
GNG2101 Group 1.4

Phone Bed Mount User Manual

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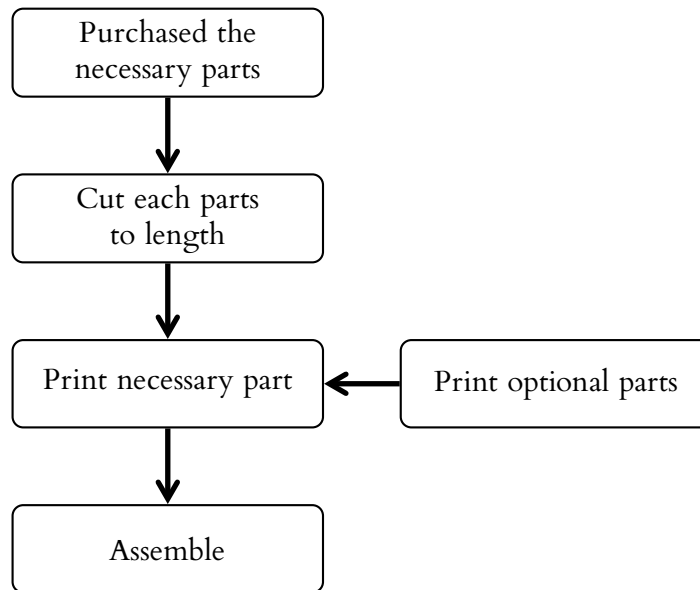
Abstract

This user manual is for a project completed under the course
GNG2101 lab from Uottawa.

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Assembly Workflow



I Introduction

This project aims to create a product to assist disabled individuals in using their phones in beds. Some assumptions were made during the initial phase of the design process, which included the following: the client has little to no mobility in both of her arms and can only her nose to navigate the phone; the clamps can only attach to the right bed railing or the headboard/railing under the headboard.

This user manual contains all the essential information needed to recreate the product — a phone bed mount. The document includes an overview regarding the purpose, scope, motive, and goal of the project; conventions, cautions, and warnings; step-to-step assemble, set-up, execution, and exit procedures; several plausible issues and solutions; and last but not least, related documentations that was recorded as what to expect regarding the production materials as well some recommendations for future work.

The intended audience of this document includes the users, project managers, and future GNG2101 students so that they can take away and understand what our group has designed in the last couple of months. This document will be open to the public on MakerRepo for all future students to see.

2 Overview

In this project, the main issue was that the client has no control over her left arm and very little control over her right arm. Because of the lack of mobility in her arms, her nose will be the primary tool for her to navigate her phone.

Note that she has no tools to hold her phone in front of her while she lies on her left side in bed. Additionally, her left arm could spasm at night, so the phone bed mount cannot be on that side of the bed. She also refuses to use the standard gooseneck phone holders because of the instability of the previous phone mount while being non-durable at the same time. This product is essential because it can attach to the railing under the headboard, which is considerably more stable. Since the side railings are designed to be easily adjusted, they wobble intensely when the client uses the phone mount. It is also made out of PVC pipes instead of the commonly used material, gooseneck, for phone mounts on the market. Therefore, this product will be more durable and stronger over time and generally more stable.

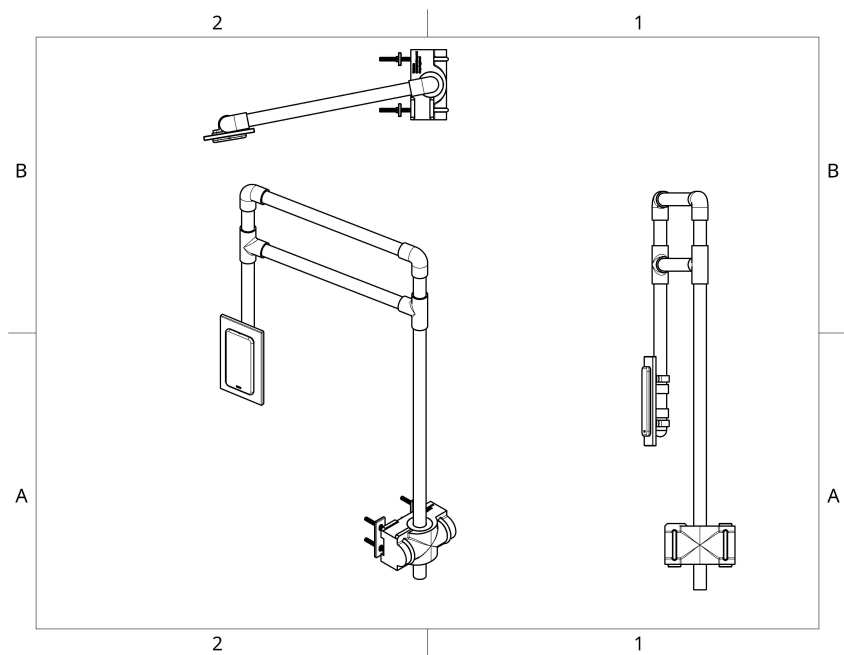


Figure 1: Phone Bed Mount

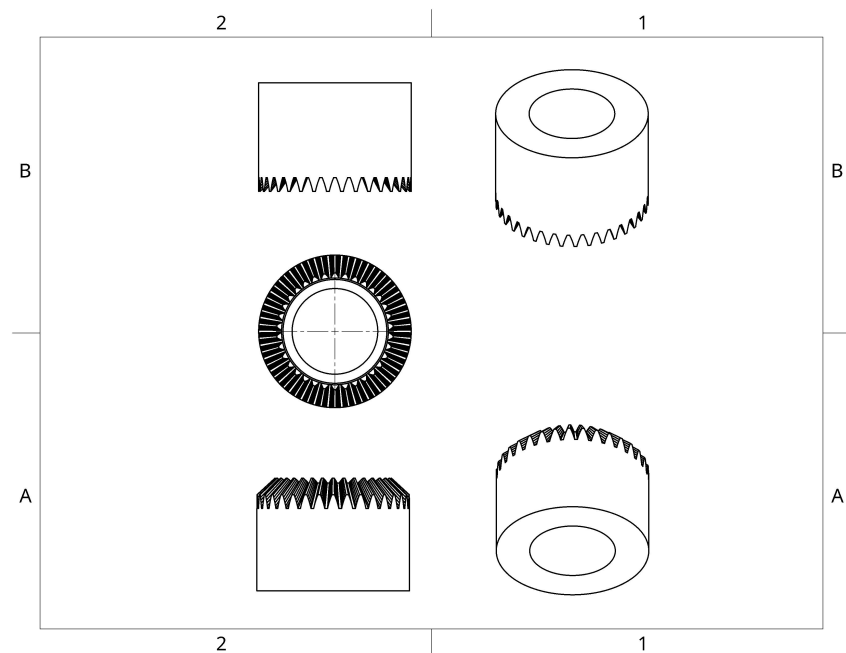


Figure 2: Locking Gear Mechanism

There were some key details that needed to be taken into consideration when designing this product. The clamp will attach to the bar below the headboard and be left there. The pole will then go into the clamp and lock into place. Then, the user can stick the phone onto the Velcro pad.

The design systems include the clamp with a gear-like attachment inside, PVC pipes specifically cut for the correct length for hanging in front of someone's head, and the Velcro pad to stick the phone onto in order for it to remain stable.

2.1 Conventions

- **Bold Text:** Used to highlight important information or actions needed.
- *Italic Text:* Used for emphasis or to indicate titles of sections

2.2 Cautions and Warnings

- *Caution: Sharp Edges*
Some parts contain **sharp edges** that may cause injury if mishandled. Handle all components with **care** and use **appropriate** protective equipment if necessary.
- *Avoid Excessive Force*
Do not twist or apply excessive force to any parts during assembly or use. Doing so may compromise the device's integrity and cause the pipes to dislodge, posing a risk of injury to the user.

- *Child Safety*

Store the device and all components in a **secure location out of reach of children**. This product contains **small, sharp parts** that could be **hazardous** if accessed by children.

3 Getting started

All parts are secured and mounted onto the clamp part. To begin assembling the system, start with the clamping mechanism.

1. **Push** the U-bolt to go through the 3D-printed parts.
2. **Use the hex screw** together with the long metal washer to tighten the clamp onto the bed frame as shown in Fig.3
3. **Push** the locking gear lower parts into the printed clamp.
If the printed part has a low tolerance and the locking gear can not stay firmly in place, use PVC cement to secure the part.

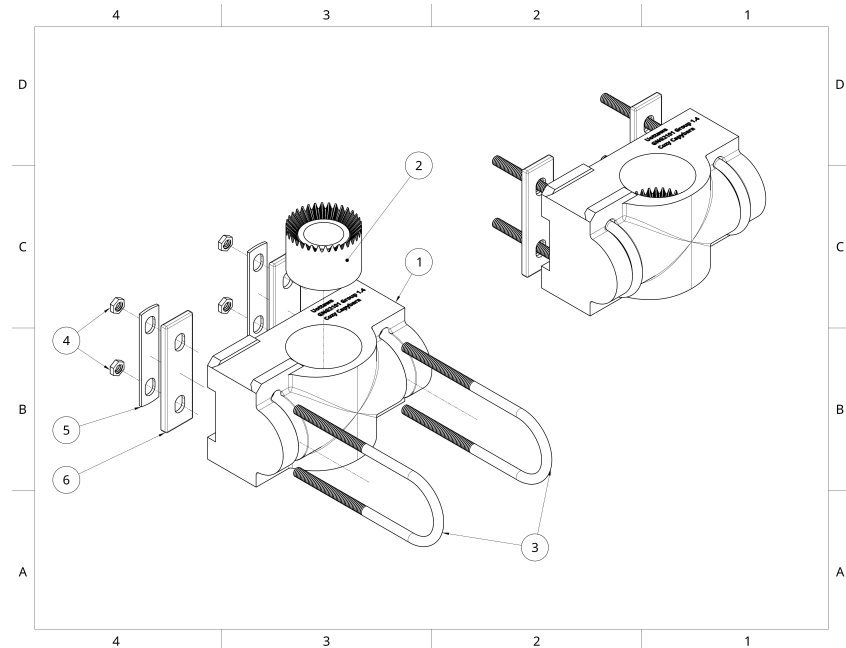


Figure 3: Front bed clamp assembly diagram

3.1 Set-up Considerations

The physical prototype's configuration is the **Clamp**, a unique 3D printed part with a gear locking mechanism glued to the bottom. The body is the **Main pole** with the other part of the locking mechanism on the bottom of it. They both attach to a pole stretching down with a Velcro **Phone Mount** that rotates to put the phone into the proper orientation. As shown in Fig.4

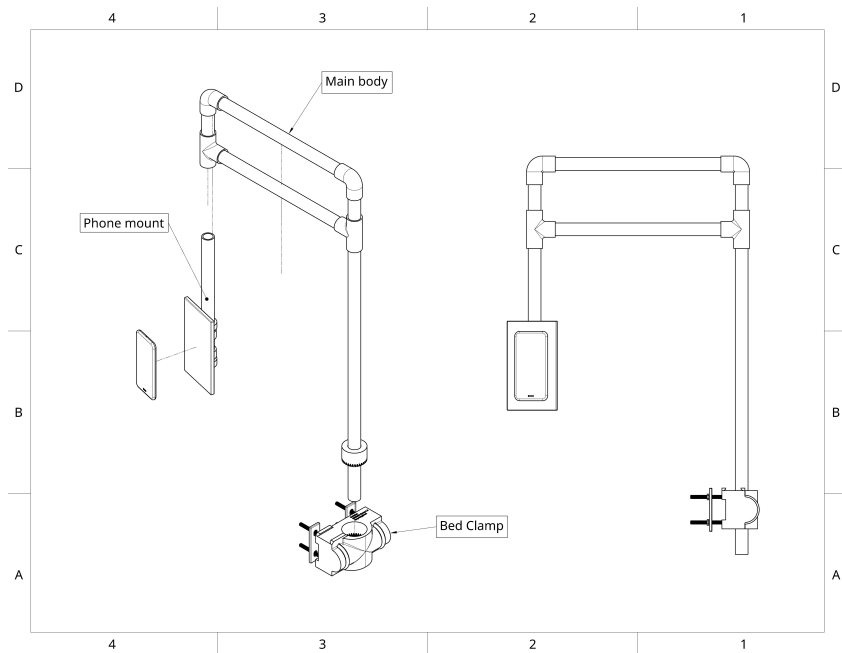


Figure 4: Complete design layout

3.2 User Access Considerations

Different users for the prototype can include people like our client who lack arm mobility. These clients must have a caretaker install the clamp for them, and then, depending on their disability, they may be able to remove the body of the prototype as well.

Other targeted users could be people recovering from surgery or other hospital illnesses or elderly people who are semi-abled. Depending on their state, they may be unable to install and remove the phone bed mount.

Individuals with chronic pain may struggle to hold the phone for a long time; in this case, the user could remove the arm from their bed, but they are unlikely to set it up on their own.

Individuals with neurological conditions often lack control over their limbs. This product could assist them assuming they are using their noses to navigate their phones. Since they cannot push it away using their nose by accident as it is locked in place, and it is made of strong PVC pipes.

Therefore, *most target clients need assistance from others to set up the device.*

3.3 Accessing the System

First, insert the clamp's indent into the metal frame with the two bolts on it, one on each side of the frame.

Put the two screws through the piece with two holes in it.

Tighten it by turning the nuts to the right until they are tight on

Put the teeth on the end of the body frame inside the clamp where the other teeth are. If it is angled too far to the right or left, **remove it and put it back** in the proper direction.

To adjust it for personal use, one must take the main pole out of the clamp and re-insert it in another direction if ones wish to rotate it that way.

The Velcro phone holder can be twisted if they want to rotate the phone.

3.4 System Organization and Navigation

- ***Clamp***

The clamp attaches to the metal bar beneath the headboard of a hospital bed with two nuts that are screwed on to hold a metal/3D printed bit that holds onto the metal bar

The gear attachment glued inside the clamp will be attached to the main body

- ***Main Body***

The main body includes arms made of PVC pipes, with one gear attached to the longer pipe and the phone holder attached to the shorter pipe.

- ***Phone Mount***

The phone holder attaches to the end of the main body with two rings as a locking mechanism. It has Velcro tapes on it to hold the phone in place.

4 Using the System

Two joins can be rotated depending on the usage.

4.1 Rotation of the main body

As shown in Fig.5:

1. **Lift up** the main body until the gear is fully disengaged
2. **Rotate** the main body until the ideal position is reached
3. **Drop** the main body into the socket until the gear is engaged

To achieve stability in the main body, the socket is exactly the size of the gear. If the main body is not aligned, try to move left or right until the gear drops in on itself to prevent damage.

4.2 Rotation of the phone mount

As shown in Fig.6:

1. **Pull** the phone mount out of the **socket**.

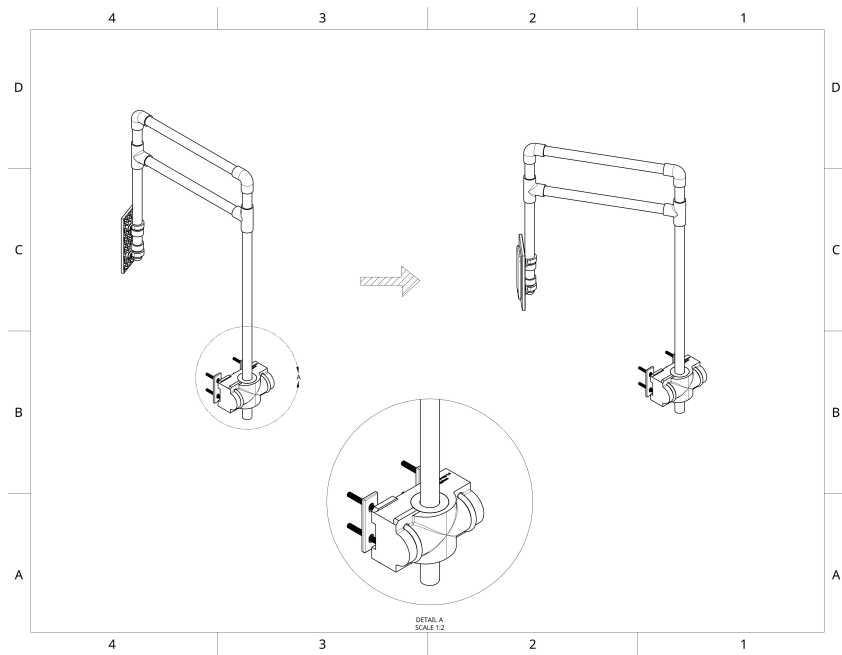


Figure 5: Rotation of the main body

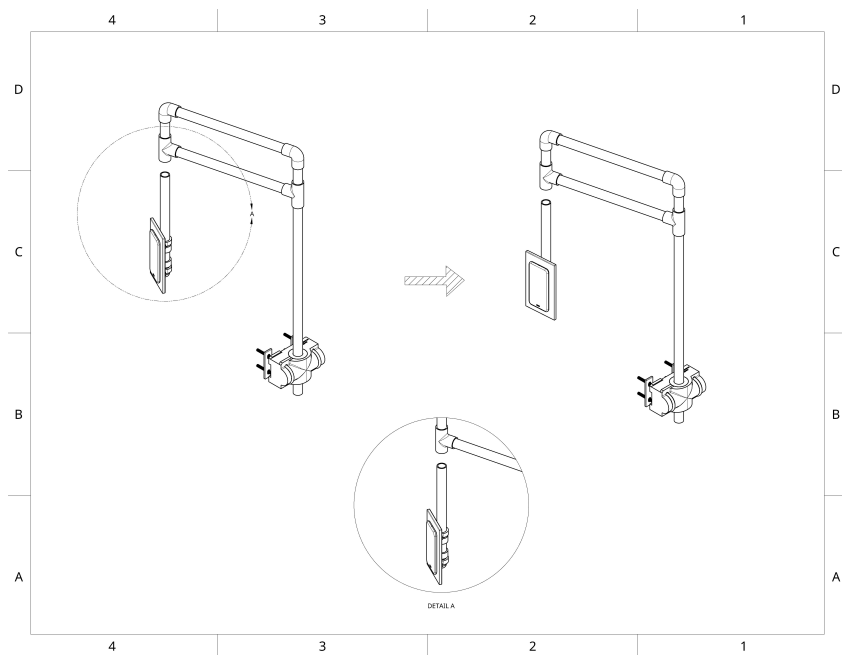


Figure 6: Rotation of the phone mount

2. **Rotate** to the position desired.
3. **Push** the phone mount back into the socket **tightly**.
 █ Hold the main body when pulling the phone mount out so the clamp's gearing is less stressed.

5 Troubleshooting and Support

5.1 Null function of the system

1. *Glued joint break*
If the glued joint **breaks** under heavy load or is used for long, Please **remove** the two sections and **re-sand** the attached surface with low-grid sandpaper. **Clean** the surface with **alcohol wipes**, then **apply PVC cement** according to the manufacturer.
2. *Gear system break*
If the gearing system **breaks or chips** so it can no longer be locked in, **re-print** the clamp. The gear system is **suggested** due to the **high position required** for the parts.
3. *Velcro failed*
If the Velcro system **no longer holds** the phone, please **add 99% alcohol** on the **mounting surface** to **remove the glue** and **attach the new Velcro**.

5.2 Maintenance

Dusting the main body and gearing system from time to time to ensure best performance

5.3 Support

For support or inquiries about the product, please get in touch with this email [zkou080@uottawa.ca] or Uottawa MakerSpace

6 Product Documentation

All parts that need to be purchased to assemble this design can be found in hardware stores such as *The Home Depot*™

6.1 BOM

6.2 Total Parts list

1. 3/4" PVC pipes x 2 (25 inches) x 2
2. 3/4" PVC pipes (6 inches) x 2
3. 3/4" PVC pipes (10 inches) x 1
4. 3/4" PVC pipes (30 inches) x 1
5. 3/4" PVC pipe clamps x2
6. 3D printed Clamp w/ PLA filament
7. 3D printed Phone mount w/ PLA filament
8. 3D printed Gear w/ resin x2

Item	Quantities	Unit Price \$	Total Price \$
3/4" PVC pipe	10 ft	10.75	12.14
3/4" PVC pipe clips	2	0.796	1.80
PLA filaments	500g	13.50	15.26
3D printer Resin	≈300g	15.90	17.96
90° PVC junctions	2	1.9	4.30
Bolts	4	0.49	0.60
Nuts	8	0.99	1.20
Male Velcro tape 1" x 3"	3	0.73	2.48
Rectangular Mending plate	2	1.27	2.87
PVC cement	1 can	13.57	15.33
5/16"x1-3/4"x4-1/4" U-bolts	2	3.23	7.30
Total cost			81.24

Table 1: Bill of Material

9. 3D printed Round end pump w/ resin x2
10. 3D printed locking ring w/ resin x2
11. 90° PVC junctions x 2
12. Bolts x 4
13. Nuts x 8
14. Male Velcro tape 1" x 4" x 3
15. PVC cement x 1 can
16. PVC T-joint x 2
17. Rectangular Mending plate x 2
18. 5/16"x1-3/4"x4-1/4" U-bolt x 2

6.3 Building Instructions

6.3.1 Main body

Material list

- Parts 1: 3/4" PVC pipes (25 inches)
- Parts 2: 90° PVC junctions
- Parts 3: 3/4" PVC pipes (6 inches)
- Parts 4: PVC T-joint
- Parts 5: 3/4" PVC pipes (30 inches)
- Parts 6: 3D printed Gear upper

1. **Assemble** the PVC pipes as shown in Figure.7 and **glue** them using **PVC cement**

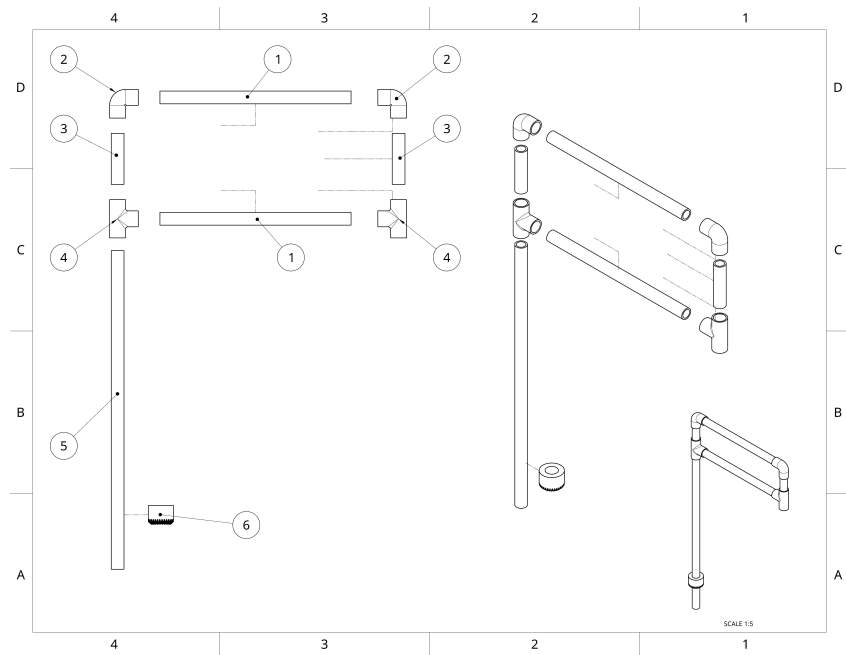


Figure 7: Main Body Exploded Diagram

2. **Insert and Glue** the gear parts to the (30 inches) PVC pipe and **glue** them to the pipe.

6.3.2 Phone mount

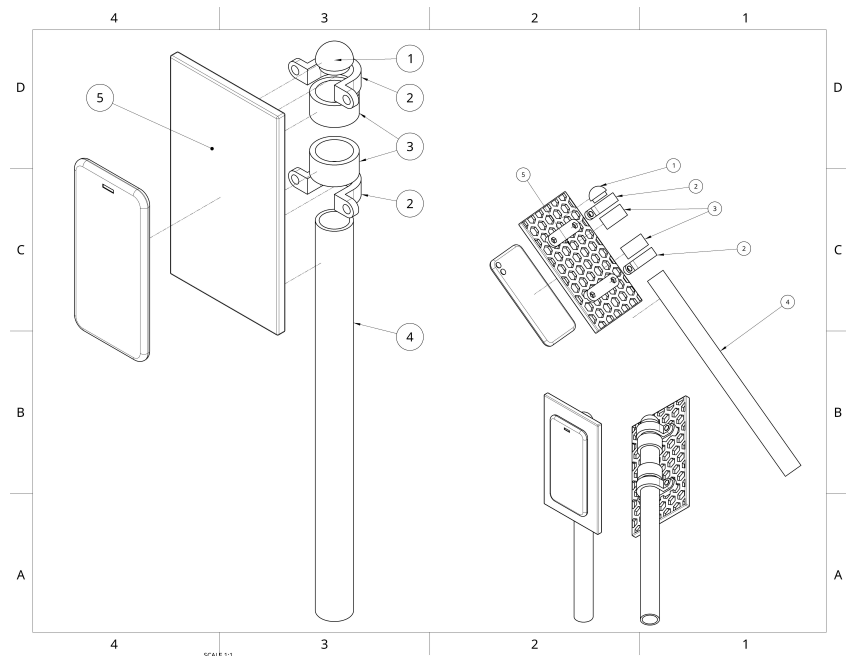


Figure 8: Phone Mount Dissected Diagram

Material list

- Parts 1: 3D printed Round end pump
 - Parts 2: 3/4" PVC pipe clamps
 - Parts 3: 3D printed locking ring
 - Parts 4: 3/4" PVC pipes (10 inches)
 - Parts 5: 3D printed Phone mount
1. **Insert** and **Glue** parts 1 and 3 onto parts 4 as shown in Fig.8 with PVC cement.
 2. **Place** part 4 in the correct location of Part 5, make sure the locking ring is aligned with the groove.
 3. **Screw** part 2 onto part 5, tighten the screw until preferred rotation resistance achieved

6.4 Testing and Validation

After each part is assembled, **wait until the cement is cured** according to the manufacturer's specs. All parts **should not deform** or **make noise** under normal usage; If so, please check the installation steps to make sure they follow the procedure.

The main body is constructed using PVC, and a small range of movement is expected.

Lightly shake or **bend** the joint to test if the cement is glued properly; no movement will be shown on the joint.

7 Conclusions and Recommendations for Future Work

This project aimed to create a phone bed mount for a client with limited mobility, allowing her to navigate her phone using her nose. Through several weeks of trial and error, requirements were made successfully by minimizing wobbliness, ensuring a lightweight design, and, most importantly, providing strong clamps and arms. Over the two weeks allocated for developing the final prototype, limited budget and time constraints restricted the team from improving further as there were big changes made to the design during the discussion in the final client meeting, i.e., prototype two did not work out as expected, and the client eventually was persuaded to move the clamp to the bar under the bed board. Therefore two important lessons were learned: first, never worry about convincing the client to change their initial requirement to the product if there is a better solution to achieve their goals; second, always be prepared to pivot toward another concept with backup plans.

In addition, prioritizing the design of the clamp was the right avenue in hindsight, with a fundamental idea of how the clamp needs to be built. Even a pivot to another clamp location was relatively smooth. However, despite the stability of the clamp, the wobbliness in the main

body was not fully eliminated due to the sudden change and limited budget, therefore to improve upon the final prototype, the main body must be reviewed, including its material, shape, and connections to the phone mount.

If more time were given to work on this project, the main body part would be reviewed and eliminate its wobbliness solely by adjusting the shape with the materials obtained. However, if there were more budget, the PVC pipes and joints (specifically the components connected to the 30-inch 3/4" pipes) could be changed to lightweight metal pipes and joints with less flexibility to reduce the wobbliness. In this project, compared to the time element, the budget was a larger reason for most compromises, such as the material chosen as well as abandoning the idea for extra functionalities.

8 Link to project and modeling

- 3D-field and drawing:
<https://cad.onshape.com/documents/6c51c4a3ca22efb431b81ff5/w/63731fcd8ef5d62c378cb222/e/113c79ba2fb4a698c3ad9819>
- MakerRepo:
<https://makerepo.com/ashnache/2090.phone-bed-mount>

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