Discovery Progress Report

***Instructions****: Read all 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. Each member of the team should submit documentation for Progress Report 1 (even if there are TWO of a given discipline on the team).*

***Design process steps included in this progress report:*** *This progress report primarily addresses the step of “discovery.” Students should be reading relevant documentation, researching applicable technical topics, observing relevant related designs, etc.*

***Teaming Expectations****: While completed individually, the Discovery progress report will form the knowledge basis of the multidisciplinary team. Therefore, team members should inform each other as points of potential integration are discovered, areas of potential difficulty, etc.*

***Documentation Considerations****: The final report will have a chapter devoted to the “discovery” phase of the design project so keeping relevant, organized notes is imperative. Consider using Google Drive or Microsoft Sharepoint to setup a team document archive. Consider setting interim writing deadlines in your project schedule.*

## Design Theory

Prior to solving any sort of design problem, you must learn about the relevant technical issues, find out how similar problems may have been solved and understand the requirements. You must *discover* relevant issues using a variety of resources and references. Old class texts, websites (commercial, professional and hobbyist may be of use), interviews with instructional and Makerspace staff could be useful. Depending on the type of project, you may need to do significant *empathy* work, talking to clients, users and even your teammates. The goal for the end of the discovery phase is to thoroughly understand the underlying physical and technical concepts, as well as the human requirements, so that you can begin to work through what *design tradeoffs* might be. Discovery work often continues throughout the entire project.

Once you have completed this progress report, you should understand the resources available to you. You should have enough information to begin weighing pros and cons of different development platforms, wireless chips, etc. You should be on the cusp of being able to determine what the appropriate scope for the control app might be.

Background Research

Provide evidence of background research exploring methods/products that might meet the functional requirements and objectives. This could be DIY videos, books, blogs, websites, etc. demonstrating the use of the methods/products you identified in a manner similar to how you might use it in your design. The goal is to familiarize yourself with a variety of possible methods for achieving your goal without yet committing to using any particular solution. Objectively identify pros and cons. Stay open to possibilities.

Once you have completed this milestone, you should have a good understanding of what is required of the Control App and some information on available opensource code options. You should also understand why hobbyist versions of this project are not necessarily very good for the challenges that the team faces.

1. What code development platforms exist for creation of a graphical control app on
   1. Android?

Android studio, Eclipse, Genymotion

* 1. iOS?

Flutter, Axcode, swift

1. Find an existing remote control app for something similar (they exist on both Google Play store and the Apple App store). Provide a screenshot. What do you like/dislike about the way the user interface on the app is configured?

I like how this remote control app looks exactly like the tv remote for Roku tv’s which makes it very easy to use. I like how the buttons still look like they are in 3D form. I do not like how there is no sound when you click a button though. When you click a button on a normal remote there is a slight click sound to it so you know you hit the button properly.

1. What types of wireless protocols are available to use with a smartphone?

Wifi, Zigbee, Z wave, Bluetooth, 6LowPAN

1. What types of wireless protocols are available to use with a computer?

Wifi, Bluetooth, Zigbee, Z wave

1. For each of the wireless protocols you just identified, find the answers to the following questions:
   1. Can you communicate both ways (send and receive information)?

Yes, wifi, Bluetooth, and Zigbee allow users to both send and receive information

* 1. Can you send two pieces of information at once? If not what is the delay between sending serially?

Yes, with wifi, there can be multiple devices on the same network at once sending information.

* 1. Can you send an alpha numeric character? A bit? An integer? A string?

Yes, you can send any numeric character through wifi, including bits, integers, and strings.

* 1. What hardware is available to receive these signals from the phone/computer?

There are lots of hardware that allow signals to be received from phones and computers, including gateways, routers, wireless access points, switches, and the most popular an Ethernet adapter.

1. To understand hardware specifications, start by googling “HC-05 specifications.” Whatever wireless receiver chip you select, you will need to understand the specifications, both for your own design purposes and so that you can pass along the relevant information to your teammates.
   1. What wireless protocol does this chip run? Who might be interested in this?

Bluetooth

* 1. How big is it? Who might be interested in this?

26.9mm x 13mm x 2.2 mm, anyone who is designing the insides of computer devices, GPS receivers, and industrial controls because they need to know how much room this chip will need.

* 1. What’s its operating voltage? Who might be interested in this?

+4V to 6V, anyone who is in charge of the electrical component of the previous listed devices.

* 1. How much current does it pull? Who might be interested in this?

30mA, again anyone who is in charge of the electrical component of the previous listed devices.

1. What happens to the instructions sent to the car from the phone/computer after they are received? Talk with your EE/CpE counterpart or study the wiring diagram to answer this.

The signal is sent from the phone or computer to the microcontroller board, which is connected to the battery and then transfers to the speed controller and the motor.

1. What is the function of the microcontroller on board the car? What development environments are native to each of the following branded development boards?
   1. Arduino Uno

The Arduino Uno microcontroller is the best board to start out with when using electronics and coding. It uses Arduino Software (IDE) 1.0.

* 1. Raspberry Pi Zero

Beginners should start with the NOOBS (New Out of Box Software)

* 1. Adafruit Feather

Includes example code written in Arduino C/C++, as projects adapt, your code will come along with you

* 1. Sparkfun RedBoard

Also uses the Arduino IDE using a USB Mini-B cable

1. How is coding a microcontroller inherently different from writing compiled code for your computer to execute?

To start things, writing code for our computers to execute is only for your computer and coding for a microcontroller can be ran by a computer, phone, and even an external controller.

1. What is the function of the motor driver? Why should you, as the App Developer, need to know this?

They are circuits used to run a motor, most commonly used for motor interfacing. The App Developer should know what everything is that is going into the car that will be controlled through the app.

1. Search for an online tutorial that walks you through controlling an RC car with a phone. Paste the reference here: While using one of these tutorials might be a good way to get started, they tend to be ill suited for our needs. What could be problematic with using one of these “hobbyist” tutorials?

[**https://www.youtube.com/watch?v=xsJ7176fLNw**](https://www.youtube.com/watch?v=xsJ7176fLNw)

The tutorials do not tend to go over a guide to code the app, the tutorials also are going over a car that does not have the same objectives and functions that ours need to have which can make the tutorials problematic.

Model

Provide a simple block diagram that shows what inputs you need (from the user, from wireless receivers, etc) and the different devices that those inputs need to be passed to in order to, ultimately, send a signal to a motor on the car. We will continue to refine this “model” but for now it can be pseudocode or a flow diagram.

User: forward, backward, right, left

Wireless receivers: controlling motors and everything associated with the motors,

## Other questions

In class, you brainstormed a list of questions with your teammates. If you answered any those questions, articulate that here. If you know of any other outstanding questions that you still need to answer, that may also be articulated here.

Resources Identified

All physical resources available at Makerspace and Light Build Room (NAH 220) have been identified and examples of how to use these resources documented and studied. Commercial resources have been investigated for purchase of physical components.

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| **Identify two open source development environments in which you might be able to code the App interface.** | **Vim and Swift** |
| **Identify at least two sources online where you find a wireless chip for the vehicle (and possibly other circuit components if no EE/CpE on your team). Identify shipping time and cost.** | **Amazon and aliexpress** |
| **List of resources in Makerspace and Light Build room that will be of use as you build your design.** |  |

## References

**Include those that you used to complete this assignment, use standard formatting so that these references can be copied into your final report.**  Those references already listed are here are to help you, but only include them if you actually use them.

* <https://components101.com/wireless/hc-05-bluetooth-module>
* <https://en.wikipedia.org/wiki/Networking_hardware>
* <https://medium.com/@hardy96tech/communication-wireless-protocols-in-iot-7da097ebbe96>
* <https://store.arduino.cc/usa/arduino-uno-rev3>
* <https://www.raspberrypi.org/products/raspberry-pi-zero/>
* <https://learn.adafruit.com/adafruit-feather/overview>
* <https://www.mepits.com/tutorial/379/electrical/motor-driver>