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Team 22: Smart Cricket Bat
Bi-Weekly Update 3

Team members: Pablo Barron
Gavin Dahl
Jiakai Hu
Nolapat Pipitvitayakul
TA: Fardeen Hasib Mozumder
Sponsor: Pranav Dhulipala

Project description

- Problem: “Cricket practice equipment lacks effectiveness without the assistance and guidance of a coach”

- Solution proposal: “Create a device that will mount on the cricket bat and, through a user friendly app, gives real time feedback on the user’s cricket swing i.e. efficiency and swing angle. Must be easy to use and set up”

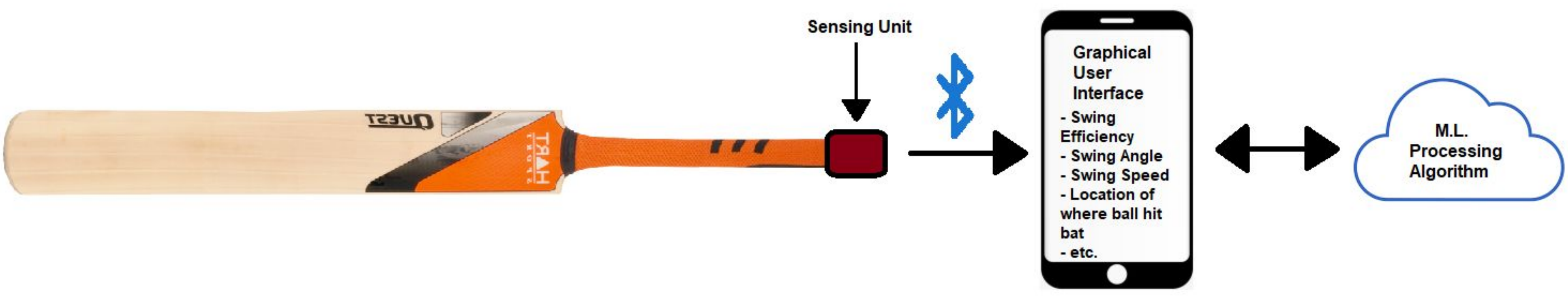

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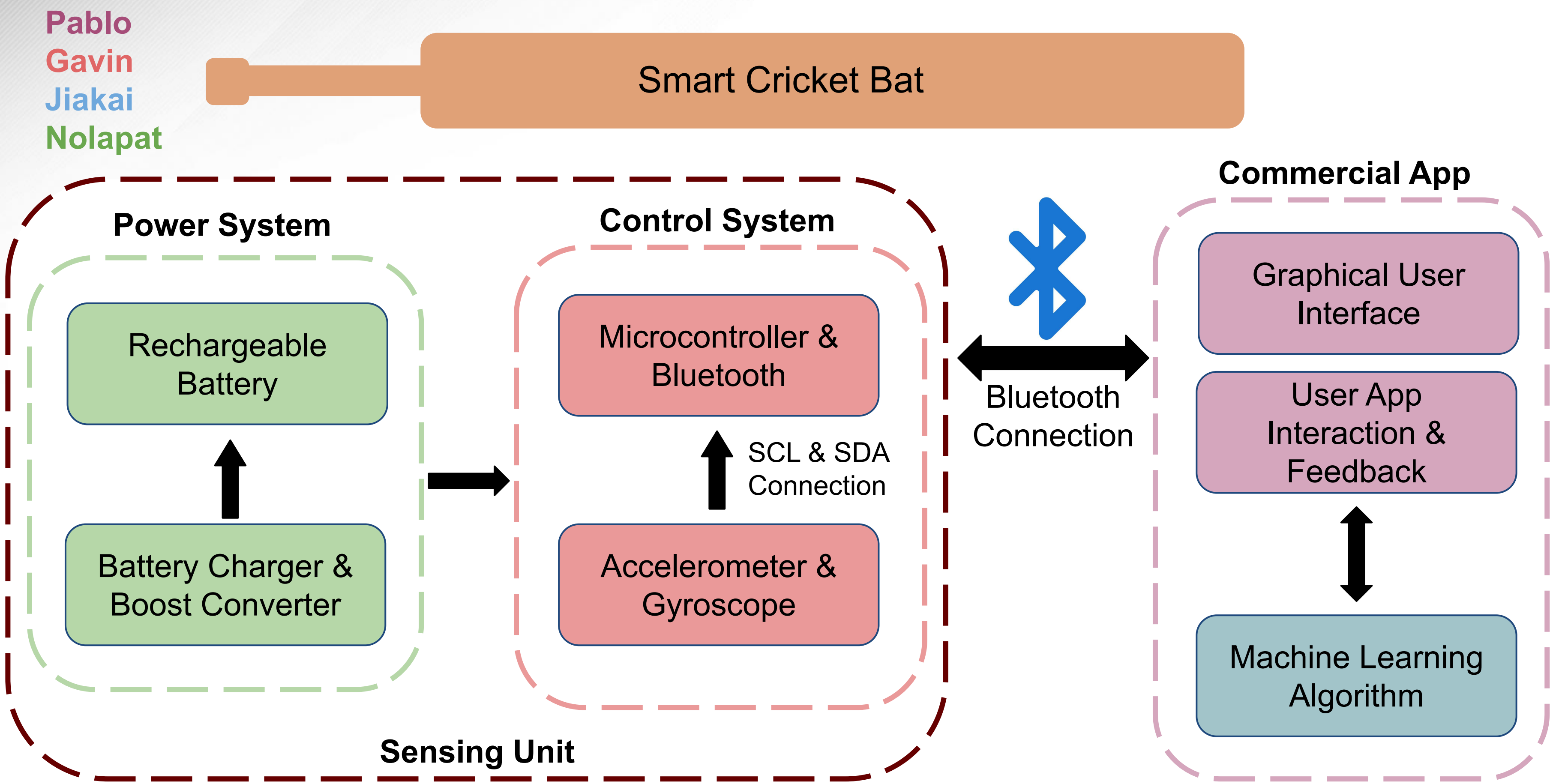
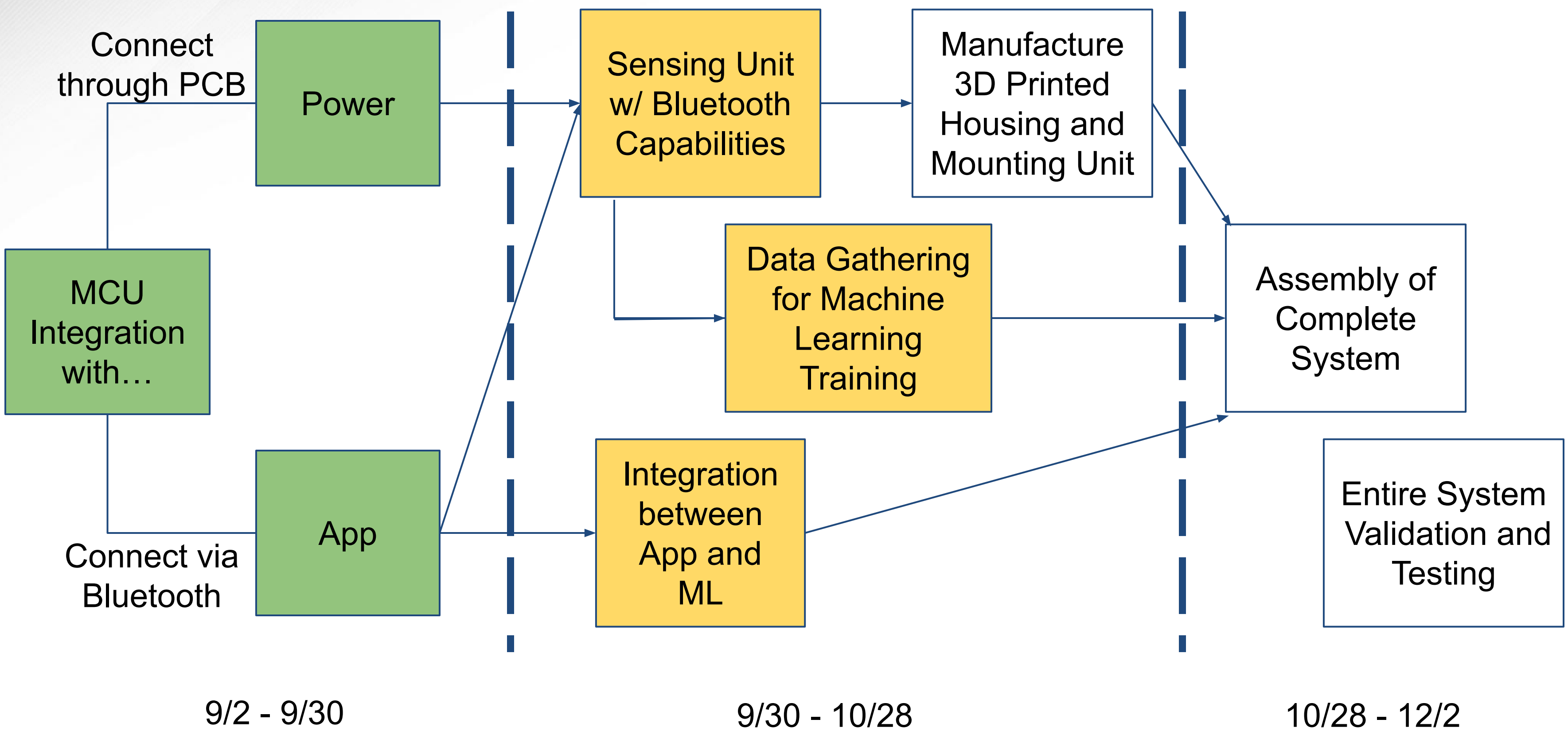
Diagram of subsystems and interface



Subsystem Overview

- Android App: Will handle user interaction and communication between the MCU and the ML algorithm. The app receives data from the MCU via a bluetooth connection. The app will then send received data to ML algorithm to be processed
- Power: Contains the boost-converter, on-board lithium battery power supply, and recharging station
- ML Algorithm: Develop the ML algorithm for finding the specific characteristics of users swing
- Control : A sensing unit that will communicate the IMU values from the swing to the user app through an MCU with bluetooth capabilities

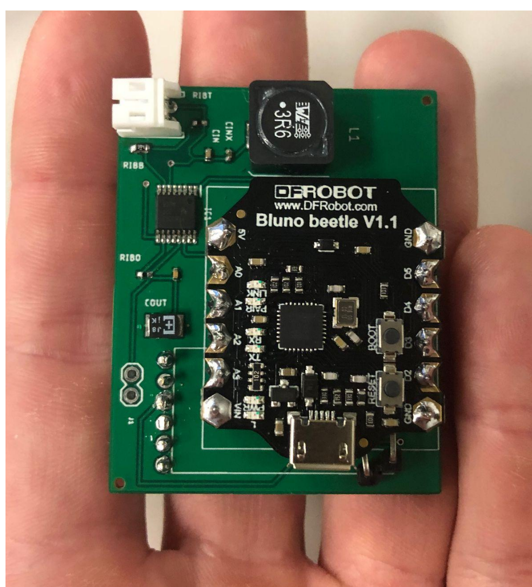
Project Timeline

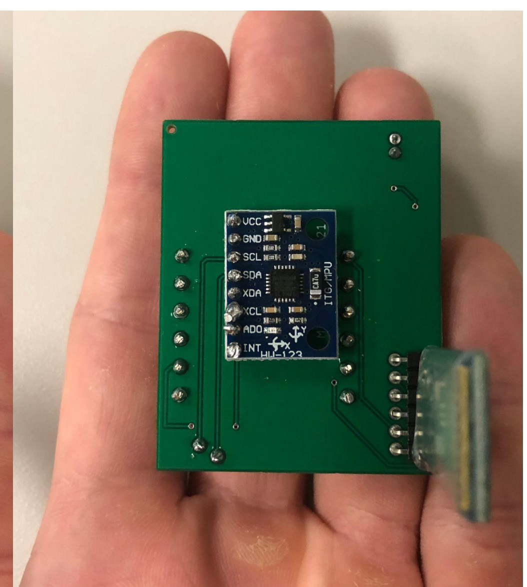


Control System

Gavin Dahl

Accomplishments since last presentation 18 hr of effort	Ongoing progress/problems and plans until the next presentation
● MCU/App Integration ● Assembled control parts of PCB ● Basic tests performed to confirm it works as intended	● PCB validation ● Housing Unit Design ● Start ML data collection

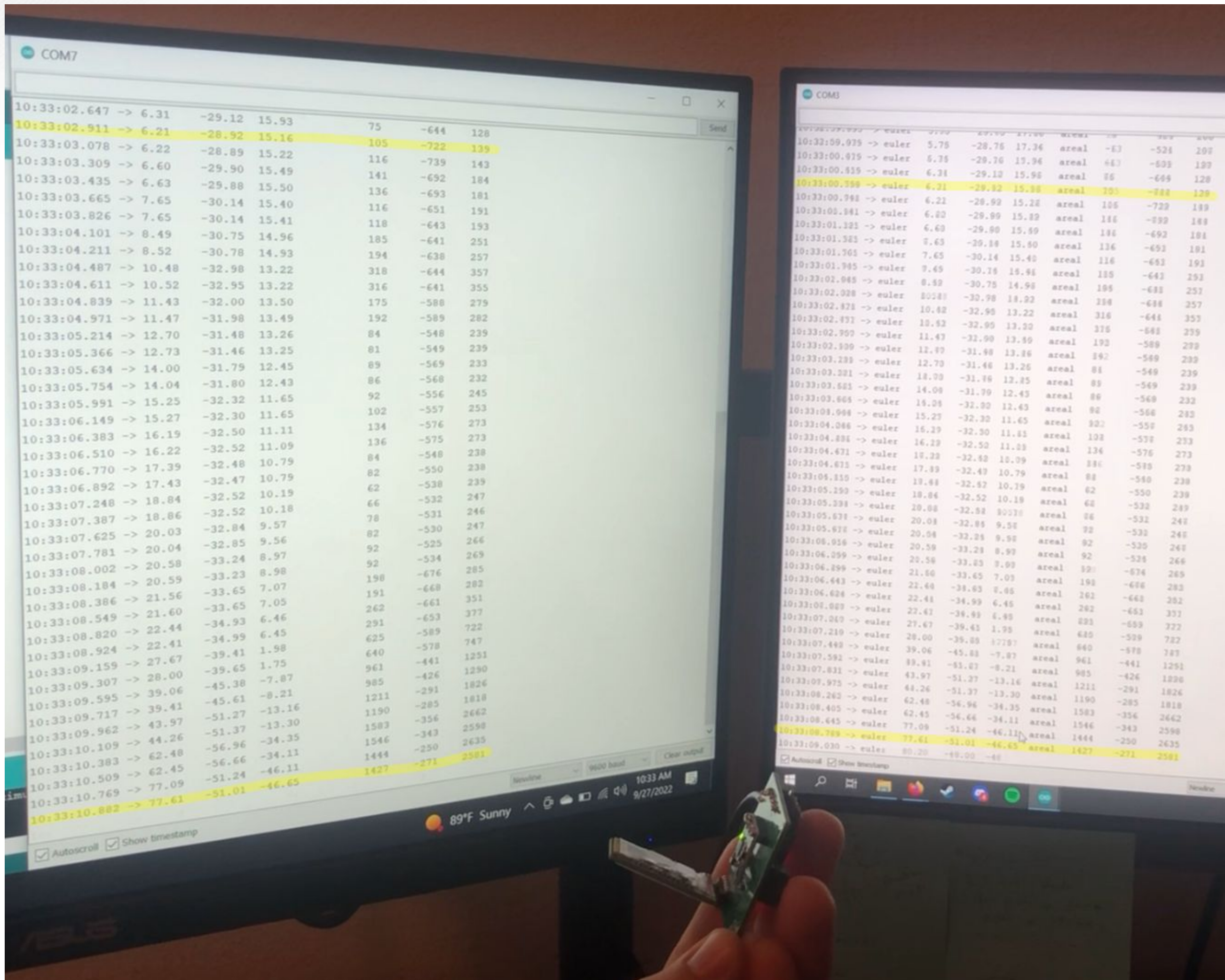




Control System

Gavin Dahl

- Left: Bluetooth
- Right: MCU
- ~2 sec delay in data transfer
- No gaps or inconsistencies in data

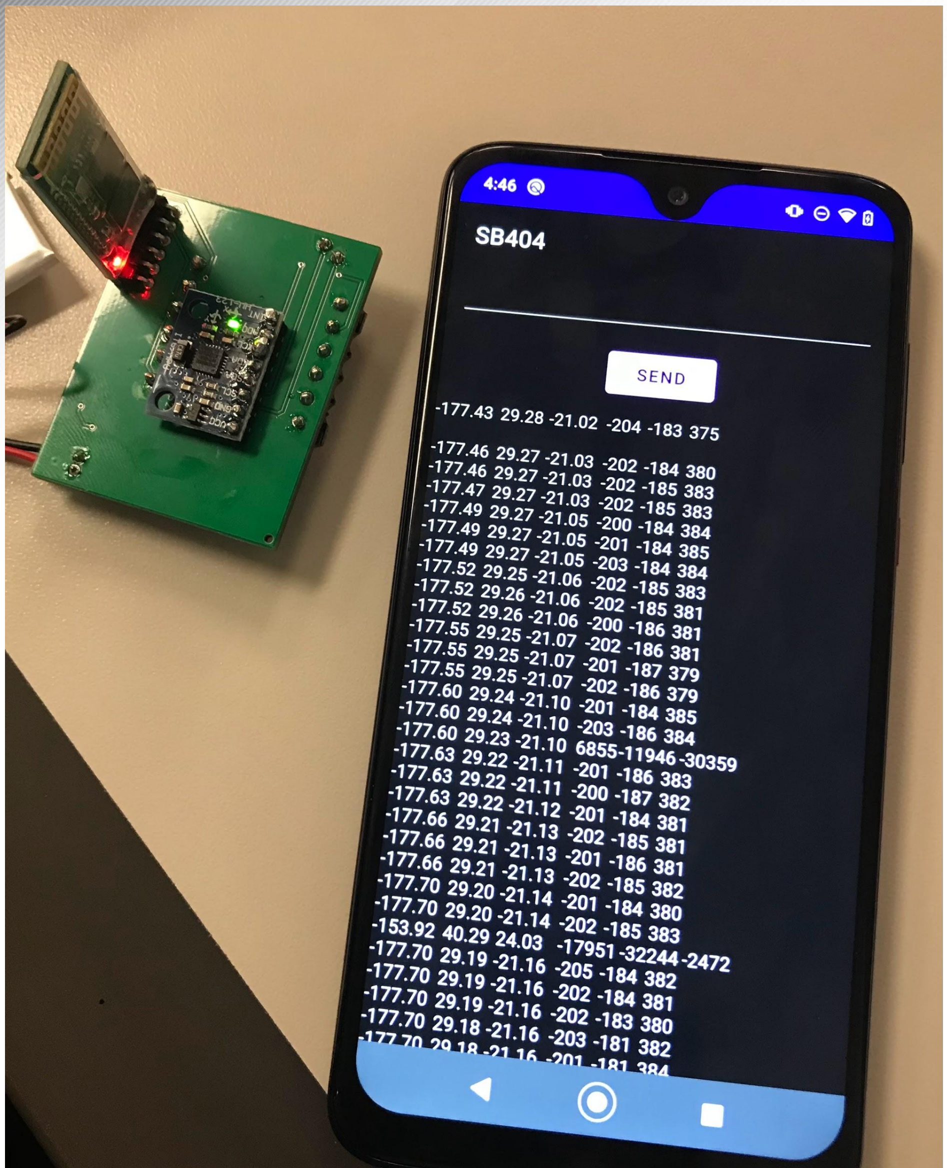


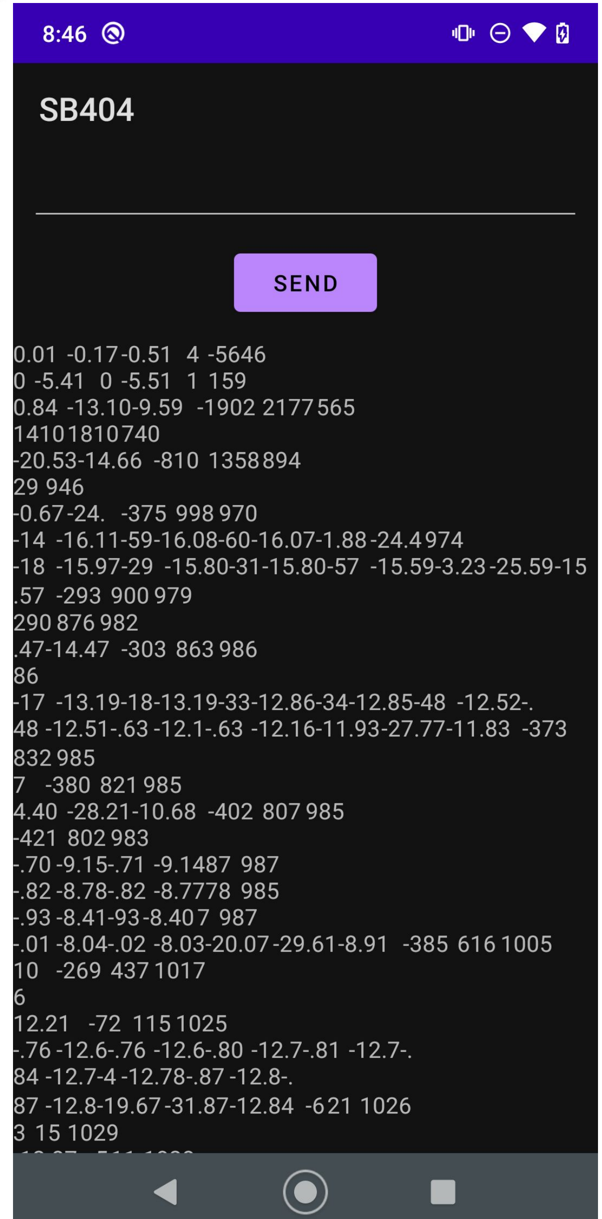
Android App

Pablo Barron

Accomplishments since last presentation: 4 Hrs	Ongoing progress/problems and plans until the next presentation
• Have completed the app integration with the control subsystem. Proper data sending connection has been established.	• Will now begin validating connectivity and data sending • Currently integrating with ML, but encountering difficulty due to Android Studio only liking TensorFlow Models

Android App

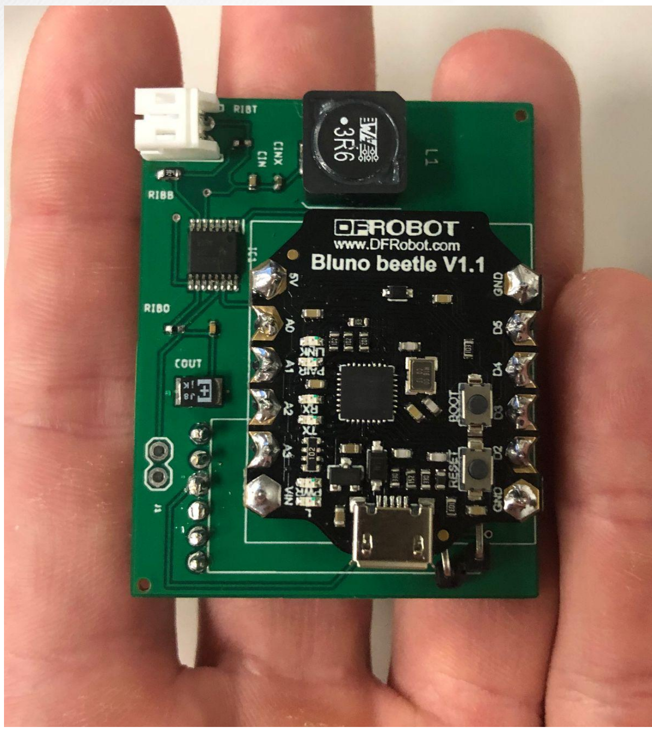

4:46
SB404
SEND
-177.43 29.28 -21.02 -204 -183 375
-177.46 29.27 -21.03 -202 -184 380
-177.46 29.27 -21.03 -202 -185 383
-177.47 29.27 -21.03 -202 -185 383
-177.49 29.27 -21.05 -200 -184 384
-177.49 29.27 -21.05 -201 -184 385
-177.49 29.27 -21.05 -203 -184 384
-177.52 29.25 -21.06 -202 -185 383
-177.52 29.26 -21.06 -202 -185 381
-177.52 29.26 -21.06 -200 -186 381
-177.55 29.25 -21.07 -202 -186 381
-177.55 29.25 -21.07 -201 -187 379
-177.55 29.25 -21.07 -202 -186 379
-177.60 29.24 -21.10 -201 -184 385
-177.60 29.24 -21.10 -203 -186 384
-177.60 29.23 -21.10 6855-11946-30359
-177.63 29.22 -21.11 -201 -186 383
-177.63 29.22 -21.11 -200 -187 382
-177.63 29.22 -21.12 -201 -184 381
-177.66 29.21 -21.13 -202 -185 381
-177.66 29.21 -21.13 -201 -186 381
-177.66 29.21 -21.13 -202 -185 382
-177.70 29.20 -21.14 -201 -184 380
-177.70 29.20 -21.14 -202 -185 383
-153.92 40.29 24.03 -17951 -32244 -2472
-177.70 29.19 -21.16 -205 -184 382
-177.70 29.19 -21.16 -202 -184 381
-177.70 29.19 -21.16 -202 -183 380
-177.70 29.18 -21.16 -203 -181 382

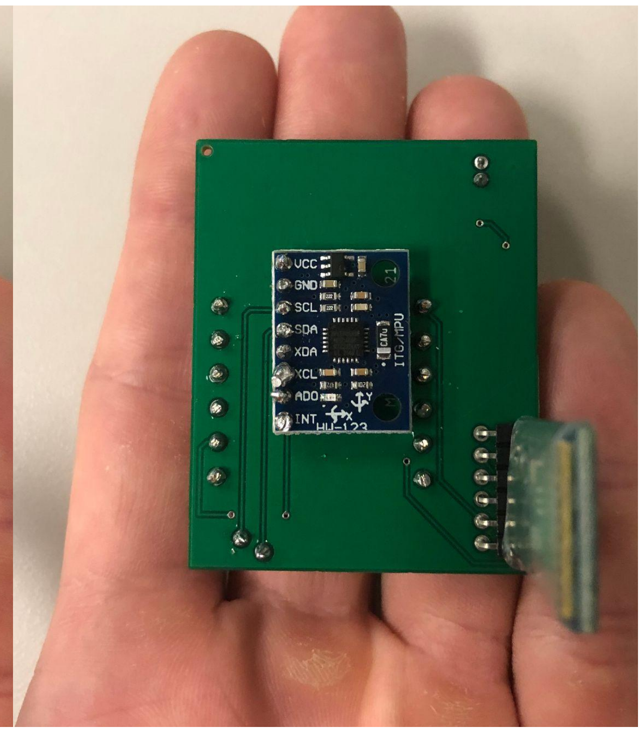

8:46
SB404
SEND
0.01 -0.17-0.51 4 -5646
0 -5.41 0 -5.51 1 159
0.84 -13.10-9.59 -1902 2177565
14101810740
-20.53-14.66 -810 1358894
29 946
-0.67-24. -375 998 970
-14 -16.11-59-16.08-60-16.07-1.88-24.4974
-18 -15.97-29 -15.80-31-15.80-57 -15.59-3.23-25.59-15
.57 -293 900 979
290 876 982
.47-14.47 -303 863 986
86
-17 -13.19-18-13.19-33-12.86-34-12.85-48 -12.52-.
48 -12.51-.63 -12.1-.63 -12.16-11.93-27.77-11.83 -373
832 985
7 -380 821 985
4.40 -28.21-10.68 -402 807 985
-421 802 983
-.70 -9.15-.71 -9.1487 987
-.82 -8.78-.82 -8.7778 985
-.93 -8.41-93 -8.407 987
-.01 -8.04-.02 -8.03-20.07-29.61-8.91 -385 616 1005
10 -269 437 1017
6
12.21 -72 115 1025
-.76 -12.6-.76 -12.6-.80 -12.7-.81 -12.7-.
84 -12.7-4 -12.78-.87 -12.8-.
87 -12.8-19.67-31.87-12.84 -621 1026
3 15 1029

Power System

Accomplishments since 403 12 hr of effort	Ongoing progress/problems and plans until the next presentation
● Assembled power parts of PCB ● Power/Control integration ● Able to power the MCU, IMU, and Bluetooth from the battery and collect data	● Add battery charging circuit to the PCB design ● Order final PCB

Power System





50.8x40.6 mm

Machine Learning

Accomplishments since last presentation:

- Transforming the .sav file to .tflite or Scikit-Learn Random Forest Model to be used by Android App

Plans until next presentation:

- More data gathering to increase accuracy

Execution plan

	9/2/2022	9/9/2022	9/16/2022	9/23/2022	9/30/2022	10/7/2022	10/14/2022	10/21/2022	10/28/2022	11/4/2022	11/11/2022	11/18/2022	11/25/2022	12/2/2022
Status Update 1														
Control System PCB														
Control System and App Communication														
Power System PCB Design														
App/Control System Itegration via Bluetooth														
Connection and Data sending Validation														
Status Update 2														
PCB Fabrication and Assembly														
ML and App Intergration														
Make App "prettier" by using images and other details														
ML Data Collection														
Data Training with New Data														
Status Update 3														
PCB Testing and Validation														
Sensing Unit Housing Design														
Sensing Unit Handle Mount Design														
Validate ML with Real Time Swings														
Status Update 4														
Final PCB Manufacturing														
Sensing Unit Housing Manufacturing														
Sensing Unit Handle Mount Manufacturing														
Status Update 5														
Complete System Integration														
System Validation														
Final Design Presentation														
Final Demo														
Final Report														

	Not Started		Jiakai Hu
	In Progress		Nolapat Pipitvitayakul
	Completed		Pablo Barron
	Behind Schedule		Gavin Dahl
			Everyone

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Validation plan

Paragraph	Test Name	Success Criteria	Methodology	Status	Responsible Engineer(s)
3.2.1.2	Sending Data via Android device	The app should be able to send and receive data	Upload the app to a simulated android phone and test by outputting data to a localized device to test data sending	UNTESTED	Pablo Barron
3.2.1.2	ML Algorithm Precision	The ML algorithm provides precise result of output data within small error ranç	Give a set of test input and see if algorithm returns the hit positions precisely.	UNTESTED	Jiakai Hu
3.2.1.3	Communication Range	Communication between the sensing unit and app stays active for a distance of up to 100ft.	Test normal functionality of the smart cricket bat's operations at 5ft intervals ranging from 0ft to 100ft.	IN PROGRESS	Gavin Dahl Pablo Barron
3.2.1.4	Wireless Connection Stablilty	Connection between sensing unit and smartphone app does not drop.	Sensing unit connected to smartphone app via bluetooth, set to default mode, and left to run for 1 hour. Connection is monitored via smart phone app.	IN PROGRESS	Gavin Dahl Pablo Barron
3.2.1.4	Full Range of Motion	Sensing unit can measure the angle of the bat at a full 360°.	Sensing unit is attached to pivoting arm on a protracter, the angle is tracked on both a piece of paper and in a text file, and then compared.	TESTED: Sensing unit tracks accurate degree of turn for all 3 axes	Gavin Dahl
3.2.1.5	Easy to Use GUI	The app is easily naviagble to allow any person, regardless of technical skills, to use our device	Upload the app to a simulated andriod phone to view the clarity of the app	TESTED: App is able to run on physical device and does not crash	Pablo Barron
3.2.1.5	Operation Time	System operates continously on battery power for a minimum of 2 hours.	Sensing unit is turned on, set to defualt mode, and left to run for 2 hours. Power is monitored via a digital multimeter.	UNTESTED	Nolapat Pipitvitayakul
3.2.1.6	Detection Range	Sensing unit can detect vibrations from at least 38in away when mounted on a bat.	Mount sensing unit on end of the cricket bat handle and hit the top of the bat 10 times to ensure full range.	TESTED: Hits on the end of the bat are noticed by the IMU	Gavin Dahl
3.2.1.7	Detection Accuracy	Sensing unit is able to detect a collison between ball and bat on any area of the cricket bat.	Mount sensing unit on cricket bat, measure data from hits in a variety of areas on the bat (at least 15) until it is confirmed there are no dead areas.	TESTED: Hitting any location (including edge cases) of the bat is noticed by the IMU	Gavin Dahl
3.2.1.8	Detection Sensitivity	Sensors are able to detect degree's of motion within 1deg of change and is able to give changes in speed to 1 decimal places.	Mount sensing unit to cricket bat, connect to PC via microUSB, and watch realtime data output of angle of bat and speed and compare to movements made in real life.	IN PROGRESS	Gavin Dahl
3.2.1.9	Ease of Use	System is easily attached to end of handle of the cricket bat, is easily connected to the app via bluetooth, and is easy to calibrated during first time start up calibrations. Whole process should take no more than 5 minutes.	Use stopwatch to measure how long it takes te user to mount device, pair to phone, and do the calibration setup.	IN PROGRESS	Full Team
3.2.3.1.1	Input Voltage (MCU)	The input voltage for our Beetle BLE board shall be between 5V - 8V.	Use multimeter to validate input voltage level.	TESTED: Boost Converter Output is 5V +- 0.1	Nolapat Pipitvitayakul
3.2.3.1.3	Battery Charging Voltage and Current	The sensing unit has a 3.7V 150mAh Lo-Pi batteries as its power supply. These can be charged through a microUSB cable that can supply 100mA of charge current with a 4.2V charge voltage.	Use multimeter and osciloscope to validate voltage levels and charge current levels.	UNTESTED	Nolapat Pipitvitayakul
3.2.3.2.1	App Data Gathering via Bluetooth	The Android device should be able to recieve data from our MCU via bluetooth	Upload the app to a simulated android phone and input different "dummy" data to see if the android device recieved the data	TESTED: Connection Error with Bluetooth Socket	Pablo Barron
3.2.4.1	Thermal Resistance	The system should be able to operate in environments with tempatures ranging from 0°C to 85°C.	Use heating mechanism to raise tempature to 85°C and test systems functionalitly. Place system in cooling mechanism to lower tempature to 0°C and test systems.	IN PROGRESS	Gavin Dahl
3.2.4.2	Shock Tolerance	The IMU should be able to handle g shocks up to a max of 10,000g.	Test dropping IMU at differing heights and then use systems normal functionality to try to validate that IMU will still function after taking shocks more than 10,000	IN PROGRESS	Gavin Dahl

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Parts Ordered

Part Description	Order Status
3 x Bluno Ble Microcontroller	Part Received
2 x HC-05 Bluetooth Module	Part Received
3 x gy-521 IMU	Part Received
1 x LiPo Battery 3.7V 150mah	Part Received
12 x Capacitor	Part Received
8 x Resistor	Part Received
3 x Inductor	Part Received
1 x Switching Voltage Regulators	Part Received
1 x JST Right-Angle Connector TH 2-Pin	Part Received

Questions?