Cicada

DESIGN DOCUMENT

Team 34

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Executive Summary

Field fires are a real and costly threat to farmers. A fire that starts in dry crop residue, a hot combine, or a stray spark can spread across acres before anyone notices, especially on large rural properties where no one is watching every field and cell coverage is spotty. By the time smoke is visible from the road, crops, equipment, and sometimes buildings are already at risk. Our project, Cicada, aims to catch these fires early and alert farmers while there is still time to respond.

Our key design requirements came from that problem. The system has to work in remote fields without Wi-Fi or reliable cellular service. Sensor nodes need to run on their own for long periods on solar and battery power. Detection has to be reliable enough that farmers trust the alerts, and the data has to reach a place where farmers can actually see it. The system also needs to be affordable and simple to set up, since it is meant for working farms rather than research sites.

To meet these requirements, we are building a network of low-power sensor nodes based on STM32 microcontrollers. Each node carries sensors that watch for signs of fire, starting with smoke and particulate detection, and later adding soil moisture and other environmental readings that help show when conditions are risky. Nodes communicate over LoRa, a long-range, low-power radio technology well suited to open farmland. Data travels to a LoRa gateway placed in the field, which forwards it to a remote server. From there, a dashboard displays sensor readings and alerts. The node firmware is being developed in Zephyr, a real-time operating system built for embedded devices.

We have made solid progress this semester. Nodes are successfully sending data to our base station, and we tested a node-to-node link across campus with low packet loss, which gives us confidence in LoRa's range. The gateway is forwarding data to our remote server, and a separate part of our team is building the dashboard that will display it. We have also ordered additional nodes to expand the network.

So far, our testing shows the core communication path works the way we need it to: data can travel long distances on low power and reach a farmer-facing interface. These results address the most basic user need, which is getting information out of a remote field reliably. We still need to validate detection accuracy and long-term power performance before we can say the full system meets every requirement.

Next, we plan to finish the node firmware, tune our fire detection thresholds, and test solar and battery performance. We will then expand from a simple link to a multi-node mesh, add more sensor types, and deploy the gateway in a real field to test range and reliability under actual farm conditions.

Learning Summary

Development Standards & Practices Used

List all standard circuit, hardware, software practices used in this project. List all the engineering standards that apply to this project that were considered.

Summary of Requirements

List all requirements as bullet points in brief.

Applicable Courses from Iowa State University Curriculum

List all Iowa State University courses whose contents were applicable to your project.

- CPRE 2880: Embedded Systems I provided the embedded skills to work with our microcontrollers, learning how to read datasheets, how to program microcontrollers and their GPIO pins, integrating sensors to record various real-world data.
- CPRE 4370: Intro to Wireless Security offered experience with ARAnet, the rural wide area network on the Iowa State campus and expanding to other areas of the Ames/Boone area. Learned about networking, wireless metrics, wireless security, and how cellular networks work.
- COMS 3090: Software Development Practices combines technical knowledge with teamwork skills in a manner reminiscent of 4190. The pure software techniques of RESTful APIs and CI/CD pipelines will be incorporated into our dashboard design.

New Skills/Knowledge Acquired

List all new skills/knowledge that your team acquired which was not part of your Iowa State curriculum in order to complete this project.

Learning Zephyr, a real-time operating system.

Virtual Machine configuration.

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1 Introduction

1.1 Problem Statement

The problem we are trying to solve is that most fires in a farm field go unnoticed until it is too late and heavy damage is sustained. We are trying to solve this problem by creating a network of nodes with sensors to detect field fires quickly and notify first responders to prevent as much damage as possible. Farmers have large amounts of land they care for and they can't always be there to monitor their fields if something happens, like a fire. These fires can start sporadically and it is often too late once the farmer realizes there is a fire. The farm fields are almost always not covered by Wi-Fi or a cellular network.

Our goal is to create nodes that farmers can deploy in their fields that will talk to each other using a mesh network and LoRa radio frequencies. LoRa is long-range networking and will provide connectivity between the nodes so they can transmit data to each other, eliminating the need to have very expensive broad-coverage cellular. The nodes will contain sensors used to detect signs of fire, such as smoke, temperature, humidity, soil moisture, and more. The nodes will be independent of each other so they can deploy far apart from each other, allowing the farmer to place them in the areas of his choice. If the nodes do detect a fire, an alarm will be raised and notify the farmer and first responders where the fire is, and provide them coordinates or a pinpoint using Google Maps.

1.2 Intended Users

Our main users are wildland firefighters and emergency dispatchers, who work in remote, high risk terrain with limited crews and need early, location specific alerts so they can respond before a small ignition spreads. Our network gives them GPS tagged smoke, VOC and temperature readings within minutes. Park rangers and forest land managers watch large areas with few staff and little cell coverage, so our solar powered LoRa mesh gives them low maintenance monitoring that runs without grid power or internet. Residents of wildland urban interface communities and farmers near fire prone land need earlier warning to evacuate or protect their homes, crops and livestock, and they benefit from faster alerts, while the optional soil moisture sensor gives farmers extra field data. Each of these benefits ties back to our problem statement, because wildfires do the most damage when they are found late, and a low cost, self powered sensor mesh shortens the time from ignition to detection in the areas where fires are most likely.

2 Requirements, Constraints, and Standards

2.1 Requirements & Constraints

Power Requirements: Our device needs to be able to operate at all times of year (battery must be functional in winter) and the device needs to be able to last about a year without maintenance.

Functional Requirements: The node detection mesh must be able to provide useful information as to the location of fires and provide data that makes it clear where there is risk and the overall "spread" of an event over time. Each node must be able to detect wildfires near them such that the total coverage of an area bounded by nodes would exceed 50% of the surface area of the bounded region.

Environmental Requirements: The nodes should not pose risk to local biodiversity or meaningfully alter the environment in the region it is placed.

Resource Requirements: Each node should not exceed the cost that lets us build the full mesh within our $500 project budget, plus any extra funding we receive from our advisors and the department. To stay within that, we will use low cost, off the shelf parts that are easy to buy, replace and repair. We will also reuse hardware we already have, like our STM32 boards, LoRa shields and base station, wherever we can.

Aesthetic requirements; Nodes should not instill fear in someone if they discover it and do not know what it is.

2.2 Engineering Standards

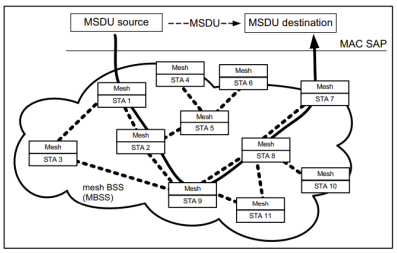
Clearly established standards have many benefits for the engineering design process. Standards allow for consistent protocols so that different teams can optimize for safety and usability without needing to start from scratch on each new project. Instead, the explicitly stated standards from IEEE allow a degree of trust that products are engineered with quality in mind. These standards are very applicable to our project which is dealing with wildfires, which is a very critical phenomenon. Our users need to be able to rely on our technology providing accurate and timely data, because emergency services could feasibly be making high-impact decisions based on the information our network provides.

The Cicada project will adhere to many specific IEEE standards, including:

1. IEEE 2700-2014; Standard for Sensor Performance Parameter Definitions
   This standard dictates how sensor data is to be calibrated, regulated, and interpreted. The paper notes how sensors are becoming increasingly more frequent and the world becomes more mechanized, but the process for testing sensor quality standards is being developed much more slowly. This standard analyzes many of the most common types of sensors and sets protocols on how the data is to be interpreted.
2. IEEE Std 802.11s-2011; Amendment 10: Mesh Networking
   This paper is an amendment to wireless communications standards specifically focusing on mesh networking. It intends to standardize the terminology related to mesh processes, which is relatively niche compared to other more common networking strategies. It is necessary to have standard networking protocols so that messages can be interpreted correctly.
3. IEEE 1063-1987; Standard for Software User Documentation
   Our third highlighted standard is software focused. Specifically, this document provides a structured outline for creating user documentation so that people who were not involved in programming a feature can thoroughly understand its capabilities. This standard aims to increase the quantity and quality of information about a software application so that users have all of the information they need to use it safely and effectively.

Each of these standards has a tangible impact on the project:

1. The *Standard for Sensor Performance Parameter Definitions* is very applicable to our project. The entire premise of early wildfire detection is dependent on receiving accurate sensor data. Each node will have a variety of sensor types, potentially including temperature, humidity, VOC, and soil quality sensors. Of these, the temperature and humidity sensors have individual sections in the standard explaining how these sensors are most effectively used in a real world project.
2. *Amendment 10: Mesh Networking* is clearly relevant to Cicada. The networking protocol is a major piece of our early design process. The nodes need to have a clearly established method of sending out data packets, so that neighboring nodes can confidently decode the information. Any loss of information could be critical in case of a wildfire, so the mesh network needs to be well-established. This document provides standards and diagrams for typical mesh networking structures, as seen below.



3. *Standard for Software User Documentation* is a very practical tool when it comes time to create documentation for our project. While a large amount of the project time will be spent testing our node sensors and the mesh communication, there are key components to the project which are entirely software-based and will need clear documentation. The React frontend will need an explanation for users on how to most effectively make use of the geographic interface we intend to build with a satellite imagery API.

We will emphasize reliability in our design. Ideally once the nodes are positioned out in the field they will last for a long lifetime with minimal downtime. This requires dependable sensors to read measurements which accurately reflect their local conditions. These sensor data are sent in packets through our LoRa mesh network. This network will follow the protocols outlined by the IEEE so that minimal package loss is achieved. We will test our sensors thoroughly before deploying them and advertising our dashboard data as legitimate. The nature of our disaster-detection project requires high accuracy and as few false positives as possible. Specifically, our team selected IEEE 1451 for sensor data sharing, IEEE 802.15.4w for low power, long range wireless networks, and IEEE 1625 for lithium-ion battery safety. Together, these standards help our nodes collect accurate data, send it reliably, and stay safe in the field without becoming a fire risk themselves.

3 Project Plan

3.1 Project Management and Tracking

Agile. Our work is split into tickets which have associated estimated efforts of completion (points).

What project management style are you adopting (e.g., agile, waterfall, waterfall+agile, other)? Justify your project management style with respect to the project goals and contexts.

Also, describe how your team will track progress throughout the course of this and the next semester. This could include Git, GitHub, Trello, Slack or any other tools helpful in project management.

3.2 Task Decomposition

In order to solve the problem at hand, it helps to decompose it into multiple tasks and subtasks and to understand interdependence among tasks. This step might be useful even if you adopt agile methodology. If you are agile, you can also provide a linear progression of completed requirements aligned with your sprints for the entire project.

3.3 Project Proposed Milestones, Metrics, and Evaluation Criteria

What are some key milestones in your proposed project? It may be helpful to develop these milestones for each task and subtask from 3.2. How do you measure progress on a given task? These metrics, preferably quantifiable, should be developed for each task. The milestones should be stated in terms of these metrics: Machine learning algorithm XYZ will classify with 80% accuracy; the pattern recognition logic on FPGA will recognize a pattern every 1 ms (at 1K patterns/sec throughput). ML accuracy target might go up to 90% from 80%.

In an agile development process, these milestones can be refined with successive iterations/sprints (perhaps a subset of your requirements applicable to a sprint).

3.4 Project Timeline and Schedule

A realistic schedule is an essential component of every well-planned project.

Most scheduling errors occur as the result of either not properly identifying all of the necessary activities (tasks and/or subtasks) or not properly estimating the amount of effort and time required to correctly complete the activity.

A detailed schedule is needed as a part of the plan:

- Start with a Gantt chart showing the tasks (that you developed and listed in the Task Decomposition section) and associated subtasks versus the proposed project calendar. The Gantt chart should be referenced and summarized in the text.
- Annotate the Gantt chart to show when each project output and deliverable will be completed.

The project schedule and Gantt chart should be adapted to an agile or waterfall management model as appropriate. For agile, a sprint schedule with specific technical milestones, requirements, and/or targets would be appropriate.

3.5 Risks and Risk Management/Mitigation

For each task, identify all salient risks (certain performance target may not be met; certain tool may not work as expected) and assign an educated guess of probability for that risk. For any risk factor with a probability exceeding 0.5 and each high severity risk, develop a risk mitigation plan. Can you eliminate that task and add another task or set of tasks that might cost more? Can you buy something off-the-shelf from the market to achieve that functionality? Can you try an alternative tool, technology, algorithm, or board?

Agile project can associate risks and risk mitigation with each sprint.

3.6 Personnel Effort Requirements

Include a detailed estimate in the form of a table accompanied by a textual reference and explanation. This estimate shall be done on a task-by-task basis and should be the projected effort in total number of person-hours required to perform the task.

3.7 Other Resource Requirements

Identify the other resources aside from financial (such as parts and materials) that will be required to complete the project.

4 Design

4.1 Design Context

4.1.1 Broader Context

Describe the broader context in which your design problem is situated. What communities are you designing for? What communities are affected by your design? What societal needs does your project address?

List relevant considerations related to your project in each of the following areas:

Area	**Description**	**Examples**
Public health, safety, and welfare	How does your project affect the general well-being of various stakeholder groups? These groups may be direct users or may be indirectly affected (e.g., solution is implemented in their communities)	Increasing/reducing exposure to pollutants and other harmful substances, increasing/reducing safety risks, increasing/reducing job opportunities
Global, cultural, and social	How well does your project reflect the values, practices, and aims of the cultural groups it affects? Groups may include but are not limited to specific communities,	Development or operation of the solution would violate a profession's code of ethics, implementation of the solution

	nations, professions, workplaces, and ethnic cultures.	would require an undesired change in community practices
Environmental	What environmental impact might your project have? This can include indirect effects, such as deforestation or unsustainable practices related to materials manufacture or procurement.	Increasing/decreasing energy usage from nonrenewable sources, increasing/decreasing usage/production of non-recyclable materials
Economic	What economic impact might your project have? This can include the financial viability of your product within your team or company, cost to consumers, or broader economic effects on communities, markets, nations, and other groups.	Product needs to remain affordable for target users, product creates or diminishes opportunities for economic advancement, high development cost creates risk for organization

4.1.2 Prior Work/Solutions

Include relevant background/literature review for the project (cite at least 3 references for literature review in IEEE Format. See link: https://ieee-dataport.org/sites/default/files/analysis/27/IEEE%20Citation%20Guidelines.pdf)

– If similar products exist in the market, describe what has already been done

– If you are following previous work (e.g., a previous senior design project), cite that and discuss the **advantages/shortcomings**

– Note that while you are not expected to "compete" with other existing products / research groups, you should be able to differentiate your project from what is available. Thus, provide a list of pros and cons of your target solution compared to all other related products/systems.

Detail any similar products or research done on this topic previously. Please cite your sources and include them in your references. All figures must be captioned and referenced in your text.

4.1.3 Technical Complexity

Provide evidence that your project is of sufficient technical complexity. Use the following metric or argue for one of your own. Justify your statements (e.g., list the components/subsystems and describe the applicable scientific, mathematical, or engineering principles)

1. The design consists of multiple components/subsystems that each utilize distinct scientific, mathematical, or engineering principles –AND–
2. The problem scope contains multiple challenging requirements that match or exceed current solutions or industry standards.

4.2 Design Exploration

4.2.1 Design Decisions

List key design decisions (at least three) that you have made or will make. These can include, but are not limited to, materials, subsystems, physical components, sensors/chips/devices, physical layout, features, etc. Describe how you made/will make these decisions and how they have affected or are likely to affect project success.

4.2.2 Ideation

For at least one design decision, describe how you ideated or identified potential options (e.g., lotus blossom technique). Describe at least five options that you considered.

4.2.3 Decision-Making and Trade-Offs

Demonstrate the process you used to identify the pros and cons or trade-offs between each of your ideated options. You may wish you include a weighted decision matrix or other relevant tool. Describe the option you chose and why you chose it.

4.3 Proposed Design

4.3.1 Overview

Provide a high-level description of your current design. This description should be understandable to non-engineers (i.e., the general public). Describe key components or subsystems and how they contribute to the overall design. You may wish to include a basic block diagram, infographic, or other visual to help communicate the overall design.

4.3.2 Detailed Design and Visual(s)

Provide a detailed, technical description of your design, aided by visualizations. This description should be understandable to peer engineers. In other words, it should be clearly written and sufficiently detail such that another senior design team can look through it and implement it.

The description should include a high-level overview written for peer engineers. This should list all subsystems or components, their role in the whole system, and how they will be integrated or interconnected. A visual should accompany this description. Typically, a detailed block diagram will suffice, but other visual forms can be acceptable.

The description should also include more specific descriptions of subsystems and components (e.g., their internal operations). Once again, a good rule of thumb is: could another engineer with similar expertise build the component/sub-system based on your description? Use visualizations to support your descriptions. Different visual types may be relevant to different types of projects, components, or subsystems. You may include, but are not limited to: block diagrams, circuit diagrams, sketches/pictures of physical components and their operation, wireframes, etc.

4.3.3 Functionality

Describe how your design is intended to operate in its user and/or real-world context. What would a user do? How would the device/system/etc. respond? This description can be supplemented by a visual, such as a timeline, storyboard, or sketch.

4.3.4 Areas of Concern and Development

How well does/will the current design satisfy requirements and meet user needs?

Based on your current design, what are your primary concerns for delivering a product/system that addresses requirements and meets user and client needs?

What are your immediate plans for developing the solution to address those concerns? What questions do you have for clients, TAs, and faculty advisers?

4.4 Technology Considerations

Describe the distinct technologies you are using in your design. Highlight the strengths, weaknesses, and trade-offs in technologies available. Discuss possible solutions and design alternatives.

4.5 Design Analysis

Discuss what you have done so far, i.e., what have you built, implemented, or tested? Did your proposed design from 4.3 work? Why or why not? Based on what has worked or not worked (e.g., what you have or haven't been able to build, what functioned as expected or not), what plans do you have for future design and implementation work? For example, are there implications for the overall feasibility of your design or have you just experienced build issues?

5 Testing

Testing is an **extremely** important component of most projects, whether it involves a circuit, a process, power system, or software.

The testing plan should connect the requirements and the design to the adopted test strategy and instruments. In this overarching introduction, give an overview of the testing strategy and your team's overall testing philosophy. Emphasize any unique challenges to testing for your system/design.

In the sections below, describe specific methods for testing. You may include additional types of testing, if applicable to your design. If a particular type of testing is not applicable to your project, you must justify why you are not including it.

When writing your testing planning consider a few guidelines:

- Is our testing plan unique to our project? (It should be)
- Are you testing related to all requirements? For requirements you're not testing (e.g., cost related requirements) can you justify their exclusion?
- Is your testing plan comprehensive?
- When should you be testing? (In most cases, it's early and often, not at the end of the project)

5.1 Unit Testing

What units are being tested? How? Tools?

5.2 Interface Testing

What are the interfaces in your design? Discuss how the composition of two or more units (interfaces) are being tested. Tools?

5.3 Integration Testing

What are the critical integration paths in your design? Justification for criticality may come from your requirements. How will they be tested? Tools?

5.4 System Testing

Describe system level testing strategy. What set of unit tests, interface tests, and integration tests suffice for system level testing? This should be closely tied to the requirements. Tools?

5.5 Regression Testing

How are you ensuring that any new additions do not break the old functionality? What implemented critical features do you need to ensure do not break? Is it driven by requirements? Tools?

5.6 Acceptance Testing

How will you demonstrate that the design requirements, both functional and non-functional, are being met? How would you involve your client in the acceptance testing?

5.7 Security Testing (if applicable)

How will you demonstrate that the security requirements, if any, are being met? What data and/or resources are being protected? What security testing principles, methods, and/or tools may be applied?

5.8 User Testing

Describe how the team will include real users to interact with the solution/product. Your user testing plan should evaluate your solution/product's usability and overall user experience by gathering user feedback through observations, surveys, etc. User feedback allows the team to identify areas for improvement and ensure the product meets user needs.

5.9 Testing Results

What are the results of your testing thus far? Include any numerical, graphical, or qualitative testing results here. How do they demonstrate compliance with the requirements or addressing user needs? Use a summary narrative to discuss what you've learned and what next steps need to be taken.

6 Implementation

Describe any (preliminary) implementations of your design thus far. Support any general, descriptive text with relevant images. If your project has inseparable activities between design and implementation, you can list them either in the Design section or this section.

7 Ethics and Professional Responsibility

Use this section to describe your considerations of engineering ethics and professional responsibility. Most importantly how are you defining engineering ethics and professional responsibility in the context of your project and what steps are you taken to ensure ethical and responsible conduct. Each section references one type of ethical/professional responsibility considerations. You may also use this introductory section to note any overarching ethical philosophy among your team.

7.1 Areas of Professional Responsibility/Codes of Ethics

This discussion is with respect to the paper by J. McCormack and colleagues titled "Contextualizing Professionalism in Capstone Projects Using the IDEALS Professional Responsibility Assessment", *International Journal of Engineering Education* Vol. 28, No. 2, pp. 416–424, 2012

Pick one of IEEE, ACM, or SE code of ethics (all linked in class slides). Create a table, like Table 1 in the McCormack et al. (2012, pg. 418)) paper, with the following columns representing: Area of Responsibility (from the paper), Definition (in your own words), Relevant Item from Code of Ethics (from the Code of Ethics you selected, and description of how your team has interacted with that area of professional responsibility or adhered to that code during your project thus far.

In text below the table, describe one area in which your team is performing well. Describe what your team is doing and how that signifies strong performance. Also describe one area in which your team needs to improve. Describe what your team is currently doing and what it should do in the future to improve.

7.2 Four Principles

Create a table with rows for each broader context area (see Section 4.1.1) and columns for each of the four principles (beneficence, nonmalificence, respect for autonomy, and justice; see Beauchamp, 2007). Within the table, identify at least one way each of the four principles applies to each of the broader context areas. Some principle-broader context connections might be more prominent than others, but you should be able to identify something for each table cell. Note: Your design may end up negative or neutral in some cell. For example, your product might perform poorly in environment-nonmaleficence because it utilizes natural resources without a positive/mitigating effect.

Below the table, note one broader context-principle pair that is important to your project. Briefly describe the benefit in that area you are working towards and how you will ensure it. Also note one broader context-principle pair in which your project/end design is or will be lacking. Describe either (a) how this negative is overcome by other positives in other areas of the project/design or (b) what your team must do to improve in this area.

7.3 Virtues

List and define at least three virtues that are important to your team. Describe what you will do or have done as a team to support these virtues among all team members.

Each team member should also answer the following:

- Identify one virtue you have demonstrated in your senior design work thus far? (Individual)
    - Why is it important to you?
    - How have you demonstrated it?
- Identify one virtue that is important to you that you have not demonstrated in your senior design work thus far? (Individual)
    - Why is it important to you?
    - What might you do to demonstrate that virtue?

8 Closing Material

8.1 Conclusion

Summarize the work you have done so far. Briefly re-iterate your goals. Then, re-iterate the best plan of action (or solution) to achieving your goals. What constrained you from achieving these goals (if something did)? What could be done differently in a future design/implementation iteration to achieve these goals?

8.2 References

List technical references and related work / market survey references. Do professional citation style (ex. IEEE). See link:

https://ieee-dataport.org/sites/default/files/analysis/27/IEEE%20Citation%20Guidelines.pdf

8.3 Appendices

Any additional information that would be helpful to the evaluation of your design document.

If you have any large graphs, tables, or similar data that does not directly pertain to the problem but helps support it, include it here. This would also be a good area to include hardware/software manuals used. May include CAD files, circuit schematics/layout, PCB testing issues, software bugs, etc.

9 Team

Complete each section as completely and concisely as possible. We strongly recommend using tables or bulleted lists when applicable.

9.1 Team Members

9.2 Required Skill Sets for Your Project

If feasible – tie them to the requirements.

9.3 Skill Sets Covered by the Team

For each skill, state who covered it.

9.4 Project Management Style Adopted by the team

Typically, waterfall, agile, or hybrid for project management.

9.5 Initial Project Management Roles

Enumerate which team member plays what role.

9.6 Team Contract

Team Members:

1) _____Cooper Hoy_____ 2) _____Marcus Yeung_____

3) _____Hrushi Bhatt_____ 4) _____Jack Rice_____

5) _____Sean Fjellman_____ 6) _____Caleb Kugel_____

7) _____Jake Ebersole_____

Team Procedures

1) Day, time, and location (face-to-face or virtual) for regular team meetings:
2) Preferred method of communication updates, reminders, issues, and scheduling (e.g., e-mail, phone, app, face-to-face):
3) Decision-making policy (e.g., consensus, majority vote):
4) Procedures for record keeping (i.e., who will keep meeting minutes, how will minutes be shared/archived):

Participation Expectations

1. Expected individual attendance, punctuality, and participation at all team meetings:
2. Expected level of responsibility for fulfilling team assignments, timelines, and deadlines:
3. Expected level of communication with other team members:
4. Expected level of commitment to team decisions and tasks:

Leadership

1. Leadership roles for each team member (e.g., team organization, client interaction, individual component design, testing, etc.):
2. Strategies for supporting and guiding the work of all team members:
3. Strategies for recognizing the contributions of all team members:

Collaboration

1. Describe the skills, expertise, and unique perspectives each team member brings to the team.
2. Strategies for encouraging and support contributions and ideas from all team members:

3. Procedures for identifying and resolving collaboration or contribution issues (e.g., how will a team member inform the team that the team environment is impeding their opportunity or ability to contribute?)

Goal-Setting, Planning, and Execution

1. Team goals for this semester:
2. Strategies for planning and assigning individual and team work:
3. Strategies for keeping on task:

Consequences for Not Adhering to Team Contract

1. How will you handle infractions of any of the obligations of this team contract?
2. What will your team do if the infractions continue?

****

a. I participated in formulating the standards, roles, and procedures as stated in this contract.
b. I understand that I am obligated to abide by these terms and conditions.
c. I understand that if I do not abide by these terms and conditions, I will suffer the consequences as stated in this contract.

1) _____ DATE _____

2) _____ DATE _____

3) _____ DATE _____

4) _____ DATE _____

5) _____ DATE _____

6) _____ DATE _____

7) _____ DATE _____

8) _____ DATE _____