PROJECT TWO: MILESTONE 3 – COVER PAGE

Team Number: Thurs-23

Please list full names and MacID's of all *present* Team Members

Full Name:	MacID:
Emilie Alain	alaine1
Ziyang Qin	qinz36
Vaisnavi Shanthamoorthy	shanthav
Arthes Matheeswaran	matheesa

MILESTONE 3 (STAGE 1) – PRELIMINARY SOLID MODEL (MODELLING SUB-TEAM)

Team Number: Thurs-23

You should have already completed this task individually prior to Design Studio 9.

1. Copy-and-paste each team member's screenshots of their preliminary solid model on the following pages (1 team member per page)
   → Be sure to clearly indicate who each model belongs to

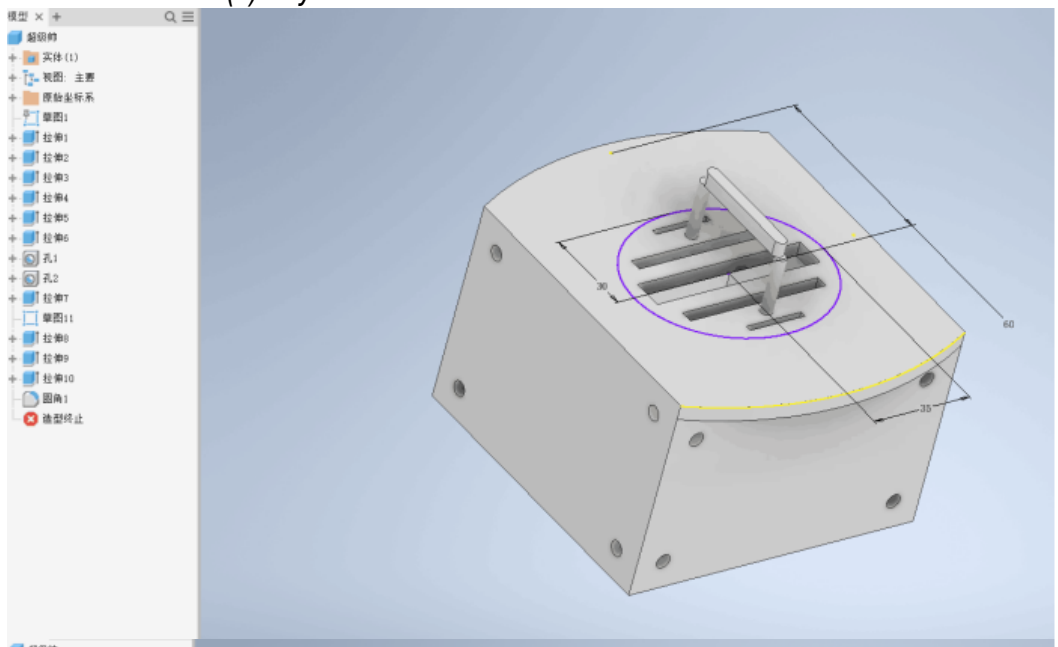
We are asking that you submit your work on both worksheets. It does seem redundant, but there are valid reasons for this:

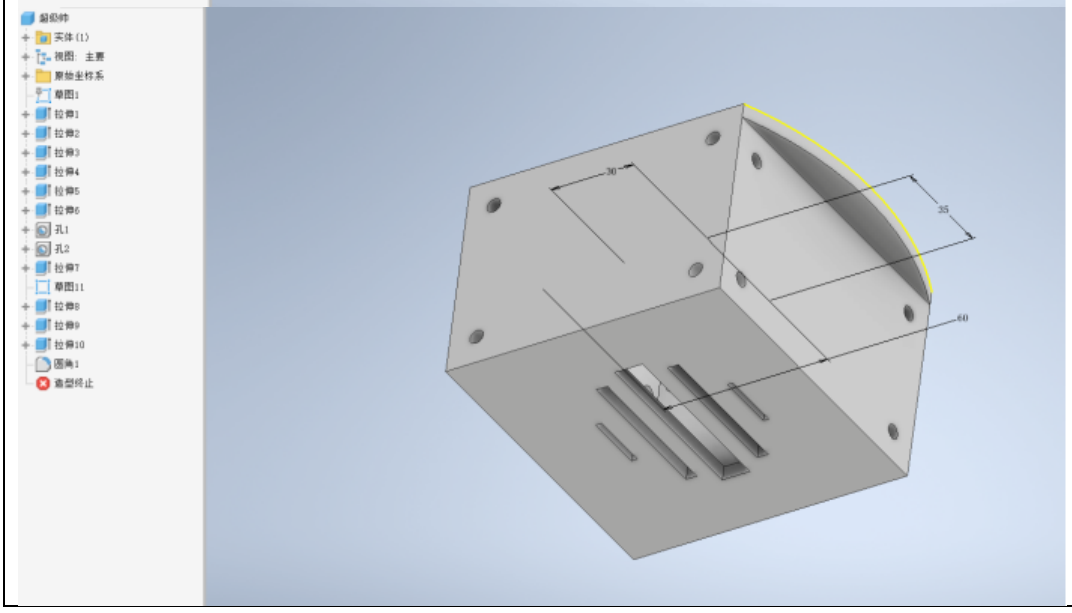
- Each team member needs to submit their solid model screenshots with the **Milestone Three Individual Worksheets** document so that it can be ***graded***
- Compiling your individual work into this **Milestone Three Team Worksheets** document allows you to readily access your team member's work
  - This will be especially helpful when completing ***Stage 3*** of the milestone

Team Number: Thurs-23

Name: Ziyang Qin	MacID: Qinz36

Insert screenshot(s) of your model below

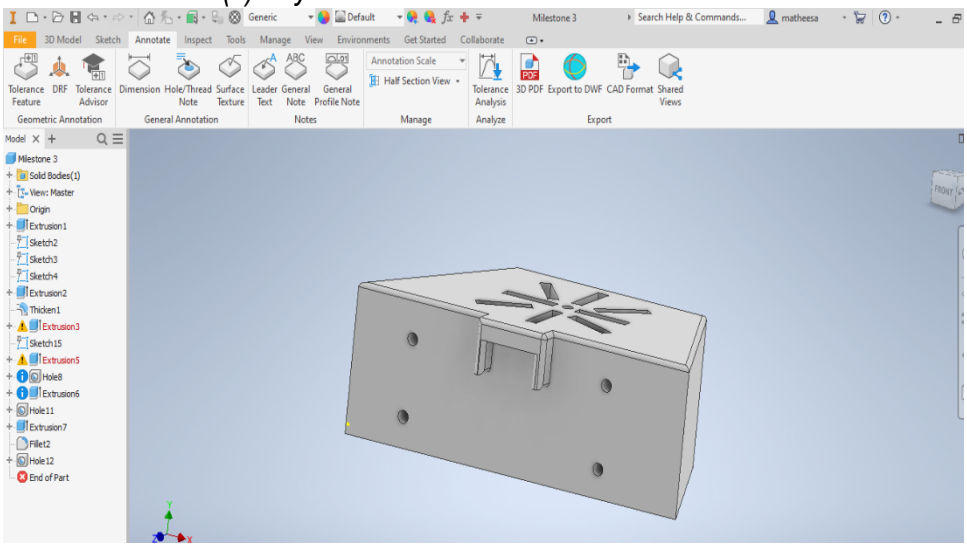


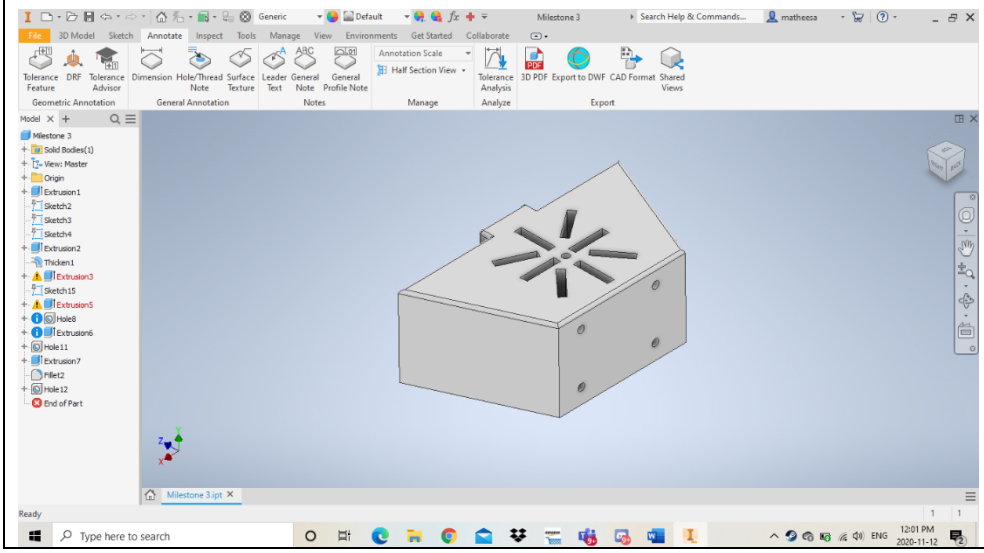


Team Number: Thurs-23

Name: Arthes Matheeswaran	MacID: matheesa

Insert screenshot(s) of your model below





*If you are in a sub-team of 3, please copy and paste the above on a new page

MILESTONE 3 (STAGE 2) – PRELIMINARY PROGRAM TASKS (COMPUTATION SUB-TEAM)

Team Number: Thurs-23

You should have already completed this task individually prior to Design Studio 9.

1. Copy-and-paste each team member's code screenshots on the following pages (1 team member per page)
   → Be sure to clearly indicate who each code belongs to

We are asking that you submit your work on both worksheets. It does seem redundant, but there are valid reasons for this:

- Each team member needs to submit their code screenshots with the **Milestone Three Individual Worksheets** document so that it can be ***graded***
- Compiling your individual work into this **Milestone Three Team Worksheets** document allows you to readily access your team member's work
  - This will be especially helpful when completing ***Stage 4*** of the milestone

Team Number: Thurs-23

Name: Emilie Alain	MacID: alaine1

```
## ------------------------------------------------------------------------------------------
## TEMPLATE
## Please DO NOT change the naming convention within this template. Some changes may
## lead to your program not functioning as intended.

import sys
sys.path.append('../')

from Common_Libraries.p2_lib import *

import os
from Common_Libraries.repeating_timer_lib import repeating_timer

def update_sim ():
    try:
        arm.ping()
    except Exception as error_update_sim:
        print (error_update_sim)

arm = qarm()

update_thread = repeating_timer(2, update_sim)


## STUDENT CODE BEGINS
## ------------------------------------------------------------------------------------------
## Example to rotate the base: arm.rotateBase(90)
arm.home()
time.sleep(2)
01 = [-0.6321, 0.2301, 0.4261]
02 = [-0.6321, 0.2301, 0.4261]
03 = [0.0, 0.6726, 0.4261]
04 = [-0.3752, 0.1366, 0.3095]
05 = [0.0, -0.3993, 0.3095]
06 = [0.0, 0.3993, 0.3095]
'''
```

```
'''
Blue box - small
>>> arm.rotate_base(90)
>>> arm.rotate_elbow(-60)
>>> arm.rotate_shoudler(50)
>>> arm.effector_position()
(0.0, 0.6726, 0.4261)
'''
'''
Blue box - large
>>> arm.rotate_base(90)
>>> arm.rotate_shoulder(5)
>>> arm.rotate_elbow(20)
>>> arm.effector_position()
(0.0, 0.3993, 0.3095)
'''

'''
Green box - small
>>> arm.rotate_base(-90)
>>> arm.rotate_elbow(-60)
>>> arm.rotate_shoulder(50)
>>> arm.effector_position()
(0.0, -0.6726, 0.4261)
'''

'''
Green box - large
>>> arm.rotate_base(-90)
>>> arm.rotate_shoulder(5)
>>> arm.rotate_elbow(20)
>>> arm.effector_position()
(0.0, -0.3993, 0.3095)
'''
```

```
'''
Red box - small
>>> arm.rotate_base(160)
>>> arm.rotate_elbow(-60)
>>> arm.rotate_shoulder(50)
>>> arm.effector_position()
(-0.6321, 0.2301, 0.4261)
'''

'''
Red box - large
>>> arm.rotate_base(160)
>>> arm.rotate_shoulder(5)
>>> arm.rotate_elbow(20)
>>> arm.effector_position()
(-0.3752, 0.1366, 0.3095)
'''
```

Team Number: Thurs-23

Name: Vaisnavi Shanthamoorthy	MacID shanthav

Insert a screenshot of your code below
First Screenshot down of code below:

File Edit Format Run Options Window Help

```
## ------------------------------------------------------------------------------------------------------------
#Name:Vaisnavi Shanthamoorthy
#macID: shanthav
#Student Number: 400319038
#Program Task: Move End Effector Function
## TEMPLATE
## Please DO NOT change the naming convention within this template. Some changes may
## lead to your program not functioning as intended.

import sys
sys.path.append('../')

from Common_Libraries.p2_lib import *

import os
from Common_Libraries.repeating_timer_lib import repeating_timer

def update_sim ():
    try:
        arm.ping()
    except Exception as error_update_sim:
        print (error_update_sim)

arm = qarm()

update_thread = repeating_timer(2, update_sim)
```

*If you are in a sub-team of 3, please copy and paste the above on a new page

Name: Vaisnavi Shanthamoorthy	MacID shanthav

Insert a screenshot of your code below
Second Screenshot of code down below:

```
## STUDENT CODE BEGINS: MOVE END EFFECTOR
## ----------------------------------------------------------------------------------------------------

from MuscleGUILib import* #import muscle sensor emulator
emg = EMGSim()

thres = 0.3 #set a threshold

#Input the xyz and abc coordinates for the respective pickup and dropoff locations
x = (float(input("Please enter the x-coordinate point for the pickup location: ")
y = (float(input("Please enter the y-coordinate point for the pickup location: ")
z = (float(input("Please enter the z-coordinate point for the pickup location: ")
a = (float(input("Please enter the a-coordinate point for the dropoff location: ")
b = (float(input("Please enter the b-coordinate point for the dropoff location: ")
c = (float(input("Please enter the c-coordinate point for the dropoff location: ")

pickup_location = [x,y,z] #store the entered values of x,y,z for the pickup location coordinates in a list
dropoff_location = [a,b,c] #store the entered values of a,b,c for the dropoff location coordinates in a list


def move_end_effector(pickup_loc,dropoff_loc):

    if arm.emg_left < thres:
        arm.control_gripper(-45) #open up the gripper fully

    if arm.emg_right >= thres:
        time.sleep(2)
        arm.move_arm (pickup_loc[0],pickup_loc[1],pickup_loc[2]) #move to the pick-up location based on the coordinates entered
        time.sleep(2)
        if arm.emg_left >= thres:
            arm.control_gripper(45) #close the gripper so that the container is secure
        time.sleep(2)
        arm.move_arm(0.4064,0.0,0.4826) #return to home base before going to the dropoff location
        time.sleep(2)
        arm.move_arm (dropoff_loc[0],dropoff_loc[1],dropoff_loc[2]) #move to the dropoff location based on the coordinates entered
        time.sleep(2)


move_end_effector(pickup_location,dropoff_location)
```

MILESTONE 3 (STAGE 3) – PUGH MATRIX (MODELLING SUB-TEAM)

Team Number: Thurs-23

1. As a team, evaluate your designs for the sterilization container in the table below
   → List your Criteria in the first column
      - You should include a minimum of 5 criteria
   → Fill out the table below, comparing your designs against the given baseline
      - Replace "Design A" and "Design B" with more descriptive labels (e.g., a distinguishing feature or the name of the student author)
      - Assign the datum as the baseline for comparison
      - Indicate a "+" if a concept is better than the baseline, a "–" if a concept is worse, or a "S" if a concept is the same

	Datum	**Ziyang**	**Arthes**
Stiffness	s	+	+
Gas permeability	s	-	s
Mass of design cannot exceed 350g	s	s	s
Allow for picking up	s	+	s
Small	s	+	+
Allow for sterilization	s	s	-
Portable	s	s	s
Total +	0	3	2
Total –	0	1	1
Total Score	0	2	1

*For a team of 3, click the top-right corner of the table to "Add a New Column"

2. Propose one or more suggested design refinements moving forward

(1) Try to add more thickness to the bottom of our container so tools will not go through the container and can be placed properly
(2) Add drawers within the container so tools can be placed in neatly and safely, i.e. not cluttered.

MILESTONE 3 (STAGE 4A) – CODE PEER-REVIEW (COMPUTATION SUB-TEAM)

Team Number: Thurs-23

Document any errors and/or observations for each team member's preliminary Python program in the space below

Identify Autoclave Bin Location Task	**Team Member Name**: Emilie Alain

1. One of the errors present in this code is that it only states the drop off locations, not the pickup location. The pickup location is a vital aspect as it is where the container is being picked up so to fix this, we would need to identify the pickup location as well.
2. A function was not explicitly defined, perhaps we could include one line in this code to be "def identify_autoclave_bin_loc ():" With this, it is more clear to anyone who reads the code, as to what task the code it is trying to achieve.
3. An assumption was made as to how far the drawer opens. This could potentially lead to error in the future as the position of the Q-arm may be too close or too far to correctly place the container in its respective correct location.
4. Variables were set to identify the proper location of each bin based on size and colour
5. Location was found by 'guessing', this could lead to error when dropping the container into the drawer (ie. Making sure the gripper is not too close to the bin that the container won't fit in it. Etc.) or when dropping the container on top of the bin, to ensure that the gripper is in the center of the box

Move End-Effector Task	**Team Member Name**: Vaisnavi Shanthamoorthy

1. The user was asked for input to determine the (x,y,z) and (a,b,c) coordinate positions for both the pickup and drop-off locations, and those values were then stored in a list. This ultimately aided in not having to repeat the position numerous times, it reduced a lot of repeated steps having to be made.
2. A threshold was set so that the muscle sensor emulator could be used to move the robotic arm to the specific coordinates pick-up and drop-off locations. In addition, the threshold is used to open and close the gripper fully. The use of the muscle sensor emulators seems to have been used accordingly as certain functions/tasks such as going to the pickup/drop-off location are being met when the certain threshold is passed or not.
3. An error present in the code for this function is the movement of the Q-arm back to home base after picking up the container and before heading to the drop-off location. With it there, no objective is being met so it is unnecessary for it to remain in the code and should be taken out.
4. time.sleep (2) was used numerous times to allow the Q-arm to understand and execute the code properly without being overwhelmed. However, perhaps, time.sleep(5) could

have been used instead to give the Q-arm more than two seconds to rest before proceeding to the next task.

MILESTONE 3 (STAGE 4B) – PROGRAM TASK PSEUDOCODE (COMPUTATION SUB-TEAM)

Team Number: Thurs-23

As a team, write out the pseudocode for each of the *remaining* tasks in your computer program in the space below.

Control Gripper

1. Gripper end-effector is positioned at the pick-up platform
2. Gripper opens up to position itself around the container
3. Gripper closes and picks up the container
4. Once Q-arm moves to the correct autoclave bin location (depending on it's colour and size), gripper opens up to release container into the correct location
    a. for the small red bin, the gripper releases and places the container at XrYrZr
    b. for the large red bin, once the drawer opens, the gripper releases and places the container at XRYRZR
    c. for the small green bin the gripper releases and places the container at XgYgZg
    d. for the large green bin, once the drawer opens, the gripper releases and places the container at XGYGZG
    e. for the small blue bin, the gripper releases and places at XbYbZb
    f. for the large blue bin, once the drawer opens, the gripper releases and places the container at XBYBZB

Open Autoclave Bin Drawer

1. If gripper closes a certain amount to grab the container (if it closes a small amount) we know the drawer must open.
2. If the colour of the container is red – open the red drawer
3. If the colour of the container is green – open the green drawer
4. If the colour of the container is blue – open the blue drawer
5. Return home

Continue or Terminate

1. Once the six containers have been successfully been placed in the correct autoclave bins, the system should terminate. If there are more containers, the system should continue until all bins have been successfully placed in their respective correct autoclave bin.