Project Planning Paper

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A R F

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**Team skills analysis**:

With the composition of 3 CS, 1 CE, and 1 EE, we have a solid background and foundation on the programming side with an equal balance on the circuitry side.

On the programming spectrum, we have backgrounds in C++, Java, Javascript, HTML, ARM, CSS, Python, SQL, MATLAB and are capable of learning any other programming language that may be necessary. As for experience, we have already established and are familiar with the creation of a website, android app, and a domain which will aid in the creation of the digital side of the ARF (Alpha Remote-Feeder). We are also familiar with the use, translation and implementation of differing databases.

With the CE and the EE major, we have real world experience in the design and use of circuitry through our internships. Another great asset that we have is modeling where 3 of us have a large background in CATIA and other 3D modeling. When we are looking at what we need to do in order to create the project, we will need a background in some sort of product that will allow us to connect to the internet (IoT) in which we have experience in using Microcontrollers, Raspberry Pi, and Arduinos.

Area of weakness on the electrical side will be integrating hardware to software that gives the commands of the actuator and auger and other possible included functions. We’ve had some experience in working with transforming AC to DC in class, but there is some uncertainty in how we will proceed on this subject. Another area of uncertainty is the power costs of some of our components and the direct path to take in order to step up the low amperage coming from an arduino output to run an object that may require more current. Fortunately, a few of us have taken Electronic circuits and have a pathway to begin designing and figuring out what components we will use.

**Legal and Ethical analysis**:

Cybersecurity could pose a real issue for our product. Through research, we’ve seen instances where the feeder has been ‘hacked’ into where someone can see through the camera attached to the feeder and can even manipulate the functions of the feeder to where someone's pet could be maliciously denied food. One way we can prevent such causes is by not including a camera to the pet feeder so that no one is capable of spying through the camera lenses.

In addition to the hacking where they prevent the dispensing of food, there will be an option that will allow the food to be dispensed without the use of electricity or the internet. When the user is far away we will need to implement security features on the software side. We don’t want to limit our functions so if we can safely secure interesting outputs we will try to include them (e.g camera)

Legal issues that may arise are through currently existing patents which already exist for products such as ours. What separates us from existing designs is the implementation of the IoT application, filtering water with a water compartment, multiple pet usage, battery backup and the ability to dispense mechanically. The unique portion with our pet feeder is the ability to use the pet feeder remotely AND have the option to use it manually if needed. The amount of food provided for an in-home animal that doesn’t need to go outside can save the pet owner money on boarding and will keep them safe and fed at home.   
 There is regulatory guidance by the FCC for RF emissions that will need to be looked into and followed. There is also an IEC standard that needs to be used for water pumps IP67 and IP68. Determining which to use will need to be decided later.

**Milestones**:

*Note: Milestones are mentioned here. Please refer to section 8 for a more direct timeline of events.*

A major project milestone will include the main key functionality of the pet feeder. This includes the physical operation of the device, and the remote-software operation of the device. These two are key for the vision and model of our project. One of the first milestones we need to hit after completing the physical build is the dispensing mechanism. This will be one of the first big hurdles we will encounter and is the main factor that decides if the rest of our project and design is feasible. Redundancy on the electrical side will want to be implemented to make sure that in the loss of power the animal doesn’t go without food; there will be a mechanical switch as well as a battery backup. Having a programmable screen could be an extra part of the project that, with time, we could implement for an even better user experience.

The next major project milestone would be the connectivity to the internet and how it will connect to the project. An evolving application is vital as it is our paramount way of controlling the feeder and how it operates. The group will first start on getting a working offline domain to operate on the feeder before moving on to the access of the internet as it will be a stepping stone to the major milestone. For the electrical side of the internet connectivity we will look into methods of getting that information to the board in order to get the desired outputs.

**Metrics**:

The metrics used to determine milestones would be the progress of the code and mechanical hardware. For the physical/mechanical portion of this, the milestone would be something such as getting the dispensary method to function correctly physically and wirelessly. Another would be being able to make sure it is reusable after multiple tests, and that the feeder could be refilled and still function adequately.

For some of the software aspects, getting the software to properly send over data to the product. Another one would be getting the product to properly send over data to the software to confirm. Of course, the more important milestones would be the actual code itself for the software. As more code is written, there should in turn be more functionality that will be available. The different aspects of the code being implemented would be the tracker for showing the progress on the software side.  
 For the hardware aspect, we want to set goals in the functionality of the product itself. First being getting the idea down as to what we want to implement, next being how effective different ways of implementation will be, another being successful prototypes and implementations of different options, Getting the device to connect to the internet, getting the test article to respond to commands sent by the user over website and lastly being the working final product.

As the project progresses, the connection between the two portions should flow smoothly between hardware and software. Failure on the hardware or software portion will result in an incomplete project. Integration of hardware/ software will be a team dedication effort.

**Acquisition Schedule**:

The project will encompass a three compartment pet feeder with a downloadable application with user credentials and remote connection to the feeder. One compartment will be for water. Ideally, this compartment will be 2 to 10 gallons. It could have a removable filter and a water pump that could circulate water through the device. The second compartment will be for dry food that will dispense through a door that closes by an actuator and an augur will cycle the food to make it move through the upper compartment into the food bowl below. The third compartment will do the same and this is generally for owners of multiple pets to appeal to a greater pool of pet owners. The main middle compartment will have an LCD screen that can have programmable feeding times apart from the app if we have time for this aspect.

The Screen will be centered on the top of the central feeder or middle of the top compartment. This screen will be connected to an arduino and the auger will be connected to a servo or other moving device that is also arduino connected. The pump and actuator will also be connected to the arduino. Power will be supplied through a transformer at a wall plug in that converts 120 VAC to 12 VDC and into the arduino. There may be a need for multiple arduino’s depending on total outputs needed as well as connecting to the internet or bluetooth to take inputs from the software and application side of the project. Because of the need for continuous power and higher currents for some of the parts described above we will need amplifiers of some kind for particular outputs.

On the application side we will have a server setup in order to connect to the devices. With this server we will have a programmable button which will operate the task accordingly depending on the input of the user. In order to incorporate an accidental click, each click will have a buffer time until another command is released. In addition to that, there will also be a prompt which states that food has already been dispensed, the user will then have to acknowledge the prompt in order to activate the button again which will dispense more. This will also have a user friendly GUI and options such as timers for scheduled feeding and different amounts of feeding options (multiple dispense options).

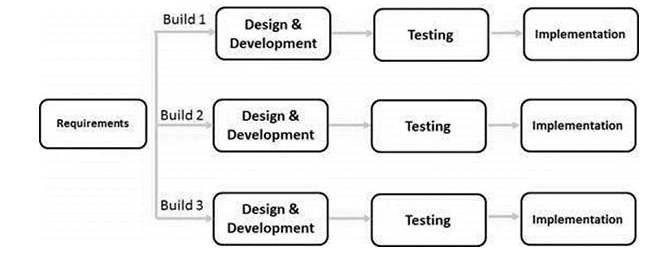
**Data Configuration Management Plan**:

When looking at the software implementation, we will use the codes created and implement it onto a domain. Since the domain will already exist on a website, that website shall already be conformed and properly set up so that people with an active internet connection will be able to access our program. We will create a multi-profile set up where a user will have to create an account and link their pet feeder so that they can access it. Credentials will prevent multiple people gaining access to unverified pet feeders that are not theirs. With that, we can then link that account to have access to a set of given scripts that will correlate to their device. The domain will communicate to the hardware through the Internet.  
 Looking at this from a hardware perspective, we take a device that is capable of connecting to the internet then we can program it to do certain tasks such as dispense food. This will be programmed through the internal board and will work depending on what the website will communicate and tell it to do. If the user wants, they can also program the feeder on site with a screen and buttons on the main feeder if we have time to implement this function. The board will have components connected to it that will be programmed to their function, receive input from the user via the application, or integrated on the product potentially. This device will have a power cable and transformer at a 120V wall plug-in and we hope to integrate a battery backup for instances where power may run out when the end user isn’t home and this will keep their pet fed for extra time. This redundancy will be advantageous to the user and will keep our product from failing too easily.

**Software Development Model**:

We chose to go with the iterative software development model. This model starts at an initial implementation, which progresses repeatedly getting more complex with each new implementation and step. The reason we are using this model is because it provides the most advantage to us as a team by allowing multiple steps and ideas to be implemented at the same time instead of waiting step by step. With this, we can create the code in parts and keep building on top of our existing code that we know was working. This will make it easier for us to debug and correct any errors that come up.

Another model that was discussed was the waterfall model, but that development model would make it more time consuming to fix a bug if one was found later in the development process. The chance of code being affected by the bug would be higher. This means that it would take some time to pinpoint what caused the bug and/or fix it in such a way that still lets the rest of the code work properly. The iterative model lets us build little by little, making it more efficient to spot bugs and easier to see what is causing the bug.



**Overall First Semester Schedule**:

As we are not entirely sure how the project will continue and how much time is needed, we were able to create a rough schedule that outlines the course for the year and when we want it due. We will go about it on a weekly basis to see if anything needs revisions and if items are pushed back. We have built in leniency of about 2 weeks maximum towards the end where we can cut down design implementation time to around 3 full weeks instead of 5 to cover any timeline issues that may arise.

|  | **Description** | **Week Due** | **Discipline** |
| --- | --- | --- | --- |
|  | Sketches | 3-6 | EE CE CS |
|  | Project Planning Paper | 4 | EE CE CS |
|  | Research (software) | 6,7,8 | CE CS |
|  | Research (hardware) | 6,7,8 | EE CE |
|  | Research (materials/housing) | 6,7,8 | EE CE CS |
|  | Research (legal/ ethical guidance and impact) | 6,7,8 | EE CE CS |
|  | Define Scope of project | 6,7 | EE CE CS |
|  | Midterm prep | 6,7 | EE CE CS |
|  | Midterm Presentation | 7 | EE CE CS |
|  | Parts acquisition (hardware and circuitry) | 7,8 | EE CE |
|  | Other acquisitions (software, website,...) | 7,8 | CE CS |
|  | Development environment Selection | 7,8 | CE CS |
|  | Interviews with potential end users. Anything missed so far that needs to be addressed? | 9 | EE CE CS |
|  | Housing Completed | 10-12 | EE CE CS |
|  | Design and development | 10-15 | EE CE CS |
|  | Present analysis conclusions | 10 | EE CE CS |
|  | Initial Prototype | 10-12 | EE CE CS |
|  | Integration tests (hardware and software) | 10-15 | EE CE CS |
|  | Testing and issues with testing | 10-15 | EE CE CS |
|  | Product Showcase Prep | 13 | EE CE CS |
|  | Fall Product Showcase | 16 | EE CE CS |
|  | Planning for SD II | 16 | EE CE CS |