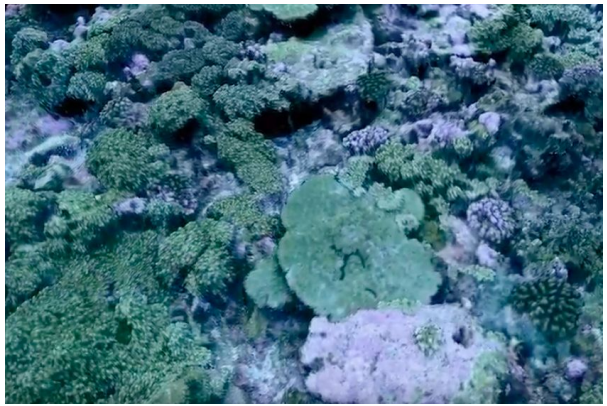
Smart Integrated Tile (S.I.T)

Project Update

Sam, Ivy, Tony

Motivation Why are we doing this?

- Scientists build 3D models to keep track of changes of coral reefs
- Depth information is needed...
- Current method is by manually measuring the depth: hard, not accurate
- A smart tile that automates this process: measure and display the depth under water. Divers with 3D camera will capture photos to get depth information.



Requirements More details...

- Waterproof (~10 meters)
- Measure the depth and display
- Rechargeable battery
- Reprogrammable
- Ability to turn on/off
- Log and transfer the depth data
- Cheap (less than $100) in order to be widely distributable to collaborators

Challenges Waterproof is too hard...

- iPhone X (IP67 rated)
  - Half an hour
  - Up to 1 meter

- Our Device
  - 4 hours
  - 10 to 15 meters
  - Salt water

Challenges Waterproof means more

- No buttons. No plugs
  - Exposed cords and pins will erod in salt water
  - Waterproof plugs or buttons are not affordable
- How to reprogram without plugs?
- How to turn ON/OFF the device?

- **Solution**:
  - Use water-resistant plugs as a temporal solution
  - Wireless charging & wireless data transmission
  - Reed switch for turning ON/OFF
  - Pogo pins for reprogramming

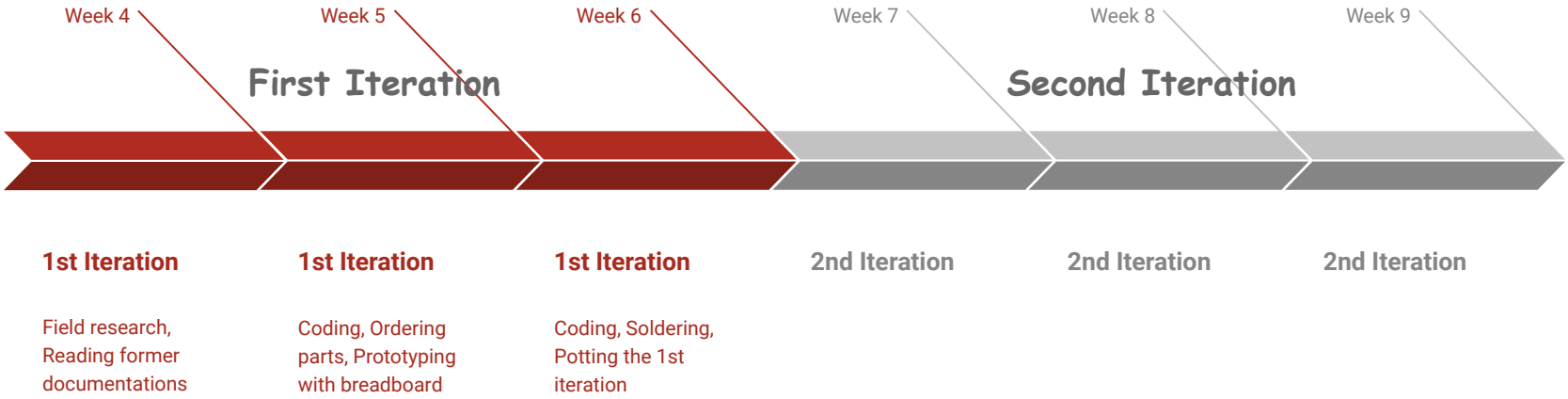
Challenges A clear display is important

- The tile should display the depth clearly enough under all conditions / in camera
- Condition under water: sunlight, wind, wave
- May have additional illumination

- **Solution**: Try and test different types of display module LED, e-paper

Objectives

- Develop and test two different prototypes
- First iteration: displays and sensors
- Second iteration: data transmission, more waterproof



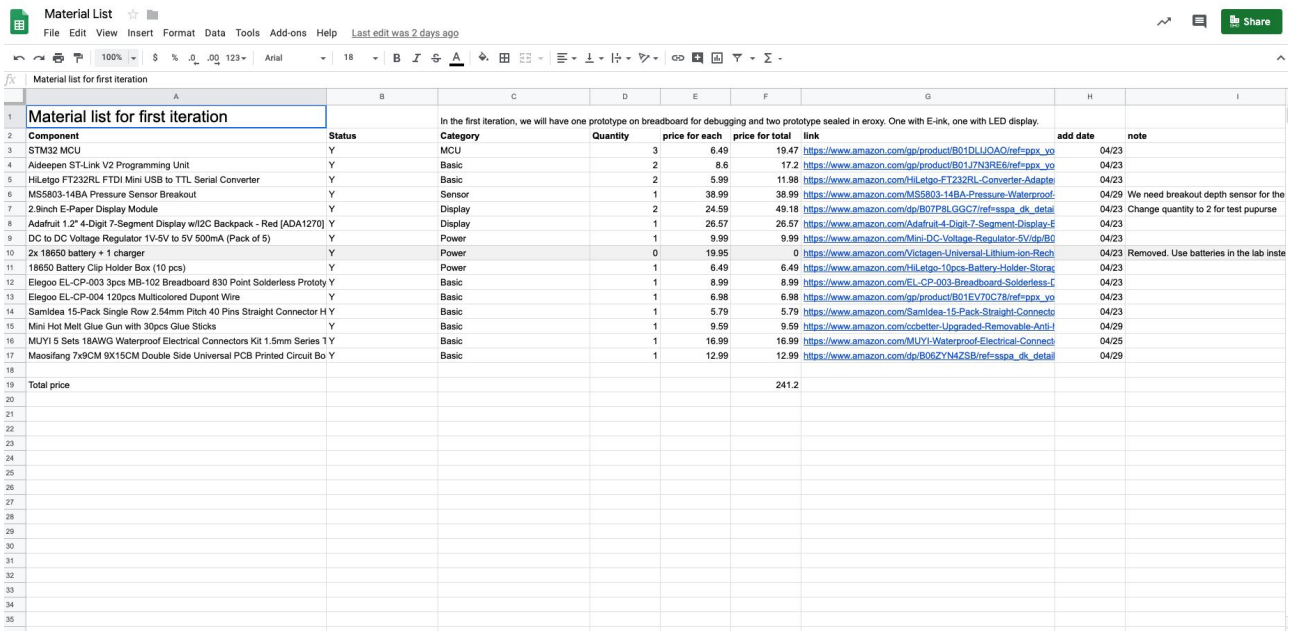
Accomplishment

1st Iteration: a fully integrated device that could be tested underwater

- Measure the depth with depth sensor
- Two display modules
- Reed Switch to turn on/off
- Battery management and display battery status

Progression

- **Buying parts**
- Breadboard
- Coding
- Soldering
- Potting
- Testing



Material List

File Edit View Insert Format Data Tools Add-ons Help Last edit was 2 days ago

Share

Material list for first iteration

	A	B	C	D	E	F	G	H	I
1	Material list for first iteration		In the first iteration, we will have one prototype on breadboard for debugging and two prototype sealed in eroxy. One with E-ink, one with LED display.						
2	**Component**	**Status**	**Category**	**Quantity**	**price for each**	**price for total**	**link**	**add date**	**note**
3	STM32 MCU	Y	MCU	3	6.49	19.47	https://www.amazon.com/gp/product/B01DLLJQAO/ref=ppx_yo	04/23	
4	Aideepen ST-Link V2 Programming Unit	Y	Basic	2	8.6	17.2	https://www.amazon.com/gp/product/B01J7N3RE6/ref=ppx_yo	04/23	
5	HiLetgo FT232RL FTDI Mini USB to TTL Serial Converter	Y	Basic	2	5.99	11.98	https://www.amazon.com/HiLetgo-FT232RL-Converter-Adapte	04/23	
6	MS5803-14BA Pressure Sensor Breakout	Y	Sensor	1	38.99	38.99	https://www.amazon.com/MS5803-14BA-Pressure-Waterproof-	04/29	We need breakout depth sensor for the
7	2.9inch E-Paper Display Module	Y	Display	2	24.59	49.18	https://www.amazon.com/dp/B07P8LGGC7/ref=sspa_dk_detai	04/23	Change quantity to 2 for test pupurse
8	Adafruit 1.2" 4-Digit 7-Segment Display w/I2C Backpack - Red [ADA1270]	Y	Display	1	26.57	26.57	https://www.amazon.com/Adafruit-4-Digit-7-Segment-Display-E	04/23	
9	DC to DC Voltage Regulator 1V-5V to 5V 500mA (Pack of 5)	Y	Power	1	9.99	9.99	https://www.amazon.com/Mini-DC-Voltage-Regulator-5V/dp/B0	04/23	
10	2x 18650 battery + 1 charger	Y	Power	0	19.95	0	https://www.amazon.com/Victagen-Universal-Lithium-Ion-Rech	04/23	Removed. Use batteries in the lab inste
11	18650 Battery Clip Holder Box (10 pcs)	Y	Power	1	6.49	6.49	https://www.amazon.com/HiLetgo-10pcs-Battery-Holder-Storag	04/23	
12	Elegoo EL-CP-003 3pcs MB-102 Breadboard 830 Point Solderless Prototy	Y	Basic	1	8.99	8.99	https://www.amazon.com/EL-CP-003-Breadboard-Solderless-D	04/23	
13	Elegoo EL-CP-004 120pcs Multicolored Dupont Wire	Y	Basic	1	6.98	6.98	https://www.amazon.com/gp/product/B01EV70C78/ref=ppx_yo	04/23	
14	Samldea 15-Pack Single Row 2.54mm Pitch 40 Pins Straight Connector H	Y	Basic	1	5.79	5.79	https://www.amazon.com/Samldea-15-Pack-Straight-Connecto	04/23	
15	Mini Hot Melt Glue Gun with 30pcs Glue Sticks	Y	Basic	1	9.59	9.59	https://www.amazon.com/ccbetter-Upgraded-Removable-Anti-H	04/29	
16	MUYI 5 Sets 18AWG Waterproof Electrical Connectors Kit 1.5mm Series 1	Y	Basic	1	16.99	16.99	https://www.amazon.com/MUYI-Waterproof-Electrical-Connecto	04/25	
17	Maosifang 7x9CM 9X15CM Double Side Universal PCB Printed Circuit Bo	Y	Basic	1	12.99	12.99	https://www.amazon.com/dp/B06ZYN4ZSB/ref=sspa_dk_detail	04/29	
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19	Total price					241.2			
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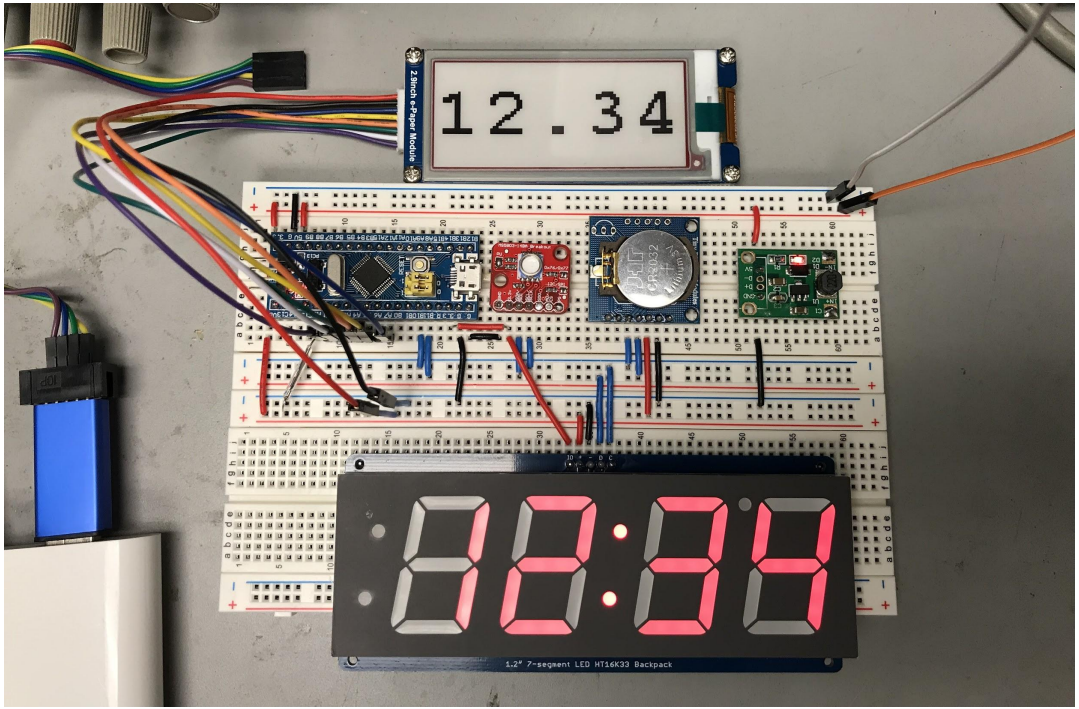

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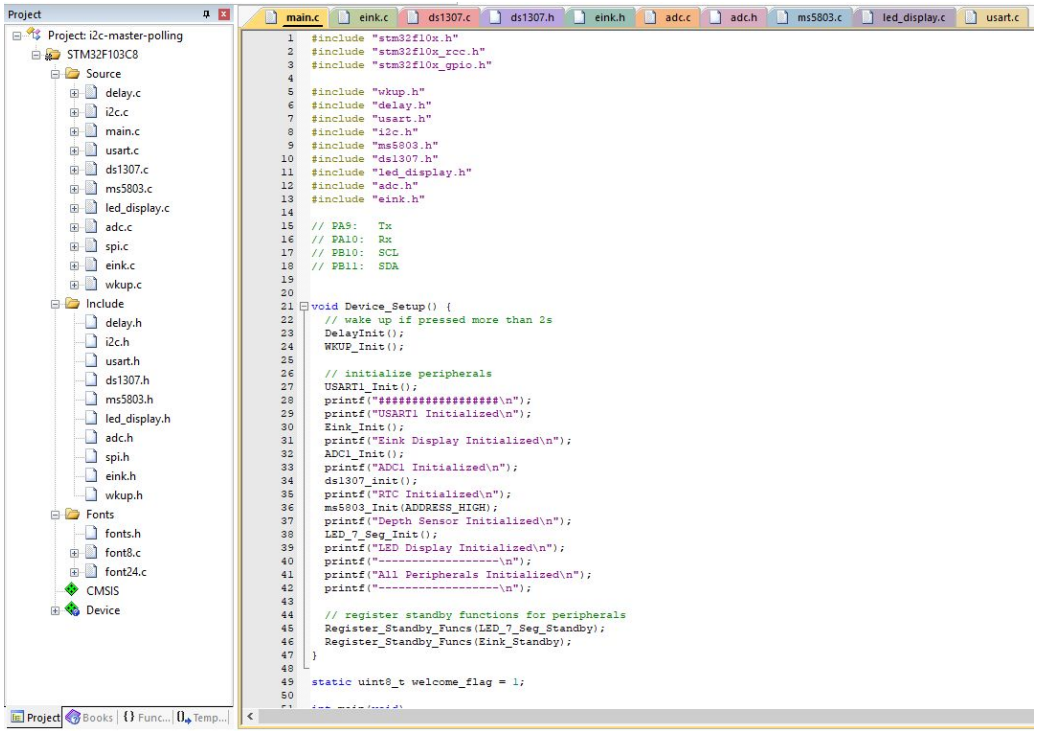

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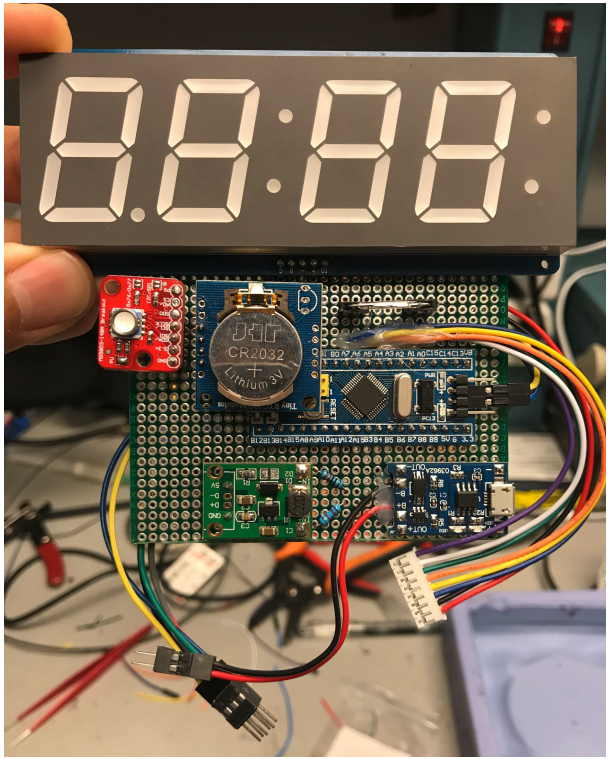

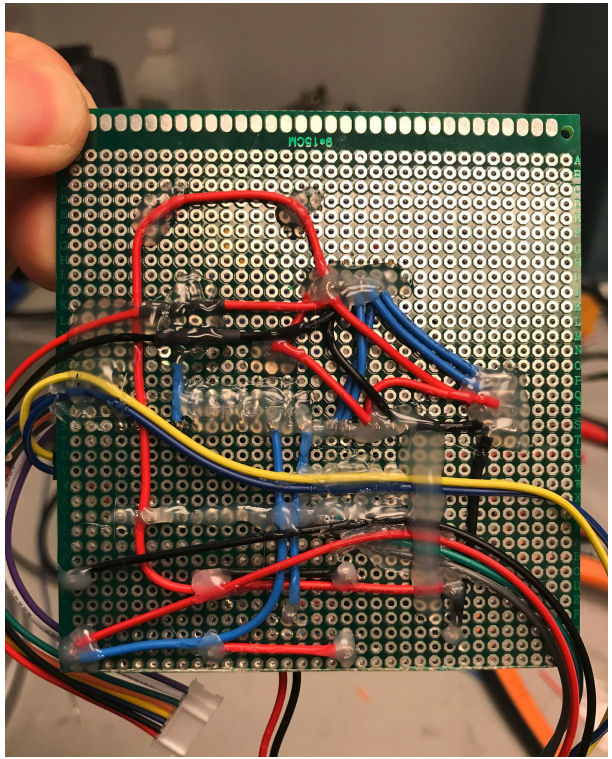

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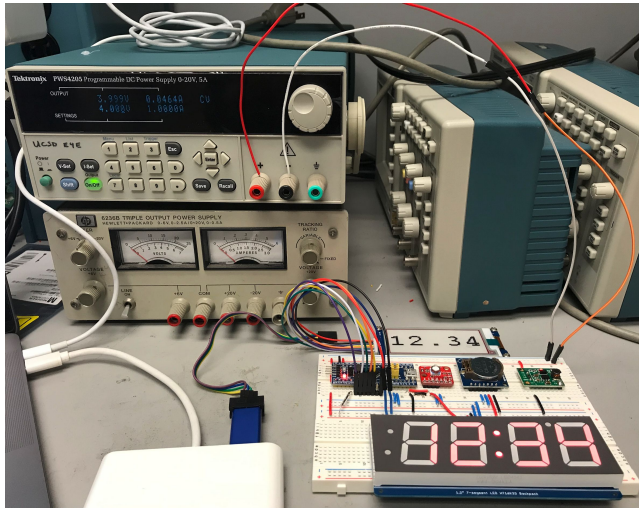
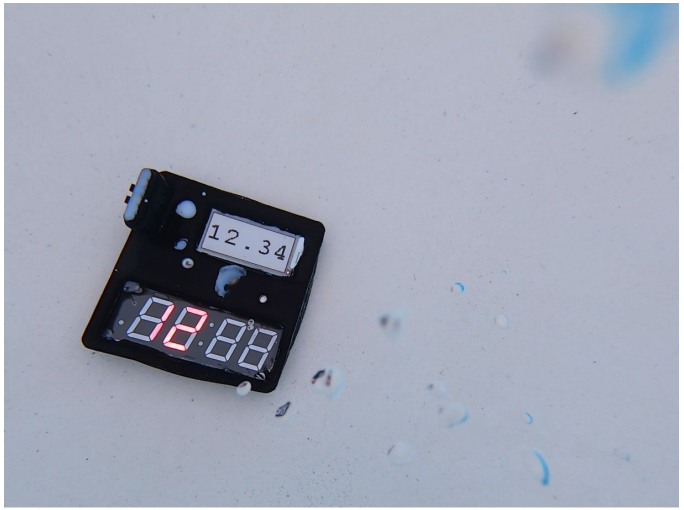
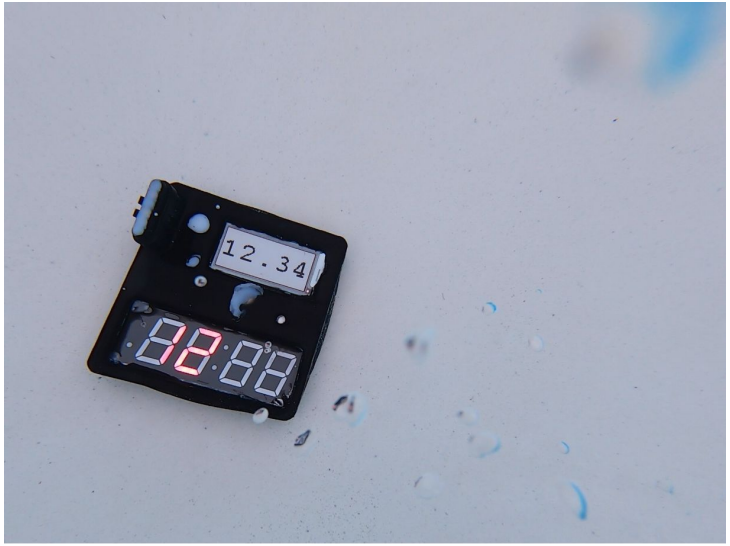




Demo



What to do next

	Second Prototype:	First Prototype:
• Boards:	PCB	soldering board
• Sensors:	depth, RTC	
• Displays:	E-ink, LED	
• Charging:	wireless	with plug & cable
• Switch:	reed switch for turning on/off	
• Reprogram:	with pads and pogo pins	with plug & cable
• Data Trans.:	Bluetooth or Zigbee SD card	with plug & cable
• GUI:	user interface to receive data	

Plan for Future Milestones

- Week 7
  - Test 1st prototype underwater
  - Design PCBs for fabrication
- Week 8
  - Add more peripherals (SD card, Bluetooth, etc.)
  - Set protocol for data transmission
  - Develop GUI for downloading data
- Week 9
  - Assemble and pot the device
  - Test 2nd underwater

Acknowledgment

- Thanks for the support from Prof. Ryan Kastner
- Thanks for the support from Dr. Brian Zgliczynski
- Thanks for the help from Eric and Nathan

Q&A

Thanks!