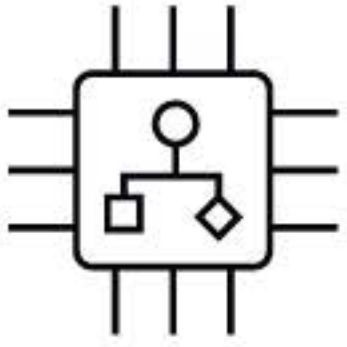# Nautical Precision Pursuit

What are the challenges with maritime navigation and safety using distance sensors?

Suggested Equipment Skill Level

Novice User

Equipment Skills

Coding

Tugboat Operator

Career & Skillset Connections
-Spatial Skills
-Detail oriented
-Technological skills

Project Guiding Themes
-Engineering design process
-Setting up Raspberry Pi
-Coding
-Utilizing breadboards

Suggested Software & Materials
-Raspberry Pi
-Various object to measure distance with

Aligned VDOE CTE Course(s) and Competencies

Technology Foundations
36-Weeks

Electronics Systems I
36-Weeks

VMASC

Nautical Precision Pursuit

Embedded System Novice Skill Level

What are the challenges with maritime navigation and safety using distance sensors?

Project Problem & Career Prompt

You are the Tugboat Operator on the Robert Burton (tugboat) that helps guide various ships through narrow passages and entering and leaving port. On the Robert Burton, you have a monitoring system that measures distance to piers, ships, etc. You noticed on your last job, your system wasn't accurate. In maritime operations, precision and accuracy are paramount and any discrepancies can lead to potentially dangerous situations. Luckily on board you have a marine engineer who specializes in electronics and instrumentation systems to redesign the system and fix it before your next job.

Project Background & Resources

Getting started with Raspberry Pi

https://projects.raspberrypi.org/en/projects/raspberry-pi-getting-started/1

Distance Sensor
https://tutorials-raspberrypi.com/raspberry-pi-ultrasonic-sensor-hc-sr04/

Investigative Questions

-How will you troubleshoot the system if your first attempt does not go as planned?
-How can you accurately mount the system so it is effective and accurate everytime?

Project Criteria

-Code and breadboard must be clean
-Final prototype must be completed prior to the project deadline

Project Constraints

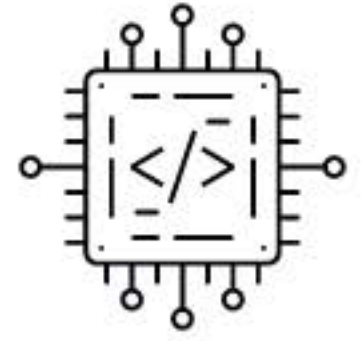-Prototype must be able to measure multiple distances

Suggested Pacing

1-2 Days of research and sketching ideas	1-2 Days of design	1-2 Days of constructing and finishing prototypes

VMASC

Nautical Precision Pursuit
Embedded System

Career & Skill Set Connections

Tugboat Operator

A tugboat operation, also know as a tug captain, is the pilot of a small vessel that helps a large barge or boat steer in tight spaces.

Essential Skills

*Fine motor control
*Navigational
*Mechanical
*Attention to detail
*Communication

Academic Pathway

High School Diploma
and
Community College/Certification
or
Bachelor's degree
or
U.S. Merchant Marine Academy

Aligned VDOE CTE Course(s) and Competencies

Workplace Readiness Skills & Work-Based Learning Opportunities & Examine All Aspects of an Industry

Technology Foundations

Exploring Technology Foundations

Describe the basics system model

Distinguish between an open- and closed-loop system

Explain what proces does in a system

Controlling an Electronic System

Analyze a problem whose solution uses electronic controls

Use engineering design to solve an identified problem using an electronically controlled device

Control a device with a microcontroller

Electronics Systems I

Introducing Circuit Components

Describe the role of conductors in a circuit

Identify control devices of electrical and electronic devices

Explain how common electronic and other electrical devices work

Designing DC Analog Circuits

Construct circuits that satisfy design briefs using solderless circuit boards/breadboards

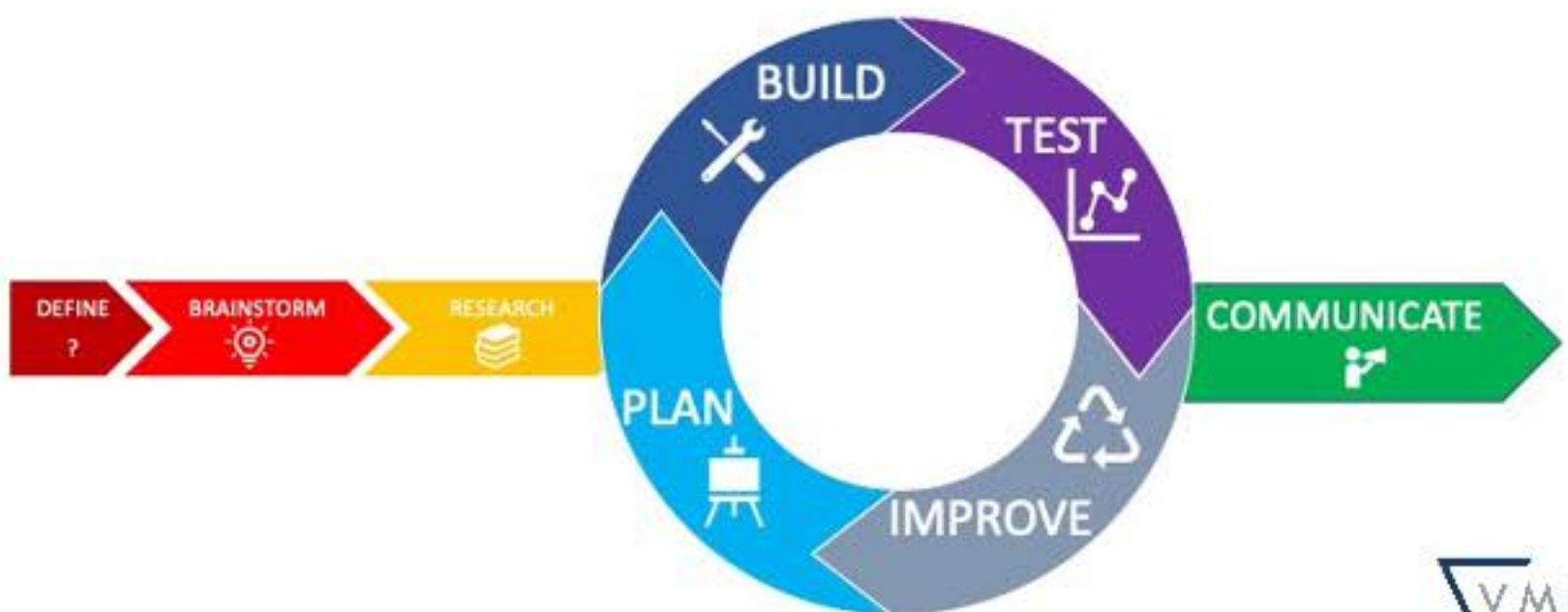Describe the process and application of troubleshooting procedures

VMASC

Project Management Plan

Team Member Roles

Team Goals & Timelines

Team Member Tasking

Sketches & Design Planning

Notes

Notes