

# DEUS EX

## Fabrication & Prototyping in the LearningLab

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# Plan

- i Introduction
- ii Implementation
- iii Demonstration
- iv Technical difficulties and Major choices / Shortcuts
- v Propose prototype
- vi Conclusion

We introduce for the first time

## Door External Unlocking System EXtra<sup>1</sup>

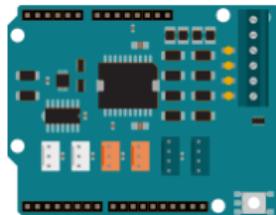
"Unlock the door in Learning Lab with the help of an authentication server"

- Lock position detection
- Motorized unlocking system
- Manual override mechanism
- Opening / closing

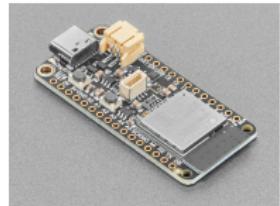
# Implementation I



(a) Arduino Uno R3 [1]



(b) Motor Shield R3 [1]



(c) esp32 Feather [2]



(d) Prusa i3 MK3S+ [4]



(e) NEMA17 [5]



(f) switch [6]

Figure – Technical components

# Implementation II

- Commanding over MQTT
- Publishing lock state
- Using a belt  $\Rightarrow$  need tension on the belt

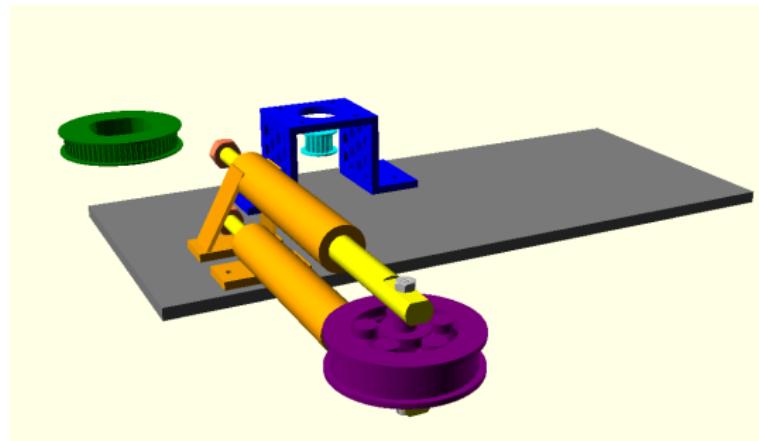
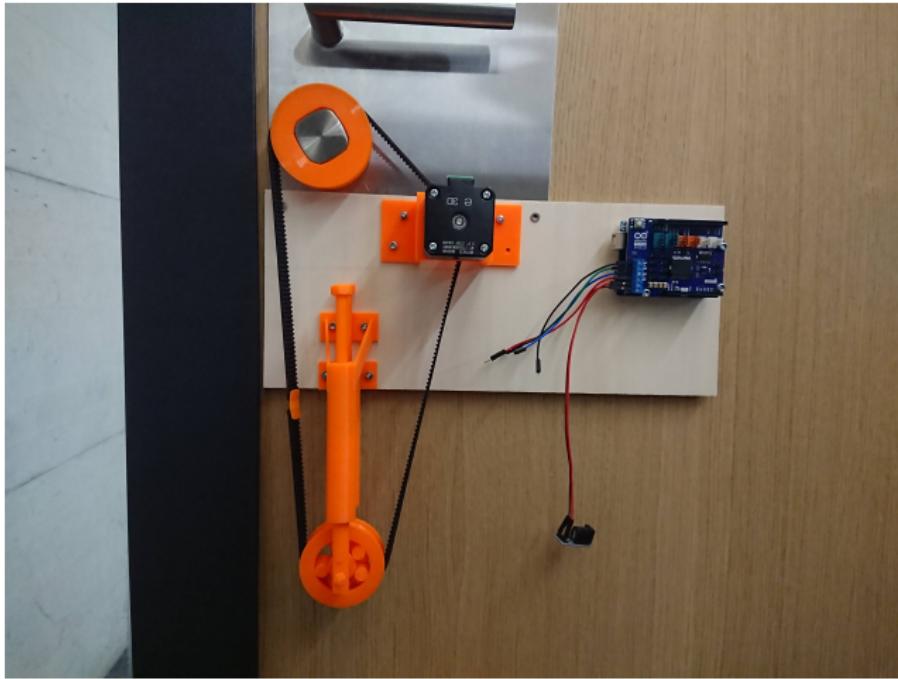


Figure – 3D printed pieces

# Demonstration



Delayed due to technical issue

## 3D Printing

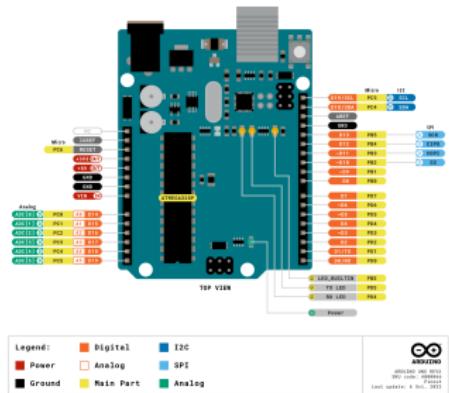
- How to measure (door knob, non-straight line)
- Strength (thickness, stress)
- Printing time
- Printer limits (minimum thickness, precision)

⇒ separate piece, focus only on some of them

## Other difficulties and shortcuts

- MQTT ⇒ Focus on mechanical part
- Power delivery ⇒ Not resolve

## Technical difficulties and Major choices / Shortcuts II



(a) Arduino UNO pinout R3 [1]

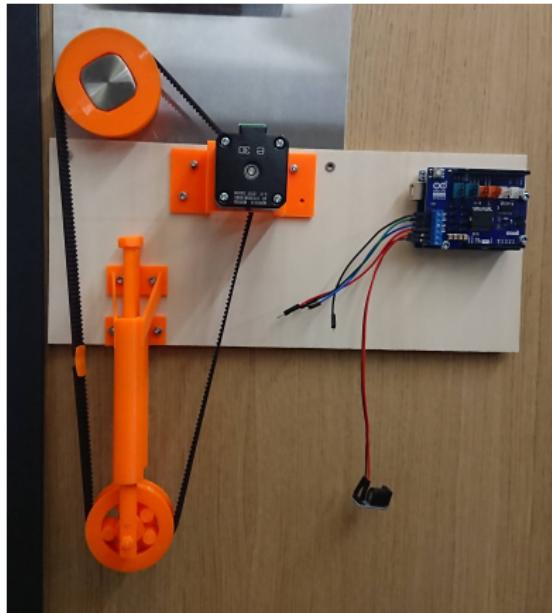
- + PWM
  - + Shield compatible
  - No WiFi module



(b) esp32 Feather pinout [2]

- + WiFi  
- No PWM

# Propose prototype



- ✓ Lock position detection
- ✓ Motorized unlocking system
- ✓ Manual override mechanism
- ✓ Opening / closing
  
- ✗ Strength
- ✗ MQTT connexion
- ✗ Portability (big, heavy, need 2 power source)
- ✗ Interaction between project

# Conclusion

We learned :

- (a) 3D Design & Printing
- (b) Motor & Switch  
programming
- (c) Arduino board (module  
available, voltage,  
difference)
- (d) Interaction between real  
world and IT



(a)



(b) [5]



(c) [1]



(d) [3]

# Sources I

- 🌐 Arduino official website, <https://www.arduino.cc/>, consulted the 20<sup>th</sup> December 2023
- 🌐 Adafruit official website, <https://learn.adafruit.com/>, consulted the 20<sup>th</sup> December 2023
- 🌐 Bing Chat, image generation,  
<https://www.bing.com/search?q=Bing+AI&showconv=1&FORM=hpcodx>,  
consulted the 20<sup>th</sup> December 2023
- 🌐 Prusa Research, Prusa i3 MK3S+, <https://www.prusa3d.com/>, consulted the 20<sup>th</sup> December 2023
- 🌐 GEMS Motor, NEMA stepper motor manufacturer,  
<https://gemsmotor.com/stepper-motor-manufacturer>, consulted the 20<sup>th</sup> December 2023
- 🌐 PLAY-ZONE.ch, <https://www.play-zone.ch/>, consulted the 20<sup>th</sup> December 2023

# Sources II

- 🌐 OpenSCAD, <https://openscad.org/>, consulted the 20<sup>th</sup> December 2023
- 🌐 Thingiverse, <https://www.thingiverse.com/>, consulted the 20<sup>th</sup> December 2023

# Demonstration

