Mechanical
8122
Mustaches

Who we are

We are FIRST® Robotics Team 8122: The Mechanical Mustaches. We're based out of William Howard Taft High School in Chicago, IL. FIRST is a youth-serving organization based around advancing STEM education. Every year there is a new challenge, and we build a 100+lb robot designed to complete a variety of different tasks.

We currently have about 50 team members ranging from freshmen to seniors.

Our Mission

Not everyone can grow a mustache, but everyone can grow as a mustache. We love to have fun! And the more mustache jokes the better!

We created Mo the robot to:

- To grow the use of the Python programming language in the FIRST® community
- To grow the FIRST® community by encouraging and empowering educators and coaches to start their own FIRST® Robotics teams
- To get robotics and FIRST® based curricula into the classroom

We also plan to use Mo in all these ways and the publicity generated by this campaign in a bid for our team to win the FIRST Impact Award and get our name in the FIRST Hall of Fame

Mo the Robot

Where did Mo come from?

Mo started as a project between me, Andrew Wingate: Mentor of FIRST Robotics team 8122, The Mechanical Mustaches; and a few students to learn electrical engineering, programming and design. We didn't really have any goals other than to have fun when we started but hoped we could use this project to serve our team in the future. The large robots are expensive and access is limited. Additionally with the large robots failing is much more frowned upon. Learning should be fun and there should be no fear of getting things wrong (especially when it comes to programming)

We did have a lot of fun and the result was Mo! We shared Mo with our own students and with other teams, teachers and educators. They liked Mo too! That's when we started development on Jerry the joypad. With a controller and a robot, this really would be the same as programming the real large robots.

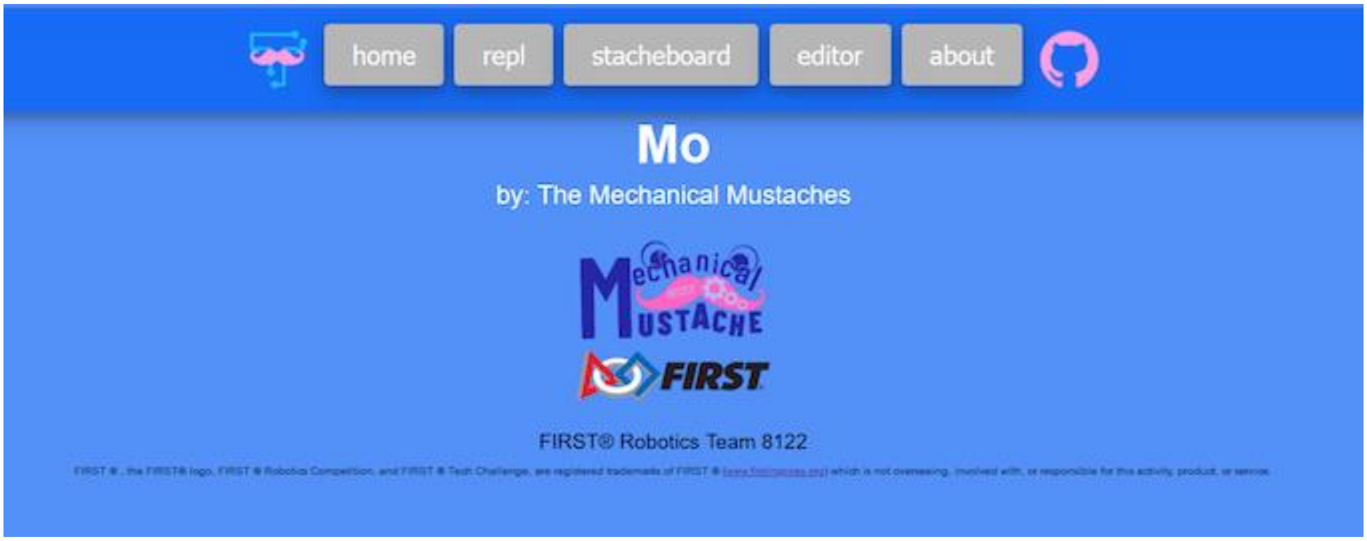
So we decided to try and get Mo into as many teams and schools as we could. We have talked with teams, and teachers. We have even talked with Chicago Public School's officials about getting Mo into real school curricula. Talks have been good and we’re looking forward to what’s coming.

We designed Mo to be easy to get started

- Mo serves his own webpages
- Mo has an easy-to-use autonomous mode
- Mo is programmed in python making learning easy
- Mo has a framework to help make complex systems easy
- Mo has many easy-to-use libraries already built in
- Mo already has many learning examples with more on the way

Mo’s Web Interface

It was one of our goals to have a system where you could get started in seconds. Turn on Mo, connect to his wifi and start playing! No programs to install, no files to open. Just start coding!



Mo

by: The Mechanical Mustaches

FIRST® Robotics Team 8122

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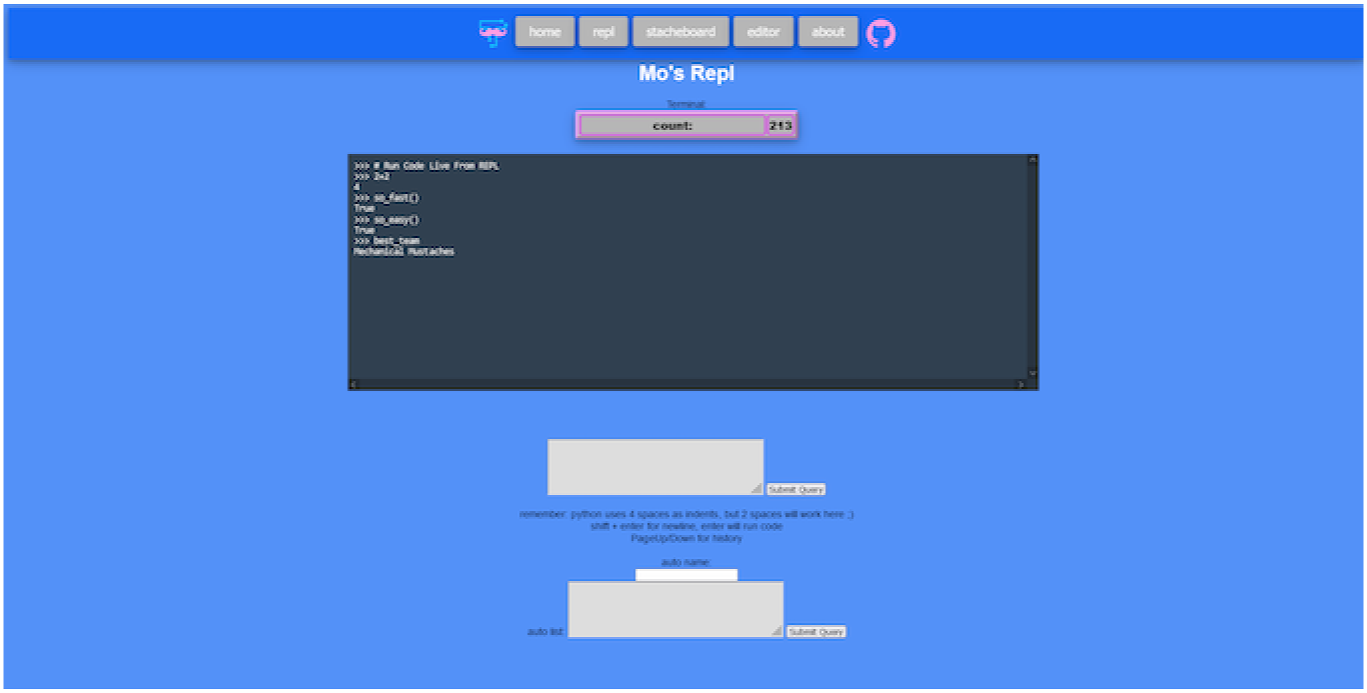
- REPL Webpage: Input code line by line and run it directly
- Stache'board Webpage: Live update of Mo's internal states and easily customized buttons
- Editor Webpage: Edit Mo's code on his own pages

Learn Quickly with Mo's REPL webpage



Mo's Repl

Terminal

count: 213

```
>>> # Run Code Live From REPL
>>> 2+2
4
>>> so_fast()
True
>>> so_easy()
True
>>> best_team
Mechanical Mustaches
```

remember: python uses 4 spaces as indents, but 2 spaces will work here ;)
shift + enter for newline, enter will run code
PageUp/Down for history

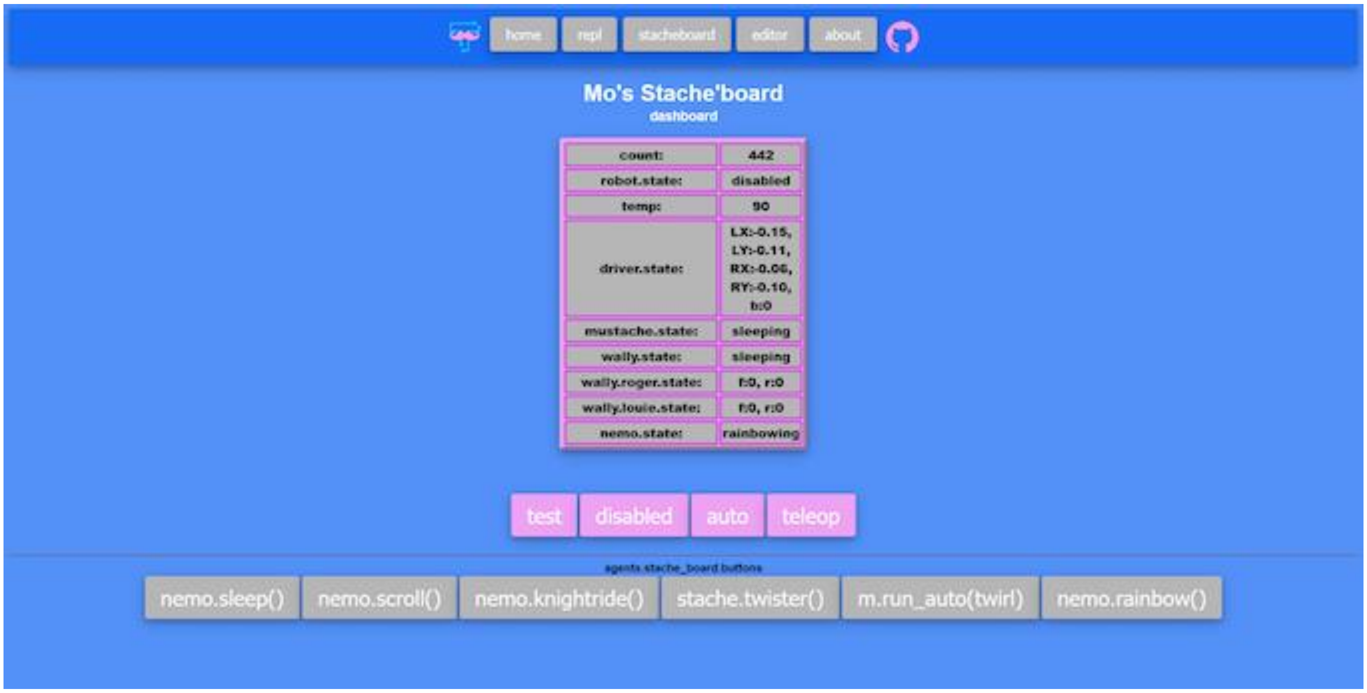
auto name:

auto list:

- With Mo's repl you can input code directly. See immediately what your code does. If there is a mistake, Mo will tell you.
- Build confidence one line at a time.

See our repl practice on our wiki page here:

See live updates with Mo's Stache'board (dashboard) webpage



Mo's Stache'board

dashboard

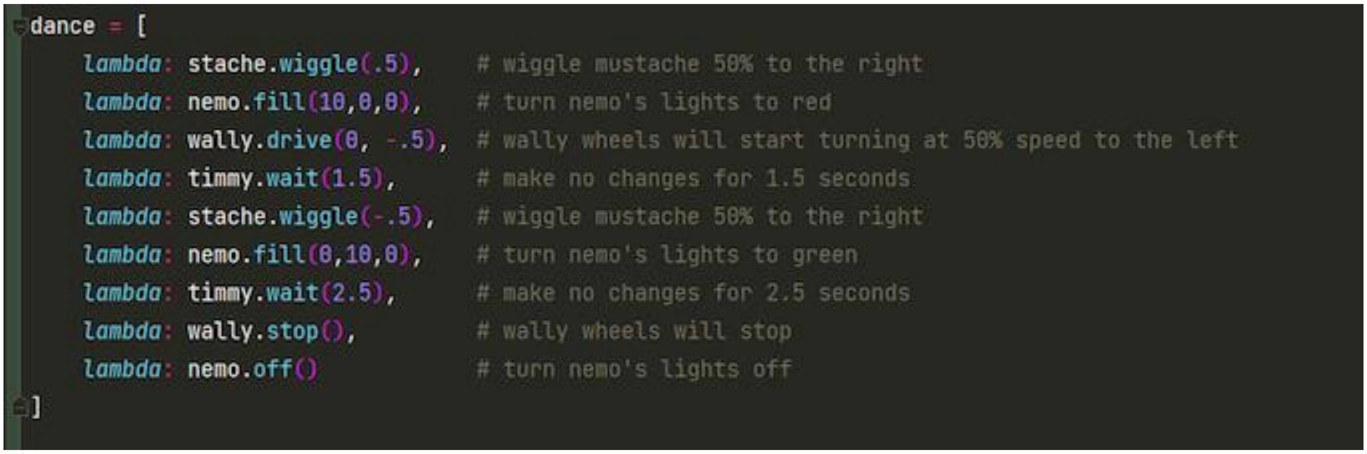
count:	442
robot.state:	disabled
temp:	90
driver.state:	LX:-0.15, LY:-0.11, RX:-0.06, RY:-0.10, b:0
mustache.state:	sleeping
wally.state:	sleeping
wally.roger.state:	f:0, r:0
wally.louie.state:	f:0, r:0
nemo.state:	rainbowing

- With Mo's Agent based architecture important information is auto populated on Mo's Dashboard
- Easily create new buttons with custom functions
- Change Mo's states just like a real FIRST® Robotics competition robot!

Mo's Autonomous Modes

Mo comes built in with easy to use and easy to understand auto modes.

Notes from Andrew: My first career was in Tool & Die where I learned to write and use G-Code (a low level language used to drive CNC machining machines.) It was natural for me to look at lines of code and understand that the machine's would run one line of code at a time, and once that line had finished, it would move on to the next. I was amazed to find there was no comparable way to run code this way in programming languages like Python or anywhere else. So in our first season together Angie and I wrote Archie (later to be renamed mm.Auto)



```
dance = [
    lambda: stache.wiggle(.5),     # wiggle mustache 50% to the right
    lambda: nemo.fill(10,0,0),     # turn nemo's lights to red
    lambda: wally.drive(0, -.5),   # wally wheels will start turning at 50% speed to the left
    lambda: timmy.wait(1.5),       # make no changes for 1.5 seconds
    lambda: stache.wiggle(-.5),    # wiggle mustache 50% to the right
    lambda: nemo.fill(0,10,0),     # turn nemo's lights to green
    lambda: timmy.wait(2.5),       # make no changes for 2.5 seconds
    lambda: wally.stop(),          # wally wheels will stop
    lambda: nemo.off()             # turn nemo's lights off
]
```

Mary had a little lambda

- Each line is executed one at a time in a very easy to understand fashion.
- Function calls are written the exact same way as you'd type it in code or in repl
- In 'auto' mode Auto will run all commands until it reaches a command like timmy.wait()
- Other wait like functions can be wait_for_a_button_press, or wait_until_an_encoder_reaches_position, or wait_for_counts and more
- We know what putting lambda before every function looks a little weird but it's how mm.Auto works.

You don't even need to put in all the lambdas

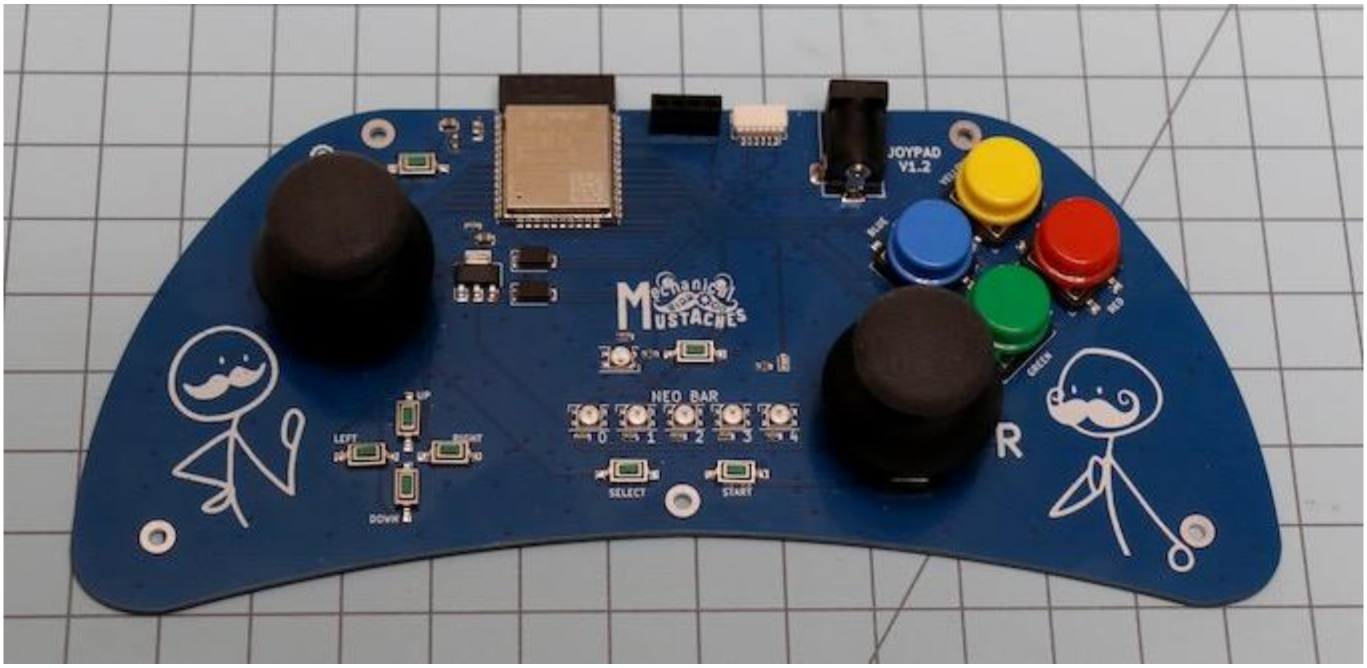
- In Mo's repl page is an Auto Maker that will automatically format a list and populate with all the lambdas

See more in depth explanations on Mo's wiki page

Real FIRST® Robotics Robots Have Controllers

So we made Jerry the Joypad.

Jerry the Joypad is a controller you can use to remotely control Mo

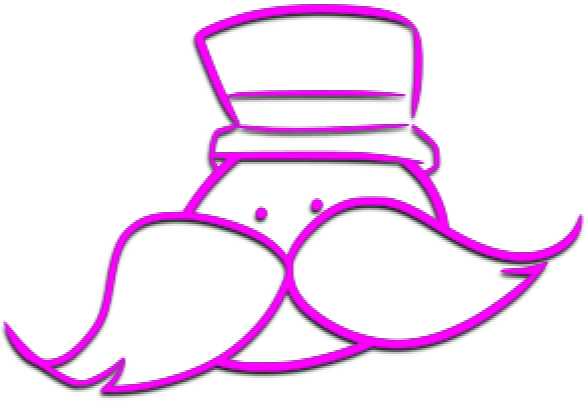


Jerry the Joypad Controller Board

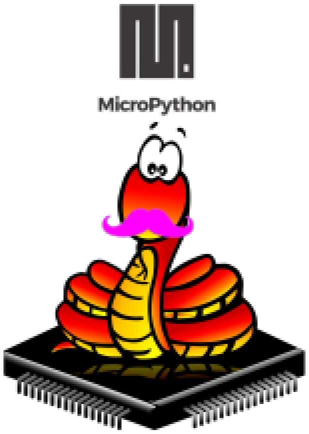
Control Mo remotely with his friend Jerry the Joypad! Learn the interactions between a robot and a controller that is exactly the same as the interactions between controllers and FIRST® Robotics Competition Robots! Jerry and Mo talk to each other over wifi and is easy to set up

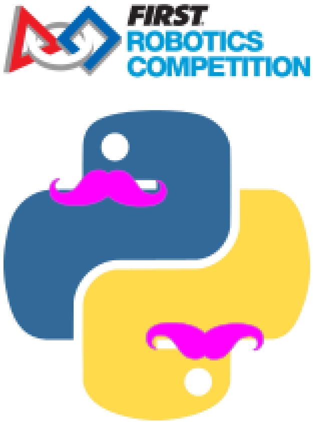
The Most-Dashing Framework

When you learn how to program a Mo bot you already know how to program the large robots for the FIRST® Robotics competitions.



ABSOLUTELY DASHING





Two Platforms

One Framework

import mechanical_mustaches

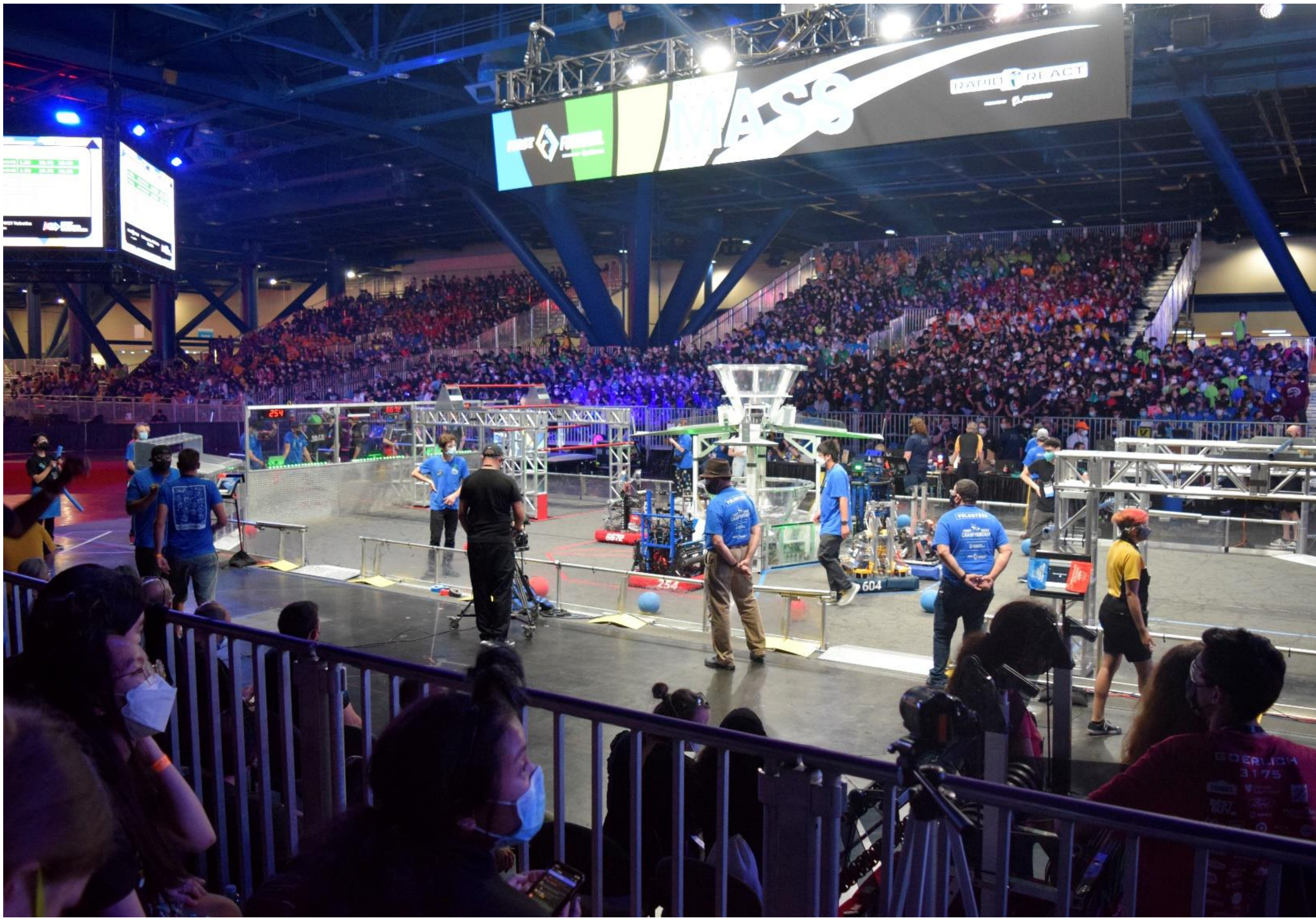
- Mo's framework and the Most-Dashing Framework were made at the same time
- Most code used with Mo can be directly used in FIRST®'s competition platforms

mm.Timer mm.Servo mm.Motor mm.Button mm.Knob

mm.Dimmer mm.DigOut

- All Mechanical Mustaches inputs and outputs have identical interfaces
- All inputs and outputs will automatically populate the stache'board and FIRST®'s Shuffleboard dashboard.

Program Mo and you can program a competition robot!



Mo is Open Source!

See our design files and code on the Mechanical Mustaches' Github pages

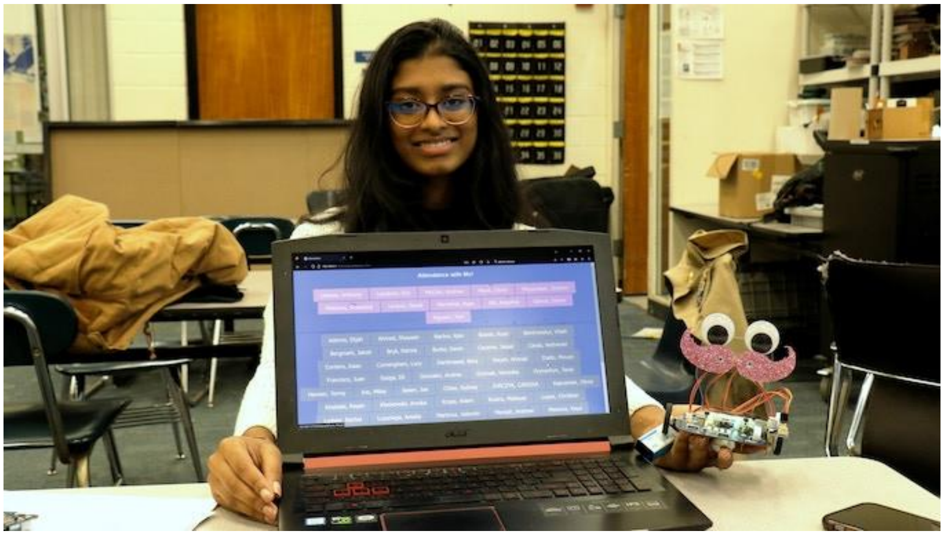
Mo and Jerry practice code and tutorials

- Mo's design files
- Jerry's design files
- Mo's source code
- Jerry's source code
- Mo's expansion boards source files

Meet Our Build / Design Team

Meet our Lead Programmer, Angelina Bill

Meet all around Designer, Editor, Programmer and More, Yehansa Dissanayake



Yehansa used a Mo bot to take attendance for all our meetings. Mo serves an easy to use webpage where students only have to click on their name, at which point that name turns pink and moves to the top. At the same time Mo records the time and then Yehansa wrote a program that parses all the data Mo creates in an easy to parse format!

Meet our Electrical Engineer, Olivia

Olivia Kapusniak, Our Electrical Engineer

The Story, Andrew's perspective:

Where did this project come from? The previous season, we started with a blinking cursor and had java as our language. I am a Python programmer but didn't feel we had the time to transition the team to a new language, so we stayed with java.   The next season Angie and I decided to not only move to Python (for obvious reasons) and create a framework to make development easier, faster and more fun! (not to mention a whole bunch of cool stuff.) Around the same time Olivia had stated her desire to major in college for computer engineering. We already completed a small circuit board project and I asked if she wanted to create a learning platform for our team. I was already using MicroPython in other projects so knew how we could mask the differences between the two platforms to create a smooth transition from little bots up to the big ones.

A few months later we knew a little about what we created and decided to create this campaign as a part of our bid for the FIRST® Robotics Impact Award. Having been a part of a few teams now, I can say without a doubt that programming is the greatest hurdle both new and established teams face every year. The FIRST® community is wonderful. On a couple occasions we had other team's programmers going around and helping teams polish their code on competition days. I wondered how many teams just don't get started because the teacher or coach just didn't think they had what it took to make a complete robot. If there was a way to cheaply prove that they were capable of creating a working program how many more teams could there be? At this point we had a few robots completed and were beginning to transition into the classroom environment. It was a goal that these robots would be able to be programmed on the hardware offered in the classrooms and more specifically CPS. In this case it was chromebooks. Not only could you not install programs on these devices, but you couldn't even stick a thumb drive into them. (This is not because they are not capable of this, but more because of decisions made by CPS as an organization.)

So Mo got browser support. Luckily the microcontroller we were already using supported wifi and we began web development. This is where I finally started to believe that we actually had something. These little Mo bots start were a really good tool. (see campaign page for more) Not only was I able to teach a few kids to code, such as my nieces and nephews, but Angie herself was able to teach a classroom full of kids to program. Not only to program but create fun games like races and more. If a high school student could teach a bunch of kids, I have real hopes that we could make an impact and move a majority of FIRST® Robotics Teams over to a language more used in industry like Python than a language being used less and less like java. It's my belief that it's a necessity that our next generations have the ability to leverage robotic technologies. They must be orders of magnitude more productive than generations of the past. No longer will having a job of taking a doughnut from a conveyor and putting it in a box be a viable choice. We not only have to do all the work we've been doing, we also need to do all the work that we wish to have, so everyone can raise their standard of living. On top of all that we need to undo much of the poor work that has been done in the past, so we may restore and create a better world. I believe it's in this generation to complete these tasks and more!

I would like to close with as much praise as I can muster to the three wonderful ladies that took charge of this project. Angie, Yehansa and Olivia have done a fantastic job and I couldn't be prouder, not only for the work completed, but for their tenacity and willingness to stand up. I don't really like phrases like "Women in STEM," but I do agree with the sentiment. What I really want to see is more women in positions of power. I am saying these words more for the women I've worked with, than the general population. I have heard from women who have felt well mentored, but overlooked when it finally came time to pass the reigns. As a mentor myself, that puts me in a difficult situation. I try at every possible occasion to relieve myself from the decision making process, so they may flex those muscles and understand how it feels. Then use those muscles when it matters and have the confidence to take charge.

Contact

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