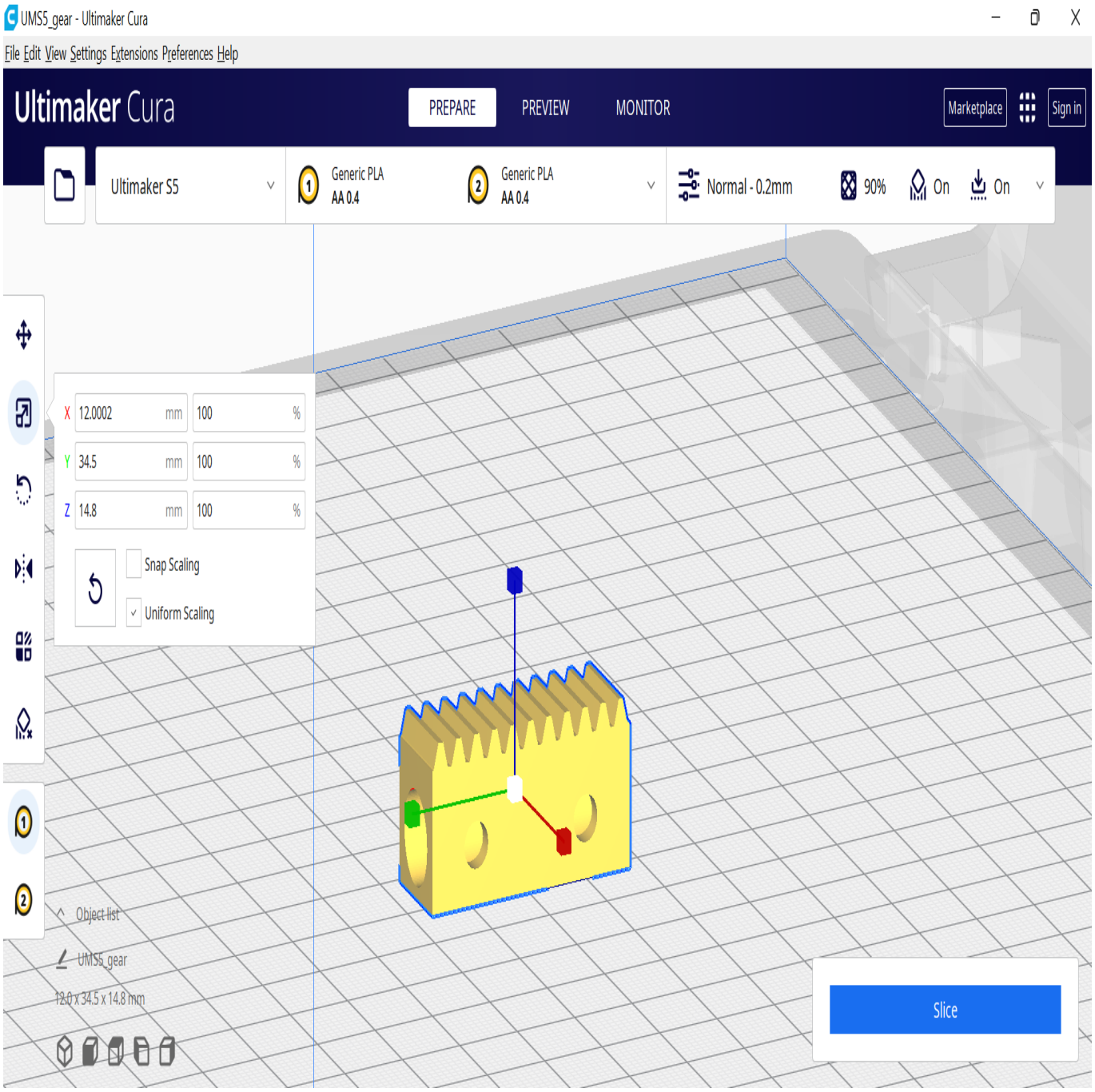

Figure 6.3: Gear2

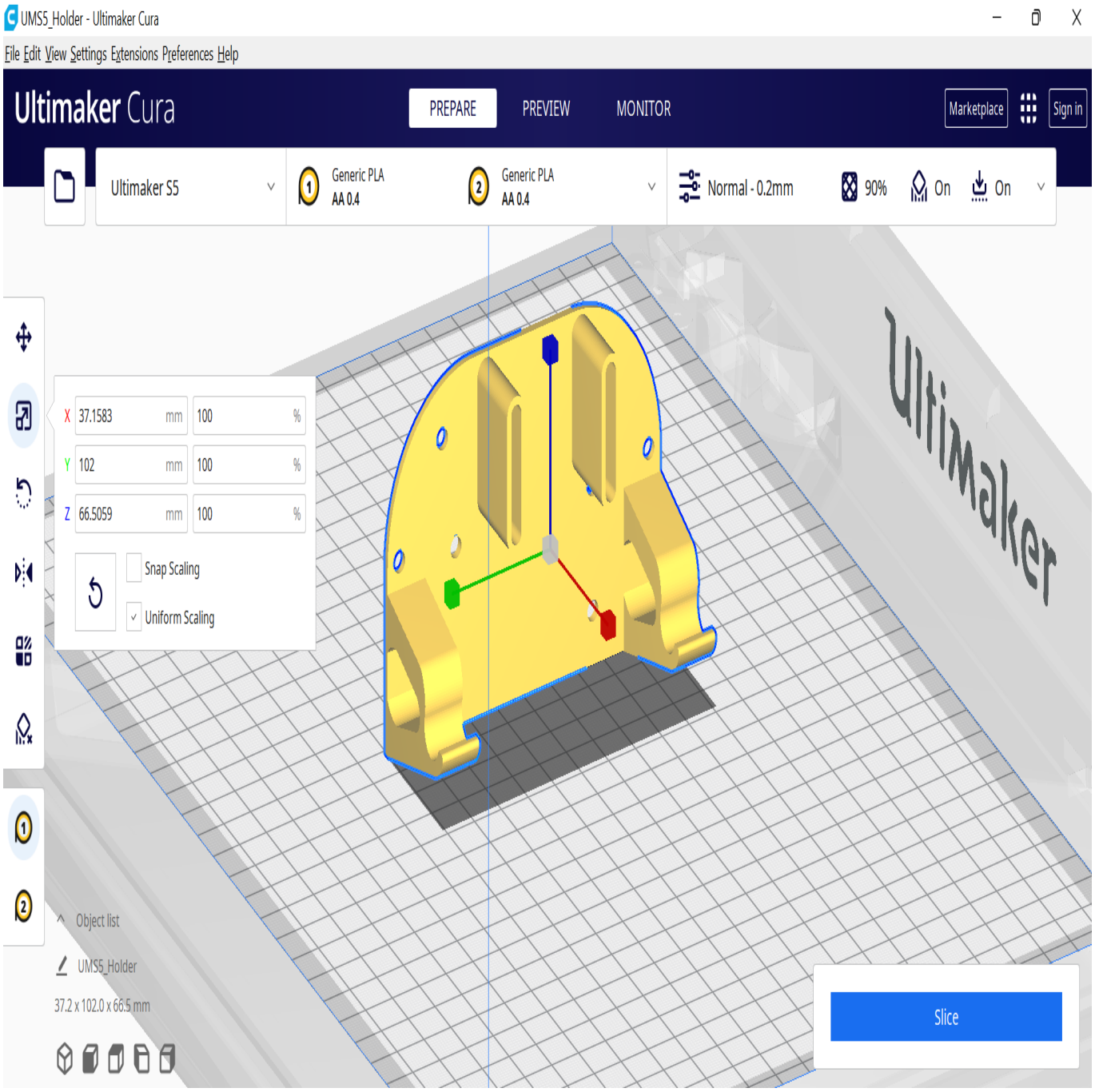

Figure 6.4: Holder

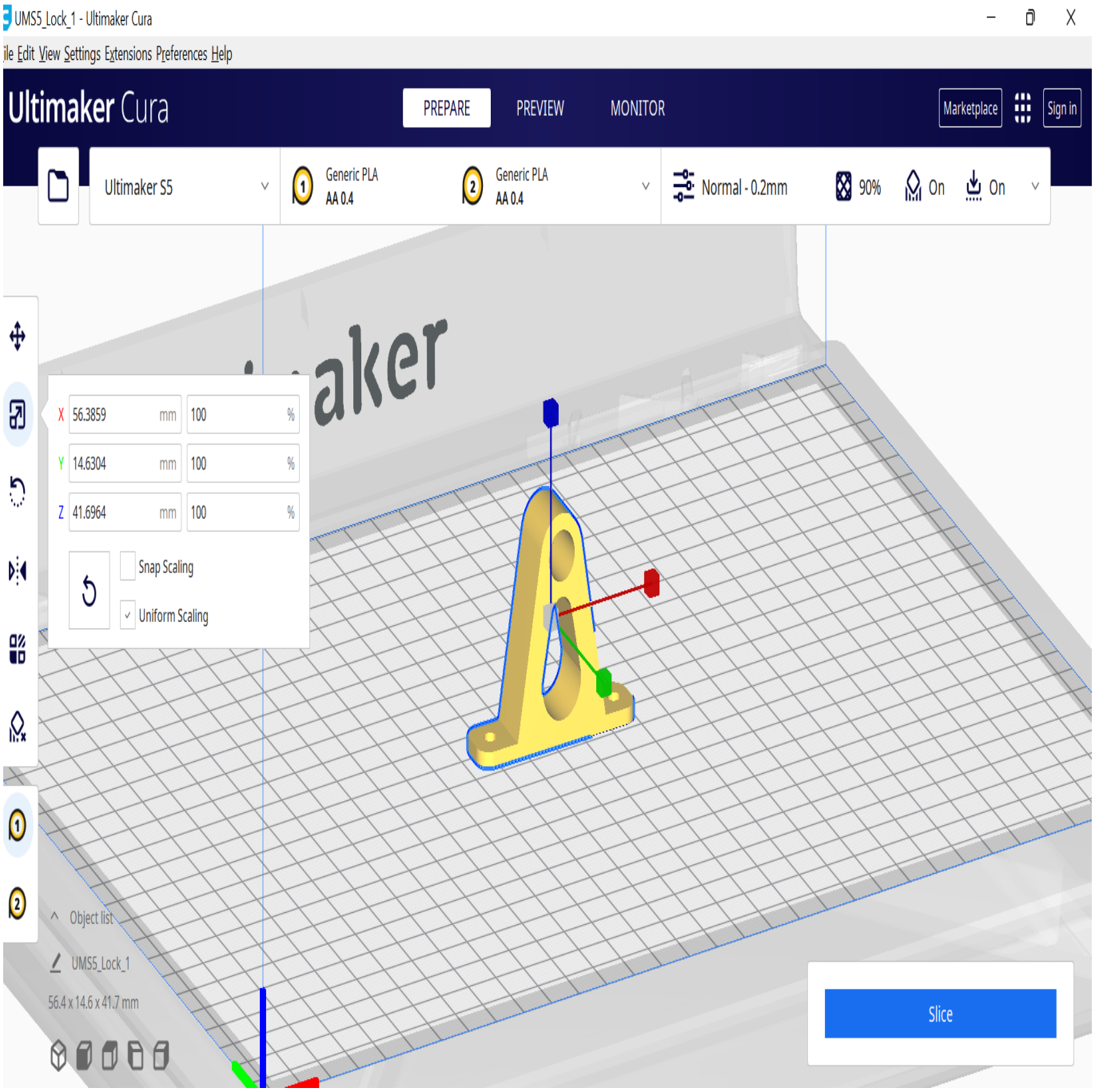

Figure 6.5: Lock

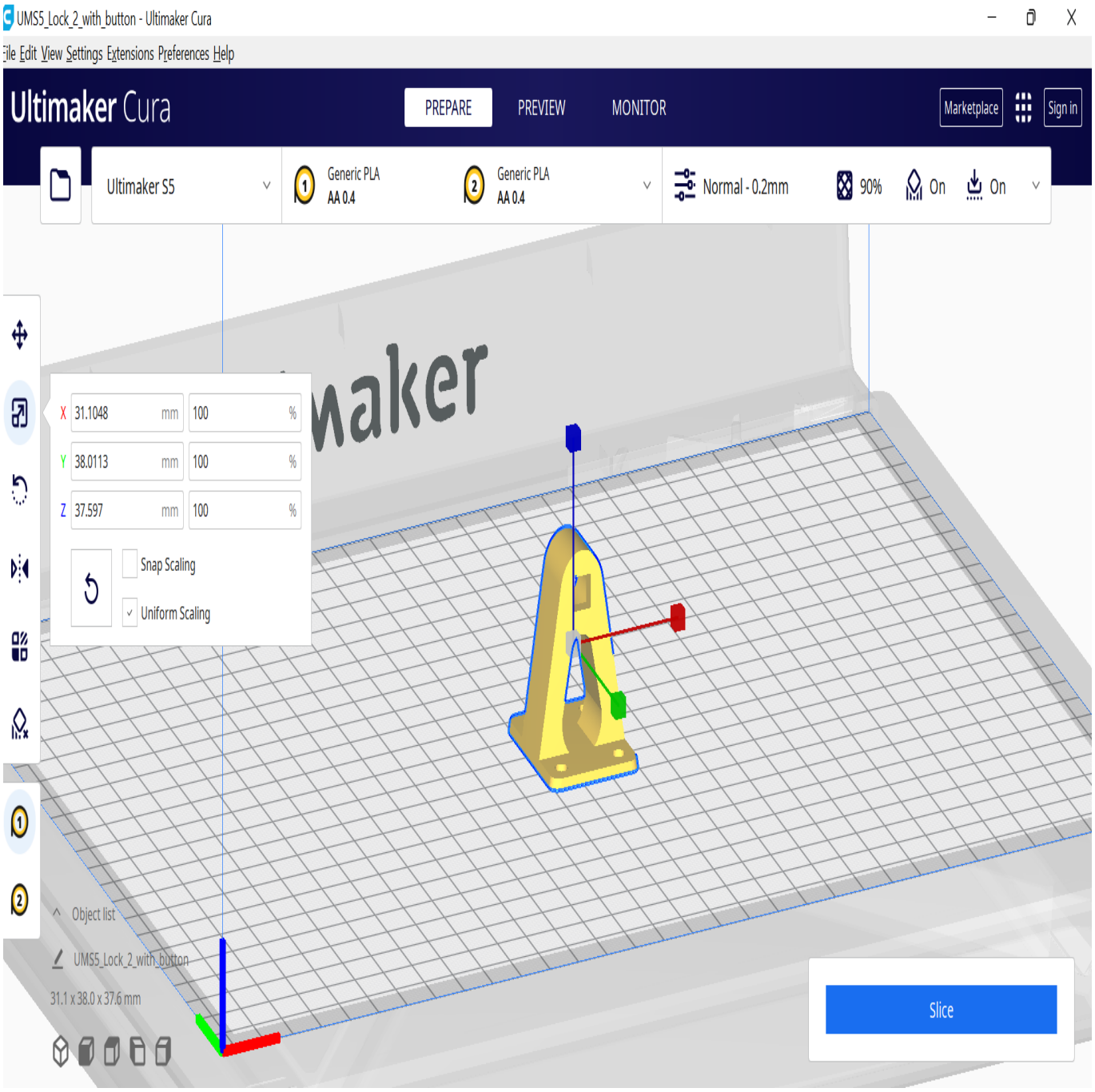

Figure 6.6: Lock2

Figure 6.7: 3D GEAR LOCK

Chapter 7

Conclusion and Scope for Further Work

This chapter concludes the report and also specifies the scope and further related work can be done on this project

7.1 Conclusion

Our project provides solution for the recent pandemic. The model is cost effective and has high efficiency. Wearing masks and maintaining social distance has become mandatory. This project encourages people to take care of their health and to follow the covid protocols. It can be used in almost all public places. Example: Schools, Colleges, Hospitals, Banks, Malls

7.2 Scope For Further Work

If a new covid variant is introduced in future then this system can be used to check whether the covid guidelines are followed or not.

This system can be installed outside the operation theater so that the doctors wear mask before entering the operation room.

After making some advances, this system can also be used to detect whether the doctors are wearing PPE Kits or not.

Face detection can also be used in highly secured places where only the known individuals will be given entry, this will reduce the chances of an intruder getting in. Example: Government Meetings

Conclusion and Scope for Further Work

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[9] Rezki Saputra and Nico Surantha. Smart and real-time door lock system for an elderly user based on face recognition. *Bulletin of Electrical Engineering and Informatics*, 10(3):1345–1355, 2021.

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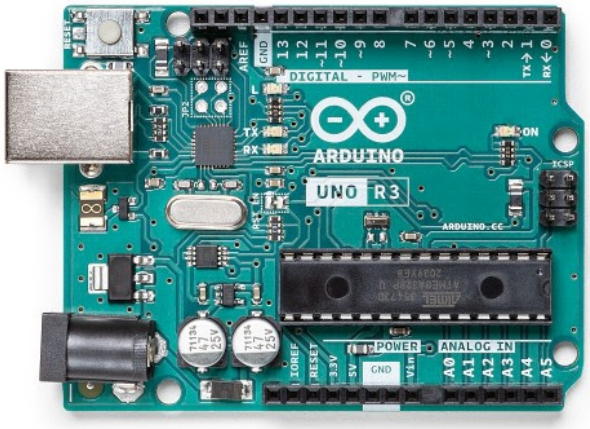
Chapter 8

Appendix

8.1 Datasheet

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

Features

- **ATMega328P** Processor
  - **Memory**
    - AVR CPU at up to 16 MHz
    - 32KB Flash
    - 2KB SRAM
    - 1KB EEPROM
  - **Security**
    - Power On Reset (POR)
    - Brown Out Detection (BOD)
  - **Peripherals**
    - 2x 8-bit Timer/Counter with a dedicated period register and compare channels
    - 1x 16-bit Timer/Counter with a dedicated period register, input capture and compare channels
    - 1x USART with fractional baud rate generator and start-of-frame detection
    - 1x controller/peripheral Serial Peripheral Interface (SPI)
    - 1x Dual mode controller/peripheral I2C
    - 1x Analog Comparator (AC) with a scalable reference input
    - Watchdog Timer with separate on-chip oscillator
    - Six PWM channels
    - Interrupt and wake-up on pin change
  - **ATMega16U2 Processor**
    - 8-bit AVR® RISC-based microcontroller
  - **Memory**
    - 16 KB ISP Flash
    - 512B EEPROM
    - 512B SRAM
    - debugWIRE interface for on-chip debugging and programming
  - **Power**
    - 2.7-5.5 volts

CONTENTS

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

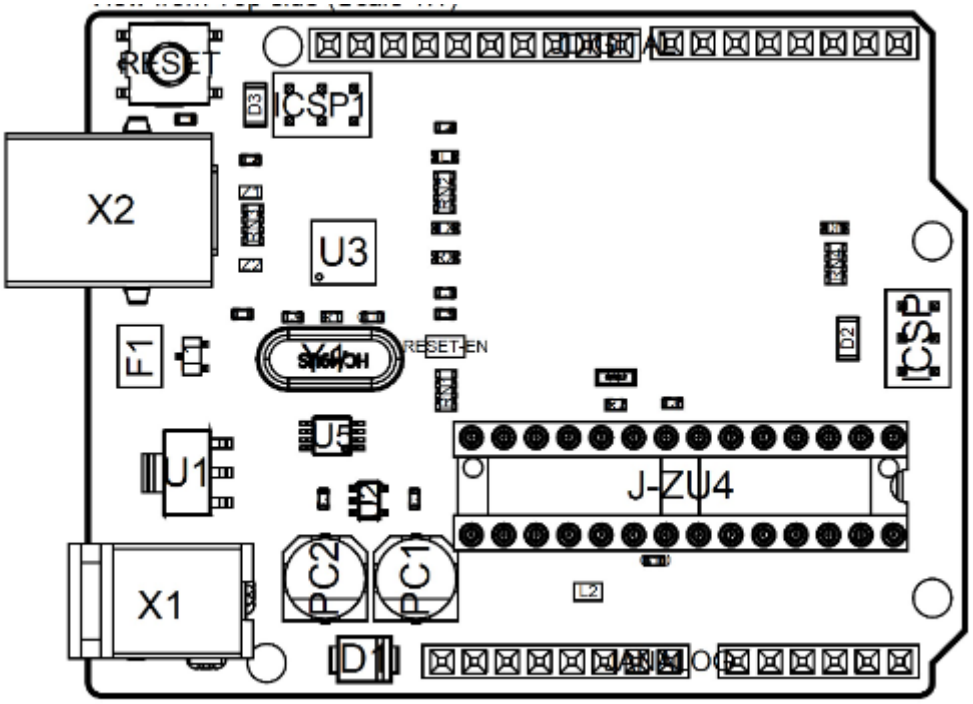
2.2 Power Consumption

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



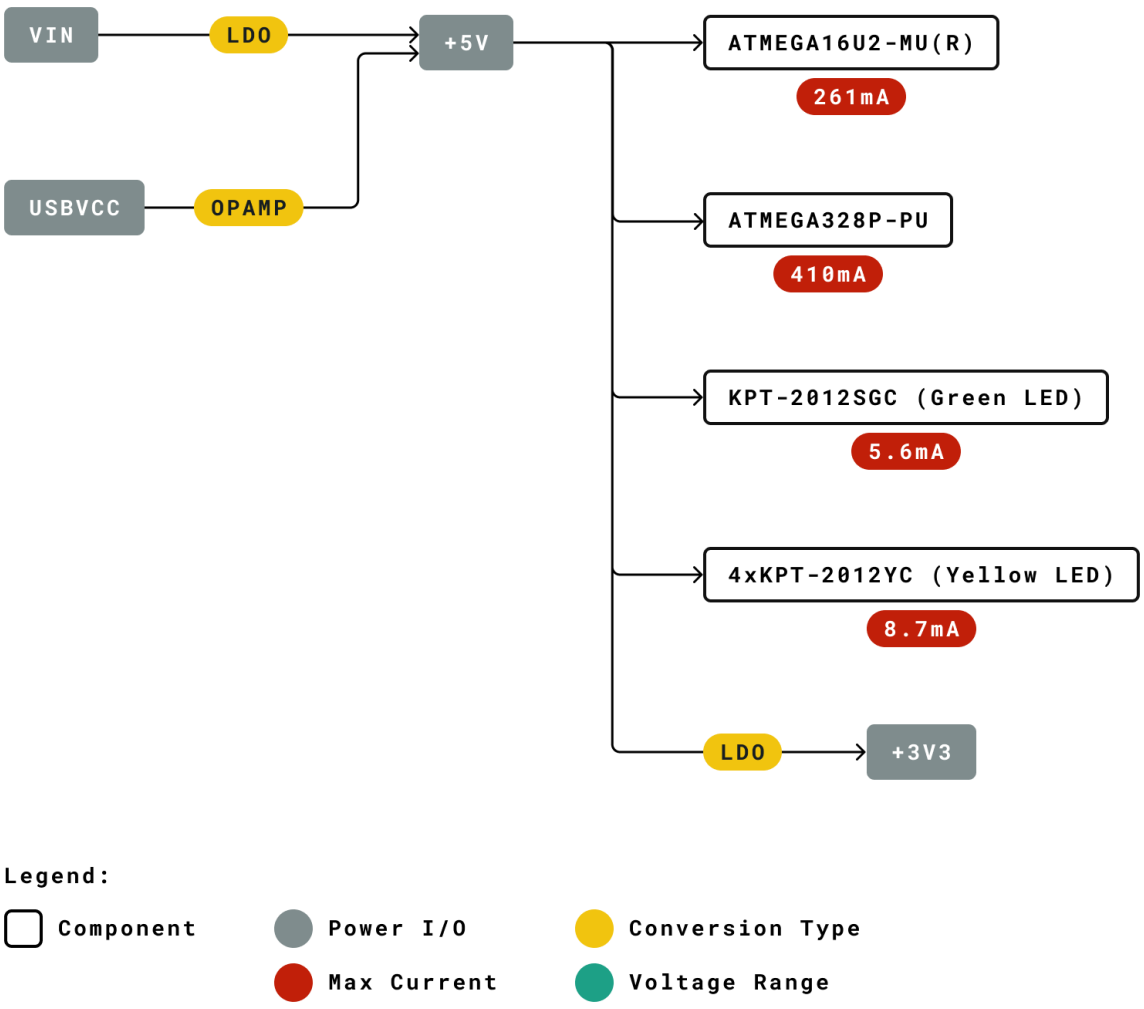
Board topology

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]

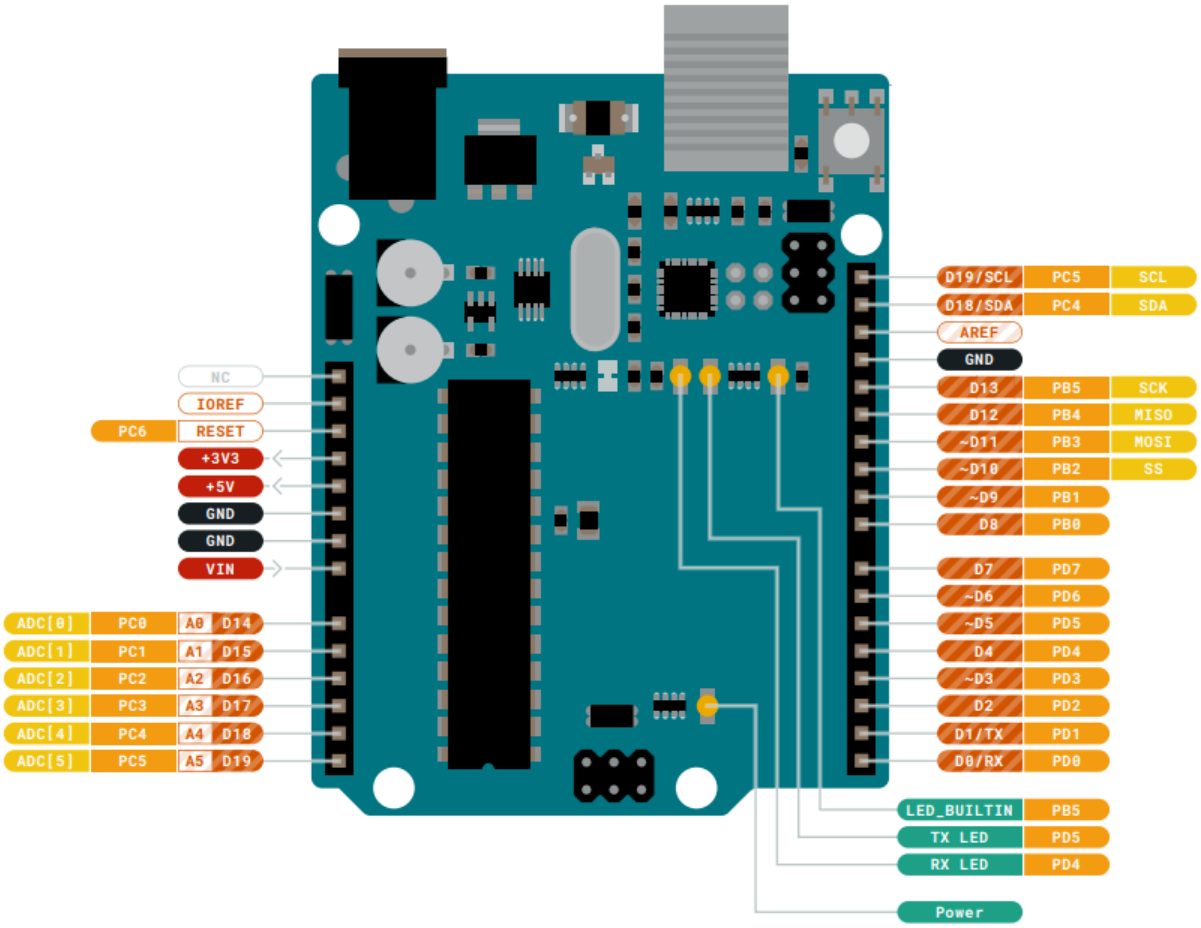
4.5 Online Resources

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

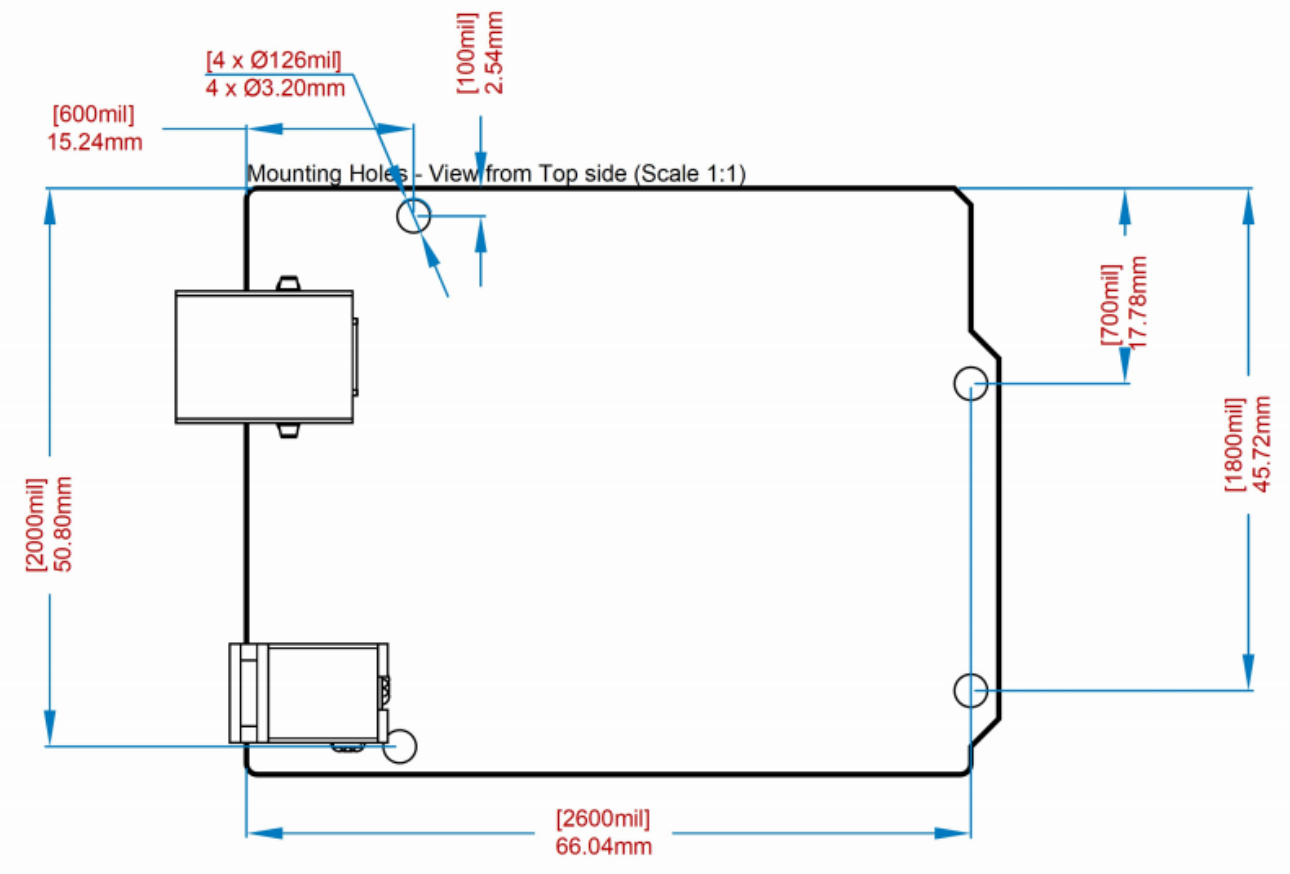
Pin	Function	Type	Description
1	NC	NC	Not connected
2	IOREF	IOREF	Reference for digital logic V - connected to 5V
3	Reset	Reset	Reset
4	+3V3	Power	+3V3 Power Rail
5	+5V	Power	+5V Power Rail
6	GND	Power	Ground
7	GND	Power	Ground
8	VIN	Power	Voltage Input
9	A0	Analog/GPIO	Analog input 0 /GPIO
10	A1	Analog/GPIO	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

6 Certifications

6.1 Declaration of Conformity CE DoC (EU)

We declare under our sole responsibility that the products above are in conformity with the essential requirements of the following EU Directives and therefore qualify for free movement within markets comprising the European Union (EU) and European Economic Area (EEA).

ROHS 2 Directive 2011/65/EU	
Conforms to:	EN50581:2012
Directive 2014/35/EU. (LVD)	
Conforms to:	EN 60950-1:2006/A11:2009/A1:2010/A12:2011/AC:2011
Directive 2004/40/EC & 2008/46/EC & 2013/35/EU, EMF	
Conforms to:	EN 62311:2008

6.2 Declaration of Conformity to EU RoHS & REACH 211 01/19/2021

Arduino boards are in compliance with RoHS 2 Directive 2011/65/EU of the European Parliament and RoHS 3 Directive 2015/863/EU of the Council of 4 June 2015 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

Substance	Maximum limit (ppm)
Lead (Pb)	1000
Cadmium (Cd)	100
Mercury (Hg)	1000
Hexavalent Chromium (Cr6+)	1000
Poly Brominated Biphenyls (PBB)	1000
Poly Brominated Diphenyl ethers (PBDE)	1000
Bis(2-Ethylhexyl} phthalate (DEHP)	1000
Benzyl butyl phthalate (BBP)	1000
Dibutyl phthalate (DBP)	1000
Diisobutyl phthalate (DIBP)	1000

Exemptions: No exemptions are claimed.

Arduino Boards are fully compliant with the related requirements of European Union Regulation (EC) 1907 /2006 concerning the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH). We declare none of the SVHCs (https://echa.europa.eu/web/guest/candidate-list-table), the Candidate List of Substances of Very High Concern for authorization currently released by ECHA, is present in all products (and also package) in quantities totaling in a concentration equal or above 0.1%. To the best of our knowledge, we also declare that our products do not contain any of the substances listed on the "Authorization List" (Annex XIV of the REACH regulations) and Substances of Very High Concern (SVHC) in any significant amounts as specified by the Annex XVII of Candidate list published by ECHA (European Chemical Agency) 1907 /2006/EC.

6.3 Conflict Minerals Declaration

As a global supplier of electronic and electrical components, Arduino is aware of our obligations with regards to laws and regulations regarding Conflict Minerals, specifically the Dodd-Frank Wall Street Reform and Consumer Protection Act, Section 1502. Arduino does not directly source or process conflict minerals such as Tin, Tantalum, Tungsten, or Gold. Conflict minerals are contained in our products in the form of solder, or as a component in metal alloys. As part of our reasonable due diligence Arduino has contacted component suppliers within our supply chain to verify their continued compliance with the regulations. Based on the information received thus far we declare that our products contain Conflict Minerals sourced from conflict-free areas.

7 FCC Caution

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference

(2) this device must accept any interference received, including interference that may cause undesired operation.

FCC RF Radiation Exposure Statement:

1. This Transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
2. This equipment complies with RF radiation exposure limits set forth for an uncontrolled environment.
3. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

English: User manuals for license-exempt radio apparatus shall contain the following or equivalent notice in a conspicuous location in the user manual or alternatively on the device or both. This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions:

(1) this device may not cause interference

(2) this device must accept any interference, including interference that may cause undesired operation of the device.

French: Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

(1) l' appareil nedoit pas produire de brouillage

(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

IC SAR Warning:

English This equipment should be installed and operated with minimum distance 20 cm between the radiator and your body.

French: Lors de l' installation et de l' exploitation de ce dispositif, la distance entre le radiateur et le corps est d 'au moins 20 cm.

Important: The operating temperature of the EUT can't exceed 85°C and shouldn't be lower than -40°C.

Hereby, Arduino S.r.l. declares that this product is in compliance with essential requirements and other relevant provisions of Directive 2014/53/EU. This product is allowed to be used in all EU member states.

8 Company Information

Company name	Arduino S.r.l
Company Address	Via Andrea Appiani 25 20900 MONZA Italy

9 Reference Documentation

Reference	Link
Arduino IDE (Desktop)	https://www.arduino.cc/en/Main/Software
Arduino IDE (Cloud)	https://create.arduino.cc/editor
Cloud IDE Getting Started	https://create.arduino.cc/projecthub/Arduino_Genuino/getting-started-with-arduino-web-editor-4b3e4a
Arduino Pro Website	https://www.arduino.cc/pro
Project Hub	https://create.arduino.cc/projecthub?by=part&part_id=11332&sort=trending
Library Reference	https://www.arduino.cc/reference/en/
Online Store	https://store.arduino.cc/

10 Revision History

Date	Revision	Changes
xx/06/2021	1	Datasheet release

Acknowledgement

It is indeed a matter of great pleasure and proud privilege in presenting this project on "Automatic Door Lock with Mask Detection". We would also like to express our deep regards and gratitude to the principal and the Examiner .

We would like to express our deep regards and gratitude to the assistant project guide- Prof.Rashmi Gokhale The completion of the project work is a milestone in student life and its execution is inevitable in the hands of guide. We are highly indebted the assistant project guide Prof.Kirti Salwani for her valuable technical guidance and knowledge to success our project with the fruitful outcome.

It is due to his enduring efforts, patience and enthusiasm, which has given a sense of direction and purposefulness to this project and ultimately made it a success. We would like to tender our sincere thanks the staff member for their co-operation. We would wish to thank the non-teaching staff and friends who have helped us all the time in one way or the other really it is highly impossible to repay the debt of all the people who have directly or indirectly helped us for performing the project.