User Manual

Getting Started

This user manual will detail the function of the automatic fish feeder, how to use it, and how to properly maintain it. The function of the automatic fish feeder is to feed goldfish in the aquaponic system at the Lopez Elementary school in Pomona, California. The fish feeder should not be used as the sole source of food for the fish, but should only be used during the weekends, holidays, or other times that regular feeding cannot be completed.

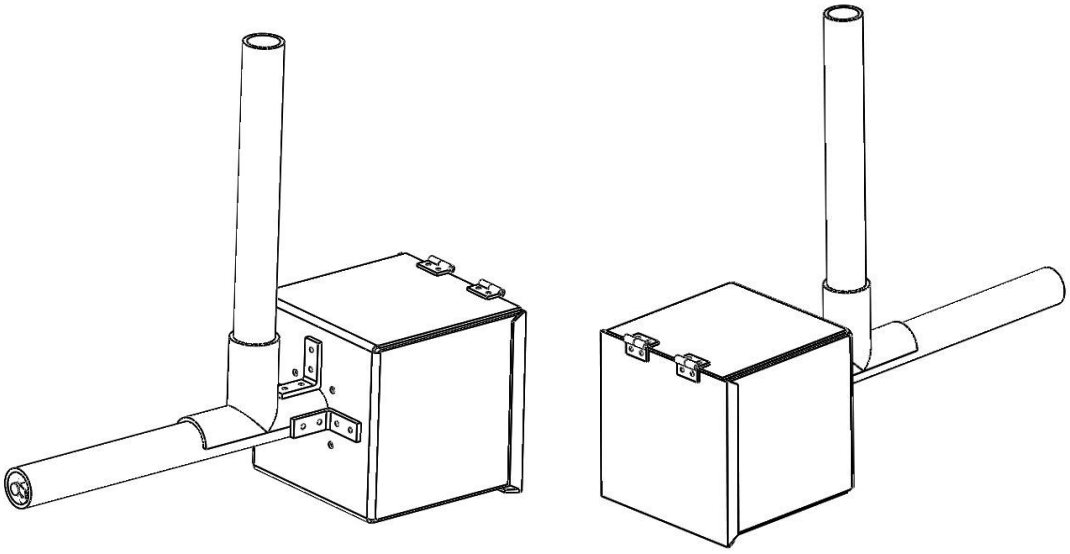


Figure 1: Drawings of Automatic Fish Feeder

Shown in the figures above, the fish feeder functions by turning a reciprocating screw, called an auger bit, that pushes the fish food forward. The end of the auger bit should be placed over the surface of the water so that the fish food falls onto the surface of the water. The fish food is placed in the vertical PVC pipe so that gravity pulls the fish food down onto the auger bit. A motor is controlled by an Arduino to feed the goldfish a certain amount at certain times of days.

Startup Procedure

1. Remove vertical PVC cap
2. Pour fish food into the vertical PVC pipe
3. Flip the on/off switch on the 9V battery pack
4. Press the primer button until fish food begins to fall out of the end of the horizontal pipe
5. Close the sheet metal box to protect the electronics
6. If possible, ensure the fish feeder feeds after 5 hours

Changing Feed Variables

In order to change the critical fish feeding variables the code for the Arduino needs to be altered directly. To do this a laptop and a USB cord is needed, as well as the installation of the Arduino IDE. The Arduino IDE can be downloaded using this link:

https://www.arduino.cc/en/Main/Software

The files necessary to change the amount of fish feed, the fish feeding time interval, and other important variable, can be downloaded from Github using the link below. Make sure to read the READ ME.txt file once the files are downloaded from github before taking any further actions.

https://github.com/alechasegawa/Automatic-Fish-Feeder

Once the Arduino IDE is installed and the automatic fish feeder files are downloaded, the code should be viewable. Close to the top of the code this section should be found:

```
//======================== adjustable variables ================================
double RPM = 10; //The RPM the stepper rotates at
double feedinterval = 5; //feed every 5 hours twice a day
double feedsubinterval = 15; //feed again after 15 minutes for smaller fish
double feedrate = 360; //360 degree turn of the auger bit
int feednumber = 2; //number of feedings per day
```

Table 1: Fish Feeder Critical Variable Descriptions

Variable	Description
double RPM	How fast, in revolutions per minute, the auger bit will rotate when feeding the fish. This normally not be changed unless assistance from a technician or other knowledgeable personel is available. Default is 10 RPM
double feedinterval	The time between feeds in hours. Default is 5 hours.
double feedsubinterval	The fish feeder feeds a default 15 minutes after every major feeding, to ensure even the smaller fish get food.
double feedrate	How much the motor rotates the auger bit in degrees. This controls how much fish food is pushed into the water. Default is 360 degrees.
int feednumber	How many times per day the fish get fed. Default is 2 times.

Once the fish feeding variables are edited the check mark button at the top left of the Arduino IDE screen should be pressed. This button runs through the code and ensures there are no errors. If an error is found, orange text will appear at the bottom of the screen describing

the issues. Once there are no issues then the Arduino should be connect via USB cord to the computer in use and the code should be reuploaded.

Maintenance

It is recommended that the automatic fish feeder be cleaned before every refill. The fish feeder can be properly cleaned using the following procedure.

1. Ensure the automatic fish feeder is empty of fish food or any other blockage
2. Remove the screws connecting the PVC pipes to the L-Brackets
3. Carefully remove the PVC pipes from the automatic fish feeder
4. Rinse the PVC pipes with water, removing any residual particulates
5. Wipe or rinse of the auger bit that is now exposed after PVC removal
6. Remount the PVC pipes to the L-brackets using the removed screws

If the automatic fish feeder system stops working, the steps outlined in the “Disaster Plan” section should be followed. This maintenance is only necessary to ensure no blockage or jamming of the system occurs over time.

Bill of Materials

Below is the list of materials used to construct the automatic fish feeder. The source of each part is listed below in case a replacement part needs to be purchased.

Table 2: Bill of Materials for Automatic Fish Feeder

Item	Name	Application	Source
Stepper Motor	Nema 17 BiPolar Stepper Motor	Screw turn mechanism	Amazon
Arduino	Arduino UNO Rev3	Microcontroller	Arduino
Reciprocating Screw (Auger Bit)	Plastic Auger replacement for Cecilware CD130	Push fish feed	Amazon
Coupling	5 to 6mm OctagonStar Flexible Couplings	Connect motor shaft to auger bit	Amazon
L-Brackets	Stainless steel 90 degree L brackets	Connect PVC to sheet metal container	Home Depot
1 inch nominal PVC	1 inch schedule 40	House auger bit and fish food	Home Depot
1 inch nominal PVC Tee	1 inch schedule 40	Connect auger bit to PVC	Home Depot
Hose Clamps			Home Depot
Pipe Straps	Stainless Steel 1 inch Tube Strap Pipe Clamp		Amazon

Disaster Plan

This disaster plan outlines what steps to take to troubleshoot the automatic fish feeder if the system stops working or other issues arise. It is important to note that the automatic fish feeder system is not critical for the aquaponic system, and if any issues arise then the fish feeder can be turned off and the fish can be fed by hand. Specific issues and how to fix them will be listed below. If the issues is not apparent, then general troubleshooting steps should be taken.

Food Jamming Auger Bit

Food or other miscellaneous items could get jammed inside the PVC and stop the automatic fish feeder from running. If this occurs then follow the steps below to clear out the jam. If any other issues arise, or it is not apparent what is causing the issue then use the general troubleshooting steps outlined below.

1. The steps to clearing a jam are the same as the steps for maintenance cleaning
2. Ensure the automatic fish feeder is empty of fish food or any other blockage
3. Ensure the automatic fish feeder is turned off
4. Remove the screws connecting the PVC pipes to the L-Brackets
5. Carefully remove the PVC pipes from the automatic fish feeder
6. Rinse the PVC pipes with water, removing any residual particulates
7. Wipe or rinse of the auger bit that is now exposed after PVC removal
8. Remount the PVC pipes to the L-brackets using the removed screws

Batteries Run Low

It is possible that either the 9V battery or the 8 pack of AA batteries could run out of charge. If this occurs then the steps below should be followed.

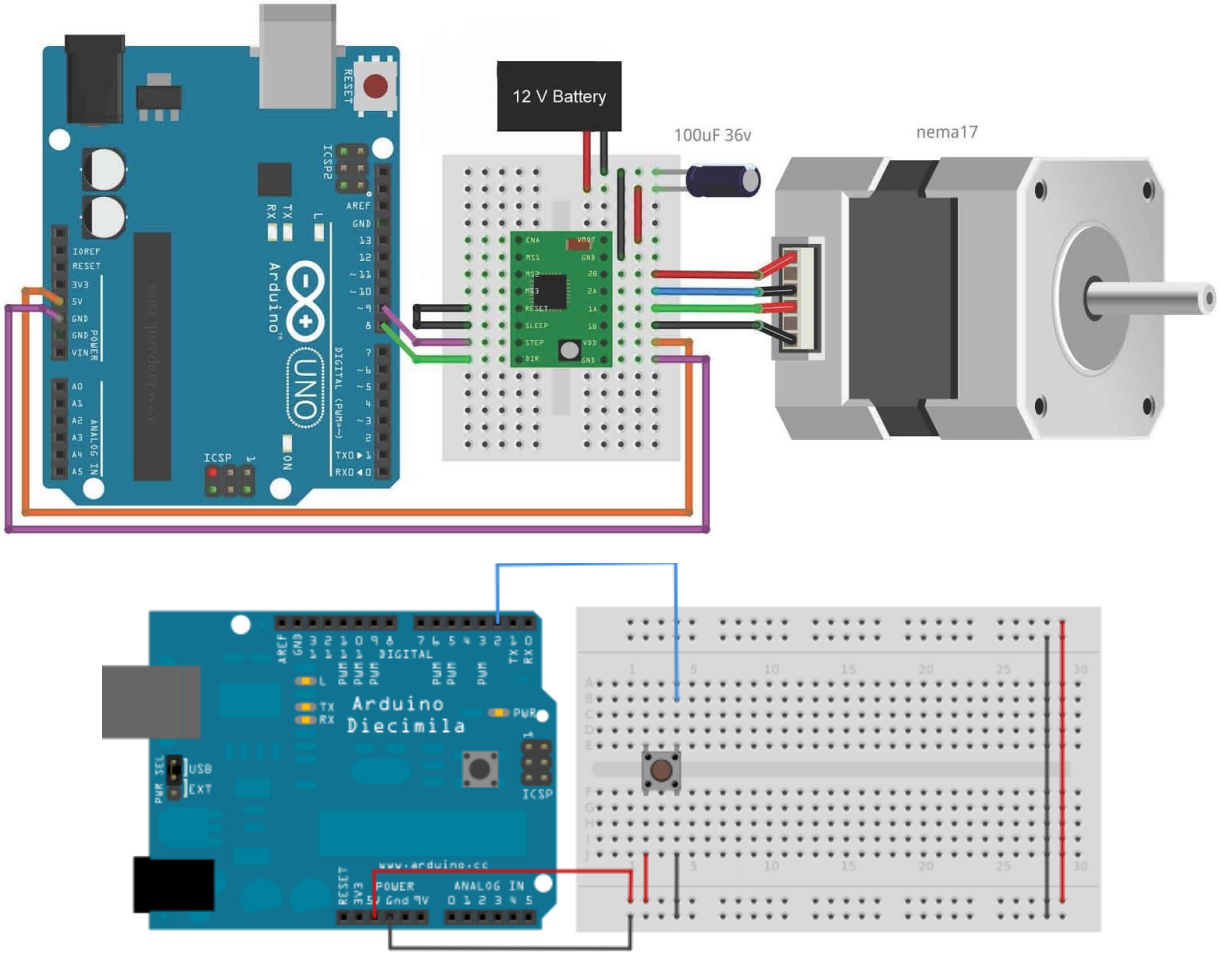
1. If the green LED on the Arduino is on, that signifies the small 9V battery is okay
2. If the green LED on the Arduino is off, the 9V battery needs to be replaced
3. If a multimeter or voltmeter is available, use a multimeter to check the voltage of the battery packs
4. If the voltage of the AA battery pack is well below 12V or the smaller battery is well below 9V then replace those batteries
5. If a multimeter or voltmeter is not available then simply try replacing the AA batteries to see if the system starts again

If these troubleshooting steps did not solve the issue, then it most likely means the batteries are not the source of the issue. Follow the general troubleshooting steps below.

General Troubleshooting Steps

These troubleshooting steps should be taken if the source of the error is not clear. If it is clear that the auger bit is jammed, or that the batteries are running low, then use the steps outlined in the respective sections above.

1. Check to see if the green LED on the Arduino is illuminated. If it is not, then the Arduino is not getting power and the 9V battery most likely needs to be replaced
2. If a fresh 9V battery does not turn the Arduino on, then the Arduino may need to be replaced
3. Remove the PVC pipes and check to see if there is any clogging
4. Check to see if the coupling is tightened around both the auger bit and the motor shaft
5. If the coupling is loose then use an allen wrench to tighten the coupling
6. Check to see if any wires have come loose
7. If any wires came loose, follow the wiring diagram for the button and the stepper motor below:



8. If all the wires appear to be connected then download the Arduino code from the Github link found in the user manual
9. Reupload the code to the Arduino, following the steps in the user manual
10. If the automatic fish feeder still does not work then completely power off the fish feeder and contact technical help using the contact information listed below
11. Continue to feed the fish manually when possible

Technical Support Contact Information
Email: alechasegawa@sbcglobal.net
Phone: (714)264-0368