



PROJECT-BASED LEARNING USING AGILE TOOLS

Michigan Career Education Conference

Keith E. Kelly

Jan. 30, 2018

- Engineering Technology
- Robotics and Automation
- Project Management
 - Systems Engineering in Practice
 - Project Management
 - Marine Technology Capstone
- Project-Based Learning
 - Microcontroller Programming
 - Microcontroller Systems

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GOALS

- Why Project-Based Learning (PBL)?
- What is it? - Identify requirements of PBL
- Agile Project Management tools
 - What are they?
 - How do they fit with PBL?
- Examples and Results

THE “IDEAL” GRADUATE

- Critical thinking, problem solver
- Communication – written, verbal, non-verbal
- Works independently or as part of a team
- Manages time and work effectively
- Technology – comfortable with challenge and uncertainty



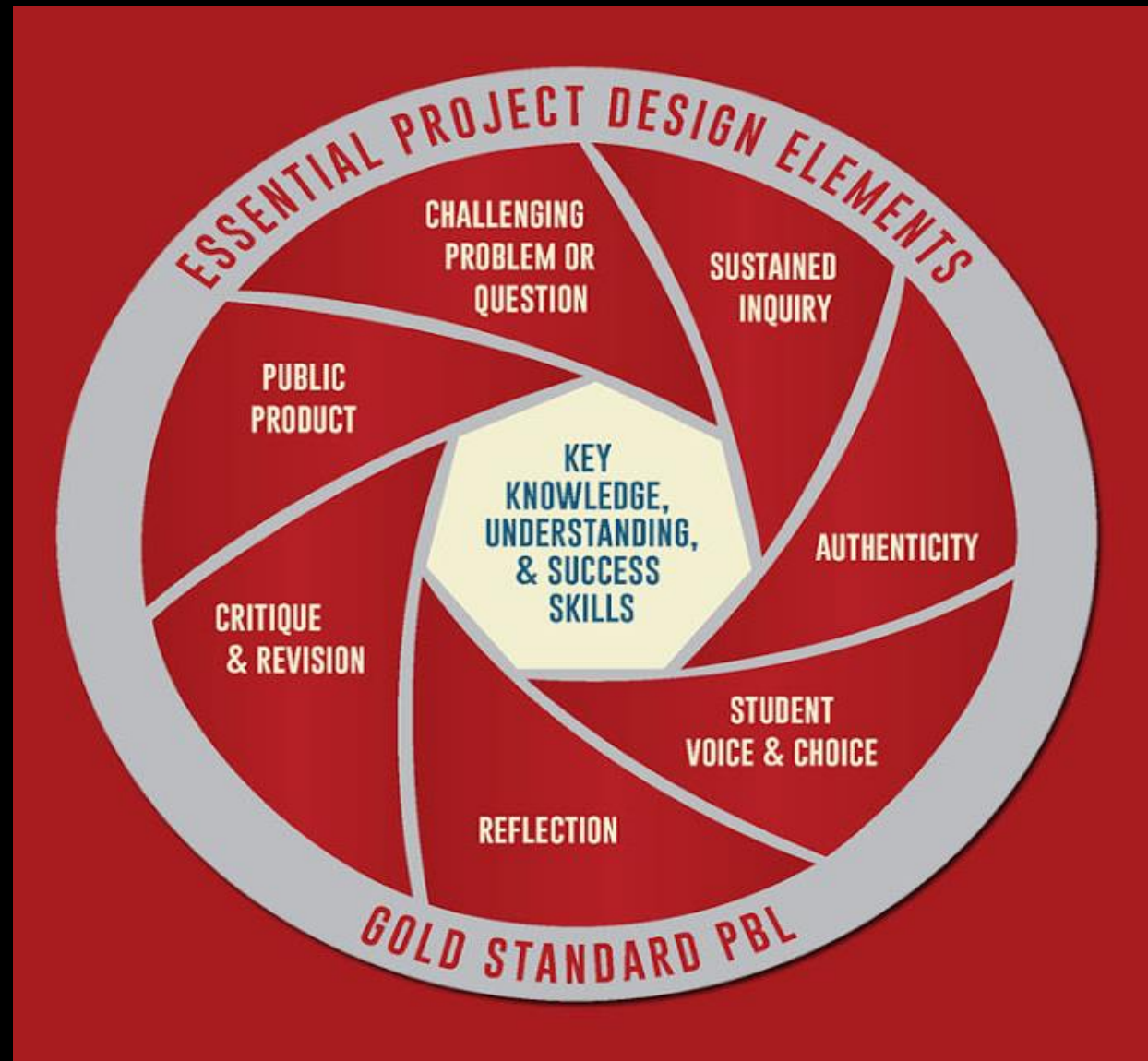
A vibrant red abstract graphic consisting of overlapping, curved, ribbon-like shapes that create a sense of depth and movement, positioned in the bottom-left corner of the slide.

STUDENT
MOTIVATION

Vision without
execution is just
hallucination

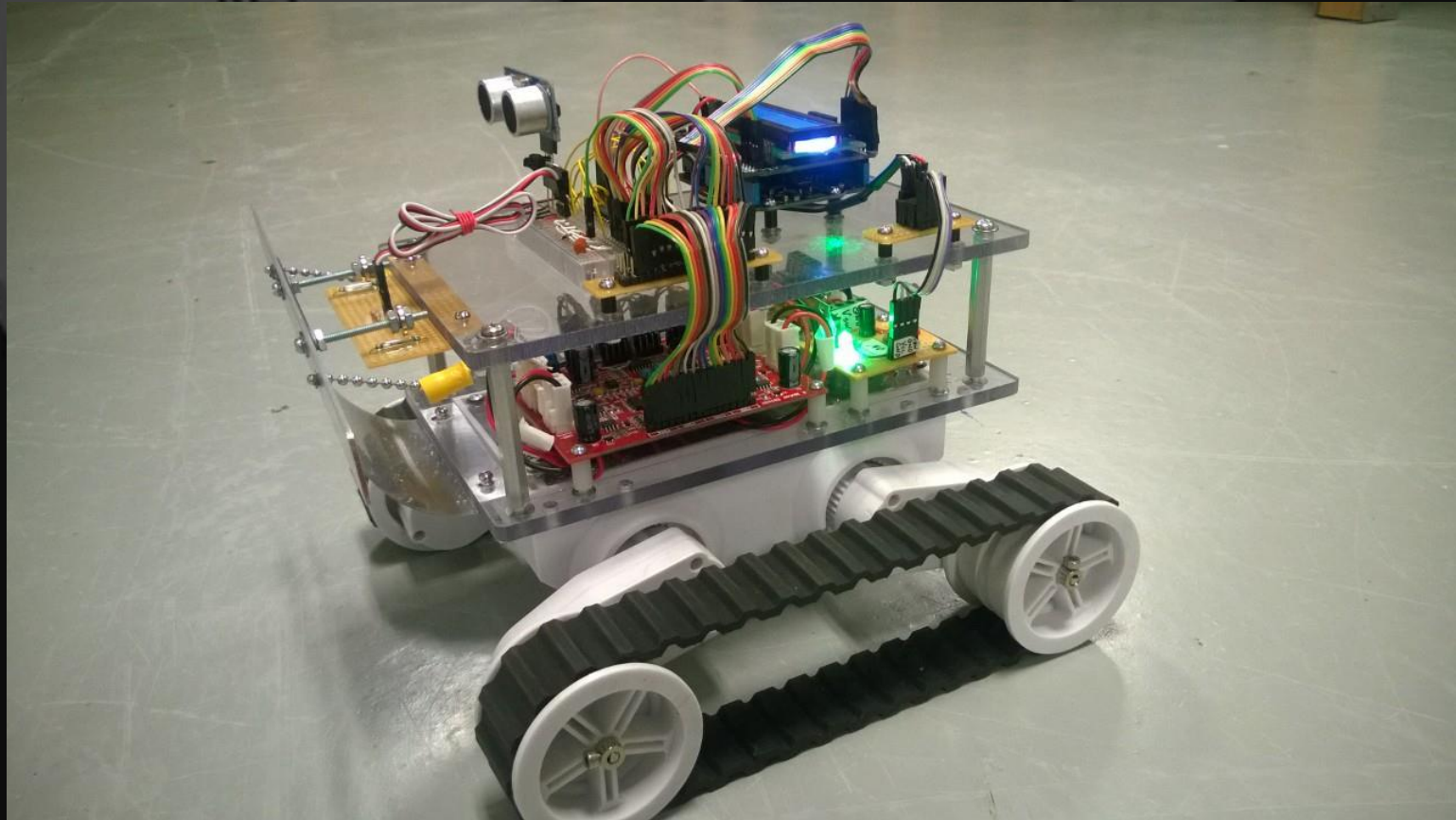
– *Henry Ford*

PBL GOLD STANDARD



CHALLENGING PROBLEM OR QUESTION

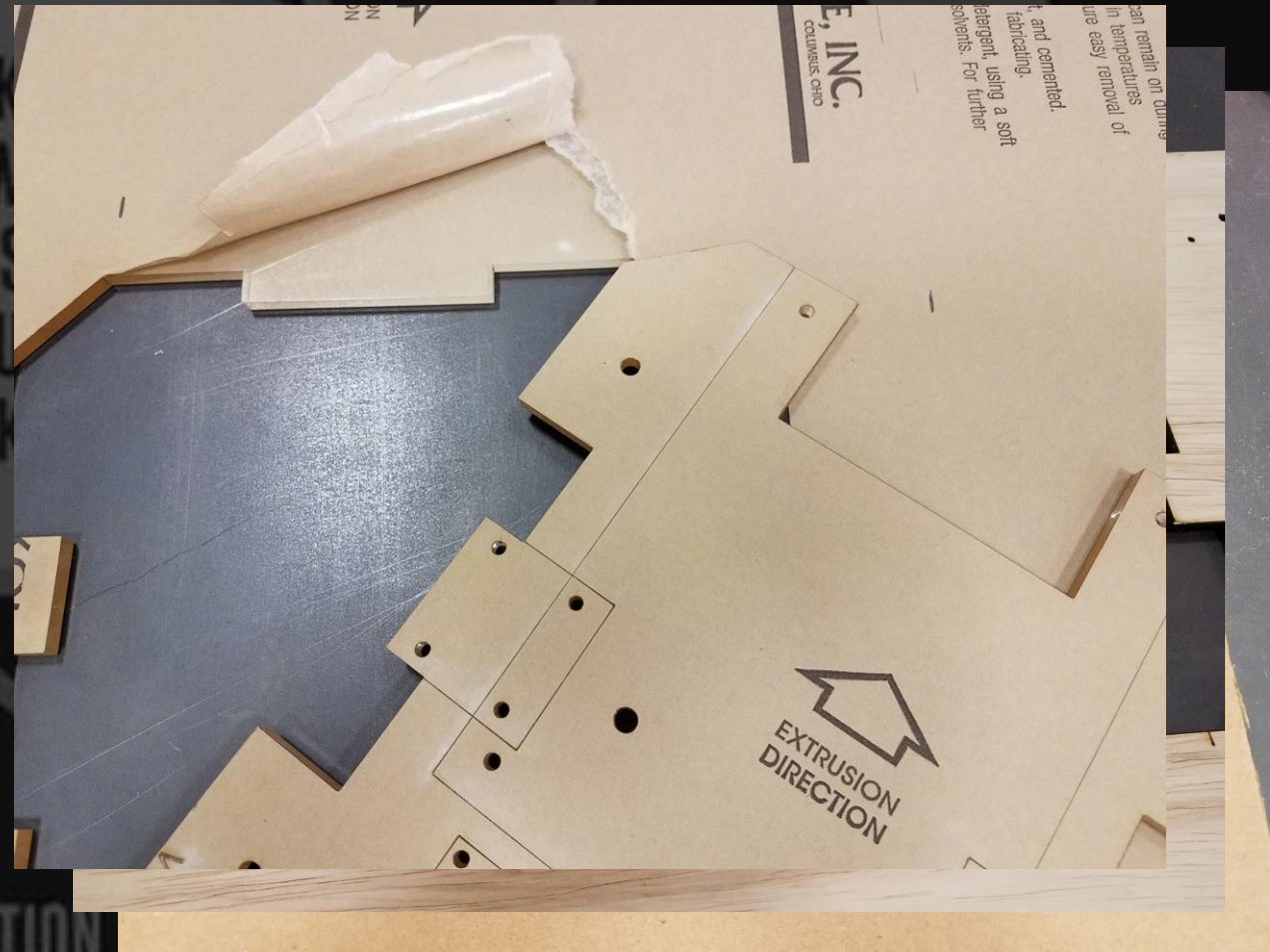
Rover Bumper Design



SUSTAINED INQUIRY

Bumper Iterations

Acrylic
Wood
Cardboard





Sprint 1	Bumper notes
Sprint 2	Phase 1
Sprint 3	Sketches
Bumper	Orthographic Drawing...
Top Plate	Test Documentation a...
ServoSonar	Mock-ups
Special	Phase 2

Objective

Get started on initial thoughts and ideas for bumper design
Make some designs and prototypes

Plan/procedure

- Brainstorm bumper designs
- Draw ideas
- Make prototype (paper)
- Make prototype (cardboard)
- Measure and draw accurately
- Make Q-CAD drawing
- Cut cardboard prototype (BOSS)
- Re-design/adjust
- Once cardboard prototype fits, cut acrylic

Design and pix

Owen and I came up with a design which requires the bumper to be in two pieces, right and left. Four switches will act as indicators of where the obstacle is and communicate to the rover what to do next.

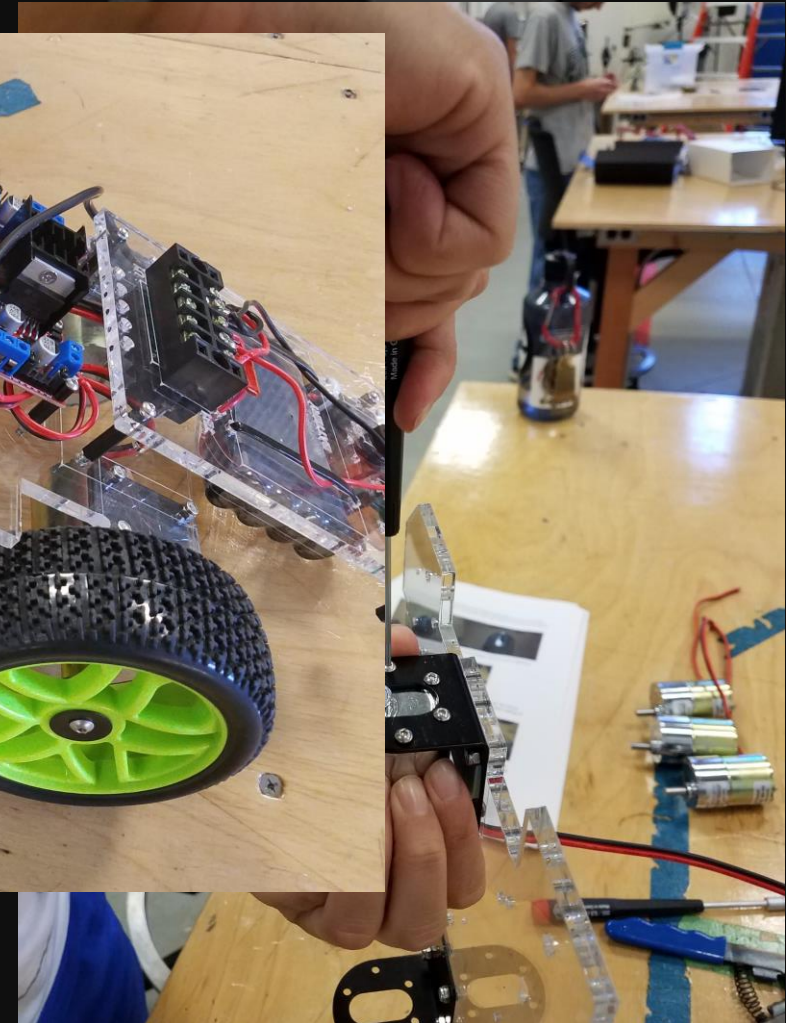
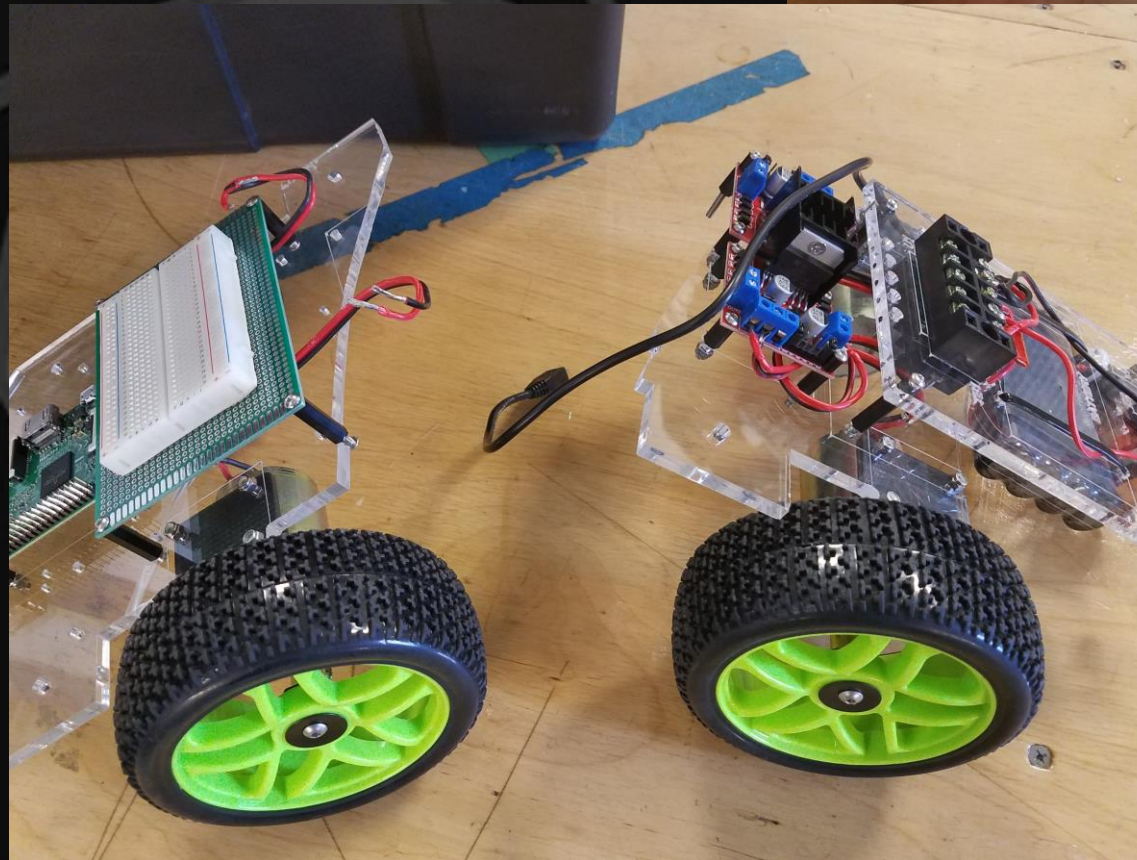
The bumper will be attached directly to the switches, as the acrylic fits snugly into the groove on the switch.

An initial bumper will be made out of cardboard.
The bumper pieces will be designed in CAD, then cut on the laser cutter.

Outcomes/Results

Rover Design AND Build

AUTHENTICITY



PUBLIC
PRODUCT

PROBLEM OR
QUESTION

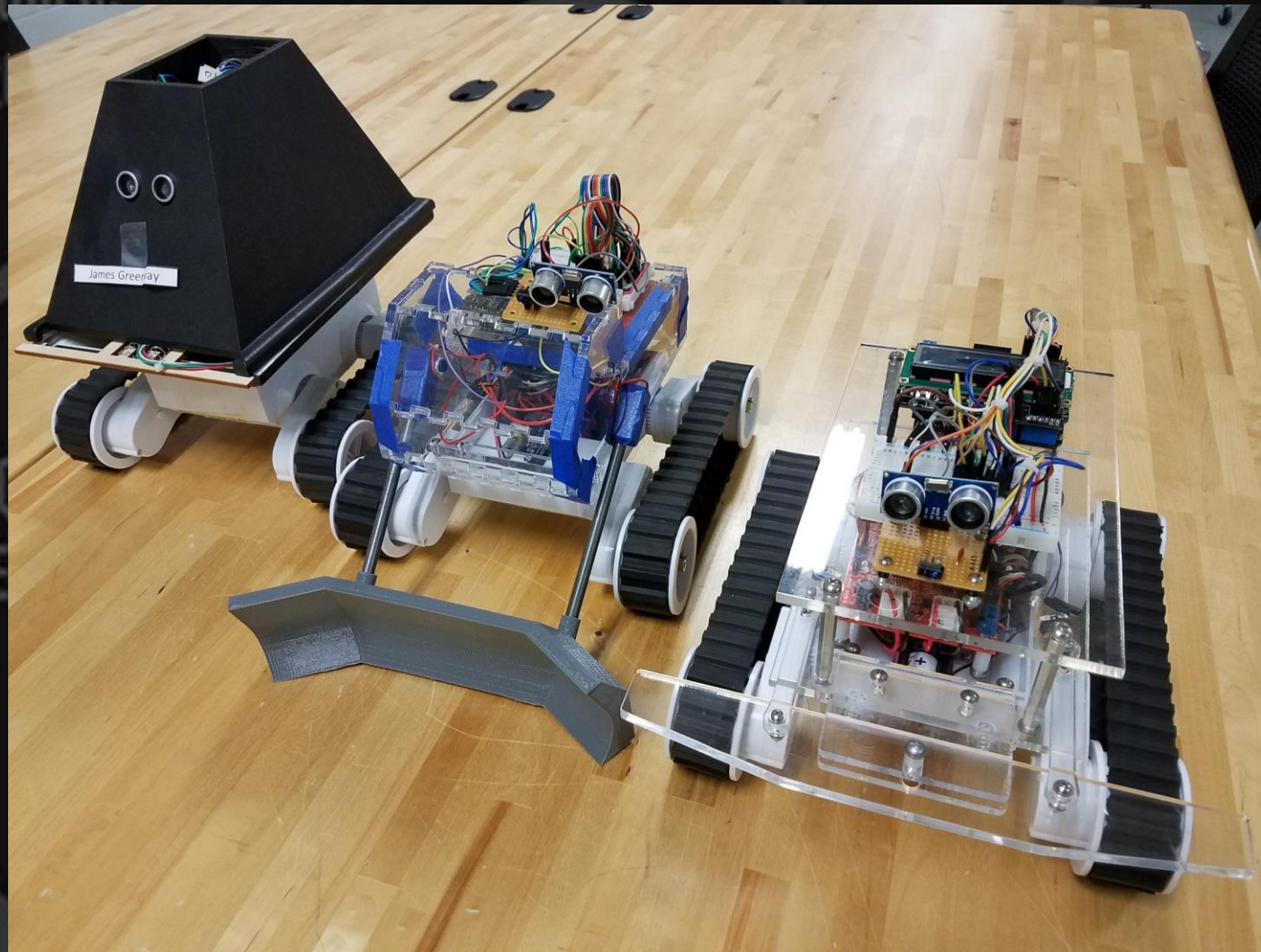
SUSTAINED
INQUIRY

UNITS

& REVISION

REFLECTION

STUDENT VOICE AND CHOICE

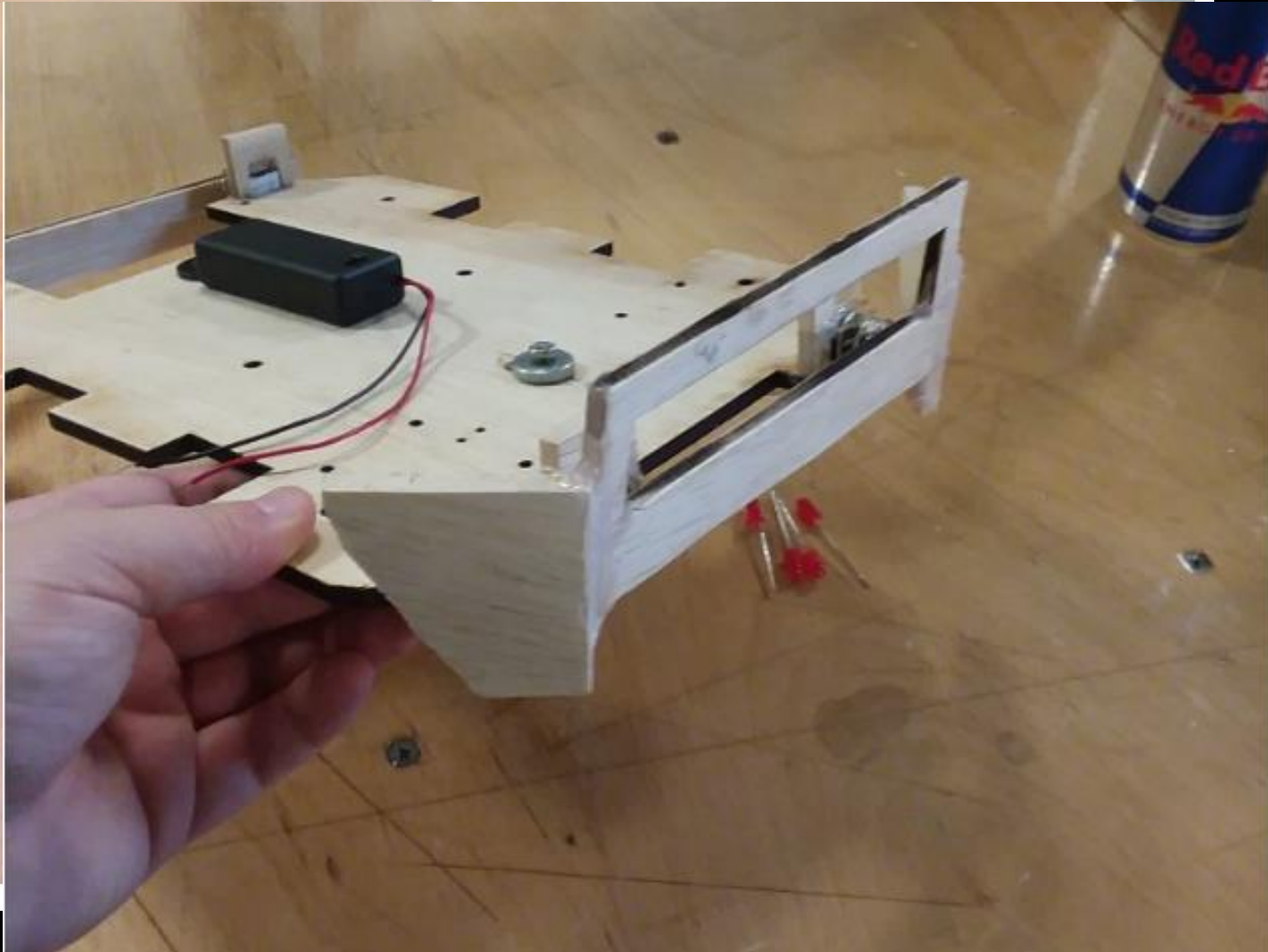




REFLECTION

- What did I accomplish since our last session?
- What do I need to accomplish today?
- What are my obstacles or impediments?

Side View:



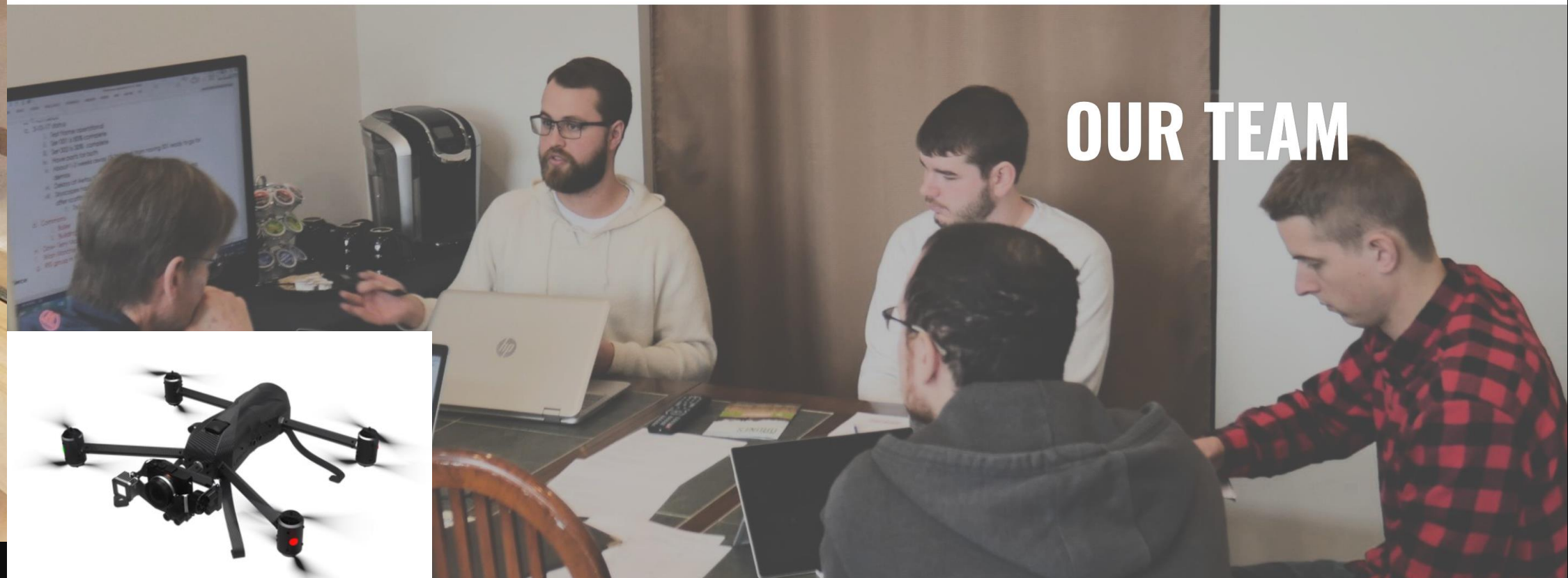
CRITIQUE AND REVISION



ON REVIEW AND PRESENTATION



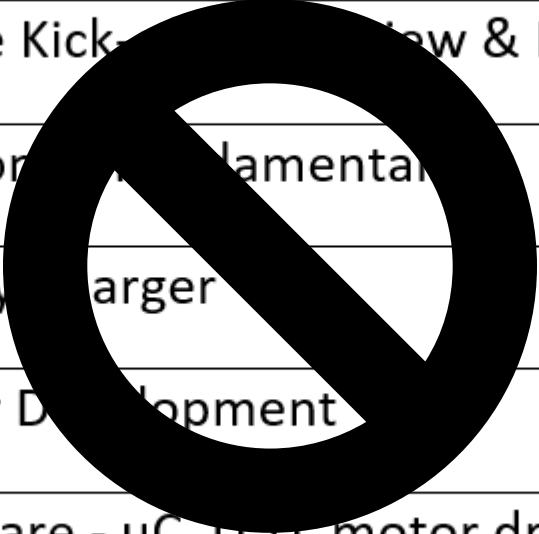
[WHO ARE WE?](#) [PRODUCT](#) [DEMONSTRATION](#) [OUR TEAM](#) [NEWS](#) [CONTACT US](#)



OUR TEAM

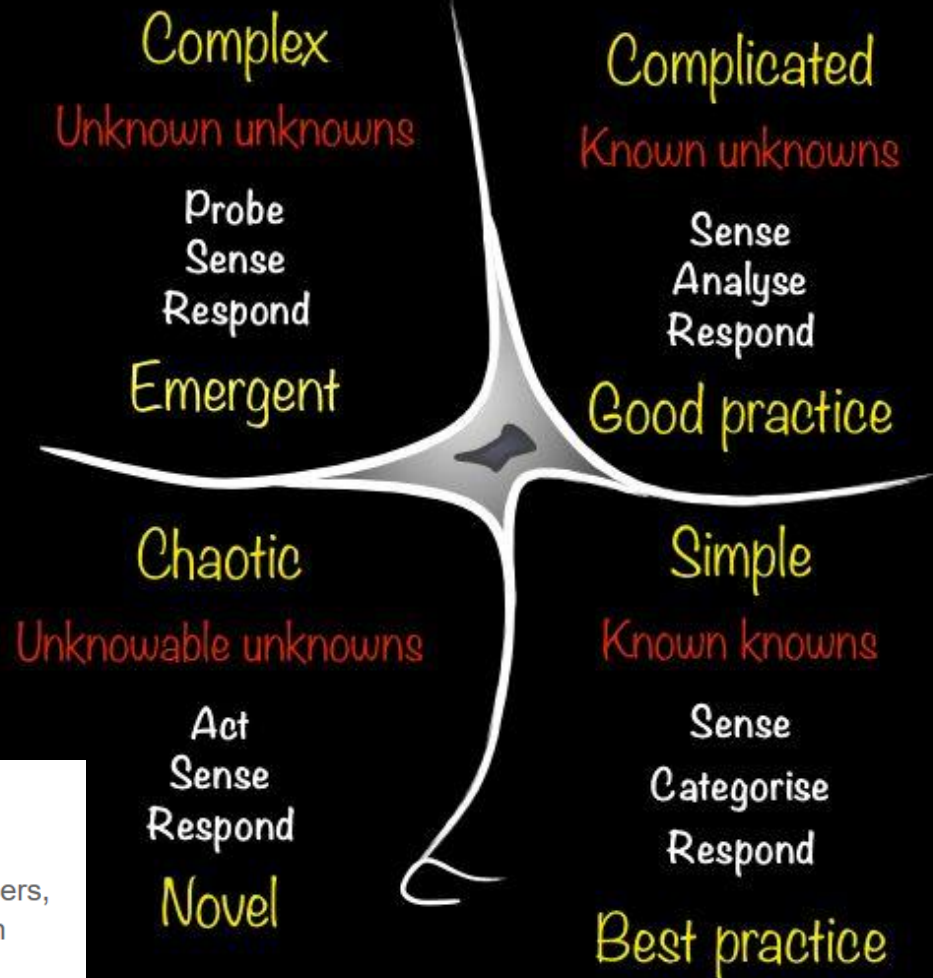
PROJECT-BASED LEARNING CHALLENGES THE INSTRUCTOR

<i>Week</i>	<i>Topic</i>
1	Course Kick-off, Review & Expectations
2	Electronics Fundamentals
3	Battery Charger
4	Sensor Development
5	Hardware - <u>uC</u> , LCD, motor driver
6	Integration



UNCERTAINTY AND EMERGING REQUIREMENTS

Cynefin



Cynefin framework - Wikipedia

<https://en.wikipedia.org/wiki/Cynefin>

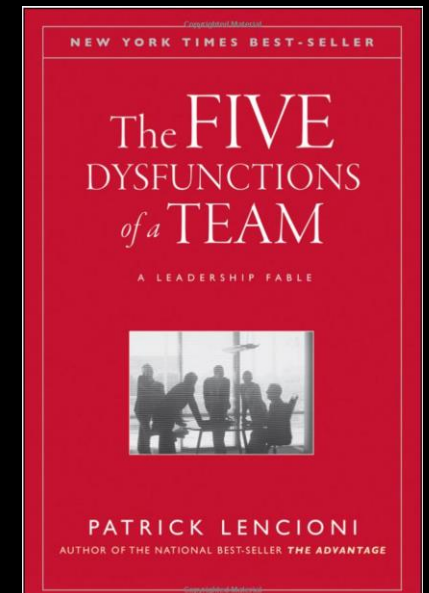
The **Cynefin framework** (/ˈklɪnɪn/ kun-EV-in) is a conceptual **framework** used to help managers, policy-makers and others reach decisions. Developed in the early 2000s within IBM, it has been described as a "sense-making device". **Cynefin** is a Welsh word for habitat.

[Background](#) · [Domains](#) · [Applications and ...](#)

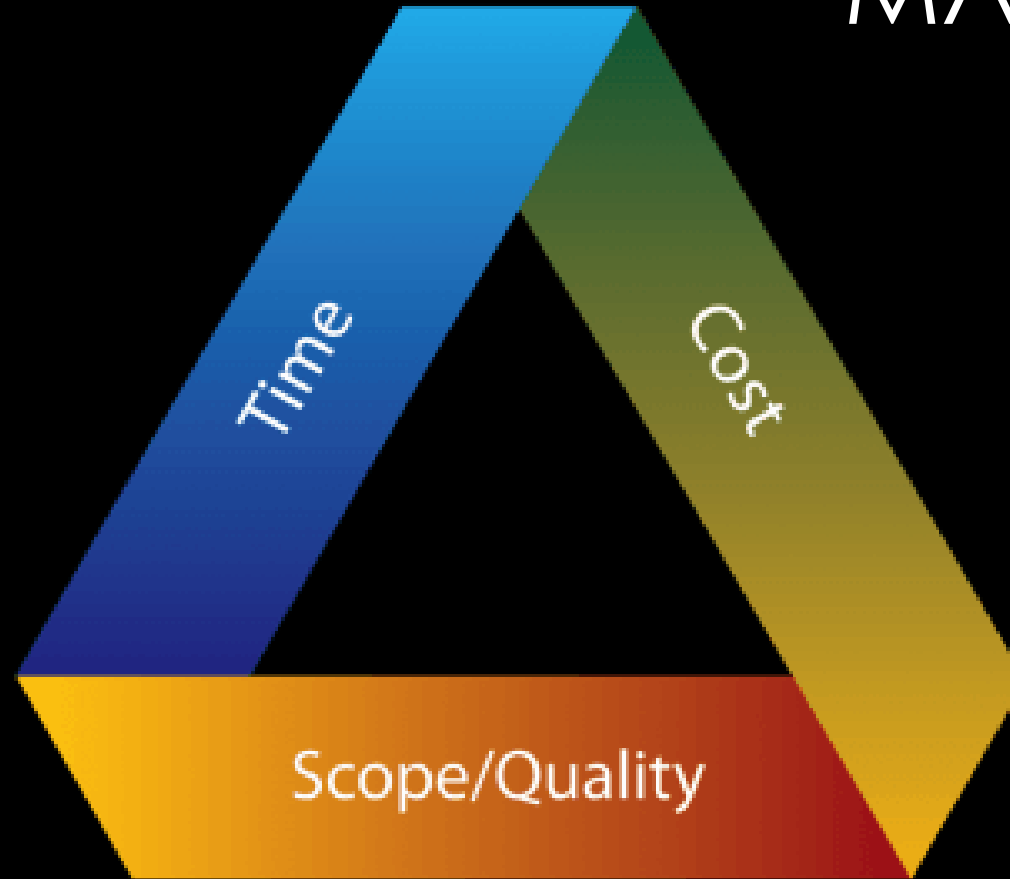


AGILE TOOLS APPLIED TO PBL

BUILD THE CULTURE



TRIPLE CONSTRAINT OF PROJECT MANAGEMENT



PROJECT SELECTION

Weighted Scoring Model for EET260

Created by:

Date:

Note: Enter your scores (1-10) for each project in the template below.

Criteria	Weight	BitCoin Mine	Makers Space	Lawn Spreadder	Bluetooth BackPack
Appropriate Scope	40%	10	7.5	8	10
Budget/Cost	10%	10	8	8.5	10
High Value To Stakeholder/product owner	15%	8	5	8	7
Appropriate Skill Set	15%	7	6.5	8.5	10
Limited Transition After Project	5%	10	4.5	5	5
		0	0	0	0
External Dependency	10%	5	5	7	8
Clearly Demonstratable deliverables	5%	7	8	8	10
Weighted Project Scores	100%	8.1	6.15	7.175	8.3



PITCH THE PROJECT

Lean Canvas

Designed for:

Designed by:

On: Day Month Year
Iteration: No.

Problem Top 3 problems	Solution Top 3 features	Unique Value Proposition Single, clear, compelling messages that states why you are different and worth buying	Unfair Advantage Can't be easily copied or bought	Customer Segments Target customers
Existing Alternatives	Key metrics Key activities you measure		Channels Path to customers	
Cost Structure Customer acquisition costs, Distribution costs, Hosting, People, etc			Revenue Streams Revenue model, Life time value, Revenue, Gross margin	

Lean Canvas is adapted from the Business Model Canvas and is licensed under the Creative Commons Attribution-Share Alike 3.0 Un-ported License

Created by Ash Maurya
Based on the book Running Lean

Lean Canvas

Designed for:

Designed by:

On: Day Month Year

Iteration: No.



Problem Top 3 problems	Solution Top 3 features	Unique Value Proposition Single, clear, compelling messages that states why you are different and worth buying	Unfair Advantage Can't be easily copied or bought	Customer Segments Target customers
Existing Alternatives	Key metrics Key activities you measure	High-Level Concept	Channels Path to customers	Early Adopters

Cost Structure Customer acquisition costs, Distribution costs, Hosting, People, etc	Revenue Streams Revenue model, Life time value, Revenue, Gross margin
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MANAGE ACTIVITIES



SCRUM



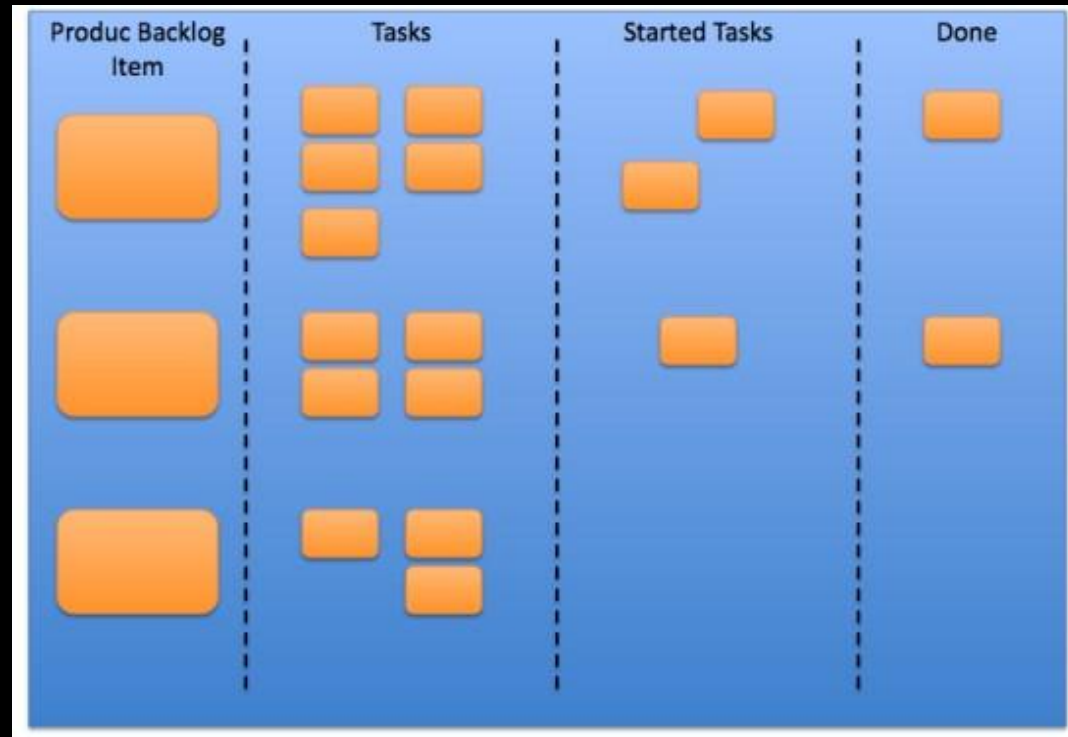
Scrum Training Series

1. Introduction to Scrum
2. Backlog Refinement Meeting
3. Sprint Planning Meeting
4. Daily Scrum Meeting
5. Sprint Review Meeting
6. Sprint Retrospective Meeting

SCRUM ACTIVITIES AND ARTIFACTS

Sprint

- Time boxed
- Specific Start/End
- Backlog Feature Selected
- Tasks Defined
- Tasks Assigned
- Status Tracked



User Role

As who, I want
what so that why.

The Goal

The Benefit

REQUIREMENTS AS USER STORIES

DEFINING SCOPE

- Creating a Backlog
- Stories!
- Deconstruction
- Trello.com

The screenshot shows a Trello board interface with the following content:

- Board Title:** F17.EET260.TeamB.Backlog
- Columns:**
 - Epic:**
 - As a team we want to create a crypto mining machine to allow the best return on investment for our project owners which will lead to a greater understanding of how this process of crypto mining works.
 - Add a card...
 - Themes:**
 - As a team we need to research the software to pick the best course of action and so we know how to proceed.
 - As a team we need to acquire the appropriate hardware and software.
 - As a team we need to assemble the hardware and software to create the mining machine.
 - As a team we need to figure out a way to display the crypto miner that will help educate and display what we did.
 - Add a card...
 - Backlog:**
 - As a team we need to research crypto currencies.
 - As a team we need to research the best hardware to create the best return on investment.
 - As a team we need to research the best software to achieve the best return on investment.
 - As a team we need to research the best way to achieve power consumption for our mining system.
 - As a team we need to create an educational piece to this to allow future students and staff gain knowledge on what we did and learned in this process.
 - Add a card...

SPRINT 0 – DEFINITION AND PITCH

The screenshot shows a Trello board titled "F17.EET260.TeamB.Sprint0" with the following columns and cards:

- PBI**:
 - As a pitch presentation, we need to communicate what cryptocurrencies actually are.
 - As a pitch presentation, we need to communicate the educational value of creating a cryptocurrency mining machine.
 - As a pitch presentation, we need to communicate the potential costs of creating the cryptocurrency mining machine.
 - Add a card...
- Tasks**:
 - Add a card...
- In-Progress**:
 - Create score sheet for student and faculty assessment. (SB)
 - Add a card...
- Done**:
 - Weighted Score Card (1)
 - Milestone (1)
 - Software Plan (1) (SB)
 - Research options for display. (1) (SB)
 - Budget (1)
 - System Drawing (1): A flowchart showing the system architecture:

```
graph TD; SolarPanel[Solar Panel 250 Watts Volts-? Amps-? 3'X5']; ChargeController[Charge Controller Volts - ?]; RaspberryPi[Raspberry Pi 5V]; VoltageConverter[Voltage Converter]; USBHub[USB Hub]; Battery[12V Marine Cycle Battery]; SolarPanel --> ChargeController; ChargeController --> VoltageConverter; Battery --> VoltageConverter; VoltageConverter --> RaspberryPi; VoltageConverter --> USBHub;
```
 - Team Charter

EXECUTION – SPRINTS 1 AND 2

F17.EET260.TeamB.Sprint1 F17.EET260.TeamB ☆ Team Visible

PBIs

- I am a Solar Panel attached securely to the outside of the building
- As a solar panel I am supplying the energy to the equipment being used for this project.
- As a prototype for a case I will give an example of what the case will look like
- As a miner I will be configured to run with my mining software
- Configure a acrylic case with a fan based cooling system for the
- Add a card...

Tasks

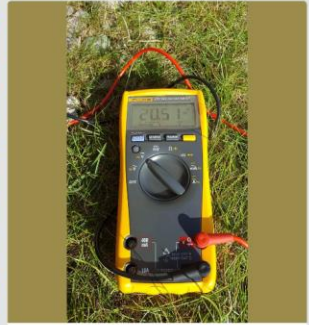


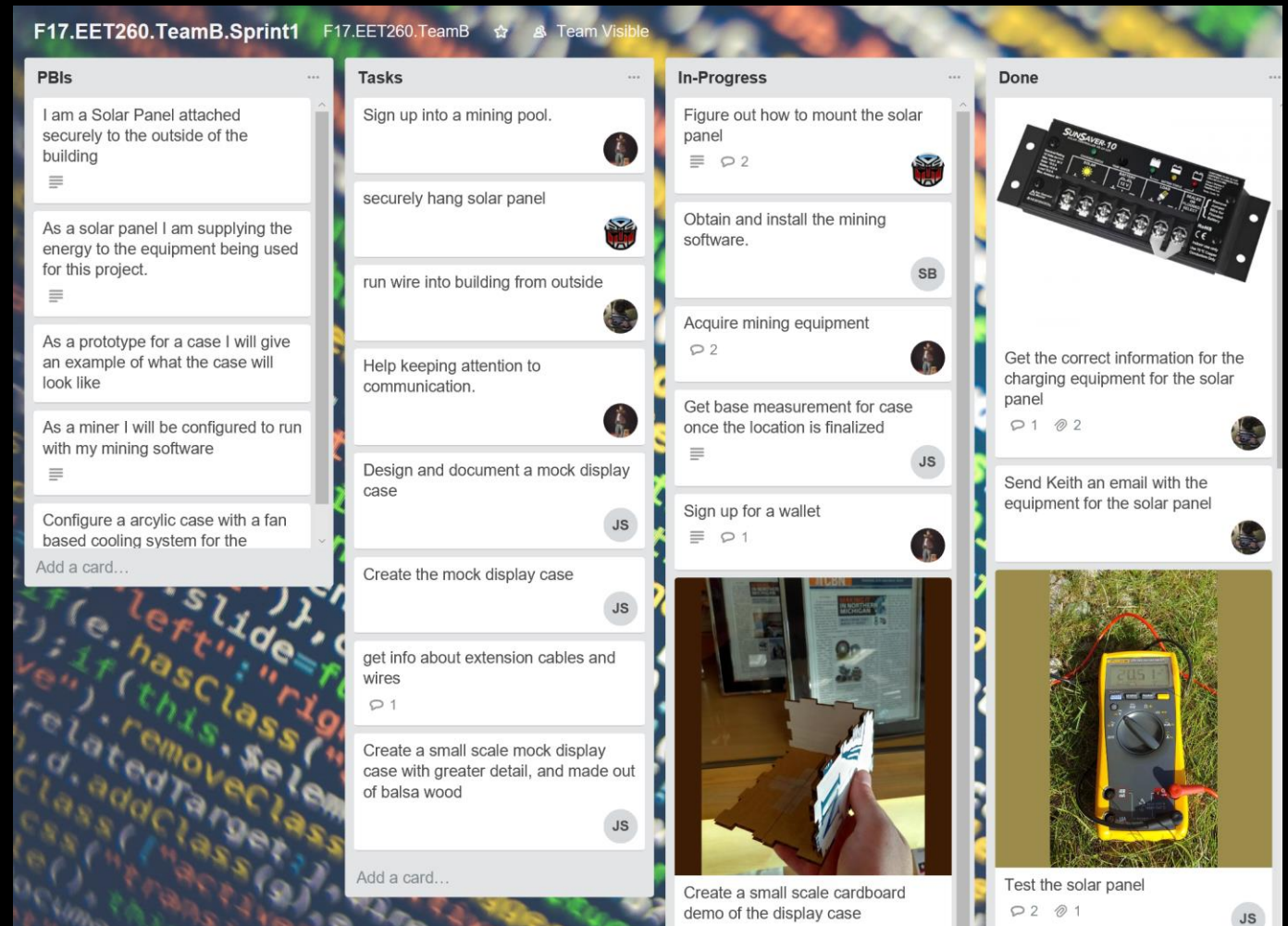
- Sign up into a mining pool.
- securely hang solar panel
- run wire into building from outside
- Help keeping attention to communication.
- Design and document a mock display case
- Create the mock display case
- get info about extension cables and wires
- Create a small scale mock display case with greater detail, and made out of balsa wood
- Add a card...

In-Progress

- Figure out how to mount the solar panel
- Obtain and install the mining software.
- Acquire mining equipment
- Get base measurement for case once the location is finalized
- Sign up for a wallet
- Create a small scale cardboard demo of the display case

Done

- Get the correct information for the charging equipment for the solar panel
- Send Keith an email with the equipment for the solar panel
- Test the solar panel



USE POST-ITS!



COMMUNICATION

The screenshot displays a web browser window with the URL <https://web.groupme.com/chats>. The interface is split into three main sections: a left sidebar for chat management, a central chat window, and a right chat window.

Left Sidebar (Chats):

- Search chats
- 2018.SP.EET260.U... 6:21 AM
Keith E. Kelly: Understanding how to use the tools is a
- 2018.SP.EET260 Mon, 9:20 AM
Keith E. Kelly: Good luck with organizing and completing
- 2018.SP.EET260.G... Jan 27, 9:06 PM
Monica Evans: (2/2) r reword them again if any of you want

Central Chat Window (2018.SP.EET260):

- Jacob May-Eschenbach: I don't think there is a test and I can't make it this weekend I got to work
- JAN 26, 3:54 PM
- Keith E. Kelly: Just capture last page of scrum training to show completion.
- SUN, 1:39 PM
- Keith E. Kelly: I know that we're just getting started, but you do need to pitch a week from Monday, you have a lot of work to complete, and we did agree to 4 hours of outside class time. I just checked Trello and GroupMe. Game - Monica is the only one with any content on the board and team texts. UAS-ROV - nothing on Trello and some texts, but no work indicated on GroupMe. Tasks are shown on Sprint 1 Trello. Take ownership, move a task to In-Progress, and start working on content. Yes, this is all new, but get started. Send me questions. Use texts or comments in Trello to inform your team.
- MON, 9:20 AM
- Keith E. Kelly: Good luck with organizing and completing pitch work this week. I've uploaded the Lean Canvas image to the Trello boards. Use this as your template when organizing your pitch to stakeholders. Let me know if there are questions.
Sent - Mon, 9:20 AM

Right Chat Window (2018.SP.EET260.UAS-ROV):

- Keith E. Kelly: Okay. Good, but what work was assigned as a result? The "Canvas" item on sprint 1 should be moved to In Progress. What about the charter document? Who is creating what? This should be indicated on the Sprint 1 board.
- Ryan Mater: There was some confusion as to what to do and where to document it. As a team we did manage to get quite a bit sorted out, i think it just didn't get documented in the right places though. As far as me being the only one showing activity we all had entries but we were just using my laptop. Is there a way to show ownership of a board entry?
6:06 AM
- Matt Goddard: @Ryan Mater what we worked on only shows on your side? Because I don't see anything. Unless you haven't put it on there
- Keith E. Kelly: First of all, good that you're working hard and it's just a problem with using the tool to document. It's okay for Ryan to build out details on the backlog board, but everyone should be using the Sprint board. Your discussion yesterday should have included planning on who was working on which parts of the pitch and charter. This planning should be shown on Sprint 1 as In Progress tasks. In-Progress tasks should have an owner. This is done by adding a member to the task. Add detail to the task with comments or attached document. For example, the draft

SPRINT REVIEW



SPRINT RETROSPECTIVE

Plus

- I think a group of strangers clicked really well and actually got some stuff done. It was kind of impressive for how little we knew and interacted with each other lead to something like that
- How well we communicated in our forum and on our board.

Delta

- better communication between members outside of class
- better understanding of roles

Actions

- Try and engage more with the team and getting them motivated

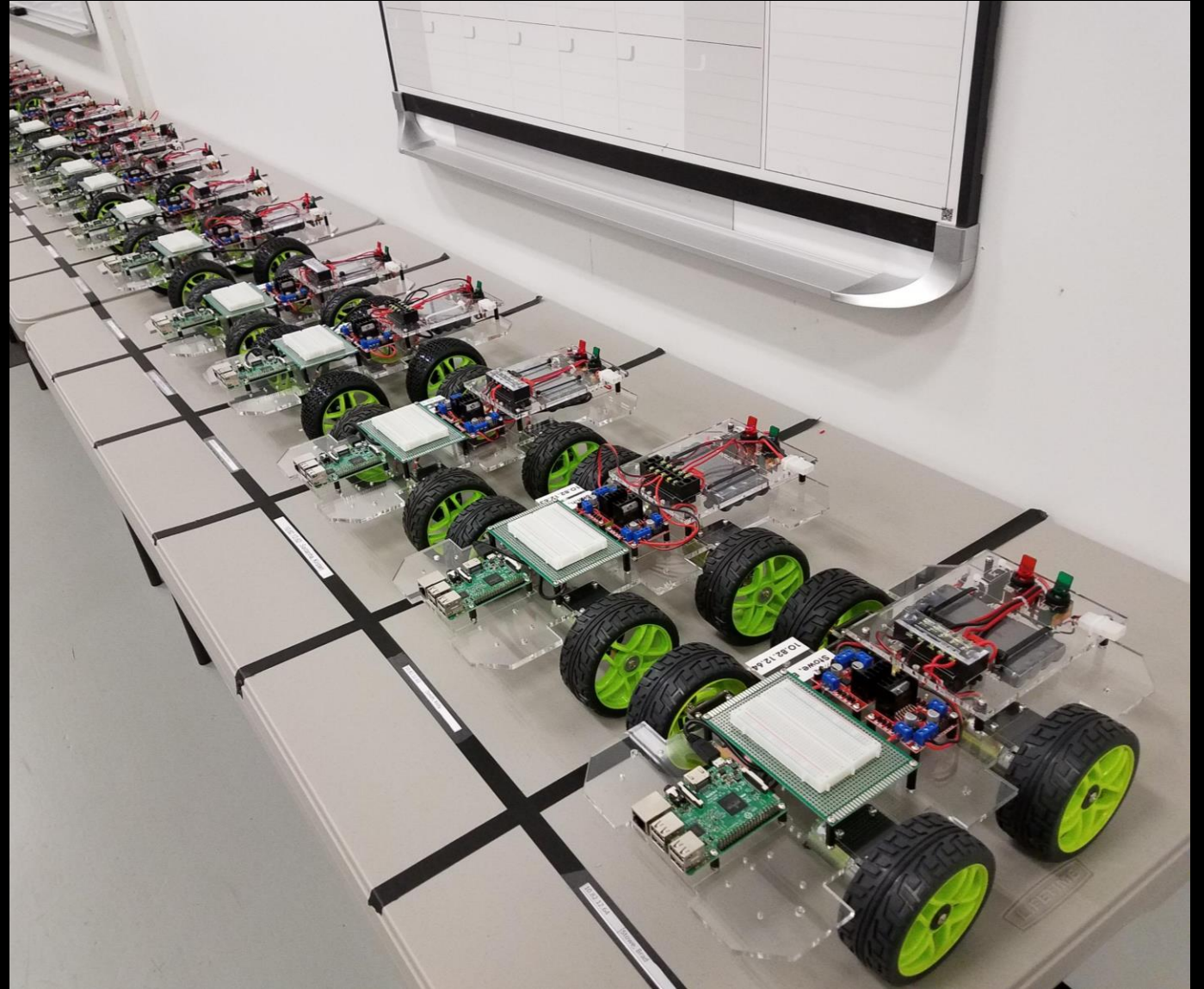


Yes, but I'm not
technical. Does
PBL and Agile
still fit?

Other
examples?

LESSONS LEARNED

- PBL works, discovery learning does not
- Learning is rich
- Learning can be messy
- Teams must be functional
- External Product Owners and Stakeholders create authenticity
- Team and individual work is public
- Team reflection must be constant





Q & A