

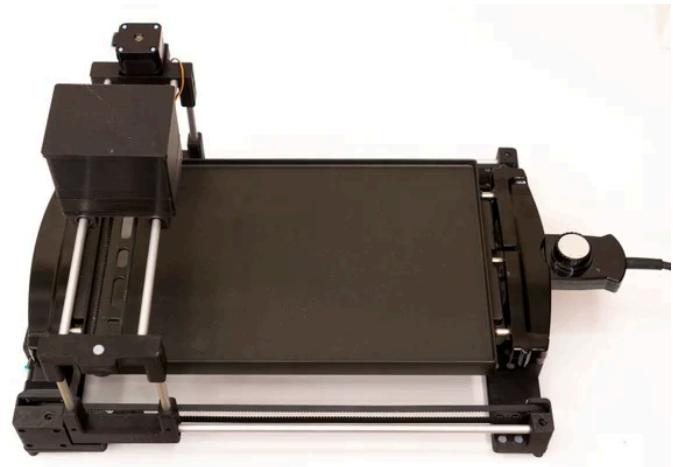
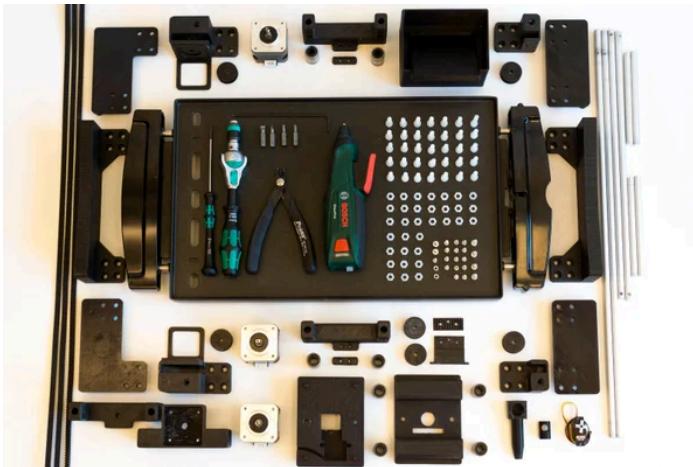
AUTODESK
Instructables

Pancake Printer

By [umuterkal](#) in [Workshop3D Printing](#)



Introduction: Pancake Printer



Pancake Printer is a fun way to print (and eat) your very own pancakes!

It's basically works like a CNC machine. X and Y axes are controlled with a small computer, and the pancake mixture is poured to the grill, passing throughout a valve mechanism. Then, you cook the pancake within 2 minutes. It's that simple and tasty!

The device is Raspberry Pi 2 controlled. The firmware is a Universal Windows Application running on Windows 10 IoT Core. So, it is easy to integrate gamepad or internet connectivity to the project.

Operation is so simple, just connect a gamepad to the Raspberry Pi 2. The print head will move according to gamepad commands.

Currently, the firmware does not support printing given drawings. It is manually controlled. But, it is much more fun!

The 3D files are located at Thingiverse project page: www.thingiverse.com/thing:989910

You're free to produce your own Pancake Printer, until it is not commercial.

In each step, the required things are listed. Here is the sum of the 3D parts, things and tools needed.

3D Parts

- Base - A x 1
- Base - B x 1
- Base - C x 1
- Base - D x 1
- Grill Holder - A x 1
- Grill Holder - B x 1
- Slot - Bottom - Free - Left x 1
- Slot - Bottom - Free - Right x 1
- Slot - Bottom - Motor - Left x 1
- Slot - Bottom - Motor - Right x 1
- Slot - Bottom - X x 2
- Slot - Top - Motor - Left x 1
- Slot - Top - Free - Right x 1
- Gear x 3
- Gear - Slotted x 3
- Gear - Cap x 6
- Head Slot x 1
- Head Holder x 1
- Head Slot Belt Cap 30 x 1
- Head Extruder x 1
- Head Gate x 1
- Head Valve x 1
- Tank Body x 1
- Tank Cap x 1
- Head Case Pin x 6

Electronics

- Raspberry Pi 2 x 1
- 8GB Micro SD Card x 1
- Microsoft Xbox 360 Wired Gamepad x 1
- 24V 6A Power Supply x 1
- Microstepping Motor Driver x 3
- Moons NEMA 17 Bipolar Stepper Motor x 3
- Micro Servo Motor (e.g. Hitec HS-53) x 1
- Connection cables

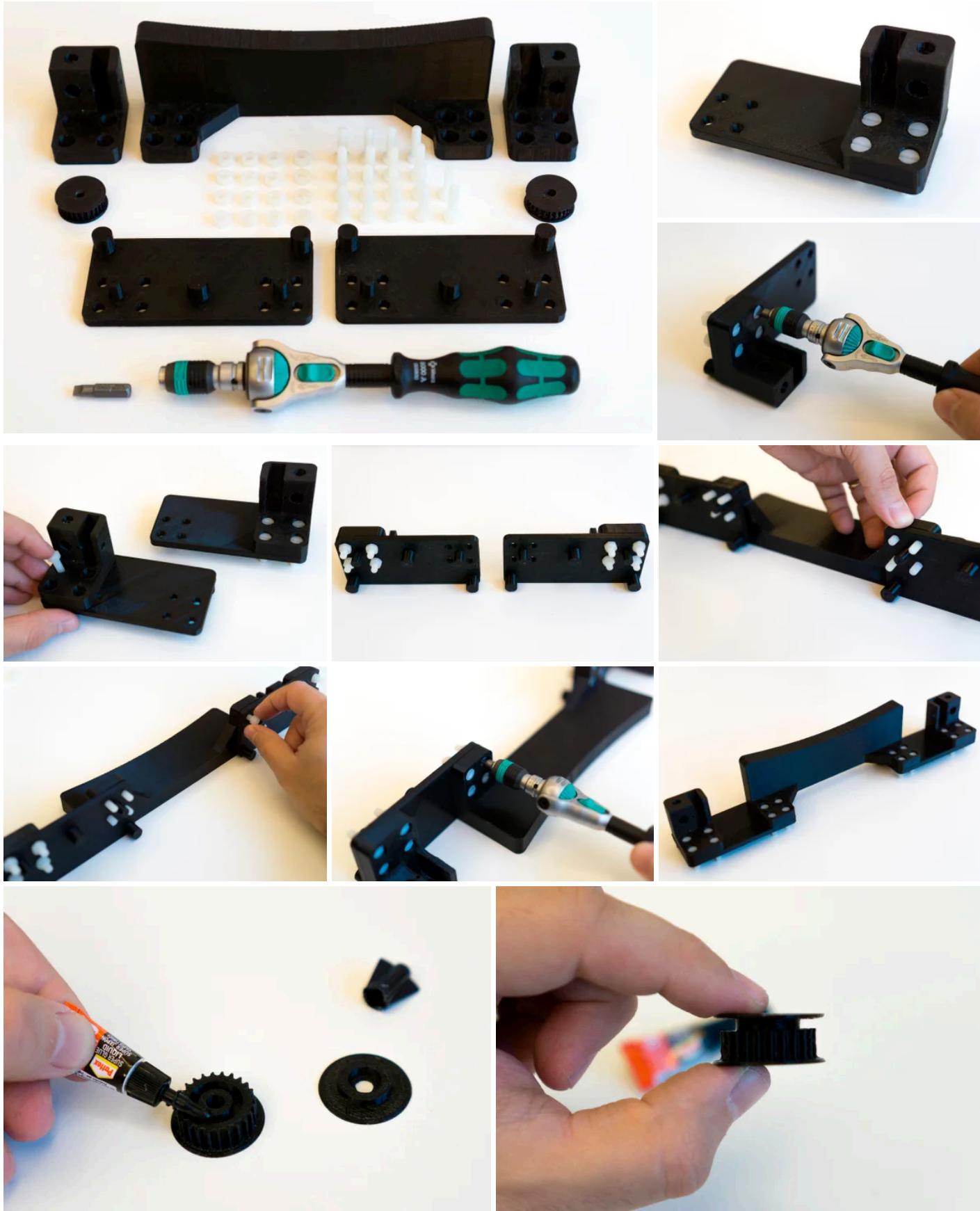
Parts

- M5x20mm Plastic Head Bolt x 18
- M3x10mm Bolt x 19
- M4x20mm Bolt x 4
- M5x20mm Slotted Plastic Screw x 16
- M5x30mm Slotted Plastic Screw x 1
- M5 Plastic Nut x 33 M3 Nut x 3
- M3 Washer x 3
- 15x25mm Linear Ball Bearing (8mm inside) x 8
- 8x480mm Rod x 2
- 8x325mm Rod x 2
- 8x115mm Rod x 4
- 963x6mm Belt x 2
- 725x6mm Belt x 1

Tools

- 1,0x5.5 Slotted Screwdriver
- TX10 Hex Key
- TX15 Hex Key
- 3mm Drill
- Hot Glue Gun
- Super Glue

Step 1: Bottom Part-A



In this step, we'll build the first part of the grill holder and the bottom drive mechanism.

Required 3D Parts:

- Grill Holder - B x 1
- Base - C x 1
- Base - D x 1
- Slot - Bottom - Free - Left x 1
- Slot - Bottom - Free - Right x 1
- Gear x 2
- Gear - Cap x 2

Required Parts:

- M5x20mm Plastic Head Bolt x 18
- M5 Plastic Nut x 16

Required Tools:

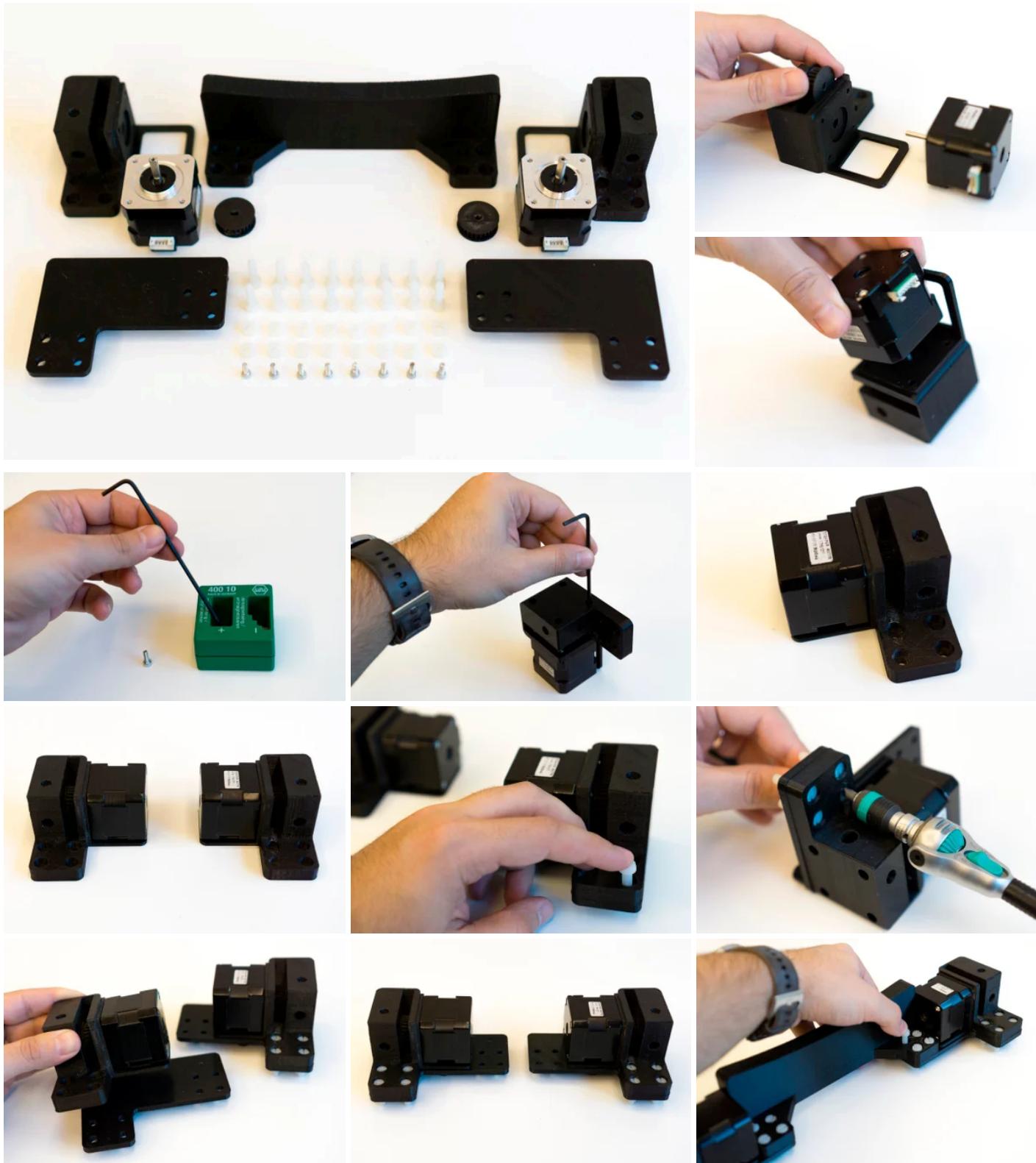
- Super Glue
- 1,0x5.5 Slotted Screwdriver

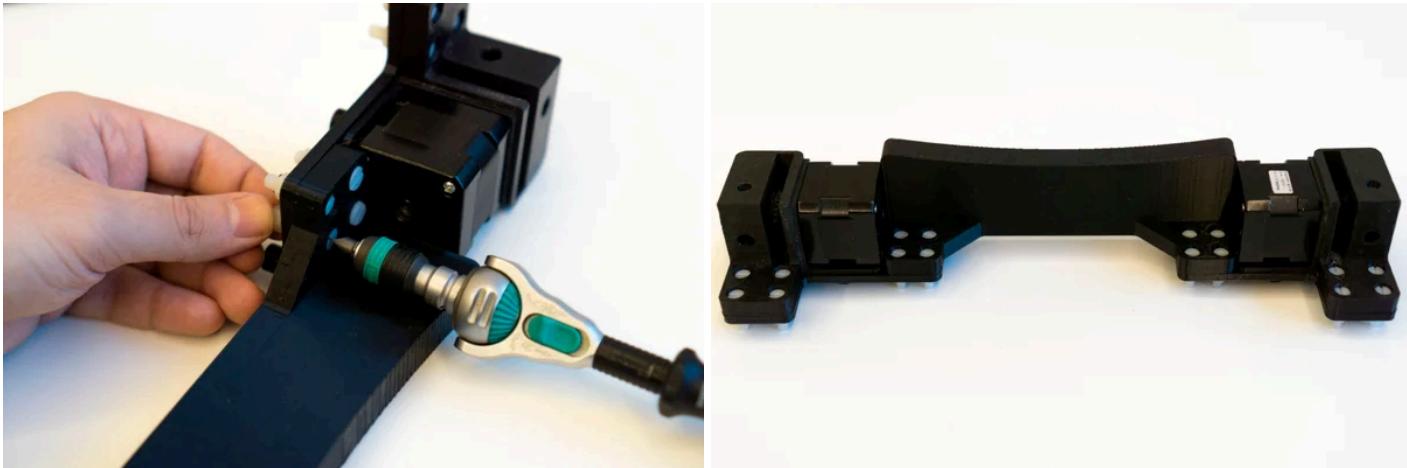
Instructions:

Connect base c and d parts with left and right slot parts. Then, attach them to the both sides of grill holder.

Apply super glue to the gear and its cap, and compress it to make a gear. We'll insert them later.

Step 2: Bottom Part-B & X-Axis Motors





Then, we'll construct the second part of the bottom drive mechanism.

Required 3D Parts:

- Grill Holder - A x 1
- Base - A x 1
- Base - B x 1
- Slot - Bottom - Motor - Left x 1
- Slot - Bottom - Motor - Right x 1
- Gear - Slotted x 2
- Gear - Cap x 2

Required Parts:

- M5x20mm Slotted Plastic Screw x 16
- M5 Plastic Nut x 16
- M3 x 10mm Bolt x 8
- NEMA 17 Moons Stepper Motor x 2

Required Parts:

- 1,0x5.5 Slotted Screwdriver
- TX10 Hex Key

Instructions:

Apply super glue to the slotted gear and its cap. Compress them.

Sand stepper motor shafts to make them comfortable with the slotted gears.

Insert gears into the slot parts, then attach stepper motors. Use magnetizer / demagnetizer tool to magnetize your hex key. Then, insert screws holding stepper motors, from the holes on the slot parts. Connect grill holder, base a / b parts and slot parts together.

Step 3: X-Axis



Now, it's time to build the X-Axis.

Required 3D Parts:

- Slot - Bottom - X x 2

Required Parts:

- 15x25mm Linear Ball Bearing (8mm inside) x 4
- 8x480mm Rod x 2
- M3x10mm Bolt x 4

Required Tools:

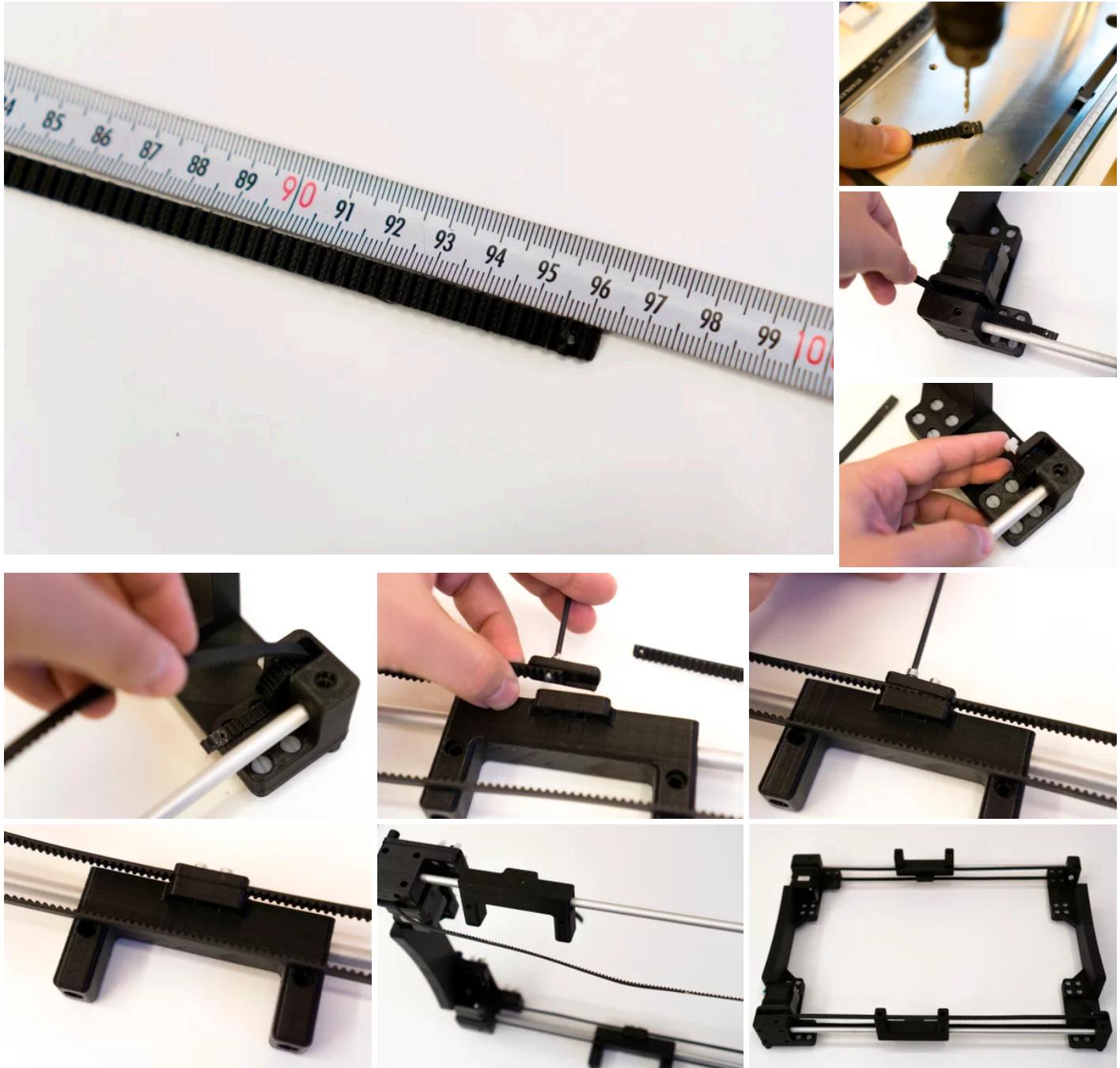
- 3mm Drill

Instructions:

First, insert the vertical ball bearings into the both sides of the slot parts. Then, cut the rods according to your grill's size. For mine, 48cm is OK. Then, if you prefer, mark the rods' drill positions, and then drill them. This is not very required since the belts will put all systems in one piece.

At the end, connect all parts together.

Step 4: X-Axis Belts



Let's connect the belts to the conveyors.

Required Parts:

- 963x6mm Belt x 2

Required Tools:

- 1,0x5.5 Slotted Screwdriver
- TX10 Hex Key

Instructions:

Cut the belts according to your grill's size. For my setup, 96.3cm is OK. You need to drill second or third gear of the belts. Then, insert the belts to the slots, and screw them. At the end, you'll have a working X-axis.

Step 5: Print Head



It's the magic of the Pancake Printer! The print head! It's as simple as connecting the pancake tank with a valve.

Required 3D Parts:

- Head Slot x 1
- Head Holder x 1
- Head Slot Belt Cap 30 x 1
- Head Extruder x 1
- Head Gate x 1
- Head Valve x 1
- Tank Body x 1
- Tank Cap x 1
- Head Case Pin x 6

Required Parts:

- Micro Stepper Motor (e.g. Hitec HS-53) x 1
- 15x25mm Linear Ball Bearing (8mm inside) x 4

Required Tools:

- Hot Glue Gun
- Screwdriver

Instructions:

First, insert 4 vertical ball bearings to the head slot. Then, apply a small amount of hot glue to valve, and combine the servo motor. Insert valve mechanism to the extruder, and push them to the head gate part, as demonstrated in the photo. Insert head case pins to head gate. Finally, combine all the parts together. Then, we'll have the pancake head.

Step 6: Y-Axis



Y-Axis gives second movement capability to the print head.

Required 3D Parts:

- Slot - Top - Motor - Left x 1
- Slot - Top - Free - Right x 1
- Gear - Slotted x 1
- Gear x 1
- Gear - Cap x 2

Required Parts:

- M3x10mm Bolt x 7
- M3 Nut x 3
- M3 Washer x 3
- M4x20mm Bolt x 4
- NEMA 17 Moons Stepper Motor x 1
- 8x325mm Rod x 2
- M5x30mm Slotted Plastic Screw x 1
- M5 Plastic Nut x 1
- 725x6mm Belt x 1

Required Tools:

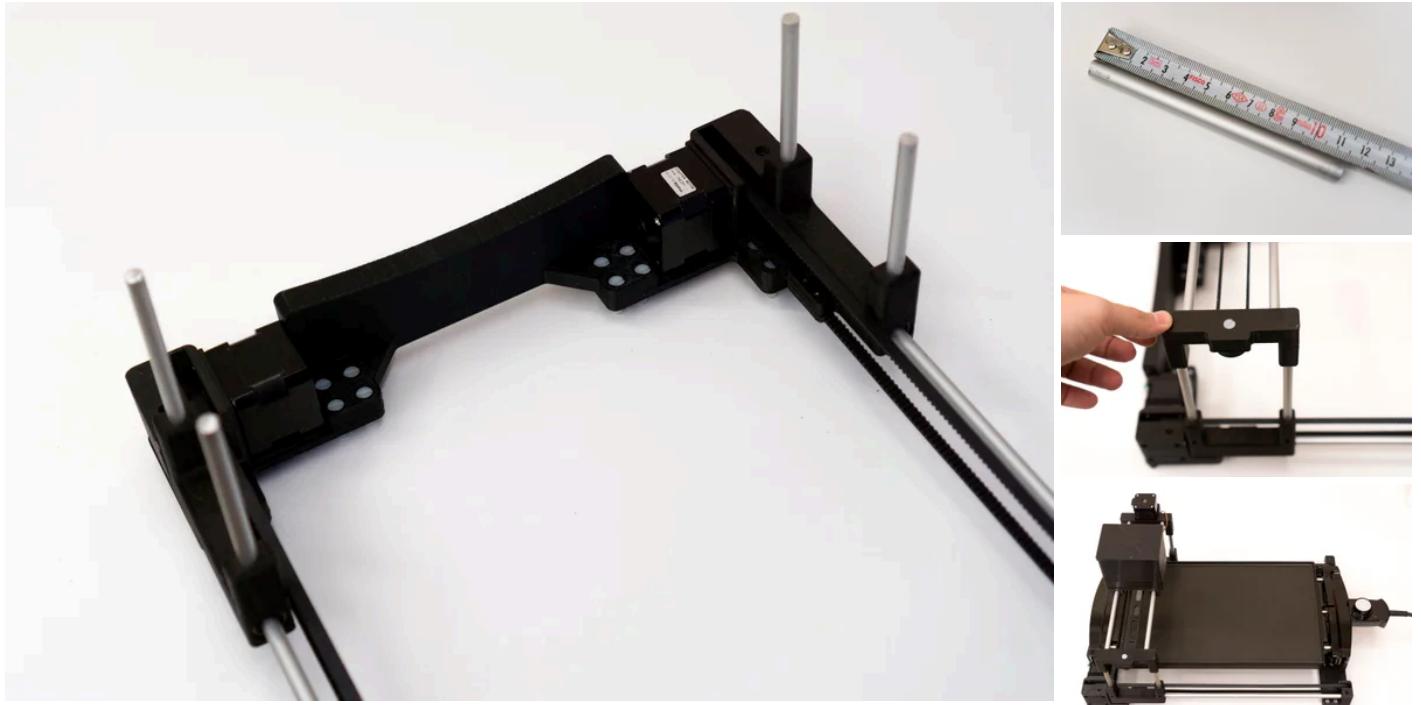
- 3mm Drill
- TX10 Hex Key
- TX15 Hex Key

Instructions:

Attach the stepper motor to motor slot, then insert slotted gear to the stepper. You'll need to sand the motor shaft to make sure it fits easily. Then, cut two pieces of 32.5cm rods. Drill two ends of the rods, according to motor slots' hole positions. Insert the rods to motor slot part, then attach print head to the rods. Next, attach the second slot to the rods. You may wish to screw slots to the rods, but it is not very critical.

In the second stage, cut 72.5cm belt, and drill its ends according to the belt cap's hole positions. Screw the belt cap to the belts. The top part will be ready.

Step 7: X-Meets-Y



Our final move on the mechanical side will be combining all the parts together.

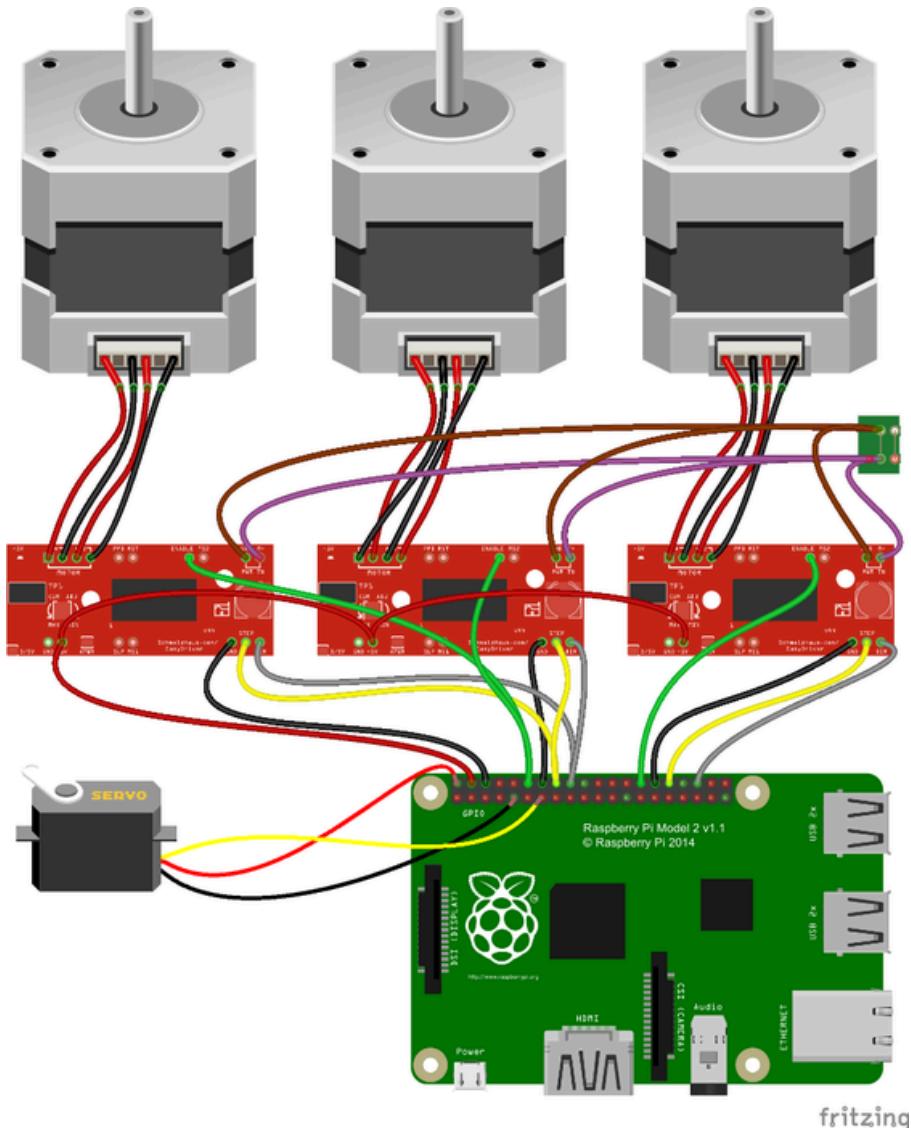
Required Parts:

- 8x115mm Rod x 4

Instructions:

Cut four 11.5cm rods, and insert them to the bottom slot holes. Attach top part to the rods. You may also wish to screw the rods, but it will eliminate the mobility of the device. So, it is up to you. (I'm using without the screws.)

Step 8: Electronics



We use Raspberry Pi 2 to control Pancake Printer. You're free to choose the stepper motor controller. It is better if the driver is capable of driving in microstepping mode.

Required Parts:

- **Raspberry Pi 2 x 1**
- Microsoft Xbox 360 Wired Gamepad x 1
- **Moons NEMA 17 Bipolar Stepper Motor x 3**
- Microstepping Motor Driver x 3
- **Connecting Cables**
- 24V 6A Power Supply x 1
- Micro Servo Motor (e.g. Hitec HS-53) x 1

Instructions:

First, connect servo motor cables to Raspberry. Here is the connections:

Servo **+5V** -> Raspberry **+5V**

Servo **GND** -> Raspberry **GND**

Servo **Signal** -> Raspberry Pin **13 (GPIO 27)**

Then, connect stepper motor drivers to Raspberry.

X Drivers **+5V** -> Raspberry **+5V**
X Drivers **GND** -> Raspberry **GND**
X Drivers **EN**-> Raspberry **12 (GPIO 18)**
X Drivers **DIR** -> Raspberry **18 (GPIO 24)**
X Drivers **STEP** -> Raspberry **16 (GPIO 23)**
X Drivers **+24V** -> Power Supply **+24V**
X Drivers **GND** / -24V -> Power Supply **GND**
Y Driver **+5V** -> Raspberry **+5V**
Y Driver **GND** -> Raspberry **GND**
Y Driver **EN**-> Raspberry **28 (GPIO 1)**
Y Driver **DIR** -> Raspberry **36 (GPIO 16)**
Y Driver **STEP** -> Raspberry **32 (GPIO 12)**
Y Driver **+24V** -> Power Supply **+24V**
Y Driver **GND** / -24V -> Power Supply **GND**

Finally, connect stepper motors to the drivers. The important thing is, X motors should turn to different directions. So, connect motor cables accordingly.

Step 9: Firmware

Pancake Printer's firmware is responsible for controlling X and Y stepper motors and the valve mechanism. It is a Universal Windows Platform (UWP) application written in C# language. What you need is installing Windows 10 IoT core for Raspberry Pi 2, and then deploying the application. You may also wish to set the application as start-up via the Windows 10 IoT Core's web panel > apps section.

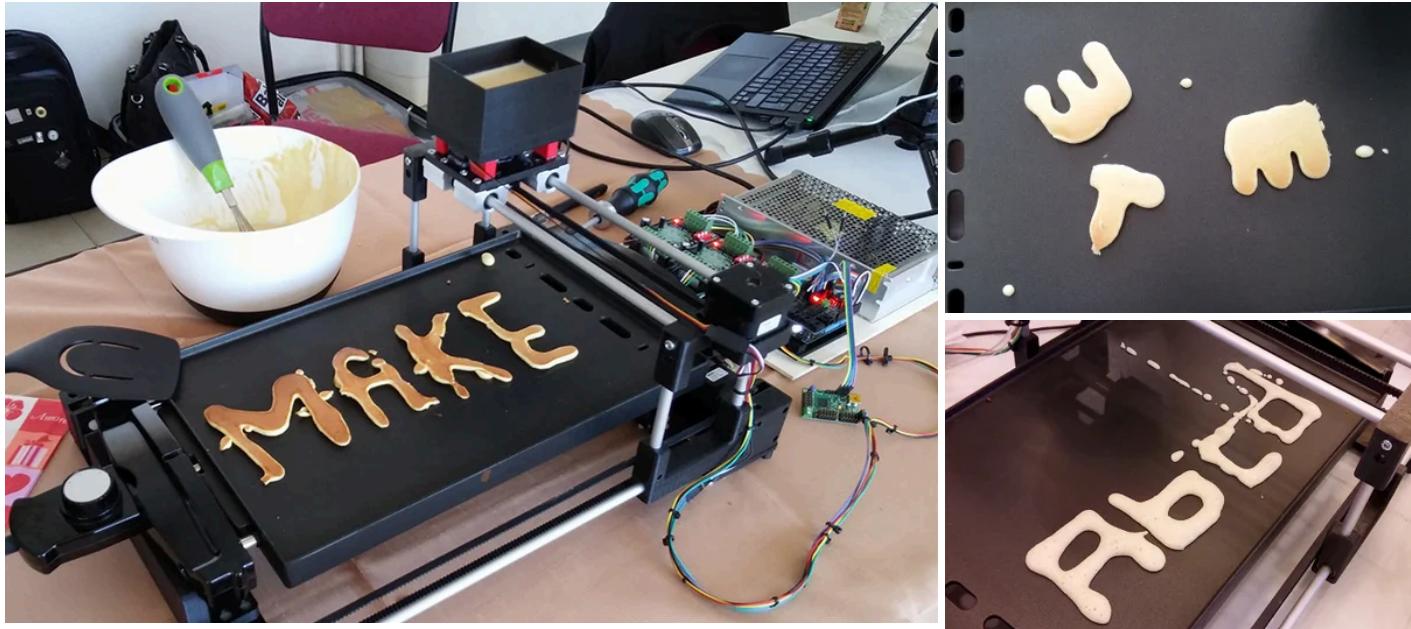
The GitHub link for the app is <https://github.com/uerkal/PancakePrinter>

All you need to do is connecting the cables, attaching a gamepad to Raspberry Pi 2 and then deploying the application.

You may use Visual Studio Community 2015 to open, edit and deploy the application.

If you need help about Windows 10 IoT Core, use following getting started link: <http://ms-iot.github.io/content/en-US/GetStarted.h...>

Step 10: Delicious Pancakes!



Since Pancake Printer is gamepad controlled, the output depends on your abilities. Good news, it is not so hard.

The photos are from my first pancake tries. The resolution depends on how fluid the pancake mix, and how fast you draw.

Happy printings!