

02/19/21 Shadman ur Rehmat

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If lost, Please return to:

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Project Information + Group Details

Project Name: IntelliBus

Team Members

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Project Advisor: Dr. Vijay Madisetti
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08/29/21

Thomas Talbot

ECE-4872 Team Meeting 1

1 2

Group Members Present: Thomas Talbot, Shadman Ahmed, Noah Chong, Yue Pan

Meeting Highlights:

- No revision of the project proposal and project summary is required from 4871
- We sketched out the relevant sections of the proposal presentation for a ~20min presentation.

Present:

- Noah researched the Open Layers maps API for data visualization on the front-end,
- Shadman set up AWS accounts for all team members.

Group To do:

09/07/21

Noah - Start setting up bare-bones of a web page to host passenger counting dashboards. Deadline - 09/08/21.

08/26/21

Shadman - finish setting AWS accounts for the team. Deadline: 08/27/21

08/27/21

Thomas - Contact Nordic customer service to see if the nRF9160 is available for purchase and if it will work with AWS. Deadline - 09/01/21

update - The board can be shipped here within 2 days and will work with AWS IoT and nRF Connect to Cloud.

09/01/21

All members - finalize and prepare notes for proposal presentation. Deadline - 09/01/21

08/26/21

Thomas W. Talbot

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Weekly Advisor Meeting 1

Group Members Present: Thomas Talbot, Yue Pan, Shadman Ahmed, Noah Chang, & Dr. Madisetti.

Meeting Highlights:

- Scheduled the proposal presentation for 09/01/21 @ 12:30 pm over Zoom.
- We showed Dr. Madisetti the key sections of our Project Proposal from ELE4871, such as the: design approach, schedule, & budget. No revisions are needed for the proposal at this time.
- ~~Dr. Madisetti~~ (future) Dr. Madisetti would like to see options for the various parts we order for the project. The options to explore for the microcontroller are the: Beagle Bone, Raspberry Pi, and nRF9160.
- Dr. Madisetti suggested that the project could be set up in a much shorter time frame with a Beagle Bone Black or Raspberry Pi. Also, testing could happen in a public doorway on-campus like in the CULC.

Group To do:

✓
08/31/21

Thomas - verify that iBasis SIM card will be enough data capacity (10MB) for our project and that it will work in Atlanta, GA.
Deadline: 09/01/21

✓
08/27/21

Thomas - Add an 'options' slide for the microcontroller (Raspberry Pi, Beagle Bone Black, & nRF9160).
Deadline: 09/01/21

08/31/21

Thomas W. Talbot

Practice Proposal Presentation

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Group Members present: Thomas Talbot, Yue Pan, Shadman Ahmed, Noah Chong

Items Discussed:

- Ran through a mock proposal presentation before tomorrow's meeting with Dr. Madisetti @ 17:30
- The presentation covered all relevant topics, but has a little lengthy.
- There is ~~was~~ repeated information on the "Description" and "System Overview" slides that can be boiled down.
- The group discussed possible opportunities for project testing including using a public doorway or another transportation department.
- Tomorrow group will meet after meeting with Dr. Madisetti and discuss product ordering and ~~the~~ the dashboard technology we will use (either Microsoft Power BI or Amazon's QuickSight)

Group to do:

09/07/21 ✓ Noah - continue spinning up webpage for project. Deadline - 09/08/21

09/07/21 ✓ Thomas & Shadman - Boil-down Description & System Overview slides. Deadline - 09/01/21

09/07/21 ✓ Noah - ~~ask~~ inquire with Dr. Russel Clarke about testing opportunities for the project. Deadline - 09/08/21

09/01/21

Thomas w/Talbot

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weekly Advisor Meeting 2

Group Members Present: Thomas Talbot, Shadman Ahmed, Yue Pan, Noah Chong & Dr. Madisetti,

Meeting Highlights:

We presented our ~20min proposal presentation to Dr. Madisetti which highlighted the relevant pieces of our senior design project like system overview, budget, & schedule.

Planned: Work with Dr. Madisetti through the appropriate steps to get approval on all project deliverables, so that we can start ordering parts.

Important Feedback from Dr. Madisetti on Proposal Presentation:

1. Identify the target customer to be transportation departments who do not currently have access to passenger count data.

2. Create a local data structure in the embedded device that synchronizes with the cloud, we can use MQTT for reliable data transmission

3. Be prepared to explain why we chose to use PIR sensors instead of visual detection,

4. We want our embedded system to be robust - make a 3D printed case.

5. Consider edge-cases for the project. Ex: What if the bus is crowded & detects a flow of people walking in? How will the back-end database handle thousands of busses transmitting passenger data to AWS.

09/01/21

Thomas W. Tidwell

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Action Items from Weekly Advisor Meeting (continued from previous page).

09/02/21

Thomas - Draft and send an email to Dr. Madisett, the course coordinator, and team members to confirm that our deliverables have been approved and we can start ordering parts.

Deadline: 09/03/21

15/10/08

09/01/21

Thomas W. Talbot

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Team Meeting Week 2

Group Members Present: Thomas Talbot, Shadman Ahad, Yve Pan, Noah Chong

Meeting highlights:

During the meeting, Shadman and Noah worked together to deploy EC2 instance ~~and~~ and attempted to run a web server. They did not finish this task and will continue work later this week.

Thomas Researched pricing for data visualization tools like Microsoft Power BI & Amazon's QuickSight. He also sent an email to Nordic Semiconductor to verify that the iBasis STM works in Atlanta GA. Question - How will AWS cost be handled since charges will not be finalized until December?

Group To Do:

✓

09/12/21

David - Research long jumper wire products or try connecting multiple wire segments together.

Deadline: 09/08/21

✓

09/10/21

Noah - Help Shadman load the web application onto an AWS instance. Deadline: 09/08/21

✓

09/05/21

Noah - Send GeoJSON format data to Shadman so that he has an idea of what the map data will look like. Deadline: 09/08/21

✓

09/05/21

Shadman - Work with Noah to deploy EC2 instance in attempt to run a web server. Deadline: 09/08/21

09/08/21

Thomas W. Talbot

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Team Meeting Week 3

Note: weekly Advisor meeting was cancelled this week because of last week's proposal presentation.

Group Members Present: Thomas Talbot, Shadman Ahmed, Noah Chong, Yue Pan.

Meeting Highlights:

- we received the nRF9160 over the mail,
- Thomas checked out a Beagle Bone Black from the SO lab to begin testing over WiFi,
- Shadman and Noah successfully setup the virtual machine to run our web server,
- Noah was able to set up separate git hub repos for our embedded application and our web application.

The link to our github repo is:

<https://github.com/IntelliBus-SeniorDesign/intellibus-embeddedapp.git>

Group To Do:

09/14/21

Shadman - Research MQTT and how to create an SNS queue to make sure our application scales appropriately. Deadline: 09/15/21

09/12/21

Thomas - Perform initial testing with the Beagle Bone Black Rev C. Deadline: 09/15/21

09/14/21

David - Perform initial boot testing of the Nordic. Set up the IDE and run a demo LED blink program. Deadline: 09/15/21

Thomas Talbot

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10/08/21 09/08/21

Getting Started with Beagle Bone Black

Documentation of Engineering Results and Data.

Group Members: Thomas Talbot (personal work).

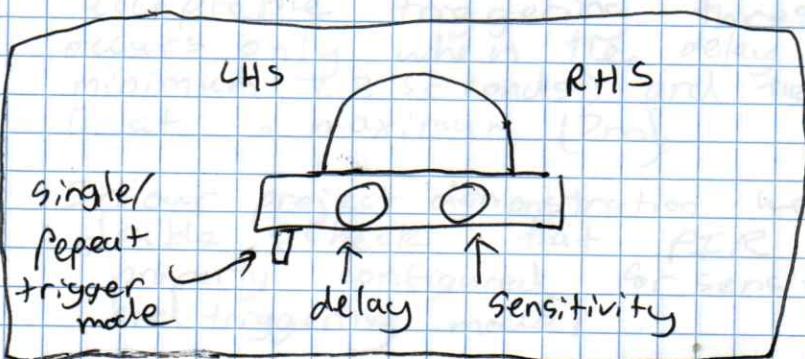
Experimental protocols / plans:

To test the PIR sensors with the Beagle Bone black I will try each distinct combination of sensitivity & delay on the PIR sensors.

Data:

Delay	Sensitivity	Acceptable Triggering Times / 10
CW	CCW	No 5/10
CCW	CCW	Yes 9/10
CW	CW	No 0/10
CCW	CW	No 2/10

The Diagram of the PIR sensor:



CW delay ↑ = increase delay approximately 5 min between readings,

CCW delay ↓ = decrease delay approximately 3 seconds between readings

CW sensitivity ↑ = Decreases sensitivity range of approximately 3m.

CCW sensitivity ↓ = increase sensitivity to 7m.

09/08/21

Thurday w/Talbot

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Getting started with Beagle Bone Black and PIR sensors,

Documentation of engineering results and data.

Group Members: Thomas Talbot (personal work session).

Based on the initial testing of the Beagle Bone Black with PIR sensors, the PIR sensors will not trigger unless the delay and sensitivity settings are both set to the left or CCW,

Additionally, the PIR sensors must be set to repeat trigger mode,

which is indicated by switch on bottom of board.

Result Discussion:

The experiment results showed that an acceptable triggering threshold (9/10) occurs only when the delay is at a minimum (3 seconds) and the sensitivity is at a maximum (2m).

In our project demonstration we need to double check that PIR sensors ~~are~~ are properly configured for sensitivity, delay, and triggering mode.

09/15/21

Thomas W. Talbot
Team Meeting 4

III

Group Members: Shadman Ahmed, David Pan,
Thomas Talbot, Noah Hong

Things Discussed: Team Updates

- Thomas worked with the Beagle Bone but consistently got low reading on PIR sensor.
- David found limitations on the PIR Sensors he is able to trigger sensor when waving his hands in front of it. But the time delay on sensors may be problematic to catch multiple people passing by.
- Shad found data specialist in GT library regarding Tableau
- Noah setup a mock website for our passenger counting system.

Action Items

09/18 ⚡ Thomas - write test program to capture entering & exiting of motion with PIR Sensors, Deadline: 09/22/21

09/18 ⚡ Thomas - Read GPIO pins on the nordic, Deadline: 09/22/21

09/28 ⚡ David - Experiment with & document how to use GPS, GPIO and LTE on the Nordic Board Deadline 09/29/21

09/21 ✓ Shad. - work with Noah on extracting Mock SAL data, Deadline 09/22/21

10/06 ⚡ Noah - Reach datapoints from the AWS API endpoint
Generate a route visualizing using some open API
Deadline: 10/06/21

09/16/21

Thomas Tellit
Personal work 09/16

12

Accomplished:

- I downloaded nRF Connect for desktop and firmware for the device,
- I ~~fixed~~ broke the mini USB connector off of the Nordic board
- I wrote a working test program with the code that uses interrupts to ~~count~~ count passengers entering/exiting

Action Items:

09/17 ✓ Thomas - Go to hive to fix mini-USB connector
Deadline: 09/22/21

09/17 ✓ Thomas - Acquire additional PIR sensors for testing (from Amazon), Deadline: 09/22/21

09/16/21

Weekly Advisor Meeting 09/16

Group Members: all

Items Discussed:

Hardware - Shared passenger counting algorithm with PIR sensor detection, Upcoming action items for fixing board and talking with GPS /LTE,

Front End / Database - Got Dynamo DB set up and working on route visualization

09/18/21

Zhansu in Solot

13

Personal Work Session

Present: I was able to hook up sensors to the nordic microcontroller and use software polling to track rising and falling edges of PIR sensor output.

This code can accurately (9/10) track the number of passengers on a bus.

I simulated passengers entering/exiting a bus by simply walking back & forth by the sensors.

The code for the embedded app is at the IntelliBus GitHub:

<https://github.com/IntelliBus-SeniorDesign/intellicbus-embeddedapp.git>

under branch "nRF9160"
see commit: 90c5a46

Action Items:

10/06 ✓

Configure mqtt-simple project to connect to AWS Deadline: 10/06

10/06 ✘

Once the sample mqtt project is working send our passenger count data over the network, Deadline: 10/13

09/22/21

Thomas W. Talbot

Team Meeting Week 5

14

Group Members Present: Thomas Talbot, Shadman Ahmed, Yue Pan, Noah Chong

Meeting highlights:

- We discussed the team guidelines for committing to the github repo. Mainly how we will use a separate branch for each feature and go through a code review process before committing to the remote repo.
- Shadman reached out to GT library data viz expert for licensing with Tableau.
- David researched more capable PIR sensors to use and plans on making a purchase this week.
- Thomas hooked up the PIR sensors to the Nordic microcontroller and used software polling to track rising edges on the PIR sensors. I was able to simulate passengers entering and exiting the bus by walking past the sensors at stomach height.
- Noah was able to fetch data from Shadman's web API and plot bus stops onto the map display.

Group To Do:

09/25

Shadman - Research implementation of websocket API which may help with data visualization, Deadline: ~~10/06/21~~ 10/06/21

09/29

Shadman - Research how AWS IoT Core will work with MQTT communication over LTE network, Deadline: 10/06/21

09/25

Thomas - Integrate mqtt sample code with the passenger counting logic, Deadline: 09/29/21

09/22/21

Schmar w/ Zelt

Group To Do Continued from week 5

15

10/06

Thomas - Research how we would build a mechanical assembly for the embedded device,
Deadline: 10/06/21

10/05

Thomas - Implement solutions to edge cases in passenger counting logic such as; triggering while bus is moving, A sensor staying high for more than 60 seconds,
Deadline: 10/06/21

09/29

Thomas - Inquire with PTS about the capacity on a GT bus, Deadline 09/29/21

09/28

David - solve the ERROR: pm-config not found for GPS sample projects at compilation. Deadline: 09/29/21

09/28

David - Work with GPS data on the board and print out GPS data to a terminal, get an idea of signal strength and fix time.
Deadline: 09/29/21

09/28

David - Merge the GPS code into Thomas's passenger counting program. Deadline: 09/29/21

10/10

Noah - Filter route visualization by type of stop (gold, red, etc), Deadline 10/13/21

09/23/21

Thomas Talbot

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Weekly Advisor Meeting 5

Group Members Present: Thomas Talbot, Yue Pan, Noah Chong, Shadman Ahmed,

Meeting Highlights:

Each team member started by going round robin through the updates from the week's team meeting.

- Dr. Madisetti suggested to look into the Bay Area Rapid Transit bus route EGTS for inspiration.
- He also was concerned that transmitting passenger count data may not be reliable.

Group To Do:

09/25 ☑

Thomas - Figure out what Quality of Service level will be used by our MATT application, Deadline: 09/30/21

Our application uses QoS 1 Quality of Service 1 which delivers a message at least once to the receiver when a receiver gets a QoS 1 message it can process it immediately. Which is good from a performance standpoint.

Thomas's Work Log

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9/29/21

Team Meeting Week 6

(Group Members Present: Thomas Talbot, Yue Pan, Noah Chong, Shadman Ahmed.

Meeting Highlights:

Shadman - researched how to set up an MQTT broker on AWS IoT. He got the certificates set up for TLS as well.

Thomas sent an email to Georgia Tech's PTS to ask about max capacity on bus.

Thomas - expanded the passenger counting program with the mqtt simple code. Still needs to ~~be~~ tested. I also gained familiarity with Timer interrupts in NRF9160 SOC.

David completed GPS testing. The testing does not work well indoors. An external GPS antenna has been ordered to help with indoor testing. David also integrated the basic agps project with Thomas's passenger counting code, (to print out GPS coordinates as a string to the terminal). David also purchased a different type of PIR sensor to use for the project as a backup/ alternative.

Noah started scaffolding how the hardware team's data should be formatted so that it can be integrated into the map. He also created an overlay on the front-end map for feature sections.

10/06

Shadman - Continue working on deploying MQTT broker on AWS IoT Core, Deadline: 10/06/21

10/06

Thomas - test MQTT simple code on mac to see if we can print out to terminal. If that works then test combined count and mqtt code, Deadline: 10/06/21

09/29/21

Thomas Workout

18

Team Meeting Week 6

Group To Do Continued:

10/06

David - Work with Thomas on setting up MQTT connection to AWS cloud, deciding on data format to send, update frequency, etc, Deadline: 10/13/21

10/19

David - Once external GPS antenna has arrived, flesh the hardware & modify the GPS antenna project to use external one. Deadline: 10/20/21

09/30/21

Weekly Advisor Meeting 6

Group Members Present: Thomas Talbot, Shackman Ahmed, Dr. Madisetti,

Meeting Highlights:

Presented team updates from week 6, went over the timeline from the proposal presentation, we are on track with the timeline from the proposal presentation but need to focus on getting MQTT working on Nordic.

Group To Do's

10/02

Thomas - Send Dr. Madisetti the type of 3D printer that my roommate has and see if that will be sufficient. Also note what materials it is able to print, Deadline: 10/07/21

10/02/21

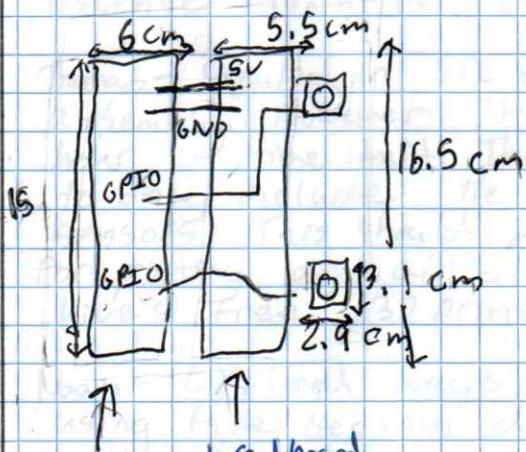
Thomas W. Falot

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Personal Work - Drawing the

Mechanical Assembly for embedded
device.

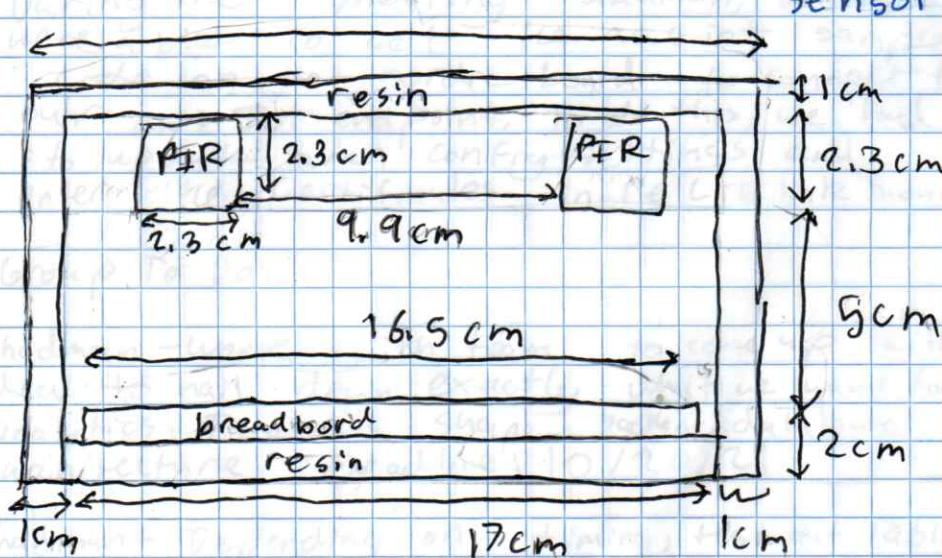
Top View: (no casing)



Right View:

pictured below
with box protecting
the entire embedded
system,

option 1: only has the
white 2.3x2.3 PIR
sensor exposed.



Concern: How will PIR sensor stay
fixed? Will we need to make the peephole
have a locking mechanism or snug fit?

Thomas w. Talbot

20

10/06/21

Team Meeting ?

Group Members: Thomas Talbot, Shadman Ahmed, Yue Pan, Noah Chong

Meeting Highlights:

Shadman - we will be able to use a Tableau license from the GT library

Thomas - Created an STL file of a 3d mechanical assembly. However, it exceeded the hive's 8 hour time limit. The design can be modified to only include the elliptical face for the sensors. This should decrease the time needed for printing and will allow us to use the hive's free 3D printing resources.

Noah - Explored ways to visualize our data rates using fake JSON data.

David - was able to get basic multithreading to work to blink two LEDs.

During the meeting Shadman, David, & Thomas were able to get the AWS IoT sample code on the Nordic board to connect to our AWS IoT endpoint. To do this, we had to update our config settings and enter the certificates in the LTE link monitor.

Group To Do:

✓ 10/10 Shadman - Work with team to come up with an idea to nail down exactly what we want for analytics. This will shape backend database architecture. Deadline: 10/20/21

✓ 10/10 Shadman - Depending on timing, test out Tableau in the library Deadline: 10/20/21

✓ 10/15 Thomas - Create an STL file for the top of Nordic board. Deadline: 10/20/21

21

Thomas vs Talbot

10/06/21

Team meeting week?

Group Members: Thomas Talbot, Shadman Ahmed, Yue Peng, Noah Chong

Group To Do: (continued)

10/19

Thomas - Break up the current design into the box and the front. Deadline: 10/20/21

(David)
10/12

Thomas - Integrate the aus-iot code with the passenger counting logic. Deadline: 10/13/21

10/10
(Shadman)

Thomas - Register the team for the senior design expo. Deadline: 10/13/21

10/10

Noah - Get updated bus information (RED bus routes missing). Deadline: 10/13/21

10/07

Noah - Continue making a robust front-end presentation for Thursday. Deadline: 10/07/21

10/12

David - Integrate GPS code with aus-iot program. Deadline: 10/13/21

10/07/21

Chamad w. tablet

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Figures

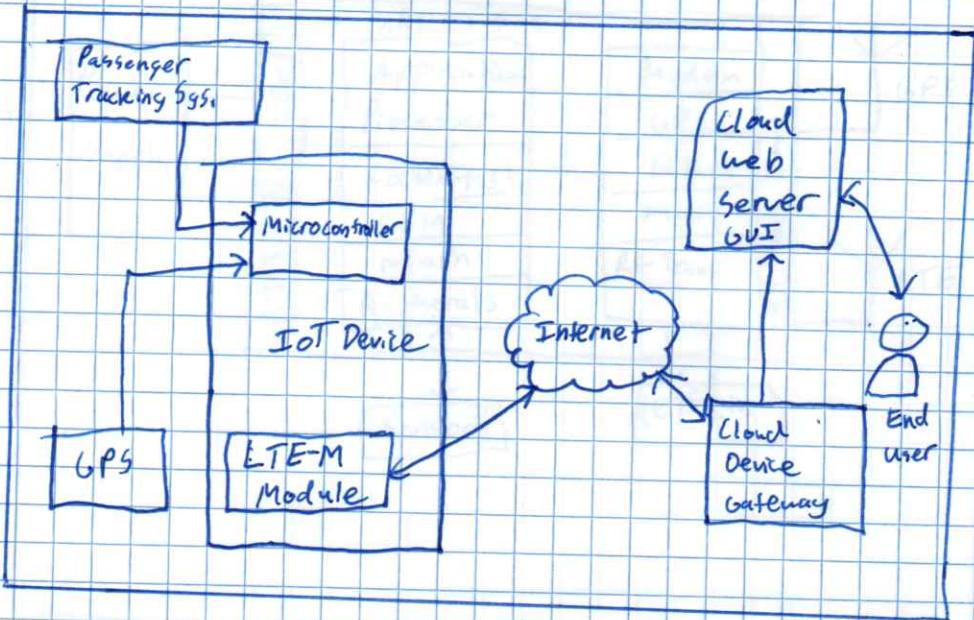


Figure 1. System level view of IntelliBus including the embedded system and web application.

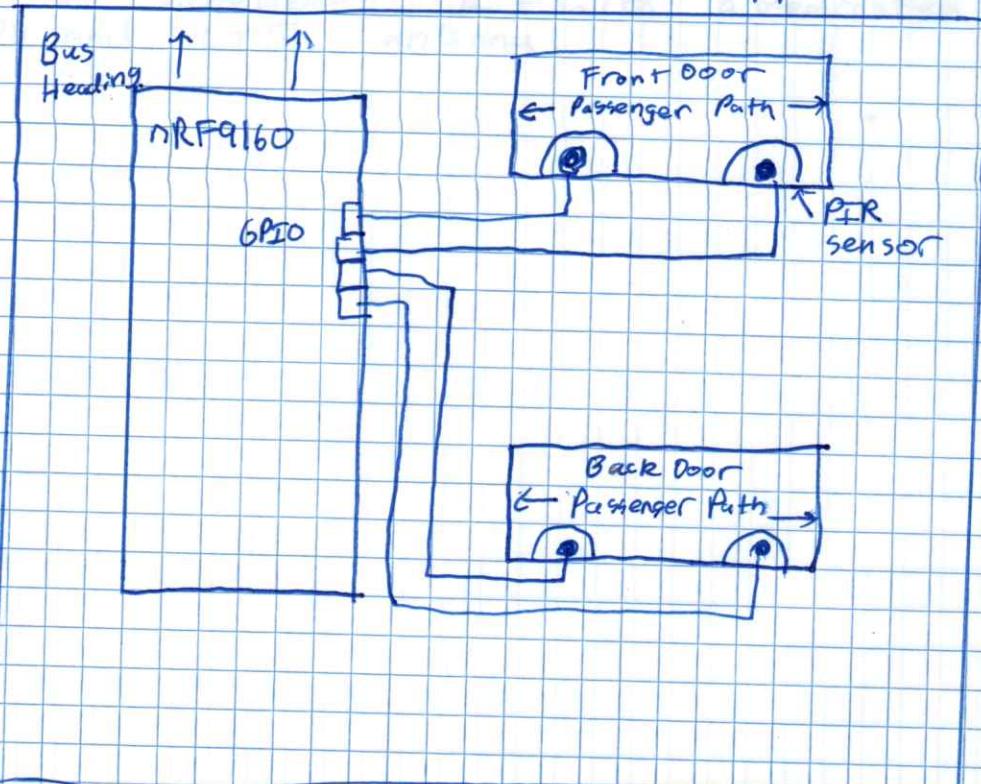


Figure 2. On-bus hardware organization detailing the PIR sensor placement.

10/07/21

Thomas W. Waller

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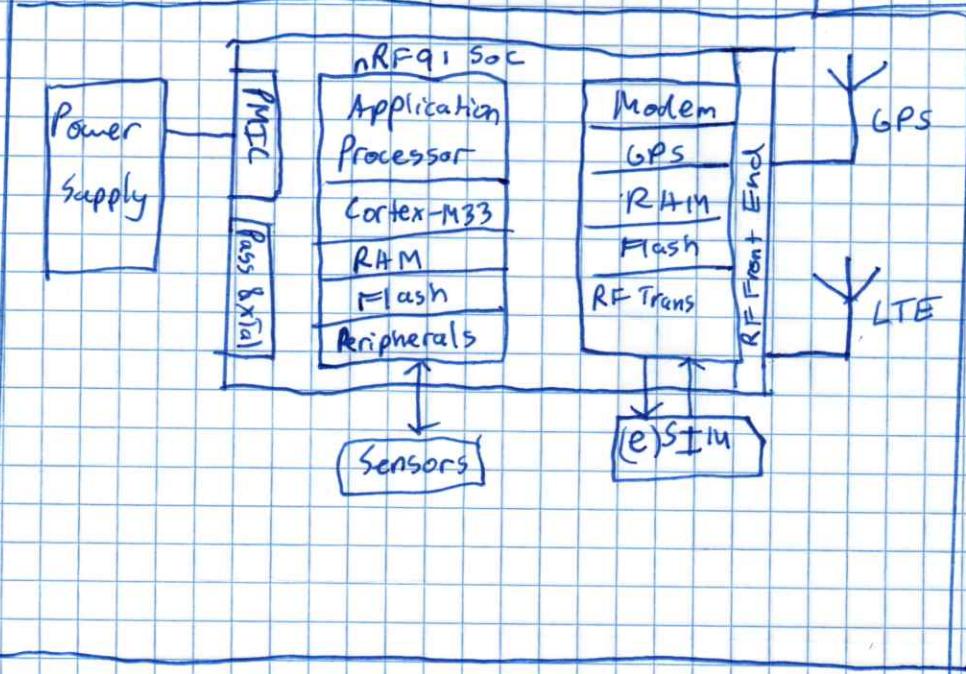


Figure 3. Detailed view of the nRF9160 cellular development kit with a dedicated GPS and LTE antenna.

10/08/21

Thomas in Talbot

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Weekly Advisor Meeting ?

Group Members: Thomas Talbot, Shadman Ahmed, Yume Pan, Noah Chong,

Meeting Minutes:

Dr. Madisetti emphasized checking out Firefly as an mqtt message broker

When we integrate AWS IoT sample code with the passenger counting logic we should be sure to carefully construct the data. For example: send over JSON data with an index bus ID, counter, GPS coordinates, timestamp, checksum, sequence #,

Noah presented his front-end map display with bus routes colored using CSS & Dr. Madisetti was very pleased.

Dr. Madisetti also liked our multithreaded programming model for using separate threads for GPS/LTE and passenger counting.

⑤
10/11

Thomas - Format JSON data with sequence # and timestamp. Deadline: 10/13/21

□

Noah - Color the entire bus route red, gold, etc.
Deadline: 10/20/21 Abandoned

⑥
10/11

Shadman - Research Firefly mqtt broker. Deadline: 10/13/21

10/13/2

Thomas M. Talbot

25

Team Meeting week 8

Group Members Present: Thomas Talbot, Yue Pan, Noah Chong, Shadman Ahmed

Meeting Highlights:

- Shadman and team registered for the senior design expo on 12/7
- The team brainstormed the MVP (minimum viable product) for the analytics dashboard.
- The analytics dashboard will include: 1) statistics showing # of total passengers and busses deployed; Passenger vs. time graph, A % change in passenger capacity; including: entered, exited and net change.
- Shadman led brainstorming session for the database architecture
- Thomas and David got the new microcontroller registered and began working with demo code in the IDE.

Group To Do:

10/19 David - Test out external GPS antenna and the new PIR sensors on the 2nd nordic board, Deadline: 10/20/21

10/19 Thomas - Create draft slides for proposal presentation. Deadline 10/20/21

10/27 Shadman and Noah - Architect and simulate the analytics side of the project. Create a dynamic endpoint to serve fake bus travel data, Deadline: 10/28/21

10/14/21

Thomas W. Talbot

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Weekly Advisor Meeting 8

Group Members: Thomas talbot, Yue Pan, Noah Chong, Shadman Ahmed.

Meeting Highlights:

- Each team member from the week, David has started testing the external GPS antenna, Shadman and Noah will begin prototyping the full database architecture and front-end analytics dashboard.
- On 10/28 the team will have the mid-term design review presentation. Dr. Madisetti requested that the team prepare a data sheet with initial results, architecture, and how the device compares with competition.
- Shadman research more recent use cases of passenger counting systems like "Transit"

Action Items

BT
10/19

Thomas - begin a draft of the datasheet for Madisetti on 10/28, Deadline 10/20/21
Switched to presentation

10/20/21

Thomas and Talbot

Team Meeting Week 9

27

Group members: Thomas Talbot, Noah Chang, Yue Pan, Shadman Ahmed

Meeting Highlights:

Thomas presented the draft of the datasheet for the presentation on 10/28. We assign sections to each group member. Thomas went to the HIRE this week to desolder the USB power and ground lines. However, ~~the~~ repair of the original board may not be possible at this point.

Group To Do:

- 11/01 Shadman - will continue working on creating fake bus movement JSON data with Python script, once that is done, create a development data pipeline to our architecture to serve the frontend. Deadline: 11/03/21
- 10/25 Shadman - Fill out section 5 of the datasheet on the data pipeline and add to section 7 on current status. Deadline: 10/27/21
Switched to presentation
- 11/01 Noah - will integrate fake bus movement data once endpoint is created. Deadline: 11/03/21
- Noah - Fill out section 7 of ~~the~~ datasheet (Analytics dashboard). Deadline: 10/27/21
Switched to presentation
- David - contact Nordic for potential warranty on original board. Deadline: 11/03/21
we received a backup one for free
- 10/26 David and Thomas - Test out LiDAR sensors on breadboard. Deadline: 10/27/21
- David - prepare notes for section 4 (Hardware System), deadline: 10/27/21
Switched to presentation

10/21/21

Thomas W. Talbot

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Weekly Advisor Meeting 9

Group Members: Thomas Talbot, Shadman Ahmed, Yue Pan, Noah Chong

Meeting Highlights:

LFOAR with a transmitter/receiver path might be ~~a~~ a better option than the 4180 distance sensor.

what, why, how, status, Other approach, Problem, Requirements, Approach, Better than other systems, Current status,

~~30min~~ • Dr. Madisetty would rather see a presentation instead of a datasheet,
~~status of each~~

For design review presentation:
Give current status of each piece, and limit to 30min.

Group To Dos

10/21

Thomas - Schedule a team meeting for early next week to go over slide content for Design review presentation. Deadline: 10/22/21

10/21

Thomas - Transfer information from the datasheet to the design review presentation. Create the additional slides needed beyond what was in the proposal presentation. Deadline: 10/22/21

10/23/21

Thomas W. Talbot

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Hardware Testing with LIDAR

Group Members: Thomas Talbot and Yue Pan

I was able to get the VL53L0X working on an I₂C bus on the ARM board microcontroller. Two LIDAR sensors can be used with a distance threshold value to detect passengers entering/exiting.

The LIDAR sensor has a 33ms time delay which is much better than the 3s time delay on PIR.

The main disadvantage of the LIDAR sensor is that it can only detect movement directly in front of it. This can be mitigated by placing the sensors at chest height.

Action Items:

11/02

Thomas - Visit the hive to 3D-print sensor housing for the VL53L0X. Deadline: 10/29/21

Thomas - Potentially send the passenger count data over USB to the Nordic board "if David cannot get I₂C to work on Nordic. Deadline: 11/03/21 we send passenger count signals over GPIO

10/27/21

Thomas in Talbot

30

Group Meeting 10

Group members: Thomas Talbot, Noah Chong, Shadman Ameed, Yifei Pan.

Meeting Highlights: Shadman got a fake bus route mapped out. He has a dump of about 300+ GPS coordinates. He also added a slide on the data pipeline to the design review presentation.

I was able to get the VL53 L0X LiDAR sensors on the mbed I2C bus. I integrated the LiDAR sensor distance threshold with the passenger counting logic. I also added a slide to the Design Review presentation on the 30 sensor housing.

Noah added slides to the design review presentation on the Analytics Dashboard and the Map Display

David fixed the cans iot ~~heat~~ project on the 2nd Nordic board. He also researched the I2C libraries for the Nordic board.

Shadman - Got fake bus route data mapped out with a dump of 300+ coordinates.

Action Items:



11/17

Shadman: Take fake bus route data up to follow sequential order. Deadline: 11/03/21



11/17

Shadman: Write python script to enter bus route data into a timed Python script. Deadline: 11/18/21



11/02

Thomas - Go to the Hive to pick up 30 printed sensor mounts, print out the microcontroller base. See if the first board can be brought back to life. Deadline: 11/03/21



11/01

Noah - send an email to Aaron Fowler to see if he can get our device on PTS bus. Deadline: 11/03/21



11/02

Noah - Finish creating mock analytics dash board. Deadline: 11/10/21

10/27/21

11/17

✓ Invoiced in Tallet

David - Try to get I²C working on the
Nordic board to test out the LIDAR sensors.
Switched to Arduino I²C.
Deadline: 11/16/21

31

10/28/21

Thomas M. Talbot

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Weekly Advisor Meeting 10

Group Members Present: Shadman Ahmed, Noah Chong, Yue Pan, Thomas Talbot, Dr. Madisetti;

Meeting Highlights: Today we presented our 30 min Design Review presentation to Dr. Madisetti and he was pleased. On the Problem and Solution areas we need to add in Quantitative numbers about the current problem facing transportation authorities. The Engineering requirements side should also have an accuracy number that we are aiming for. He was happy with our schedule and we were on time to do total system integration.

For the demo we can build an artificial gateway for data and use mock GPS coordinates, keep the GPS fixed for the demo site and only show the passenger counting system working as a stationary bus.

Group to do:

- Noah - update the problem and solution slide to have quantitative numbers, 11/04/21
- Thomas - Update engineering requirements slide to have accuracy numbers, 11/04/21 - Deadline
- Thomas - Change 3D printed sensor housing to have a wall in the middle. 11/04/21 - Deadline
- Thomas - Go to hire and purchase wood for the project; Deadline: 11/04/21

10/28/21

10/28/21

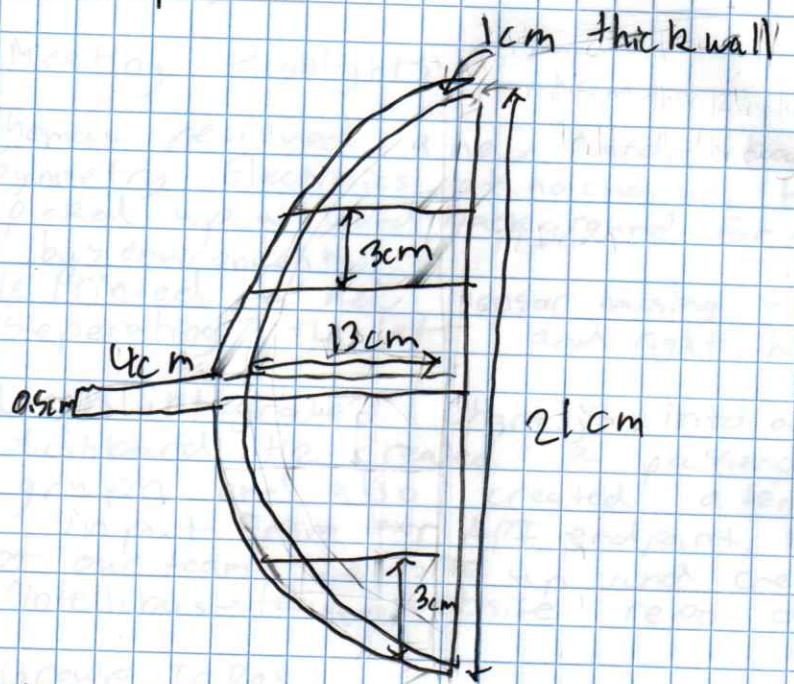
Thomas in Talbot

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Sketch of what I want sensor

Housing to look like.

Group Members: Thomas Talbot



The inner wall is 4.5cm high

The outer wall is only 1cm high.

This is iteration two of my sensor housing.

Thomas M. Talbot

11/03/21

Team Meeting 11

Group Members: Thomas Talbot, Shadman Ahmed, Noah Chong, Yee Pan

Meeting Highlights:

Thomas received a new Nordic board from Symmetry Electronics at no charge. He also picked up a wood background for the simulated bus environment.

He printed a new sensor housing with a wall separating the left and right hand side.

Noah integrated Chart.js into our analytics dashboard. He created a passengers vs. time graph and also created a templated JSON input from our API endpoint. Noah also got our team website up and created an 'intellibus-team-website' repo on GitHub.

Group To Do's

Thomas - print out a second casing for the Nordic board. Deadline: 10/17/21

11/10 Thomas - glue the wood together that will be used as a background or purchase new wood. Deadline: 11/17/21

11/12 Thomas - Drill holes in the new sensor housing to run wires to the mbed / Nordic. Deadline: 11/17/21
- Switched to cardboard box 11/12/21

11/23 Thomas - test the LIDAR sensors on mbed with wood background and the new sensor housing with wall. Deadline: 11/10/21

11/17 Thomas - Register the new Nordic board. Deadline: 11/10/21

11/09 Noah - Set up green route into our data pipeline. Deadline: 11/10/21

11/03/21

Thomas W. Falchet

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Group To Do continued...

- 11/29 Shadman - create a synthetic API system and test it sending data to MQTT broker on Aws IoT. Deadline: 11/17/21
- Shadman - Create an SNS queue. Understand how it works and how we can get sequential data from it in Lambda and then our API. Deadline: 11/17/21 switched to Kinesis Stream
- 11/16 Shadman - Add rules for storing into DB. Deadline 11/17/21.

11/10/21

Thomas W. Talbot

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Team Meeting Week 12

Group Members: Thomas Talbot, Shadman Ahmed, Yue Pan, Noah Cheng,

Team Updates:

Thomas - 3D printed the 2nd nordic microcontroller casing. I looked into the Design Expo poster it is due on 12/7 and needs to be 4x3 we can print out on 3rd floor of Price Gilbert. The final report is due on 12/13 and requires updates since 4871.

Shadman - Completes making the MQTT synthesizer, so now we have mock coordinates being sent to the broker. We also discussed logic for ingress/egress on mock APC.

David - The new infrared sensors perform much better than the original PIR sensors. However the effective range is only 20cm, we should pivot to using LiDAR with the Arduino I2C library.

Noah - His startup may result in future time conflicts, He added bus icons to the map

Action Items:

11/19 ✓ Thomas - find a suitable power Point template for our poster! Deadline: 11/23/21

11/12 ✓ Thomas - modify the 3D printed sensor housing for LiDAR to eliminate the curved shape, Deadline: 11/17/21

11/16 ✓ Shadman - Create AWS resource to Stream/Queue our MQTT data. Add a random number generator for passenger ingress/egress, Deadline: 11/17/21

11/15 ✓ David - integrate passenger count with aws-iot to send data to Shadman. Deadline: 11/17/21

11/11/21

Thomas & Talbot
weekly Advisor Meeting 12

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Group Members: Thomas, Talbot, Noah Chong,
Kee Pan, Shadman Ahmed

We presented our team updates to Dr. Macisett; and he had no feedback. The goal for everyone is getting HW integrated with Cloud datapipeline before time runs out.

There were no new action items from this meeting.

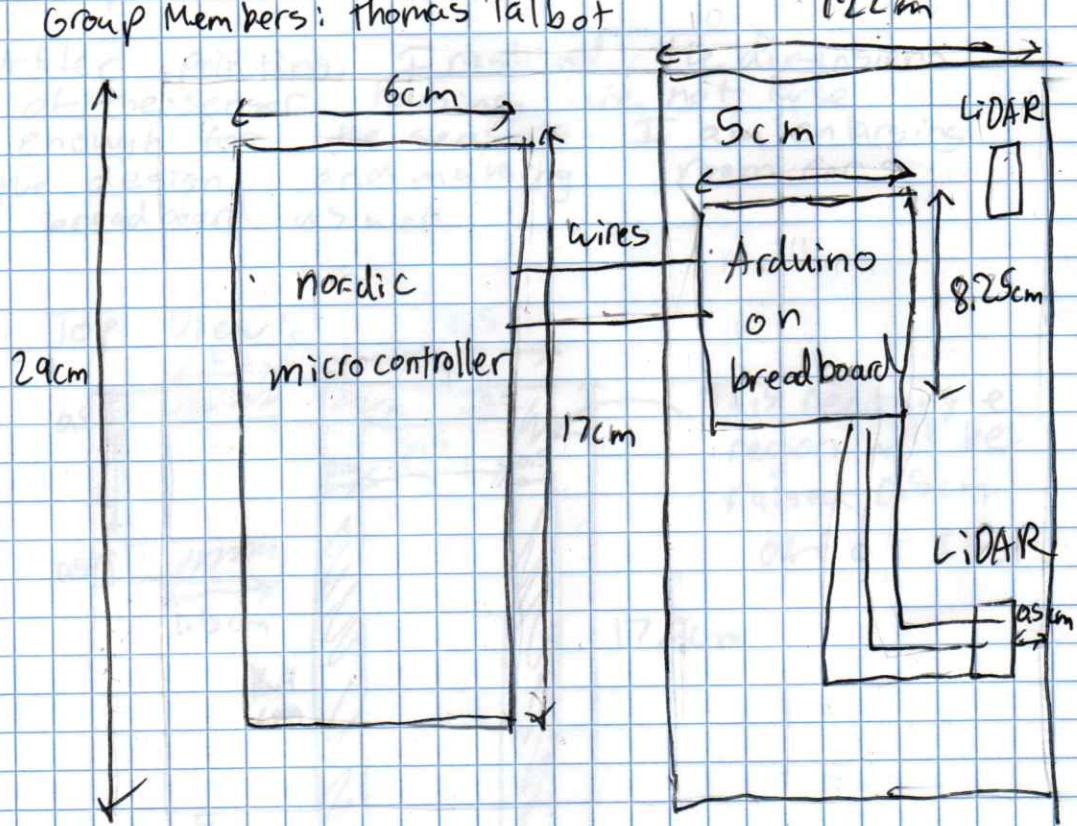
IV/12/21

Thomas W. Talbot

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Sketch of sensor housing
for LiDAR sensors

Group Members: Thomas Talbot

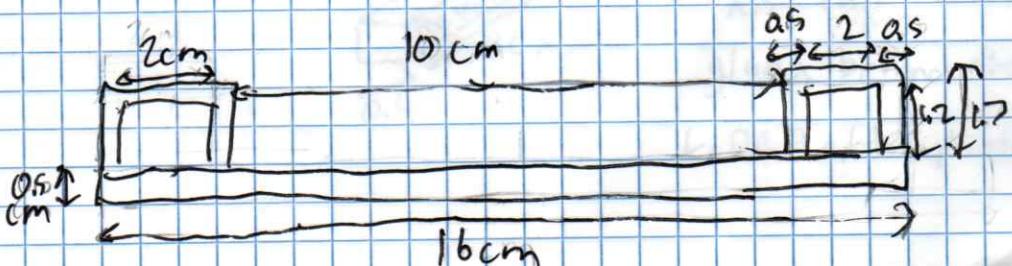


The VL53L0X ToF LiDAR sensor dimensions

16 mm height 19 mm width

The front facing view of the 3D printed housing

all distances are in cm



11/16/21

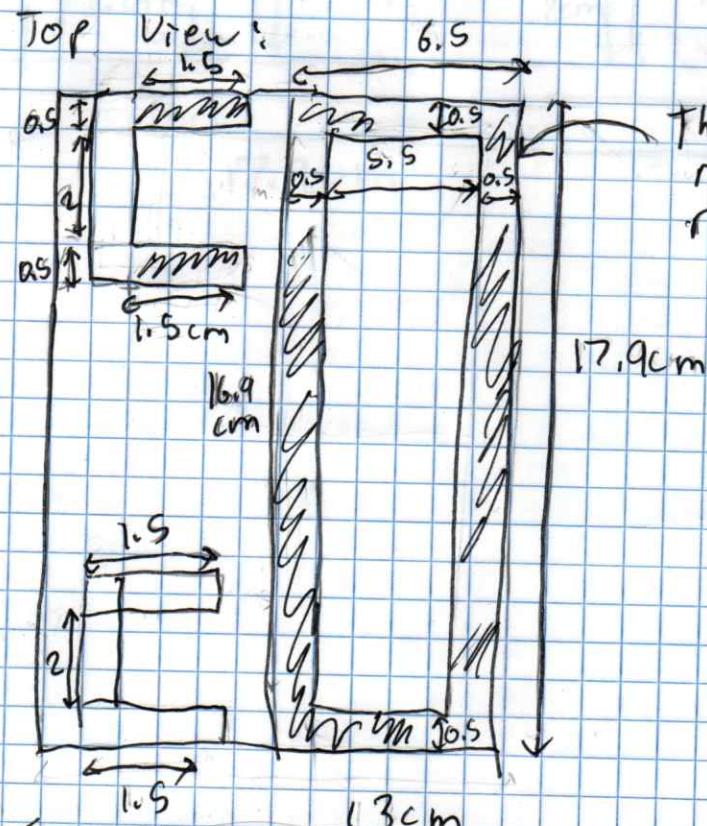
Thomas W. Talbot

Sketch of sensor housing

for LiDAR sensors revised.

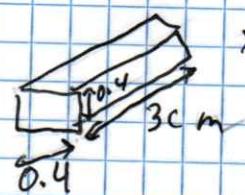
Group Members: Thomas Talbot

After printing, I realized the dimensions of the sensor housing are not large enough for the sensors. I am enlarging the design and making room for a breadboard as well.



Separately
wires

3D print something to protect the



this can be
glued behind the
LiDAR after printing.

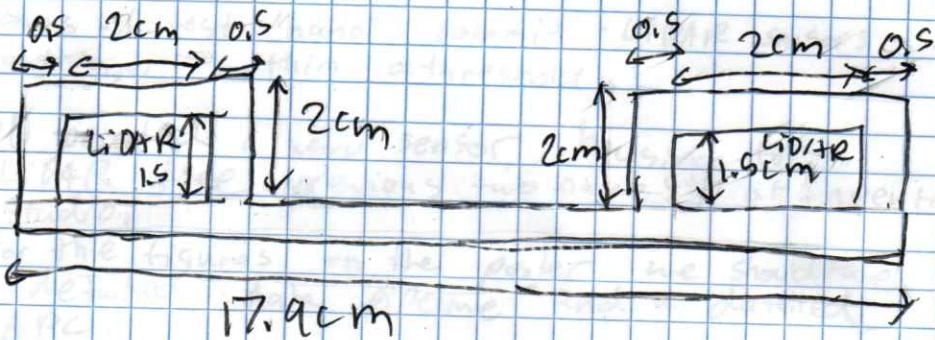
39

11/16/21

Thomas W. Talbot

40

Group Members: Thomas Talbot
Side
Sketch of ~~top~~ view of LiDAR housing



11/17/21

Thomas W. Talbot

4/1

Team Meeting week 13

Group Members: Thomas Talbot, Yue Pan, Shadman Ahmed, Noah Chong

team Updates:

Thomas - Latest "nano" commit - LiDAR sensors to trigger within a threshold.

- 3D printed a new sensor housing for LiDAR (see previous two pages), at Invention Studio,
- For the figures on the poster we should have a detailed data pipeline and a detailed APC.

Shadman - have a SVS Queue set up with an IoT Rule that puts MQTT data on queue.
we have scheduled a team meeting for Tues. 11/23

David - The multi threading of a niosiot project and GPIO project have been combined. Also worked with Thomas to read from I2C LiDAR sensors.

Action Items:

11/21 Thomas - Fill out poster brainstorming sheet and make APC figure for the poster. Deadline: 11/23

Create a new 3D printed housing that does not have a breadboard. Deadline: 11/23 Abandoned

11/19

- Go to the library to purchase ~~a wood backdrop~~ see where poster printing happens Deadline: 11/19
- Test out LiDAR sensors with new 3D printed housing. Deadline: 11/19.

11/21

- Purchase a wood backdrop for the project! Deadline: 11/23

IV(1/21)

Thomas W. Tallet

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Team Meeting week 13 continued ...

Action Items continued

D

Shadman - work on getting SNS queue from lambda function, Deadline : 1/23 (changed to Kinesis Stream)

P

1/29

Shadman - make an API endpoint to pull latest info from queue, Deadline : 1/23

1/21

Shadman - work on adding random passenger counts to the green route, Deadline: 1/23

T

1/21

Noah - Create colored routes for green and red using geoson.io, Deadline : 1/23

B

1/21

Noah - work with Shadman to process the queued MATT data, Deadline : 1/23

11/18

Thomas m. Talbot

Group Members: Thomas Talbot, Shadman Ahmed, Yue Pan, Noah Chong.

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Advisor Meeting week ~~12~~ 13

Team Updates: members went round robin and shared their updates for the week. Shadman asked Dr. Madisetti about implementing a Kinesis data stream.

Action Items:

11/21 D

Thomas - think about how to incorporate the LiDAR testing with numerical results, deadline: 11/23/21

I could have a column for distance away in mm and a column for accurate count,

11/23/21

Thomas W. Talbot

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Hardware Team Meeting LiDAR Results

Group Members: Thomas Talbot and Yue Pan (David)

The purpose of this meeting is to collect numerical data on the accuracy of the LiDAR sensors and passenger counting logic.

The threshold distance in the Arduino code was adjusted from 30 mm - 1000mm

Threshold (1000 mm)	Sensor 2	Sensor 1	Psg Count
IN	1	0	0
	1	1	1
	1	1	2
	1	1	3
	0	0	3
	1	1	4
	1	1	5
	1	1	6
	1	1	7
Leaving Bus	0	0	
OUT	0	0	
	1	1	6
	1	1	5
	1	1	4

45

Thomas W. Falter

Sensor 2

Sensor 1

P5g Count

11/23/21

1

0

4

1

0

4

1

1

3

1

1

2

1

1

1

800 mm

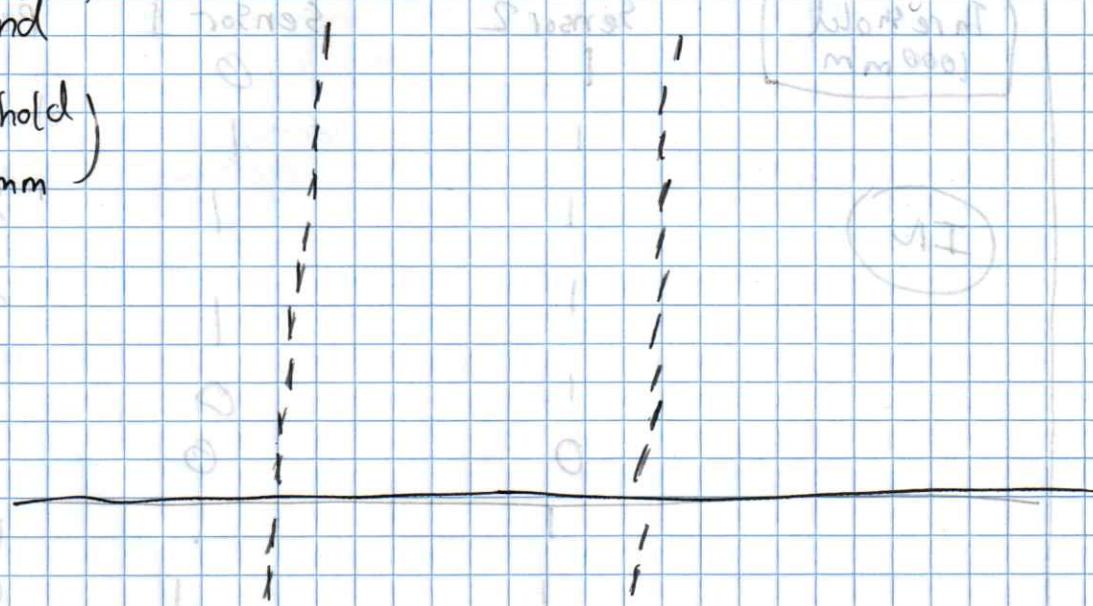
Round

(threshold)

1000 mm

Sensor 2

Sensor 1



* This round was disqualified from results
since it used the incorrect threshold.

800 round
threshold 800mm

11/23/21

Thomas M. Teller

L 46

Sensor 2

Sensor 1

Psg Count

1
2
3
4
5
6
7
8
9
10

9
8
7
6
5
4
3
2
1
0

(IN)

(OUT)

in front of sensor 1 position 800+ mm
then moving 700 mm to the right
returning to original point again and afterwards

600mm

11/23/21 Obunco m2000

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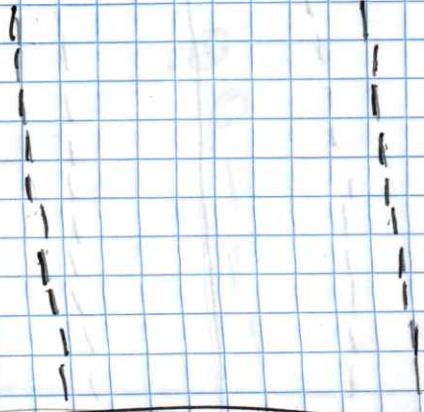
Sensor 2

Sensor 1

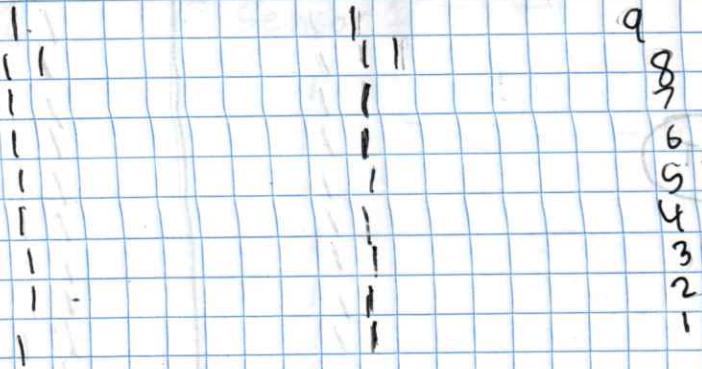
P3g count

1
2
3
4
5
6
7
8
9
10

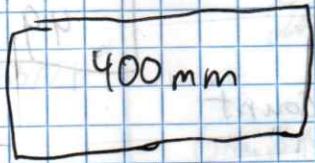
(IN)



(OUT)



* Note: When test subject waved his hand in front of 2nd sensor before first sensor it counted him going the opposite direction



11/23/21

Thomas W. Dohle

L 48

Sensor 2

Sensor 1

Psg Count

(IN)

/ / / / / / / / / /

/ / / / / / / / / /

1
2
3
4
5
6
7
8
9
10

(OUT)

/ / / / / / / / / /

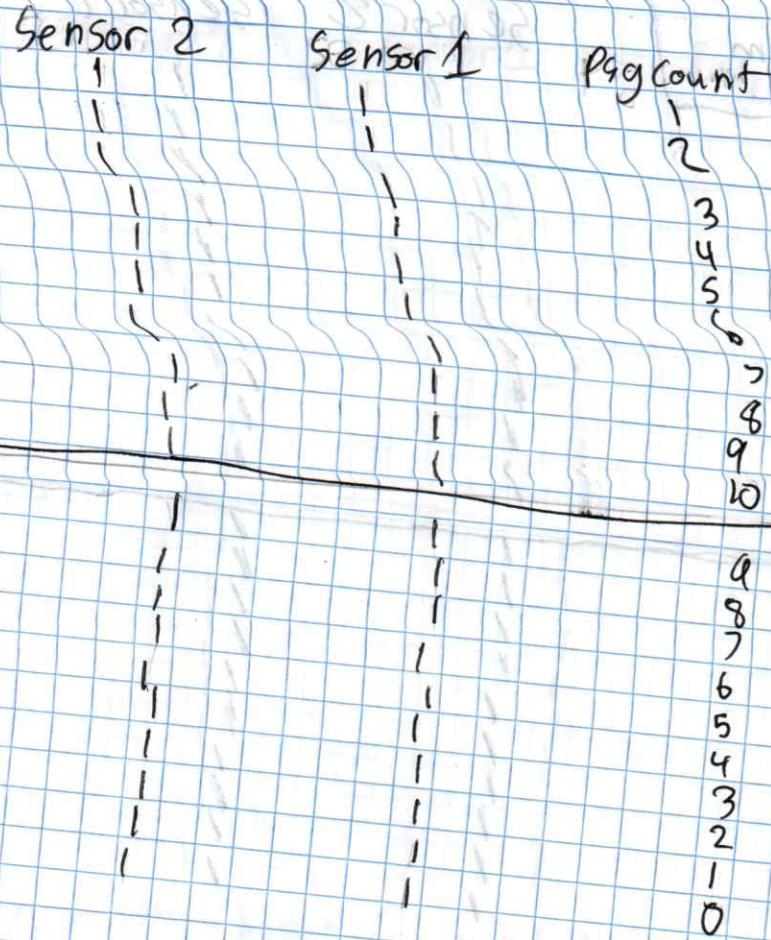
/ / / / / / / / / /

9
8
7
6
5
4
3
2
1
0

11/23/21 Idrissa m. Falu

200 mm

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Discussion of LiDAR test results: The LiDAR sensors performed as expected in their advertised range of 30mm-1000mm. At 1000mm, the sensor only performs with about 65% accuracy.

The LiDAR sensors will operate within a typical bus doorway (2.5 feet). The results from today's test were incorporated into the Expo Poster figure on sensor precision.

During the live demonstration, the sensor threshold distance was set to 500mm based on this test.

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11/23/21

Thomas w. David team meeting week 14

50

Group Members: Shadman Ahmed, Thomas Talbot, Noah Chong, Yue Pan

Team Updates:

Thomas - 3D printed LiDAR box at the Aero Maker Space, created a schematic for the APC for the design Expo poster, also created tables to show experimental results of LiDAR sensor testing, created wooden backdrop for sensors,

David - Sent data from Nordic board to AWS IoT gateway using a "Device Shadow".

Shadman - worked on creating an API proxy for consuming Kinesis Stream.

Group To Do:

11/23

Thomas - check on status of 3D prints. Deadline: 11/23/21
Printed by 12/13

11/26

Thomas - Fill out the Results & Methodology section of the Expo poster. Deadline: 11/28/21

11/29

David - Test out the added logic on Nordic board to discount a rising edge after 3 seconds.
Deadline: 11/28/21

David - work on integrating passenger counting project with GPS. Deadline: 11/28/21 Abandoned

12/03

Shadman - Create documentation for the Expo Poster
Deadline 11/28/21

12/02

Shadman - add random counts to MATT synthesizer.
Deadline 11/28/21

11/27

Shadman & Noah - test out the GUI with the backend. Deadline: 11/28/21

11/27

Shadman & Noah - Create API endpoints of other dashboard items (like current bus count and passenger change etc.). Deadline: 11/28/21.

~~12/01/21~~

Thomas in Talbot

Team Meeting week 15

51

Group Members: Thomas Talbot, Yue Pan, Shadman Ahmed, Noah Chong

Team updates:

Thomas - Filled out sections of the Expo Poster, including purpose statement, problem, solution, and work relating to the embedded system.

Thomas - Verified his sections of the Final Project Report.

Thomas & David - added edge case for out of order sensor triggering. Resets the passenger counting logic on the Nordic after a false out of order triggering.

Shadman - Live MQTT data is available from API endpoint (from Kinesis stream).

David - received 2nd board from Thomas and registered with Nordic Cloud service.

Group To Do:

12/14

Thomas - Print out Expo Poster. Deadline 12/3/21

12/10

Thomas - Add Figures from the poster into the Design Review presentation. Deadline 12/3/21

12/14

Thomas - Draft recording of the beginning of the Expo video. Deadline: 12/3/21 (Not completed)

12/13

Shadman - Add a data pipeline graph to the Expo poster with the average end-end latency. Deadline: 12/3/21

12/14

David - Send an email with Lab reimbursement info for parts ordered. Deadline: 12/6/21

Thomas W. Zellot

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12/1/21

Group To Do Continued..

12/2
TODAY

David - Send an email to senior design lab to ask about AWS refund. Deadline: 12/3/21

12/2
TODAY

Noah - Add images of the map display and the analytics dashboard to the front end map display. Deadline 12/3/21

12/2
TODAY

Noah - Create a bar chart for the active busses
Deadline: 12/3/21

12/21

Thomas n Talbot

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Weekly Advisor Meeting IS

Group Members: Thomas Talbots, Yue Pan, Shadman Ahmed, Noah Chong

Each team member went around and presented their updates from the weekly team meeting.

Action Items:

12/2 Thomas - Send Dr. Madisetti an email with the team's Expo booth number, cell phone number, and Expo Grant details. Deadline: 12/2/21

12/3 Thomas - send Dr. Madisetti an email with the Expo poster and the results of tomorrow's live bus demonstration. Deadline 12/3/21

12/3 Shadman - Provide hardware team with the ability to log into AWS and view data pipeline. Deadline 12/3/21.

12/5/21

Thomas Talbot

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Team Testing Meeting for Full System integration

Group Members: Thomas Talbot, Yue Pan, Noah Chang, Shadman Ifthimad

At the team meeting we selected the Expo poster that we will use at the expo.

We also uploaded the historical documentation to the website for ECE4871.

During the meeting, we video taped the full system integration of our project, showing the passenger counting with LiDAR, sending packets over the LTE network, and updating the count in the database.

Group To Do:

12/8

Thomas - assign parts of the final report.
Deadline: 12/8/21

12/7

Thomas - bring poster, shoebox, and backdrop to the Expo. Deadline 12/7/21

12/6

Noah - Put together the video for the Expo.
Deadline 12/6/21

12/6

Noah - Add all three streams to the front end. Deadline 12/6/21

12/6

Noah - Update the team website. Deadline 12/13/21

12/7

Shadman - Bring easel and table, and extra monitors to the Expo. Deadline 12/7/21

12/7

David - Write code to fix the count ingress/egress data on webpage. Deadline 12/17/21

12/6

David - Submit request for project reimbursement.
Deadline 12/06/21

12/7/21

Thomas Talbot

Senior Design Expo

55

Group Members: Thomas Talbot, Yue Pan, Shadman Ahmed,
Moh Chony

The following code is running on the Arduino Nano:

<https://github.com/Intellibus-SeniorDesign/intellibus-embedded-app/tree/nano/LiDARWithArduino.cpp>

The following code is running on the nRF9160 during the demos:

https://github.com/Intellibus-SeniorDesign/intellibus-embedded-app/blob/nRF9160/intellibus_auisiot_counting_reset.c

During the Expo the team received positive from judges and attendees. The passenger count and map display functioned as expected.

However, because this was down in the East coast we were unable to show our full data visualization.

We met our advisor Dr. Lijay Modisetti and he was pleased with our work.

Action Items:

- Thomas & David - return reimbursed parts to the senior design lab in Van Leer. Deadline: 12/14/21
- Moh - update the executive summary & approach of Final Report. Deadline: 12/13/21
- Thomas - update the conclusion, tech specs, schedule, cost analysis, of the Final Report; Deadline: 12/13/21
- David - update the introduction, design approach, and project demonstration of final report. Deadline: 12/13/21
- Shadman - update the design approach & conclusion of final report. Deadline: 12/13/21