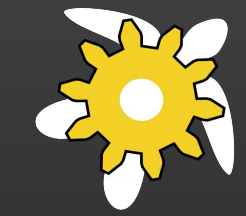
TEXAS A&M UNIVERSITY
ROBOTICS TEAM & LEADERSHIP EXPERIENCE

Programming and Git/GitHub

TURTLE Hatchling

Attendance



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Git and GitHub

Why use Git/GitHub?

Git/GitHub are incredibly powerful tools. Think about a Google Doc for your code but on steroids. You can:

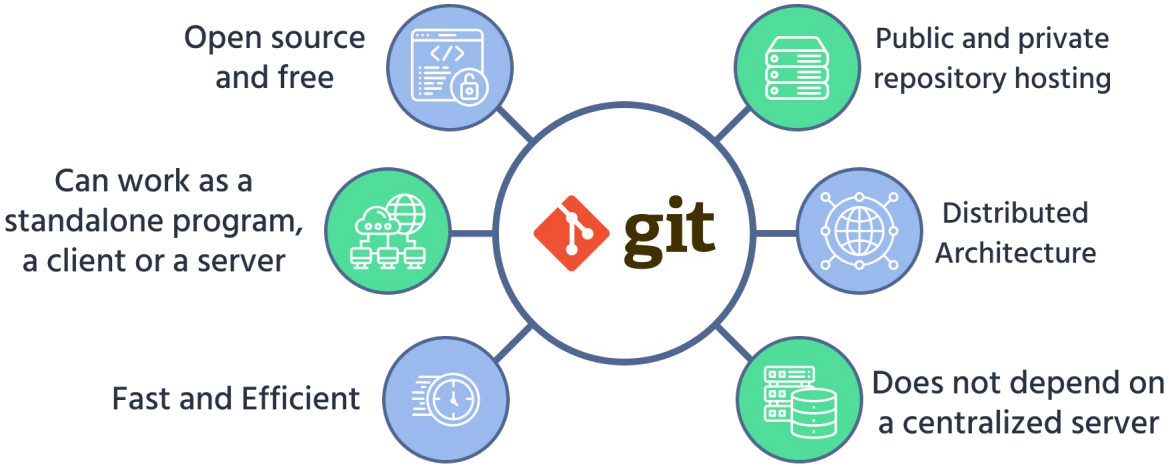
- Have multiple people working offline and sync everyone's changes later seamlessly
- Quickly swap between different iterations of your code with a single command
- Develop multiple new features independently of each other using branches

What is Git?

- Standalone Local software that is either already installed (Linux and Mac) or must be installed (Windows)
- Allows you to track changes and work on projects offline
- Can commit new changes or revert to previous versions
- Base system software that is used as a tool by Github

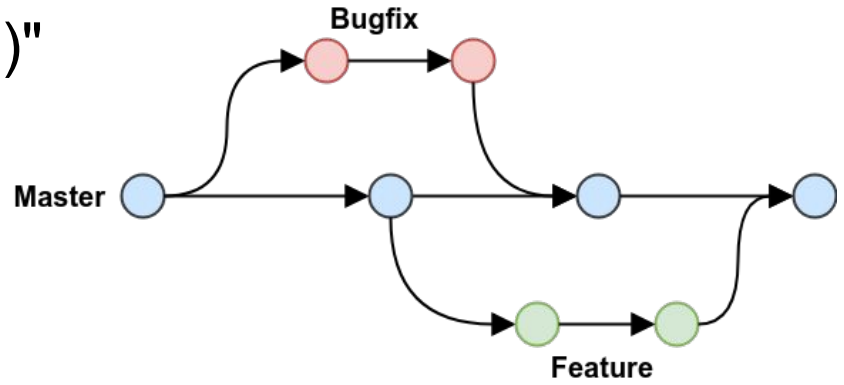
Why is Git Important?

- Git is the tool used by GitHub and is what powers it
- The base software that allows you to make repositories (branches), save (push) progress, and revert to previous versions of repositories
- Allows for offline project management through various branches and repositories



What are Branches?

- A duplicate of the code to change which you can personalize and NOT affect the original main branch
- Changes in one branch don’t affect other branches
- Allows you to make changes in code and if you mess up at any point and break the app etc, you can simply delete branch and get back at main
- Use it to not mess up main branch: (Unbroken branch, not updated unless absolutely clear new code is good)
- When you get a good branch made, you can MERGE into the main branch and then delete the forked branch
- "SirTURLE merged 1 commit into main from auth (branch)"



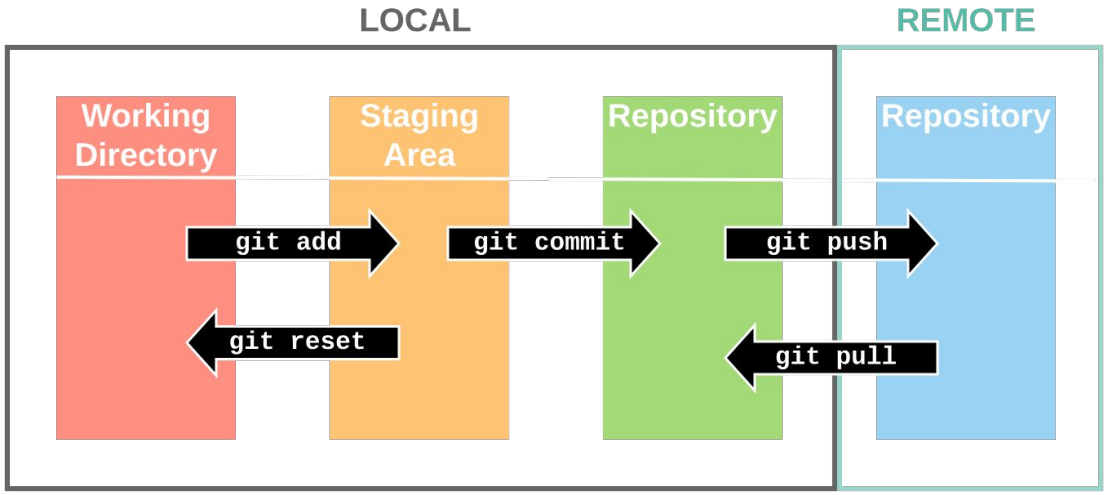
Basics Commands of Git

Initialize a new repository:

- “git init”

Save Progress:

- “git add .”
  - This adds all unsaved progress
- Can specify which file to add as well
  - “git add <file name>”
- Puts specified files into the staging process to then be committed



Commit Changes:

- “git commit -m “<describe changes>”

More Git Commands

Checkout

- Allows you to create new branches and go back to previous versions of your repositories
- "git checkout -b <name of branch>"
    - Creates a new branch
    - Once created, omit the “-b” to switch between branches
- “git checkout <hashcode>”
    - Can be used to go to previous versions of a branch

Merge

- Used to sync all changes made in one branch to another one
- “git merge <branch receiving the changes> <branch supplying the changes>
    - “git merge main hotfix_branch”
        - This would update your main branch with all the fixes you’d made in hotfix_branch

More Git commands

Branch

- Used for various tasks in managing branches
- “git branch -d <branch name>”
  - Deletes a branch, usually done once its been merged to main

See the status of your repository:

- “git status”
  - Total overview with uncommitted files, current branch, etc.
- “git log”
  - Only outputs a log of all commits made

More Git Commands

Clone:

- “git clone <repository link>”
- This clones the repository to your current directory

Push Changes:

- “git push origin main”
  - Pushes changes from local branch to remote repository (called “origin” by default)

Pull Submitted Changes:

- “ git pull origin main”
- Pulls changes from the main branch of the remote repository (named “origin”) and merges them into your current local branch

What is GitHub?

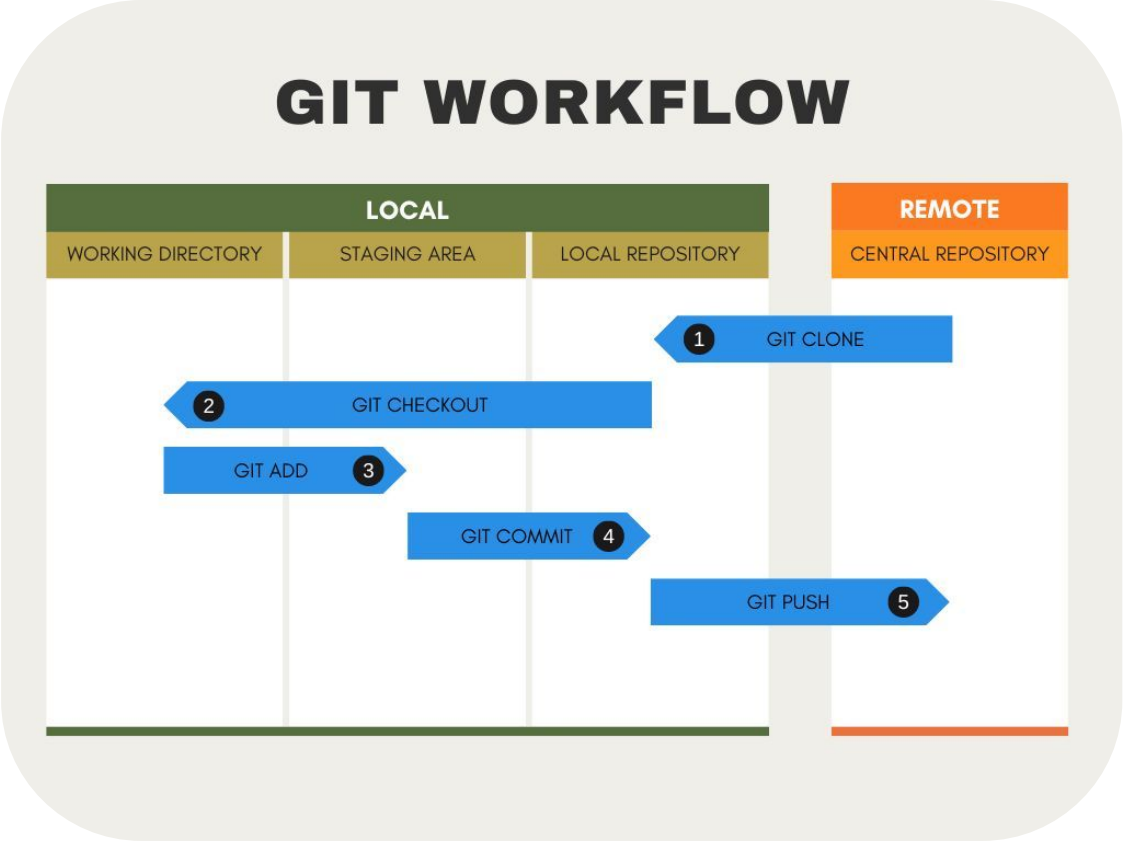
- The online version of Git
- Web-based platform which uses and relies on Git
- Allows you to collaborate with others and pull from their projects
- Can be accessed through VSCode as well as through the terminal

GitHub

GitHub Basics

GitHub basically works by having a remote copy of your repository stored on its servers.

- Remote repository is called “origin” in any git commands you use
- To sync changes between your local and remote repositories, we use the “git push” command
  - Typically looks something like “git push origin *branch_name*”

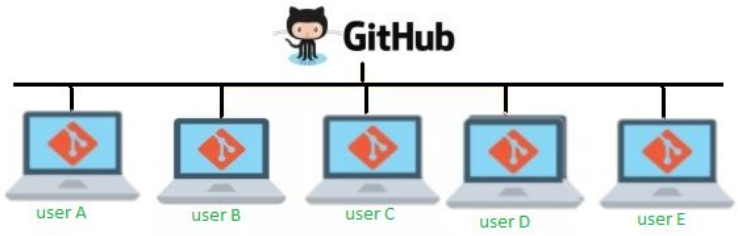


What is GitHub's Application?

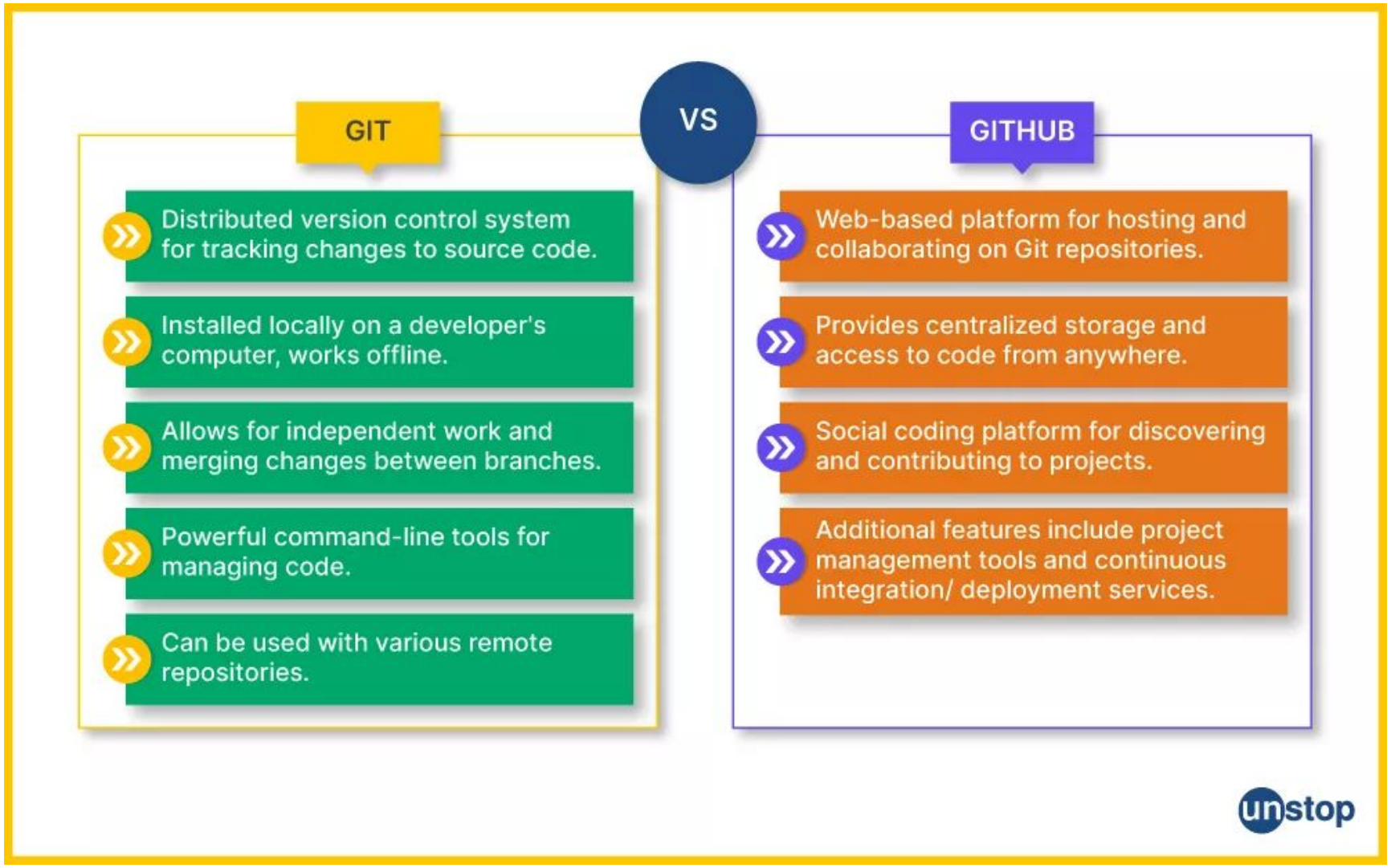
- Used for collaborative programming
- Utilized worldwide in business environments
- Facilitated Teamwork

Where is this applied:

- In advanced projects, GitHub is used to help organize projects and files, and collaborate on deliverables
- In Hatchling, GitHub can be used with your teams to program your competition robots



Git vs GitHub



GitHub Setup (one or both)

Command Line

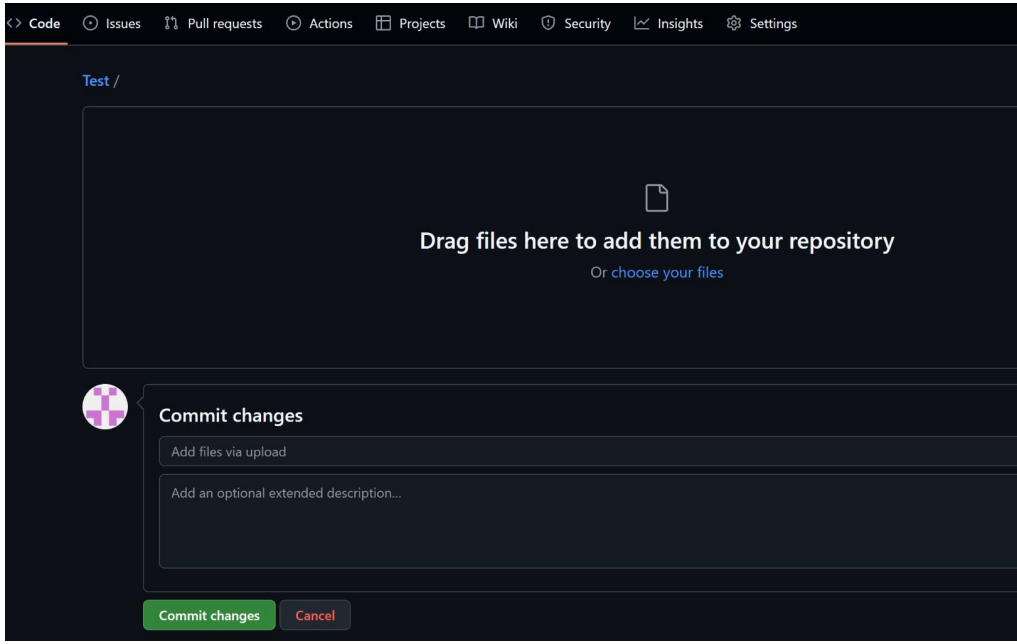
- Allows for access to GitHub from anywhere on your computer using the command line
- Easy way is with GitHub CLI
- Download and install from website
- gh auth login
- winget install --id GitHub.cli

VS Code Integration

- Only works inside VS Code
- On the left side bar press Accounts
- Login to Github with your browser
- This is what I use normally

GitHub Method 1 (Existing Code)

- Inside your project press “Initialize Repository”
- Stage and commit changes with a relevant commit message
- Login to GitHub and create a new repository
  - DO NOT make a README
  - Copy and paste the contents of “…or push an existing repository from the command line” to the project terminal and run them
  - Refresh GitHub to check that it worked



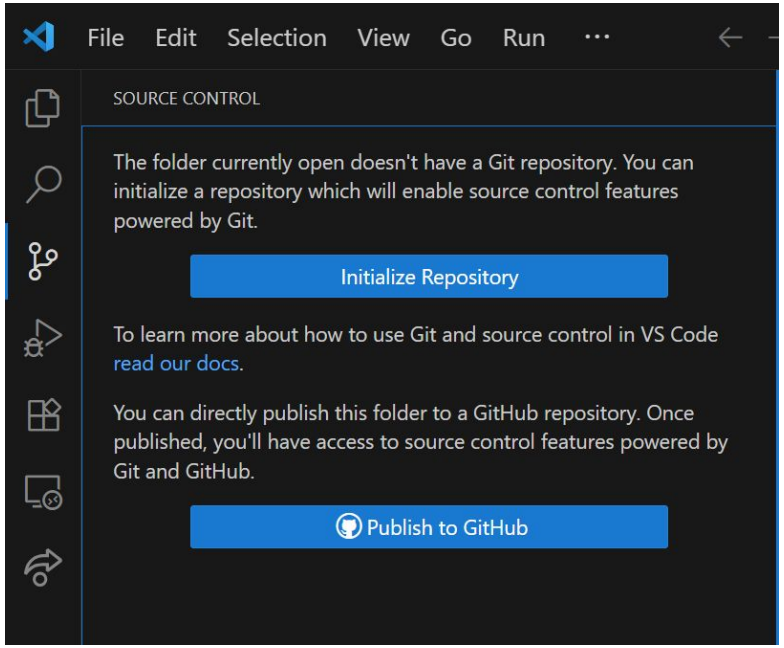
GitHub Method 2 (Before Code)

- Login to GitHub and create a new repository
  - README is optional for now. You should make one eventually to explain your projects
- Run ‘git clone <https copied from GitHub repo>’ in any terminal navigated to your storage location
  - Refresh GitHub to check that it worked
  - cd and add files as needed

```
C:\Users\nwmer>git clone https://github.com/NathanMer/Test
Cloning into 'Test'...
warning: You appear to have cloned an empty repository.
```

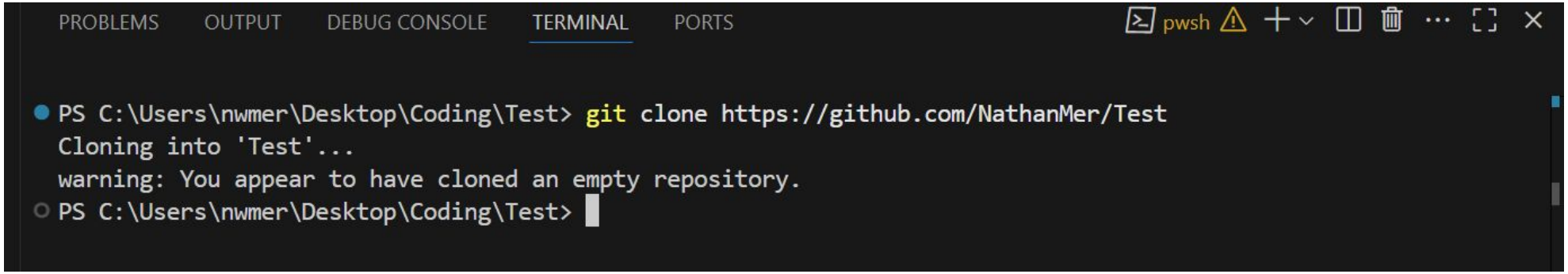
GitHub VSCode (Before Code, Source Control)

- Click “Initialize Repository” under Source Control
- Stage changes
- Commit changes through Source Code
- Can also select “Publish to GitHub” to put the opened file into a repository.



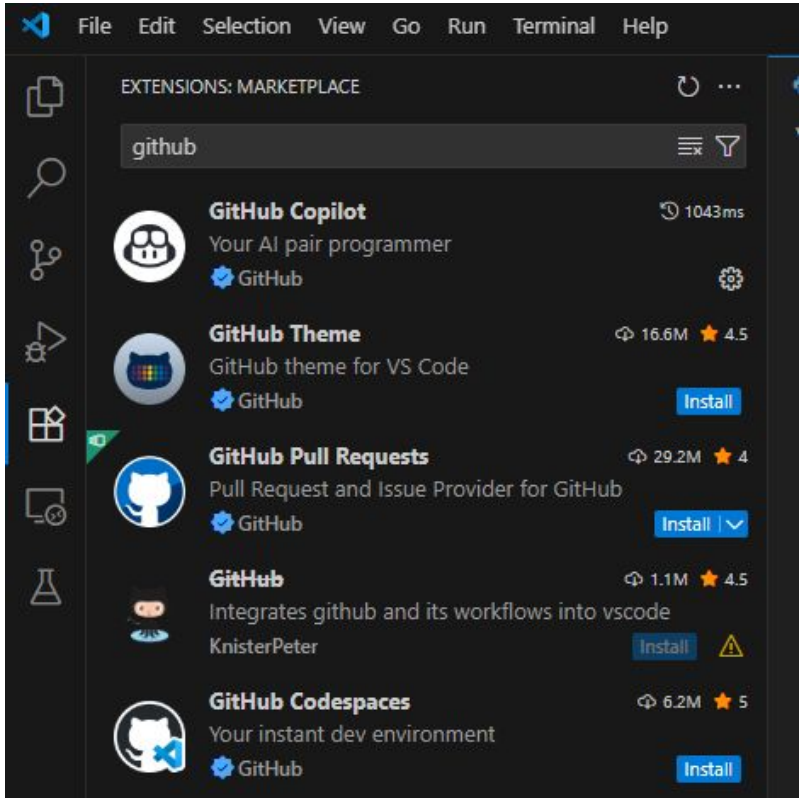
GitHub VSCode (Before Code, Terminal)

- VSCode setup method:
  - Click Accounts on left side bar and sign into GitHub
  - Run ‘git clone <https copied from GitHub repo>’ in VS Code terminal navigated to your storage location
- Refresh GitHub to check that it worked
- Create a new folder, initialize git, add files, and commit changes



VS Code Extensions

- Along with GitHub Copilot, many GitHub extensions are available on VS Code which makes it (in my opinion) easier to use. Extensions such as “GitHub Repositories” make GitHub navigation easier.
  - EX: GitHub Repositories allows you to access and easily switch to repositories linked onto your GitHub account



Commitment Issues

- GitHub does not automatically sync changes
- Code must be pulled and pushed to your remote version
- Before you push
  - Add your files to **commit** (Called stage in VS Code)
    - ‘git add <files>’ or ‘git add *’ (* adds all tracked files)
  - Commit your changes that you want to push
    - ‘git commit -m “<message>”’ (write a descriptive commit message)
- You can use ‘git status’ to make sure there won’t be issues first
  - These can usually be avoided with ‘git stash’ and ‘git stash pop’
  - The merge editor in VS Code also works

Helpful Links:

- How to use a terminal:
  - Linux: https://terminalcheatsheet.com/
  - Mac: https://support.apple.com/guide/terminal/welcome/mac
  - Windows (PS): https://www.pdq.com/powershell/
- GitHub:
  - https://github.com/
- GitHub & Git Tutorials:
  - https://youtu.be/mJ-qvsxPHpY?si=UorlNq0JFX33fm5z
  - https://youtu.be/a9u2yZvsqHA?si=-rjfo1pnPLrxPvJH
  - https://youtu.be/USjZcfj8yxE?si=k_AI8ScCOkn90lwF
- Setup GitHub through VSCode
  - https://youtu.be/z5jZ9IrSpqk?si=LU47SwwvsZwUebmN

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Let’s Code

Three Example Programs

- Blink
  - Simple led blinking code to test PlatformIO IDE VS Code extension setup and ESP32-Wroom-32D interfacing.

- ESP32Servo
  - Simple servo movement code to practice looking up datasheets

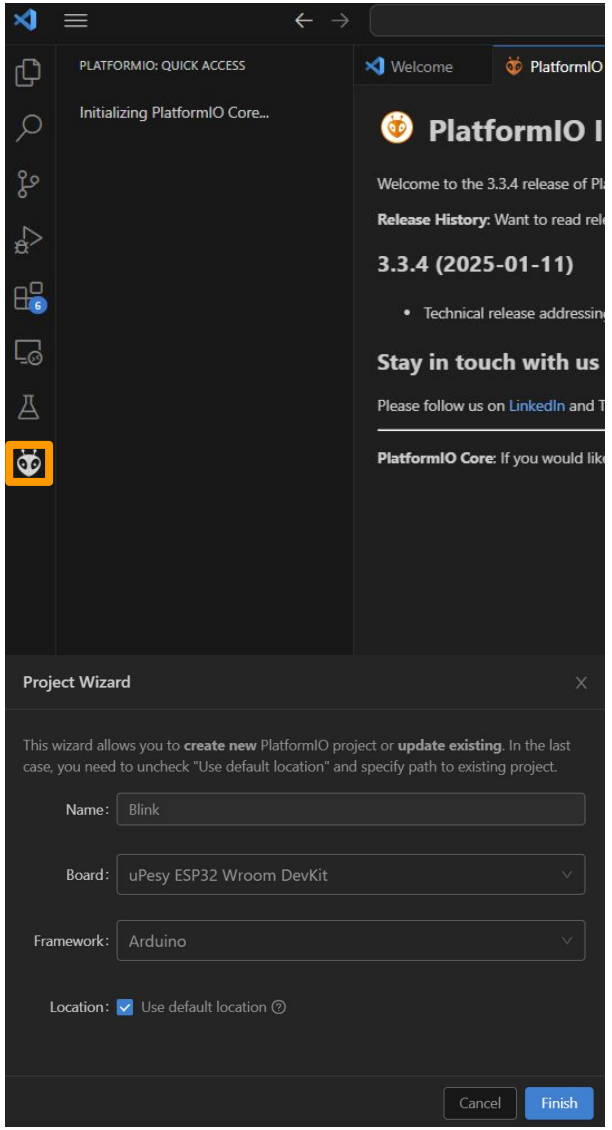
- HC-SR04
  - Simple distance displaying code to demonstrate sensors implementation.

Example codes can be found at
https://github.com/turtle-robotics/Hatchling-Examples

New Project

- Click the PlatformIO logo in the activity bar (left)
- QUICK ACCESS > PIO Home > Open > New Project
- Name: Blink
- Board: uPesy ESP32 Wroom DevKit
- Framework: Arduino
- Location: <place to store code that you'll remember>

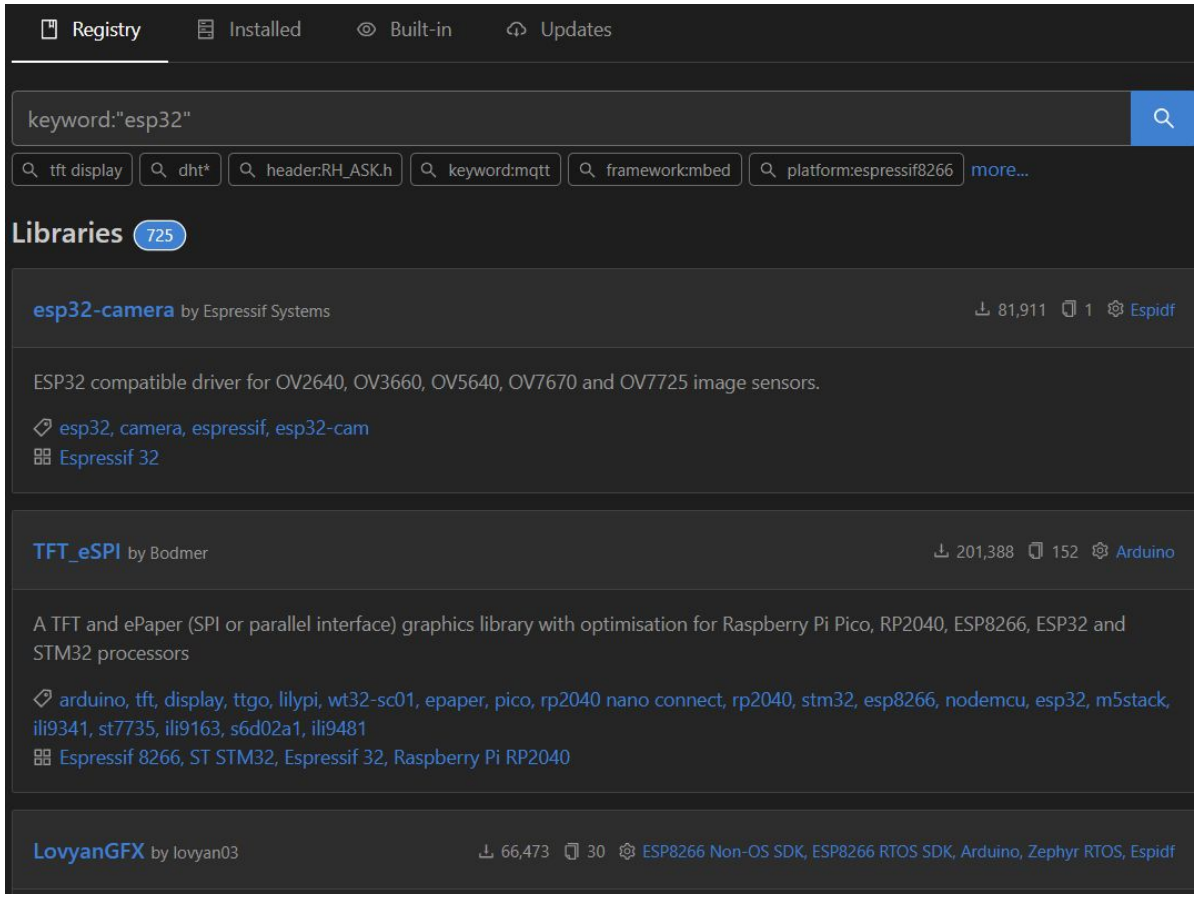
Note: It may take a minute to load



Code Libraries

- More complicated electronics like servos or sensors need more code to send/receive their data
- Libraries will have documentation that explains how to use them

Note: Like COTS Cad files, someone's probably already did this work for you!



Code Libraries

Code libraries are pre-written modules of code, often containing useful classes/functions

- Basically, you use someone else's code to do common tasks you don't want to re-write code for

To use a code library, we "import" it at the beginning of our code.

- PlatformIO automatically writes in the Arduino library

Importing in C++

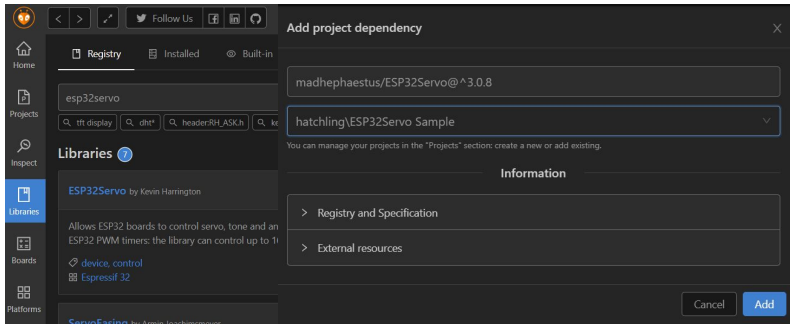
Key-word for importing - `#include`

The Arduino library is where all your reading, writing, serial printing, etc. functions are coming from

```
1  #include <Arduino.h> // imports the Arduino library, contains stuff like digitalWrite() and digitalRead()
2
3  void setup() {
4    // put your setup code here, to run once:
5  }
6
7  void loop() {
8    // put your main code here, to run repeatedly:
9  }
```

Downloading New Libraries

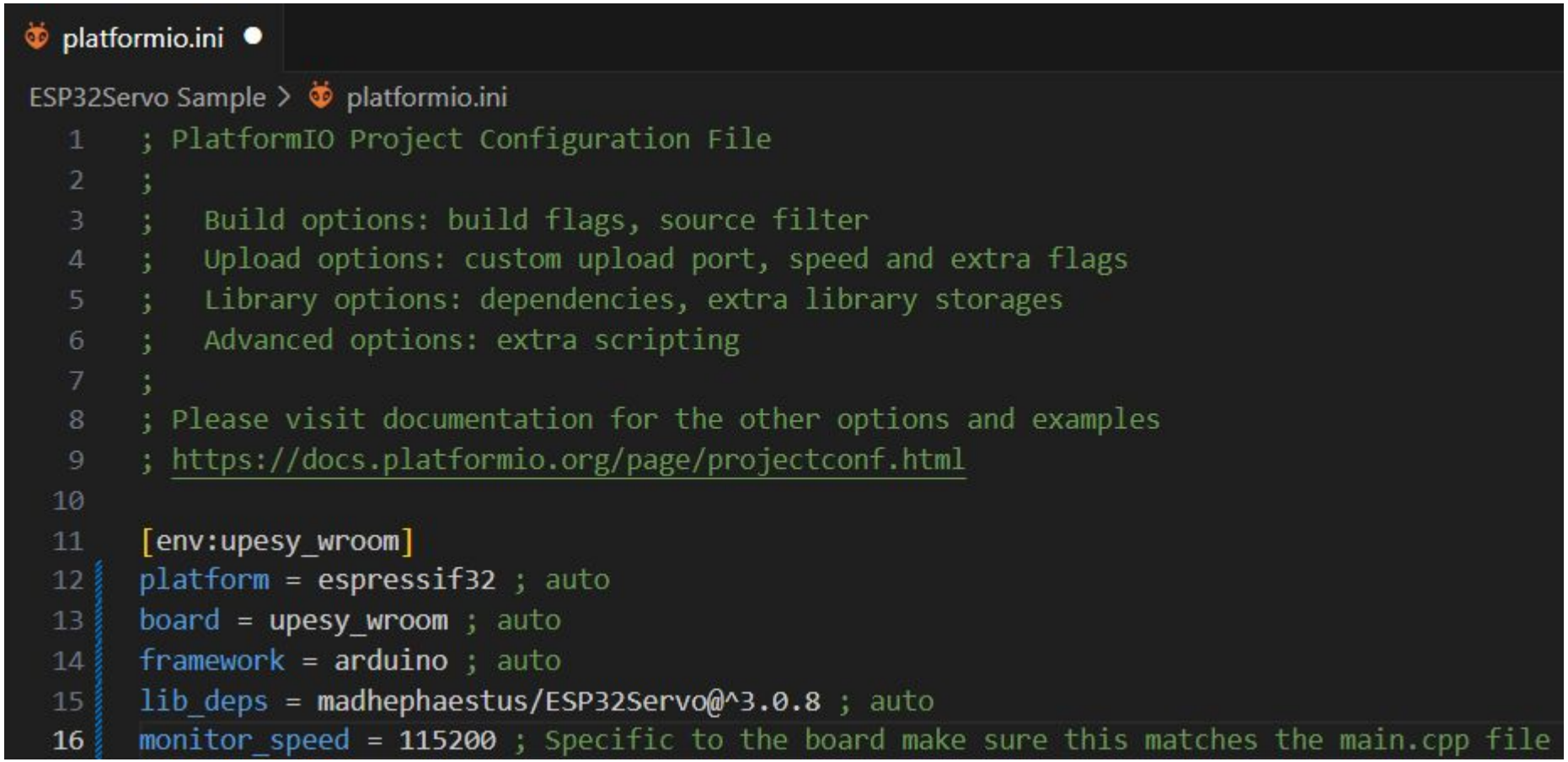
- Click the PlatformIO logo in the activity bar (left)
- QUICK ACCESS > PIO Home > Libraries
- Name: ESP32Servo
- Add to Project



<u>Documentation is your best resource for using any libraries you import</u>

pls pls pls read documentation

platformio.ini



Note: lib_deps will auto populate when importing libraries through PlatformIO

SG90 Servo Datasheet Lookup

Ultrasonic Sensor (HC-SR04) Example

Next, use the HC-SR04 distance sensor

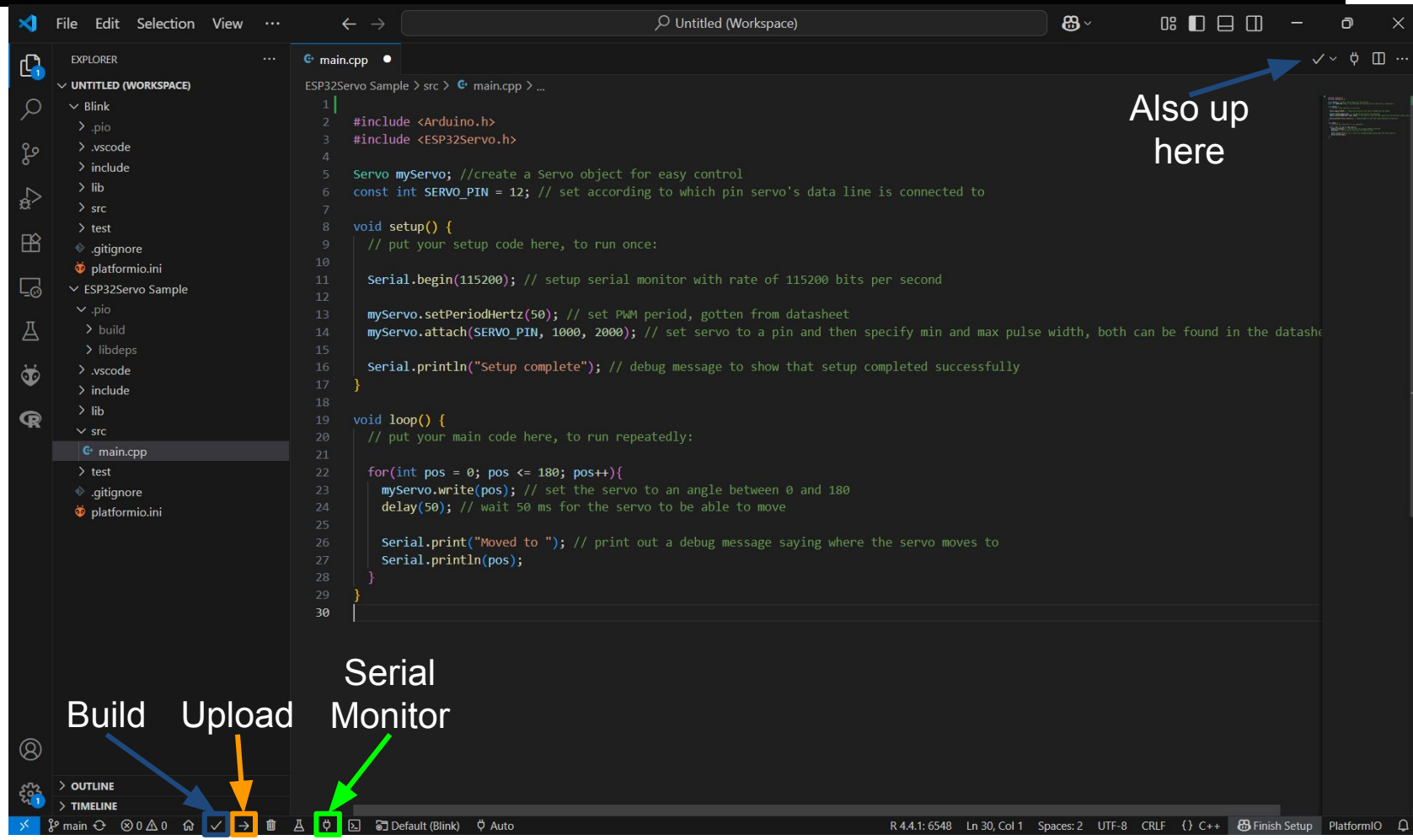
- Create a new project
- Click the PlatformIO logo in the activity bar (left)
- QUICK ACCESS > PIO Home > Libraries
- Name: HC-SR04
- Add to Project

HC-SR04 Datasheet Lookup

Build and Upload Code

Build: Checks for syntax errors then compiles your code into a MCU readable machine language.

Upload: Transfers compiled code to MCU



If your ESP32 is doing what you intended, congrats!

If not, you have some troubleshooting to do…

Next Milestone

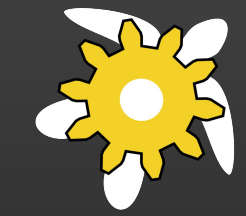
Milestone: Prototype Review

Date: Week 9 - Prototype (2 week from today)

Expectation: Have a CAD assembly of a drive system. Have a finished electronics wiring diagram.

Exceed Expectation: Have a CAD of the entire robot and started prototyping. Began programming the robot.

Impact: We will review design viability and suggest improvements. Potential to prototype your mechanism.



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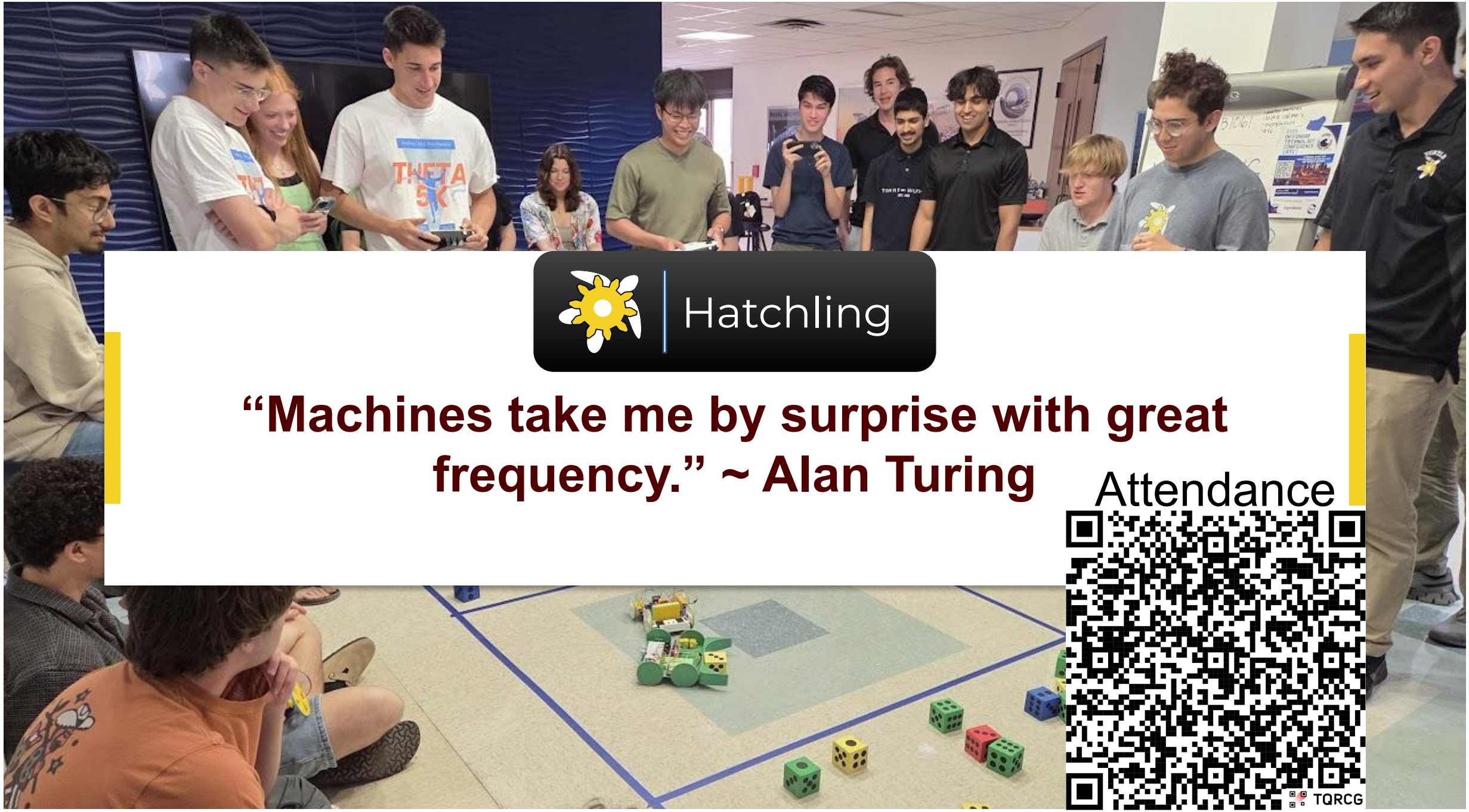
Electronics and Soldering!

Next Week



Hatchling

“Machines take me by surprise with great frequency.” ~ Alan Turing

Attendance