ISEF RESEARCH PLAN/PROJECT SUMMARY

Research Plan for Engineering Design Projects

Define a need/identify problem:

The problem is that we have animals that eat or disrupt our gardens. I want to come up with an automated device that will scare squirrels and birds when they get near the plants but not harm them.

DefineTarget User for your product:

My target group is aimed at amateur gardeners who want to protect their vegetables from squirrels and birds who are eating them.

This (see photo) is currently on the market but I'm making mine automated and better built as well as integrating an Arduino and automated system.

This is what I found on the internet as ways to scare off squirrels from gardens:

How To Keep Squirrels Away From Tomato Plants

1. solar electric fencing.
2. bird netting.
3. sprinkle hot pepper on them, or Tabasco sauce (cayenne pepper is good too)
4. hang a plastic owl on a plant hook near the tomatoes: it'll swing around in the breeze and the squirrels will stay away.
5. cage your tomatoes.

https://www.treehugger.com/ways-to-keep-squirrels-from-eating-your-tomatoes-4864233

Design criteria:

Criteria for my design:

- **Cost to purchase or use:** I want to keep my prototype/product cost under $75.00 and then have the plans available for others to build and to sell the finished product for under $75.00.
- **Lifespan/Protection from outside elements such as rain and wind:** I want my product to have a covering to keep the electronic parts from getting wet and stop working.
- **Size: I** am trying to determine what my size constraints will be but ideally, I want my product to work for a small-sized garden or several plants.
- **Harming the animals:** I do not want the animals to be harmed in any way but just frightened enough to not return and eat the plants.

Do I have the skills to design this prototype? I am learning how to work with an Arduino and writing code using some tutorials. I also have an older brother who I can ask for technical assistance.

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Materials & Design Plans (materials used and how to construct your prototype)

Materials:

My design was an Arduino connected to a passive infrared sensor and breadboard with jumper cables to connect the components together. I watched YouTube tutorials on how to code and build the Arduino.

Testing

From my drawing, I built the device (jumper cables, breadboard, infrared PIR motion sensor, Arduino buzzer) and added an LED to alert me when the device would go off. This helped me know when the 20,000 Hz sound went off, since I could not hear it (I could hear the other frequencies).

By watching other people's videos and codes, I tweaked the code here and there until it worked.

I connected the Arduino to a powerbank and then walked into my front-yard and placed the Squirrel Squealer down in the grass (hidden) close to the plants that they liked to eat. I hid 3 meters away, and waited for squirrels to pass by. I tested four different frequencies 20,000 Hz, 15,000 Hz, 5,000 Hz, and 3,000 Hz for 30 minutes for each sound in two locations.

I will use my design criteria (listed above) and test the device to determine if the prototype will be successful at scaring off squirrels without causing them any harm.

RISK AND SAFETY: Identify any potential risks and safety precautions needed. **Identify HOW you will reduce risks.** List any chemicals, tools, contents under pressure, potentially hazardous activities or materials, lab work, etc.

Safety goggles and adult supervision will be used when cutting any material or working with wires to protect eyes and hands. Adult will supervise wiring but no electrical outlets will be used; only a battery.

Works Cited/BIBLIOGRAPHY:

https://www.arduino.cc/ - https://hackaday.com/2018/04/30/training-the-squirrel-terminator/ - https://www.gardendesign.com/how-to/squirrels.html - https://www.finegardening.com/article/how-to-design-a-pest-proof-vegetable-garden - https://bonnieplants.com/gardening/keeping-squirrels-out-of-the-garden/

Training the squirrel terminator:

https://hackaday.com/2018/04/30/training-the-squirrel-terminator/

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