SOFE 4590U: Embedded Systems
Fall 2021
Assignment 3 : Embedded system configuration Assistant

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Due Date: Dec 2, 2021

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1 - Introduction

     There are many possible embedded systems available for purchase, and developers must know which one is suitable before deciding which one to buy. The hardware choices contain the options for Wi-Fi, Android compatibility, sound processing and more. This assignment will mention the different motives that should be investigated when selecting the right hardware for embedded systems.

2 - Embedded Systems Rationale

2.1 - Coral Dev Board

The Coral Dev Board [1] is a single-board computer developed by Coral.ai from Google[2]. They are driven to making artificial intelligence more accessible for embedded systems environments. The price for this system is $169.99, it also includes WiFi, 1GB RAM, and machine learning with Tensorflow[3]. Therefore, this SBC would be good for machine learning / artificial intelligence applications.

2.2 - Hikey 970 Development Board

The Hikey 970 Development Board [1] is a single-board computer developed by 96Boards[4]. This board was developed for accelerated AI and deep learning. The price is $299, it includes WiFi, 6GB RAM, and excels in Machine learning. This high-end solution is great for fast artificial intelligence, deep learning and photo processing.

2.3 - NVIDIA Jetson Nano

The Jetson Nano Developer Kit [1] is another single-board computer developed by NVIDIA. This kit was developed specifically for AI application but is a general-purpose computer and quite affordable. The Jetson Nano costs $89.00, comes without WiFi, 4GB RAM but also is equipped with a GPU capable and specifically designed for artificial intelligence. This is a generally average non-WiFi solution with machine learning capabilities.

2.4 - Nvidia Jetson TX2

The Jetson TX2 [5] is another powerful machine-learning single-board computer developed by NVIDIA. The graphics processing unit that this computer uses are of the 10 series also developed by NVIDIA. While having 8GB of RAM, WiFi and machine learning capabilities, this computer is also the most expensive on this list at $399 as a starting rate. This computer is very powerful for machine learning and deep learning.

2.5 - Odroid XU4

The Odroid XU4 [5] is a single-board computer from a South Korean company called Hard Kernel. The name is derived from 'Android' and 'Open', however, the Odroid hardware is not open source. The price point for this hardware is $130.25 [6], it includes WiFi, 2GB RAM, machine learning capabilities[7] as well as an Android operating system. This is a great option for android machine learning.

2.6 - Raspberry Pi 4 Model B

The Raspberry Pi 4 Model B [1][5][8] is the most popular single-board computer created by the Raspberry Pi Foundation. This board is considered the best bang-for-buck value when compared to other manufacturers. The model B starts at $35 and runs its own OS called Raspbian which is a version of Debian OS. It has WiFi, anywhere from 1GB RAM to 8GB,but does not have machine learning or Android OS. This is the most well-rounded embedded system with overall performance, reliability and affordability.

2.7 - Raspberry Pi Zero

While on the affordable Raspberry Pi topic, we can discuss the Raspberry Pi Zero [1][5]. This board, also developed by the Raspberry Pi Foundation, is the most affordable single board computer on the market. At a cost of only $5, the board provides 512MB of RAM, no wifi, no gpu but 1 computing core. This is perfect for low energy consumption, low cost embedded systems.

2.8 - Raspberry Pi Zero W

Similar to the above mentioned Raspberry Pi, the Raspberry Pi Zero W [1] is the same device as the Raspberry Pi Zero, but offers WiFi and Bluetooth connectivity at the cost of $10 instead of $5. Since these boards are so small, they can be found inside security cameras, robots and will be very useful for other cheap miniature wireless devices.

2.9 - Respeaker Core v2.0

The Respeaker Core v2.0 [1] is a board that is created by Respeaker.io[9]. This audio-processing specialized board is the all-in-one solution for smart-speakers. At $99, it offers WiFi, 1GB RAM, Android OS, and fully documented speech algorithms. This is the textbook definition of a perfect computer for speech related embedded systems.

2.10 - UDOO Quad

The UDOO Quad [5], created by UDOO. It provides the functionalities of the Arduino and the Raspberry Pi on a single board. The single board computer costs $135, it provides WiFi, 1GB RAM but no built in machine-learning functionalities. This board would be great for a system that requires a strong and reliable connection and this will also be an easier solution instead of spending hours creating an interface where the devices can communicate with one another.

3 - Configuration Assistant Program

The Embedded Configuration Assistant program was developed in Python and compiled into an executable using PyInstaller. This program will ask you questions regarding an embedded systems project and depending on the answers, it will return a list of hardware suggestions to use in the project. The program uses dictionaries to store the point values as well as tuples to handle answers and suggestion elements instead of strings or lists. This is because strings and lists are less memory efficient than tuples in python and they process faster[10].

Source Code included in submission folder and also available on GitHub. Please use the README.md file as a manual for this program: https://github.com/OwaisQuadri/ESYS_A3

3.1 - Demonstration

This demonstration is showing the functionality of the "Embedded Configuration Assistant" program. It takes inputs of 'y'(yes) and 'n'(no) to various questions to gauge the user's application of the embedded systems. The program uses this information to generate a score for each embedded system and returns the device with the highest score to the user. Multiple devices can be suggested to the user, and if the program decides to output multiple suggestions, they are sorted from lowest price to highest price.

Personal link to video:

https://drive.google.com/file/d/1521O87pZIvqXaw5fePDUJsTN5TCSEK51/view?usp=sharing

Link to video in shared drive:

https://drive.google.com/file/d/1TdMINW_CsKuJXJHHXjP4Dk-IBLkODbVb/view?usp=sharingv

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