Deliverable H - Prototype III and Customer Feedback GNG 1103D

Group #9

March 28, 2021

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Troop and Sandeep Sinha

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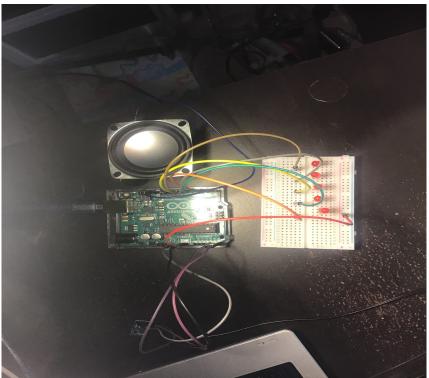
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Problem Statement

The JAMZ developers need an emergency beacon that transmits accurate and quick location information about the drone to the operator in live time by interpreting the data received from the sensors as well as alerting nearby citizens of the downed drone with flashing lights and a voice system.

Summary of Previous Deliverable

In our previous deliverable, we provided the testing results for prototype 2 of our emergency beacon for the JAMZ drone. It started out with a recap of the testing done in prototype 1 and the improvements that were made to prototype 1 for the prototype 2 testing. Included in the prototype 2 testing is an analytical model of the various subsystems, including the location, altitude, light and voice subsystems, and an analytical model of the entire system with all the subsystems combined. The previous deliverable also contained the test results for the various subsystems and the circuit designs for each of them. The deliverable finished off with a 3D model of what the case for the emergency beacon would roughly look like, and the Wrike update was added in at the end.





The figure above shows the complete emergency beacon system, with the light, voice, and altitude subsystems, all connected to the Arduino, either via a breadboard or directly with jumper cables. The system is being powered with a USB cable, connected to a computer.

Testing, Results and Improvements on Prototype II

On the previous deliverable, the initial model for each of the subsystems was built and we were able to test the code to ensure the wiring on these physical models was correct. This was done for each subsystem but the location subsystem and for a basic overall beacon to ensure the functionality of the system. For this deliverable, those results were improved upon by modifying the code, improving the subsystem layout, completing the location subsystem and making sure the subsystems are capable of sending data to the Arduino. In this round of testing, the light subsystem code was left the same and the only change made was that the lights are now activated when the altitude subsystem determines the drone is too low. Also, the number of LED lights was increased from 4 to 8 in order to increase their visibility and activate lights in a specific order to warn anyone near the drone. The voice subsystem was only tested as a component of the overall subsystem however it was modified to increase the volume of the sound produced by increasing the voltage passed through to 5V and changing the resistors. After multiple tests, an appropriate volume was reached. Also, the automated message that was added to the code in prototype 2 was modified and completed for this prototype. The final changes made to the code allow for the system to be activated and the automated message to be played after the altitude sensor determines a threshold altitude has been crossed. For this prototype, the altitude subsystem was tested only as a part of the overall beacon and it was able to successfully interpret atmospheric pressure when the beacon altitude is too low and then activate the voice and light subsystems. The location subsystem was completed for this prototype after we received the part and we were able to test the subsystem's ability to interpret GPS data to provide an accurate location. It was tested multiple times and functioned very well, however we are still having difficulties connecting this subsystem to the overall beacon in order to send this information to the JAMZ operator. We will need to modify the code and possibly improve upon the systems wiring in order to have it functioning as a part of our overall beacon for design day. The final improvement for this prototype was the addition of a protective case laser cut from acrylic; it was tested by placing all the components of the case to ensure that it is the proper size. We plan to improve upon this case by waterproofing the case and making sure that the speakers can still be heard and the LED's are still highly visible.

Task		Member Responsible	Due date
Fixing of components	 Location subsystem Altitude subsystem 	Sandeep Elsa	March 15 th , 2021
	 Voice and light subsystem a. Voice b. Lights 4. All-around connections 	Karen Jacob Tri	
Testing of the physical prototype	 Test each subsystem Location subsystem Altitude subsystem Voice and light subsystem 	Elsa and Karen	March 17 th , 2021

Table 1 - Tasks Plan for Prototype 2.5 and 3

	a. Voiceb. Lights5. All-around connections		
Fixing of components	 Location subsystem Altitude subsystem Voice and light subsystem a. Voice b. Lights All-around connections 	Sandeep Elsa Karen Jacob Tri	March 22 nd , 2021
Testing of the physical prototype	 Test each subsystem Location subsystem Altitude subsystem Voice and light subsystem a. Voice b. Lights 5. All-around connections 	Elsa and Karen	March 24 th , 2021
Deliverable1.Analytic modelH2.Formatting3.Summary of previous deliverable4.Testing, results and improvement methods of the first prototype5.Testing results6.Inkscape design7.Encasing8.Presentation9.Wrike update		Jacob, Elsa and Karen Tri Sandeep Jacob Elsa and Karen Jacob Tri Tri Karen	March 28 th , 2021

Prototype 2.5

The main objective of prototype 2.5 was to test different codes while still satisfying design criteria. The subsystems tested were the voice and location subsystem.

Analytical Model

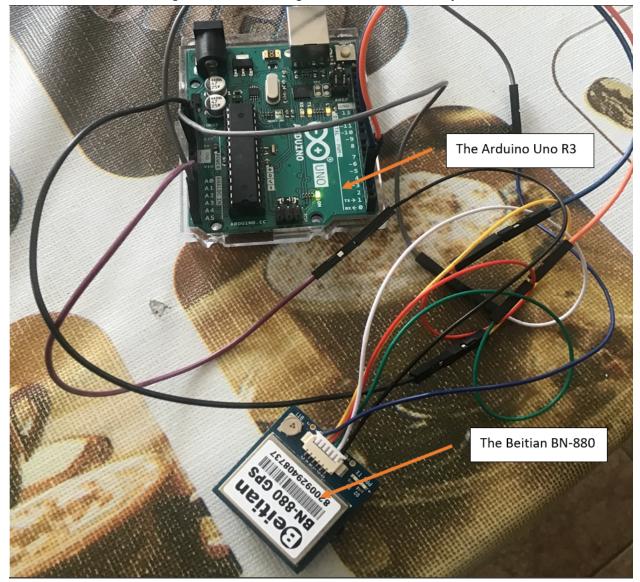


Figure 2 - Detailed Diagram of the Location Subsystem

The figure above is a detailed diagram of the location subsystem which includes the Beitian BN-880 as well as the Arduino Uno. The Beitian BN-880 is connected through the I2C bus of the Arduino using the SDA and SCL pins as well as pins 3 and 4. The product is also connected to the Arduino in the ground and 5V pins.

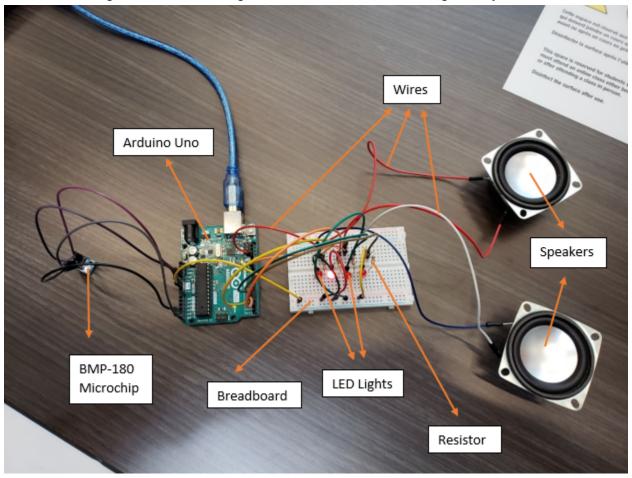


Figure 3 - Detailed Diagram of the Voice, Altitude and Light Subsystems

The figure above is a detailed diagram of the integrated system including the voice, light and altitude subsystems. For the voice subsystem, we have the two speakers that are connected to the breadboard and then the Arduino Uno and they display an automated message. For the light subsystem, the figure shows four red LED lights that are connected to the breadboard and their function is to light up, one after the other, in case of an emergency. Lastly, the altitude subsystem, it is made of the BMP-180 Microchip which uses wires to directly connect to the Arduino Uno. Its function is to measure the altitude and send the data to the operator and the other subsystems. Once the altitude drops below a specified threshold, the voice and light subsystems are activated.

Altitude Subsystem

For this prototype, the altitude subsystem was not tested separately, but only in the fully integrated prototype.

Location Subsystem

This section contains testing done for the location subsystem. The first two tests tested if the Beitian BN-880 was functioning properly.

Test 1

Test ID	Member(s) Responsible	Test Objective	Description of Prototype Used and of Basic Test Method	Descriptions of Results and How These Results Will Be Used	Estimated Test Duration and Planned Start Date	Stopping criteria
1	Elsa	To test the functioning of the Beitian BN-880.	The prototype contained the Arduino, the Beitian BN-880 and connecting wires. A code was used to test if the Beitian BN-880 printed the coordinate data to the serial monitor.	The results were a coordinate printed to the serial monitor. In the future, this code can be used as a baseline to check if the product is working.	March 15 th , 2021 Test Duration: approximately 2 minutes.	The prototype was deemed satisfactory when it printed coordinates to the serial monitor.

Table 2 - Test Plan 1 for the Location Subsystem for Prototype 2.5

The first test of this subsystem tested if the Beititan BN-880 was functioning properly. The test was finished once it printed coordinates to the serial monitor. In the future, the test results will be used as a signal to move onto checking if the product satisfies design criteria and as a baseline for the proper execution of the location subsystem.

Results

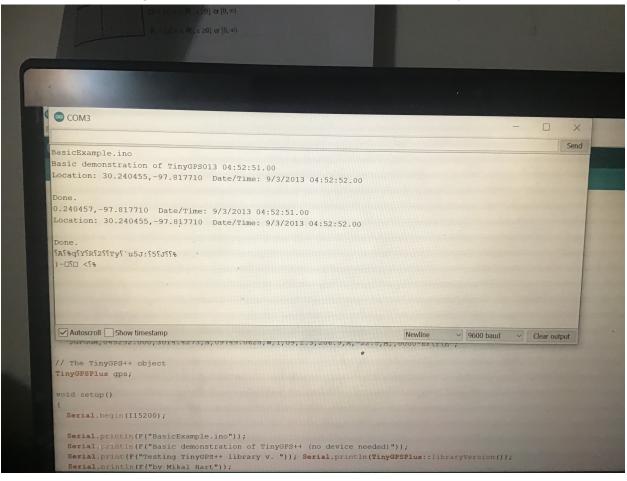
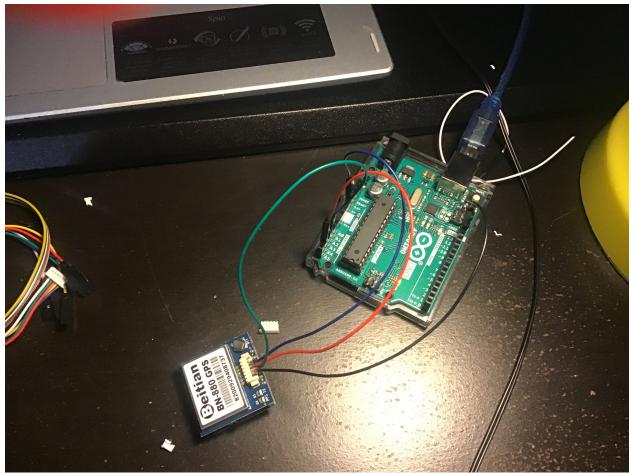


Figure 4 - Code Results for Test 1 of the Location Subsystem

The figure above shows the code results of this test. It was retrieved from here.



The figure above shows the setup used for the location subsystem.

Test 2

Test ID	Member(s) Responsible	Test Objective	Description of Prototype Used and of Basic Test Method	Descriptions of Results and How These Results Will Be Used	Estimated Test Duration and Planned Start Date	Stopping criteria
2	Elsa and Karen	To test if the Beitian BN-880 satisfies the design criteria.	The prototype contained the Arduino, the Beitian BN-880 and connecting wires. A code was used to test if the Beitian BN-880 printed	The test failed as the live coordinates of the product were not printed on the serial monitor.	March 15 th , 2021 Test Duration: approximately 2 minutes.	The prototype was deemed satisfactory when it printed the live coordinates

Table 3 - Test Plan 2 for the Location Subsystem for Prototype 2.5

		the coordinate data to the serial monitor.			of the prototype to the serial monitor.
--	--	--	--	--	--

The objective of this test was to test if the Beitian BN-880 could satisfy design criteria. The test failed as it printed checkmarks to the serial monitor instead of coordinates.

Results

Figure 6 - Code Results for Test 2 of the Location Subsystem

СОМЗ	
1:16:29.310 -> SatElevTracker.ino 1:16:29.310 -> Displays GPS satellitnge 1:16:29.310 -> Testing TinyGPS++ library v. 1.0.2 1:16:29.310 -> by Mikal Hart 1:16:29.310 -> Disconstructure 21:16:29.310 -> Disconstructure	
Autoscroll Show timestamp	Newline V 9600 baud V

The figure above shows the results of the second test done on the location subsystem. It was retrieved from this <u>file</u>.

This test had the same setup as test 1 for this subsystem.

Voice Subsystem

This section contains testing done for the voice subsystem in prototype III. For this prototype, the final code modification was done to display the automated message needed for the emergency beacon. The code for the voice subsystem was taken and later modified from <u>this website</u>. No other modifications were needed for this prototype, all the wiring was working properly.

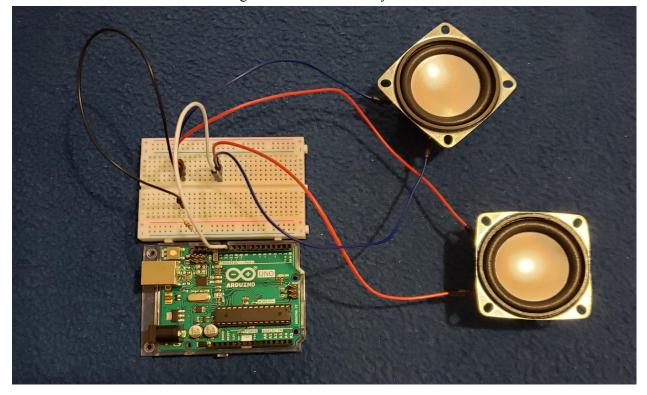


Figure 7 - The Voice Subsystem

Test 1

Test ID	Member(s) Responsible	Test Objective	Description of Prototype Used and of Basic Test Method	Descriptions of Results and How These Results Will Be Used	Estimated Test Duration and Planned Start Date	Stopping criteria
1	Karen	To test the functioning of the code to relay an automated message	The prototype contained the Arduino, two speakers, one resistor and connecting wires. A code was executed through the Arduino.	The speakers turned on using a code and were able to play the automated message.	March 15 th , 2021 Test Duration: approximately 2 minutes.	The prototype was deemed satisfactory when the speakers played the automated message.

Table 4 - Test Plan 1 for the Voice Subsystem for Prototype 2.5

This test focused on having a functional automated message using the "talkie" library. The words chosen for the final automated message play: 'Danger, operator is on alert '.

Light Subsystem

This subsystem was not tested separately for this prototype. It was only tested in the fully integrated prototype.

Interconnections

This section contains testing done on the complete prototype. While all the components were connected to the Arduino, only the speakers were tested in the first prototype.e.

Test ID	Member(s) Responsible	Test Objective	Description of Prototype Used and of Basic Test Method	Descriptions of Results and How These Results Will Be Used	Estimated Test Duration and Planned Start Date	Stopping criteria
1	Elsa and Karen	To test the different types of	The prototype contained the Arduino and all	The automated message could be heard from	March 17 th , 2021	The prototype was

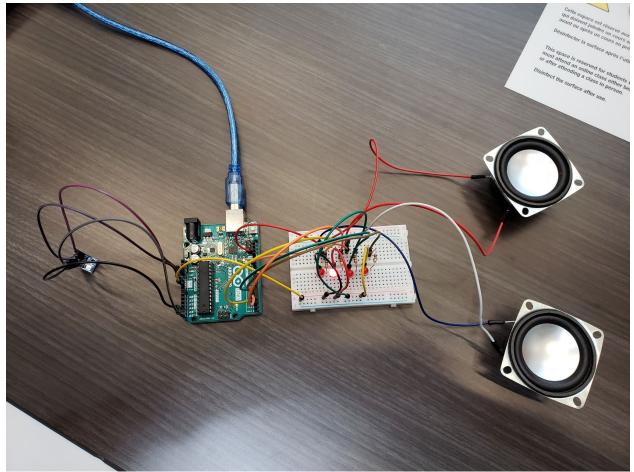
Table 5 - Test Plan 1 for the Voice Subsystem for Prototype 2.5

	automated messages for the voice subsystem.	other subsystems except the location subsystem. A code was used to test the different outputs of the speaker.	the speakers. In the future, it will be decided which type of automated message best satisfies design criteria.	Test Duration: approximately 2 minutes.	deemed satisfactory when the speakers executed the automated message.
--	--	--	--	---	--

This test focused on alternate ways to execute an automated message. In this code, the words executed are included in an Arudino library, contrary to the previous code which was a pre-recorded message. In the future, the code that best satisfies the design criteria will be chosen in the final product.

Results





Prototype III

The main objective of the third prototype was to complete the prototype using various steps of integration.

Analytical Model

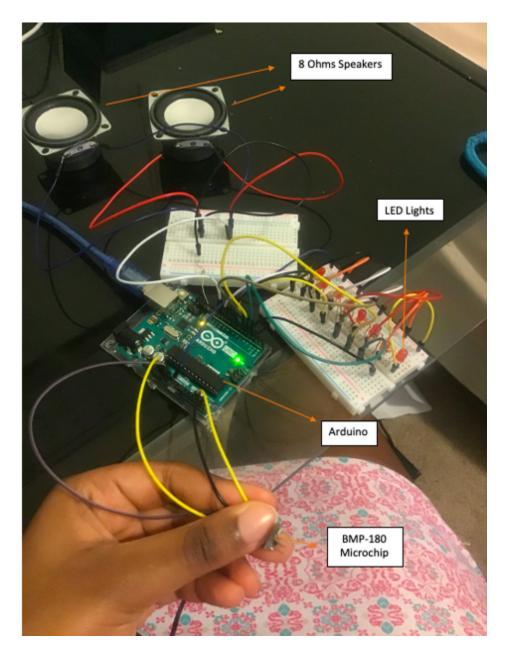


Figure 9 - Detailed Diagram of Complete Prototype

In the figure above, the speakers are connected to the breadboard and are capable of relaying an automated message that is set in the code. The 8 LED lights are connected to the breadboard and flash one

after another to warn pedestrians to keep away and also the lights increase drone visibility to help the JAMZ team find the drone if it has been downed. The BMP180 microchip is able to measure the atmospheric pressure and when connected to the Arduino, these values can be used to determine the drone's altitude. The Arduino controls all the subsystems, all data and commands are interpreted within the Arduino.

Location Subsystem

This section contains isolated testing done for the location subsystem. The tests were to determine if the Beitian BN-880 could satisfy design criteria using two different codes.

Test 1

	1401		Tor the Location S	5405y5tem 101 1 10	totype III	
Test ID	Member(s) Responsible	Test Objective	Description of Prototype Used and of Basic Test Method	Descriptions of Results and How These Results Will Be Used	Estimated Test Duration and Planned Start Date	Stopping criteria
1	Elsa	To test if the Beitian BN-880 can satisfy design criteria.	The prototype contained the Arduino, the Beitian BN-880 and connecting wires. A code was used to test if the Beitian BN-880 printed the coordinate data to the serial monitor.	The results were coordinate data that was printed to the serial monitor. The data was live as it changed according to the movement. In the future, either this code or the one used in the next cde will be used in the final prototype.	March 25 th , 2021 Test Duration: approximately 4 minutes.	The prototype was deemed satisfactory when it printed live coordinates to the serial monitor.

Table 6 - Test Plan 1 for the Location Subsystem for Prototype III

This test focused on printing the live coordinates to the serial monitor. The code also included extra features that may be used in the final prototype. In the future, this code may be included in the final prototype. The code was found in the TinyGPS++ library which can be downloaded from <u>here</u>.

Results

Figure 10 - Code Results of the Location Subsystem

© COM4 14:06:33.360 -> 3 4.0 45.444679 -75.474670 479 03/25/2021 18:06:30 596 119.30 10.22 3.89 N 5346 54.03 NE 60967 120 0 14:06:34.387 -> 3 4.0 45.444684 -75.474655 491 03/25/2021 18:06:31 607 121.10 10.22 3.89 N 5346 54.03 NE 61504 122 0 14:06:35.378 -> 3 4.0 45.444694 -75.47467 487 03/25/2021 18:06:32 609 120.90 39.70 5.22 NE 5346 54.03 NE 61982 124 0 14:06:36.413 -> 3 4.0 45.444791 -75.474617 494 03/25/2021 18:06:33 616 110.30 50.07 6.43 NE 5346 54.03 NE 61982 124 0 14:06:37.427 -> 3 4.0 45.444721 -75.474617 494 03/25/2021 18:06:34 624 120.20 53.60 6.83 NE 5346 54.03 NE 63007 128 0		
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14:00:12,00 → An extensive example of many interesting TingeR9++ features 14:00:12,00 → by Mkual Mart 14:00:12,00 → by Mkual Mart	1	
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14:09:27.588 -> 0	100.0 45.444						346 54.03		13291 186	0		
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The figure above shows the results of this test on the location subsystem.

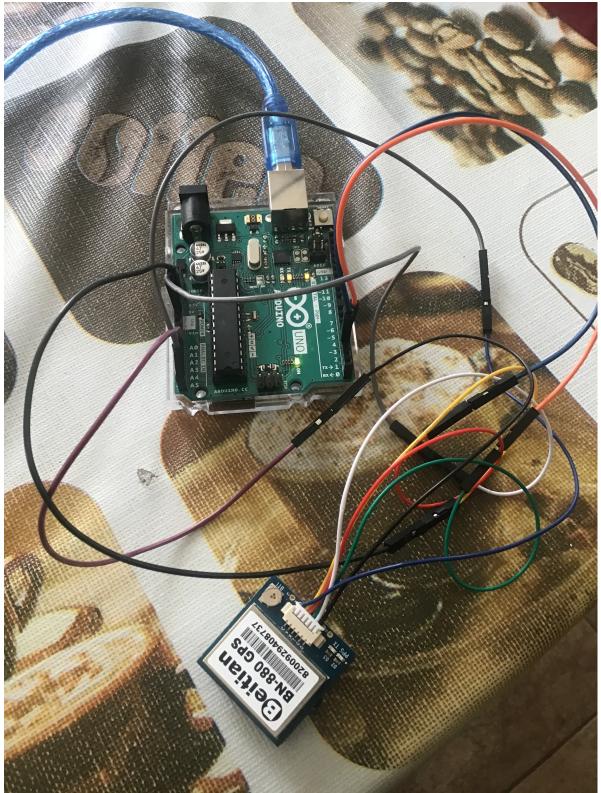


Figure 11 - The Location Subsystem

The figure above shows the setup of the location subsystem.

Test 2

Test ID	Member(s) Responsible	Test Objective	Description of Prototype Used and of Basic Test Method	Descriptions of Results and How These Results Will Be Used	Estimated Test Duration and Planned Start Date	Stopping criteria
2	Elsa	To test if the Beitian BN-880 can satisfy design criteria.	The prototype contained the Arduino, the Beitian BN-880 and connecting wires. A code was used to test if the Beitian BN-880 printed the coordinate data to the serial monitor.	The results were coordinate data that was printed to the serial monitor. The data was live as it changed according to the movement. In the future, either this code or the one used in the next cde will be used in the final prototype	March 25 th , 2021 Test Duration: approximately 3 minutes.	The prototype was deemed satisfactory when it printed live coordinates to the serial monitor.

Table 7 - Test Plan 2 for the Location Subsystem for Prototype III

The second test tested the same as the previous test for this subsystem. This code had less features than the previous test but still satisfies design criteria. In the future, this code may be used in the final prototype. The code was found in the TinyGPS++ library. This library can be downloaded from <u>here</u>.

Results

Figure 12 - Code Results of the Location Subsystem

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11.20.20.010 / Docucion. 10.111/11, /0.1/100/		
14:20:25.087 -> Location: 45.444744,-75.474067 14:20:25.087 -> Location: 45.444744,-75.474067		
L4:20:25.643 -> Location: 45.444744, 75.474067		
4:20:25.734 -> Location: 45.444744,-75.474067		
4:20:25.794 -> Location: 45.444744,-75.474067		
L4:20:25.865 -> Location: 45.444744,-75.474067		
L4:20:26.043 -> Location: 45.444744,-75.474067		
4:20:26.091 -> Location: 45.444744,-75.474067		
14:20:26.091 -> Location: 45.444744,-75.474067	Date/Time: 3/25/2021 18:20:23.00	
14:20:26.740 -> Location: 45.444744,-75.474067	Date/Time: 3/25/2021 18:20:24.00	
L4:20:26.821 -> Location: 45.444744,-75.474067	Date/Time: 3/25/2021 18:20:24.00	
4:20:26.874 -> Location: 45.444744,-75.474067		
4:20:27.031 -> Location: 45.444744,-75.474067		
L4:20:27.094 -> Location: 45.444744,-75.474067		
4:20:27.094 -> Location: 45.444744,-75.474067		
4:20:27.651 -> Location: 45.444744,-75.474067		
4:20:27.770 -> Location: 45.444744,-75.474067		
4:20:27.810 -> Location: 45.444744,-75.474067 4:20:27.857 -> Location: 45.444744,-75.474067		
4:20:27.857 -> Location: 45.444744,-75.474067		
L4:20:28.092 -> Location: 45.444744,-75.474067		
L4:20:28.092 -> Location: 45.444744,-75.474067		
L4:20:28.732 -> Location: 45.444744,-75.474067		
L4:20:28.827 -> Location: 45.444744,-75.474067		
4:20:28.874 -> Location: 45.444744,-75.474067		
14:20:29.011 -> Location: 45.444744,-75.474067		
L4:20:29.097 -> Location: 45.444744,-75.474067		
14:20:29.097 -> Location: 45.444744,-75.474067		
14:20:29.673 -> Location: 45.444744,-75.474067		
14:20:29.767 -> Location: 45.444744,-75.474067	Date/Time: 3/25/2021 18:20:27.00	
14:20:29.814 -> Location: 45.444744,-75.474067	Date/Time: 3/25/2021 18:20:27.00	
14:20:29.860 -> Location: 45.444744,-75.474067		
L4:20:30.053 -> Location: 45.444744,-75.474067		
14:20:30.100 -> Location: 45.444744,-75.474067		
14:20:30.100 -> Location: 45.444744,-75.474067	Date/Time: 3/25/2021 18:20:27.00	
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<pre>4(19:17.167 → Location: 45.444732,-75.473678 (4:19:17.03) → Location: 45.444732,-75.473678 (4:19:17.03) → Location: 45.444732,-75.473678 (4:19:17.05) → Location: 45.444732,-75.473678 (4:19:17.95) → Location: 45.444732,-75.473701 (4:19:17.96) → Location: 45.444732,-75.473701 (4:19:18.139) → Location: 45.444732,-75.473701 (4:19:18.189 → Location: 45.444732,-75.473701 (4:19:18.180) → Location: 45.444732,-75.473701 (4:19:18.180) → Location: 45.444732,-75.473701 (4:19:18.180) → Location: 45.444732,-75.473710 (4:19:18.180) → Location: 45.444725,-75.473731 (4:19:18.180) → Location: 45.444725,-75.473731 (4:19:18.19.49) → Location: 45.444725,-75.473731 (4:19:19.180) → Location: 45.444725,-75.473731 (4:19:19.19.40) → Location: 45.444725,-75.473731 (4:19:19.19.40) → Location: 45.444725,-75.473731 (4:19:19.10.40) → Location: 45.444725,-75.473731 (4:19:19.10.40) → Location: 45.444725,-75.473731 (4:19:19.10.40) → Location: 45.444725,-75.473731 (4:19:19.63) → Location: 45.444728,-75.473730 (4:19:20.105) → Location: 45.444728,-75.473709 (4:19:20.105) → Location: 45.444728,-75.473709</pre>	Date/Time: 3/25/2021 18:19:14.00 Date/Time: 3/25/2021 18:19:14.00 Date/Time: 3/25/2021 18:19:14.00 Date/Time: 3/25/2021 18:19:15.00 Date/Time: 3/25/2021 18:19:16.00 Date/Time: 3/25/2021 18:19:17.00 Date/Time: 3/25/2021 18:19:17.00	
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$\begin{array}{l} 4(19:17.167 \rightarrow \text{Location: } 45.444732,-75.473678\\ 4(19:17.76) \rightarrow \text{Location: } 45.444732,-75.473701\\ 4(19:17.95) \rightarrow \text{Location: } 45.444732,-75.473701\\ 4(19:17.96) \rightarrow \text{Location: } 45.444732,-75.473701\\ 4(19:17.96) \rightarrow \text{Location: } 45.444732,-75.473701\\ 4(19:18.18) \rightarrow \text{Location: } 45.444732,-75.473701\\ 4(19:18.18) \rightarrow \text{Location: } 45.444732,-75.473701\\ 4(19:18.180 \rightarrow \text{Location: } 45.444732,-75.473701\\ 4(19:18.180 \rightarrow \text{Location: } 45.444732,-75.473701\\ 4(19:18.180 \rightarrow \text{Location: } 45.444725,-75.473731\\ 4(19:18.194 \rightarrow \text{Location: } 45.444725,-75.473731\\ 4(19:19.1937 \rightarrow \text{Location: } 45.444725,-75.473731\\ 4(19:19.1937 \rightarrow \text{Location: } 45.444725,-75.473731\\ 4(19:19.194 \rightarrow \text{Location: } 45.444725,-75.473731\\ 4(19:19.194 \rightarrow \text{Location: } 45.444725,-75.473730\\ 4(19:19.63) \rightarrow \text{Location: } 45.444725,-75.473709\\ 4(19:20.165 \rightarrow \text{Location: } 45.444728,-75.473709\\ 4(19:20.056 \rightarrow \text{Location: } 45.444728$	Date/Time: 3/25/2021 18:19:14.00 Date/Time: 3/25/2021 18:19:14.00 Date/Time: 3/25/2021 18:19:14.00 Date/Time: 3/25/2021 18:19:15.00 Date/Time: 3/25/2021 18:19:16.00 Date/Time: 3/25/2021 18:19:17.00 Date/Time: 3/25/2021 18:19:18.00 Date/Time: 3/25/2021 18:19:18.00 Date/Time: 3/25/2021 18:19:18.00 Date/Time: 3/25/2021 18:19:18.00	
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<pre>14:19:17.120 → Location: 45.444723, -75.473678 14:19:17.107 → Location: 45.444723, -75.473678 14:19:17.63 → Location: 45.444732, -75.473678 14:19:17.63 → Location: 45.444732, -75.473701 14:19:17.951 → Location: 45.444732, -75.473701 14:19:17.951 → Location: 45.444732, -75.473701 14:19:18.186 → Location: 45.444725, -75.473701 14:19:18.186 → Location: 45.444725, -75.473731 14:19:18.186 → Location: 45.444725, -75.473731 14:19:18.186 → Location: 45.444725, -75.473731 14:19:19.19.4 → Location: 45.444725, -75.473731 14:19:19.184 → Location: 45.444725, -75.473730 14:19:20.011 → Location: 45.444728, -75.473709 14:19:20.011 → Location: 45.444728, -75.473709 14:19:20.052 → Location: 45.444728, -75.473709 14:19:20.059 → Location: 45.444728, -75.473709 14:19:21.054 → Locat</pre>	Date/rime: 3/25/2021 18:19:14.00 Date/rime: 3/25/2021 18:19:14.00 Date/rime: 3/25/2021 18:19:14.00 Date/rime: 3/25/2021 18:19:15.00 Date/rime: 3/25/2021 18:19:16.00 Date/rime: 3/25/2021 18:19:17.00 Date/rime: 3/25/2021 18:19:18.00 Date/rime: 3/25/2021 18:19:18.00 Date/rime: 3/25/2021 18:19:18.00	Newline V 115200 baud V Clear outbu

The figure above shows the code results of the second test of the location subsystem.

The setup was the same as the previous test.

Interconnections

This section contains testing done on the interconnected subsystems. The first two tests tested only two subsystems while the final test was done on the voice, light and altitude subsystems.

Light and Altitude Subsystem

Test ID	Member(s) Responsible	Test Objective	Description of Prototype Used and of Basic Test Method	Descriptions of Results and How These Results Will Be Used	Estimated Test Duration and Planned Start Date	Stopping criteria
2	Elsa	The test was to ensure that these two subsystems could work together and not if they satisfied their design criteria.	The prototype contained the LED lights, the 8 resistors, the BMP180 and the connecting wires. An integrated code was used using the codes from previous prototypes.	The results were both subsystems working properly. In the future, these results will be used to form the complete prototype.	March 25 th , 2021 Test Duration: approximately 5 minutes.	The code was deemed satisfactory when the subsystems functioned properly.

Table 8 - Test Plan 1 for the Light and Altitude Subsystem for Prototype III

In this test, an integrated code created from the two isolated codes for these subsystems were used to test if these subsystems could work together in one Arduino. When the lights turned on and the BMP180 printed to the serial monitor, the test was stopped. These results will be used to connect to the other subsystems at the end.

Results

Figuru 13 - Code Results of the Light and Altitude Subsystem

о сомз	
EBOOT	
BMP180 init success	
paseline pressure: 1004.93 mb	
relative altitude: 0.5 meters, 2 feet	
relative altitude: 0.1 meters, 0 feet	
relative altitude: 0.4 meters, 1 feet	
relative altitude: 0.4 meters, 1 feet	
relative altitude: 0.8 meters, 2 feet	
relative altitude: 0.9 meters, 3 feet	
relative altitude: 0.6 meters, 2 feet	
relative altitude: 0.5 meters, 2 feet	
relative altitude: 0.1 meters, 0 feet	
relative altitude: 0.8 meters, 3 feet	
relative altitude: 0.7 meters, 2 feet	
relative altitude: 0.1 meters, 0 feet	
relative altitude: 0.3 meters, 1 feet	
relative altitude: 0.8 meters, 3 feet	
relative altitude: -0.1 meters, -0 feet	
relative altitude: 0.1 meters, 0 feet	
relative altitude: -0.1 meters, -0 feet	
relative altitude: 1.1 meters, 4 feet	
relative altitude: 1.1 meters, 3 feet	
relative altitude: 0.5 meters, 2 feet	
relative altitude: 0.3 meters, 1 feet	
relative altitude: 0.9 meters, 3 feet	
relative altitude: 0.3 meters, 1 feet	
relative altitude: 0.5 meters, 2 feet	
elative altitude: 0.3 meters, 1 feet	
Autoscroll Show timestamp	N

The figure above shows the code results of the light and altitude subsystem.

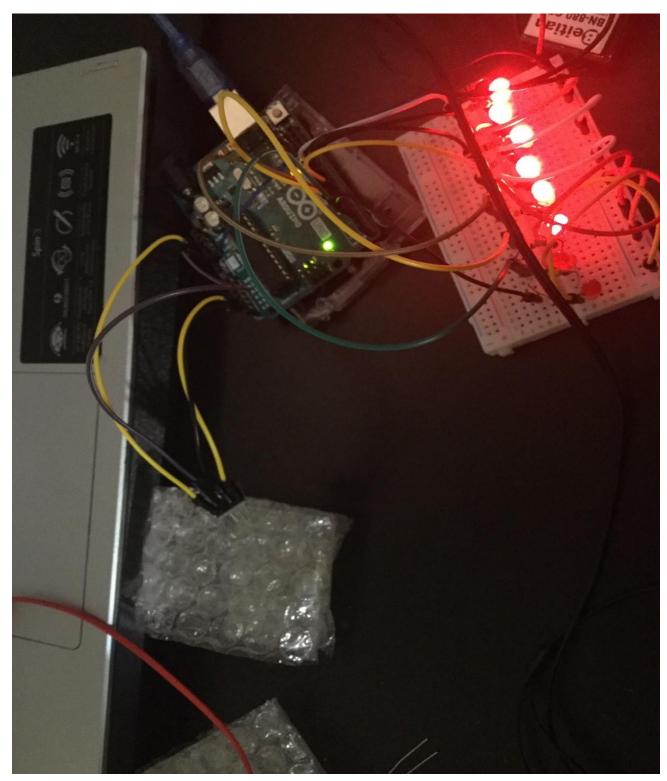


Figure 14 - The Light and Altitude Subsystem *

The figure above shows the setup of the light and altitude subsystem.

Voice and Location Subsystem

Tuble y Test Than T for the voice and Elocation Subsystems for Trototype in	Table 9 - Test Plan	1 for the Voice and	Location Subsystems	for Prototype III
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Test ID	Member(s) Responsible	Test Objective	Description of Prototype Used and of Basic Test Method	Descriptions of Results and How These Results Will Be Used	Estimated Test Duration and Planned Start Date	Stopping criteria
2	Elsa	This test was to determine if the location and voice subsystems could work together.	The prototype included an Arduino, the two speakers, the Beitian BN-880 and the connecting wires. An integrated code was used to test if the subsystems worked properly.	The subsystems functioned properly. These results will be used in the final prototype to setup and integrate into one code.	March 25 th , 2021 Test Duration: approximately 5 minutes.	The results were deemed satisfactory when the subsystems function properly.

In this test, an integrated code created from the two isolated codes for these subsystems were used to test if these subsystems could work together in one Arduino. When the speakers relayed the message and the Beitian BN-880 printed to the serial monitor, the test was stopped. These results will be used to connect to the other subsystems at the end.

Results

Figure 15 - Code Results of the Voice and Location Subsystem

© COM4		-	D	×
				Ser
viceExample.ino				
simple dean attached GPS module				
sting TinyGPS++ library v. 1.0.2				
Mikal Hart				
viceExample.ino				
simple demonstration of TinyGPS++ with an attached GPS module				
esting TinyGPS++ library v. 1.0.2				
/ Mikal Hart				
ocation: INVALID Date/Time: 3/27/2021 23:55:55.00				
ocation: INVALID Date/Time: 3/27/2021 23:55:55.00				
ocation: INVALID Date/Time: 3/27/2021 23:55:55.00				
ocation: INVALID Date/Time: 3/27/2021 23:55:55.00				
Autoscroll Show timestamp	Newline	e v 115200 baud	Clear	out

The figure above shows the code results of this test. As the test was to determine if the Beitian BN-880 could work with the voice subsystem, it was tested indoors (it is for this reason that it printed "invalid").

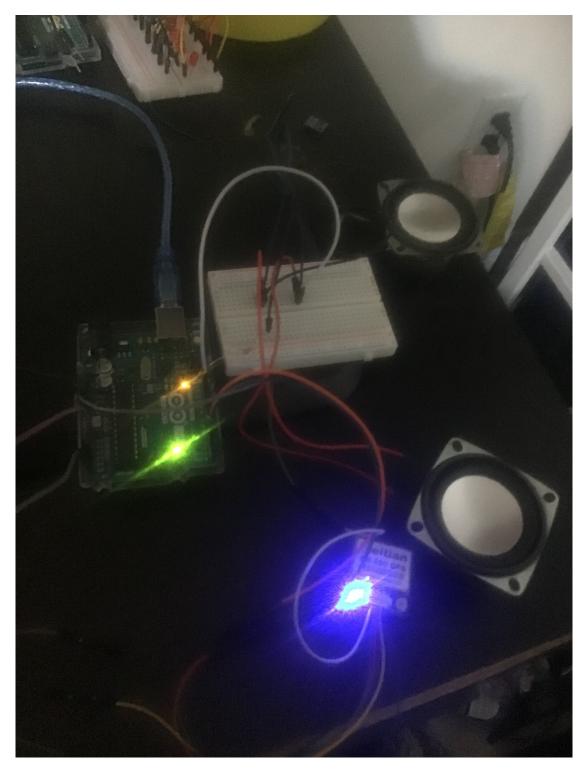


Figure 16 - The Voice and Location Subsystem

The figure above shows the setup of these two subsystems.

Final Prototype

Test ID	Member(s) Responsible	Test Objective	Description of Prototype Used and of Basic Test Method	Descriptions of Results and How These Results Will Be Used	Estimated Test Duration and Planned Start Date	Stopping criteria
1	Elsa	This test was to determine if the voice and light subsystem could be dependent on the altitude subsystem.	A code using a threshold value was used to test if the voice and light subsystems would turn on after the altitude subsystem went below the threshold value.	The results were the voice and light subsystem turning on only after the altitude subsystem went below the threshold value. In the future, the location subsystem will be integrated in the prototype.	March 27 th , 2021 Test Duration: approximately 4.5 minutes.	The test was complete after the voice and light subsystem turned on after the altitude subsystem went below the threshold value.

Table 10 - Test Plan for the Complete Prototype (Without the Location Subsystem) for Prototype III

This test tested if the voice and light subsystems could be reliant on the altitude subsystem. The results were the voice subsystem relaying the automated message and the lights turning on after the altitude subsystem fell below the threshold value. In the future, the location subsystem will be integrated in this final prototype.

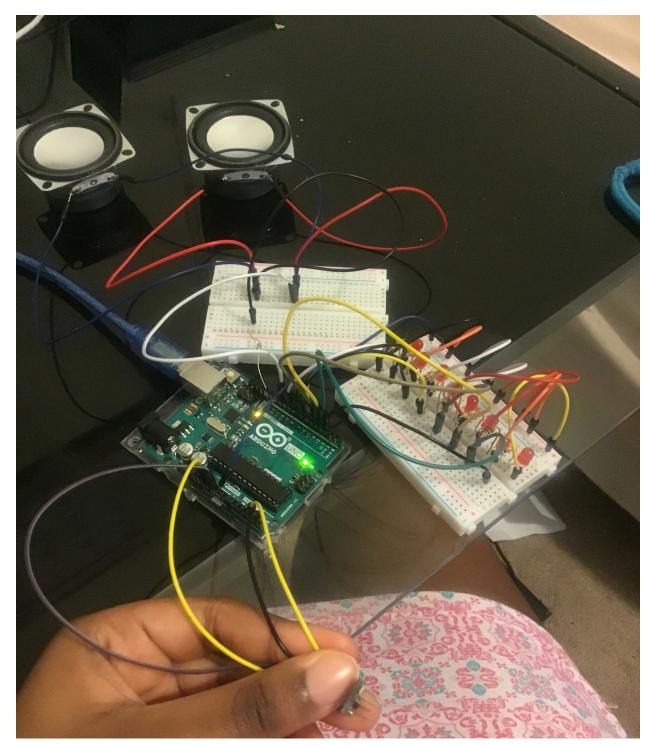
Results

© СОМЗ	 _ D
REBOOT	
BMP180 init success	
baseline pressure: 992.45 mb	
relative altitude: 0.7 meters,	
relative altitude: 0.5 meters,	
relative altitude: 0.6 meters,	
relative altitude: 0.9 meters,	
relative altitude: 0.8 meters,	
relative altitude: 0.3 meters,	
relative altitude: 0.5 meters,	
relative altitude: 0.3 meters,	
relative altitude: 0.5 meters,	
relative altitude: 0.3 meters,	
relative altitude: -0.2 meters,	
The drone has fallen.	

Figure 17 - Code Results of the Complete Prototype

The figure above shows the code results of the complete prototype.

Figure 18 - The Complete Prototype



The figure above shows the setup of the complete prototype.

Encasing

As a part of the overall system, the group has created an acrylic box via laser cutting. The box plays a role as a protective case for the electronics contained inside the box. Our TAs recommended that the box have speaker holes on the top surface as well as a separate piece with congruent holes to be placed on top of the speaker holes. In between, there is plastic that will prevent debris from entering inside the box. The holes will allow sound from the speakers to go through so that pedestrians will be able to hear it. The box has a height of 54.372 mm, a width of 271.920 mm, and a length of 152.585 mm. The acrylic box can accommodate the prototype while still ensuring that the weight and cost are minimized.

Prototype I

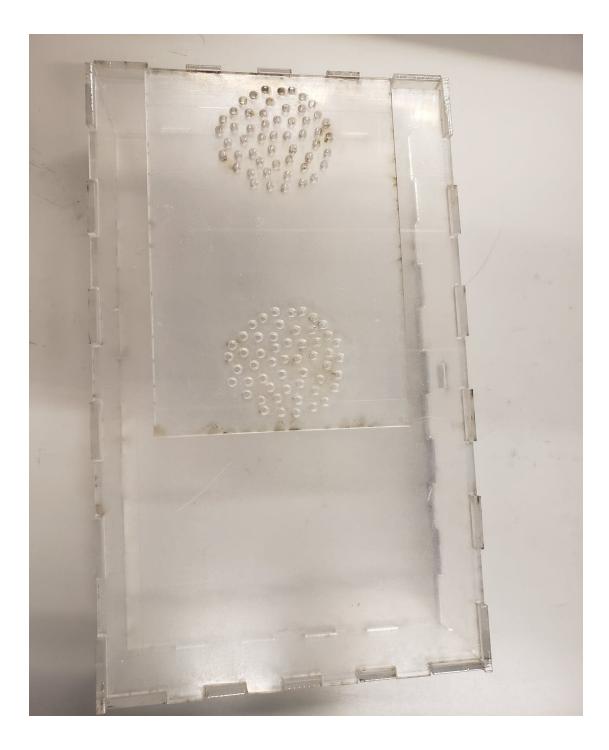
Figure 19 - The Initial Prototype Encasing



The figure above demonstrated the initial encasing for the prototype. In this step, we did not laser cut all the parts for the case because it was unnecessary but was only used to confirm our dimensions. Luckily, we cut this using MDF before using our acrylic because we found out that our final prototype did not fit using these dimensions. Consequently, we made the necessary adjustments.

Prototype II

Figure 20 - The Final Prototype Encasing



The figure above shows the final case design that will be used to protect our final prototype. We used a laser cutter to get a detailed cut and to ensure that no water gets inside and damages our prototype. It was made a little bigger than needed to guarantee that all the components of our prototype can fit easily. The only openings made on the encasing is to ensure the voice from the speakers come out. To prevent debris from entering our case, we have laser cut an extra acrylic part with congruent holes as the top face of the box to protect our prototype.

Future Work

Before Design Day, the location subsystem will be added to the integrated prototype and tested again. Additionally, we need to test the prototype again after soldering to ensure that nothing was damaged in the process. Lastly, we need to ensure that our prototype is waterproof as per client's request.

Wrike update

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	1	Computer Laboratory	11/01/2021	30/04/2021		🖹 Computer Laboratory • Karen H.
	2	Meeting Minutes	11/01/2021	30/04/2021		Months v =
	3	To-do lists	11/01/2021	30/04/2021		
	4	Updating Tasks on W	11/01/2021	30/04/2021		
	5	Deliverable J	24/01/2021	26/03/2021		Deliverable J + Sandeep S. +4
	6	V Deliverable H	24/01/2021	28/03/2021		Deliverable H + Sandeep S. +4
	7	 Adjustement of c 	14/03/2021	16/03/2021		Adjustement of components based on feedback • Karen H. +4
	8	Altitude subs	14/03/2021	15/03/2021		Altitude subsystem • Elsa L.
	9	Light subsyst	14/03/2021	15/03/2021		Light subsystem + Jacob T.
	10	Location sub	14/03/2021	15/03/2021		Location subsystem • Sandeep S.
	11	Voice subsyst	14/03/2021	15/03/2021		Voice subsystem • Karen H.
	12	Overall proto	14/03/2021	16/03/2021		Overall prototype • tthai074@uottawa.ca
	13	Inkscape design	14/03/2021	16/03/2021		Inkscape design + Jacob T
	14	Testing of the ph	14/03/2021	17/03/2021		Testing of the physical prototype • Karen H. +1
	15	Presentation	14/03/2021	18/03/2021		Presentation • thai074@uottawa.ca
	16	Analytical model	14/03/2021	28/03/2021		Analytical model • Sandeep S.
	17	Formatting	14/03/2021	28/03/2021		Formatting - tthai074@uottawa.ca
	18	Improvements of	14/03/2021	28/03/2021		Improvements of the previous prototype • Jacob T.
		Summary of prev	14/03/2021	28/03/2021		Summary of previous deliverable + Sandeep S.
	20	Wrike update	14/03/2021	28/03/2021		Wrike update • Karen H.
^	21	Deliverable I	24/01/2021	08/04/2021		Deliverable I • Elsa L. +4
	22	Deliverable K	24/01/2021	11/04/2021		Deliverable K • Elsa L
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Appendices of Prototype 2.5

Appendix I

Code for the Location Subsystem

Test 1

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File Edit Sketch Tools Help	6	^
		Q.
BasicExample		•
<pre>Serial.println(F("by Mikal Hart")); Serial.println();</pre>		
<pre>while (*gpsStream) if (gps.encode(*gpsStream++)) displayInfo();</pre>		
<pre>Serial.println(); Serial.println(F("Done.")); }</pre>		
<pre>void loop() { }</pre>		
<pre>void displayInfo() { Serial.print(F("Location: ")); if (gps.location.isValid()) { Serial.print(gps.location.lat(), 6); Serial.print(r(",")); Serial.print(gps.location.lng(), 6); } else { Serial.print(F("INVALID")); } }</pre>		
◯◯ Updates available for some of your <u>libraries</u> ★	Arduino Uno o	n COM3
BasicExample Arduino 1.8.13	 - 0	×
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<pre>include <tiny9e9++.h></tiny9e9++.h></pre>	<pre>BasicExample 5 include <tinygps++.h> This sample sketch should be the first you try out when you are testing a TinyGPS++ (finyGPSPIus) installation. In normal use, you feed TinyGPS++ objects characters from a serial NMEA GPS device, but this example uses static strings for simplicity. // A sample NMEA stream. onst char *gpsStream = "SGREMO, 045103.000, A, 3014.1995, N, 09749.2872, W, 0.67, 161.46, 030913, ,, A*7C\r\n" "SGREMO, 045103.000, A, 3014.1995, N, 09749.2872, W, 0.67, 161.46, 030913, ,, A*7T\r\n" "SGREMO, 045200.000, A, 3014.1995, N, 09749.2873, W, 1.09, 1.2, 211.6, M, -22.5, M, ,0000*62\r\n" "SGREMO, 045201.000, 3014.3820, N, 09748.9514, W, 36.88, 65.02, 030913, ,, A*7T\r\n" "SGREMO, 045251.000, A, 3014.3252, N, 09749.0628, W, 1.09, 1.3, 200.5, M, -22.5, M, ,0000*6C\r\n" "SGREMO, 045251.000, A, 3014.4273, N, 09749.0628, W, 1.09, 1.3, 200.5, M, -22.5, M, ,0000*6F\r\n"; // The TinyGPS++ object ingdEPSPlus gps; oid setup() Serial.begin(115200); Serial.println(F("BasicExample.ino")); </tinygps++.h></pre>
<pre>helude <tinygps++.h> This sample sketch should be the first you try out when you are testing a TinyGPS++ (TinyGPSFlus) installation. In normal use, you feed TinyGPS++ objects characters from a serial NMEA GPS device, but this example uses static strings for simplicity. A sample NMEA stream. nst char *gpsStream = "SGPRMC,045103.000,A,3014.1984,N,09749.2872,W,0.67,161.46,030913,,,A*7C\r\n" "SGPGR0,045104.000,3014.1985,N,09749.2873,W,1.09,1.2,211.6,W,-22.5,W,,0000*62\r\n" "SGPGR0,045104.000,3014.43854,N,09749.2873,W,1.09,1.2,211.6,W,-22.5,W,,0000*62\r\n" "SGPGR0,045104.000,3014.43854,N,09749.2873,W,1.09,1.2,211.6,W,-22.5,W,,0000*62\r\n" "SGPGR0,04521.000,3014.43854,N,09749.0626,W,0.51,217.94,030913,,,A*7D\r\n" "SGPGR0,045251.000,3014.4275,N,09749.0628,W,1.09,1.3,206.9,W,-22.5,W,,0000*6F\r\n"; The TinyGPS++ object aygOPSPlue gps; id setup() Secial.println(f("BasicExample.ino")); Secial.println(f(Theorem) for the first y. ")); Secial.println(f(Theorem) for first y. The first y. ")); Secial.println(f(Theorem) for first y. Theorem) for first y. Theorem for first y. Theore</tinygps++.h></pre>	<pre>helude <tinygps++.h> This sample sketch should be the first you try out when you are testing a TinyGPS++ (TinyGPSFlus) installation. In normal use, you feed TinyGPS++ objects characters from a serial NMEA GPS device, but this example uses static strings for simplicity. A sample NMEA stream. st char *gpsStream = *GSPEMC,045103.000, A, 3014.1984, N, 09749.2872, W, 0.67, 161.46, 030913, ., A*7C\r\n" *GSPGBA,045103.000, A, 3014.1985, N, 09749.2873, W, 1.09.1.2, 211.6, M, -22.5, M, 0000*6C\r\n" *GSPGBA,04510.000, 3014.4275, N, 09749.5814, W, 30.688, 65.02, 030913, ., A*7T\r\n" *GSPGBA,045251.000, A, 3014.4275, N, 09749.0626, W, 0.51, 217.94, 030913, ., A*7D\r\n" *GSPGBA,045252.000, 3014.4273, N, 09749.0628, W, 1, 09, 1.3, 206.9, M, -22.5, M, 0000*6F\r\n"; The TinyGPS++ object xyGPSPHus gps; id setup() Secial.begin(115200); Secial.println(F("BasicExample.ino")); </tinygps++.h></pre>
<pre>This sample NEA Stream. (TinyGPSFlus) installation. In normal use, you feed TinyGPS++ objects characters from a serial NMEA GPS device, but this example uses static strings for simplicity. A sample NMEA GPS device, but this example uses static strings for simplicity. SepEMC, 045103.000, A, 3014.1984, N, 09749.2873, W, 0.67, 161.46, 030913, ., A*7C\r\n" SepEMC, 04503.000, A, 3014.1985, N, 09749.2873, W, 1.09, 1.2, 211.6, M, -22.5, M, 0000*62\r\n" SepEMC, 045201.000, A1.9864, N, 09749.5873, W, 1.09, 1.2, 211.6, M, -22.5, M, 0000*62\r\n" SepEMC, 045201.000, A1.9864, N, 09749.5814, W, 36.68, 65.02, 030913, ., A*7T\r\n" 'SGPEMC, 045251.000, A3.914.4275, N, 09749.0626, W, 0.51, 217.94, 030913, ., A*TT\r\n" 'SGPEMC, 045251.000, 3014.4275, N, 09749.0626, W, 0.51, 217.94, 030913, ., A*TT\r\n" 'SGPEMC, 045251.000, 3014.4273, N, 09749.0626, W, 1.09, 1.3, 2006.9, W, -22.5, M, 0000*67\r\n" 'SGPEMC, 045252.000, 3014.4273, N, 09749.0626, W, 1.09, 1.3, 2006.9, W, -22.5, M, 0000*67\r\n" 'SGPEMC, 045251.000, p3 (1.4273, N, 09749.0626, W, 1.09, 1.3, 2006.9, W, -22.5, M, 0000*67\r\n" 'SGPEMC, 045251.000, p3 (1.4273, N, 09749.0626, W, 1.09, 1.3, 2006.9, W, -22.5, M, 0000*67\r\n" 'SGPEMC, 045252.000, 3014.4273, N, 09749.0626, W, 1.09, 1.3, 2006.9, W, -22.5, M, 0000*67\r\n"; The TinyGPS++ object vgGPSFlug gps; idd setup() setial.println(F("Basic Gemonstration of TinyGPS++ (no device needed)")); setial.println(F("Basic Gemonstration of TinyGPS++ (no device needed)")); setial.println(F("Basic Gemonstration of TinyGPS++ (no device needed)")); setial.println(F("Testing TinyGPS++ Ibbrary v. ")); Setial.println(TinyGPSFlug::11braryVersion());</pre>	<pre>This sample NEA first you try out when you are testing a TinyGPS++ (TinyGPSFlus) installation. In normal use, you feed TinyGPS++ objects characters from a serial NMEA GPS device, but this example uses static strings for simplicity. A sample NMEA stream. ist char *gpsStream = 'GGPEMC,045103.000,A,3014.1984,N,09749.2873,W,1.09,1.2,211.6,M,-22.5,M,,0000*62\r\n" 'GGPGA,045021.000,A,314.4275,N,09749.0263,W,0.51,217.94,030913,,,A*77\r\n" 'GGPGA,045251.000,A,3014.4275,N,09749.0628,W,1.09,1.3,206.9,M,-22.5,M,,0000*6F\r\n"; The TinyGPS++ object 'gGPEMC,045251.000,A,3014.4273,N,09749.0628,W,1.09,1.3,206.9,M,-22.5,M,,0000*6F\r\n"; The TinyGPS++ object 'gGPSHLa gps; id setup() ierial.begin(115200); Berial.println(F("BasicExample.ino")); </pre>
<pre>yqPSPlus gps; d setup() terial.begin(115200); terial.println(F("BasicExample.ino")); terial.println(F("Basic demonstration of TinyGFS++ (no device needed)")); terial.println(F("Testing TinyGFS++ library v. ")); Serial.println(TinyGFSPlus::libraryVersion());</pre>	<pre>wyGPSPlus gps; d setup() erial.begin(115200); erial.println(F("BasicExample.ino"));</pre>
<pre>erial.println(F("BasicExample.ino")); erial.println(F("Basic demonstration of TinyGPS++ (no device needed)")); erial.print(F("Testing TinyGPS++ library v. ")); Serial.println(TinyGPSPlus::libraryVersion());</pre>	erial.println(F("BasicExample.ino"));
<pre>Serial.print(F("Testing TinyGPS++ library v. ")); Serial.println(TinyGPSPlus::libraryVersion());</pre>	
	<pre>Serial.print(F("Testing TinyGPS++ library v. ")); Serial.println(TinyGPSPlus::libraryVersion());</pre>

The code was retrieved from this folder.

Test 2

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SateliteTracker			
<pre>#include <tinygps++.h> #include <softwareserial.h> /* This sample code demonstrates how to use an array of TinyGPSCustom objects to monitor all the visible satellites.</softwareserial.h></tinygps++.h></pre>			^
Satellite numbers, elevation, azimuth, and signal-to-noise ratio are not normally tracked by TinyGPS++, but by using TinyGPSCustom we get around this.			
The simple code also demonstrates how to use arrays of TinyGP8Custom objects, each monitoring a different field of the \$GPGSV sentence.			
<pre>It requires the use of SoftwareSerial, and assumes that you have a 4800-baud serial GPS device hooked up on pins 4(EX) and 3(TX). */ static const int RXPin = 4, TXPin = 3; static const uint32_t GPSBaud = 4800;</pre>			
// The TinyGPS++ object TinyGPSPlus gps;			
<pre>// The serial connection to the GPS device SoftwareSerial ss(RXPin, TXPin);</pre>			
/* From http://aprs.gids.nl/nmea/:			~
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* From http://aprs.gids.nl/nmea/:	
serven integer/rapisigkus.itz/imisar.	
GPS Satellites in view	
eg. SGFGSV, 3, 1,11, 03, 03, 111, 00, 04, 15, 270, 00, 06, 01, 010, 00, 13, 06, 292, 00*74 SGFGSV, 3, 2, 11, 14, 25, 170, 00, 16, 57, 208, 39, 18, 67, 296, 40, 19, 40, 246, 00*74 SGFGSV, 3, 3, 11, 22, 42, 067, 42, 24, 14, 311, 43, 27, 05, 244, 00,,,, *4D	
<pre>1 = Total number of messages of this type in this cycle 2 = Message number 3 = Total number of SVs in view 4 = SV FRN number 5 = Elevation in degrees, 90 maximum 6 = Azimuth, degrees from true north, 000 to 359 7 = SNR, 00-99 dB (null when not tracking) 6 =111 = Information about second SV, same as field 4-7 12-155 Information about third SV, same as field 4-7 16-19= Information about fourth SV, same as field 4-7 7/</pre>	
static const int MAX_SATELLITES = 40;	
<pre>HinyGPSCustom totalGPGSVMessages(gps, "GPGSV", 1); // \$GPGSV sentence, first element</pre>	
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SatelliteTracker Arduino 1.8.13	Arduino Uno an COM3 — 🗂 🗙
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<pre>le Edit Sketch Tools Help le Edit Sketch Tools Help static const int MAX_SATELLITES = 40; NinyGPSCustom totalGPGSVMessages(gps, "GPGSV", 1); // SGPGSV sentence, first element NinyGPSCustom messageNumber(gps, "GPGSV", 2); // SGPGSV sentence, second element NinyGPSCustom satNumer(gps, "GPGSV", 3); // SGPGSV sentence, third element NinyGPSCustom satNumer(gl); // to be initialized later NinyGPSCustom satNumer(gl); // to be initialized later NinyGPSCustom satNumer(gl); NinyGPSCustom snr[4]; truct int elevation; int elevation; int asimuth; int asimith; int asimith; sats(MAX_SATELLITES); roid setup()</pre>	× ت – م
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SatelliteTracker	
<pre>Serial.println(F("SatelliteTracker.ino")); Serial.println(F("Monitoring satellite location and signal strength using TinyGPSCustom")); Serial.print(F("Testing TinyGPS++ library v. ")); Serial.println(TinyGPSPlus::libraryVersion()); Serial.println(F("by Mikal Hart")); Serial.println();</pre>	^
<pre>// Initialize all the uninitialized TinyGPSCustom objects for (int i=0; i<4; ++i) { satNumber[i].begin(gps, "GPGSV", 4 + 4 * i); // offsets 4, 8, 12, 16 elevation[i].begin(gps, "GPGSV", 5 + 4 * i); // offsets 5, 9, 13, 17 azimuth[i].begin(gps, "GPGSV", 6 + 4 * i); // offsets 6, 10, 14, 18 snr[i].begin(gps, "GPGSV", 7 + 4 * i); // offsets 7, 11, 15, 19 } }</pre>	
<pre>void loop() { // Dispatch incoming characters if (ss.available() > 0) { gps.encode(ss.read()); }</pre>	
<pre>if (totalGPGSVMessages.isUpdated()) { for (int i=0; i<4; ++i) { { } {</pre>	v

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{ for (int i=0; i<4; ++i)	^
for (Int 1=0; 1<4; ++1)	
<pre>int no = atoi(satNumber[i].value());</pre>	
<pre>int no = ato(satNumber[1].Value()); // Serial.print(F("SatNumber is ")); Serial.println(no);</pre>	
if (no >= 1 && no <= MAX_SATELLITES)	
1	
<pre>sats[no-1].elevation = atoi(elevation[i].value());</pre>	
<pre>sats[no-1].azimuth = atoi(azimuth[i].value());</pre>	
<pre>sats[no-1].snr = atoi(snr[i].value());</pre>	
<pre>sats[no-1].active = true;</pre>	
}	
}	
<pre>int totalMessages = atoi(totalGPGSVMessages.value());</pre>	
<pre>int currentMessage = atoi(messageNumber.value());</pre>	
if (totalMessages == currentMessage)	
(
<pre>Serial.print(F("Sats=")); Serial.print(gps.satellites.value());</pre>	
<pre>Serial.print(F(" Nums="));</pre>	
<pre>for (int i=0; i<max ++i)<="" pre="" satellites;=""></max></pre>	
if (sats[i].active)	
Serial.print(i+1);	
<pre>Serial.print(F(" "));</pre>	
<pre>Serial.print(F(" Elevation="));</pre>	×
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SatelliteTracker			
<pre>serial.print(F(" Elevation=")); for (int i=0; i<max_satellites; "));="" (sats[i].elevation);="" ++i)="" <="" azimuth=")); for (int i=0; i<MAX_SATELLITES; ++i) if (sats[i].active) { Serial.print(sats[i].azimuth); Serial.print(sats[i].azimuth); Serial.print(r(" if="" pre="" serial.print(f("="" serial.print(r("="" serial.print(sats[i].elevation);="" }=""></max_satellites;></pre>			~
<pre>} Serial.print(F(" SNR=")); for (int i=0; i<max_satellites; (sats[i].active)<="" ++i)="" if="" pre=""></max_satellites;></pre>			
<pre>if (sats[i].active) { Serial.print(sats[i].snr); Serial.print(F(" ")); }</pre>			ł
Serial.println();			
<pre>for (int i=0; i<max_satellites; ++i)="" sats[i].active="false;</pre"></max_satellites;></pre>			
1	Arduir	no Uno on (сомз

SatelliteTracker | Arduino 1.8.13 File Edit Sketch Tools Help

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lliteTracker	
{ Serial.print(sats[i].elevation);	
<pre>Serial.print(sats[1].elevation); Serial.print(F(" "));</pre>	
<pre>Serial.print(F(" Azimuth="));</pre>	
for (int i=0; i <max_satellites; ++i)<="" th=""><th></th></max_satellites;>	
if (sats[i].active)	
{	
<pre>Serial.print(sats[i].azimuth);</pre>	
<pre>Serial.print(F(" "));</pre>	
}	
<pre>Serial.print(F(" SNR="));</pre>	
<pre>for (int i=0; i<max_satellites; ++i)<="" pre=""></max_satellites;></pre>	
if (sats[i].active)	
<pre>Serial.print(sats[i].snr);</pre>	
<pre>Serial.print(F(" "));</pre>	
}	
Serial.println();	
<pre>for (int i=0; i<max_satellites; ++i)<="" pre=""></max_satellites;></pre>	
<pre>sats[i].active = false;</pre>	
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The code was retrieved from this folder.

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Appendix II

Code for the Voice Subsystem

```
#include "Talkie.h"
#include "Vocab US Large.h"
#include "Vocab Special.h"
Talkie voice;
void setup() {
}
void loop() {
    voice.say(spPAUSE2);
    voice.say(sp2 DANGER);
    voice.say(sp2 DANGER);
    voice.say(sp2 MOVE);
    voice.say(sp2 OPERATOR);
    voice.say(sp2 IS);
    voice.say(sp2 ON);
    voice.say(sp2 ALERT);
}
```

Appendices of Prototype III

Appendix I

Code for Test 1 of the Location Subsystem

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	₽
FullExample §	
finclude <tinygps++.h></tinygps++.h>	
finclude < SoftwareSerial. h>	
/*	
This sample code demonstrates the normal use of a TinyGPS++ (TinyGPSPlus) object.	
It requires the use of SoftwareSerial, and assumes that you have a	
4800-baud serial GPS device hooked up on pins 4(rx) and 3(tx).	
<pre>~/ static const int RXPin = 4, TXPin = 3;</pre>	
static const mint32 t GFSBaud = 9600;	
// The TinyGPS++ object	
FingGPSPlus gps;	
// The serial connection to the GPS device	
SoftwareSerial ss(RXFin, TXFin);	
void setup()	
Serial begin (115200);	
ss. <mark>begin</mark> (GFSBaud);	
<pre>Serial.println(F("FullExample.ino"));</pre>	
<pre>Serial.println("An extensive example of many interesting TinyGPS++ features"));</pre>	
<pre>Serial.print(F("Testing TinyOPS++ library v. ")); Serial.println(TinyOFSPlus::libraryVersion()); Serial.printlc(f(Why Wind) When Yest);</pre>	
Serial.println(?'by Mikal Hart")); Serial.println();	
seria.printin(); Sarial.printin(); Sarial.printin(P("Sats HDOP Latitude Longitude Fix Date Time Date Alt Course Speed Card Distance Course Card Chars Sentences Che	rksum")):

FullExample | Arduino 1.8.13 ٥ \times _ File Edit Sketch Tools Help ۰Q FullExample § ss.begin (GPS Serial.println(F("FullExample.ino")); Serial.println(F("An extensive example of many interesting TinyGFS++ features")); Serial.println(F("by Mial Hart")); Serial.println(F("by Mial Hart")); Serial.println(); Serial.println(F("Sats HDOP Latitude Longitude Fix Date Time Date Alt Course Speed Card Distance Course Card Chars Sentences Checksum")); Serial.println(F(" (deg) (deg) Age Age (m) --- from GFS ---- to London ---- FX FX Fail")); Serial.println(F(" ----- to London ---- FX FX Fail")); Age } void loop() { static const double LONDON_LAT = 51.508131, LONDON_LON = -0.128002; printInt(gps.satellites.vale(), gps.satellites.valid(), 5); printFloat(gps.hdop.hdop(), gps.hdop.isValid(), 6, 1); printFloat(gps.location.lat(), gps.location.isValid(), 11, 6); printFl(gps.location.age(), gps.location.isValid(), 12, 6); printTl(gps.location.age(), gps.location.isValid(), 5); printFloat(gps.latlitude.meters(), gps.altitude.isValid(), 7, 2); printFloat(gps.squee.deg(), gps.course.isValid(), 7, 2); printFloat(gps.squee.deg(), gps.speed.isValid(), 6, 2); printFloat(gps.course.isValid() ? TinyGPSPlus::cardinal(gps.course.deg()) : "*** ", 6);

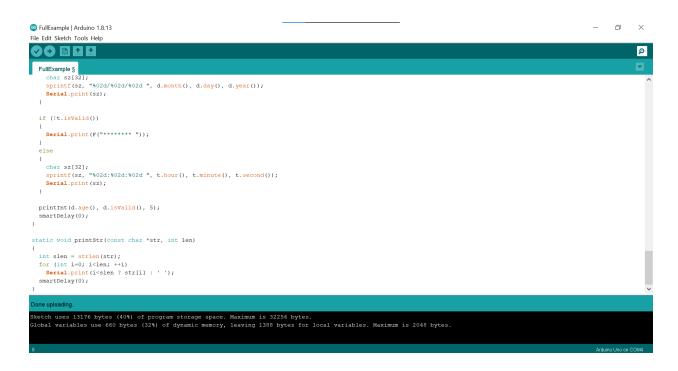
© FullExample Arduino 1.8.13	_	٥	\times
File Edit Sketch Tools Help		_	_
			₽
FullExample §			
unsigned long distanceKmTOLondon =			^
(unsigned long)TinyGPSPlus::distanceBetween(
<pre>gps.location.lat(),</pre>			
gps.location.lng(),			
LONDON_LAR, LONDON LON) / 1000;			
printInt(distanceRmToLondon, gps.location.isValid(), 9);			
			- 1
double courseToLondon =			- 1
TinyGPSPlus::courseto(- 1
gps.location.lat(), gps.location.lat(),			
gps. research ring(), London Lar,			
LONDON LON);			
-			
<pre>printFloat(courseToLondon, gps.location.isValid(), 7, 2);</pre>			
<pre>const char *cardinalToLondon = TinyGPSPlus::cardinal(courseToLondon);</pre>			
<pre>printStr(gps.location.isValid() ? cardinalToLondon : "*** ", 6);</pre>			
<pre>printInt(gps.charsProcessed(), true, 6);</pre>			
<pre>printInt(gps.sentencesWithFix(), true, 10);</pre>			
<pre>printInt(gps.failedChecksum(), true, 9);</pre>			
Serial.println();			
Done uploading.			
Sketch uses 13176 bytes (40%) of program storage space. Maximum is 32256 bytes.			
Global variables use 660 bytes (32%) of dynamic memory, leaving 1388 bytes for local variables. Maximum is 2048 bytes.			
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Se FullExample Arduino 1.8.13	-	đ	\times
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	~
FullExample §	
if (millis() > 5000 && gps.charsProcessed() < 10)	^
<pre>Serial.println(F("No GPS data received: check wiring"));</pre>	
}	
// This custom version of delay() ensures that the gps object	
// is being "fed".	
static void smartDelay(unsigned long ms)	
<pre>unsigned long start = millis();</pre>	
do	
{	
while (ss.available())	
gps.encode(ss.read());	
<pre>} while (millis() - start < ms);</pre>	
}	
static void printFloat(float val, bool valid, int len, int prec)	
(
if (!valid)	
while (len> 1)	
Serial.print('*');	
Serial.print('');	
}	
else	
{	
Serial nrint/val nrect.	
Done uploading.	
Sketch uses 13176 bytes (40%) of program storage space. Maximum is 32256 bytes.	
Global variables use 660 bytes (32%) of dynamic memory, leaving 1388 bytes for local variables. Maximum is 2048 bytes.	
8	Arduino Uno on COM4

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			P
FullExample §			
<pre>Serial.print(val, prec); int vi = abs((int)val); int fine = prec + (val < 0.0 ? 2 : 1); // . and - flen += vi >= 1000 ? 4 : vi >= 100 ? 3 : vi >= 10 ? 2 : 1; for (int i=flen; i<len; ++i)<br="">Serial.print(' '); } smartDelay(0); }</len;></pre>			^
<pre>static void printInt(unsigned long val, bool valid, int len) { char sz[32] = "***********************************</pre>			
<pre>for (int i=strlen(sz); i<len; (len="" ++i)="" ;="" if="" sz[i]=" "> 0) sz[len-1] = ' '; Serial.print(sz); smartPelay(0);</len;></pre>			ł
}			
<pre>static void printDateTime(TinyGPSDate &d, TinyGPSTime &t) {</pre>			~
Done uploading.			
Sketch uses 13176 bytes (40%) of program storage space. Maximum is 32256 bytes. Global variables use 660 bytes (32%) of dynamic memory, leaving 1388 bytes for local variables. Maximum is 2048 bytes.			
8	Arduin	no Uno on C	COM4
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	مور مور
FullExample §	
}	^
<pre>static void printDateTime(TinyGPSDate id, TinyGPSTime it)</pre>	
<pre>if (!d.isvalid())</pre>	
{ Serial.print(F("********* "));	
}	
else (
<pre>char sz[32]; sprintf(sz, "%02d/%02d/%02d ", d.month(), d.day(), d.year());</pre>	
<pre>Serial.print(sz); }</pre>	
<pre>if (!t.isValid())</pre>	
(Serial.print(F("******** "));	
3	
else {	
<pre>char sz[32]; sprintf(sz, "%02d:%02d:%02d ", t.hour(), t.minute(), t.second());</pre>	
Serial.print(sz);	
,	~
Done uploading.	
Sketch uses 13176 bytes (40%) of program storage space. Maximum is 32256 bytes.	
Global variables use 660 bytes (32%) of dynamic memory, leaving 1388 bytes for local variables. Maximum is 2048 bytes.	
8	Arduino Uno on COM4



The code was found in the TinyGPS++ library. This library can be downloaded from here.

Code for Test 2 of the Location Subsystem



So DeviceExample Arduino 1.8.13	-	đ	\times
File Edit Sketch Tools Help			
			₽.
DeviceExample §			
<pre>void setup()</pre>			-
Serial.begin(115200); ss.begin(0595Baud);			
ss. Jeylii (Brabaudi ,			- 6
<pre>Serial.println(F("DeviceExample.ino"));</pre>			- 1
Serial.println(F("A simple demonstration of TinyGPS++ with an attached GPS module"));			- 1
<pre>Serial.print(F("Testing Tiny@F8++ library v. ")); Serial.println(Tiny@F8Flus::libraryVersion()); Serial.println(F("bw MixH Hart");</pre>			- 1
Serial println();			- 1
}			
void loop()			
// This sketch displays information every time a new sentence is correctly encoded.			
<pre>while (ss.available() > 0) if (gps.encode(ss.read()))</pre>			
11 (gps.encode(ss.tead())) displayInfo();			
if (millis() > 5000 && gps.charsProcessed() < 10)			
{ Serial.println(F("No GFS detected: check wiring."));			
while(true);			
}			
3			~
<			>
Sketch uses 8922 bytes (27%) of program storage space. Maximum is 32256 bytes.			
Global variables use 520 bytes (25%) of dynamic memory, leaving 1528 bytes for local variables. Maximum is 2048 bytes.			
	_		

DeviceExample | Arduino 1.8.13

File Edit Sketch Tools Help **P** DeviceExample § ^ void displayInfo()
{ Serial.print(F("Location: "));
if (gps.location.isValid()) if (gps.ideation.lat(), 6);
Serial.print(gps.location.lat(), 6);
Serial.print(gfs.location.lng(), 6); } else Serial.print(F("INVALID"));
} Serial.print(F(" Date/Time: "));
if (gps.date.isValid()) { Serial.print(gps.date.month()); Serial.print(F("/")); Serial.print(gps.date.day()); Serial.print(F("")); Serial.print(gps.date.year()); } < > ketch uses 8922 bytes (27%) of program storage space. Maximum is 32256 bytes. Hobal variables use 520 bytes (25%) of dynamic memory, leaving 1528 bytes for local variables. Maximum is 2048 bytes.

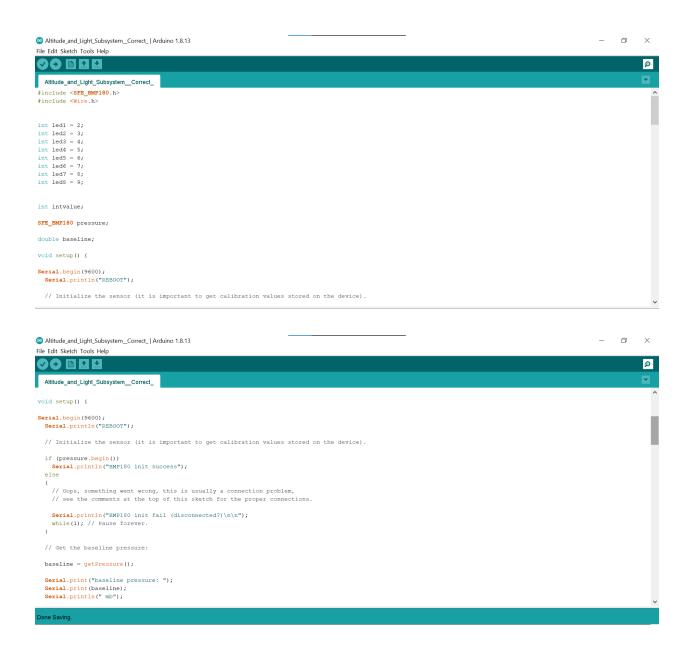
– o ×

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eviceExample §	
<pre>Serial.print(F("INVALID"));</pre>	
<pre>srial.print(F(" "));</pre>	
(gps.time.isValid())	
<pre>if (gps.time.hour() < 10) Serial.print(F("0"));</pre>	
<pre>Serial.print(gps.time.hour()); Serial.print(F(":"));</pre>	
<pre>if (gps.time.minute() < 10) Serial.print(F("0")); Serial.print(gps.time.minute());</pre>	
<pre>Serial.print(F(":")); if (gps.time.second() < 10) Serial.print(F("0"));</pre>	
<pre>Serial.print(gps.time.second());</pre>	
<pre>Serial.print(F(".")); if (gps.time.centisecond() < 10) Serial.print(F("0"));</pre>	
<pre>Serial.print(gps.time.centisecond());</pre>	
se	
<pre>Serial.print(F("INVALID"));</pre>	
<pre>rial.println();</pre>	
ch uses 8922 bytes (27%) of program storage space. Maximum is 32256 bytes. al variables use 520 bytes (25%) of dynamic memory, leaving 1528 bytes for local variables. Maximum is 20	
ch uses 8922 bytes (27%) of program storage space. Maximum is 32256 bytes. Mal variables use 520 bytes (25%) of dynamic memory, leaving 1528 bytes for local variables. Maximum is 20	
al variables use 520 bytes (25%) of dynamic memory, leaving 1528 bytes for local variables. Maximum is 20	Arduino Uno on
l variables use 520 bytes (254) of dynamic memory, leaving 1528 bytes for local variables. Maximum is 20	
l variables use 520 bytes (25%) of dynamic memory, leaving 1528 bytes for local variables. Maximum is 20 iceExample Arduino 1.8.13 it Sketch Tools Help	Arduno Uno ar
l variables use 520 bytes (25%) of dynamic memory, leaving 1528 bytes for local variables. Maximum is 20 nceExample Arduino 1.8.13 it Sketch Tools Help	Arduno Uno ar
l variables use 520 bytes (259) of dynamic memory, leaving 1528 bytes for local variables. Maximum is 20 viceExample Arduino 1.8.13 it Sketch Tools Help → ↑ ↑ ↑ ↑ ↑ ↑ ↑	Arduino Uno on
ul variables use 520 bytes (25%) of dynamic memory, leaving 1528 bytes for local variables. Maximum is 20 viceExample Arduino 1.8.13 iit Sketch Tools Help	Arduino Uno on
l variables use 520 bytes (259) of dynamic memory, leaving 1528 bytes for local variables. Maximum is 20 //ceExample Arduino 1.8.13 it Sketch Tools Help →	Arduino Uno on
<pre>1 variables use 520 bytes (25%) of dynamic memory, leaving 1528 bytes for local variables. Maximum is 20 wiceExample Arduino 1.8.13 lit Sketch Tools Help</pre>	Arduino Uno on
<pre>l variables use 520 bytes (25%) of dynamic memory, leaving 1528 bytes for local variables. Maximum is 20 ////////////////////////////////////</pre>	Arduino Uno on
<pre>l variables use 520 bytes (25%) of dynamic memory, leaving 1528 bytes for local variables. Maximum is 20 wiceExample Arduino 1.8.13 it Sketch Tools Help wiceExample § Serial.print(F(""NVALID")); rial.print(F("")); (qps.time.isValid()) if (qps.time.hour() < 10) Serial.print(F("0")); Serial.print(ps.time.hour());</pre>	Arduino Uno on
<pre>viceExample Arduino 1.8.13 iit Sketch Tools Help viceExample Arduino 1.8.13 iit Sketch Tools Help viceExample \$ Serial.print (F(" ")); (gps.time.hour() < 10) Serial.print (F("0")); Serial.print (gr(:")); if (gps.time.hour() < 10) Serial.print (F("0")); Serial.print (gr(:")); if (gps.time.hour() < 10) Serial.print (F("0")); </pre>	Arduino Uno on
<pre>viceExample Arduino 18.13 bit Sketch Tools Help viceExample Arduino 18.13 bit Sketch Tools Help viceExample § Serial.print (F(""NVALID")); rial.print (F(""NVALID")); rial.print (F("")); (gps.time.hour() < 10) Serial.print(F("0")); Serial.print (gps.time.hour()); Serial.print (gp:.time.minute()); Serial.print (gps.time.minute()); Serial.print (gps.time.minute()); Serial.print (gps.time.minute()); Serial.print (gps.time.minute()); Serial.print (gps.time.minute()); Serial.print (gps.time.minute()); Serial.print (gps.time.minute()); Serial.print (gps.time.minute());</pre>	Arduino Uno on
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<pre>l variables use 520 bytes (25%) of dynamic memory, leaving 1528 bytes for local variables. Maximum is 20 ideceExample [Arduino 1.8.13 it Sketch Tools Help ideceExample § ideceExample § ideceExample § ideceExample (F("INVALID")); ital.print(F("INVALID")); ital.print(F("INVALID")); ital.print(F("")); (qps.time.hour() < 10) Serial.print(F("0")); iderial.print(gps.time.hour()); iderial.print(gps.time.intent()); iderial.print(gps.time.intent()); iderial.print(gps.time.intent()); iderial.print(gps.time.intent()); iderial.print(gps.time.second()); iderial.gps.time.second(); iderial.</pre>	Arduno Uno ar
<pre>AceExample Arduino 1.8.13 AceExample Arduino 1.8.13 it Sketch Tools Help AceExample { Comparison of the second () {</pre>	Arduino Uno on
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<pre>l variables use 520 bytes (25%) of dynamic memory, leaving 1528 bytes for local variables. Maximum is 20 diceExample [Arduino 1.8.13 it Sketch Tools Help leaving for the second second</pre>	Arduino Uno on
<pre>l variables use 520 bytes (25%) of dynamic memory, leaving 1528 bytes for local variables. Maximum is 20 idexample [Arduino 1.8.13 it Sketh Tools Help idexample 5 erial.print (F("INVALID")); ial.print (F("INVALID")); ial.print (F("INVALID")); ial.print (F("INVALID")); irial.print (F("INVALID")); irial.print (gps.time.hour()); erial.print (gps.time.minute()); erial.print (gps.time.minute()); erial.print (gps.time.second()); erial.print (gps.time.centisecond()); erial.print (gps.time.centisecond()); e</pre>	Arduno Uno ar
<pre>l variables use 520 bytes (25%) of dynamic memory, leaving 1528 bytes for local variables. Maximum is 20 AceExample [Arduino 1.8.13 iit Sketch Tools Help Comment (F("INVALID")); AceExample 5 Serial.print (F("INVALID")); fial.print (F("")); (qps.time.hour() < 10) Serial.print (F("0")); Serial.print (gps.time.hour()) < 10) Serial.print (F("0")); Serial.print (gps.time.hour()); Serial.print (gps.time.imute()); Serial.print (gps.time.second()); Serial.print (gps.time.second()); Serial.print (gpt.time.second()); Serial.print (gpt.time.second()); Serial.print (gpt.time.centisecond()); Serial.print (gr("INVALID")); </pre>	Arduino Uno on
ul variables use 520 bytes (25%) of dynamic memory, leaving 1528 bytes for local variables. Maximum is 20 viceExample Arduino 1.8.13 dit Sketch Tools Help	Arduino Uno on

The code was found in the TinyGPS++ library. This library can be downloaded from here.

Appendix II

Code for Light and Altitude Subsystem



litiude_and_Light_Subsystem_Correct_ Arduino 1.8.13 Edit Sketch Tools Help	٥
<pre>titude_and_Light_Subsystem_Correct_ / Get the baseline pressure:</pre>	
aseline = getPressure();	
erial.print("baseline pressure: ");	
<pre>srial.print(baseline); srial.println(" mb");</pre>	
era.princin(mb),	
<pre>inMode (led1, OUTPUT);</pre>	
inMode (led2, OUTPUT);	
inMode (led3, OUTPUT);	
inMode (led4, OUTPUT);	
inMode (led5, OUTPUT);	
<pre>inMode (led6, OUTPUT);</pre>	
inMode (led7, OUTPUT);	
<pre>inMode (led8, OUTPUT);</pre>	
d loop() {	
ouble a,P;	
/ Get a new pressure reading:	
= getPressure();	
e Saving.	

S Altitude and Light_Subsystem_Correct_ Arduino 1.8.13 File Edit Sketch Tools Help	– 0 ×
	<u>م</u>
Altitude_and_Light_SubsystemCorrect	
<pre>P = getPressure();</pre>	^
// Show the relative altitude difference between	
// the new reading and the baseline reading:	
<pre>a = pressure.altitude(P,baseline);</pre>	
<pre>Serial.print("relative altitude: ");</pre>	
<pre>if (a >= 0.0) Serial.print(" "); // add a space for positive numbers Serial.print(a,1);</pre>	
<pre>serial.print(a,1); Serial.print("meters, ");</pre>	
if (a >= 0.0) Serial.print(" "); // add a space for positive numbers	
Serial.print(a*3.28084,0);	
<pre>Serial.println(" feet");</pre>	
delay(500);	
(
digitalWrite (led1, HIGH);	
delay(100);	
digitalWrite (led2, HIGH);	
delay(100);	
<pre>digitalWrite (led3, HIGH);</pre>	
delay(100);	×

ltitude_and_Light_Subsystem_Correct_ Arduino 1.8.13 Edit Sketch Tools Help	- 0
ltitude_and_Light_SubsystemCorrect_	6
<pre>digitalWrite (led2, HIGH); delay(100);</pre>	
<pre>digitalWrite (led3, HIGH); delay(100);</pre>	
<pre>digitalWrite (led4, HIGH); delay(100);</pre>	
<pre>digitalWrite (led5, HIGH); delay(100);</pre>	
<pre>digitalWrite (led6, HIGH); delay(100);</pre>	
<pre>digitalWrite (led7, HIGH); delay(100);</pre>	
<pre>digitalWrite (led8, HIGH); delay(100);</pre>	
<pre>digitalWrite(led1, LOW); delay(100);</pre>	
<pre>digitalWrite(led2, LOW); delay(100);</pre>	

<pre>Nuture and Light_Subsystem_Correct digitalWrite (led5, L00); delay(100);</pre>	<pre>Nttude_and_Light_Subsystem_Correct_ digitalWrite (led5, LON); delay(100); digitalWrite (led6, LON);</pre>	
<pre>digital#rite (led5, LOW); delay(100); digital#rite (led6, LOW); delay(100); digital#rite (led7, LOW); delay(100); digital#rite (led8, LOW); delay(100); } digital#rite (led8, LOW); delay(100); } f char status; double getPressure() { char status; double 7, P, P0, a; // You must first get a temperature measurement to perform a pressure reading. // You must first get a temperature measurement to perform a pressure reading. // You must first get a temperature measurement to perform a pressure reading. // You must first get a temperature measurement: // If request is successful, the number of ms to wait is returned. // If request is successful, 0 is returned. status = pressure.startTemperature(); Done Saving. he sketch name had to be modified.</pre>	<pre>digitalWrite (led5, LOW); delay(100); digitalWrite (led6, LOW);</pre>	
<pre>delq(100); digitalWrite (led6, L0%); delq(100); de</pre>	<pre>delay(100); digitalWrite (led6, LOW);</pre>	
<pre>delay(100); digitalWrite (led7, LOW); delay(100); digitalWrite (led8, LOW); delay(100); } ; couble getPressure() char status; double getPressure() char status; double T,P,p0,a; // You must first get a temperature measurement to perform a pressure reading. // Start a temperature measurement: // If request is unscessful, the number of ms to wait is returned. // If request is unscessful, o is returned. status = pressure.startTemperature(); one Swing. he sketch name had to be modified.</pre>		
<pre>delay(100); digitalWrite (led8, LOW); delay(100); ; cubi getPressure() cubi getPressure() cubi getPressure() cubi getPressure() // You must first get a temperature measurement to perform a pressure reading. // You must first get a temperature measurement to perform a pressure reading. // Start a temperature measurement: // Start a temperature measurement: // If request is successful, the number of ms to wait is returned. // If request is successful, the number of ms to wait is returned. // If request is successful, the number of ms to wait is returned. // If request is unsuccessful, the number of ms to wait is returned. // If request is unsuccessful, the number of ms to wait is returned. // If request is unsuccessful, the number of ms to wait is returned. // If request is unsuccessful, the number of ms to wait is returned. // If request is unsuccessful, the number of ms to wait is returned. // If request is unsuccessful, the number of ms to wait is returned. // If request is unsuccessful, the number of ms to wait is returned. // If request is unsuccessful, the number of ms to wait is returned. // If request is unsuccessful, the number of ms to wait is returned. // If request is unsuccessful, the number of ms to wait is returned. // If request is unsuccessful, the number of ms to wait is returned. // If request is unsuccessful, the number of ms to wait is returned. // If request is unsuccessful, the number of ms to wait is returned. // If request is unsuccessful, the number of ms to wait is returned. // If request is unsuccessful, the number of ms to wait is returned. // If request is unsuccessful, the number of ms to wait is returned. // If request is unsuccessful, the number of ms to wait is returned. // If request is unsuccessful, the number of ms to wait is returned. // If request is unsuccessful, the number of ms to wait is returned. // If request is unsuccessful, the number of ms to wait is returned. // If request is unsuccessful, the number of ms to wait is returned. // If request is unsuccessful, th</pre>	deray(100),	
<pre>delay(100); delay(100); d</pre>		
<pre>char status; double T,P,p0,s; // You must first get a temperature measurement to perform a pressure reading. // Start a temperature measurement: // If request is successful, the number of ms to wait is returned. // If request is unsuccessful, 0 is returned. // If request is unsuccessful, 0 is returned. // status = pressure.startTemperature(); one Saving. ne sketch name had to be modified.</pre>	delay(100);	
<pre>char status; double T,P,p0,a; // You must first get a temperature measurement to perform a pressure reading. // Start a temperature measurement: // If request is successful, the number of ms to wait is returned. // If request is unsuccessful, 0 is returned. status = pressure.startTemperature(); one Saving. ne sketch name had to be modified.</pre>		
<pre>char status; double T,P,P0,a; // You must first get a temperature measurement to perform a pressure reading. // Start a temperature measurement: // If request is successful, the number of ms to wait is returned. // If request is unsuccessful, 0 is returned. status = pressure.startTemperature(); one Saving. me Saving.</pre>	ble getPressure()	
<pre>// Start a temperature measurement: // If request is successful, the number of ms to wait is returned. // If request is unsuccessful, 0 is returned. status = pressure.startTemperature(); me Saving. e sketch name had to be modified.</pre>		
<pre>// If request is successful, the number of ms to wait is returned. // If request is unsuccessful, 0 is returned. status = pressure.startTemperature(); one Saving. we sketch name had to be modified.</pre>	/ You must first get a temperature measurement to perform a pressure reading.	
one Saving. e sketch name had to be modified.	/ If request is successful, the number of ms to wait is returned.	
he sketch name had to be modified.	tatus = pressure.startTemperature();	
mbers, dashes, dots and underscores. Maximum length is 63 characters.	ch names must start with a letter or number. followed by letters.	



There is no source for this code because it was adjusted based on the codes for the altitude and light subsystem.

Code for Voice and Location Subsystem

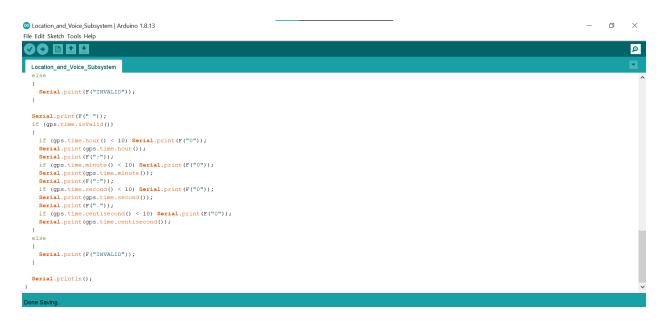
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			ø
ocation_and_Voice_Subsystem			
clude "Talkie.h" .clude "Vocab US Large.h"			
clude "Vocab_Special.h"			
clude <tinygfs++.h> clude <<mark>SoftwareSerial</mark>.h></tinygfs++.h>			
kie voice;			
tic const int RXFin = 4, TXFin = 3; tic const uint32_t GPSBaud = 9600;			
yGPSPlus gps;			
<pre>twareSerial ss(RXPin, TXPin);</pre>			
d setup() {			
erial.begin (115200); s.begin (GPSBaud);			
<pre>erial.println(F("DeviceExample.ino"));</pre>			
erial.println(F("A simple demonstration of TinyGPS++ with an attached GPS module"));			
<pre>erial.print(f("Testing TinyGFS++ library v. ")); Serial.println(TinyGFSFlus::libraryVersion()); erial.println(F("by Mikal Hart")); erial.println();</pre>			
erial.printin();			
ocation_and_Voice_Subsystem Arduino 1.8.13	-	Ø	×
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ocation_and_Voice_Subsystem			
d loop() {			
{ voice.say(spPAUSE2);			
<pre>voice.say(sp2_DANGER); voice.say(sp2_DANGER);</pre>			
<pre>voice.say(sp2_MOVE);</pre>			
<pre>voice.say(sp2_OPERATOR); voice.say(sp2_IS);</pre>			
voice.say(sp2_ON);			
<pre>voice.say(sp2_ALERT);)</pre>			
thile (ss.available() > 0)			
if the second term and the second (DA)			
<pre>if (gps.encode(ss.read())) displayInfo();</pre>			
<pre>displayInfo(); f (millis() > 5000 && gps.charsProcessed() < 10)</pre>			
<pre>displayInfo();</pre>			

Location_and_Voice_Subsystem Arduino 1.8.13	——————————————————————————————————————
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	٩
Location_and_Voice_Subsystem	×
<pre>void displayInfo()</pre>	í í
{ Serial.print(F("Location: "));	
if (gps.location.isValid())	
((gp3.10000101.15v0110())	
<pre>Serial.print(gps.location.lat(), 6);</pre>	
<pre>Serial.print(F(","));</pre>	
<pre>Serial.print(gps.location.lng(), 6);</pre>	
}	
else	
{	
<pre>Serial.print(F("INVALID"));</pre>	
}	
<pre>Serial.print(F(" Date/Time: "));</pre>	
if (gps.date.isValid())	
(
<pre>Serial.print(gps.date.month());</pre>	
<pre>Serial.print(F("/"));</pre>	
<pre>Serial.print(gps.date.day());</pre>	
<pre>Serial.print(F("/"));</pre>	
<pre>Serial.print(gps.date.year());</pre>	
}	
else	
1	
<pre>Serial.print(F("INVALID"));</pre>	×

Location_and_Voice_Subsystem | Arduino 1.8.13 File Edit Sketch Tools Help

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	₽.
Location_and_Voice_Subsystem	
<pre>Serial.print(gps.date.year());</pre>	^
}	
else	
(
<pre>Serial.print(F("INVALID"));</pre>	
}	
<pre>Serial.print(F(" "));</pre>	
if (gps.time.isValid())	
{	
<pre>if (gps.time.hour() < 10) Serial.print(F("0"));</pre>	
<pre>Serial.print(gps.time.hour());</pre>	
<pre>Serial.print(F(":"));</pre>	
<pre>if (gps.time.minute() < 10) Serial.print(F("0"));</pre>	
<pre>Serial.print(gps.time.minute());</pre>	
<pre>Serial.print(F(":"));</pre>	
<pre>if (gps.time.second() < 10) Serial.print(F("0"));</pre>	
<pre>Serial.print(gps.time.second());</pre>	
<pre>Serial.print(F("."));</pre>	
<pre>if (gps.time.centisecond() < 10) Serial.print(F("0"));</pre>	
<pre>Serial.print(gps.time.centisecond());</pre>	
}	
else	
{	
<pre>Serial.print(F("INVALID"));</pre>	
}	
	×

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There is no source for this code because it was adjusted based on the codes for the altitude and light subsystem.

Code for Final Prototype

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Final_PrototypeWithout_Lcation_Subsystem_		
nclude <sfe bmp180.h=""> //BMP180 library</sfe>		
nclude <wire.h> //BMP180 library</wire.h>		
nclude "Talkie.h" // Speaker library		
nclude "Vocab_US_Large.h" //Speaker library		
nclude "Vocab_Special.h" //Speaker library		
<pre>lkie voice; //initialize voice variable</pre>		
t led1 = 2;		
t led2 = 3;		
t led3 = 4;		
t led4 = 5;		
t led5 = 6;		
t led6 = 7;		
t led7 = 8;		
t led8 = 9;		
t intvalue;		
E_BMP180 pressure;		
uble baseline;		
id setup() { Serial.begin(9600);		

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			P
Final_PrototypeWithout_Lcation_Subsystem			
oid setup() (^
Serial begin (9600);			
Serial.println("REBOOT");			
if (pressure.begin())			
<pre>Serial.println("BMP180 init success");</pre>			
else			
{			
<pre>Serial.println("BMF180 init fail (disconnected?)\n\n");</pre>			
while(1);			
3			
<pre>baseline = getPressure();</pre>			
Serial.print("baseline pressure: ");			
Serial.print(baseline);			
Serial.println(" mb");			
{			
pinMode (led1, OUTPUT);			
pinMode (led2, OUTFUT);			
pinMode (led3, OUTPUT);			
pinMode (led4, OUTFUT);			
pinMode (led5, OUTPUT);			~

Final_Prototype_Without_Lcation_Subsystem_ Arduino 1.8.13 e Edit Sketch Tools Help	
<pre>Final_PrototypeWithout_Lcation_Subsystem_ pinMode (led4, OUTPUT); pinMode (led5, OUTPUT); pinMode (led6, OUTPUT); pinMode (led7, OUTPUT); pinMode (led8, OUTPUT);</pre>	
}	
bid loop() (
double a,F;	
<pre>P = getPressure();</pre>	
a = pressure.altitude(P,baseline);	
<pre>Serial.print("relative altitude: "); if (a >= 0.0) Serial.print(" "); Serial.print(a,1); Serial.print(" meters, \n"); if (a <= 0.0) //if altitude reading {</pre>	
<pre>Serial.print("The drone has fallen.\n");</pre>	

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File Edit Sketch Tools Help			P
Final_PrototypeWithout_Lcation_Subsystem_			
<pre>voice.say(spPAUSE2);</pre>			^
<pre>voice.say(sp2_DANGER);</pre>			
voice.say(sp2_DANGER);			
voice.say(sp2_MOVE);			
voice.say(sp2_OPERATOR);			
voice.say(sp2 IS);			
voice.say(sp2 on);			
<pre>voice.say(sp2_ALERT);</pre>			
<pre>digitalWrite (led1, HIGH);</pre>			
delay(100);			- 61
digitalWrite (led2, HIGH);			
delay(100);			
<pre>digitalWrite (led3, HIGH);</pre>			
delay(100);			
<pre>digitalWrite (led4, HIGH);</pre>			
delay(100);			
<pre>digitalWrite (led5, HIGH);</pre>			
delay(100);			
digitalWrite (led6, HIGH);			
delay (100);			~

ial Prototype_Without_Lcation_Subsystem_ Arduino 1.8.13 dit Sketch Tools Help	- 0
al_PrototypeWithout_Lcation_Subsystem_	
<pre>digitalWrite (led7, HIGH); delay(100);</pre>	
<pre>digitalWrite (led8, HIGH); delay(100);</pre>	
<pre>digitalWrite(led1, LOW); delay(100);</pre>	
<pre>digitalWrite(led2, LOW); delay(100);</pre>	
<pre>digitalWrite (led3, LOW); delay(100);</pre>	
<pre>digitalWrite (led4, LOW); delay(100);</pre>	
<pre>digitalWrite (led5, LOW); delay(100);</pre>	
<pre>digitalWrite (led6, LOW); delay(100);</pre>	
<pre>digitalWrite (led7, LoW); delav(100);</pre>	

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Final_PrototypeWithout_Lcation_Subsystem_	
} delay(500);	^
3	
<pre>double getPressure() //altitude function (char status; double T,P,p0,a;</pre>	
<pre>status = pressure.startTemperature(); if (status != 0) { // Wait for the measurement to complete:</pre>	

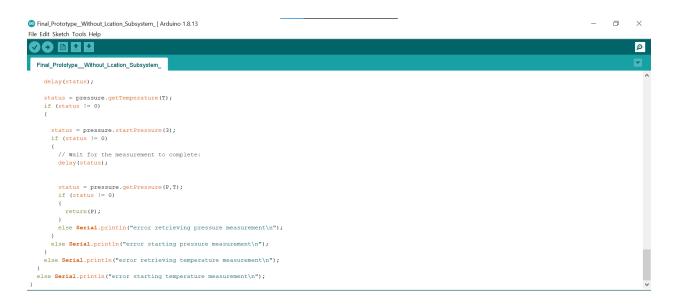
delay(status); status = pressure.getTemperature(T);
if (status != 0)
{ status = pressure.startPressure(3); if (status != 0) (// Wait for the measurement to complete:

Final_Prototype_Without_Lcation_Subsystem_ | Arduino 1.8.13

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Final_PrototypeWithout_Lcation_Subsystem_	
} delay(500);	^
3	
<pre>double getPressure() //altitude function {</pre>	
char status; double 7, P, p0, a;	
<pre>status = pressure.startTemperature(); if (status != 0) {</pre>	
<pre>// Wait for the measurement to complete: delay(status);</pre>	
<pre>status = pressure.getTemperature(T);</pre>	
if (status != 0)	
<pre>status = pressure.startPressure(3); if (status != 0)</pre>	- 1
<pre>{ // Wait for the measurement to complete: // Wait for</pre>	~

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There is no source for this code because it was adjusted based on the codes for the altitude and light subsystem.