



USE CASE 11

Automatic Pet Feeder

Age & Level

Group of students, Spain
17 years old

A small group of three Spanish students aged 17 are very close friends since they attended two years ago the same class. Although very different in personality, they discovered that they have similar interests like making and also 3D printing. They have followed already some of the TinkerCAD tutorials and 3D courses and printed some small personalised models that they designed in the tutorials such as a keyfob with their name on and a chess piece. The students have also already used an Arduino to make a light flash on and off at specific time intervals, sewing it on a bag.

Primary Actor and Main Goal

The girls share the common interest of loving animals. Two of them - Maria and Francesca - have dogs at home and like to spend time walking them after school. The other girl, Marla does not have a dog but has a cat and a guinea pig. All three girls love meeting up after school going to each other's homes for snacks and a drink and fussing their own and each other's pets and when the weather is nice taking the dogs to a local park where there is a large field that the dogs can run about on.

Although the girls all have access to technology at home and in school - they all have mobile phones and tablets, the girls are not particularly interested in school technology lessons.

Practical technology lessons in school often mean using hand tools and spending a long time trying to shape materials, get parts to fit and get a good surface finish.

Due to their lack of practical skills and limitation with the tools, equipment and materials, the products they made were not very creative or inspiring, as complex shapes are difficult to produce using the tools and materials they had access to.

However when they experienced 3D printing, although they only designed and 3D printed a couple of small items, this made them realise that they could use their creative skills to design something unique using a variety of shapes and forms and that the 3D printer would make it for them and produce a really nice finish. This opened up their eyes to the opportunities for making products as the technology allowed them a lot more creative freedom.

Topic and Content

The girls experiment with programming an Arduino building on their previous experience of switching an LED on at certain time intervals they adapt this so that the Arduino will rotate a servomotor at defined time intervals. They soon realise that this will allow them to produce an artefact with moving parts.

The girls want to produce a real product that solves a problem, they understand the value of using craft materials to explore their ideas and refine them to make a working prototype, but see the added value that using a 3D printer brings. The ability to 3D print solid parts in specific shapes and sizes combined with the Arduino would allow them to create a functional, usable product.

Description of Environment and Possible Pre-conditions

Their IT teacher, Jose, is fairly innovative and recently he has done some projects with students using Arduinos. He has seen already several activities with 3D prints in this context and even has one used already in the FabLab Barcelona. At some point he mentions in his class the 3D print, and Marla, who is usually not showing much interest, suddenly starts to talk about different options how a 3D printer could be used for the daily life and that it could solve several problems and issues of society. When asking which examples she would think of, several other students start to come up with ideas. Thus Jose is asking his students to think of possible projects till next week, how these projects could be addressed and to sketch a plan on how to produce these items.

At the same day, Jose gets in contact with the FabLab Barcelona and he is very fond of the offer to have a 3D printer borrowed for one week for a fairly small fee. He gets the recommendation from a FabLab team member to talk to some more experienced users in the lab to gain more experience on the 3D printer before starting the projects with the kids and to check out the Unified User Interface of eCraft2Learn.

Preparatory Work

One week later, the students' mind-mapped ideas. Maria, Francesca and Marla love their pets thus they decided to make something that would be useful for pet owners.

They decided to incorporate an Arduino controlled servo motor with 3D printed parts to make a pet feeder that can be used to feed pets at timed intervals whilst the pet's owner is away from the home for an extended period of time. Facilitated by their class teacher, the students gather and bring in from home a range of recyclable materials such as cardboard, food packaging and containers along with the craft materials, Arduino and electronics available in the classroom.

Description of Activity

The students experiment with programming an Arduino, building on their previous experience of switching an LED on at certain time intervals, they adapt this so that the Arduino will rotate a servomotor at defined time intervals.

They discuss and sketch several ideas, and then they experiment with the craft materials to test and refine their ideas. Finally they produce a design for a pet feeder which they think will work, it contains 3 separate food trays with a cover that covers up 2 of the trays, they want to rotate the cover of their feeder every 8 hours so that the next tray of food is uncovered for the pet to eat. This would mean that a pet can be fed at regular intervals for 24hrs without human intervention.

The students produce a prototype design from plastic food cartons and cardboard, however craft materials do not provide enough robustness for a working solution, so the three girls decide to use 3D printing to fabricate the feeder trays and cover. Using Tinkercad the students produce a 3D model of their design. They realise they need somewhere in the design to store the Arduino board, the wires and the design also needs to hold the servo motor in place which is attached to the rotating lid. They adapt their design to accommodate this by including a bottom casing that holds the trays and the electronics. The trays need to be removable so they can be washed and filled with food. They adapt the lid so that it has sides that fully enclose the bottom casing.

The Tinkercad designs were saved, then sliced using the Cura software prior to 3D printing. When all of the parts had printed the girls programmed the Arduino and assembled the model.

Other Stakeholders and their Possible Interests

Finally the pet feeder works exactly the way the girls have designed it and they agreed that Francesca will take it at home to show it to her parents, handing it over to Maria one week after.

Success and Condition

All three girls are very proud of their product. And they realize how astonished their parents were with what they were able to design and build.

Failure and Conditions

They reported their parents exactly what issues they had to face and how they solved them (like one part was starting to wear down slightly and one hot end was clogged)



When the girls first attempted to print the casing they found that one corner of the model came away from the print bed and warped. They aborted the print, recalibrated the Print Bed and applied a thin layer of glue to the print bed. This solved the problem and the second attempt to print worked well.

Upon testing the assembled model, the lid was found to be a bit too tight to rotate smoothly and made a scraping sound as it moved. The girls watched a short video in the UUI that showed how to resize a model in Cura, then they resized their lid design in Cura to make it slightly bigger and reprinted it, the second print fitted well and moved much smoother when rotated by the servo motor.

Barriers/Facilitators

All three girls realized that the support of the teacher and the facilitator in the FabLab was great to have, since they gave valuable tips on how to proceed with the printing when they had issues.

Variations

As for Marlas pet, the girls decide to adapt it to the smaller size of her cat.