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| --- | --- |
| **Group** 27 | Item Tracker |
| **Major:** | **Team members:** |
| CS | Mohammad Aljagthmi |
| EE | Ryan Ly |
| CEG | Jake Manser |
| CS | Donald Taylor |

**HW/SW Design Trade**

Hardware/software design choice to be made (include its identification within your system architecture):

Controller - Size

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Design Options for Microcontroller | | | |
| Criteria | Raspberry Pi Zero W | Arduino MKR WiFi 1010 | Adafruit Feather M0 WiFi – ATSAMD21 + ATWINC1500 | Adafruit HUZZAH ESP8266 breakout |
| Constraint 10 | 5 mm | ####  We know it is well under 2 cm | 8 mm | 5 mm |
| Constraint 20 | 30.5 mm | 25 mm | 22.8 mm | 25 mm |
| Constraint 30 | 66 mm | 61.5 mm | 53.65 mm | 38 mm |
| Constraint 40 | 9.3 g | 32 g | 6 g | 5 g |

Controller – Wi-Fi Compatibility

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Design Options for Microcontroller | | | |
| Criteria | Raspberry Pi Zero W | Arduino MKR WiFi 1010 | Adafruit Feather M0 WiFi – ATSAMD21 + ATWINC1500 | Adafruit HUZZAH ESP8266 breakout |
| Requirement 1.0 | ####  Commercial products adhere to IEEE 802.11 | ####  Commercial products adhere to IEEE 802.11 | ####  Commercial products adhere to IEEE 802.11 | ####  Commercial products adhere to IEEE 802.11 |
| Requirement 2.0 | ####  Depends on SW development | ####  Depends on SW development | ####  Depends on SW development | ####  Depends on SW development |
| Requirement 3.0 | ####  Comms via Wi-Fi | ####  Comms via Wi-Fi | ####  Comms via Wi-Fi | ####  Comms via Wi-Fi |
| Constraint 70 | ####  Commercial products adhere to IEEE 802.11 | ####  Commercial products adhere to IEEE 802.11 | ####  Commercial products adhere to IEEE 802.11 | ####  Commercial products adhere to IEEE 802.11 |
| Standard 10 | ####  Commercial products adhere to IEEE 802.11 | ####  Commercial products adhere to IEEE 802.11 | ####  Commercial products adhere to IEEE 802.11 | ####  Commercial products adhere to IEEE 802.11 |

Controller - Controller

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Design Options for Microcontroller | | | |
| Criteria | Raspberry Pi Zero W | Arduino MKR WiFi 1010 | Adafruit Feather M0 WiFi – ATSAMD21 + ATWINC1500 | Adafruit HUZZAH ESP8266 breakout |
| Constraint 60 | #### | #### | #### | #### |
| Constraint 160 | ####  Depends on Ryan’s performance | ####  Depends on Ryan’s performance | ####  Depends on Ryan’s performance | ####  Depends on Ryan’s performance |
| Constraint 180 | #### | #### | #### | #### |
| Standard 40 | #### | #### | #### | #### |
| Standard 90 | ####  Depends on Ryan’s performance | ####  Depends on Ryan’s performance | ####  Depends on Ryan’s performance | ####  Depends on Ryan’s performance |
| Standard 100 | #### | #### | #### | #### |

Lighting – Size/Power consumption

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Design Options for Microcontroller | | | |
| Criteria | Raspberry Pi Zero W | Arduino MKR WiFi 1010 | Adafruit Feather M0 WiFi – ATSAMD21 + ATWINC1500 | Adafruit HUZZAH ESP8266 breakout |
| Constraint 60 | ####  Does not have integrated LED | ####  Does not have integrated LED | ####  Does not have integrated LED | ####  Has integrated LED |

We chose to use the Adafruit HUZZAH ESP8266 breakout because it fits the size constraints while having the required Wi-Fi and microcontroller functionality. Wiring constraints and Wi-Fi usage are dependent on other parts of the design.

Power Source - Size

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Design Trades for Power Source | | | | |
| Criteria | 4 AAA Batteries in Series | 6V NiMH Battery pack | Solar cells | 2 3V button cell batteries in series | Hamster wheel and hamster |
| Constraint 10 | 178 mm | 72 mm | 145 mm | 24.5 mm | 342.9 mm |
| Constraint 20 | 10.5 mm | 50 mm | 145 mm | 24.5 mm | 304.8 mm |
| Constraint 30 | 10.5 mm | 15mm | 2.5 | 10 mm | 127 mm |
| Constraint 40 | 46 g | 141.748 g | 80 g | ~25 g | 997.903 g |
| Standard 40 | #### | #### | #### | #### | #### |

Power Source – Voltage output

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Design Trades for Power Source | | | | |
| Criteria | 4 AAA Batteries in Series | 6V NiMH Battery pack | Solar cells | 2 3V button cell batteries in series | Hamster wheel and hamster |
| Voltage Output | 6V | 6V | 6V | 6V | To Be Determined |

We chose to use the 2 3V button cell batteries in series implementation because it is the smallest choice that can supply the required voltage to the microcontroller.

Attachment Method – Secure attachment

|  |  |  |  |
| --- | --- | --- | --- |
|  | Design Trades for Attachment Method | | |
| Criteria | Rubber Bands | Hook-and-Loop Fasteners | Epoxy |
| Requirement 4.0 | #### | #### | #### |
| Standard 20 | #### | #### | #### |

Attachment Method – Removable

|  |  |  |  |
| --- | --- | --- | --- |
|  | Design Trades for Attachment Method | | |
| Criteria | Rubber Bands | Hook-and-Loop Fasteners | Epoxy |
| Requirement 4.1 | #### | #### | #### |

Attachment Method – Capable of reattachment

|  |  |  |  |
| --- | --- | --- | --- |
|  | Design Trades for Attachment Method | | |
| Criteria | Rubber Bands | Hook-and-Loop Fasteners | Epoxy |
| Requirement 4.2 | #### | #### | #### |

We chose to use the hook-and-loop fasteners (Velcro ©) because it can be removable and reusable. We chose hook-and-loop fasteners over rubber bands because it is faster to remove and reattach with hook-and-loop fasteners than with rubber bands. Rubber bands also have the added disadvantage of adding extra strain and stress on the tracker’s external case.

Case – Damage resistance

|  |  |  |  |
| --- | --- | --- | --- |
|  | Design Trades for Case | | |
| Criteria | Tupperware | Wrap plastic cling wrap | Wrap in Aluminum foil |
| Requirement 18.0 | #### | #### | #### |
| Requirement 19.0 | #### | #### | #### |
| Requirement 20.0 | #### | #### | #### |
| Requirement 21.0 | #### | #### | #### |
| Can a Wi-Fi signal pass through it? | #### | #### | #### |

We chose to use plastic cling wrap because it is the most form fitting external material that a Wi-Fi signal can still pass through.

GUI – Programming Language

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Design Options | | | | |
| Criteria | Option 1  Java | Option 2  C++ | Option 3  Swift | Option 4  Python | Option 5  JRuby |
| Req No. 3.0 | Used for mobile app development | Used for mobile app development | Used for mobile app development | Used for mobile app development | Used for mobile app development |
| Req. No. 7.0 | Is Multi-Platform | Is Multi-Platform | Is IOS exclusive | Is Multi-Platform | Can be used on Android devices |
| Familiarity with language | All team members have experience | Some team members have experience | No experience | Some team member have little experience | No experience |
| Has Tracking Library Tools | Redpin |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

GUI – Platform for Delivery

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Design Options | | | | |
| Criteria | *Option 1*  *(model no.)* | *Option 2*  *(model no.)* | *Option 3*  *(model no.)* | *Option 4*  *(model no.)* | *Option 5*  *(model no.)* |
| *Req. 20* | **###** | **###** | **###** | **###** | **###** |
| *Req. 150*  *(data rate)* | **450 Mbps** | **450 Mbps** | **866 Mbps** | **1.73 Gbps** | **54 Mbps** |
| *Req. 175* | **###** | **###** | **###** | **###** | **###** |
| *Const. 20*  *(weight)* | **500g** | **150g** | **400g** | **600g** | **250g** |
| *Const. 50* | **###** | **###** | **###** | **###** | **###** |
| *Std. 20* | **###** | **###** | **###** | **###** | **###** |

Database - Language

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Design Options | | | | |
| Criteria | Postgres | SQL | MySQL | Room | Firebase |
| *Req. 20* | **###** | **###** | **###** | **###** | **###** |
| *Req. 150*  *(data rate)* | **450 Mbps** | **450 Mbps** | **866 Mbps** | **1.73 Gbps** | **54 Mbps** |
| *Req. 175* | **###** | **###** | **###** | **###** | **###** |
| *Const. 20*  *(weight)* | **500g** | **150g** | **400g** | **600g** | **250g** |
| *Const. 50* | **###** | **###** | **###** | **###** | **###** |
| *Std. 20* | **###** | **###** | **###** | **###** | **###** |