

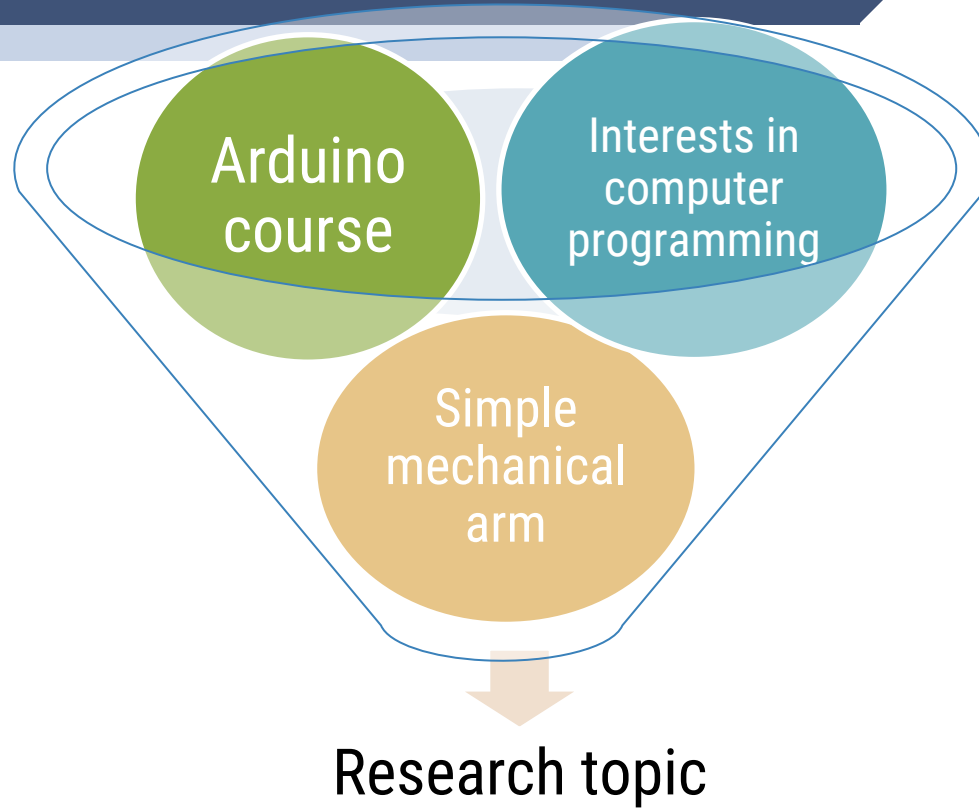
# Independent Study- Remotely controlled Excavator

**Researcher:** Hsu, Yu-Wei & Hsieh, Cheng-Che

**Adviser:** Ms. Chang, Mr. Wang



# Motivation





## Goal

### Create a mini excavator

Scoops and  
lifts

Can be  
remotely  
controlled

# Introduction of the project

Introduce excavator at each stage

# Introduction

Mechanical arm

First version

Second version

Third version  
(Excavator Research project)

Chengche

Chengche & Yowei

“ First version-  
Mechanical arm

# 🔍 1<sup>st</sup> Version – Mechanical Arm

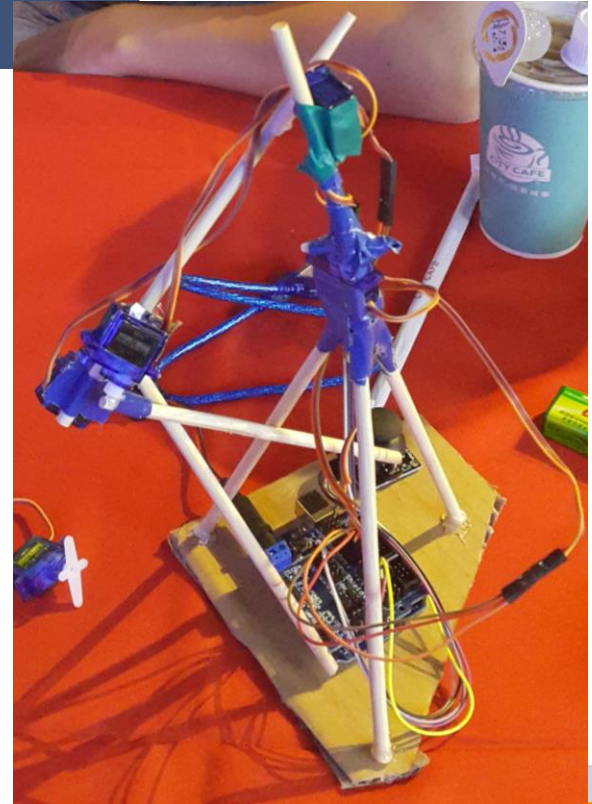
A simple version of mechanical arm

Hardware:

- Bamboo chopsticks
- Tape, hot glue
- Motors(sg90)
- Joystick

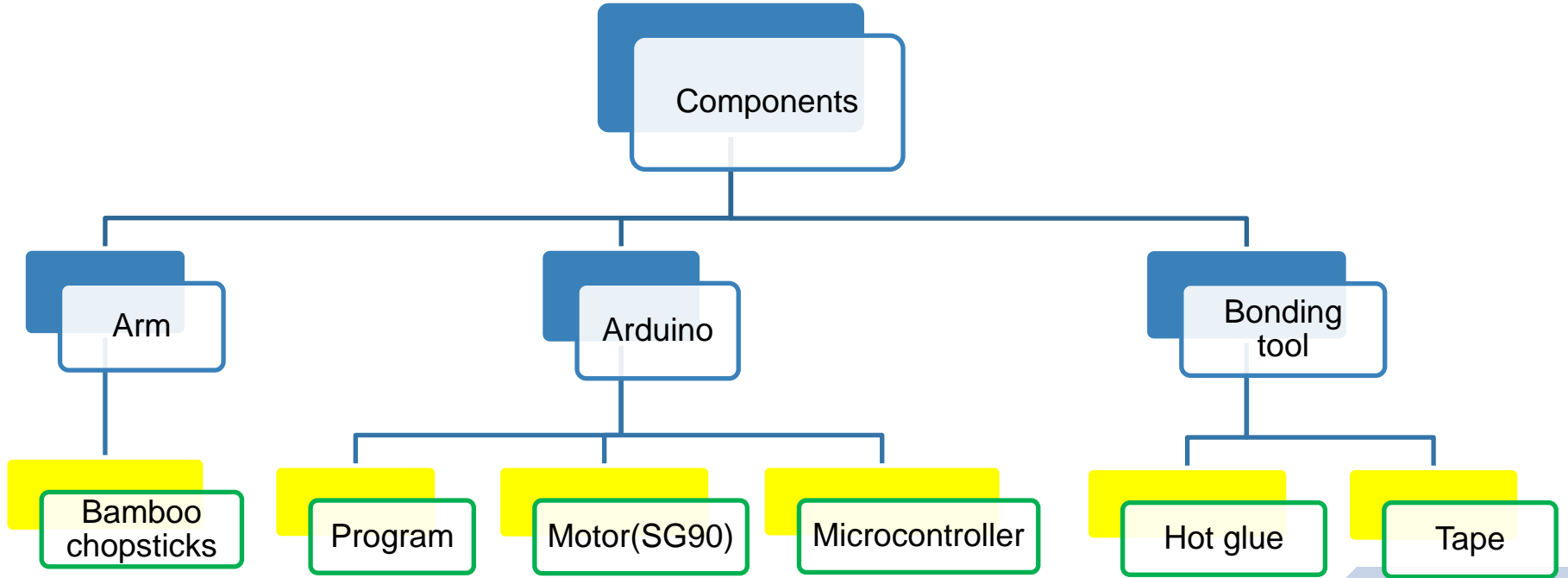
Software:

- Arduino IDE





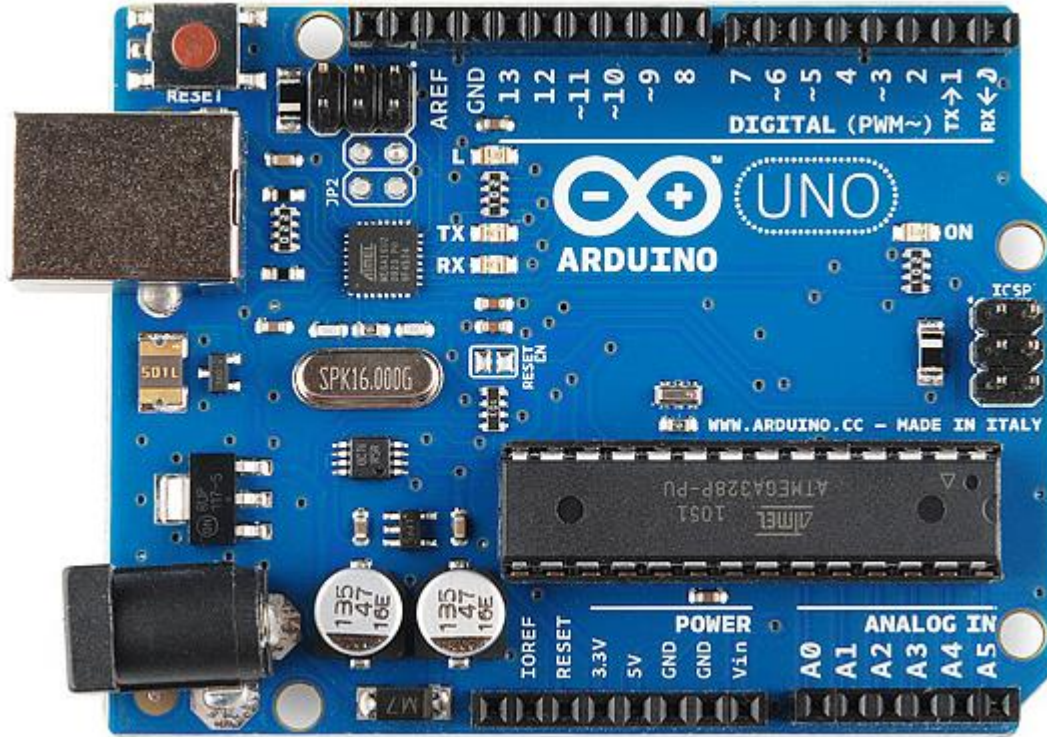
# Components







# Arduino board



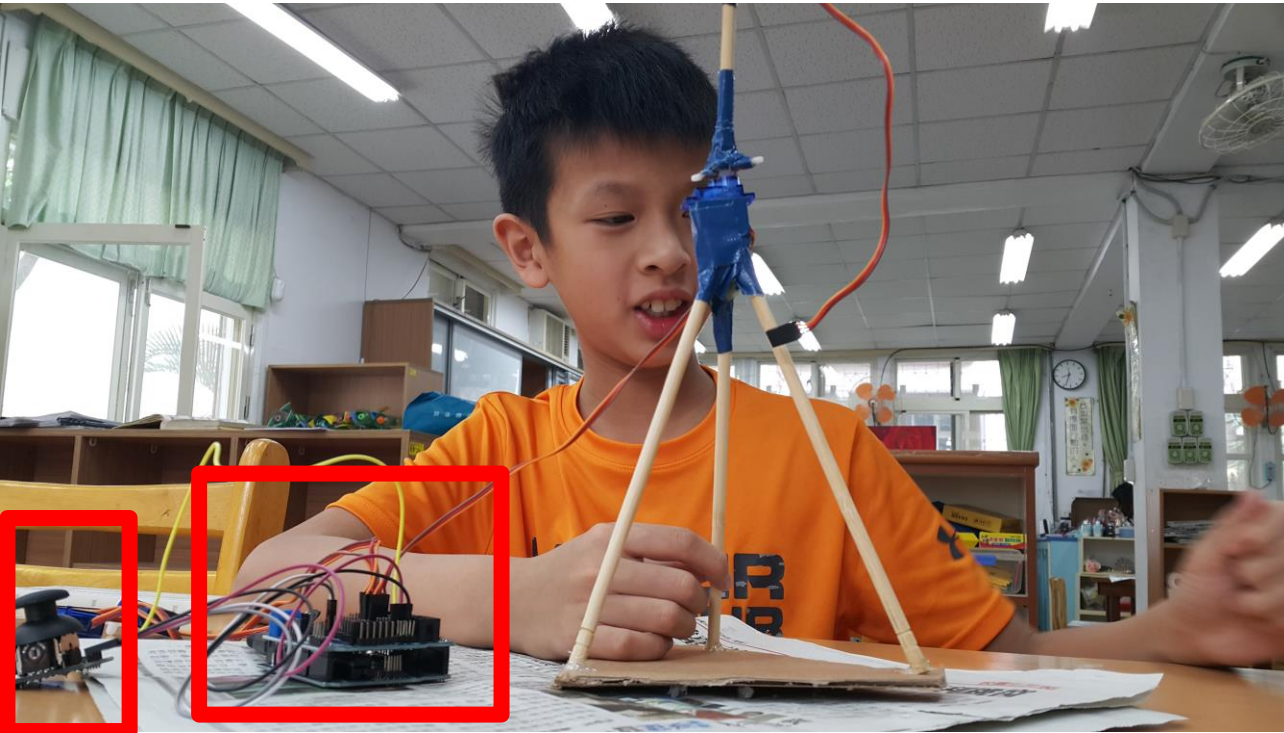
Arduino  
course in  
grade



Use Arduino to  
write programs



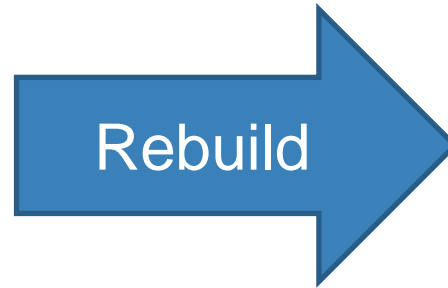
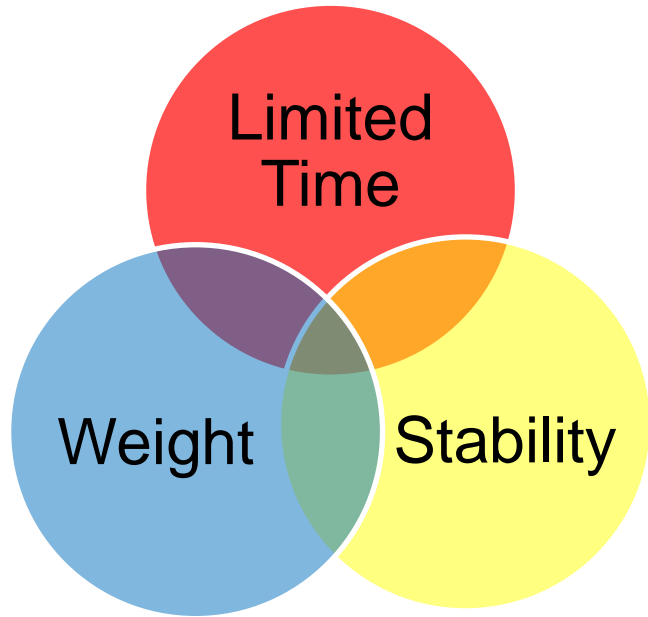
## Pictures of work



Connecting motors and joystick to the Arduino board.



# Problems



Second  
version

“ Second version-  
Mechanical arm



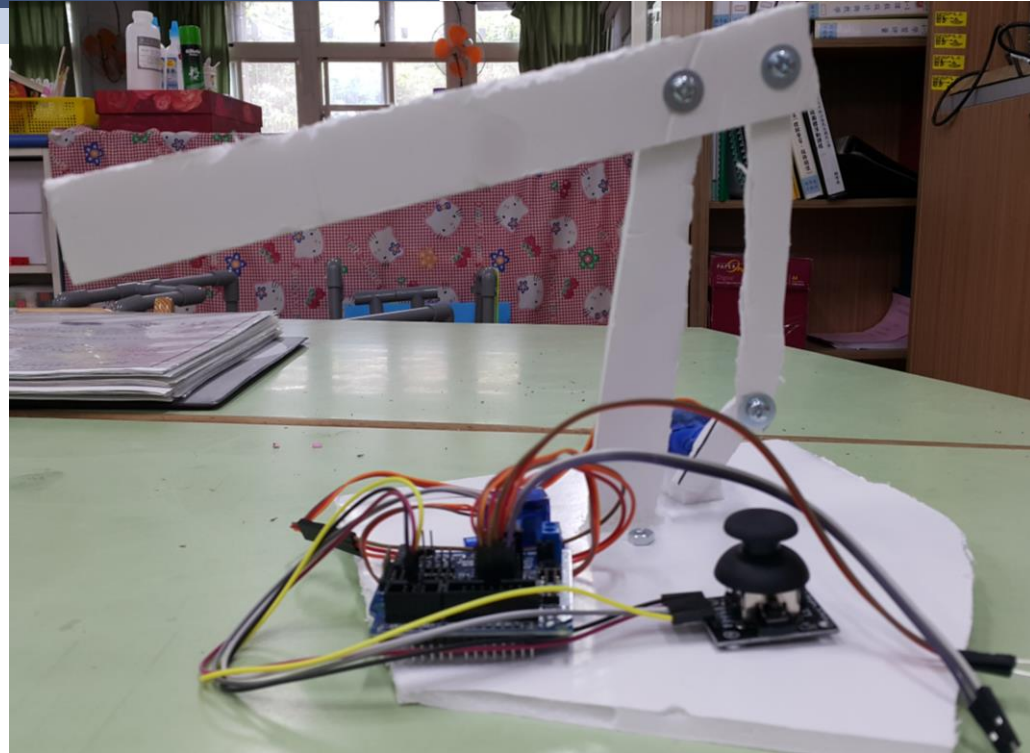
## 2<sup>nd</sup> Version – Mechanical Arm

### Hardware:

- Foam board
- Tape, hot melt adhesive
- Motors(sg90)
- Joystick
- Screws

### Software:

- Arduino IDE





## Idea of design

Changes made to the base:

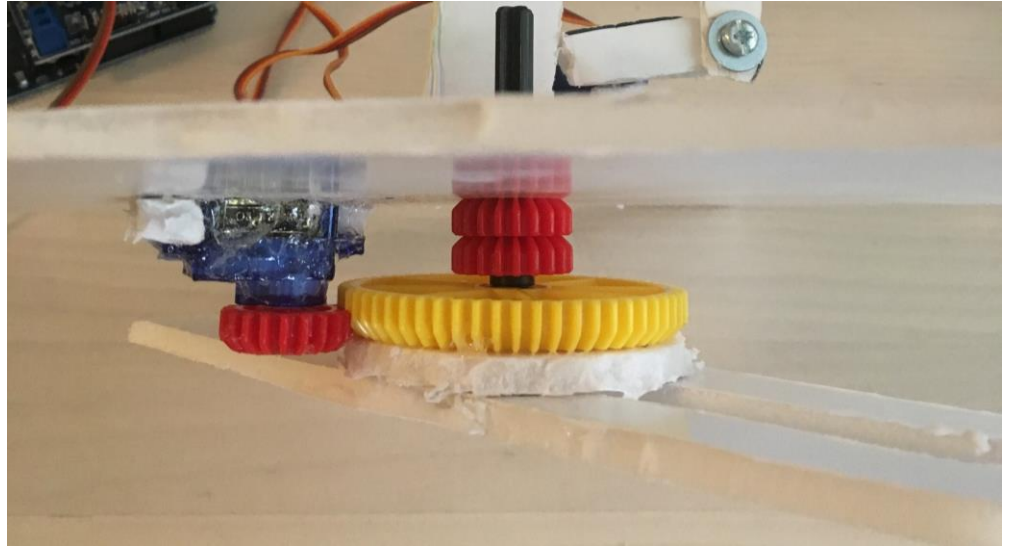
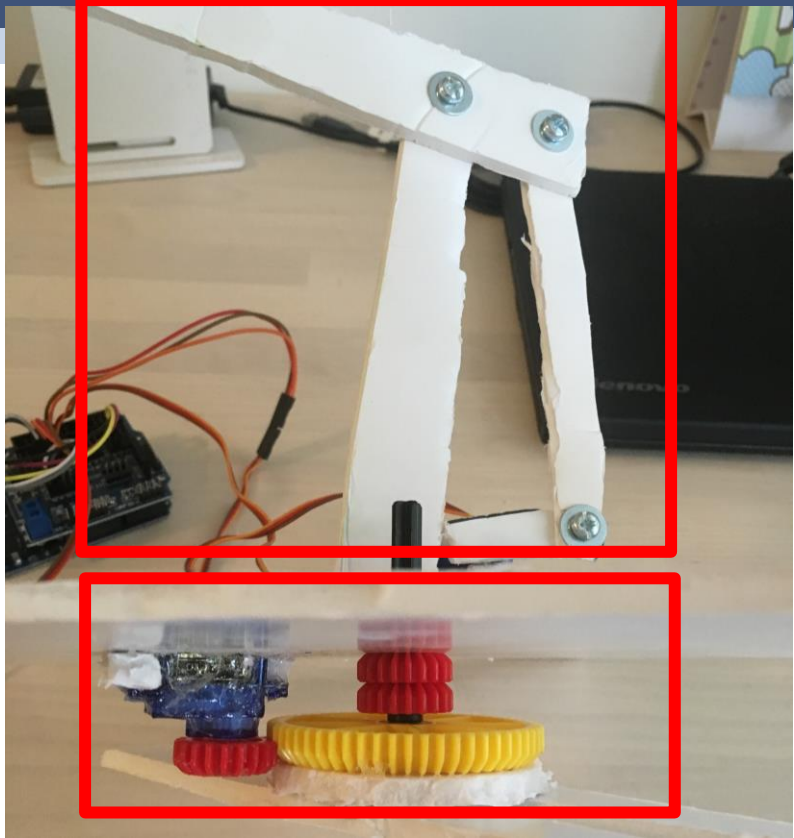
1. Use *three-bar linkage mechanism* to make the arm move
2. Add motors and gearwheels at the bottom



1. Reduce weight at the top of the structure
2. Make the base turn

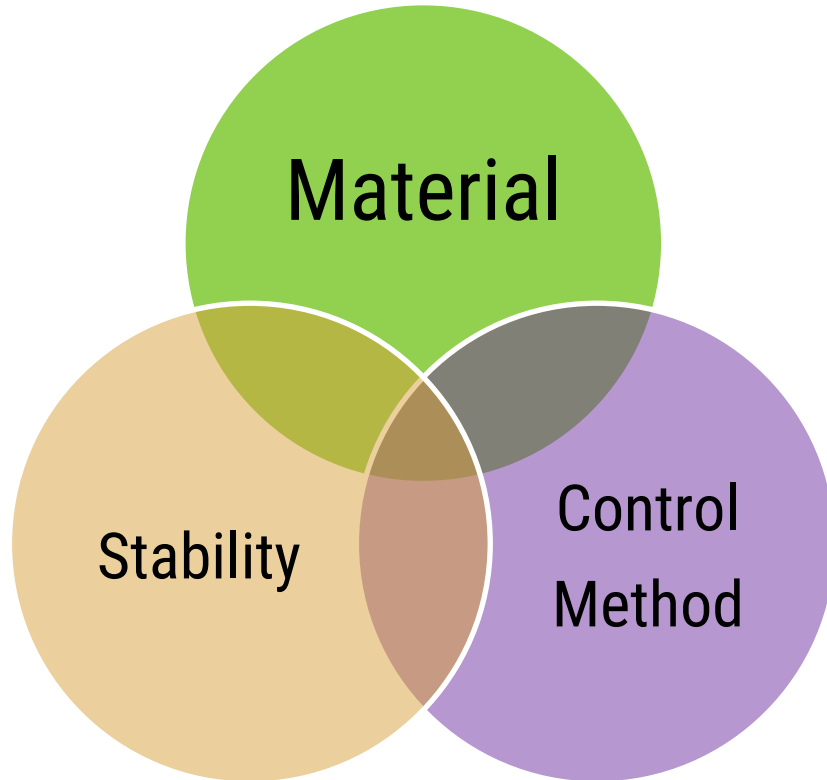


# Changes to the base





# Problems

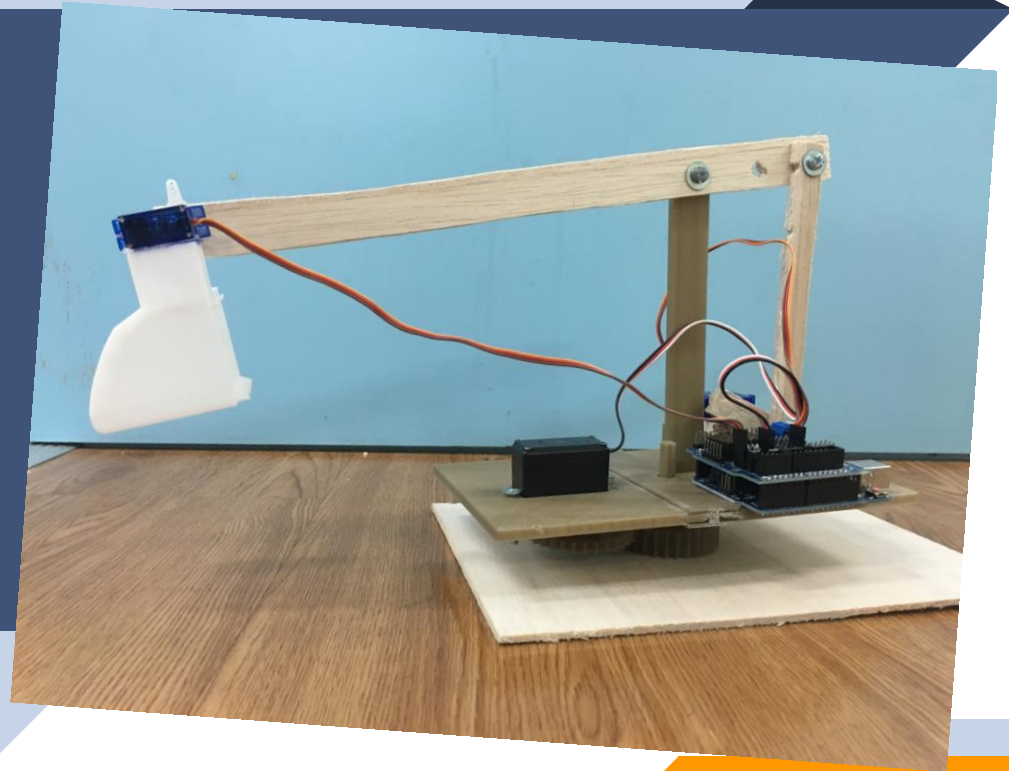


Third version



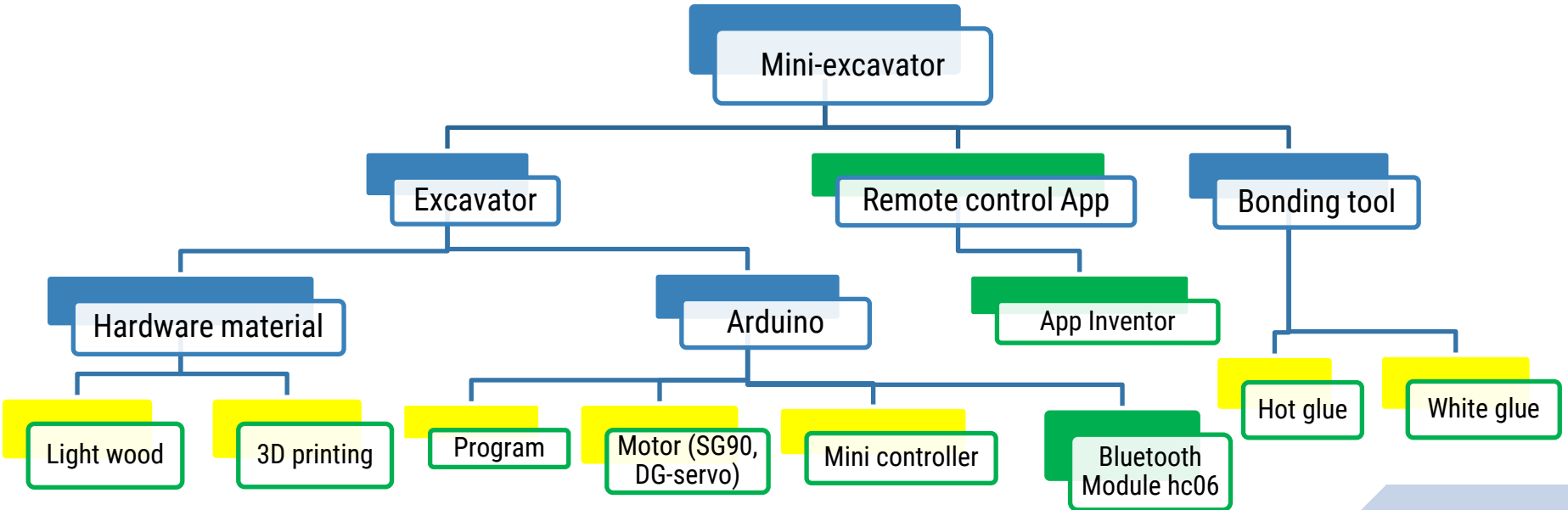
“

# Third version: Mini-excavator



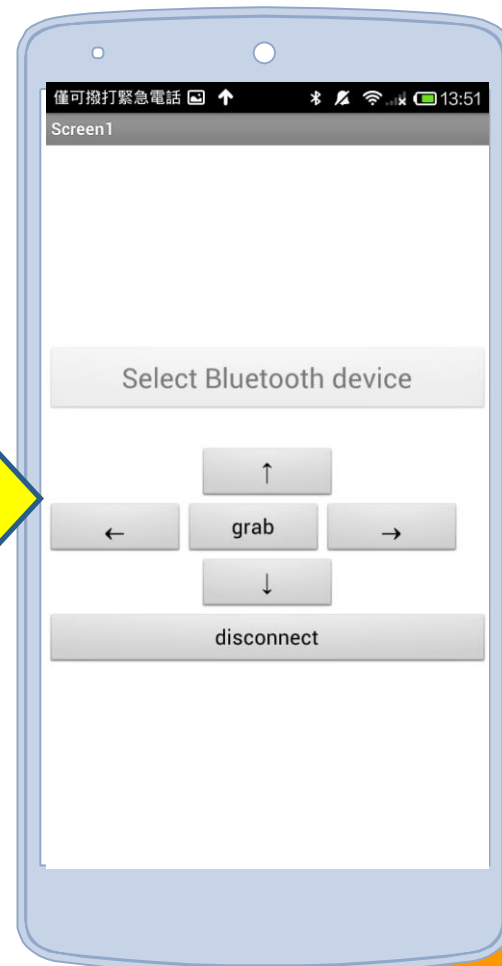
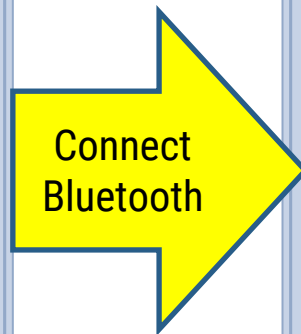
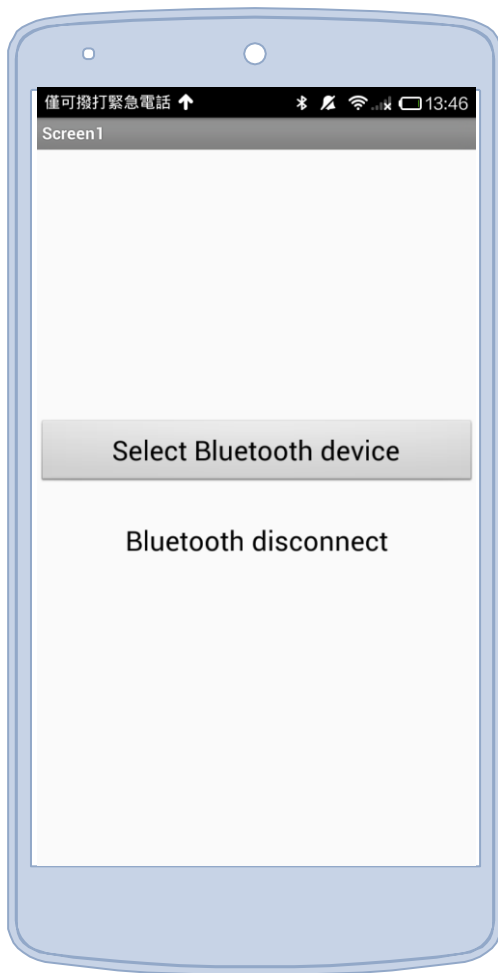


# 3rd Version Components





Use App Inventor to  
build an app to control  
the excavator.



**Blocks**

- Built-in
  - Control
  - Logic
  - Math
  - Text
  - Lists
  - Colors
  - Variables
  - Procedures
- Screen1
  - ListPicker1
  - Label2
  - Button1
  - HorizontalArranger1
    - Button2
    - Label1
    - Button8

Rename Delete

**Media**

Upload File ...

**Viewer**

```
when ListPicker1 .AfterPicking
do
  if
    call BluetoothClient1 .Connect
      address ListPicker1 . Selection
    then
      set Button1 . Visible to true
      set Button2 . Visible to true
      set HorizontalArrangement1 . Visible to true
      set Button8 . Visible to true
      set Label1 . Visible to false
      set ListPicker1 . Enabled to false

when ListPicker1 .BeforePicking
do
  set ListPicker1 . Elements to BluetoothClient1 . AddressesAndNames

when Button8 .Click
do
  call BluetoothClient1 .Disconnect
  set Button1 . Visible to false
  set Button2 . Visible to false
  set HorizontalArrangement1 . Visible to false
  set Button8 . Visible to false
  set Label1 . Visible to true
  set ListPicker1 . Enabled to true

initialize global button1Press to 0
initialize global button2Press to 0
initialize global button3Press to 0
initialize global button4Press to 0

when Button1 .TouchDown
do
  set global button1Press to 1

when Button2 .TouchUp
do
  set global button2Press to 0

when Button2 .TouchDown
do
  set global button2Press to 1

when Button3 .TouchUp
do
  set global button2Press to 0

when Button3 .TouchDown
do
  set global button2Press to 1

when Button4 .TouchUp
do
  set global button2Press to 0

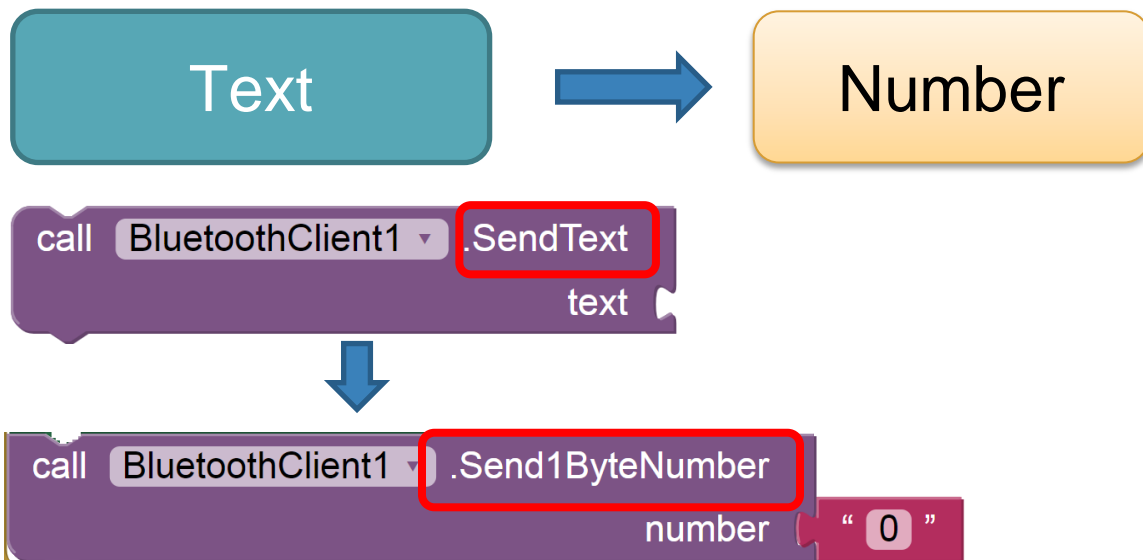
when Button4 .TouchDown
do
  set global button2Press to 1

when Button5 .Click
do
  if
    Button5 . Text = grab
  then
    set Button5 . Text to open
    call BluetoothClient1 .SendByteNumber
      number 5
  if
    Button5 . Text = open
```



# Difficulties with App Inventor

Debugging example:

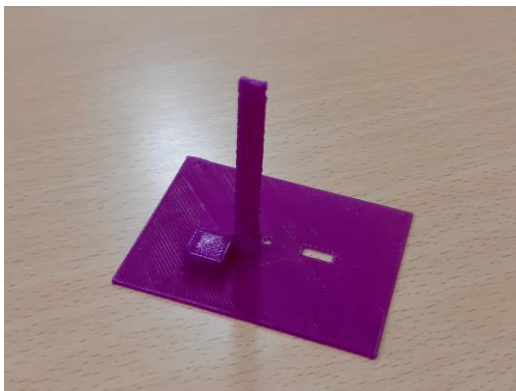




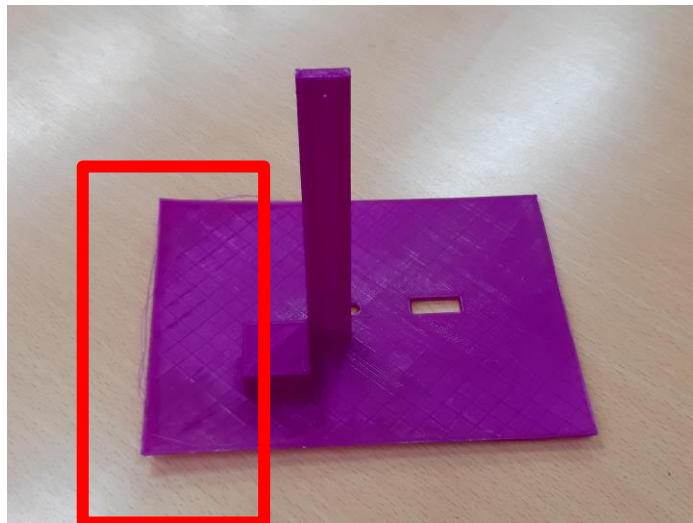
# Problems- 3D printing

Sizing problem  
Curved base

0.3 times



0.7 times



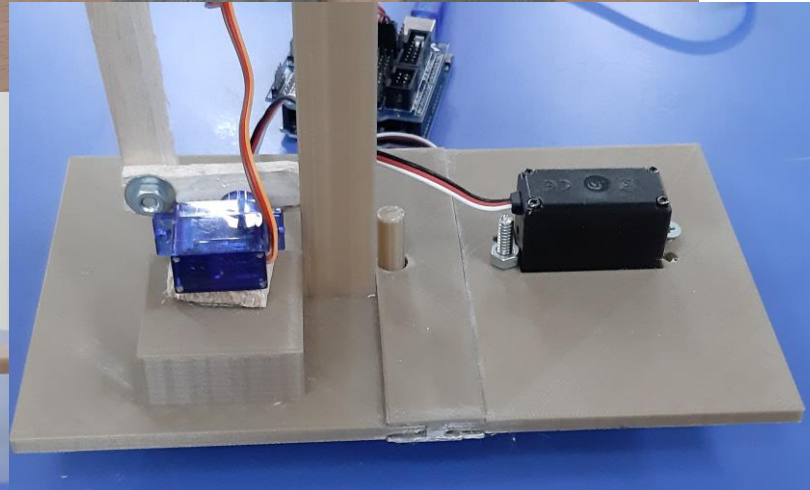
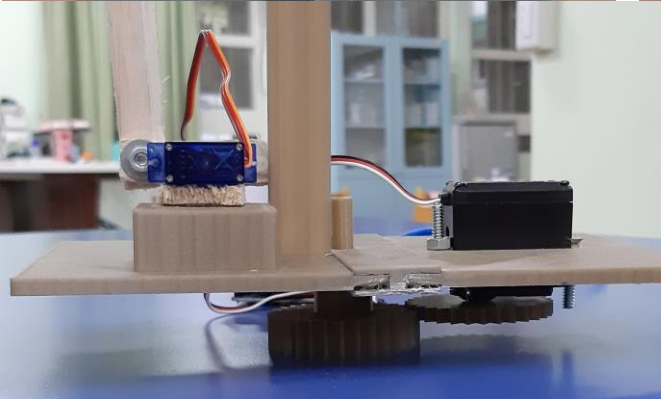


# Problems- 3D printing

**Uneven board**



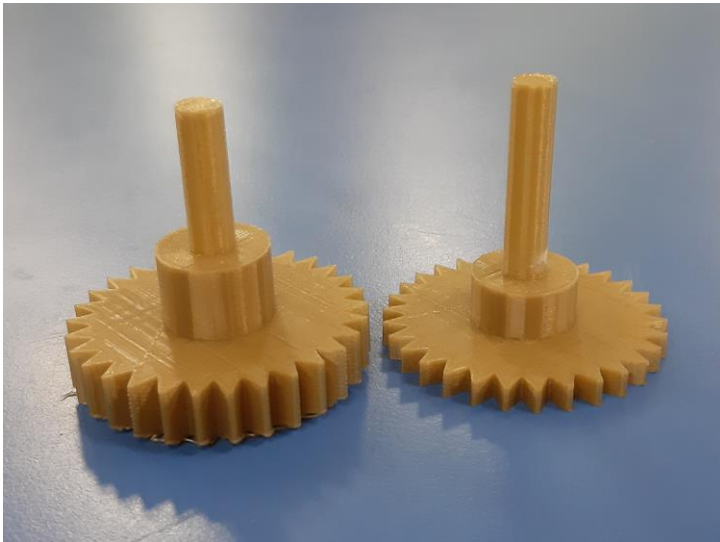
Repair 3D printing machine



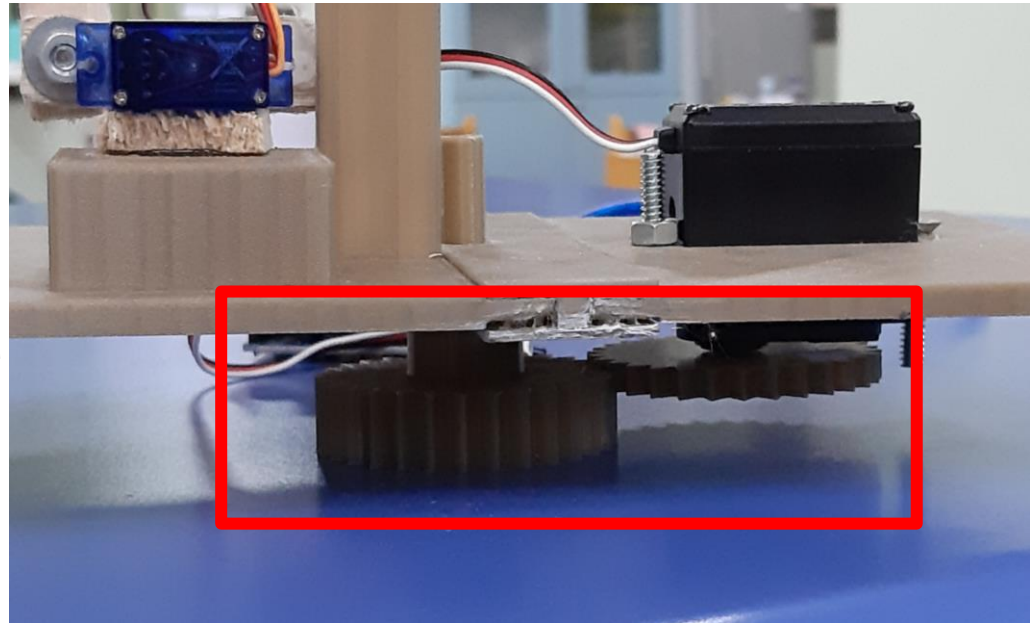


# Problems- 3D printing

## Printing the gear wheels



Resize

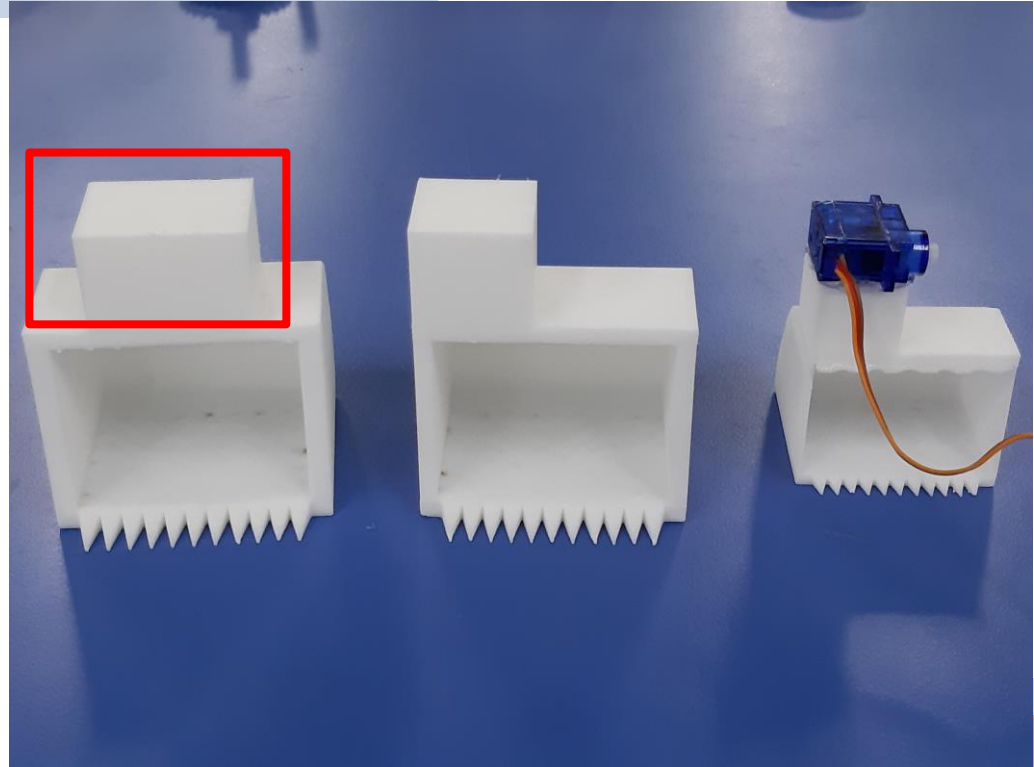






## Problems- 3D printing

3 different models





# Change of Motor

## Motor



The motor can't turn because of the weight.





## Problems- Arduino

Bluetooth module  
can't be powered

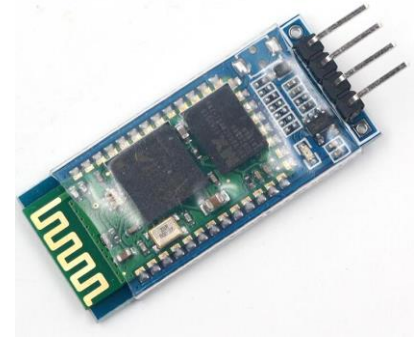


Change  
a bluetooth  
module

Unable to connect

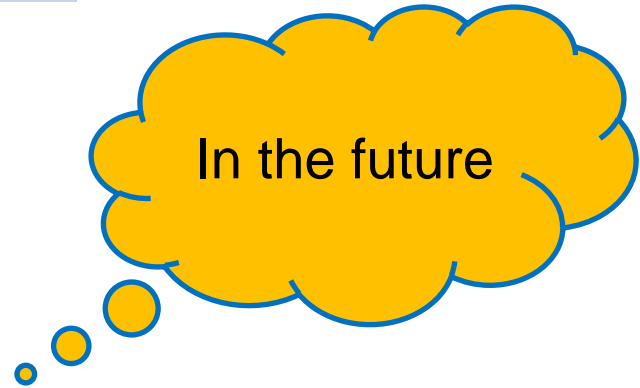
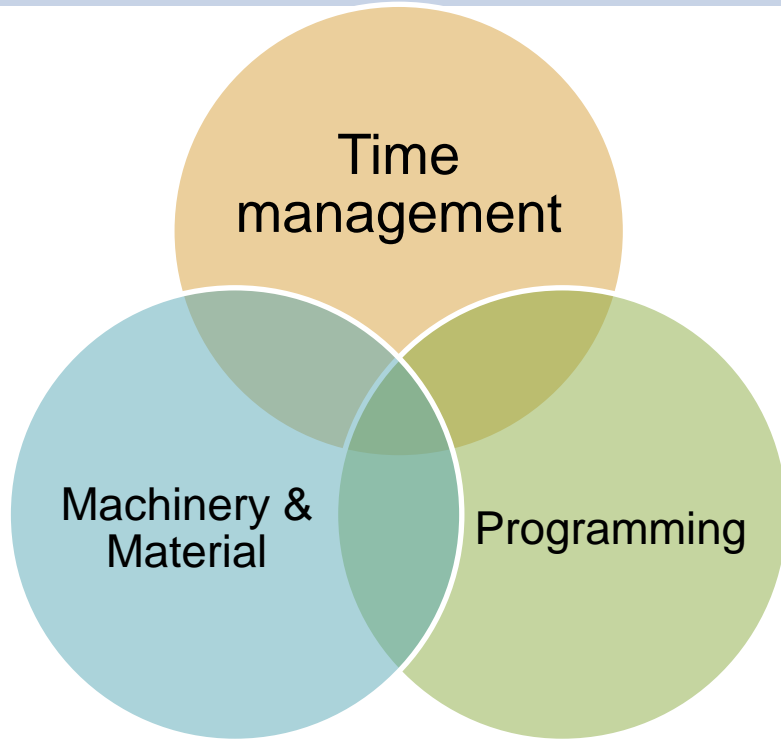


Change  
a phone





# Experience and Suggestion





Thanks!