Robotics Projects

9/14/2015

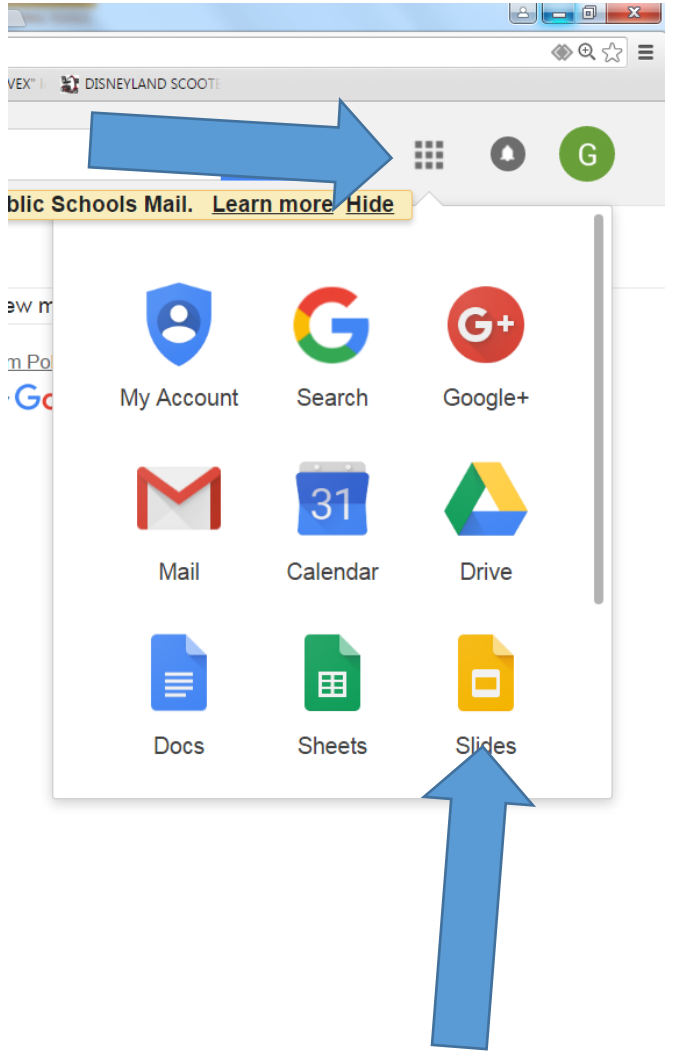
View the Challenge

Setup Engineering Notebooks and Complete the First Four Pages

Continue to Disassemble Last Season's Robots

Today

- Create a **gmail** account if you do not have one.
- Create a Google ‘Slides’ document for your engineering notebook.
  - Log in (create if needed) to your gmail account



- Name it ‘YourNameEngineeringNotebook2016-2017’
- Share it with
- **‘SmithTitanRobotics@gmail.com’**
- When teams are finalized you will need to share it with your teammates as well.

Engineering Notebook

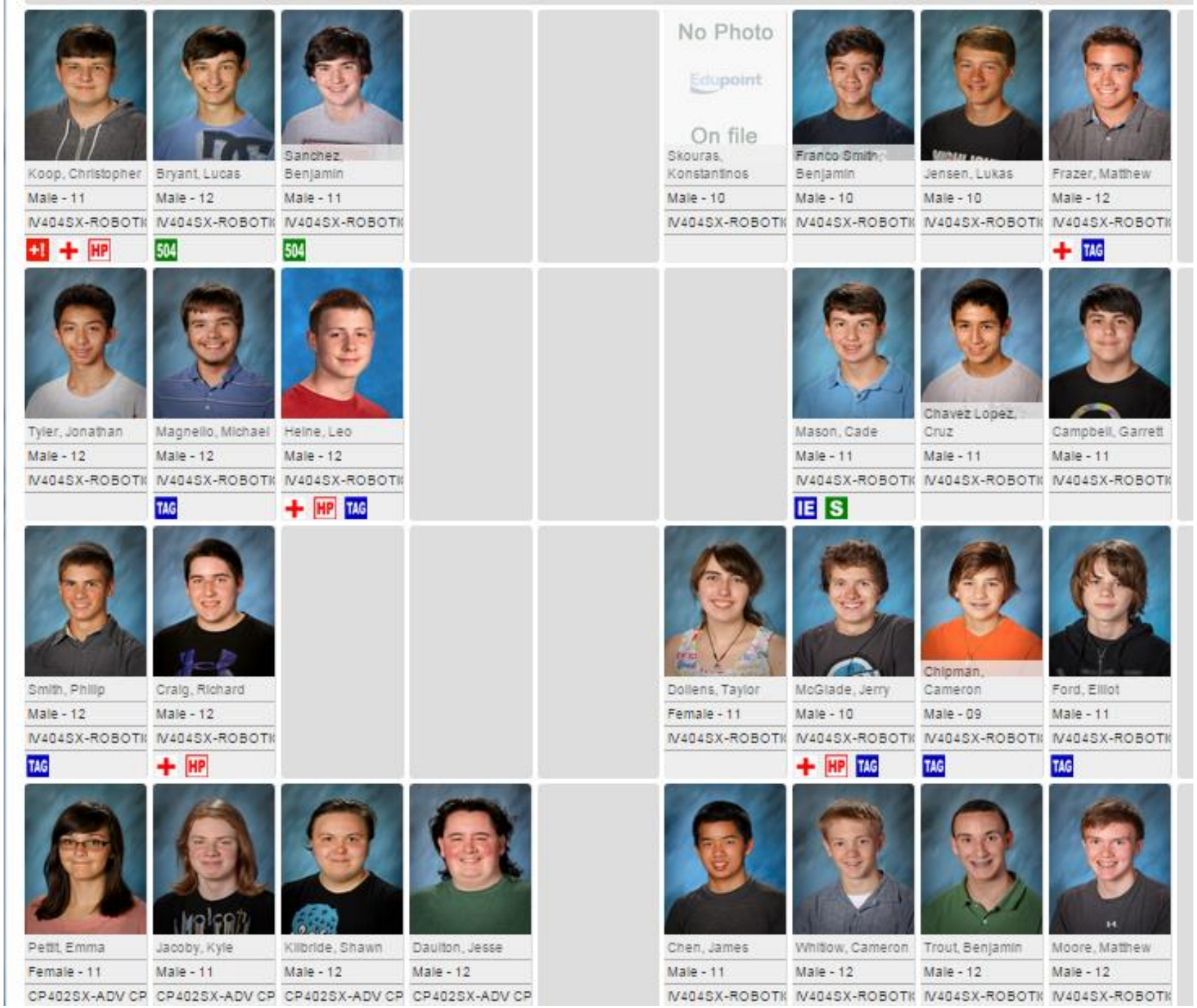
- Page 1:Introduction
  - Name, age, Picture of you, year in school
  - Hobbies interests, If you had to pick a career, what would it be?
- Page 2
  - Table of Contents
- Page 3
  - The time commitment you are willing to put into your team.
  - Skill Set: Classes, abilities, skills that you bring to the robotics team.
  - Roles you would like to take: Builder, programmer, captain, driver, research, promotions, fund raising, product owner, Scrum master…
- Page 4
  - Describe a 'Dream Team'. You may include names if you would like. No guarantees, but it will help me in finalizing the teams.
- Page 5: Sprint Backlog
  - This page will have the tasks your team commits to complete during the next Sprint.
  - At the start of each sprint (3 weeks) you will have another sprint backlog page.
- Page 6, …
  - Have a 'Yesterday', 'Today' and 'In the Way' columns.
  - A place for the date and a place for pictures, date and comments.
- Second to last page: References Slide
  - Links to the VEX Challenge Wiki Page
  - Links to Forums
  - Links to other references you find valuable to your team
- Last Page: Contacts

When finished, continue with disassembling last season's robots.

Day 2: Learning Objectives

- **Break into teams.**
- Brainstorm different strategies for the robot your are designing.
- As a team, set a direction for the strategy your team will begin pursuing this season.
- As a team develop a problem statement for your team.

First Shot at Teams



Strategize: How is your team going to attack this problem?

- Go to the field in the back room
- Talk strategies with your team. Get on the field to get an understanding of the challenges.
- What skill sets will make the robot successful?
- What pair robots will make the best alliance?
- Find some matches online to see how some of the design choices have played out.
- **Go online to look at 'reveals' or other mechanisms that do what you are hoping to do to help clarify you**
- **In your individual journals document the strategy/strategies your team wants to implement this season. The strategy will drive your design.**

Defining the Problem

- **Use the info from your research, your strategy and your team discussions to create a three+ sentence definition describing what you want your robot to be able to do.**
- This should be something you could put on a business card to market your robot to other teams.
- **Make sure a copy of this is in your team and individual journals.**

Day 3: Learning Objectives

- Using your team strategy and problem statement develop specifications and constraints for your robot.
- Begin brainstorming ideas for your robot design.

Specifications and Constraints

- **<u>Specifications: What your robot can do/be</u>**
  - Stable: Will not tip over if placed on a 45 degree angle
  - High Traction: Will not slip when pushed with 8 lb. force
  - …
- **<u>Constraints: What your robot can't do/be</u>**
  - Must fit into an 18"x18"x18"
  - May not use more than 12 motors, or 10 with pneumatics
- **As a team develop at least 8 specifications and 8 constraints for your robot. Use your team strategies to guide the specifications and constraints that you see as important to your design. Record these in your team and individual journals.**

Brainstorming

- **The goal is to generate as many ideas as possible to help you develop the best product as early as possible**

- **Brainstorming Rules**

- **Every person** and every idea has **equal worth**
- **Every** (school appropriate) idea is a good idea!
- Encourage **wild and exaggerated** ideas
- Go for **quantity** at this stage, not quality
- **Build** on ideas put forward by others

Time for the Storm

- Team Roles
  - Recorder (Into the team Engineering Journal)
  - Encourager
  - Thought provoker(s) (Idea generators)
- Rotate roles every 3 minutes
- **Brainstorm and record ideas for your robot I'll tell you when to rotate rolls**

Day 5 Learning Objectives

- Research to find options for your design.
- Continue to brainstorm ideas for your design.
- Start assembling ideas, specifications and constraints to help in selecting your robot design.

Research

- **Each individual will use the internet to research ideas for your robot designs**
- Research 5 minutes
- Share 5 minutes (Every person shares!)
  - Add ideas to your brainstorm list
- Research 5 minutes
- Share 5 minutes (Every person shares!)
  - Add ideas to your brainstorm list

Selecting your Design Direction

- The team will be using a Decision Matrix to help in determining your direction.
- Record this in your team journal and copy into your individual journal

Prioritize: What is the best idea?

- Weigh the advantages and disadvantages of each alternative?
- Set up alternatives in a matrix for analysis (See next slide.)
- Mark the grid (Can use other scales)
  1. + = 1: Better. (Above Average)
  2. 0 = 0: No appreciable difference. (Average)
  3. - = -1: Worse. (Below Average)

Simple Decision Matrix

Specifications / Constraints	Economical	Feasible	Practical	Reliable	Size	Performance	Total
Alternatives							
Tracts							
Dune Buggy							
2 Legs							
Propeller							
Rack and Pinion+Diff.							
Helicopter							
Hoover Craft							
6-wheel:Banana Split							

Put your Specifications and Constraints along the top row

Rate (+, 0, -) each alternative for each specification/constraint in the grid.

Total the score for each alternative in the totals column.

Place your brainstorm and researched ideas along the first column. Do not include the 'off-the-wall' suggestions.

Weighted Decision Matrix Option

How the alternative rates x Importance of specification = score in g

Specifications	Economical	Feasible	Practical	Reliable	Size	Performance	Total
Weighted Importance of specification/ constraint (1 to 5)	1	4	5				
Alternatives							
Trackbot with Scissor	5x1=5	5		4x5=	3x2	3x5=15	86
Omni-bot with 6-bar	4x1=4	4x4=1	=16	15	=10	3x5=15	76
Rack and Pinion + Differential	3x1=3	1x4=4	3x4=12	3x5= 15	3x2 =6	3x5=15	55
6 wheel: Banana Split	4x1=4	3x5=15	5x5=25	5*5= 25	4x2 =8	5x5=	102

Specifications and Constraints

Weights based on the importance of the specification/constraint.

Score = Weight x Rating of alternative

Alternatives

Totals

Day 6 Learning Objective

- Time to select your team robot design.

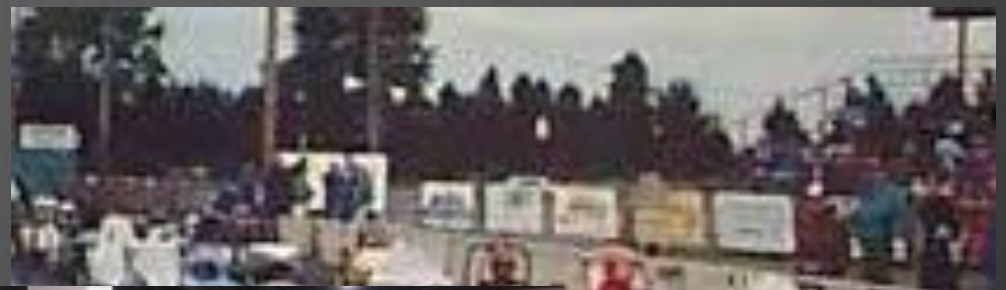
Select your design

- Use the rating from the Decision Matrix to help you select the design.
- You do not have to select a particular design that rated highest in the Decision Matrix.
  - Sometimes a robot that is OK at everything but good at nothing comes out high in the ranking
- Your team has the final say in your design direction, but you should be able to justify it.
- **Record your design choice and why in your engineering journal.**

Day 7:
Using Scrum to Improve Teamwork, Communication, Quality and Speed

South Metro-Salem STEM Partnership

STEM Projects Over the Years

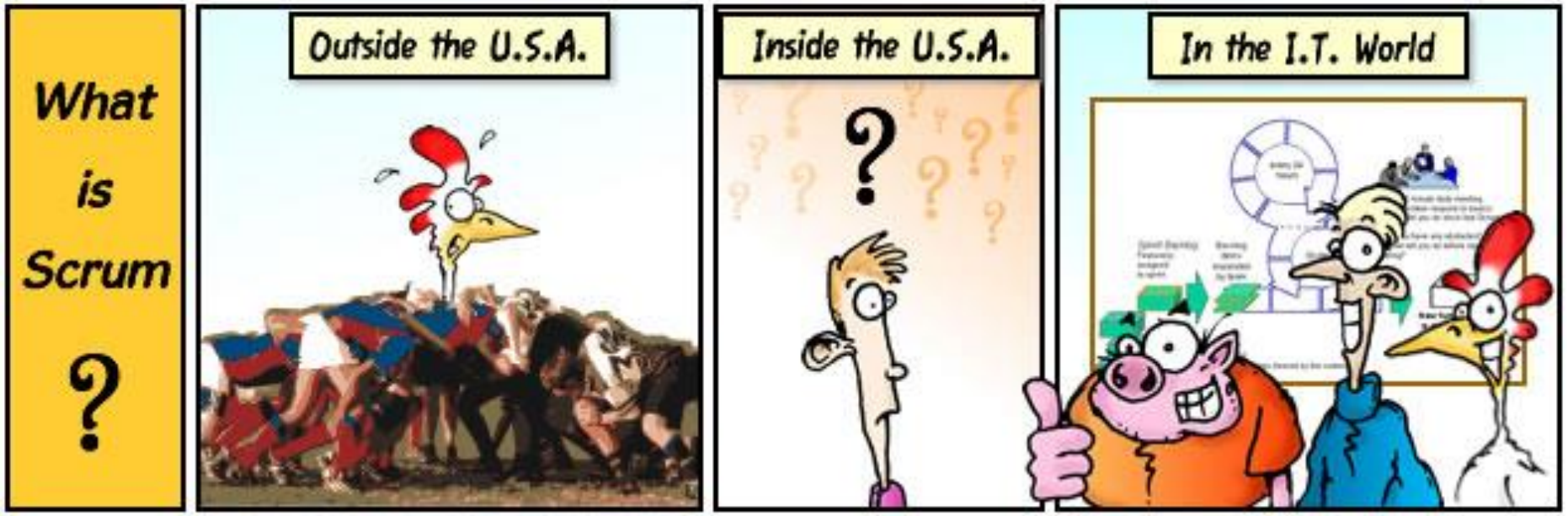


How can I help students work more effectively in teams?

South Metro-Salem STEM Partnership

Goals for this session

- You will have a basic understanding of…
  - The Principle behind Scrum: Agile Manifesto
  - The People: Committed vs. Involved
  - The Plane: Hands on Example
  - The Process: From idea to product
  - The Potential: You can see how it could help your students succeed.



The Principle:
Agile Manifesto

Scrum is one application of Agile product development.

- We are uncovering **better ways of developing *products*** by doing it and helping others do it.

Through this work we have come to value:

- **Individuals and interactions** over processes and tools
- **Working *products*** over comprehensive documentation
- **Customer collaboration** over contract negotiation
- **Responding to change** over following a plan

- That is, while there is value in the items on the right, we value the items on the left more.

Why Scrum?

Yahoo's Survey of Teams that Switched to using Scrum

- Improved Productivity (Productivity up 38%)
- Improved Morale (52% yes vs. 9% no)
- Improved Accountability/Ownership (62% yes vs. 6% no)
- **Improved Collaboration/Cooperation** (81% yes vs. 1% no)
- Improved quality (44% yes vs. 10% no)
- 85% of new users prefer to continue using Scrum

Some Companies that use Scrum

What is Scrum?

Scrum is a way for teams to work together to develop a product.

Product development, using Scrum, occurs in small pieces, with each piece building upon previously created pieces.

Building products one small piece at a time encourages creativity and enables teams to respond to feedback and change, to build exactly and only what is needed.

From Industry to My Classroom (Robotics)

Part 1. Pre-Scrum: Determined Initial Design Direction

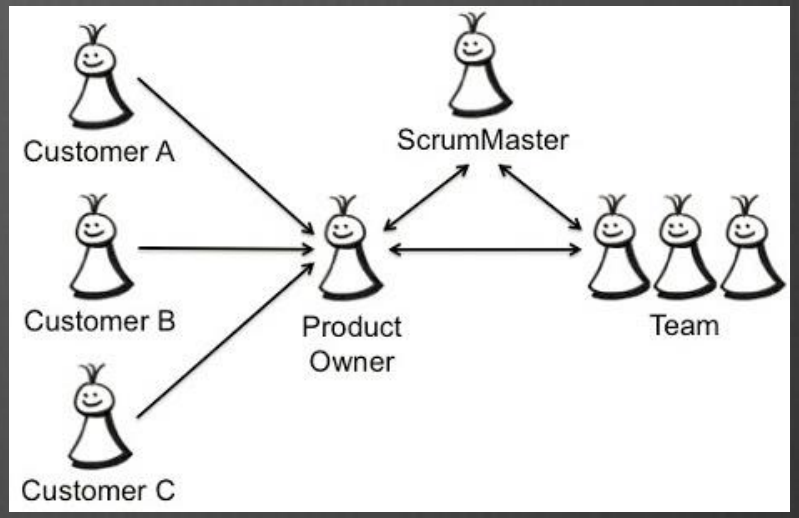
- Defined **what** the robot is to do
- Set **Specifications** and **Constraints**
- Researched and Brainstormed Solutions
- Selected the Original Design Direction

Part 2. Develop the product in Teams using Scrum

- Establish Roles
- Apply Process

South Metro-Salem STEM Partnership

Role: Product Owner



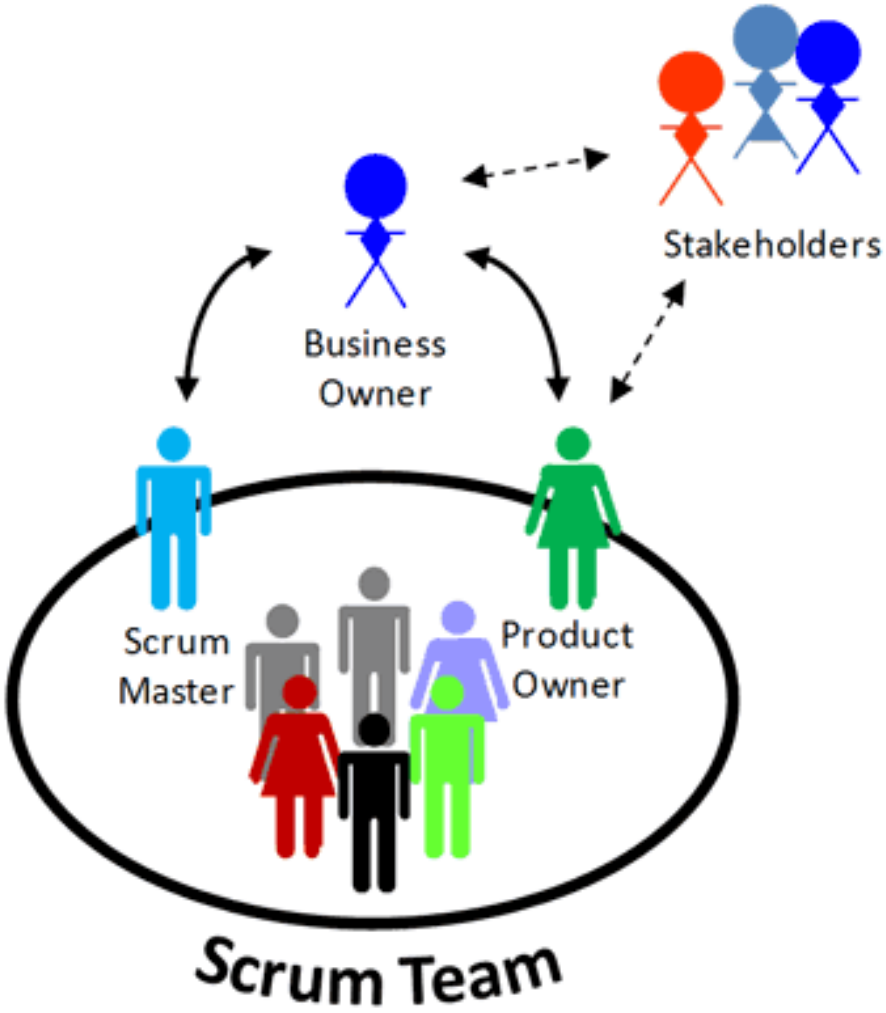
- Represents the Customer to the Scrum Team.
- Decides what will be built and in which order. (Organizes Product Backlog)
- Maximizes the Return on Investment (ROI) of the team.
- Decides when something is ‘Done.’
- Class: Role rotates between team members.

People: Scrum Master (Team Leader)

- Servant Leader
- Conductor of Ceremonies (Meetings)
  - Daily Scrum
  - Sprint Planning
  - Sprint Reviews
  - Sprint Retrospectives
- Monitoring and Tracking
- Shields the Team from distractions.
- Class: Runs the team meetings.

People: Scrum Team

- A Scrum Team is a collection of individuals working together to deliver the requested and committed product increments.
- Scrum Master
- Product Owner
- Class: Your Student team.



Scrum Process

1) A Project Begins "We want to build a robot to …"

2) **Product Owner** with help from the team, prioritizes list of tasks into a '**Product Backlog**.'

3) **Scrum Master** leads **team** in the **Sprint Planning Meeting** to create a **Sprint Backlog**. A list of top Product Backlog entries that can be completed in the next **Sprint**.

4) **Sprint**
1-4 Week
Team works to complete items from the Sprint Backlog.

4a,b,c,…
Daily Scrum
Yesterday
Today
In the Way

5) **Sprint Review:**
Demonstrate potentially shippable product.

6) **Sprint Retrospective**
What went well?
What did not go well?
What changes need to occur?

Tracking Progress

Problems: Impediments

Product Backlog	**To do Sprint Backlog**	**Doing (Tasks)**	**Done (Tasks)**
Prioritized list of tasks	Prioritized list of tasks the team has committed to complete in this Sprint.	The Tasks currently in progress.	Approved by the Product Owner

Retrospective: End of Sprint

After the Sprint answer the questions:
What went well?
What did not go well?
What can we do better?

Scrum Getting Started Task

I put together a list of potential tasks to help students generate their Sprint Backlog

- Sprint Planning Meeting
- Using the Link to potential items for your product backlog, as a team select items that you will commit to complete in the next two weeks.
- https://docs.google.com/spreadsheets/d/1GcX-He1I54ns9twiONBjoNB52DP72vPJ7zqWnAndmx8/edit?usp=sharing
- There is also a link on the class website.
- Place items that you intend to complete, but cannot commit to completing in the next sprint.

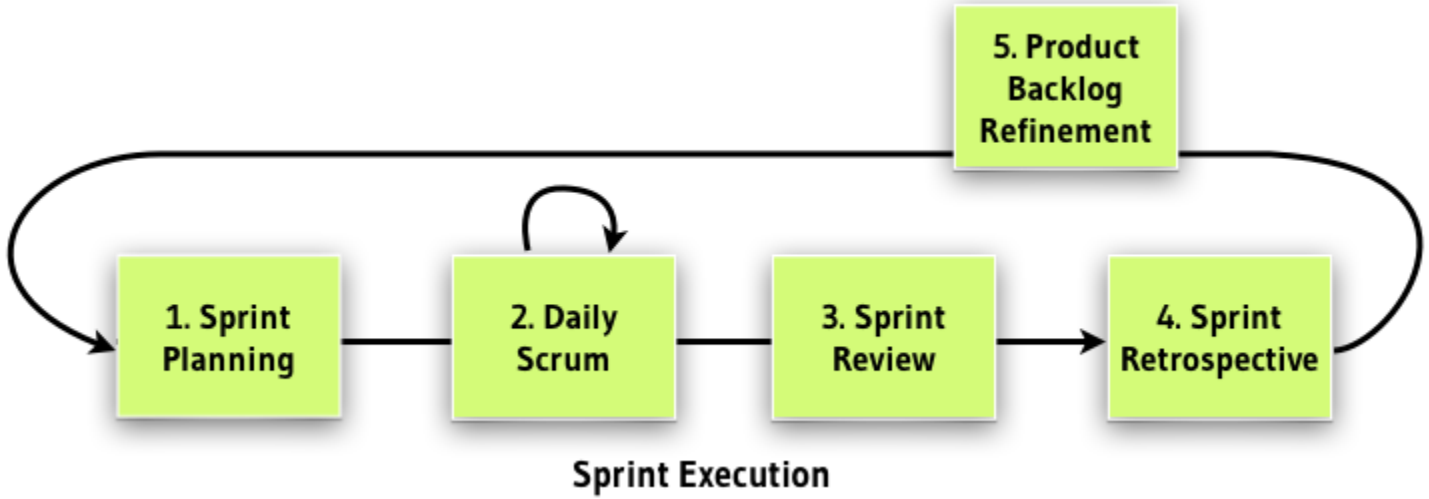
Complete this on Monday

- Select Product Owner: Quality Control
- Select Scrum Master: Team Leader
- Build Sprint Backlog:
  - Tasks you can get done by the end of the fist Sprint

Sprint…

- Daily Scrum Meeting:
  - What was done yesterday?
  - What do you intend to do today?
  - What is getting in your way of success?
- Work:
  - Select a task
    - Add your name to the sticky note
    - Move the note to the ‘Doing’ column
  - When you finish a task, demonstrate it to your Product Owner. If it passes, the product owner signs off and the note is moved to the ‘Done’ Column.
  - At the end of the sprint your team will demonstrate the ‘Done’ items.

End of Sprint Meetings (At the end of the Sprint. I use 3-weeks for the Sprint Time Length)

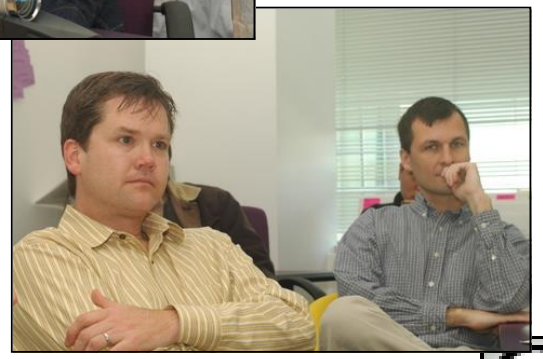


Outline for the Day on Friday

- Sprint Review Meetings: Demonstrate your product to the class
  - Class gives feedback
- Sprint Retrospective Meetings:
  - First within the team
  - Next with the entire class
- Demonstrate Team Notebook to Mr. Smith
  - Show the work of each team member.
- Sprint Planning Time
  - Committing to what you will accomplish by Wednesday, November 18th
  - Friday November 20th is an in-class tournament

The Sprint Review

- Team presents what it accomplished during the sprint
- Typically takes the form of a demo of new features or underlying architecture
- Informal
  - No slides
- Whole team participates
- Invite the world



Sprint Review Outline

- Demonstrate what is working on your product
- Product owner declares what is ‘Done’
- Stick to the goals of the Sprint.
- Add new ideas/tasks to the Product Backlog. Your team can determine if they should be added to the next Sprint.
- If something did not get done, put it on the product backlog. On Monday your team can determine to place it in the next Sprint.

Sprint Retrospective

- Periodically take a look at what is and is not working
- Typically 15–30 minutes
- Done after every sprint
- Whole team participates
  - ScrumMaster
  - Product owner
  - Team
  - Possibly customers and others

Sprint Retrospective: Good/ Bad/ Change

- Whole team gathers and discusses:

What went well.

What did not go well.

What should change

This is just one of many ways to do a sprint retrospective.

Sprint planning

- Team selects items from the product backlog they can commit to completing
- Sprint backlog is created
  - Tasks are identified and each is estimated (1-16 hours)
  - Collaboratively, not done alone by the ScrumMaster
- High-level design is considered

As a driver I want the robot to be able to move using the competition template.

Complete the frame
Attach motors, controller battery
Write the drivers control code
Test the driving code
Move code into competition template.

Scrum Process

1) A Project Begins "We want to build a robot to …"

2) **Product Owner** with help from the team, prioritizes list of tasks into a '**Product Backlog**.'

3) **Scrum Master** leads **team** in the **Sprint Planning Meeting** to create a **Sprint Backlog**. A list of top Product Backlog entries that can be completed in the next **Sprint**.

4) **Sprint**
1-4 Week
Team works to complete items from the Sprint Backlog.

4a,b,c,…
Daily Scrum
Yesterday
Today
In the Way

5) **Sprint Review:**
Demonstrate potentially shippable product.

6) **Sprint Retrospective**
What went well?
What did not go well?
What changes need to occur?

Tracking Progress

Problems: Impediments

Product Backlog	**To do Sprint Backlog**	**Doing (Tasks)**	**Done (Tasks)**
Prioritized list of tasks	Prioritized list of tasks the team has committed to complete in this Sprint.	The Tasks currently in progress.	Approved by the Product Owner

Retrospective: End of Sprint

After the Sprint answer the questions:
What went well?
What did not go well?
What can we do better?