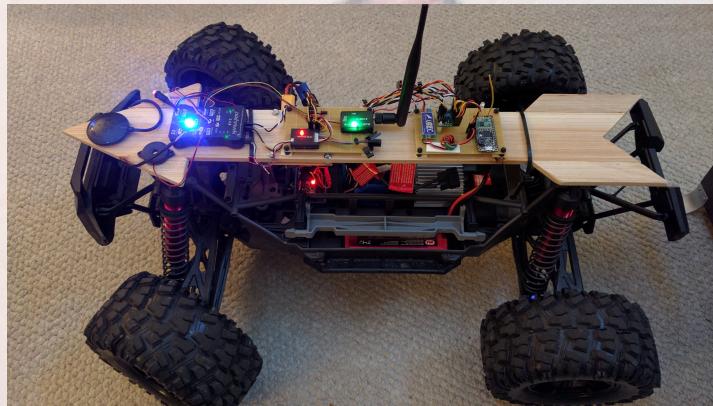


Magellan Program



Another in our series
of informational
talks

Brought to you by:

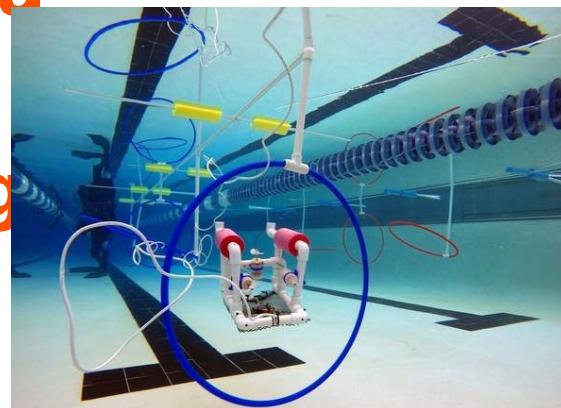
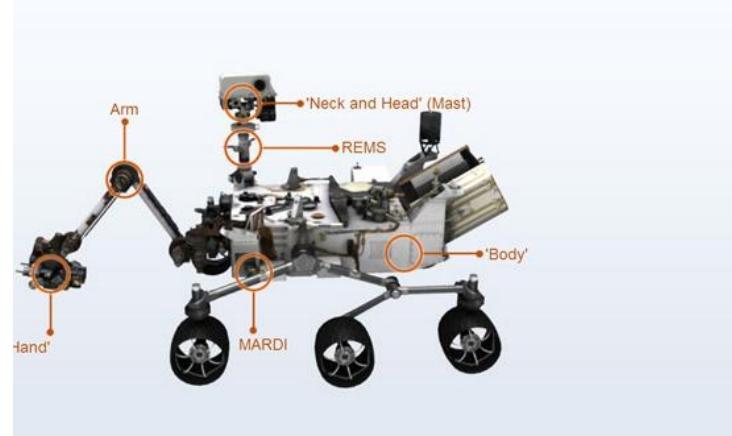
Robot Garden
www.robotgarden.org



Robot Garden Marquee Program

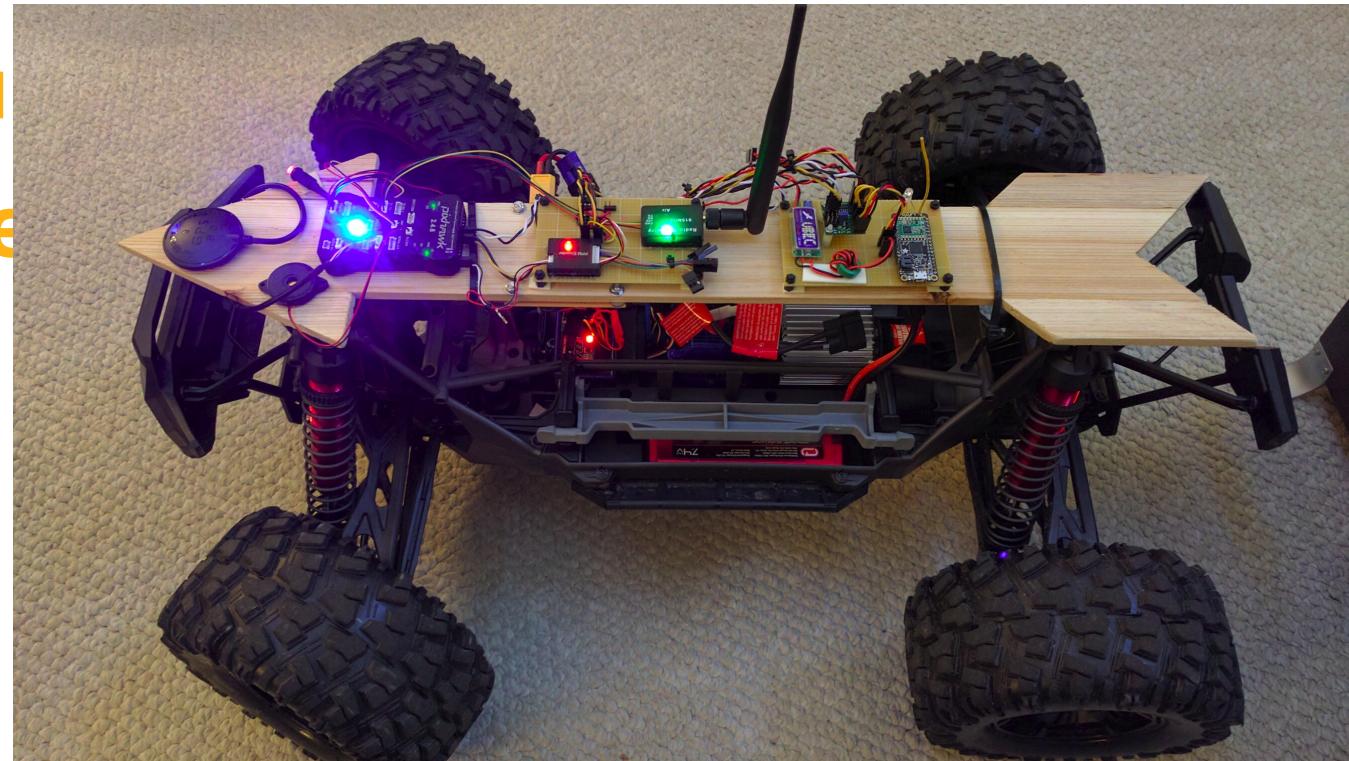
Three programs launched in 2016:

- Magellan
- Cousteau
- Lindberg



What is the Magellan Program?

- A Repeatable Platform
- Autonomous
- Competitive
- Improving
- Supportive



RC2Robot SIG

- RC2Robot is a **SIG**
- Sponsored by Robot Gardener
- Find our schedule **HERE**
- RoboMagellan Competition



ROBOGAMES



What is RoboMagellan?

- RoboMagellan Rules
- Outdoors
- Autonomous
- Navigate to Cones
- Come see us!



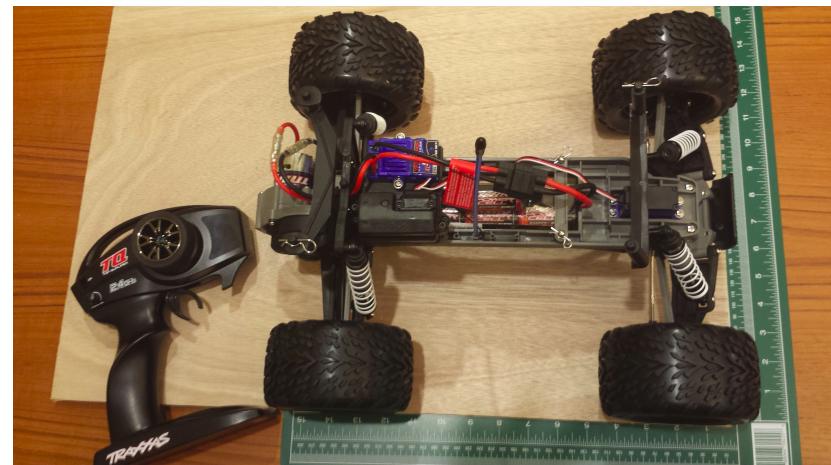
Recap

- *Magellan Project*
- Victoria
- RC2Robot SIG
- RoboMagellan



The Plan

- The Vehicle
- Processor and Sensors
- Electronics
- Sensor Platform
- The Software



Chassis Selection

The RC Choice

- Traxxas X-Maxx

- + Size 19 pounds, 30" long, 20" v
- + Large - 1/5th scale
- + Heavy -
- + >35mph, TONS OF FU

- - Price

- Stampede

- + Inexpensive
- + good sensor test platform
- - Insufficient for urban obstacles, but



Robot Electronic Hardware

- UP Board
- RealSense and USB Camera

- Sensors

- PixHawk
- GPS
- Compass
- IMU
- Barometer
- Ultrasonic sensors

- Safety switch



Robot Software

- ArduPilot/Mission Planner



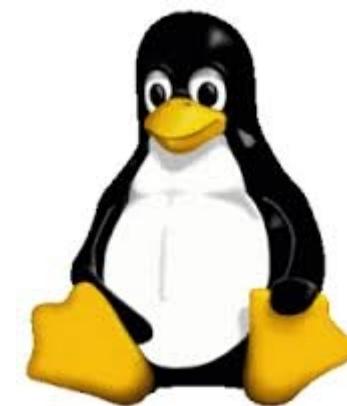
- Linux

- ROS+MavROS

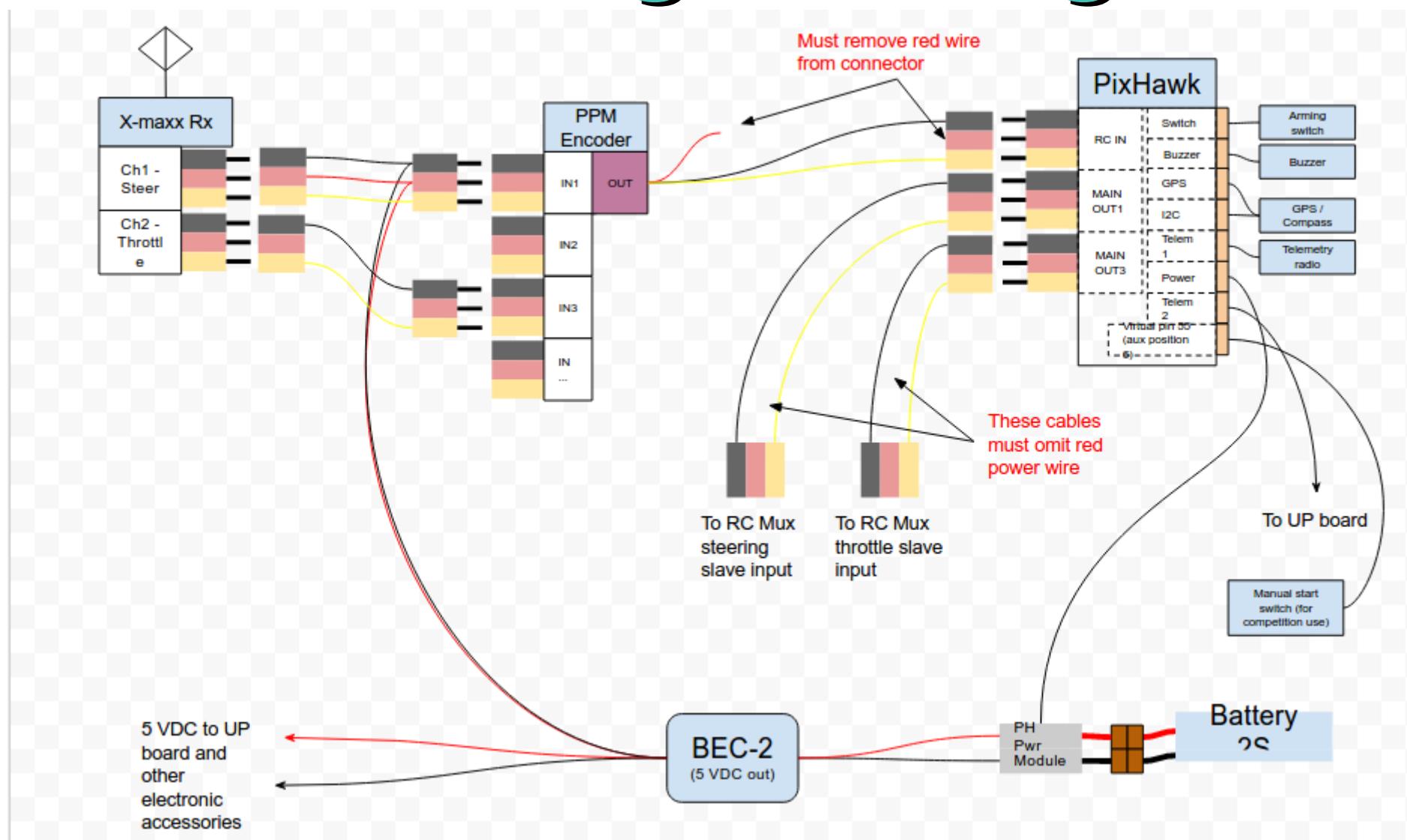
- Cone Identification Software

- Custom

- Safety Switch

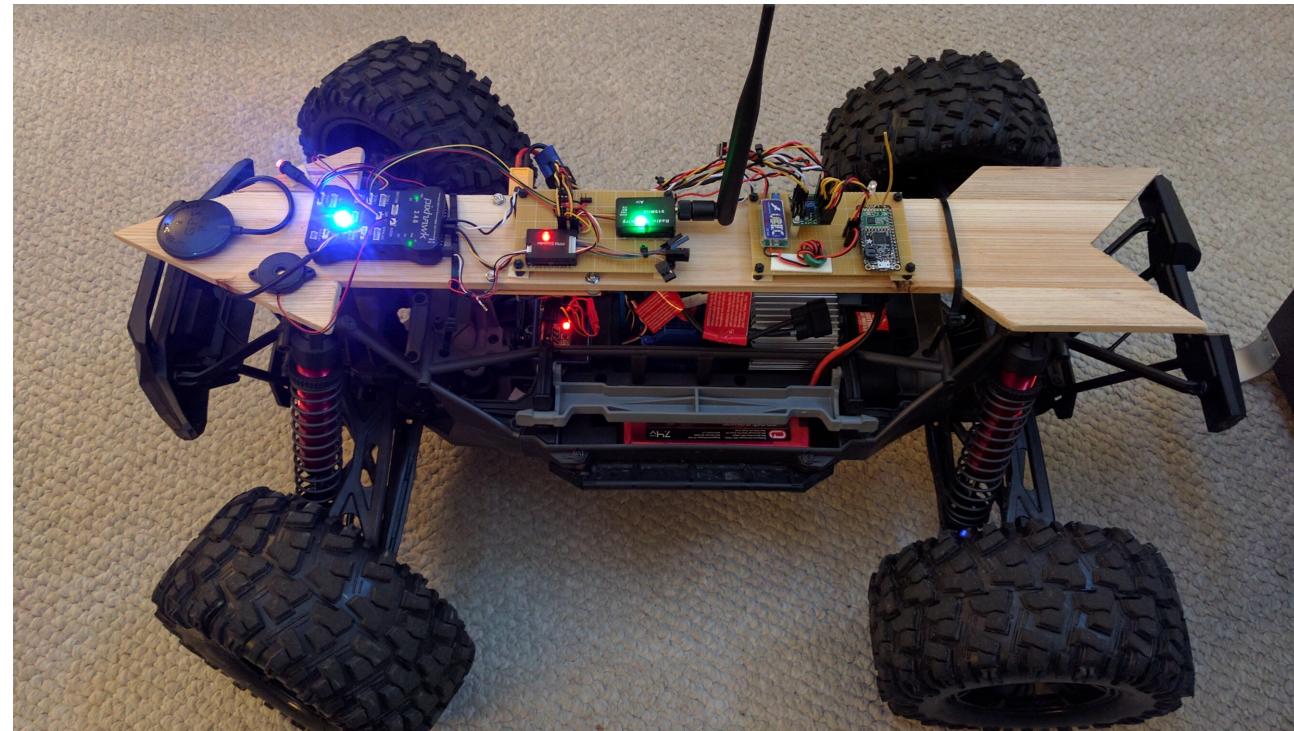


Victoria Logical Diagram



2017 RoboMagellan RC2Robot Entrants

- Entdecker 2
 - X-Maxx Chassis
- Victoria
 - X-Maxx Chassis
- SkyWaTCH
 - Actobotics from ServoCity



Entdecker

- 2016 2nd place regional
 - Built by a member of Robot Garden
 - 1/10th Scale Stampede RC Car
 - Hybrid ArduPilot and ROS
 - GPS, PixHawk, Camera



Questions?



This presentation is available at:

https://github.com/ProgrammingRobotsStudyGroup/robo_mag_ellian

Appendix



License/Copyright

**The materials for this class
are licensed under the
Apache license. See the file
LICENSE for details.**

- Copyright 2017 F Douthit
- Licensed under the Apache License, Version 2.0 (the "License");
you may not use this file except in compliance with the License.
You may obtain a copy of the License at
<http://www.apache.org/licenses/LICENSE-2.0>.
- Unless required by applicable law or agreed to in writing,
software distributed under the License is distributed on an "AS
IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY
KIND, either express or implied. See the License for the specific
language governing permissions and limitations under the
License.



Additional References

● The Manufacturers

● Commercial

- Autodesk, Fusion 360 and Maya: <http://www.autodesk.com/>
 - Fusion 360 can be obtained for free so long as it is not used in a commercial endeavor
- Solidworks: <http://www.solidworks.com/>
- CorelCAD: <http://www.coreldraw.com/en/product/corel-cad/>
- EagleCAD: <https://cadsoft.io/>
- Adobe Illustrator: <http://www.adobe.com/products/illustrator.html>

● Free or Free and Open Source

- TinkerCAD - Free but not Open Source: <https://www.tinkercad.com/>
- Sketchup - Free but not Open Source: <http://www.sketchup.com/>
- FreeCAD - Free and Open Source: <http://www.freecadweb.org/>
- OpenSCAD - Free and Open Source: <http://www.openscad.org/>
- Blender - Free and Open Source: <https://www.blender.org/>
- KiCAD - Free and Open Source: <http://kicad-pcb.org/>
- Inkscape - Free and Open Source: <https://inkscape.org/>

● Online Resources

- Wikipedia: https://en.wikipedia.org/wiki/Computer-aided_design
- Maker Culture/Movement Wiki: https://en.wikipedia.org/wiki/Maker_culture



Attributions

- **Special thanks to Robot Garden for providing the content and branding of this presentation**
<http://robotgarden.org/>
- **Special thanks to the Free and Open Source platforms upon which much of the original art in this presentation were made:**
 - **FreeCAD**
 - **GIMP**
 - **Kazam Desktop video software**
 - **OpenShot video editor**
 - **And of course our friends at Canonical for making the Ubuntu distribution this document was authored on**



Magellan Program



Another in our series
of informational
talks

Brought to you by:

Robot Garden
www.robotgarden.org



What brought you to this class? Did you have something in mind to make?

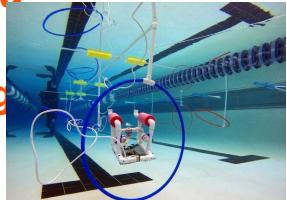
Robot Garden Marquee Program

Three programs launched in 2016:

- Magellan



- Cousteau



- Lindberg

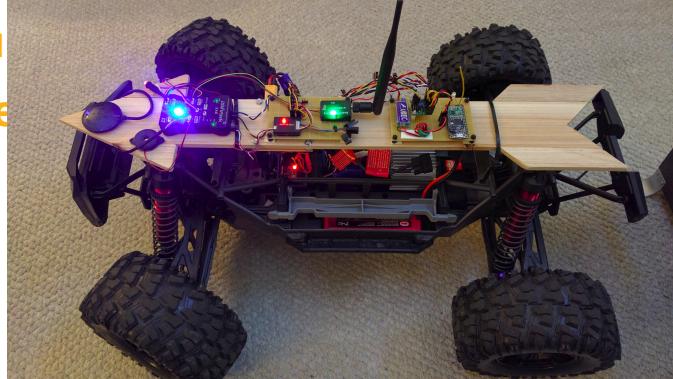


Robot Garden launched three marquee programs in 2016 related to robotics. Each was named after a famous adventurer

- *Magellan – Rover robot platform that encourages the building of autonomous robots
- * Cousteau – aquatic discovery
- * Lindberg – Aviation explorer post #997 which is now forming. Will we have flying robots? Maybe!

What is the Magellan Program?

- A Repeatable Platform
- Autonomous
- Competitive
- Improving
- Supportive



- * An easy reference platform that is in the public domain
- * We are now exploring autonomous navigation with robotics
- * We're engaged in competitions designed for autonomous robotics
- * We continue to improve on the design so that we can move into search and rescue applications
- * Our special interest group or SIG supports individuals and our community with good resources to make them successful

RC2Robot SIG

- **RC2Robot is a SIG**
- **Sponsored by Robot Garden**
- **Find our schedule HERE**
- **RoboMagellan Competition**



ROBOGAMES



- * Special Interest Group set up for builders of autonomous rovers (robots)
- * It is sponsored by Robot Garden and Robot Garden hosts our events
- * You can find our weekly meeting schedule on the Robot Garden event calendar
- * Team members are focused on building robots for RoboMagellan Competition

What is RoboMagellan?

- RoboMagellan Rules
- Outdoors
- Autonomous
- Navigate to Cones
- Come see us!



- * Follow the link for the full rules about RoboMagellan.
- * It's outdoors, similar to the Darpa Grand Challenge
- * It's autonomous – in fact you can only have one controller for the competition, a kill switch
- * Robots navigate to cones on the course and for added bonus, can touch them without knocking them over.
- * Our team, Team Robot Garden, is planning to compete with it's competition robot Victoria in the RoboMagellan competition in Pleasanton April 21-23, 2017

Recap

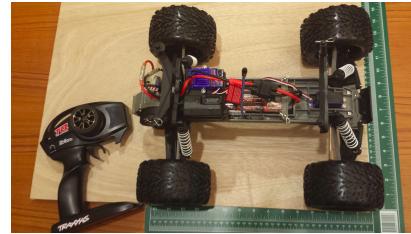
- **Magellan Project**
- **Victoria**
- **RC2Robot SIG**
- **RoboMagellan**



- * Magellan Project is Robot Garden's autonomous navigation robotic project
- * Robot Garden has sponsored Team Robot Garden and their Bot, Victoria
- * RC2Robot is Robot Garden's special interest group and it hosts weekly events
- * RoboMagellan will be Team Robot Garden's first contest.

The Plan

- The Vehicle
- Processor and Sensors
- Electronics
- Sensor Platform
- The Software



- * We have to design or select the right vehicle or chassis to start from
- * We also have to choose which processor to use and which sensors we'll use in conjunction with the processor to be able to do all the tasks autonomously
- * Once we have the electronics, we have to design and build them out
- * With the design and build of the electronics, we then need to have a platform put on the vehicle which we can mount the electronics onto
- * Finally with the platform in place, we can write the software, test it and then we can win!

Chassis Selection

The RC Choice

• Traxxas X-Maxx

- + Size 19 pounds, 30" long, 20" wide
- + Large - 1/5th scale
- + Heavy -
- + >35mph, TONS OF FU
- - Price



• Stampede

- + Inexpensive
- + good sensor test platform
- - Insufficient for urban obstacles, but



We elected to use an RC Vehicle as they are rugged and purpose built. The large size comes in handy when curb climbing and dealing with other obstacles. We also elected to use Traxxas RC vehicles since they come prebuilt. We had a few options, here are the two we are utilizing

Robot Electronic Hardware

- UP Board
- RealSense and USB Camera
- Sensors
 - PixHawk
 - GPS
 - Compass
 - IMU
 - Barometer
 - Ultrasonic sensors
- Safety switch



Robot Software

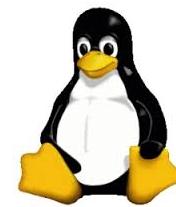
- ArduPilot/Mission Planner



- Linux



- ROS+MavROS



- Cone Identification Software



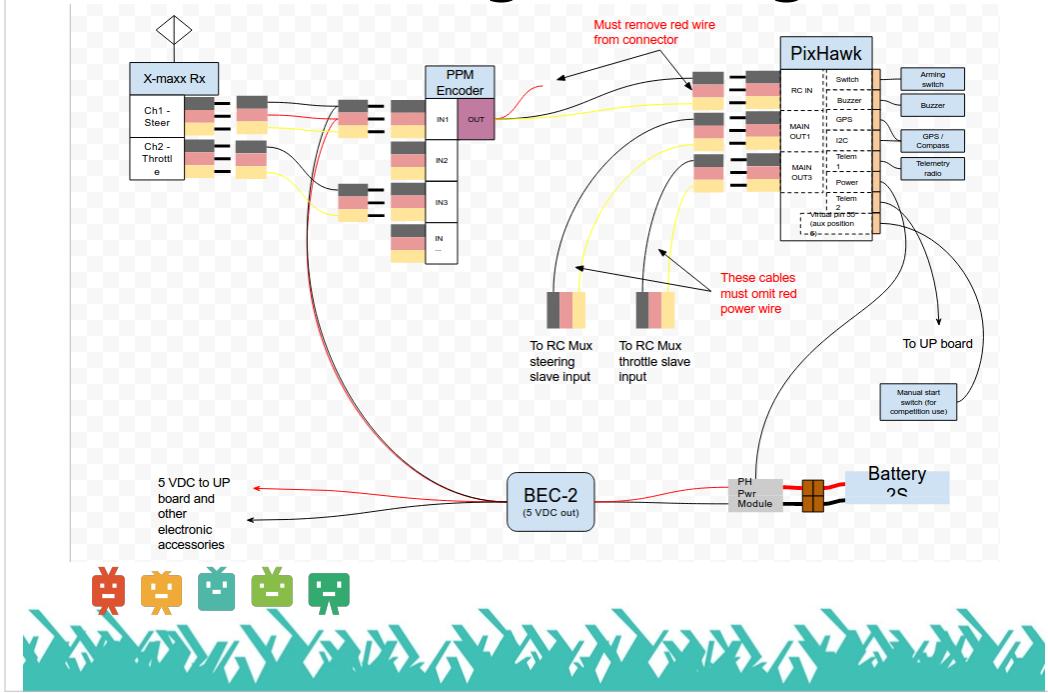
- Custom

- Safety Switch



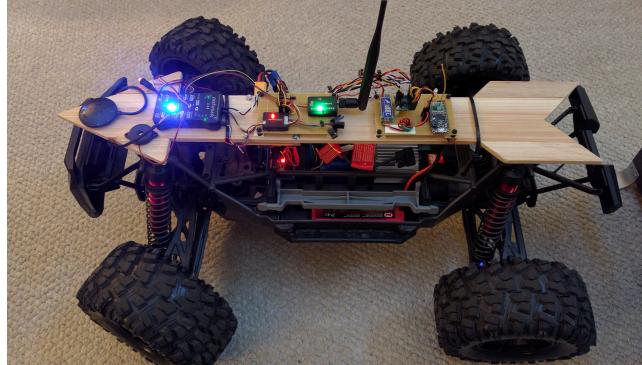
- * ROS: MavROS and custom nodes
- * Custom sensor control and data acquisition software

Victoria Logical Diagram



2017 RoboMagellan RC2Robot Entrants

- Entdecker 2
 - X-Maxx Chassis
- Victoria
 - X-Maxx Chassis
- SkyWaTCH
 - Actobotics from ServoCity



Entdecker

- 2016 2nd place regional
- Built by a member of Robot Garden
- 1/10th Scale Stampede RC Car
- Hybrid ArduPilot and ROS
- GPS, PixHawk, Camera



Questions?



This presentation is available at:

https://github.com/ProgrammingRobotsStudyGroup/robo_mag

ellian

This slidedeck is in LibreOffice and PDF format and a copy can be obtained at the Robot Garden github site, located here at the url listed on this page. The QR code to the right will take you to the same location: https://github.com/RobotGarden/cad_intro

This material is considered Free and Open Source material. We ask only that you preserve the Robot Garden attributions and would prefer if any derivative work preserve the Apache 2 or similarly open license.

There is an appendix to this document that anyone interested more in this topic might want to reference for additional information including the license under which this material is copyrighted.

Appendix



As I mentioned, there are many applications that benefit from CAD.

Listed on this page are some, but by no means all of them. As you can imagine, this is a very empowering technology used in many technical fields. In fact I've spoken with educators who say that students that have had some exposure to CAD have a leg up when they go to college. Listed here are some that I will describe in case you don't know what I'm referring to.

- * Part Design – just as it sounds – you have a part or solid you need to model and create. Think knobs, gears, brackets and the likes
- * Landscaping and Building architecture are probably familiar to most people but if not, please just ask.
- * Mechanical designing is where parts come together to make working machines – imagine a set of gears coming together and rotating
- * Electronics schematics are used anytime you have a piece of electronics and need to design circuits and the likes.
- * Yes even Animation is a form of CAD and there are softwares out there to aid in creating these
- * Even more beyond this!

License/Copyright

**The materials for this class
are licensed under the
Apache license. See the file
LICENSE for details.**

- Copyright 2017 F Douthit
- Licensed under the Apache License, Version 2.0 (the "License");
you may not use this file except in compliance with the License.
You may obtain a copy of the License at
<http://www.apache.org/licenses/LICENSE-2.0>.
- Unless required by applicable law or agreed to in writing,
software distributed under the License is distributed on an "AS
IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY
KIND, either express or implied. See the License for the specific
language governing permissions and limitations under the
License.



The list here is by no means exhaustive, nor does it cover the spectrum of applications we just went through. If you're truly interested in CAD, you should spend a little time researching the type of CAD program that would meet your needs best. Let me talk a little bit to each of these programs

- * Fusion 360 – best suited for parts and mechanical design – can also do CAM. Free for inventors, but quite pricey if you intend to use it for commercial application
- * SolidWorks – best suited for parts and mechanical design. Major competitor to Fusion 360 – takes into account materials and their properties
- * CorelCAD – parts and mechanical design, but at a much lower cost than Autodesk or Solidworks softwares
- * Eagle CAD is commercial CAD designed specifically for circuit/electronics design
- * Adobe Illustrator is a vector graphics software used for 2D manufacturing such as laser cutting and engraving
- * Autodesk has an offering in nearly every CAD application and their vector graphics software is called Maya
- * TinkerCAD – geared for easy adoption with an intuitive interface. Often used for kids and mostly in the parts design space
- * Sketchup is 3D CAD geared more towards room and building designs
- * FreeCAD is largely a parts design tool, although it is actively being developed to do more in the future
- * OpenSCAD brings a development based UI to parts design. You literally write the code that makes the objects
- * Blender is a software for creating Animations
- * KiCAD is a competitor to Eagle CAD and is used in electronics/electrical schematics
- * InkScape is a free and open source vector graphics software similar to Illustrator

Additional References

- **The Manufacturers**
 - **Commercial**
 - Autodesk, Fusion 360 and Maya: <http://www.autodesk.com/>
 - Fusion 360 can be obtained for free so long as it is not used in a commercial endeavor
 - Solidworks: <http://www.solidworks.com/>
 - CorelCAD: <http://www.coreldraw.com/en/product/corel-cad/>
 - EagleCAD: <https://cadsoft.io/>
 - Adobe Illustrator: <http://www.adobe.com/products/illustrator.html>
 - **Free or Free and Open Source**
 - TinkerCAD - Free but not Open Source: <https://www.tinkercad.com/>
 - Sketchup - Free but not Open Source: <http://www.sketchup.com/>
 - FreeCAD - Free and Open Source: <http://www.freecadweb.org/>
 - OpenSCAD - Free and Open Source: <http://www.openscad.org/>
 - Blender - Free and Open Source: <https://www.blender.org/>
 - KICAD - Free and Open Source: <http://kicad-pcb.org/>
 - Inkscape - Free and Open Source: <https://inkscape.org/>
- **Online Resources**
 - Wikipedia: https://en.wikipedia.org/wiki/Computer-aided_design
 - Maker Culture/Movement Wiki: https://en.wikipedia.org/wiki/Maker_culture



Although CAD is strictly part of the design phase, it is still important to keep in mind the materials that are being targeted for what you're creating since it can impact the process. For example, in 3d printing through a common extrusion style printer where there is a nozzle ejecting melted material in layers to form an object, if you design something with sharply overhanging faces, you might have troubles, so the best orientation of the part may be laying on it's side or even upside down!

It's also important to think about the type of manufacturing you will be utilizing. Additive as in the 3d printing example or subtractive where you might be using a CNC Mill, laser cutter or similar technology.

Finally the process of CAM should be a consideration – complexity goes up as more dimensions come into play – 2D is very simple for example on a laser cutter or simple CNC milling. 2.5D greatly simplifies the process of creating a part with a CNC mill over 3D and of course true 3D with curves and the likes is the most complicated CAM process.

Attributions

- Special thanks to Robot Garden for providing the content and branding of this presentation
<http://robotgarden.org/>
- Special thanks to the Free and Open Source platforms upon which much of the original art in this presentation were made:
 - FreeCAD
 - GIMP
 - Kazam Desktop video software
 - OpenShot video editor
 - And of course our friends at Canonical for making the Ubuntu distribution this document was authored on



Now I'm going to shift gears and bring up some videos I've made while creating and manipulating objects in FreeCAD to give you a sense of how the tool works and then I'll give you a chance to ask any questions you have.