

SMART BIRD HOUSE

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1. Introduction

As many people know birds are as important to the environment as to the humans, for example they help with cross-pollination which help with the production of healthy seeds that humans can use in agriculture, which at the same time help to the seed propagation that the environment needs to grow more nature. Therefore for this and more reason they should have appropriate places to nest.

Because of deforestation many birds don't have safe places to nest so as the causatives persons the least we can do is give them a safe place to live and eat. Bird houses provide secure spaces where birds can nestle meanwhile people can have a new hobby that benefits the wildlife. There are many benefits of having a bird house, they improve your mental health, you get to have a new wild pet as you see them in your garden, and you can see the eggs hatch. And with the computer vision you get to learn about them and have more data.

For the smart bird house with computer vision people can watch when a bird come and know the conditions of the house at that specific moment. When a bird come the camera will take a picture and upload it to Google Drive, the name of the file will be the date and time in which have been taken. It will also send a email with the temperature and humidity at the time the picture was taken.

2. Methods and Materials

2.1. How to build a bird house

It's important to build the bird house according to the specific species you are looking for. Steps for building a bird house:

- Choose your bird.
- Investigate the need for your specific bird so it fulfils its needs.
- Select the proper materials.
- Build the house so it won't need much maintenance, it needs to stay dry and warm.
- Provide ventilation.
- Make it safe from predators and do not add perches.
- Locate your bird house.

To build your bird house this link is helpful:

[\[\[https://www.adfg.alaska.gov/index.cfm?adfg=livingwithbirds.birdhousetips#:~:text=Wood%20is%20the%20best%20material,3%2F4%2Dinch%20plywood\]helpful\]](https://www.adfg.alaska.gov/index.cfm?adfg=livingwithbirds.birdhousetips#:~:text=Wood%20is%20the%20best%20material,3%2F4%2Dinch%20plywood]helpful)

To select the material of your bird house this link is helpful:

<https://woodworkly.com/best-wood-for-birdhouse/>

The best location for a bird house depends on the needs of the bird species. Although there are some

recommendations such as been away from trees and predators by being mounted on a pole that is 5 to 30 feet off the ground. Also is suggested to be camouflaged so predators don't find it easy and attacked it.

For setting a bird house there are some recommendations to consider, for example:

- Accessible for people to watch it. It's true that it needs to be camouflaged for predators but is also important to bird watchers to observe it and maintain, to keep it clean when is emptied and of course to see the birds.
- Nesting materials. It is recommended to have the bird house furnished with some nesting materials so birds can be comfortable, for example with pine needles, dead grass, string and thread to mention some of them.
- Bird houses should be spaced apart. Some birds are territorial so the houses should be spaced by at least 25 feet apart, so the birds are comfortable in their houses.
- Shading from the sun is not required. Keep in mind the color of the house and the material so it won't overheat in the summer. It's not necessary that the house is place in a shadow place, but it can provide some protection from the afternoon sun.

To place your bird house this link is helpful:

<https://birdingoutdoors.com/whats-the-best-location-for-a-bird-house/>

2.2. Hardware

2.2.1. ESP32-CAM



Link to the figure:

<https://www.reichelt.de/de/de/entwicklerboards-esp32-kamera-2mp-25--debo-cam-esp32-p266036.html?r=1>

Link to the specifications and data sheet:

<https://loboris.eu/ESP32/ESP32-CAM%20Product%20Specification.pdf#:~:text=Module%20Model%20ESP32-CAM%20Package%20DIP-16%20Size%2027%2A40.5%2A4.5%02%C3%84%C2%B10.2%02%C3%85mm%20SPI,Storage%20Environment%20-40%20%01%07~%2090%20%01%07%2C%20%3C%2090%25RH>

The ESP32-CAM has a very competitive small-size camera module that can operate independently as a minimum system with a footprint of only 27*40.5*4.5mm and a deep sleep current of up to 6mA.

ESP-32CAM can be widely used in various IoT applications. It is suitable for home smart devices,

industrial wireless control, wireless monitoring, QR wireless identification, wireless positioning system signals and other IoT applications. It is an ideal solution for IoT applications.

ESP-32CAM adopts DIP package and can be directly inserted into the backplane to realize rapid production of products, providing customers with high-reliability connection mode, which is convenient for application in various IoT hardware terminals.

Why was this module chosen?

2.2.2. Mini PIR Motion Sensor



Link to the figure: <https://www.seeedstudio.com/Grove-mini-PIR-motion-sensor-p-2930.html>

Link to the specifications and data sheet:

<https://www.seeedstudio.com/Grove-mini-PIR-motion-sensor-p-2930.html>

The Grove - mini PIR motion sensor is a compact, low power consumption, and cost-effective PIR sensor which is suitable for applications with relatively less detection distance requirements.

Features

- Adjustable sensitivity: a reserved pin out on board to solder a slide rheostat to adjust the sensitivity
- Easy to use: Grove compatible interface and supports both Arduino and Raspberry Pi platforms
- Mini size: 20mm x 20mm x 12mm

2.2.3. Temperature and Humidity Sensor DHT22



Link to the figure: <https://cityos-air.readme.io/docs/4-dht22-digital-temperature-humidity-sensor>

Link to the specifications and data sheet:

<https://thepihut.com/products/dht22-temperature-humidity-sensor-extras#:~:text=The%20DHT22%20uses%20a%20capacitive,careful%20timing%20to%20grab%20data.>

<https://pdf1.alldatasheet.com/datasheet-pdf/view/1132459/ETC2/DHT22.html>

The DHT22 is a basic, low-cost digital temperature and humidity sensor. Due to its low cost and ease of use, you'll find project examples all over the web for these simple sensors.

The DHT22 uses a capacitive humidity sensor and thermistor to measure the surrounding air, then provides that data via a digital output signal on the data pin. They're easy to use, however, they require some careful timing to grab data. Body size 27mm x 59mm x 13.5mm

2.2.4. UartSBee V5



Link to the figure: <https://www.seeedstudio.com/UartSBee-V5.html>

Link to the specifications and data sheet: <https://www.seeedstudio.com/UartSBee-V5.html>

UartSBee v5' is FTDI cable compatible USB to Serial adapter equipped with BEE socket(20pin 2.0mm). The integrated FT232RL can be used for programming or communicating with MCUs. On the other hand, you might connect your PC to various wireless applications via a Bee compatible module. UartSBee provides breakouts for the bit-bang mode pins of FT232RL as well. This Bit-bang mode pins (8 I/O pins) can be used as a replacement for applications involving PC parallel port which is scarce now a day.

2.2.5. Universal USB/DC/Solar Lithium Ion/Polymer charger



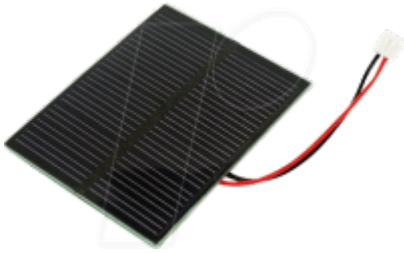
Link to the figure:

<https://www.exp-tech.de/en/modules/lipo-charger/10407/universal-usb/dc/solar-lithium-ion/polymer-charger>

Link to the specifications and data sheet: <https://www.adafruit.com/product/4755>

This charger is the only one you need to keep all your Lithium Polymer (LiPoly) or Lithium Ion (Lion) rechargeable batteries topped up. No matter the power source at your disposal! The Adafruit Universal USB / DC / Solar Lithium Ion/Polymer Charger can use USB, DC or Solar power, with a wide 5-10V input voltage range! The charger chip is super smart, and will reduce the current draw if the input voltage starts to dip under 4.5V, making it a perfect near-MPPT solar charger that you can use with a wide range of panels.

2.2.6. Solar panel



Link to more specifications about solar panels: <https://www.britannica.com/technology/solar-panel>

A solar pannel is a component of a photovoltaic system that is made out of a series of photovoltaic cells arranged to generate electricity using sunlight. Size 13 cm x 15 cm.

2.3. Software

3. Results

4. Discussion and Conclusion

4.1. Improvements

As always there are some improvements that can be made. It would be better to use an infrared camera so even when it's dark the pictures are visible. Also for the current design of the house there can be some improvements by providing more holes so it has more ventilation and it wont accumulate water.

6. Bibliography

This links are helpful to build, design and select the proper materials for your bird house:

<https://www.birdhouses101.com/bird-houses/materials-used-for-building-birdhouses/>

<https://www.thespruce.com/before-you-build-a-birdhouse-386647>

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