THE DESK

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https://github.com/Zakiyanggg/TheDesk/

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Abstract

We decided to design a system that can automatically locate your phone on a surface and the wireless charging base will move to the right position and start charging your phone or other wireless charging device. This could be applied to a bed side table or a working desk. Our initial idea is using Raspberry Pi to support the CV part and generate coordination information to the motor control system, which we prefer to use an UNO board. For sensors, we just need a webcam to capture the object on the table surface. We might upgrade the camera to stereo type in order to get more accurate location information. We need two step motors to drive the linear slide rails. Two sets of linear rails can let the charging pad move across the entire surface. A charging pad that supports most common fast charging devices. It might be hard to train the ML module to recognize a smart phone on a messy table and Raspberry pi only supports a few packages for computer vision modules including TensorFlow Lite, Coco and etc. which the functionality is quite limited. We also need to design a system to collect the free wires flying around two rails, to make sure they won't entangle. For safety features, We need to put switches that prevent the motors going too far that might damage the rails or gears.

Motivation

Have you ever had situations when you put your phone on the charging pad, but in the morning you find it didn't charge the phone because the device was not put in the center or you accidentally move it from the center? As a daily wireless charging device user, I usually recheck my phone to make sure it's charging properly, but with The DESK, I do not need to spend the extra time and energy.

Goals

- Two linear rails can drive the wireless charger to destination
- CV module can recognize multiple device that need to be charged on the surface
- After fully charging first device, the charging pad can move to the next

A. Milestone 12/03

Using computer vision to figure out the positioning system, and verify the slide can move the charging pad to the desired location.

B. Final Demo 12/17

Achieve some extra functions on the system and figure out a way for multiple devices charging situations.

Methodology

Camera + Pi

- ➜ Use Computer Vision to locate the device
- ➜ Convert the location information to the preset coordinate system
- ➜ Generate PWM signal to drive the step motors

Linear Slides + Step motor

- ➜ Create two linear slides system
- ➜ Set start / stop point on slides
- ➜ Push charging pad to the desired location
- ➜ Reset after charging finished

Components

Raspberry Pi 4: Running Ubuntu Linux system. We need a pi to run the computer vision configuration code, in order to recognize multiple chargeable devices on the table surface.

Linear rails with step motors: Two linear rails are needed to drive the charging pad throughout the entire surface.

Arduino board: We might need an Arduino board since we learnt how to generate PWM signals. It's possible that the Pi can handle this job but we might need extra work to figure out how GPIOs work on the Pi.

Webcam: The only sensor type device we need to support computer vision. We might upgrade it to stereo type since it will provide more detailed distance information.

Evaluation

What is your metric for evaluating how well your product/solution solves the problem? Think critically on this section. Having a boolean metric such as "it works" is not very useful. This is akin to making a speaker and if it emits sound, albeit however terrible and ear wrenching, declare this a success.

It is recommended that your project be something that you can take pride in. Oftentimes in interviews, you will be asked to talk about projects you have worked on.

Timeline

Week	Task
Week 1: 11/09 - 11/15	Final project proposal. Order table, slides, motor and sensors. Install required package for Raspberry Pi.
Week 2: 11/16 - 11/22	Research on computer vision. Figure out the slides position and install them. Design a good stand for the motor using 3D printer.
Week 3: 11/23 - 11/29	Program the Raspberry Pi with the camera. Control the servo motor to achieve precise positioning control. Ensure the computer vision can cooperate with the motor system.
Week 4: 11/30 - 12/06	Milestone 1: make sure the system can response within designed time range and test some edge situations.
Week 5: 12/07 - 12/10	Continue programming and add up the function for multiple devices support. Some other add-on features will be considered as well.

Proposal Presentation

https://youtu.be/05yN_9fll7I

References

https://www.macrumors.com/guide/airpower/

https://www.amazon.com/OrangeA-20-1500mm-Carriage-Automated-Equipments/dp/B07DMG4P94/ref=sr_1_11?keywords=linear+rails&qid=1636783823&sr=8-11