2017

Report Fablab: The Making

INSTRUCTABLE AND REPORT

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Concept Timer

The timer is an object that helps keeping track of time with the help of a clock hand and rgb LEDs. The LEDs are what make this object unique, keeping track of time with lighting effects is an interesting concept. If we memorize the lighting effect on a given time, we do not have to look directly at the timer to see how much time has passed.

Uses

This object can be used while making food. Starting the timer on the hour mode, gives the ability to keep track of minutes with the clock hand and seconds with the lighting effects. The minute mode could also be used for miscellaneous timer tasks, but would likely be used more because of the visual attractiveness of the object in this mode.

Paper Prototype

The earliest protoype had the two essential parts in it. Places for the 12 LED lights and a hole for the clock hand to rotate in.

FIGURE 2 - PAPER PROTOTYPE BACK

FIGURE 1 - PAPER PROTOTYPE SIDE

FIGURE 3 - PAPER PROTOTYPE SIDE 2

PICTURE PROTOTYPE

Fablab Machines

I used the 3D printer, laser cutter and soldering stations inside the Fablab. 3D prints were sometimes done with support. I used the laser cutter to both cut and engrave.

Electrical Circuit

The circuit used can be found in the “Fritzing folder”.

Step by step guide

Material List

- Arduino uno
- Stepper motor (with driver)
- 12 rgb LED's
- Jumper wires
- wood 2mm
- Plexiglass 2mm
- Standoff spacers (2 cm long)
- Screws for standoff spacer
- Screws for stepper motor attachment
- Soldering tin
- Heat shrink tubing
- Wood glue
- Super glue
- (optional) breadboard
- Resistors (6 x 10k, 2x 1k)

Tool List

- Laser cutter
- 3D printer
- Soldering station
- Drill

Steps

Step 1: Laser cutting

We start off by laser cutting the parts we need. All files can be found in the "Lasercutting" folder. The ClockFaceDefBelowEngraved file can be changed with whatever engraving you want. Be aware that the holes are made for the specific components I have. If your LEDs or standoff spacers need bigger holes, don't forget to change the sizes.

The ClockFaceDef and ClockFaceDefBelow files are to be cut with plexiglass.

The ClockFaceDefBelowEngraved and Arduino CaseDef files are to be cut out of wood.

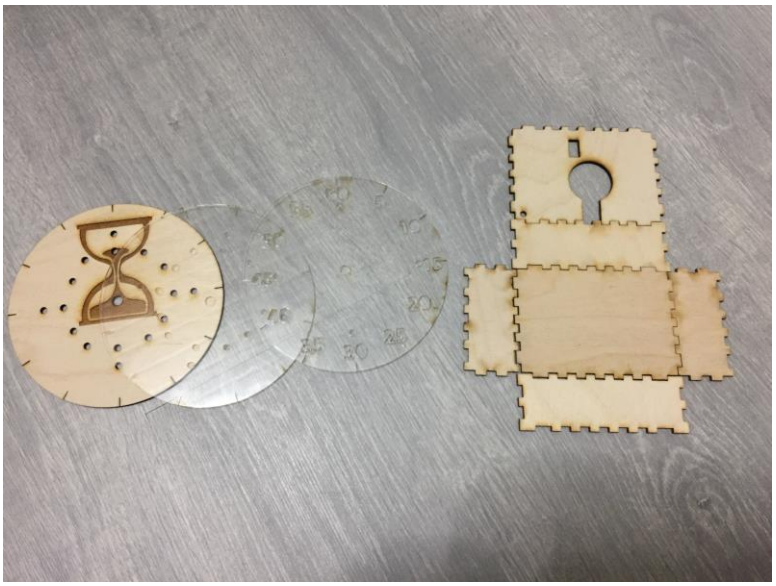

FIGURE 4 - LASER CUT PARTS

Step 2: 3D print all components

Print all the components inside the “3D printing” folder.

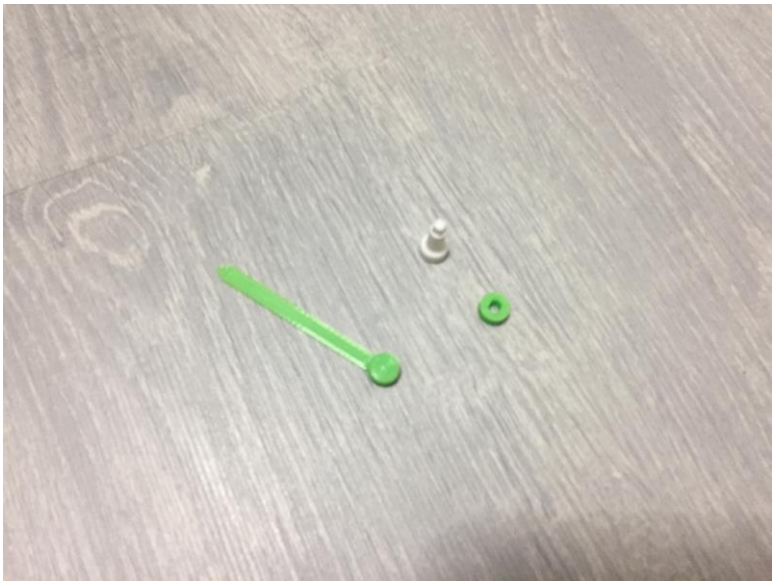

FIGURE 5 - 3D PRINTED COMPONENTS

Step 3: (optional) Test hardware

To check if all the LEDs and stepper motor works, we can connect all the components to a breadboard and the arduino uno. The electronics schema can be found in the “Fritzing” folder. The resistors I used worked best for my LEDs. Your rgb LEDs might work better with other resistance levels. I used the same wire colors in the fritzing file as the picture below.

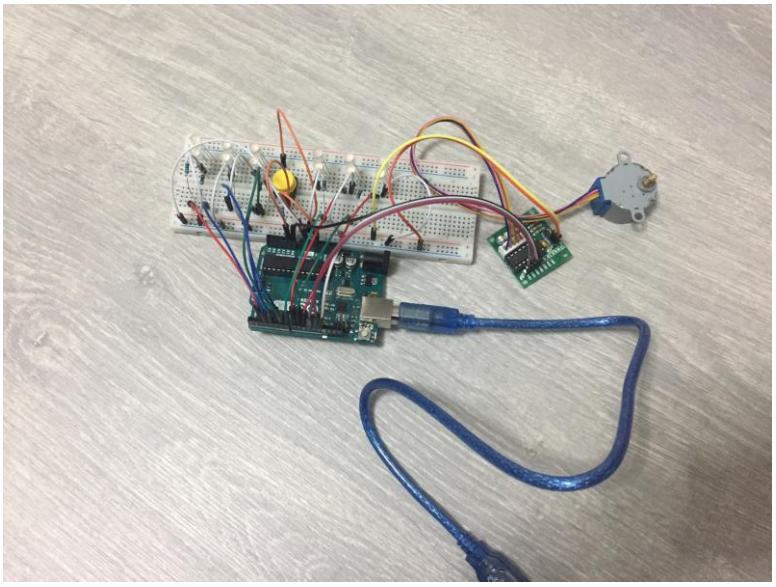

FIGURE 6 - BREADBOARD TEST

Step 4: Assemble arduino case

Next up, it's time to glue together the arduino case. I used wood glue which takes a long time before drying. Do not glue the top and back parts just yet, these will be glued in a later step.

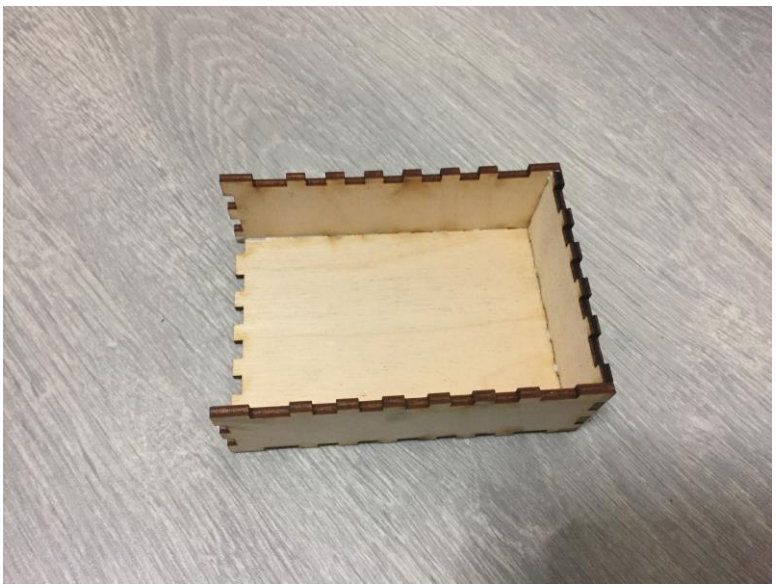

FIGURE 7 - ARDUINO CASE PARTIALLY GLUED

Step 5: Attach stepper motor to back

The stepper motor needs to be attached to the back part of the timer. I drilLED holes in the plexiglass and wood, and attached the stepper motor with screws. Be cautious, the holes in the plexiglass and wooden part should be aligned.

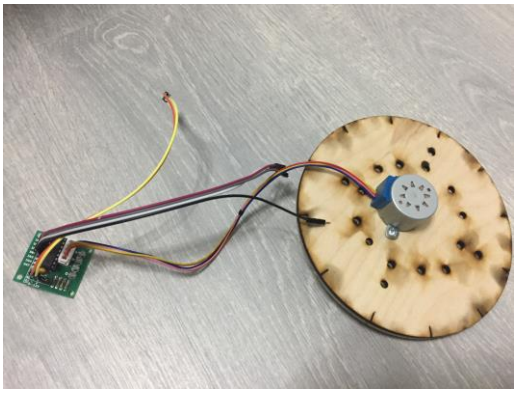

FIGURE 9 - STEPPER MOTOR ATTACHED BACK

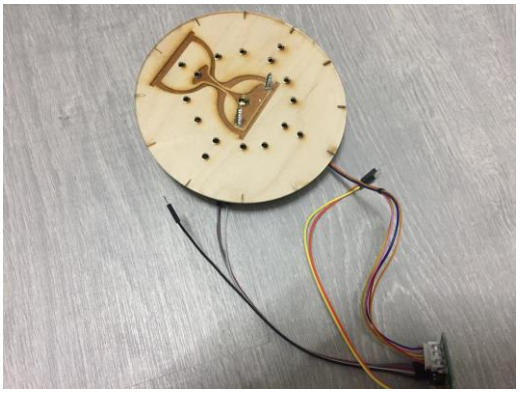

FIGURE 8 - STEPPER MOTOR ATTACHED FRONT

The screws sticking out does not look too nice I should say, maybe a point to improve upon later.

Step 6: Attach rgb LEDs to back

This was a huge step for me (took 2-3 hours). All rgb LEDs need to be placed in the twelve holes available, and soldered to the ground pin, and every needed color to a separate wire. I cut off the legs of the LEDs that were not used by that specific LED. Also be careful with legs not touching each other. I used some heat shrink tubing to prevent cables from touching each other.

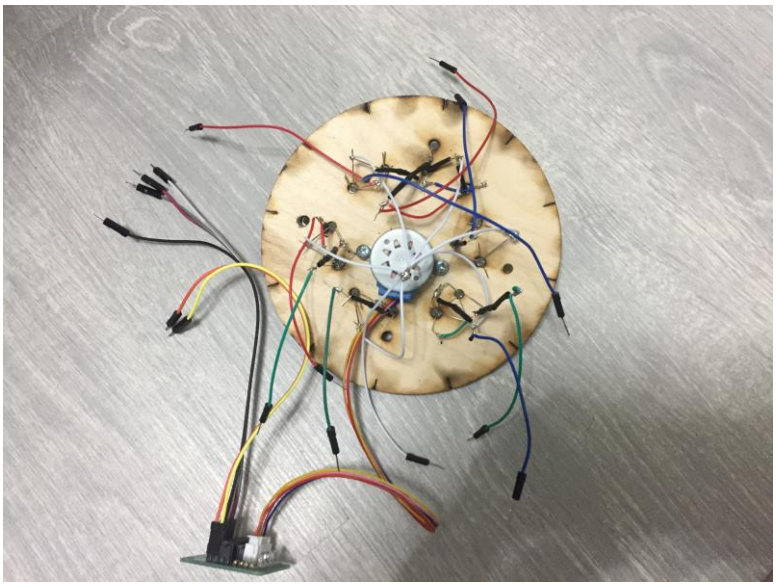

Figure 10 - LEDs Attached and Soldered

Step 7: Attach button on top part of the arduino case

Same as the LEDs, the wires are soldered of the button. The connections to the button should be made through the little square hole on the top part of the arduino case.

Step 8: Solder last few wires

Two wires of the stepper motor also have to be soldered. The power and ground pin.

Step 9: Try and make everything fit

Now the time has come to tidy up the back side of the timer. Start by putting all wires from the LEDs into the right pins, after that the wires of the stepper motor. If everything looks right, put the top part on the case. The big hole on the top is for all the wires that go in and out of the case.

Step 10: Glue case top and case to timer

Pretty straight forward. Use wood glue to glue the top part of the case. And then glue the case to the timer. The bottom of the case is also where the whole object rests on. See the picture below for a case attached to the timer.

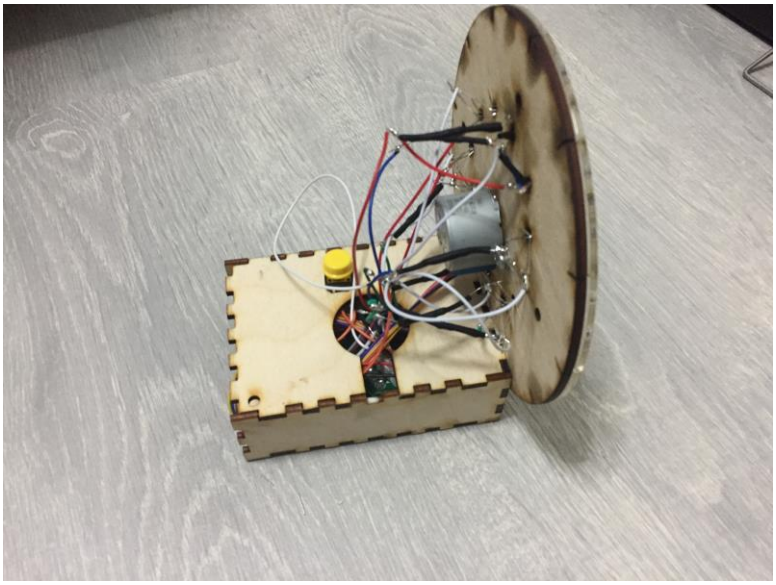

Figure 11 - Case Glued to Back

Step 11: Attach two printed components

The back side of the timer is done, now for the front side. First slide in the first component into the stepper motor. Glue the second component onto this component

Figure 12 - Both Components

Step 12: Use standoff spacers to attach the front and back side of the timer

Standoff spacers should easily be fitting in the four holes cut at every 90 degree of the timer.

Step 13: Click last 3d print component on the timer and we are done :).

The last printed component is the clock hand. This component easily clicks onto the middle component sticking out. No need to glue these two parts together.

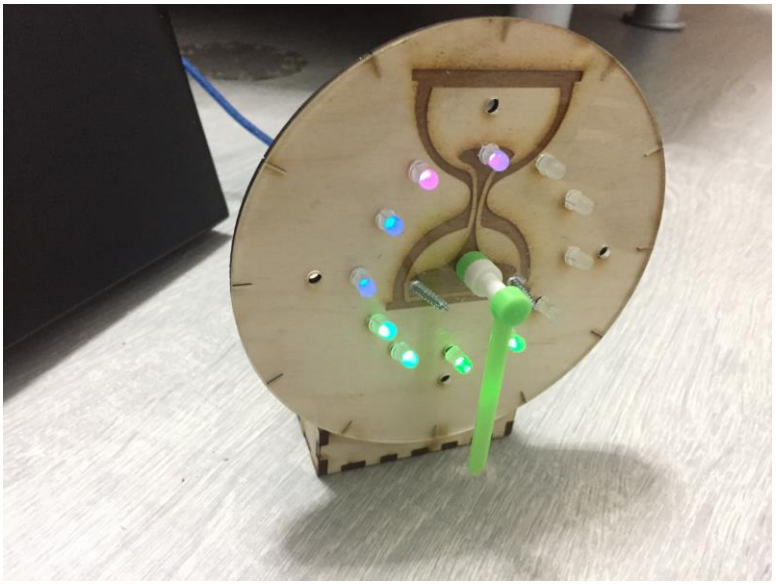

Figure 13 - End Result (Missing Front)