AI Design Contest – Activity 1: Setting Up for Success

Team Name:

Team Member Names:

Purpose:

- Team is provided with an overview of the contest that states the goals of each activity and lists the deliverables that will be created during each activity.
- Team will assign a team role to each member to divide different work responsibilities.
- Team is provided with a timeline that displays when each activity must be submitted.
- Team will use their understanding of the overview, timeline, and assigned roles to develop a team work plan that schedules time each week for working on the activities.
- Team will complete background reading that familiarizes them with conceptual information they will use to understand the contest goals and complete the different activities.
- **Team should use this activity to (1) plan how they will complete contest requirements, and (2) understand the technical context behind designing a smart energy management system that can achieve different design goals**.

Table of Contents

Part 1: Contest Overview

This contest is made up of five activities. Through the first four activities, you will learn about power usage and energy consumption, and how to measure and calculate them for different household devices. You will collect data from your home devices, analyze that data, and use what you learn about how your devices operate to model a smart energy system that can manage a specific scenario in your home. By the end of the contest, you will create an executive summary about your findings and give a presentation about your new smart design.

Instructions: Read the **Activity Goals and Checklist** table on Page 3 so that you understand the different parts of the contest. "Activity Goals" lists what you will be doing during each activity. "Deliverables" lists different parts of each activity that you will need to complete so you can create a strong final design.

Part 2: Assigning Team Roles

Each of your team members is an equal participant in your team's design process. Below is a table with five role names and descriptions. Read the descriptions in the table and assign a role to each team member. These positions each have key responsibilities that are important to your project's success.

Instructions: Write each team member's name in the table next to their assigned role.

Role Name	Description	Team Member Name
Project Manager	- Manages the contest work plan - Makes sure activities are completed according to schedule - Assigns tasks to themself and team members	
Design Engineer	- Leads the team discussions about data analysis and how this affects design - Manages the design process	
Quality Engineer	- Reviews and submits each activity - Makes sure the activities are completed in full and turned in on time - Manages the completion of the final executive summary	
Project Spokesperson	- Manages the completion of the final presentation - Makes sure the presentation is recorded correctly - Leads the presentation - Finalizes the executive summary and presentation	

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Activity Goals and Checklist		
Activity Name	Activity Goals	Deliverables Checklist
Activity 1: Setting Up for Success	- Assign project roles to each team member. - Plan days and times to meet w/ team, mentor, teacher. - Read background information to understand concepts related to the contest design goals.	____Roles assigned to each team member ____Scheduled times for teamwork, meeting with your teacher, and checking in with your mentor ____PDF of filled-out calendar of your team's work plan ____Activity 1 main takeaways summary ____Activity 1 PDF submitted
Activity 2: Measuring Home Device Operations	- Use a power monitor to measure the power usage of 8 household devices. - Record power usage and approximate time slots to create a device power schedule. - Use Excel to calculate total power usage and energy consumption of your devices over a 24-hr period. - Graph your power usage data in MS Excel.	____Table 2.1: inventory of home devices ____Table 2.2: raw device power usage schedule ____3 power schedule graphs: (1) "short-term", (2) "long-term", and (3) "all" devices ____Table 2.3: calculated 24-hr energy consumption of devices ____Table 2.4: device proportions of total energy consumption ____Activity 2 main takeaways summary ____Activity 2 PDF submitted
Activity 3: Designing for Smart Energy Management	- Analyze the device data you collected and graphed. - Use your understanding of the data to create energy goals for a specific home scenario. - Graph and design new device power usage schedule that meets your new goals. - Create a model that shows how AI can apply conditions for a smart energy management system.	____Table 3.1: max/min power usage and energy consumption ____Discussion questions about max/min data, different types of devices, and cost relationships ____Discussion about new goals for your home scenario ____New graph of power usage data for your home scenario ____Table 3.2: new power schedule for your home scenario ____Flow diagram modeling the conditions and data for a smart energy system for your home scenario ____Activity 3 main takeaways summary ____Activity 3 PDF submitted
Activity 4: Proposing Your Design	- Create an executive summary of what you learned about your home's operations and how this informed your new design - Create a presentation about how your data helped you model a management system for the goals of your home scenario.	____Executive Summary report PDF submitted ____Design Presentation PowerPoint PDF submitted ____Video Presentation MP4 submitted ____Activity 4 PDF submitted
Activity 5: Appreciating Your Peers' Work	- Review other teams' final presentations - Discuss other teams' strengths with your team - Vote on your favorite video	____Discussion with your team about other teams' presentations ____Likes on other teams' video presentations

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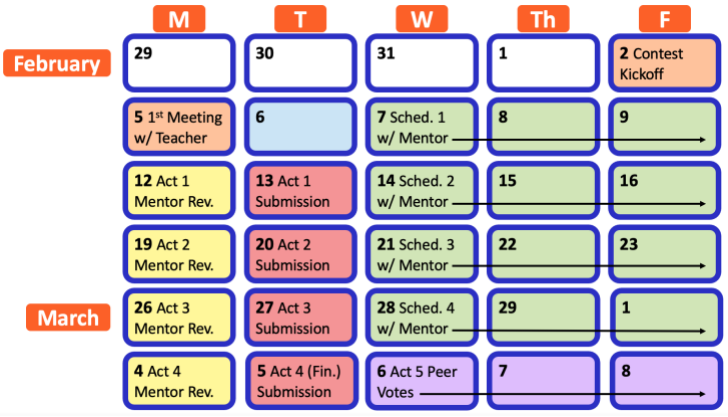
Part 3: Team Work Plan

Contest Activity Timeline

Below is an image of the contest Activity Timeline. This timeline shows important dates of the contest, and it is important to keep these dates in mind as you work on each of the activities to complete your deliverables. You can also find this timeline at the top of your team's Channel in Microsoft Teams.



Deadlines

The most important deadlines from the Activity Timeline are listed below.

- **Tuesday, February 13th –** Activity 1 Due
- **Tuesday, February 20th –** Activity 2 Due
- **Tuesday, February 27th –** Activity 3 Due
- **Tuesday, March 5th –** Activity 4 Due
- **Friday, March 8th –** Activity 5 Due

Contest Work Plan

Instructions: In this section, you will create an official contest work plan for your team. First, decide how often you will meet in-person to work as a team. Write your answer under the first question below. Then, choose which days of the week work best for everyone to meet. Finally, choose times of the day that your team can meet to work together, and write them below under the third question.

1. How many times a week will your team meet?

2. Which days of the week will your team meet? Highlight them below.

   Monday Tuesday Wednesday Thursday Friday

3. What times of the day will your team meet?

Your mentor will review each Activity on Microsoft Teams the Monday before you turn it in. However, you also need to pick a day and time each week to check in with your mentor during the activity to ask them questions. Mentor check-in days should be between Wednesday and Friday.

Instructions: Chat or meet with your mentor over Microsoft Teams to determine a day and time that works best for everyone in your team and your mentor.

4. Which day of the week will you meet with your mentor? Highlight it below.

   Wednesday Thursday Friday

5. What time of the day will your team and your mentor meet?

You will be able to refer to this document throughout the contest to check when you are meeting and if you are on track.

Now that you have decided when to meet, you can make your Team Work Plan official by entering it into a team calendar. Below is an image of a calendar that shows an example of a Team Work Plan. Look over the example calendar, then fill out the blank calendar, on the next two pages, with the work plan your team created. The blank calendar already includes the important contest deadlines.

Example Team Work Plan

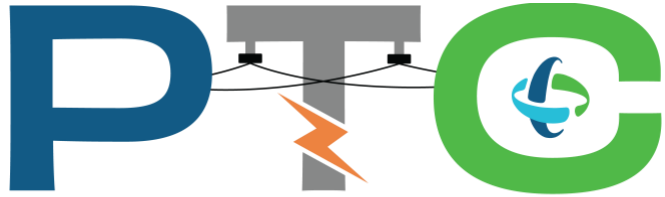
February, 2024

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY
29	30	31	01	02	03	04
				Contest Start!		
05	06	07	08	09	10	11
First meeting with team		Teamwork day! In class 12-1 PM		Meet with mentor at 4 PM!		
12	13	14	15	16	17	18
Teamwork day! In class 12-1 PM *Activity 4 Mentor Final Review*	Activity 1 Submission	Teamwork day! In class 12-1 PM		Meet with mentor at 4 PM!		
19	20	21	22	23	24	25
Teamwork day! In class 12-1 PM *Activity 4 Mentor Final Review*	Activity 2 Submission	Teamwork day! In class 12-1 PM		Meet with mentor at 4 PM!		
26	27	28	29	01	02	03
Teamwork day! In class 12-1 PM *Activity 4 Mentor Final Review*	Activity 3 Submission	Teamwork day! In class 12-1 PM		Meet with mentor at 4 PM!		

March, 2024						
MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY
26	27	28	29	01	02	03
Teamwork day! In class 12-1 PM *Activity 4 Mentor Final Review*	Activity 3 Submission	Teamwork day! In class 12-1 PM		Meet with mentor at 4 PM!		
04	05	06	07	08	09	10
Teamwork day! In class 12-1 PM *Activity 4 Mentor Final Review*	Activity 4 Submission	Teamwork day! In class 12-1 PM	Meet with mentor at 4 PM!	Activity 5 Submission		
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

Filling out your team calendar: Fill out your Team Work Plan calendar by clicking on the calendar on the following two pages. When you click a day in the blank calendar, so that your cursor is in the corresponding box, you can write the details of your work plan. When your cursor is in each box, you will see a "Table Design" tab at the top of Word. Use the "Shading" option (paint bucket icon) under that tab to highlight your different types of work goals in different colors. You can customize the colors you use, but here is an example: Highlight the days you will meet as a team each week in BLUE and write a description in the box. Highlight the days you will meet with your mentor each week in GREEN and write a description in the box. The important contest dates and due dates for each activity are already highlighted in RED. Feel free to add any other important dates and time-based goals that you come up with!

File Saving Instructions: After you have finished filling out your Team Work Plan calendar, save those two pages of this document as a PDF file, named "Team Work Plan_[Team Name].pdf." You will submit this file using the submission instructions at the end of this document.



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February, 2024

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY
29	30	31	01	02	03	04
				Contest Kickoff!		
05	06	07	08	09	10	11
12	13	14	15	16	17	18
Activity 1 Mentor Final Review	Activity 1 Submission					
19	20	21	22	23	24	25
Activity 2 Mentor Final Review	Activity 2 Submission					
26	27	28	29	01	02	03
Activity 3 Mentor Final Review	Activity 3 Submission					

March, 2024

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY
26	27	28	29	01	02	03
Activity 3 Mentor Final Review	Activity 3 Submission					
04	05	06	07	08	09	10
Activity 4 Mentor Final Review	Activity 4 Submission			Activity 5 Submission		
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

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Part 4: Background Reading

Instructions: Read the background information below. This will help you learn the key concepts of the contest so that you can understand your design process.

Key Terms

Circuit – A path for electricity that starts from a power source

Electricity – A type of energy found in different forms (positive or negative); electricity can form on its own or be made by people

Power – A source of energy

System – A connected group of things that work individually and together

Energy Consumption – The amount of electricity and other types of energy that are used

Voltage – Electric strength measured in volts

Current – A movement of positive or negative electric particles (such as electrons)

Machine Learning – When a computer learns from data without being specifically programmed

1. Electricity and Power

Gas, coal, solar energy, and wind can be used to produce electricity. Most of the electricity in the United States is generated using fossil fuels [1].

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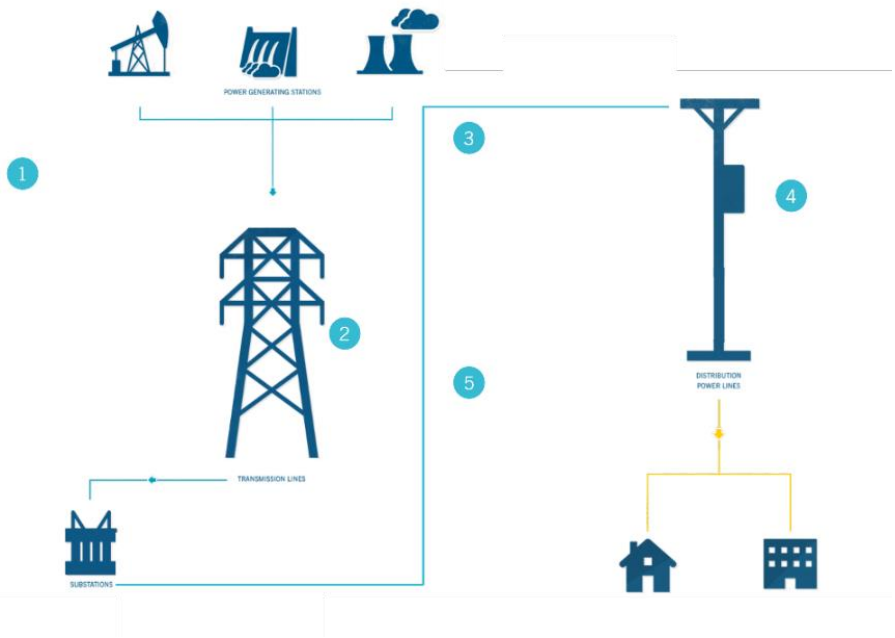
Electricity is generated in power plants using these different energy sources. Once it is generated, the electricity travels through big cables to special stopping points called substations. From the substations, the electricity moves through more cables to reach users. When electricity travels, the amount of it that travels in a certain amount of time is called power. The substations help control how much electrical power from the power plants is divided among different user types [2]. Some user types are stores, schools, hospitals, and homes.



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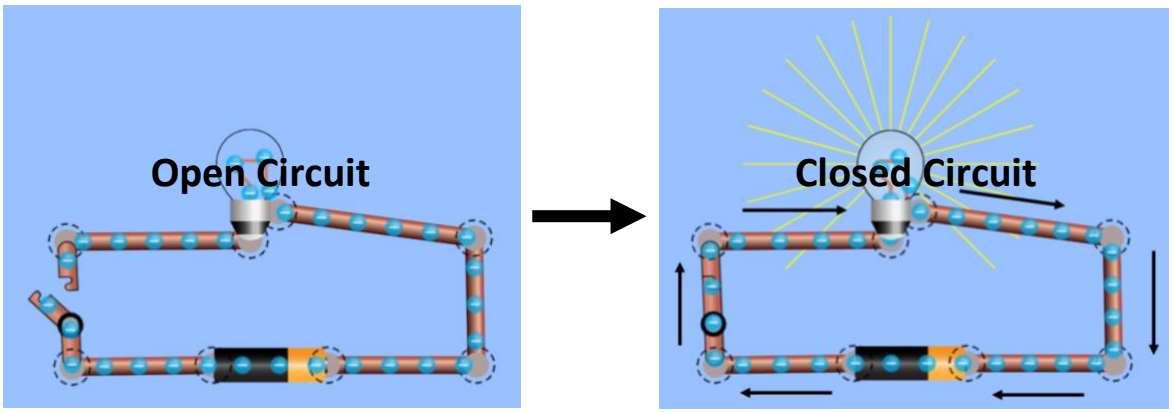
Once it reaches your home, the electrical power received from a substation is then sent to different parts of the house through a collection of circuits. A circuit is like your circulatory system. Your blood vessels are like wires in a circuit. The vessels carry blood throughout your body to different organs. The wires in a circuit carry an electric current to different parts of an electrical system [3]. Circuits come in all different sizes. Your house is like one big, complicated system of circuits. Each household appliance or device is a part of the electrical system to which electricity and power are supplied. When a device is turned off, its circuits are open, and when you turn the device on, you close the circuit.



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2. Home Appliances and Devices

Home appliances and devices use different amounts of power and energy when they are on and when they are off. There used to be a greater difference between the amount of energy the appliance uses when on and off. Now, many appliances in a typical American household are always drawing power [5]. This means the amount of power a device or appliance draws while on and off could be very similar. Some appliances are always on. That said, household appliances and devices have become more energy efficient over time. They now use less energy and electricity to perform the same tasks as before.

3. Monitoring Energy Usage

There are tools that can monitor the energy consumption of appliances and devices in an electrical system. The data gathered from these tools can be used to create a plan for energy conservation. It is important that these tools are inexpensive and non-intrusive. A non-intrusive tool can monitor the power used by your home without having to access the electrical circuits built into the home's walls and structure [6]. The measurement device you will be using for this project will measure the power consumption of individual devices and appliances in a non-intrusive way.

The total amount of electricity that is provided to your home from energy companies is tracked using built-in meters. Within these meters, special sensors keep an eye on two important things: voltage (V) and current (I). Voltage is the strength of electricity, which is the difference in the amount of electrical particles, between two places in a wire. These particles can be positive or negative [7], and this difference causes them to move. Current represents how much and in what direction these small electric particles are moving. The power used by your home's circuits is found by multiplying the voltage and current values of each circuit. So, your home's built-in meters tell you how much power you are using by measuring how strong and fast the electricity is moving through the circuits.

$$P = V \times I$$

Power represents the flow of energy per unit of time. Power (P) is measured in watts (W), and electric energy (E) is measured in watt-hours (W h). This means energy is equal to power multiplied by time. The power usage and operating time data of your home's appliances and devices can be used to find their total energy usage.

$$E = P \times t$$

$$Whr = W \times hr$$

4. Understanding Household Energy Usage

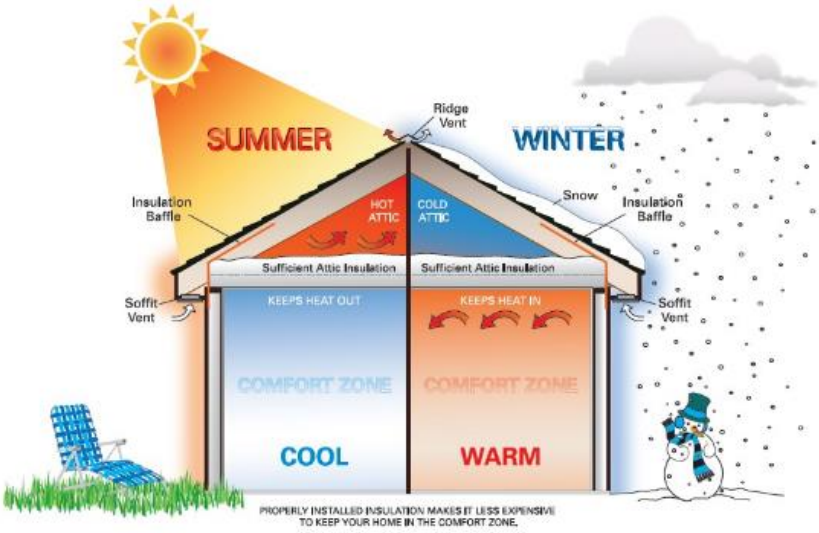
When an appliance is used, electricity flows to the appliance to power it. This electricity is a form of energy that is converted into the appliance's ability to do work that performs tasks. For example, when a refrigerator is given electricity, it cools your food. Electricity provided to your home by power plant substations is usually measured in kilowatt-hours (kW h), which is equal to 1000 watt-hours (W h).

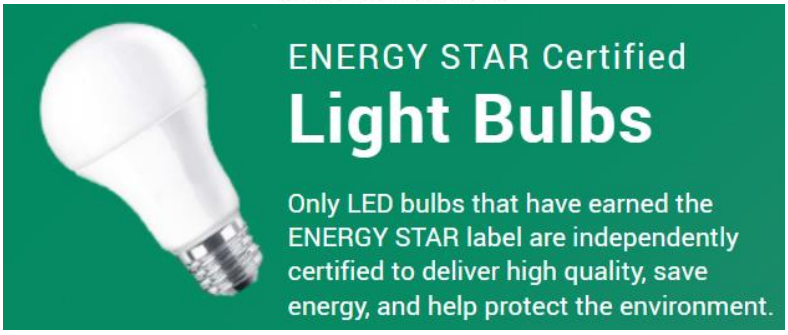
The average US household consumes about 11,000 kilowatt-hours of electricity per year [8]. This electricity is provided to houses by energy companies. These companies charge for the energy they supply. Florida's Duke Energy's typical residential customer, a single home, uses about 1,000 kW h of

electricity per month and has a bill of $171.83 [9]. This is a rate of about 17 cents per kilowatt-hour of electricity. So, the more energy a household uses, the higher their electric bill will be. This is a big reason why power efficiency and preventing energy waste is important. Saving energy saves money.

5. Power Optimization

Power optimization is the use of automated tools to minimize power and energy waste [10]. This can be accomplished in many ways and with different technologies. Smart power strips reduce the energy that is wasted when electronics are plugged in and not in use. LED lights are more energy efficient than incandescent light bulbs, which waste more energy by giving off heat. Proper roof and window insulation is important when it comes to heating and air conditioning [11]. These technologies can all lead to less energy being transferred to the outside environment. This means your HVAC unit, for example, will use less energy to keep the house at a desired temperature.





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Artificial Intelligence (AI) can be used to optimize power usage in households. Using AI, a system of household appliances can be automatically operated to adjust their total energy consumption based on how often you need them to be on or off. This ensures the most efficient use of energy without changes to the desired tasks you need your devices to perform.

6. Smart Energy Management

Smart home energy management systems can help users automatically control their energy usage. For example, different smart technology products can be used to track how your devices operate and then remotely manage them from a phone application. This way, your devices can be programmed to act on a schedule. Smart systems can also detect and provide alerts about issues in appliance and device performance [12]. A common example of a technology used in a household smart system is a smart thermostat. A smart thermostat can monitor and adjust the temperature of a home on its own, based on changes in weather and the time of day, and this reduces energy usage when your HVAC (air conditioning) system is not needed. HVAC systems consume more energy than any other appliance in the home, so having a smart thermostat is very helpful for saving money and energy. Artificial intelligence plays a part in how accurately these smart appliance systems can operate.

Copyright: https://www.energystar.gov/products/smart_home_energy_mgnt_systems

7. What is “Artificial Intelligence”?

Artificial intelligence is the ability of a computer to also do tasks that humans can do. AI has gained popularity in recent years, and it is now being used in many fields to solve complex problems. Commonly, AI is used for personal assistants, to customize social media, and in smart appliances.

The internet of things (IoT) is a network of physical devices that are embedded with sensors and network connectivity that allows them to collect and share data. This system allows these smart devices to talk to each other, exchange data, and perform tasks on their own. There are many ways to automate appliances with an IoT system in your household [13]. An example of an IoT device that can be used to manage appliances is a smart plug, which automatically turns appliances and devices “on” or “off” by sensing different conditions related to a schedule for when you typically use them.

AI in smart energy management systems can use the sensor data from connected devices to make energy management better for the residents. Certain AIs rely on machine learning. Machine learning is the use of data to imitate the way that humans learn. This allows smart systems to gradually

improve their accuracy as AI analyzes patterns in the data it collects with sensors. Data can be analyzed by AI in real time to optimize the appliances operations and improve their performance [14].

This contest will lead your team through the process of analyzing power usage data so that you can design and model how your own smart energy system will make decisions.

Part 5: Main Takeaways

Instructions: Write a 1-3 paragraph summary, in the space below, of your main takeaways about what you learned from this activity. How will these ideas help you with the rest of the contest?

Part 6: Submit This Activity:

- Meet with your team's mentor to check your work and make changes as needed.
- Save this document as a PDF with the title **Activity_1_[Team Name].pdf** and then have your **quality engineer** submit your PDF here: https://ufl.qualtrics.com/jfe/form/SV_0020ZwvCFoQoZj8
- In the submission survey, there will be additional instructions to upload your Team Work Plan.

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