Define Progress Report

***Instructions****: Read all Milestone 2 information. Answer all questions. Digitally submit this document with your answers inserted. Name the document your-last-name. Any other documents requested should be uploaded as well, with a similar naming convention, eg your-last-name\_ 1. Realize that your design responsibilities do not end with the questions you answer. The questions are simply there to guide you to pertinent information, relevant steps you might need to take, etc. One Milestone 2 document should be submitted for each discipline involved in the design. That means if there are multiple designers working within the same discipline then* ***while each must submit*** *a Define Milestone, it may be the* ***same*** *document. DESIGNERS are responsible for ensuring the accuracy of ALL calculations.*

***Design process steps included in this Milestone:*** *The main purpose of the Define Progress Report is for the design team to work towards turning verbal and written requirements into engineering specifications and design metrics. Designers should continue to research areas of technical relevance and begin working towards creating initial purchase lists (AFTER specifications have been determined) and begin planning physical experiments and numerical modeling exercises such that they may better understand design tradeoffs.*

***Teaming Expectations****: If more than one designer on a team is working within a discipline, for this milestone they may work together. The entire team will have to work together to form a complete set of functions, objectives and constraints which will then define the entire multidisciplinary design problem.*

## Design Theory

At this stage in the process, designers may have enough knowledge to understand what physical and technical concepts may be important to the design, but still lack clear definition of exactly what the design **must do** and what the **goals** are for the design. Each design team has compiled a list of *solution neutral* attributes, which were derived from asking “WHY?” Why might we want a particular feature or component in the design? Asking “why” enough times, eventually led us to a list of **design attributes**. Now the attributes must be organized into those that are functions and those that are objectives.

**Functions** refer to things that the design must DO. Functions are verb oriented, action words. Once identified they are organized into a “Black-Box” functional diagram (see Dym Chapter 4) which forces the designer to clearly identify **inputs** and **outputs** of the design. Design inputs are typically materials, energy and/or information. Design outputs are transformed materials, energy and information (including waste). Once inputs and outputs are very clear to the designer, the second stage functional diagram is created, in which the “top” of the box is removed and **subfunctions** are identified. Most, if not all, subfunctions should be assigned a **functional specification**. A specification answers, using specific numbers and engineering units “How much?”, “How large?”, “What size?”, etc. All potential design solutions need to satisfy the functionality identified in the functional diagram.

**Objectives** are the goals for the design. Objectives are adverbs and adjectives, describing what the design should be or how or to what extent the design should do something. Objective should be organized into a tree that relates high level objectives to lower level ones (see Dym Chapter 3). Objectives at the lowest level of the tree should be assigned **metrics**. That is, designers should ask how could two competing designs, each satisfying minimal functionality, be judged against the objectives? Measurable metrics could have units, could be binary (yes/no), or could be some way of quantifying an essentially qualitative metric (think “aesthetically pleasing”).

**Constraints** arise when there are clear limits on the design that don’t necessarily relate to the functionality that it needs to achieve. Constraints might stem from safety-related objectives. They could be physical dimensions if the design must “fit” somewhere. They often relate to following standards or design codes. Constraints form go/no-go boundaries for the design and MUST be satisfied.

Looking forward, we will use functions for design **ideation**. Designers can brainstorm different ways of satisfying each function and then mix and match those methods together, resulting in a large number of potentially viable solutions to the design problem. Feasible design concepts (those that satisfy minimum functionality) will then be compared against design objectives and metrics will be applied to decide which design satisfies those objectives to the highest degree.

Functional Specifications and Measurable Metrics

Include a copy of your team’s functional diagram (both with the black box top “on” and “removed”) and objectives tree with this document submission. NOTE: These diagrams should be digitized and report ready; NOT a snapshot of a hand drawn diagram. They should be saved as a separate pdf document.

1. **Complete the table below to the best of your ability for sub-functions that fall within your discipline purview (add rows as necessary). You will need to determine as many specifications for those functions as you can – some will come from numerical models, some from background research, some may be educated guesses. Indicate where your specifications came from in the appropriate column.**

|  |  |  |
| --- | --- | --- |
| **Function** | **Specification** | **Reference/Resource** |
| **Turning car** | **Using method in code for turning, likely switch statement, method will tell wheels to turn to right or left** | <https://edu.parrot.com/apps.html> |
| **Moving car forward and backwards** | **Using method for moving forward or backwards, method will tell wheels to rotate forward or backward** | <https://edu.parrot.com/apps.html> |
| **Stopping car** | **Method for stopping car, will tell wheels to slow down** | <https://edu.parrot.com/apps.html> |
| **Activate 4 wheel drive** | **Method for forcing car to use all 4 wheels for turning and moving** | <https://edu.parrot.com/apps.html> |
| **Using speed control** | **Method will allow car to only move at set speed which is to be determined** | <https://edu.parrot.com/apps.html> |

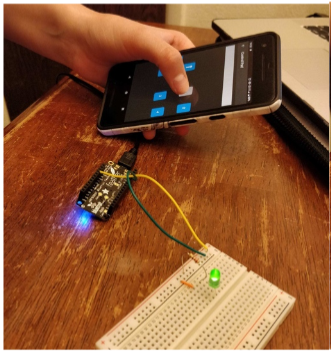
1. **Complete the table below to the best of your ability for all low-level objectives that fall within your discipline purview (add rows as necessary). You will need to provide a measurable metric for each low-level objective.**

|  |  |
| --- | --- |
| **Low-level objective** | **Metric** |
| **Connect phone/computer to car** | **Test products** |
| **Use external controller to run app on phone/computer** | **Test products** |

1. **List any constraints relevant to your portion of the design problem. Be sure to check all relevant Cat’s Conundrum Documentation.**

Must use a programmable chip in vehicle, must allow the user to control vehicle’s motion via graphical user interface, must use speed control, vehicle cannot jump or fly, can’t use pre written code from external source

Planning for physical experiments and/or numerical modeling

1. **As you consider which wireless protocol might work best for controlling the vehicle, it would be logical to test at least two different wireless protocols. The Makerspace has a variety of wireless development board options that you can use to test different options.**
   1. **Choose two different wireless protocols to test. If you are not sure which ones to choose, try the two that appear in the circuit diagrams in your discipline overview document (HCO6 Bluetooth Module, Adafruit 32u4 Bluefruit). Indicate which wireless boards you are selecting here:** I have not done this test yet, I did not plan out my time for this test, but I will do this test before choosing which protocol to purchase.
   2. **Do a very SIMPLE test. See if you can wirelessly light up an LED (a picture of someone doing this is shown below – it’s SUPER simple to wire up!)**

**Take a photo or sketch your simple circuit for each wireless board that you test.**

**A useful instructable for wiring up LEDs can be found here:** [**https://www.instructables.com/id/LEDs-for-Beginners/**](https://www.instructables.com/id/LEDs-for-Beginners/)

**The Makerspace can loan most of the supplies for this!**

* 1. **Consider the design objectives that might be relevant to this test. How did each wireless board perform? Use your metrics to assess.**

I have not done this test yet, I did not plan out my time for this test, but I will do this test before choosing which protocol to purchase.

* 1. **What information might be of use to others on your team from this test? Who might want to have input on the wireless protocol that you choose? Why?**

The size of the wireless protocol, the power that is needed to power it. ME’s could have input with choosing the device due to size and where it will sit in the vehicle. EE’s would also want to have input with this due to the wiring that will be done for other elements of the electronics of vehicle.

1. **Identify *at least* one other experiment or numerical model that you will create to better understand design parameters. One idea might be start testing different development environments for the app interface. Plan out this/these experiment(s)/model(s). Keep in mind this can/will be used in the final report.**
2. **Experiment/model seeks to determine:**

Which software will be best to use for programming my app.

1. **Design parameters to be investigated:**

Which software I am most comfortable with using, which software is easiest to understand, will determine if app will be for iOS, Mac, Android, or Windows.

1. **What constitutes a “good” result?**

If the software is easy to use and easy to follow, if I am confident I can use the software to program my app.

1. **Supplies required:**

Computer

1. **Data/information to be recorded:**

Syntax of different software, how easy it is to understand, how to program to electronics in vehicle

Model

Update your block diagram of the wireless transfer of information from the user to the vehicle. **Resubmit your pseudocode or flow diagram and summarize major changes made HERE:**

Class turnLeft { Class moveForward{ Class brake{

//will code later } //will code later } //will code later }

Class turnRight{ Class moveBackwards{ Class speedControl{

//will code later } //will code later } //will code later }

main method {

switch statement {

case turnLeft: case brake:

case turnRight: case speedControl:

case moveForward: default:

case moveBackward:

}

## Purchase List

**Begin to identify any other items that *may* need to be purchased for your portion of the design. Begin to compile a list of those items here and their estimated costs.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Part name/part #** | **Vendor** | **Quantity** | **Item cost** | **Shipping cost** | **Ship Time** |
| **ARDUINO UNO R3** | **Amazon** | **1** | **18.45** | **0** | **2 days** |
| **HC-06 Bluetooth** | **Amazon** | **1** | **8.99** | **0** | **2 days** |
| **Micro servo** | **Adafruit** | **1** | **5.95** | **4.00** | **5 days** |
| **Breadboard** | **BC robotics** | **1** | **3.95** | **2.00** | **5 days** |
|  |  |  |  |  |  |

## References

**Include those that you used to complete this assignment, use standard formatting so that these references can be copied into your final report.**

<https://www.amazon.com/Arduino-A000066-ARDUINO-UNO-R3/dp/B008GRTSV6>

<https://www.aliexpress.com/item/32699170254.html>

<https://www.bc-robotics.com/shop/solderless-breadboard-half/>

<https://www.adafruit.com/product/169>