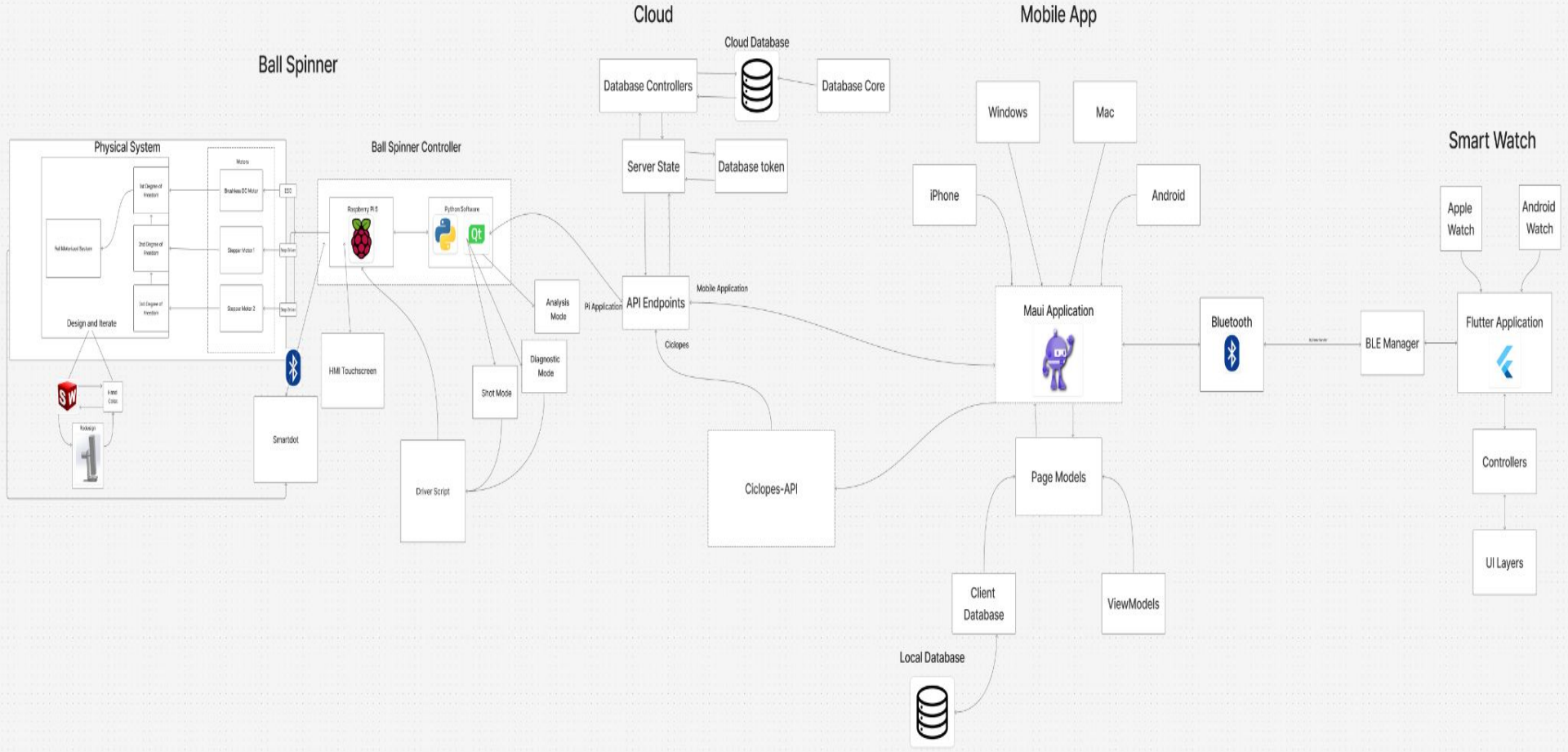
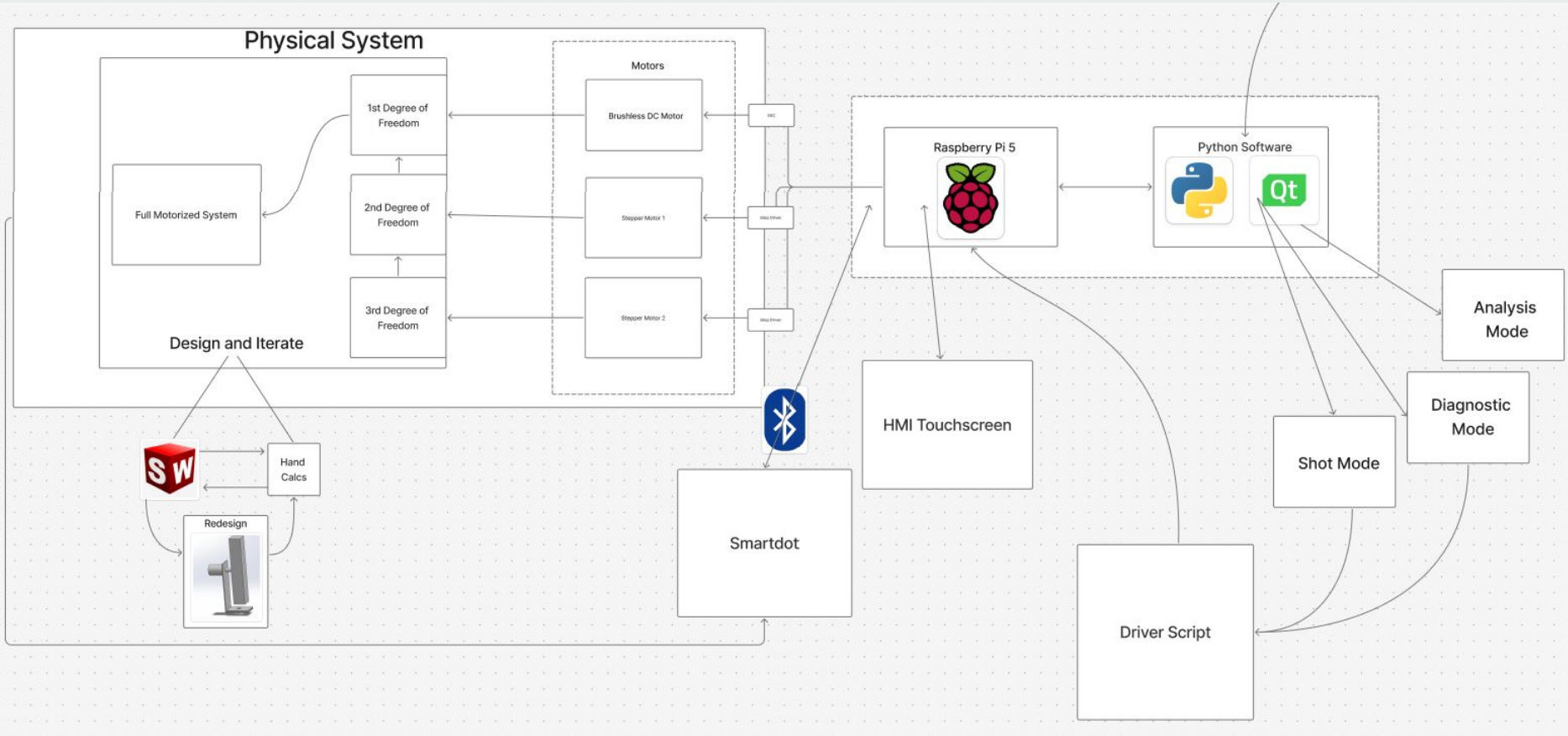
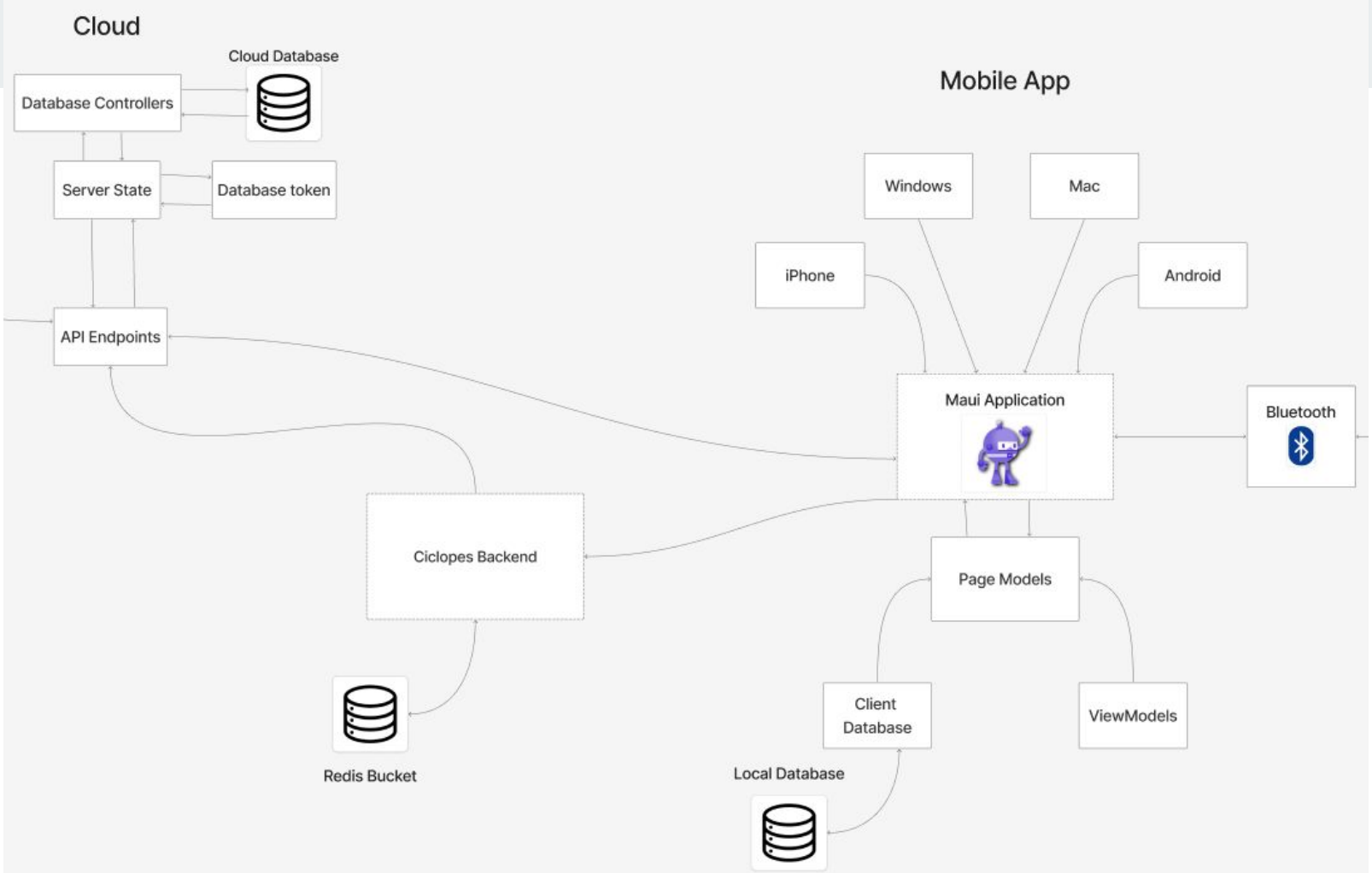
Milestone 1

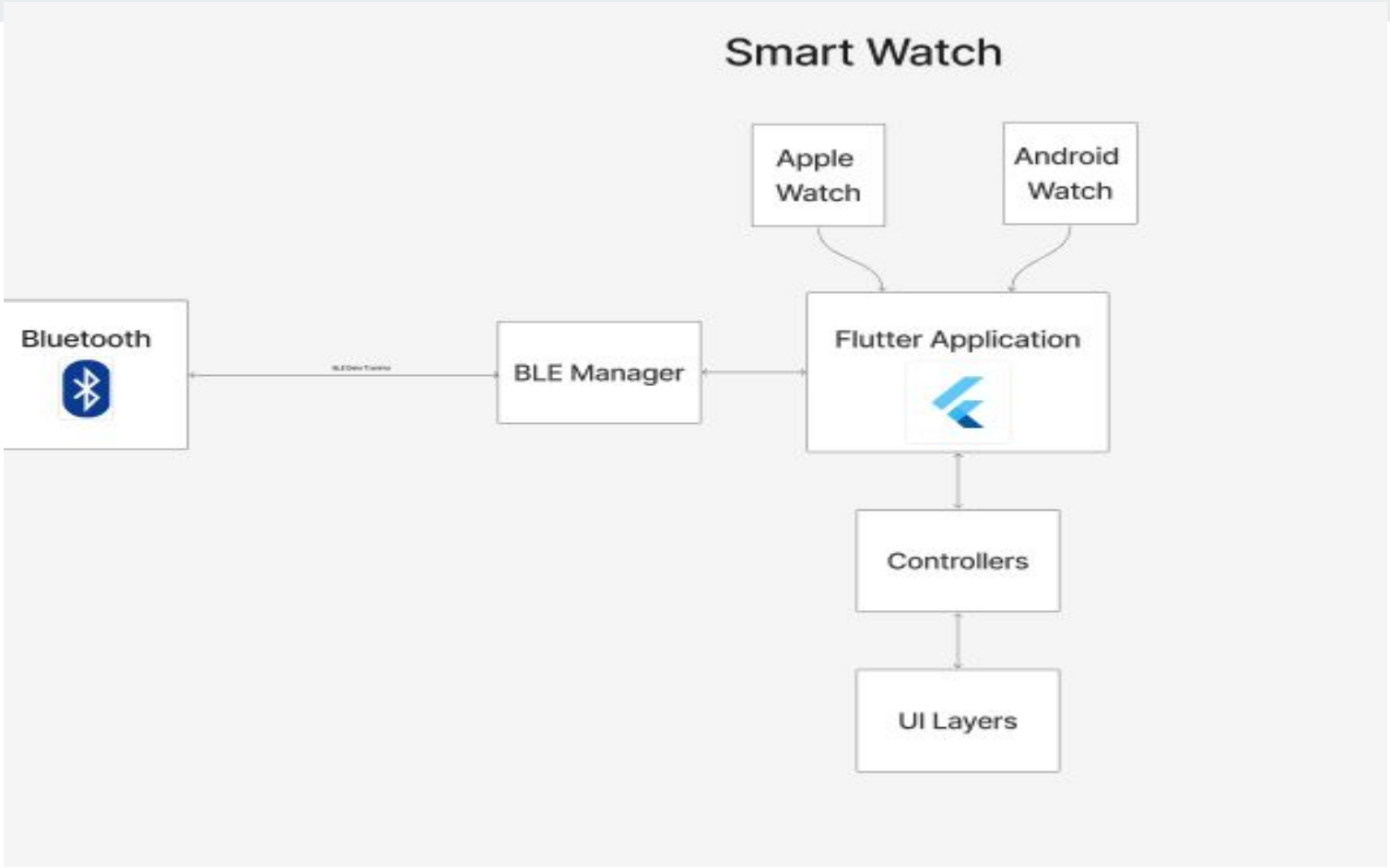
Matt Brown, Josh Byers, Charles Carroll, Zach Cox, Joseph Downey, Gabe Manero, Jakeb Nielsen, Andrew Olvera, Gavin Wentz, Hunter Wolfe

HIGH LEVEL OVERVIEW

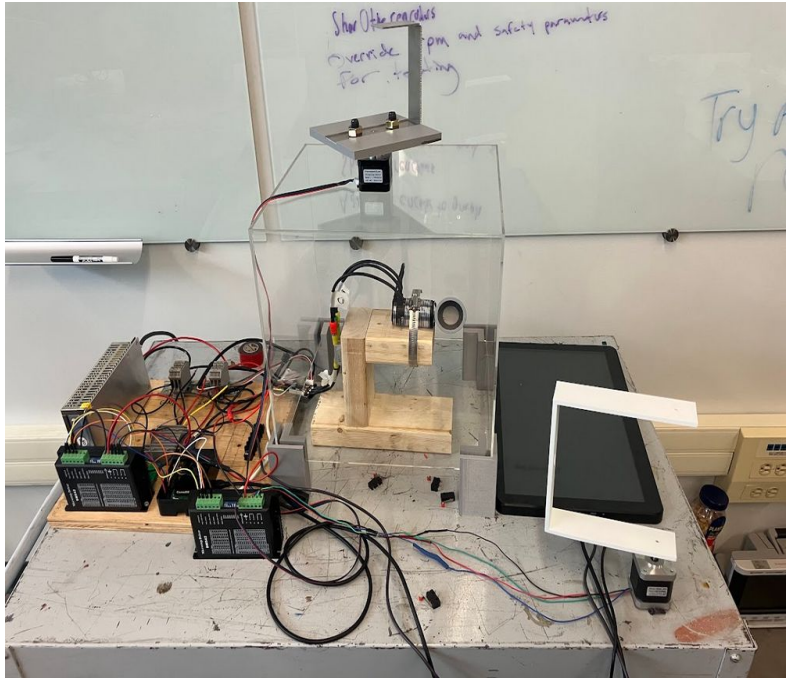



Physical System
Motors
1st Degree of Freedom
2nd Degree of Freedom
3rd Degree of Freedom
Full Motorized System
Design and Iterate
Brushless DC Motor
Stepper Motor 1
Stepper Motor 2
Raspberry Pi 5
Python Software
Qt
Analysis Mode
Diagnostic Mode
Shot Mode
HMI Touchscreen
Smartdot
Driver Script
Hand Calcs
Redesign

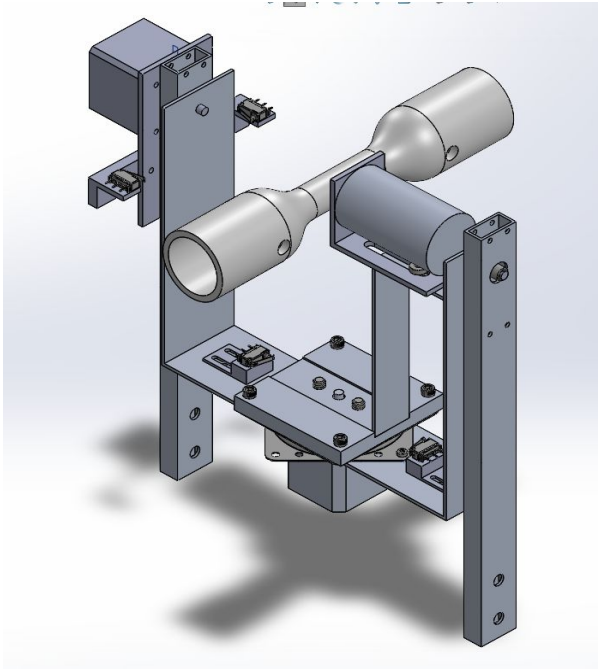

Cloud
Cloud Database
Database Controllers
Server State
Database token
API Endpoints
Ciclopes Backend
Redis Bucket
Mobile App
Windows
Mac
iPhone
Android
Maui Application
Bluetooth
Page Models
Client Database
ViewModels
Local Database


Smart Watch
Apple Watch
Android Watch
Bluetooth
BLE Manager
Flutter Application
Controllers
UI Layers

Physical Design Overview



Prototyped Degrees of Freedom at the End of Fall Milestone 3.



Final Design for Ball Spinner.

Physical Design Team (Goals and Achievements for MS1)

Goals

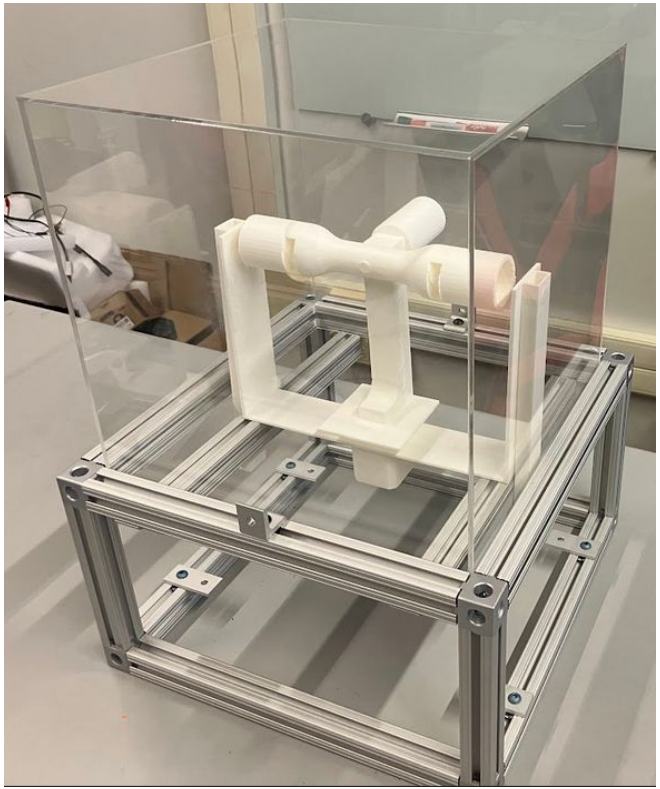
- Fully designed 3D model of ball spinner and electronics enclosure ready for fabrication

Achievements

- Ball Spinner Design Completed
- Enclosure Design Completed and Structural Frame Built
- All material ordered for fabrication
- Plan for fabrication determined

Key Technologies

- SOLIDWORKS - 3D model ball spinner designs as well as enclosure layout
- 3D Print Lab - create rapid prototypes and fabricate non-load bearing components
- Shop - fabricate and adjust metal parts



3D Modeled and Printed Ball Spinner System inside an in progress Electronics Enclosure

Physical Design Team (Future: MS2)

Goals

- Continue work on enclosure (Bottom panel and acrylic box mounting)
- Completed 1st and 2nd degree assembly
- Ensure assembly is ready for motor mounting

Team Pi Demo

Team Pi (Goals for MS1)

- Get unit testing implemented
- Add override mode to diagnostic mode page
- Improve UI for touch accessibility
- Add analysis options to the analysis mode page
- Estop implementation
- Oscilloscope testing
- Update system schematic
- Finish PCB development

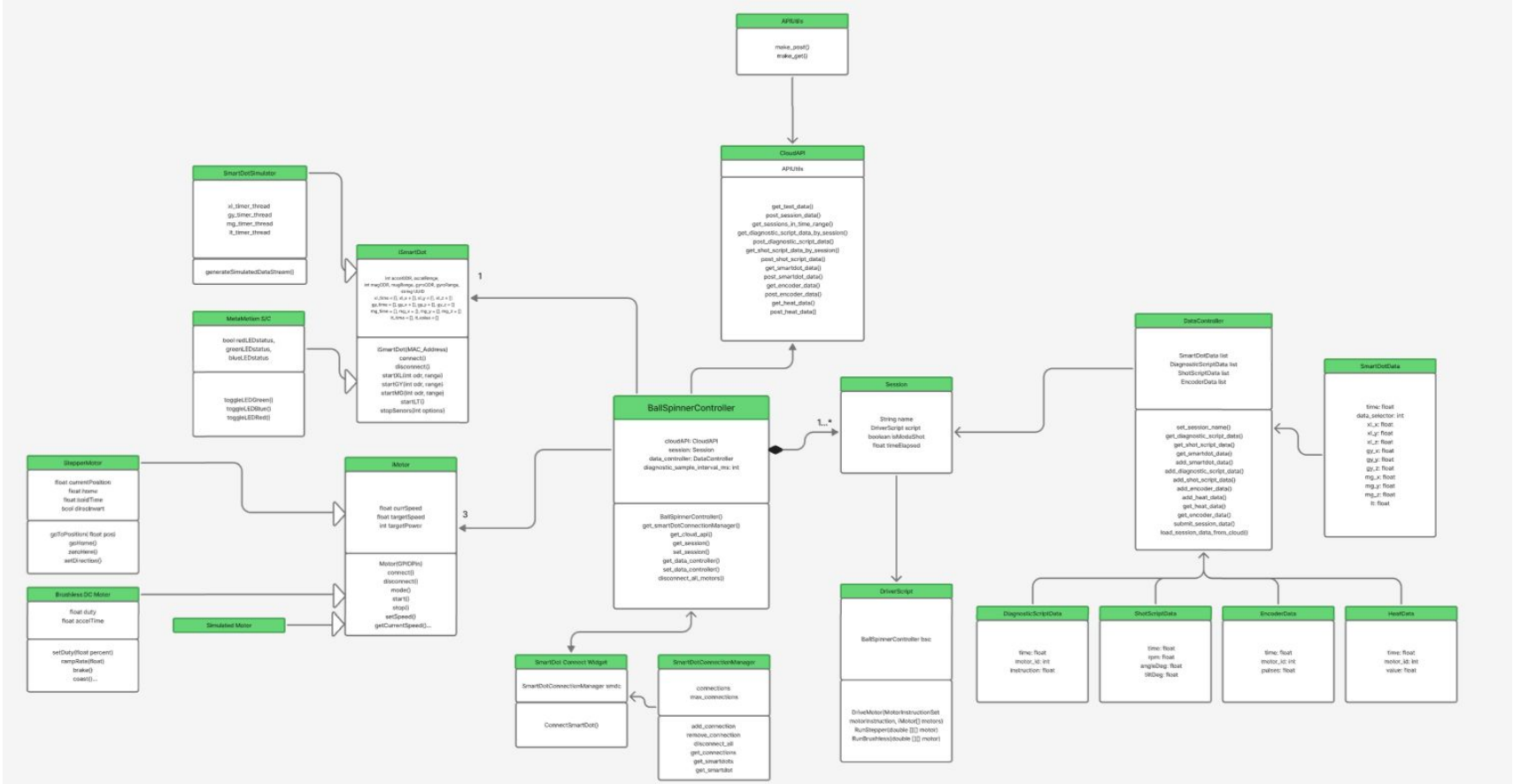
Team Pi (MS1 Achievements)

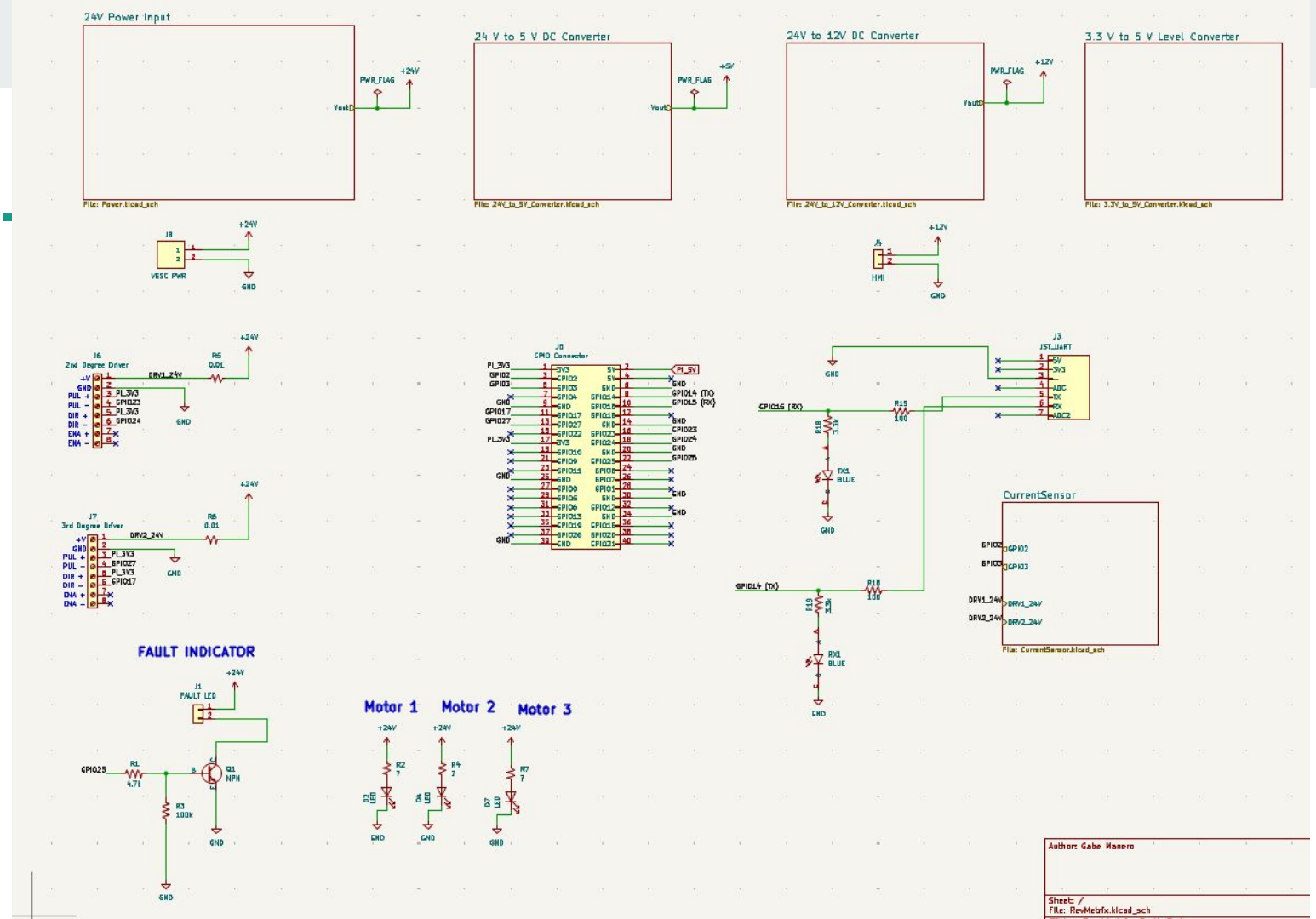
- Got basic unit testing implemented
- Added override mode to diagnostic mode page
- Added global style sheet for improved touch capability
- Display encoder data for the primary motor.
- Added analysis options to the analysis mode page
- Estop Integration
- Tested oscillations with and without logic level shifter
- Completed update of schematic
- Finished PCB schematic and layout

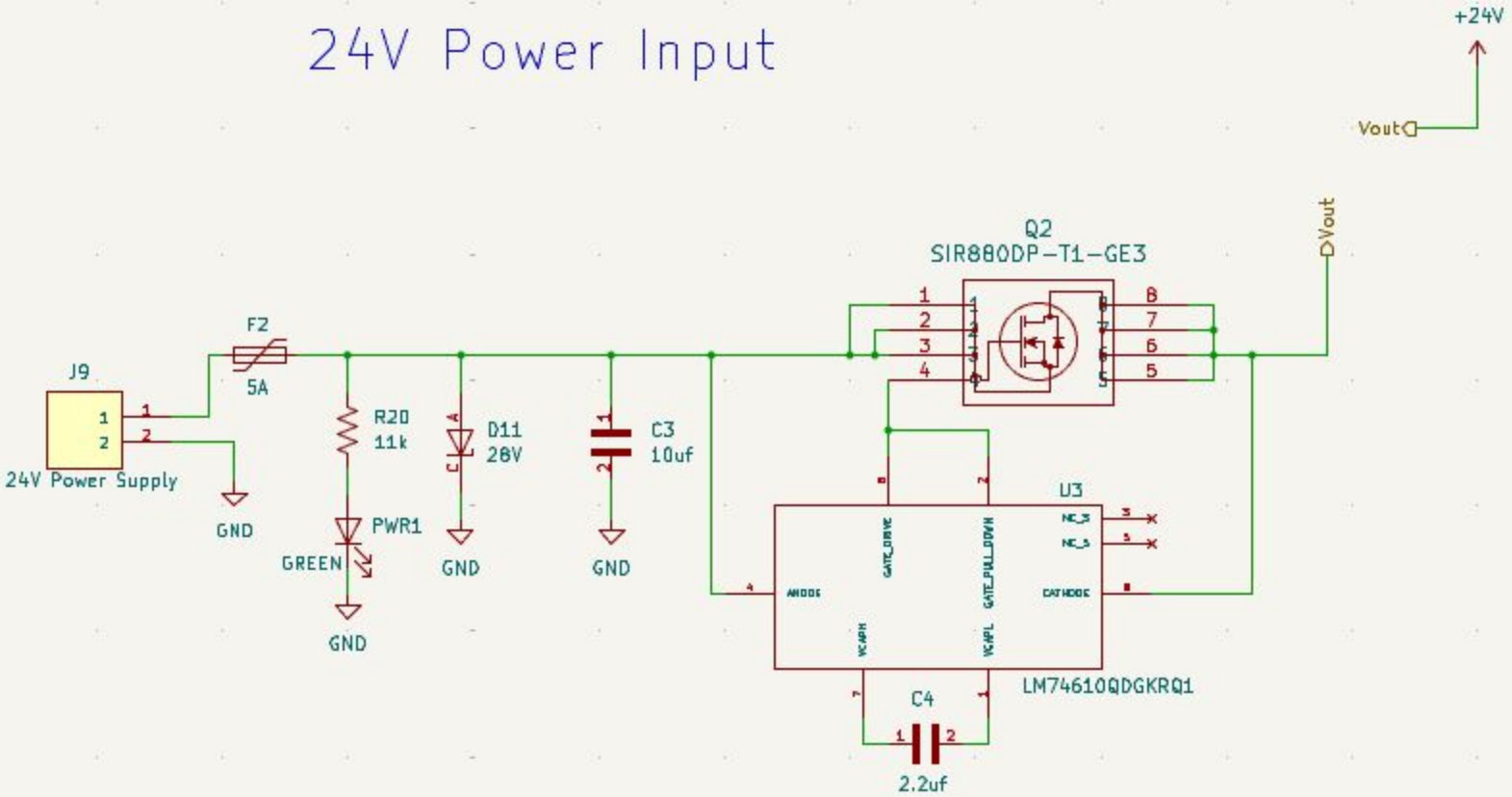
Team Pi (Future: MS2)

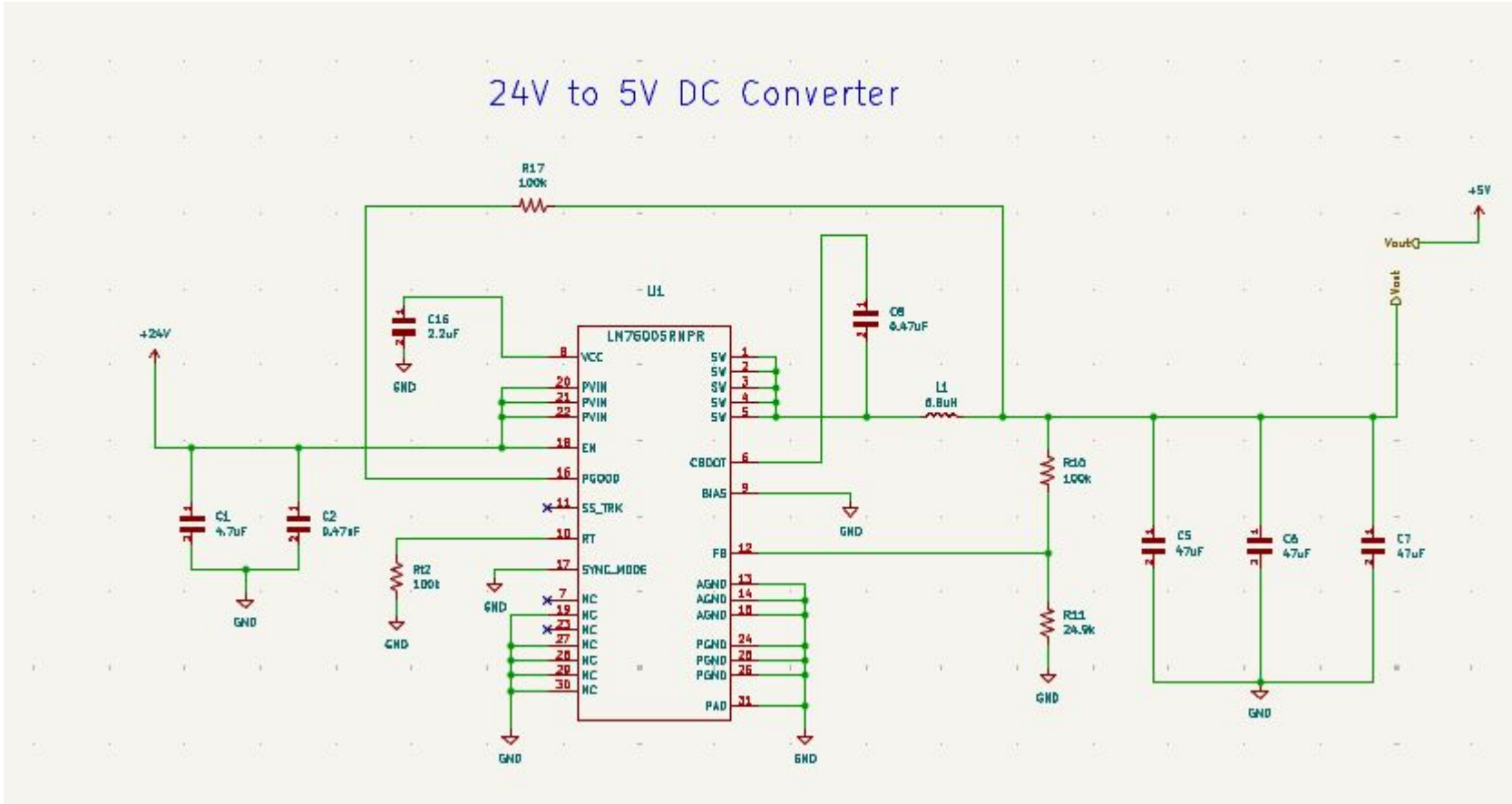
- Add encoders to the 2 stepper motors
- Finalize the wavelet implementation within the analysis mode page
- Build standalone app
- Adding ENA connection for both stepper drivers to drop current
- Switching to UART comms for VESC
- PCB routing and order

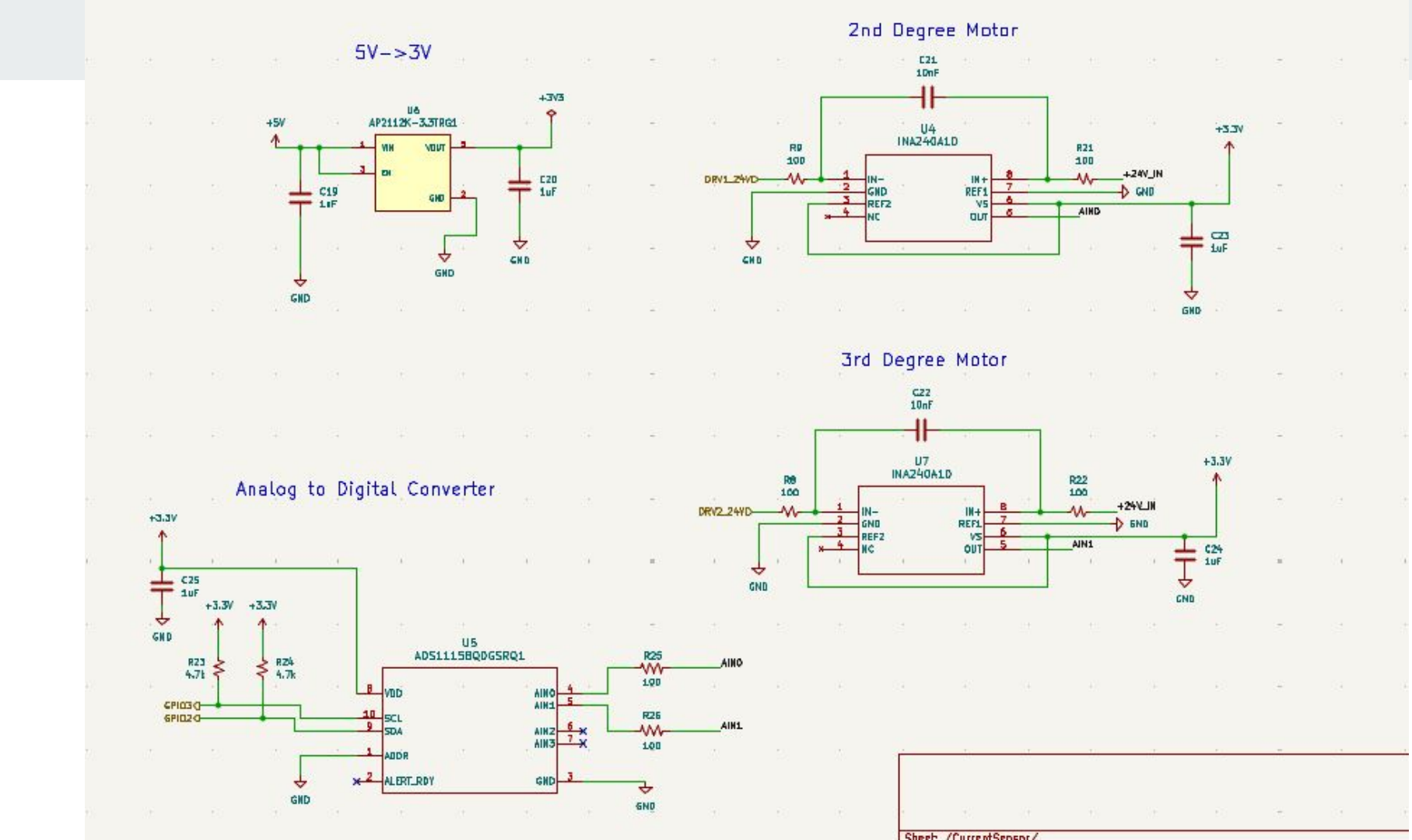
Team Pi UML

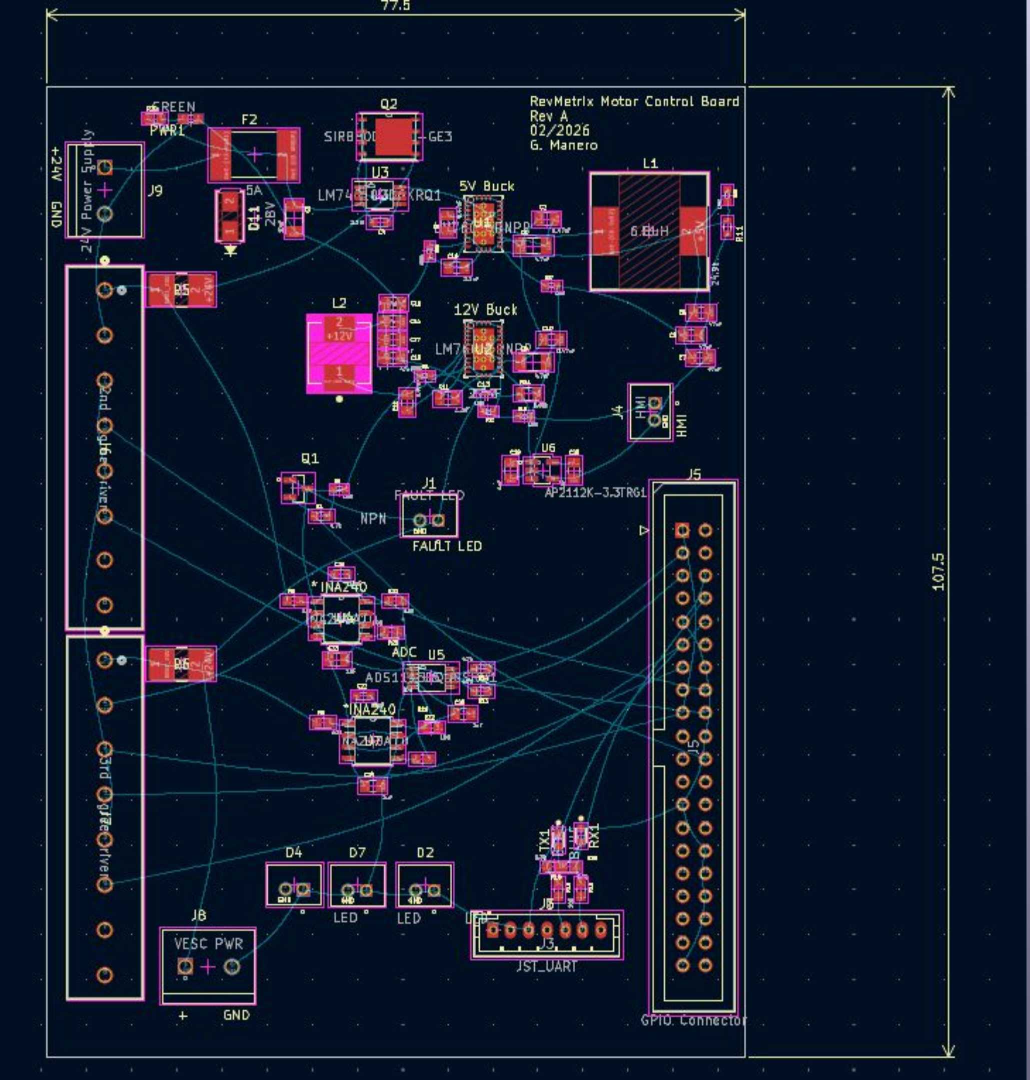

APIUtils
make_post()
make_get()
CloudAPI
APIUtils
get_last_data()
post_session_data()
get_sessions_in_time_range()
get_diagnostic_script_data_by_session()
post_diagnostic_script_data()
get_shot_script_data_by_session()
post_shot_script_data()
get_smartdot_data()
post_smartdot_data()
get_encoder_data()
post_encoder_data()
get_heat_data()
post_heat_data()
SmartDotSimulator
xl_timer_thread
gy_timer_thread
mg_timer_thread
ft_timer_thread
generateSimulatedDataStream()
MetaMotion S/C
bool redLEDstatus,
greenLEDstatus,
blueLEDstatus
toggleLEDGreen()
toggleLEDBlue()
toggleLEDRed()
iSmartDot
iSmartDot(MAC_Address)
connect()
disconnect()
startXL(int odr, range)
startGY(int odr, range)
startMD(int odr, range)
startLT()
stopSensors(int options)
1
BallSpinnerController
cloudAPI: CloudAPI
session: Session
data_controller: DataController
diagnostic_sample_interval_ms: int
BallSpinnerController()
get_smartDotConnectionManager()
get_cloud_api()
get_session()
set_session()
get_data_controller()
set_data_controller()
disconnect_all_motors()
1...*
Session
String name
DriverScript script
boolean isModeShot
float timeElapsed
DataController
SmartDotData list
DiagnosticScriptData list
ShotScriptData list
EncoderData list
set_session_name()
get_diagnostic_script_data()
get_shot_script_data()
get_smartdot_data()
add_smartdot_data()
add_diagnostic_script_data()
add_shot_script_data()
add_encoder_data()
add_heat_data()
get_heat_data()
get_encoder_data()
submit_session_data()
load_session_data_from_cloud()
SmartDotData
time: float
data_selector: int
xl_x: float
xl_y: float
xl_z: float
gy_x: float
gy_y: float
gy_z: float
mg_x: float
mg_y: float
mg_z: float
ft: float
StepperMotor
float currentPosition
float rtheme
float toldTime
bool directwart
getToPosition(float pos)
getHome()
zeroHere()
setDirection()
Brushless DC Motor
float duty
float accelTime
setDuty(float percent)
rampRate(float)
brake()
coast()...
Simulated Motor
IMotor
float currSpeed
float targetSpeed
int targetPower
Motor(GPIOPin)
connect()
disconnect()
mode()
start()
stop()
setSpeed()
getCurrentSpeed()...
3
SmartDot Connect Widget
SmartDotConnectionManager smdc
ConnectSmartDot()
SmartDotConnectionManager
connections
max_connections
add_connection
remove_connection
disconnect_all
get_connections
get_smartdots
get_smartdot
DriverScript
BallSpinnerController bsc
DriveMotor(MotorInstructionSet motorInstruction, IMotor[] motors)
RunStepper(double [][] motor)
RunBrushless(double [][] motor)
DiagnosticScriptData
time: float
motor_id: int
instruction: float
ShotScriptData
time: float
rpm: float
angleDeg: float
tiltDeg: float
EncoderData
time: float
motor_id: int
pulses: float
HeatData
time: float
motor_id: int
value: float


24V Power Input
PWR_FLAG
+24V
Vout
File: Power.kicad_sch
24 V to 5 V DC Converter
PWR_FLAG
+5V
Vout
File: 24V_to_5V_Converter.kicad_sch
24V to 12V DC Converter
PWR_FLAG
+12V
Vout
File: 24V_to_12V_Converter.kicad_sch
3.3 V to 5 V Level Converter
File: 3.3V_to_5V_Converter.kicad_sch
J8
VESC PWR
+24V
GND
J4
HMI
+12V
GND
J6
2nd Degree Driver
DRV1_24V
R5
0.01
PL_3V3
GPIO23
GPIO24
J7
3rd Degree Driver
DRV2_24V
R6
0.01
PL_3V3
GPIO27
GPIO17
J5
GPIO Connector
PI_5V
GPIO14 (TX)
GPIO15 (RX)
GPIO25
J3
JST_UART
5V
3V3
ADC
TX
RX
ADC2
GPIO15 (RX)
R15
100
R18
3.3k
TX1
BLUE
GPIO14 (TX)
R16
100
R19
3.3k
RX1
BLUE
CurrentSensor
GPIO2
GPIO3
DRV1_24V
DRV2_24V
File: CurrentSensor.kicad_sch
FAULT INDICATOR
J1
FAULT LED
GPIO25
R1
4.7k
Q1
NPN
R3
100k
Motor 1
Motor 2
Motor 3
R2
?
R4
?
R7
?
D2
LED
D4
LED
D7
LED
GND
Author: Gabe Manero
Sheet: /
File: RevMetrfx.kicad_sch

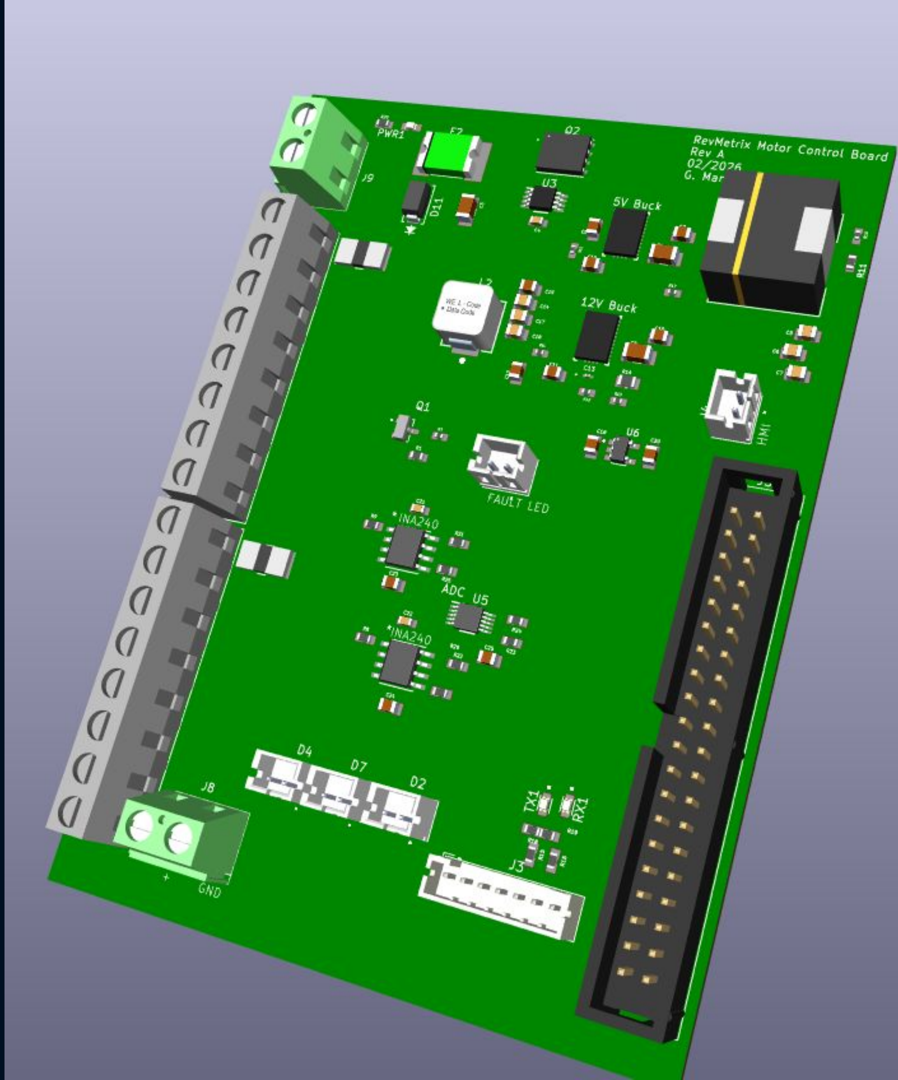

24V Power Input
+24V
Vout
Vout
Q2
SIR880DP-T1-GE3
J9
24V Power Supply
F2
5A
R20
11k
D11
28V
C3
10uf
PWR1
GREEN
GND
GND
GND
GND
U3
LM74610QDGKRQ1
C4
2.2uf


24V to 5V DC Converter
R17
100k
+5V
Vout
D Vout
U1
LM76005RNPR
C16
2.2uF
GND
+24V
C8
0.47uF
L1
0.8uH
VCC
PVIN
PVIN
PVIN
EN
PGOOD
SS_TRK
RT
SYNC_MODE
NC
NC
NC
NC
NC
NC
NC
SW
SW
SW
SW
SW
CBOOT
BIAS
FB
AGND
AGND
AGND
PGND
PGND
PGND
PAD
C1
4.7uF
C2
0.47uF
Rt2
100k
R10
100k
R11
24.9k
C5
47uF
C6
47uF
C7
47uF


5V->3V
U6
AP2112K-3.3TRG1
+5V
VIN
VOUT
EN
GND
+3V3
C19
1uF
C20
1uF
2nd Degree Motor
C21
10nF
U4
INA240A1D
R20
100
R21
100
DRV1_24VD
IN-
GND
REF2
NC
IN+
REF1
VS
OUT
+24V_IN
AIN0
C23
1uF
3rd Degree Motor
C22
10nF
U7
INA240A1D
R0
100
R22
100
DRV2_24VD
AIN1
C24
1uF
Analog to Digital Converter
C25
1uF
R23
4.7k
R24
4.7k
U5
ADS1115BQDGSRQ1
VDD
SCL
SDA
ADDR
ALERT_RDY
AIN0
AIN1
AIN2
AIN3
R25
100
R26
100
GPIO3
GPIO2
Sheet /CurrentSensor/

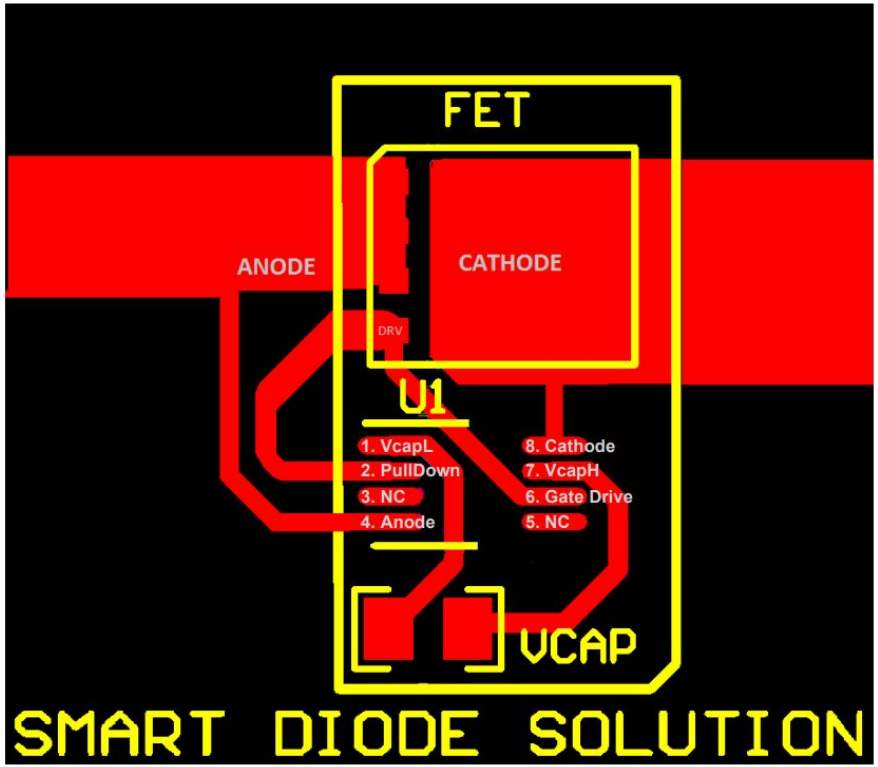


77.5
107.5
RevMetrix Motor Control Board
Rev A
02/2026
G. Manero
GREEN
PWR1
F2
5A
Q2
U3
L1
6.8uH
J9
+24V
GND
24V Power Supply
D11
5V Buck
L2
+12V
12V Buck
J4
HMI
Q1
NPN
J1
FAULT LED
U6
AP2112K-3.3TRG1
J5
INA240
ADC
U5
D4
D7
D2
LED
TX1
RX1
J8
VESC PWR
+
GND
J3
JST_UART
GPIO Connector



RevMetrix Motor Control Board
Rev A
02/2026
PWR1
F2
Q2
U3
J9
D11
5V Buck
12V Buck
Q1
U6
HMI
FAULT LED
INA240
ADC U5
INA240
D4
D7
D2
J8
+
GND
TX1
RX1
J3

10.2 Layout Example



Layout Example

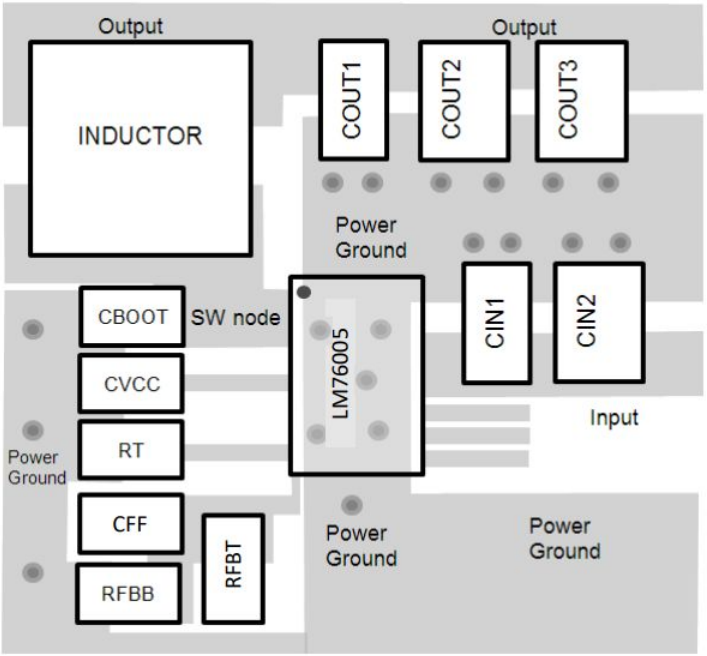
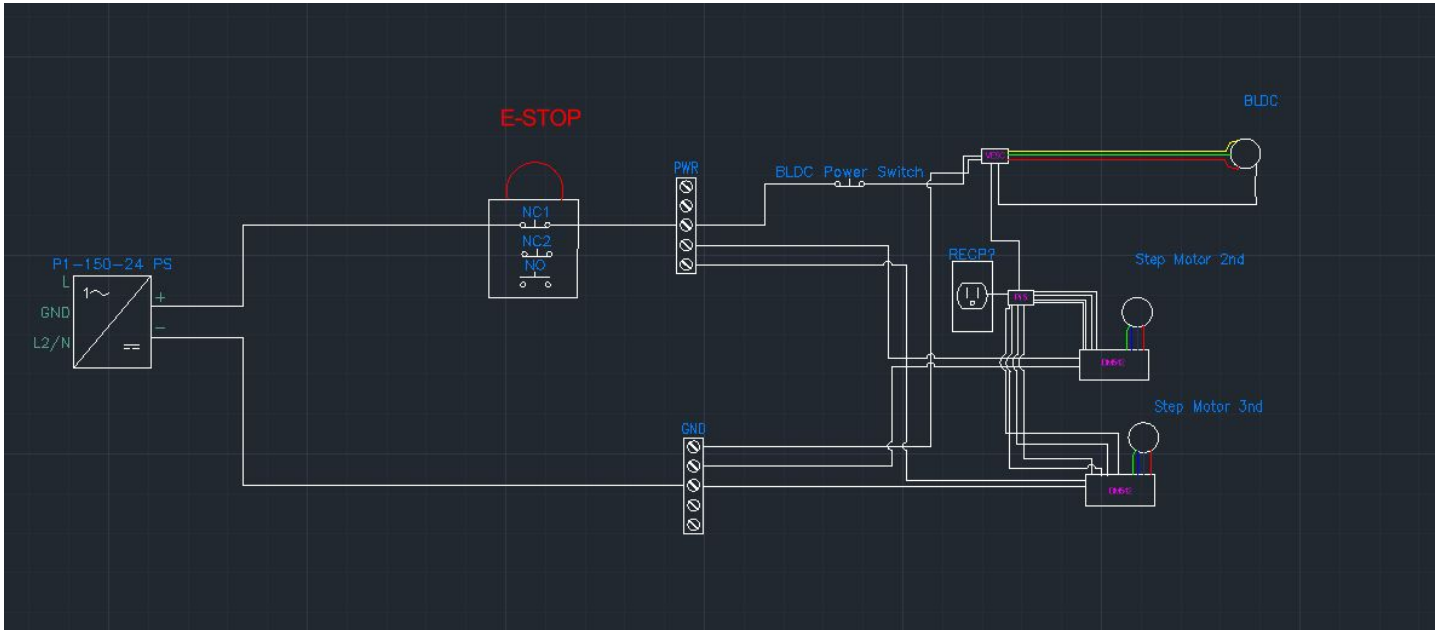
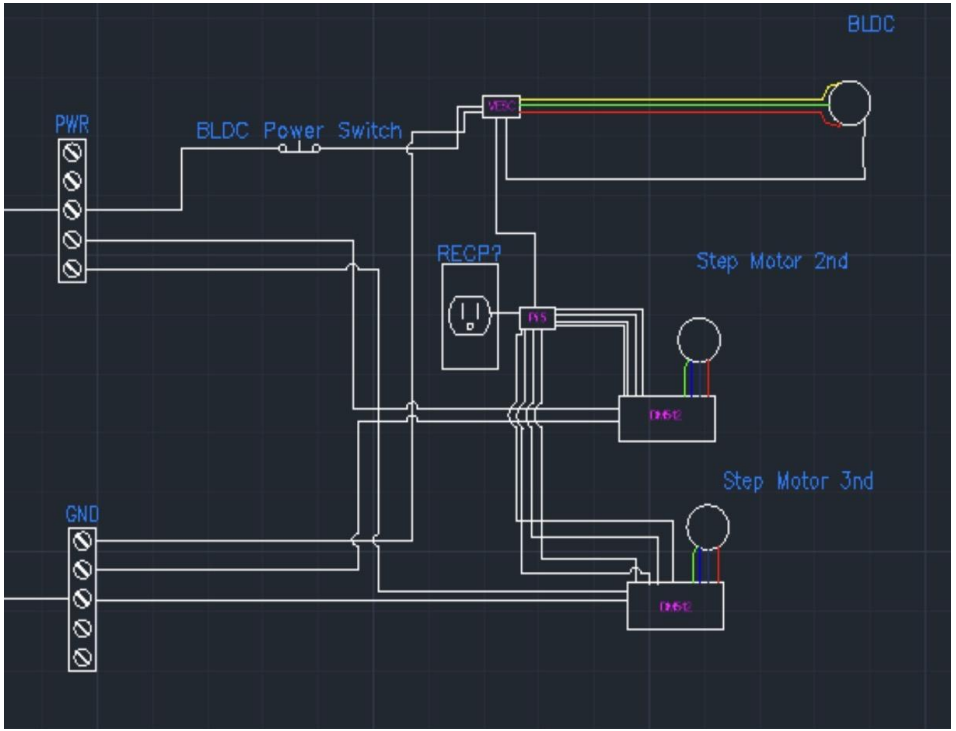


Figure 10-3. LM76005 Layout

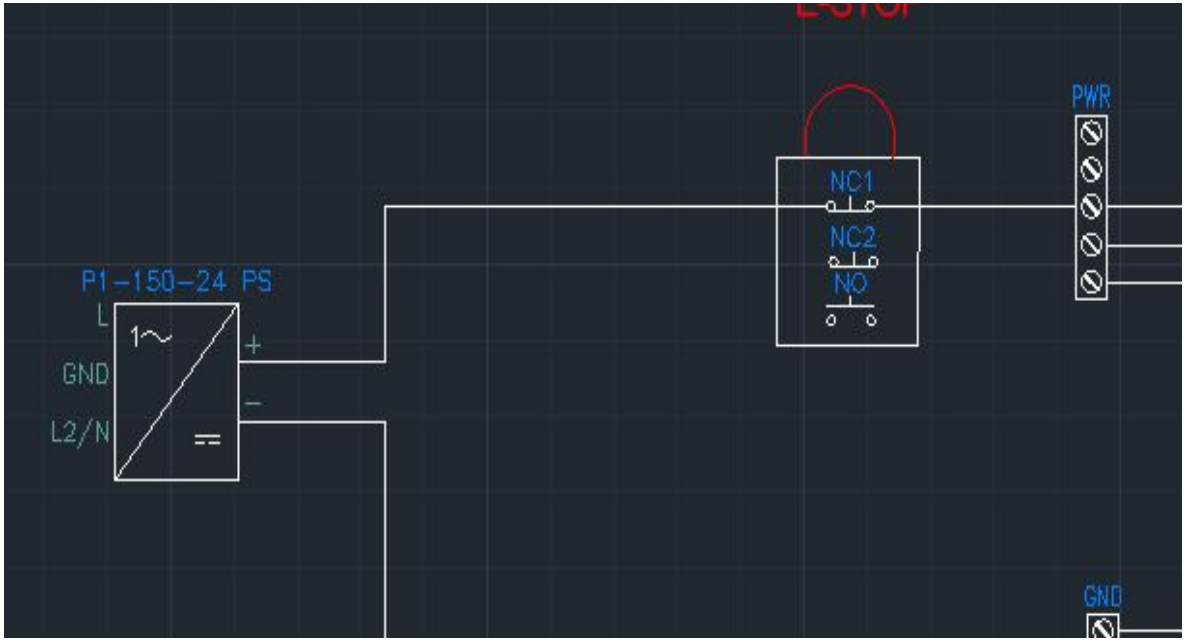
Team Pi Current Electrical System



Unchanged Portion

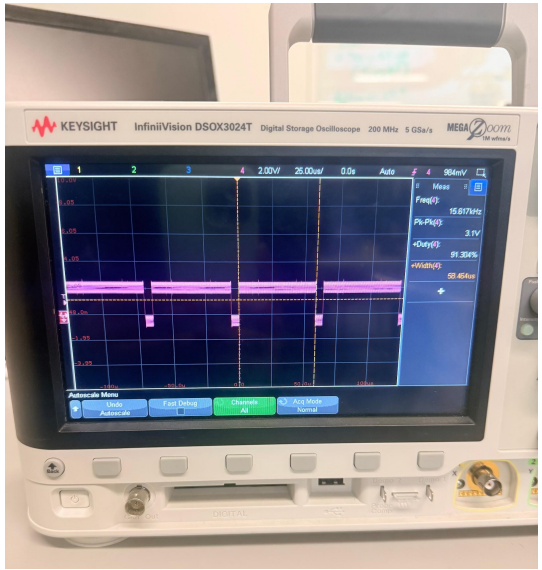


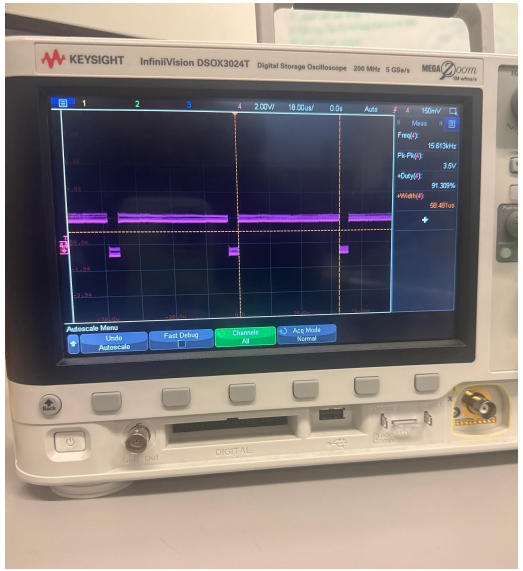
E-STOP



Oscilloscope Testing

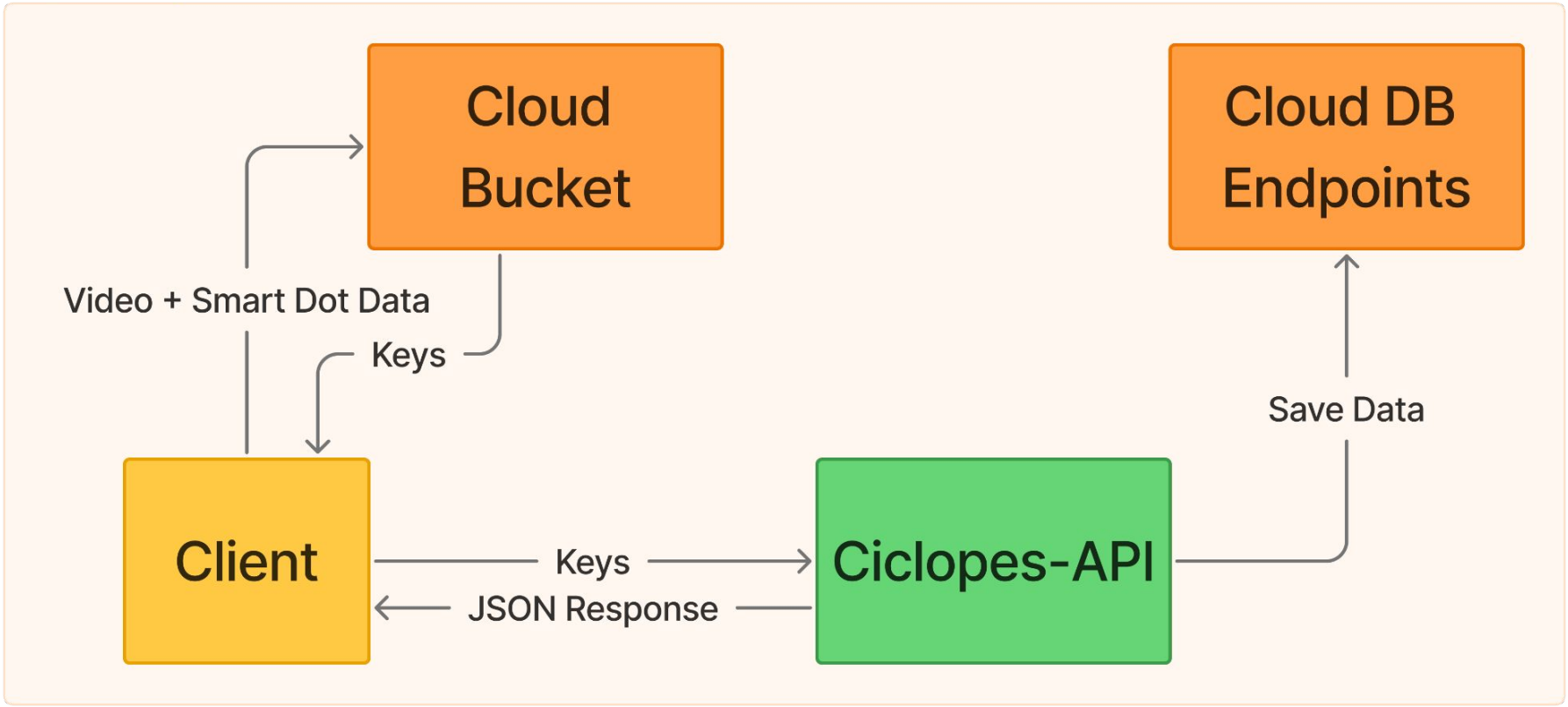
Capture 1	Capture 2
Frequency 15.617 kHz	15.613 kHz
Peak-to-Peak 3.1 V	3.5 V
Duty Cycle 91.304%.	91.309%
Pulse Width 58.46 µs	58.48 µs



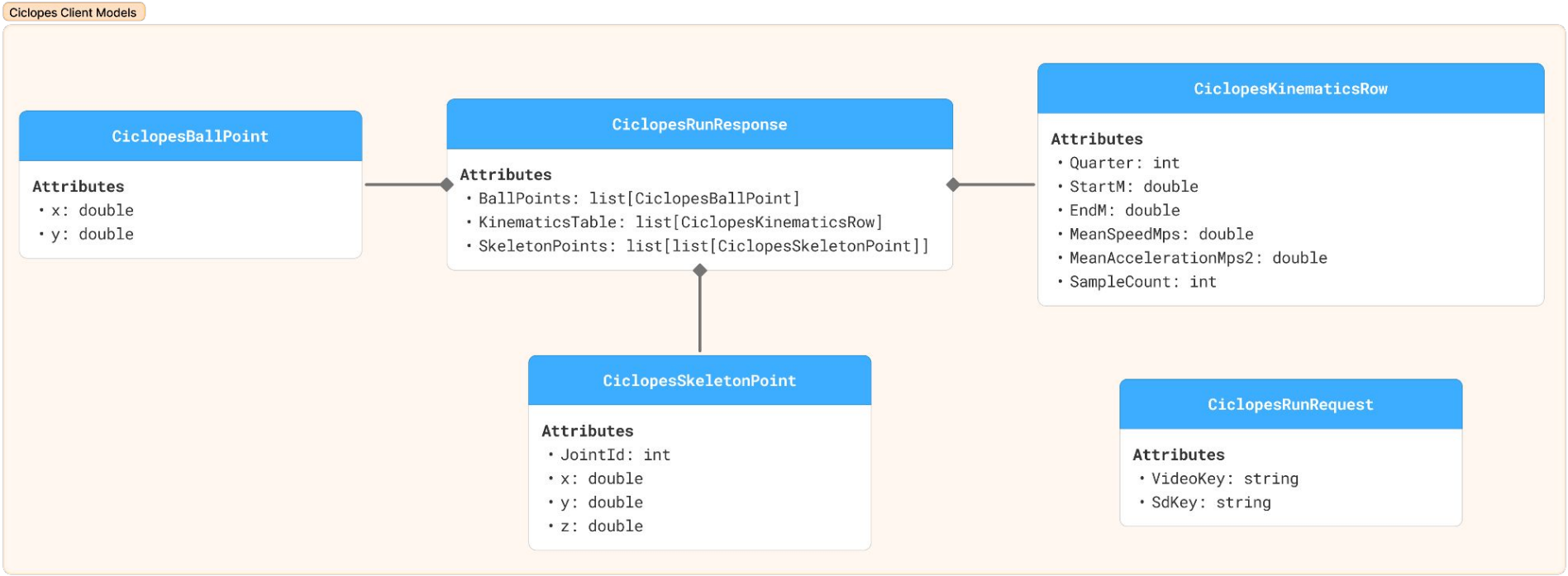


Ciclopes - Overview

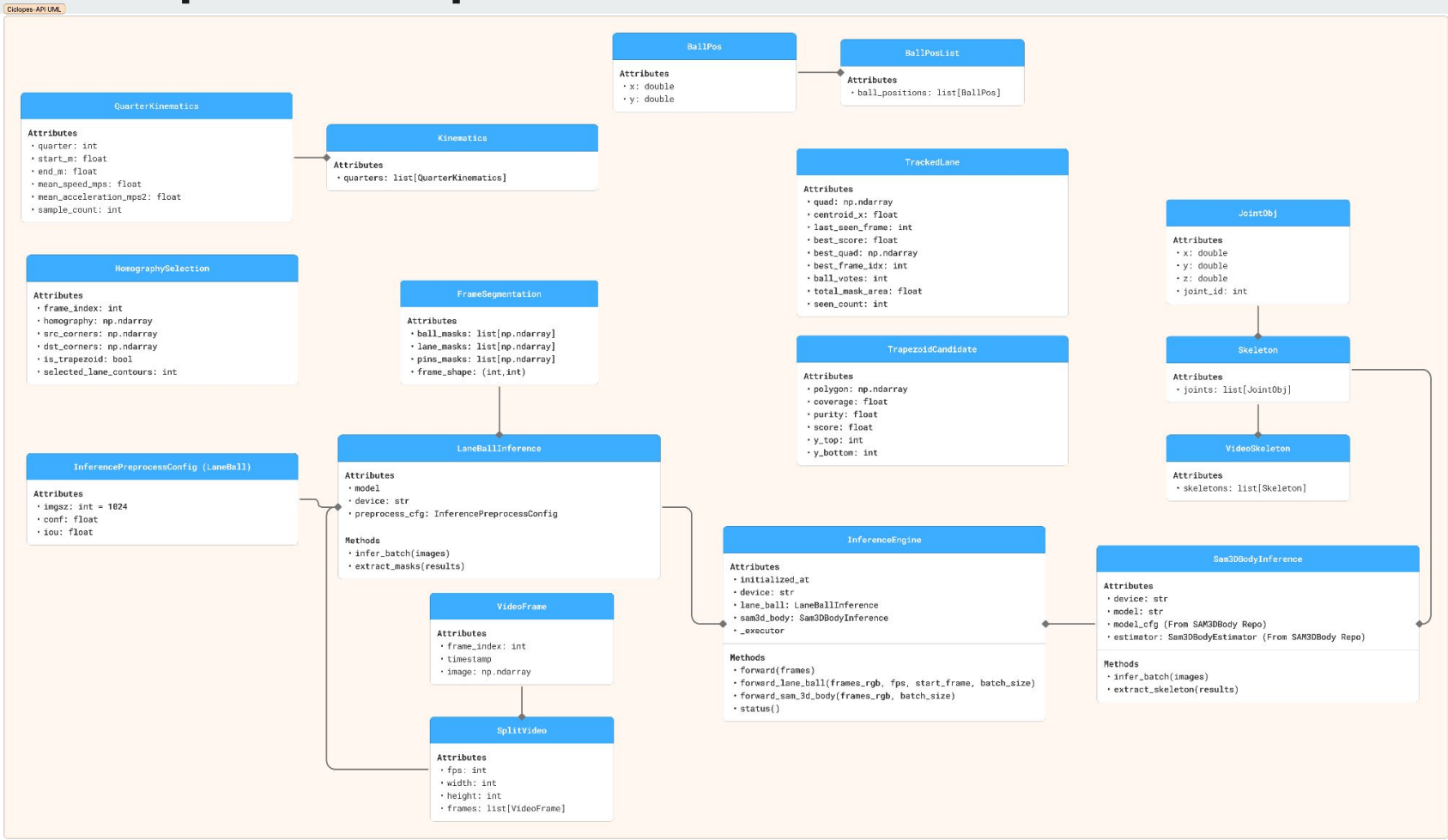
Ciclopes Architecture



Ciclopes - Client Side Models



Ciclopes - Ciclopes-API UML / Architecture



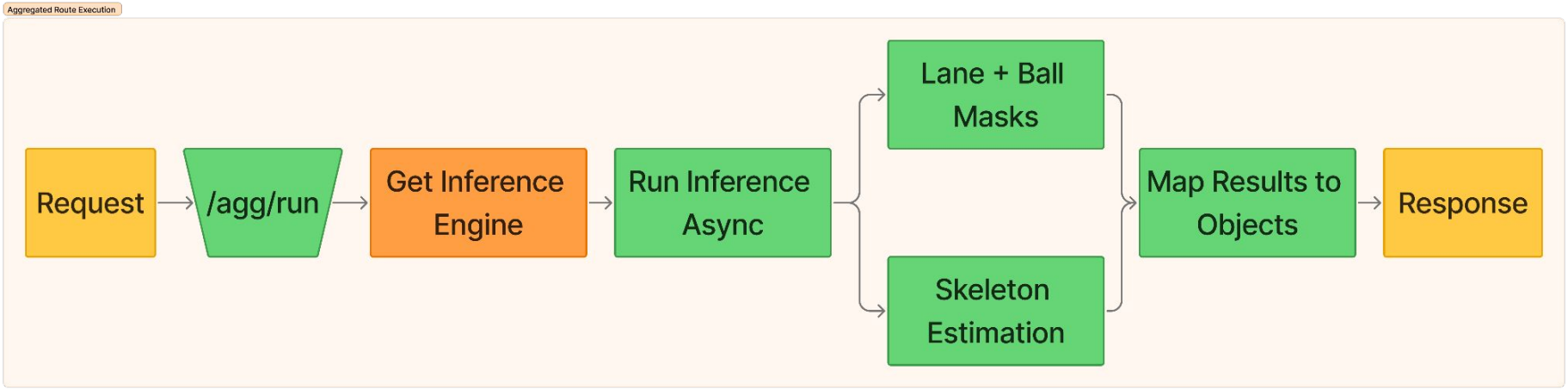
Ciclopes - Goals for MS1

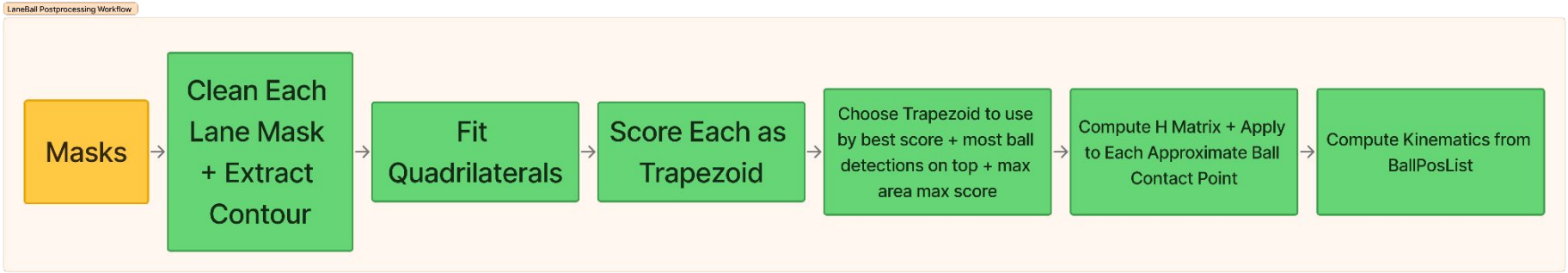
- Develop Ciclopes-API service
    - Lane/Ball detection/segmentation + Pose estimation
- Implement functionality from last semester's testing
- Prototype frontend integration

Ciclopes - Accomplishments for MS1

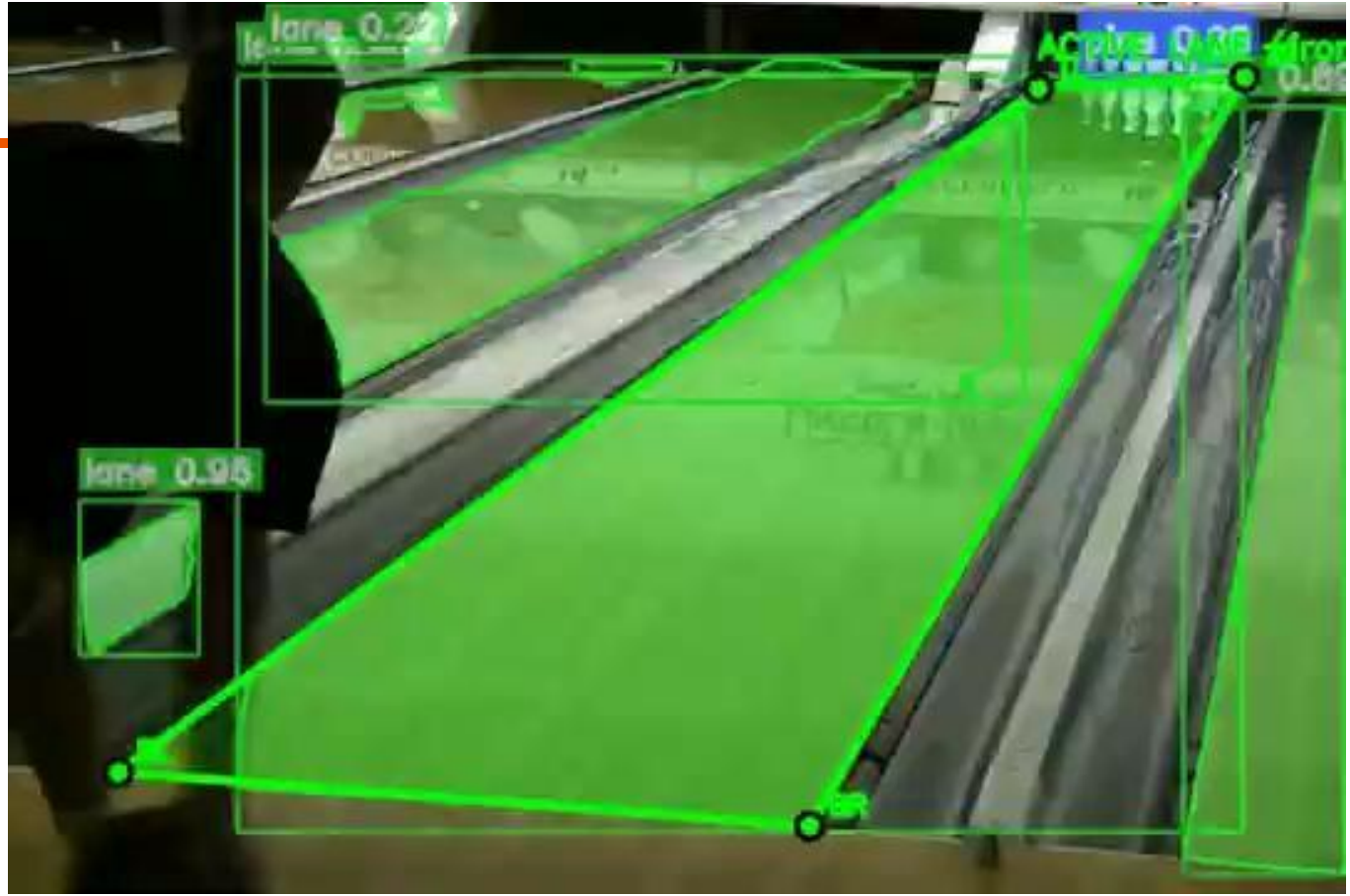
- Developed Ciclopes-API service
- Implemented and improved upon last semester's processing implementation
  - Trapezoid from segmentation for corner points
  - Scoring of lane trapezoid fittings + take max
  - Auto detection of used lane
- Prototyped client side UI + workflow

Ciclopes - Ciclopes-API Execution

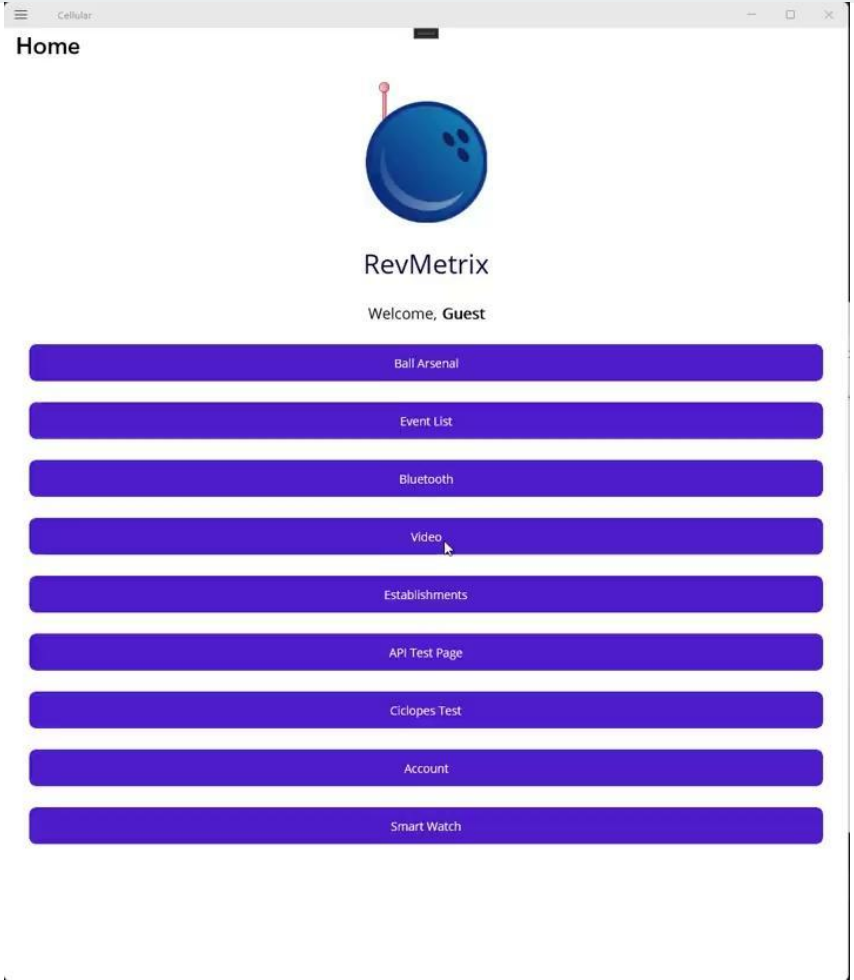




Ciclopes - Inference + Lane Selection Overlay



Ciclopes - Mock Demo



Ciclopes - Goals for MS2

- Integrate fully into client application
  - Improve upon UI for better user experience
  - Improved data visualization for interpretability
- Utilize smart dot data for release and ground point detection
  - PoseEstimation from average approach time before release and a few frames after
  - LaneBall from ground contact after
- Non blocking inference of SAM3D Body
  - Separate API calls for LaneBall and SAM3D Body – LaneBall will finish much faster
- Implement edge case handling
  - Ball leaving lane
  - Many frames without ball detection
- Real world test
- Stretch Goal: Prototype on device inference for one architecture
  - Experiment with camera setup workflow for immediate user feedback

Wiki (MS1 Goals)

- Get team members setup for development
- Update for last semesters presentations
- Start adding this semester’s progress

Wiki (MS1 Achievements)

- Most team members are set up for development
- Updated the site for last semester
  - Proposal
  - Milestone Presentations
- Added 2026 Capstone
  - Proposal
  - Current state
    - Mobile App

Search...

- 2024 Capstone
- 2025 Capstone
- 2026 Capstone
- Ciclopes
- SmartDot
- What is RevMetrix

MORE

- CS400 RevMetrix Home Page
- CS402 RevMetrix Home Page
- GitHub Organization
- Google Drive
- Credits

English
Neon

WELCOME TO REVMETRIX

- 2024 Capstone
  2024 Capstone
- 2025 Capstone
  2025 Capstone
- 2026 Capstone
  2026 Capstone
- Ciclopes
  2025 Capstone
- SmartDot
  - ISmartDot Interface
    Information about the ISmartDot interface
  - SmartDot Hardware
    Information about the SmartDot hardware
  - SmartDot Simulator
    Information about the SmartDot Simulator
- What is RevMetrix
  2025 Capstone

Search...

- 2025 Capstone
  - 2025 RevMetrix
  - 2025 Technologies Used
  - Project Milestones
    - Spring 2025
      - Milestone 1
      - Milestone 2
      - Final Presentation
    - Fall 2025
      - Milestone 1
      - Milestone 2
      - Final Presentation
  - Project Proposals
    - Spring 2025
    - Fall 2025
  - Set Up
    - .Net Upgrade
    - Ball Spinner Application

2025 CAPSTONE

2025 Capstone

- 2025 RevMetrix
  2025 Capstone
- 2025 Technologies Used
  2025 Capstone
- Project Milestones
  2025 Project Milestones
- Project Proposals
  A list of all assignments completed throughout 2025
- Set Up
  for help

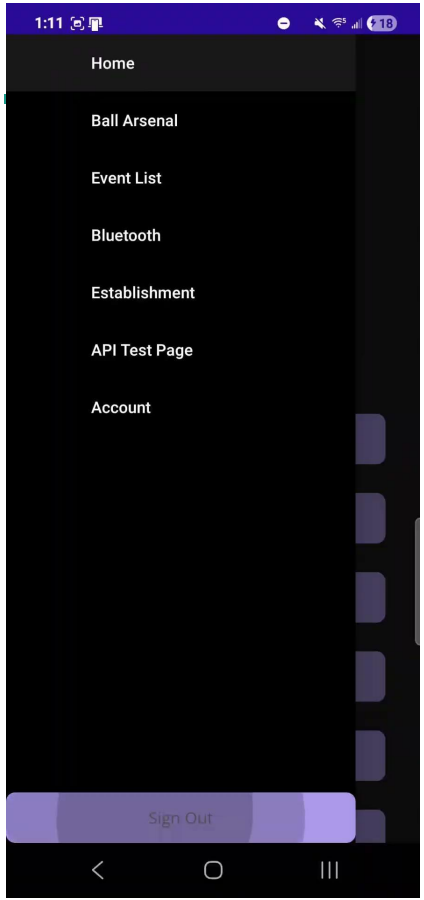
Search...
Project Proposal
2026 Technologies Used
Current State of RevMetrix
Backend
Ball Spinner Application (Deprecated)
Ball Spinner Controller
Ballspinner Physical Design
Cloud
Mobile Application
Main Page
Login
Registration
Ball Arsenal
Shot Page
Account
Stats
Project Milestones

MOBILE APPLICATION

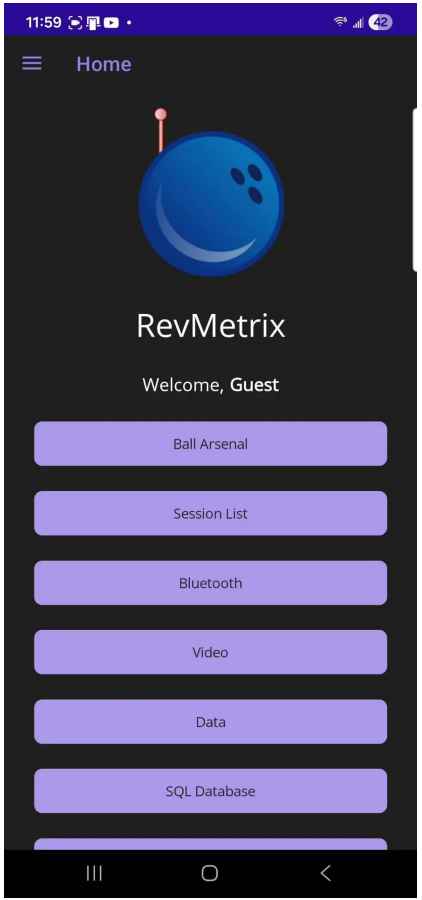
App Pages

- Main Page
  Default home page
- Login
  Login to the app
- Registration
  Create an account
- Ball Arsenal
  Mobile Application
- Shot Page
  Shot input
- Account
  User information
- Stats
  Bowling statistics

Mobile App - Demo!



Video page



Mobile App (MS1 Goals)

- Improve event and session creation/navigation
- Update ball arsenal for ball colors
- Implement Ciclopes Additions

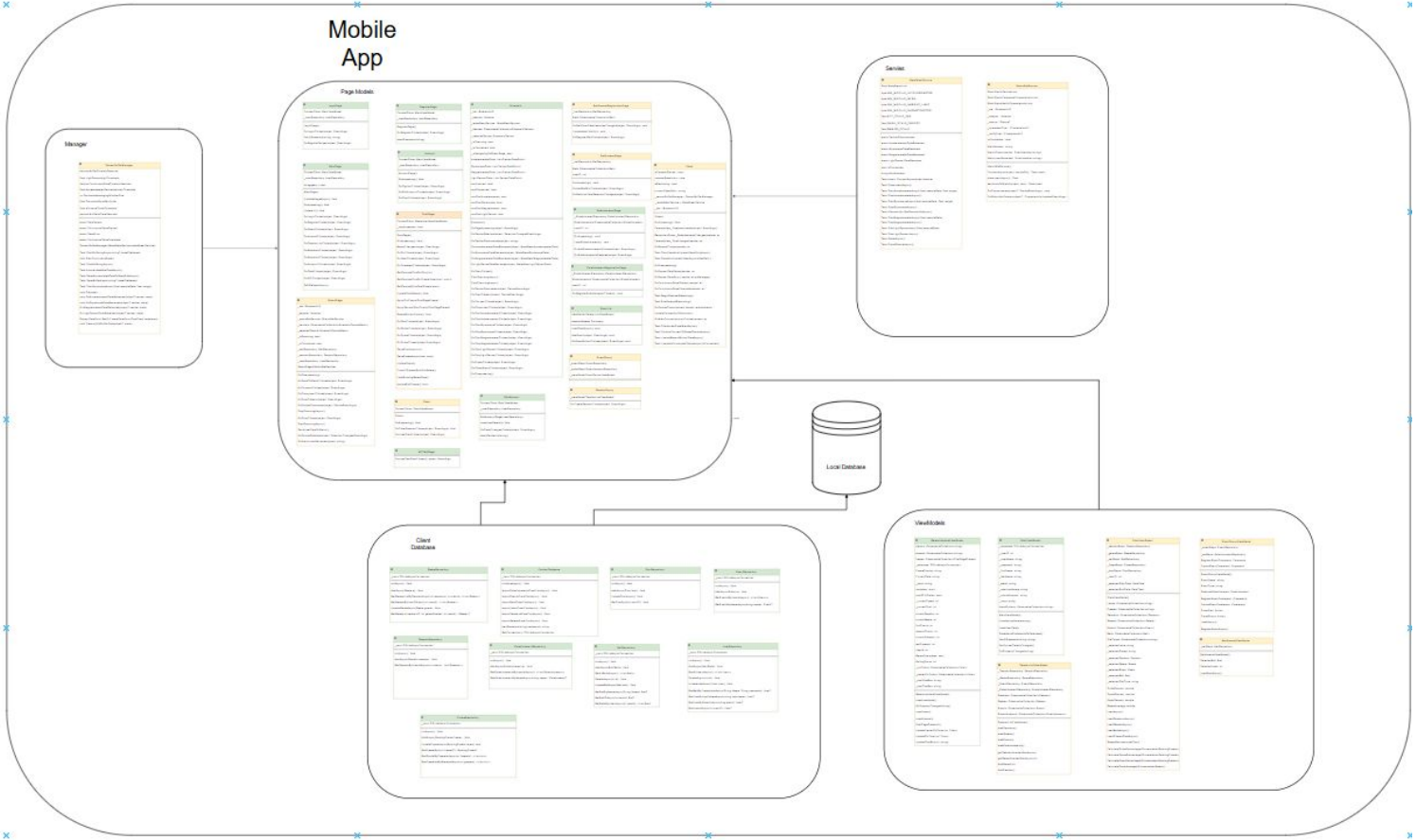
Mobile App (MS1 Achievements)

- Events and Sessions
  - New popups for creation
  - Changed navigation from main page to games
- Ball Arsenal
  - Added ball customization for ball color
- CellularCore/Unit Testing
  - DateTimeCalculator
  - StringToColorConverter
- Ciclopes Additions
  - Integrated SmartDot into Video Page
  - Take Derivative of acceleration data
  - Save the SmartDot data and video to send to cloud
- Made adjustments to Bluetooth Page and Service
  - Added auto connect Feature
  - Added Device data
  - Refactored Service to make it closer to C++ Code
- Got MMS and MMC* working
  - MMS has all the features that the Metawear app has
  - MMC has most of the features that the Metawear App has - Gyro and Mag not working

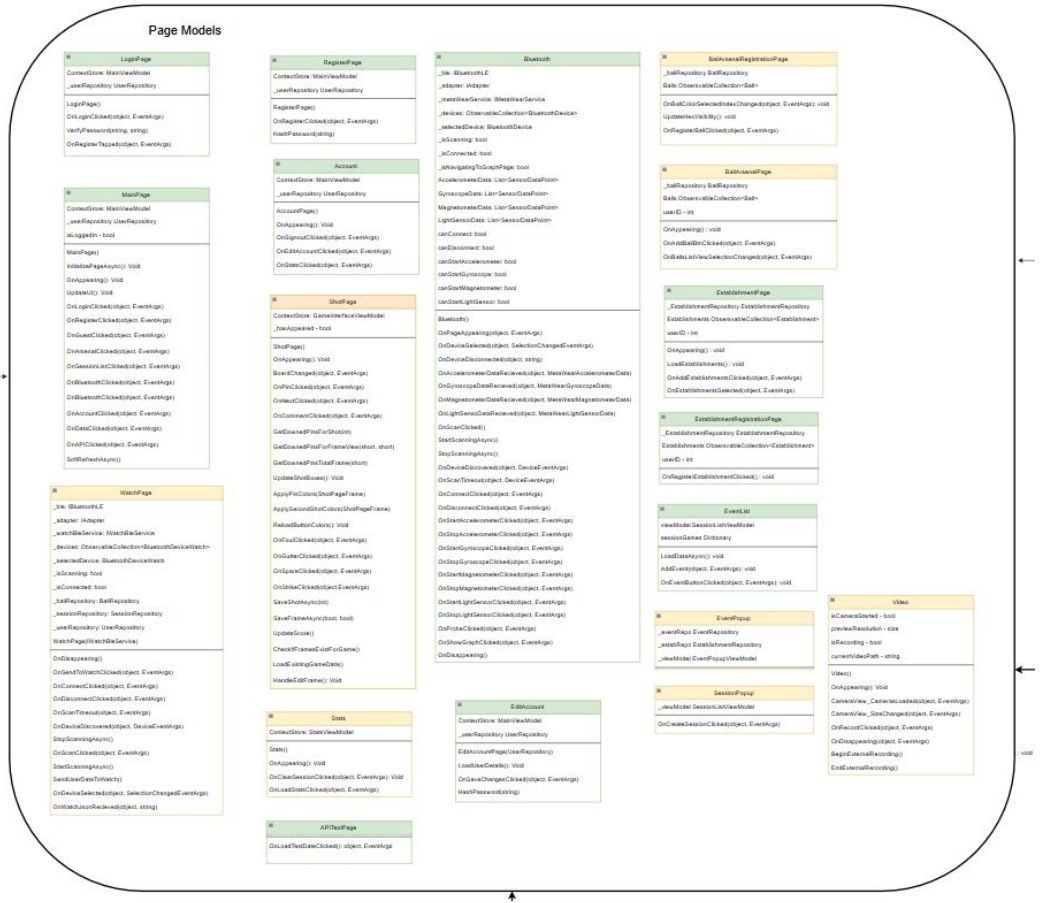
Mobile App (Future: MS2)

- Improve Stats Page
  - Add onto bits used for shots
  - Calculate more stats from the database
- Add requested features to Ball Arsenal and Event/Establishment creation
- Create Cloud Sync Feature
- Improve Ciclopes
- Improve Bluetooth to MMS and MMC

Mobile UML Overview



Mobile UML - Page Models

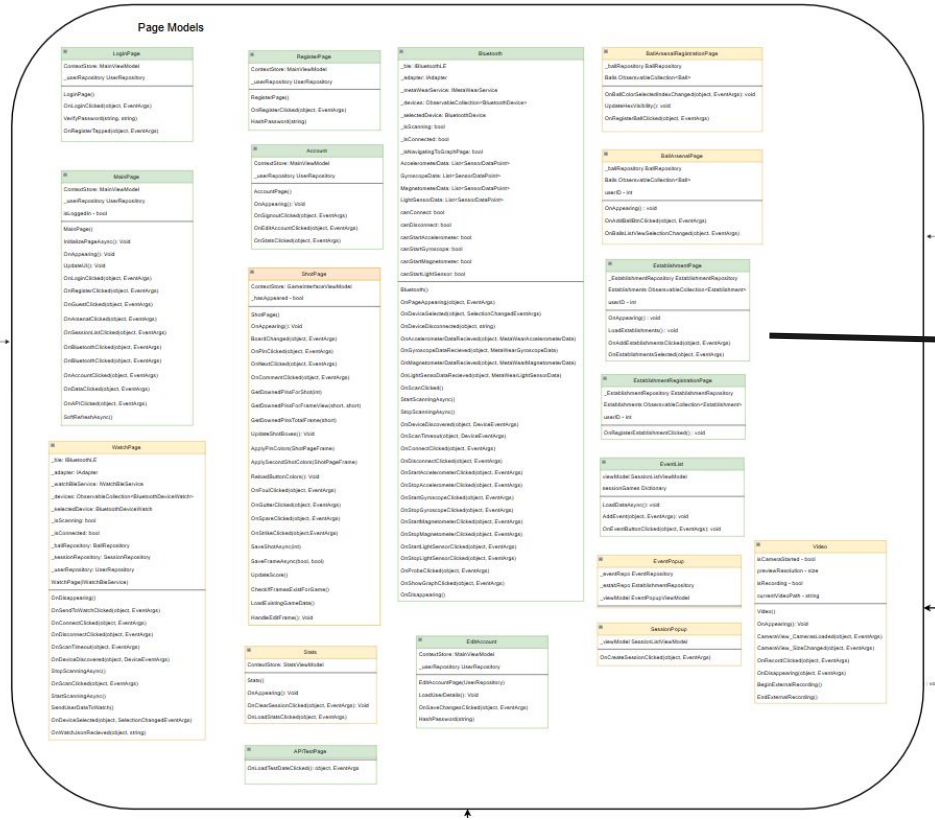


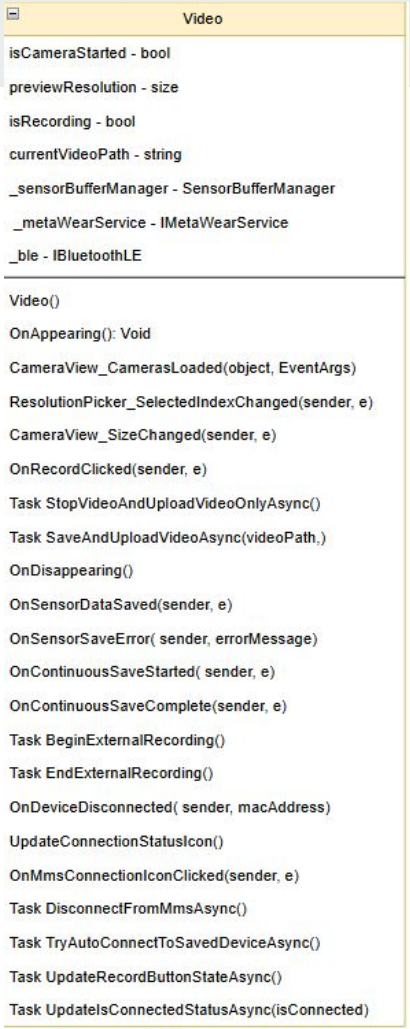
Implemented

Partially Implemented

Not Yet Implemented

Mobile UML - Video





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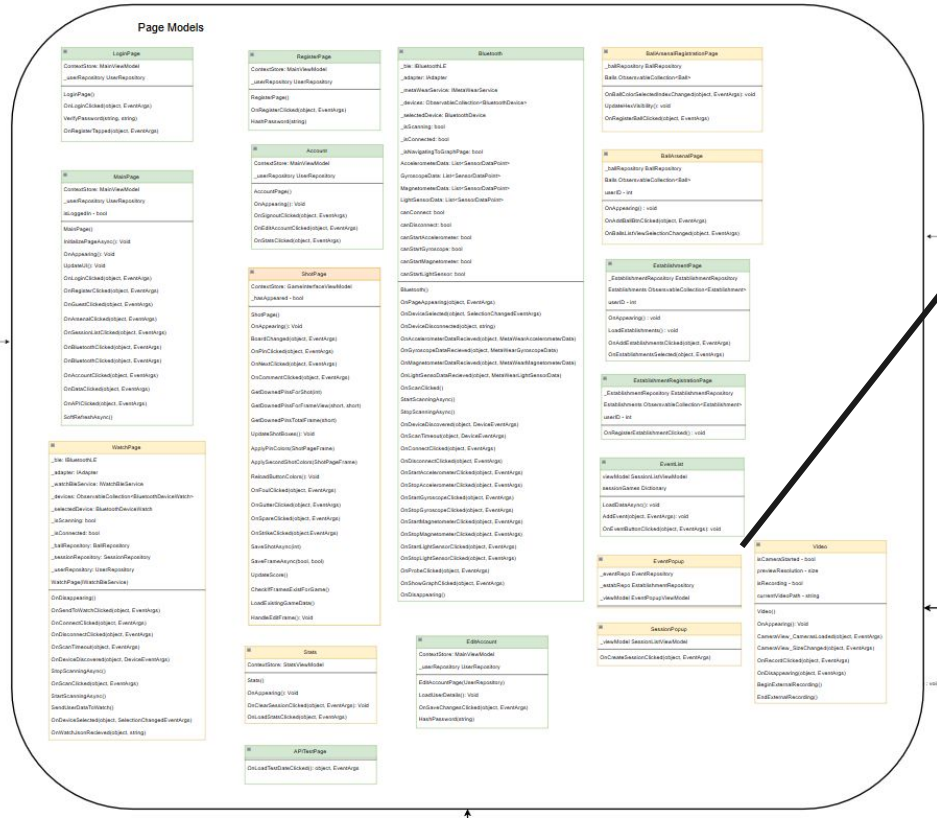
Not Yet Implemented

Mobile UML - Page Models



EventPopup
_eventRepo EventRepository
_estabRepo EstablishmentRepository
_viewModel EventPopupViewModel
InitializeComponent()
ShowAlert()
ClosePopup()

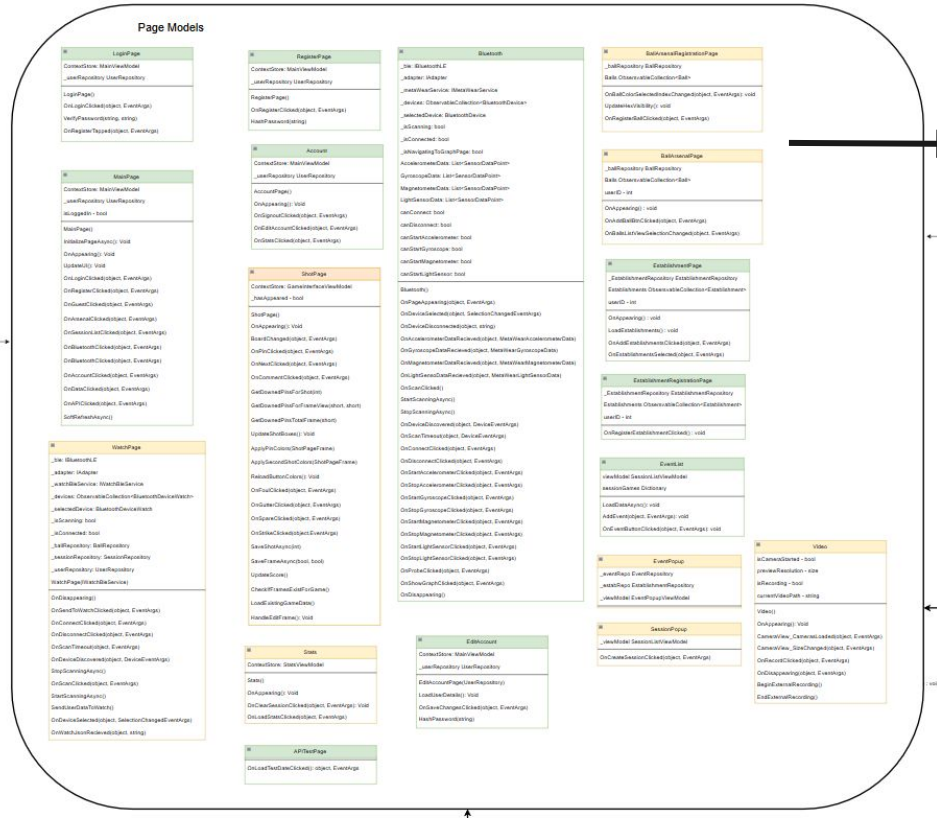
SessionPopup
_viewModel SessionListViewModel
OnCreateSessionClicked(object, EventArgs)
ClosePopup()

Implemented

Partially Implemented

Not Yet Implemented

Mobile UML - Page Models



BallArsenalRegistrationPage
_ballRepository BallRepository
Balls ObsersvableCollection<Ball>
OnBallColorSelectedIndexChanged(object, EventArgs): void
UpdateHexVisibility(): void
OnRegisterBallClicked(object, EventArgs)

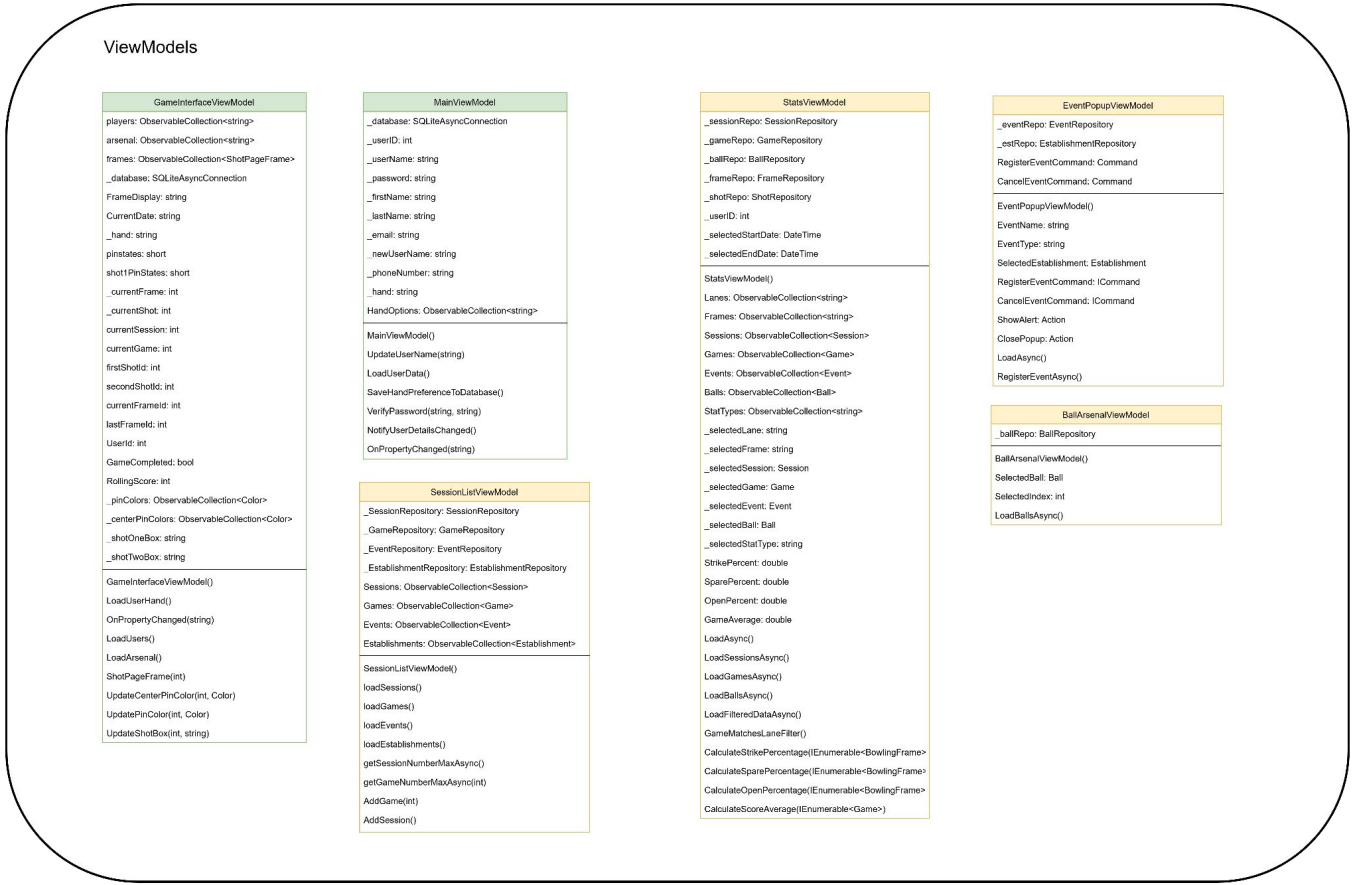
BallArsenalPage
_ballRepository BallRepository
Balls ObsersvableCollection<Ball>
userID - int
OnAppearing() : void
OnAddBallBtnClicked(object, EventArgs)
OnBallsListViewSelectionChanged(object, EventArgs)

Implemented

Partially Implemented

Not Yet Implemented

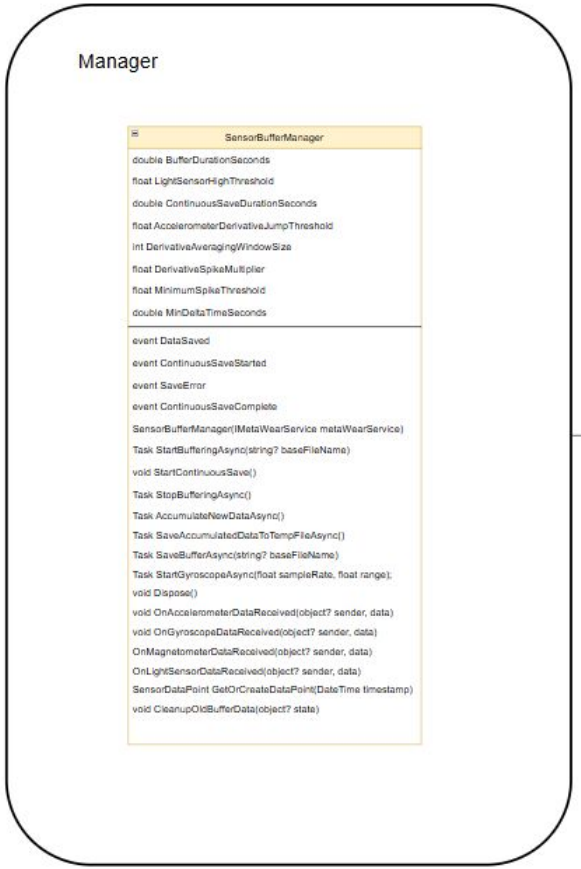
Mobile UML - View Models



Mobile UML - Database

Client
Database

Mobile UML - Managers

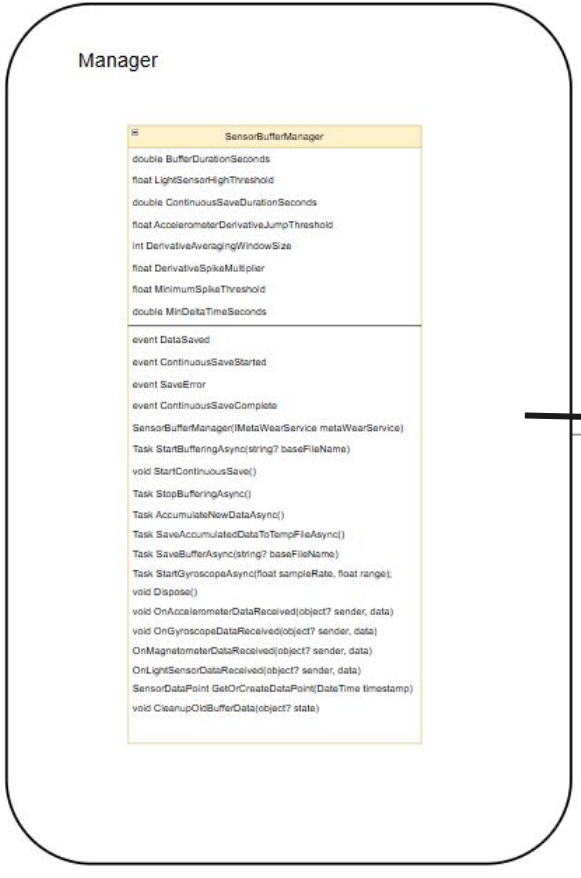


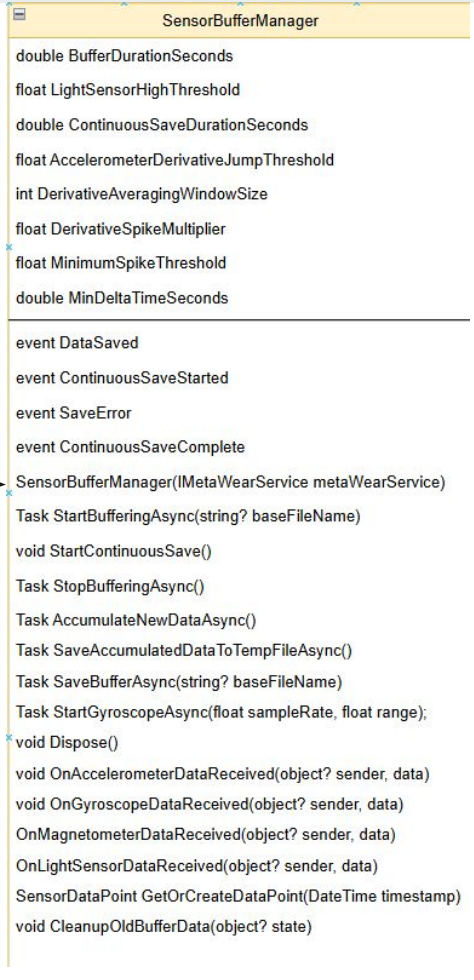
Implemented

Partially Implemented

Not Yet Implemented

Mobile UML - SensorBufferManager



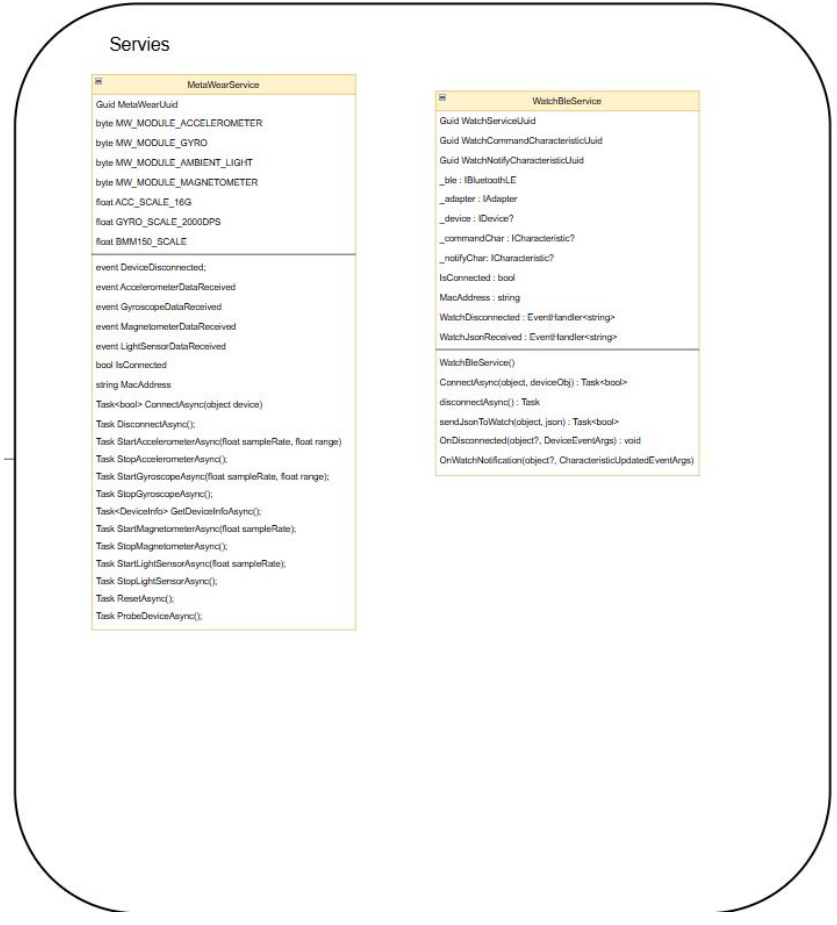


Implemented

Partially Implemented

Not Yet Implemented

Mobile UML - Services



Implemented

Partially Implemented

Not Yet Implemented

Mobile UML - MetaWearService

Servies

MetaWearService

Guid MetaWearUuid
byte MW_MODULE_ACCELEROMETER
byte MW_MODULE_GYRO
byte MW_MODULE_AMBIENT_LIGHT
byte MW_MODULE_MAGNETOMETER
float ACC_SCALE_16G
float GYRO_SCALE_2000DPS
float BMM150_SCALE

event DeviceDisconnected;
event AccelerometerDataReceived
event GyroscopeDataReceived
event MagnetometerDataReceived
event LightSensorDataReceived
bool IsConnected
string MacAddress
Task<bool> ConnectAsync(object device)
Task DisconnectAsync();
Task StartAccelerometerAsync(float sampleRate, float range)
Task StopAccelerometerAsync();
Task StartGyroscopeAsync(float sampleRate, float range);
Task StopGyroscopeAsync();
Task<DeviceInfo> GetDeviceInfoAsync();
Task StartMagnetometerAsync(float sampleRate);
Task StopMagnetometerAsync();
Task StartLightSensorAsync(float sampleRate);
Task StopLightSensorAsync();
Task ResetAsync();
Task ProbeDeviceAsync();

WatchBleService

Guid WatchServiceUuid
Guid WatchCommandCharacteristicUuid
Guid WatchNotifyCharacteristicUuid
_ble : IBluetoothLE
_adapter : IAdapter
_device : IDevice?
_commandChar : ICharacteristic?
_notifyChar: ICharacteristic?
IsConnected : bool
MacAddress : string
WatchDisconnected : EventHandler<string>
WatchJsonReceived : EventHandler<string>

WatchBleService()
ConnectAsync(object, deviceObj) : Task<bool>
disconnectAsync() : Task
sendJsonToWatch(object, json) : Task<bool>
OnDisconnected(object?, DeviceEventArgs) : void
OnWatchNotification(object?, CharacteristicUpdatedEventArgs)

MetaWearService

Guid MetaWearUuid
byte MW_MODULE_ACCELEROMETER
byte MW_MODULE_GYRO
byte MW_MODULE_AMBIENT_LIGHT
byte MW_MODULE_MAGNETOMETER
float ACC_SCALE_16G
float GYRO_SCALE_2000DPS
float BMM150_SCALE

event DeviceDisconnected;
event AccelerometerDataReceived
event GyroscopeDataReceived
event MagnetometerDataReceived
event LightSensorDataReceived
bool IsConnected
string MacAddress
Task<bool> ConnectAsync(object device)
Task DisconnectAsync();
Task StartAccelerometerAsync(float sampleRate, float range)
Task StopAccelerometerAsync();
Task StartGyroscopeAsync(float sampleRate, float range);
Task StopGyroscopeAsync();
Task<DeviceInfo> GetDeviceInfoAsync();
Task StartMagnetometerAsync(float sampleRate);
Task StopMagnetometerAsync();
Task StartLightSensorAsync(float sampleRate);
Task StopLightSensorAsync();
Task ResetAsync();
Task ProbeDeviceAsync();

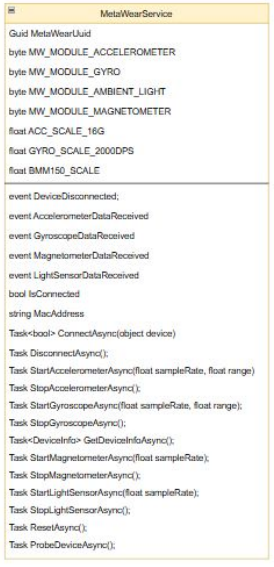
Implemented

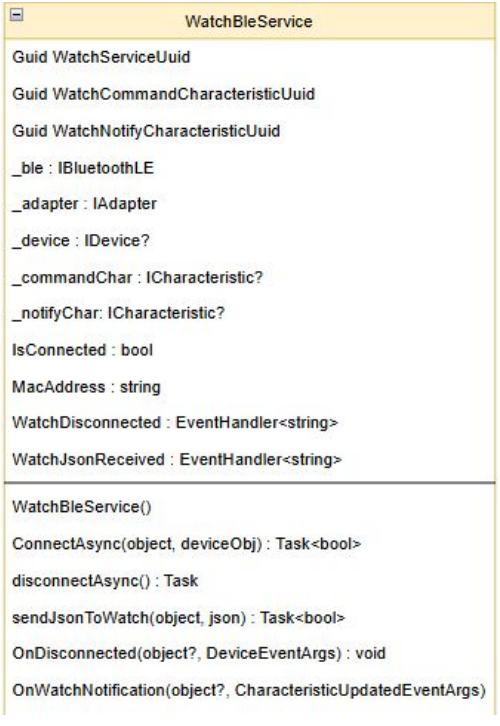
Partially Implemented

Not Yet Implemented

Mobile UML - WatchBleService

Servies



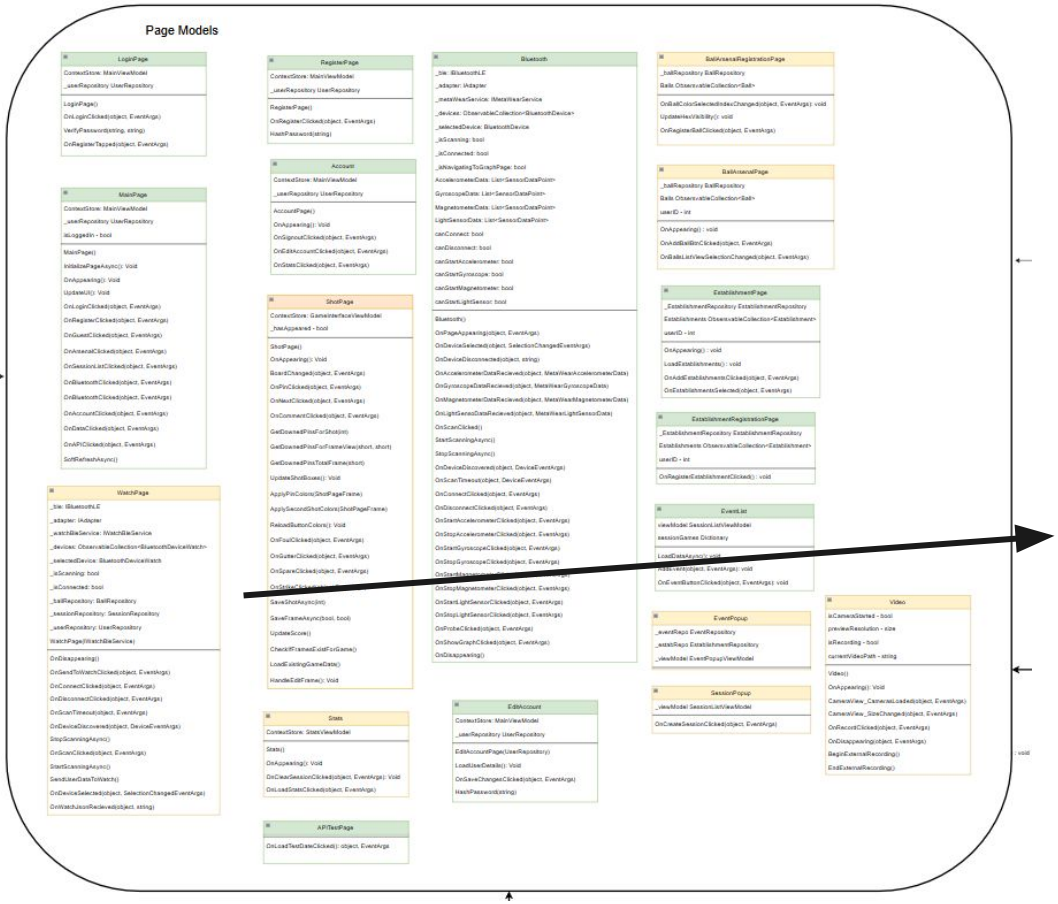


Implemented

Partially Implemented

Not Yet Implemented

Mobile UML - WatchPage



WatchPage

_ble: IBluetoothLE

_adapter: IAdapter

_watchBleService: IWatchBleService

_devices: ObservableCollection<BluetoothDeviceWatch>

_selectedDevice: BluetoothDeviceWatch

_isScanning: bool

_isConnected: bool

_ballRepository: BallRepository

_sessionRepository: SessionRepository

_userRepository: UserRepository

WatchPage(IWatchBleService)

OnDisappearing()

OnSendToWatchClicked(object, EventArgs)

OnConnectClicked(object, EventArgs)

OnDisconnectClicked(object, EventArgs)

OnScanTimeout(object, EventArgs)

OnDeviceDiscovered(object, DeviceEventArgs)

StopScanningAsync()

OnScanClicked(object, EventArgs)

StartScanningAsync()

SendUserDataToWatch()

OnDeviceSelected(object, SelectionChangedEventArgs)

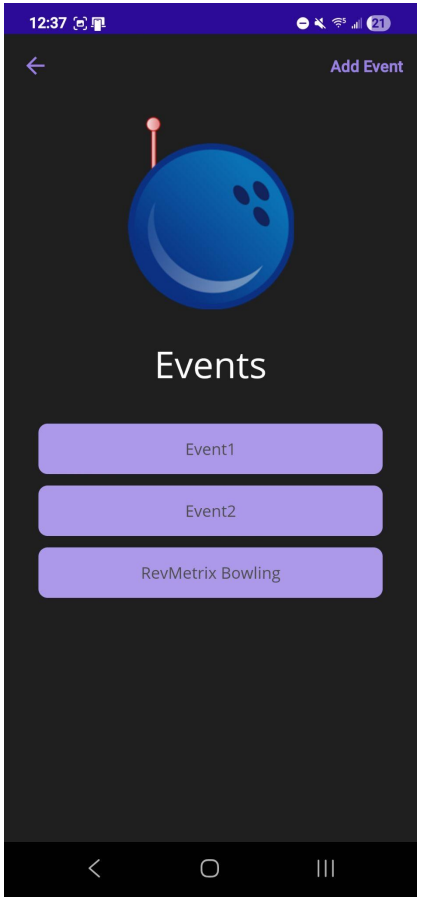
OnWatchJsonRecieved(object, string)

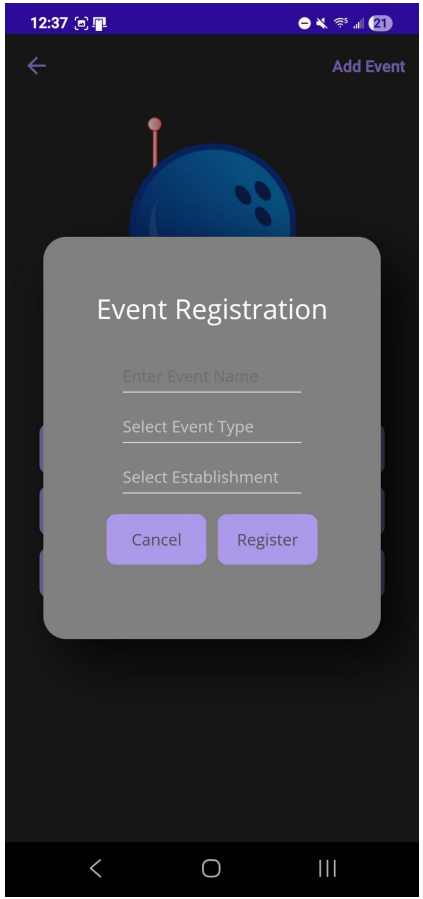
Implemented

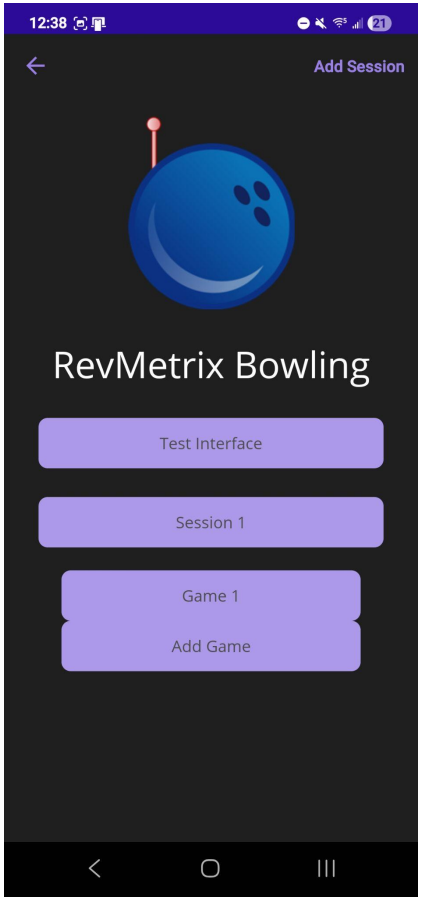
Partially Implemented

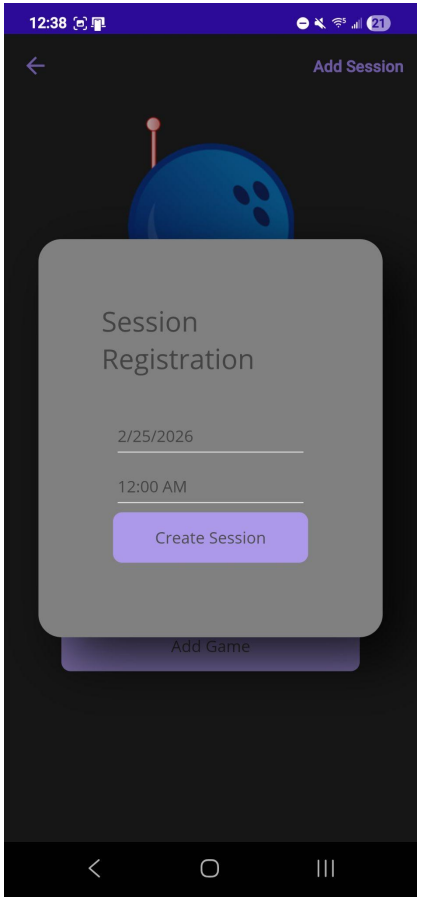
Not Yet Implemented

Mobile App - Event and Session Creation

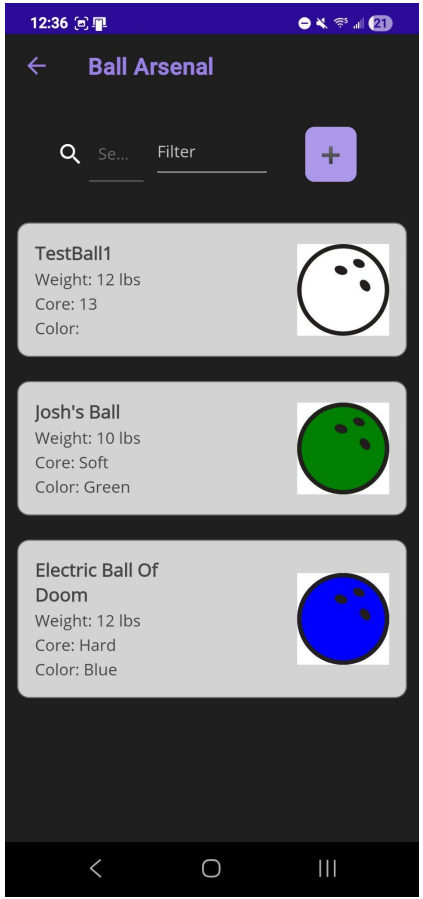


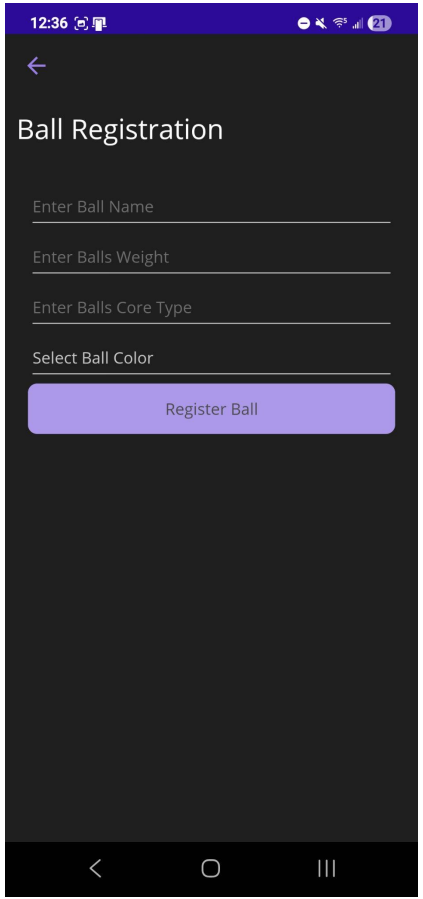




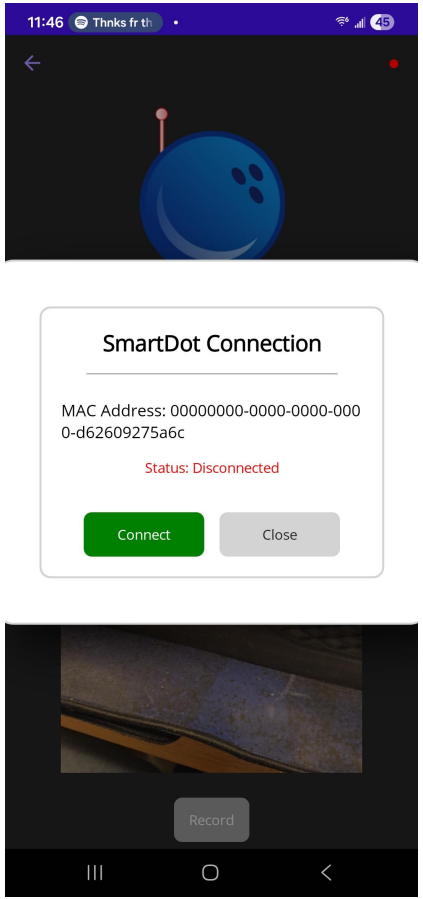


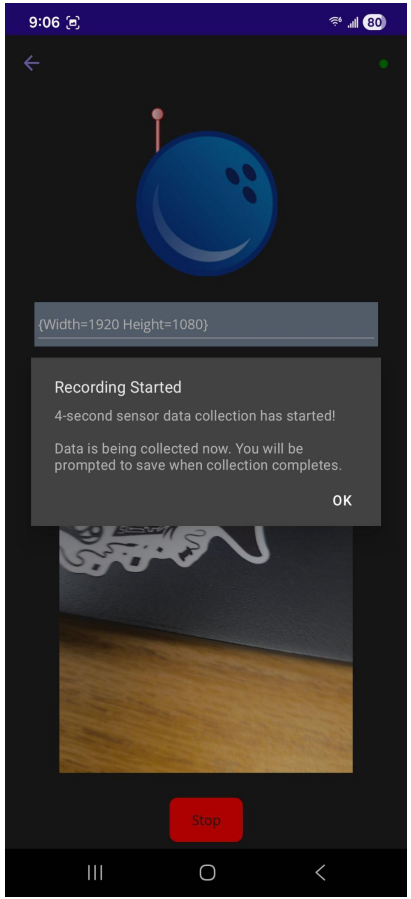
Mobile App - Ball Arsenal Updated

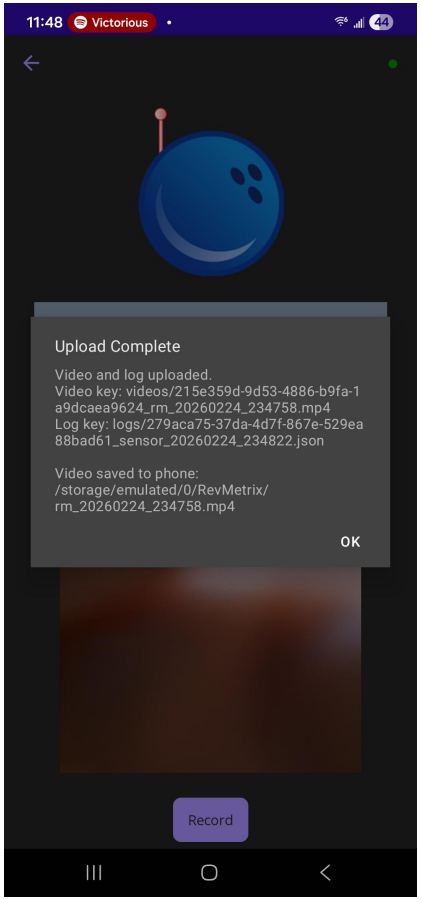




Mobile App - Video Page Update








```
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  "Timestamp": "2026-02-11T09:06:31.8845012-05:00",
  "AccelX": 0.029296875,
  "AccelY": -0.015625,
  "AccelZ": 2.069336,
  "GyroX": null,
  "GyroY": null,
  "GyroZ": null,
  "MagX": null,
  "MagY": null,
  "MagZ": null,
  "Light": null
},
{
  "Timestamp": "2026-02-11T09:06:38.6709449-05:00",
  "DerivativeX": 0.20601425,
  "DerivativeY": -0.48069993,
  "DerivativeZ": -0.06867142,
  "Magnitude": 0.5274752
}
],
"AccelerometerJumpTimestamps": [
  "2026-02-11T09:06:33.8911359-05:00",
  "2026-02-11T09:06:33.9121762-05:00",
  "2026-02-11T09:06:33.9207842-05:00",
  "2026-02-11T09:06:33.9420981-05:00",
  "2026-02-11T09:06:33.9509122-05:00",
  "2026-02-11T09:06:35.7710992-05:00",
  "2026-02-11T09:06:35.7720761-05:00",
  "2026-02-11T09:06:37.5586354-05:00",
  "2026-02-11T09:06:37.6101412-05:00",
  "2026-02-11T09:06:37.616562-05:00",
  "2026-02-11T09:06:37.6370357-05:00",
  "2026-02-11T09:06:37.6392407-05:00",
  "2026-02-11T09:06:37.668138-05:00",
  "2026-02-11T09:06:37.6914524-05:00",
  "2026-02-11T09:06:37.7304047-05:00"
],
"JumpCount": 15,
"TotalDerivativeCalculations": 676
```
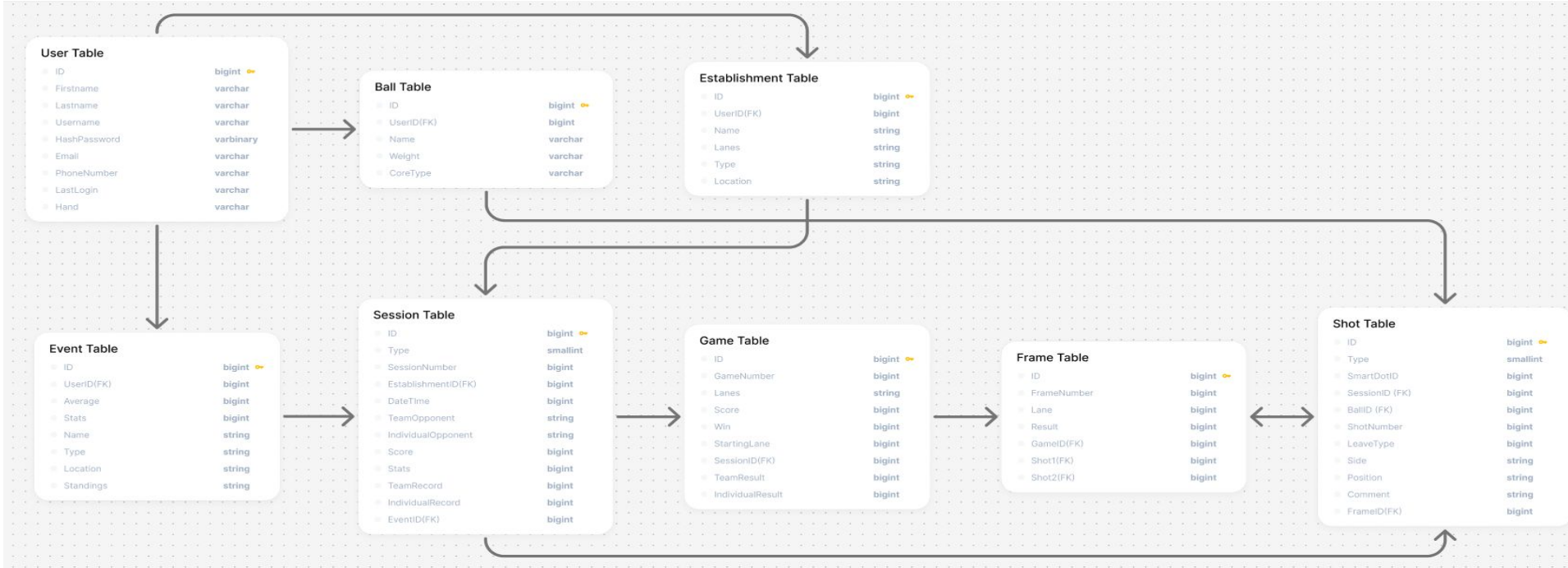

Database Schema



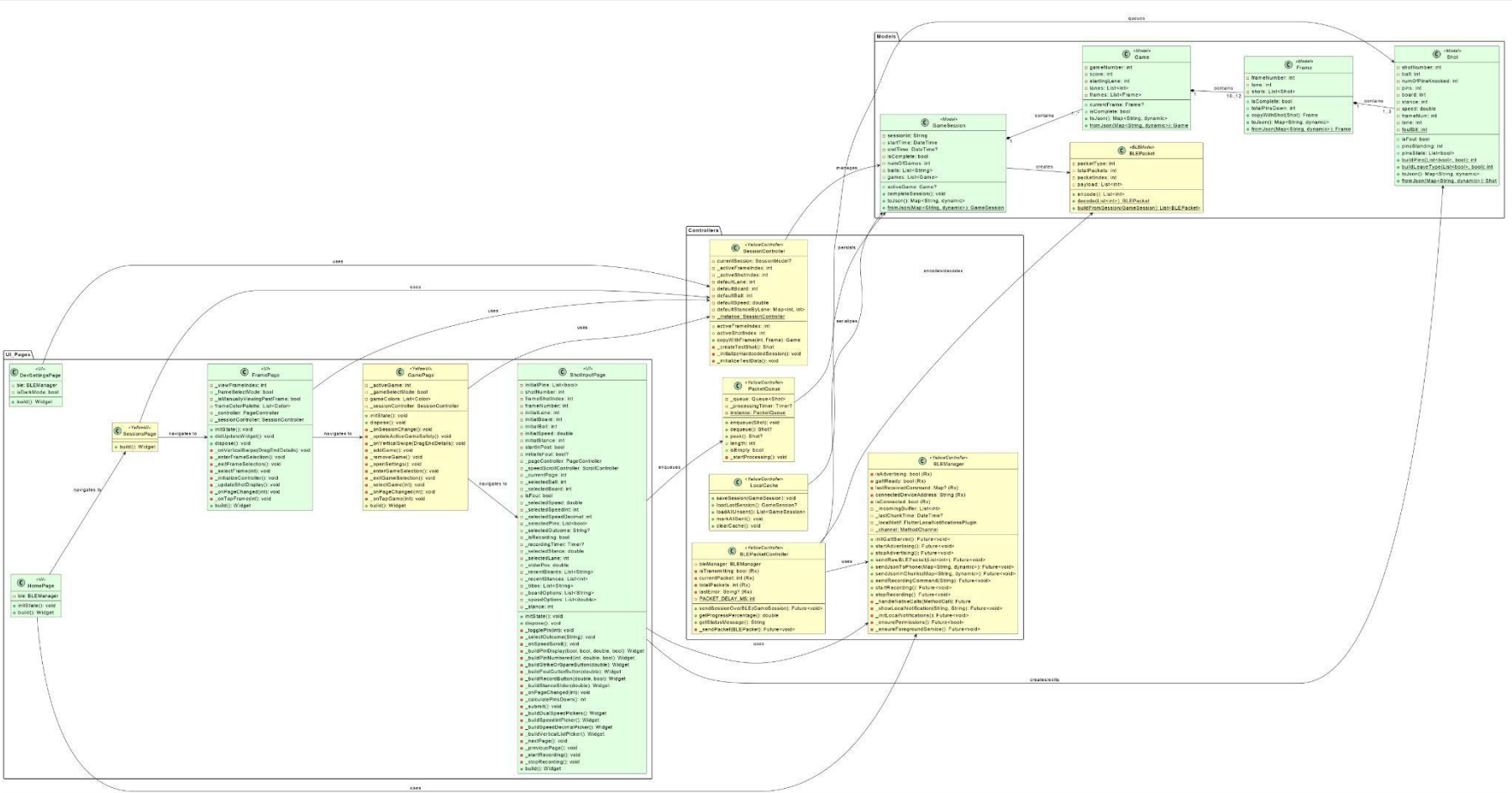
Cloud (MS1 Goals and Accomplishments)

- CI/CD from Main to Digital Ocean (DockerHub)
- Fix Mobile App API Points(Key)
- Get Spaces Object Storage for Ciclopes

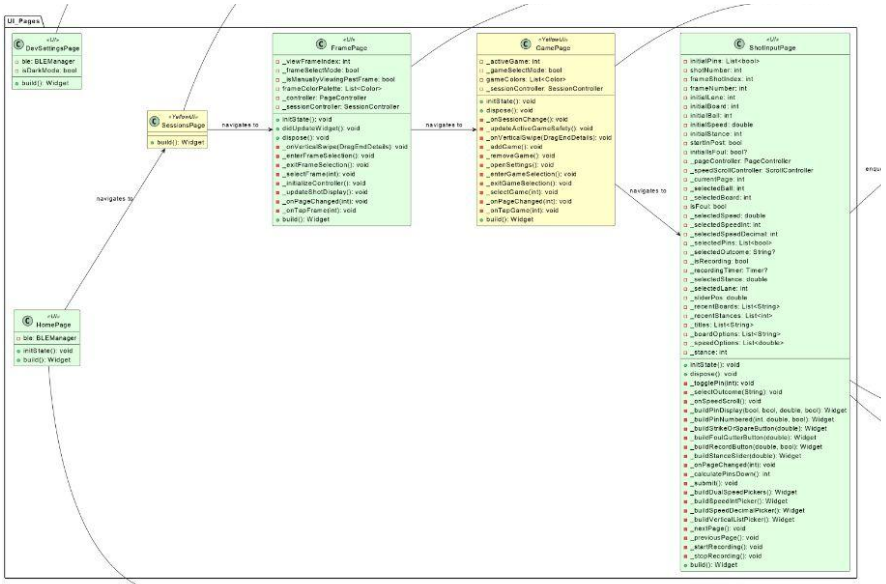
Cloud (Future: MS2)

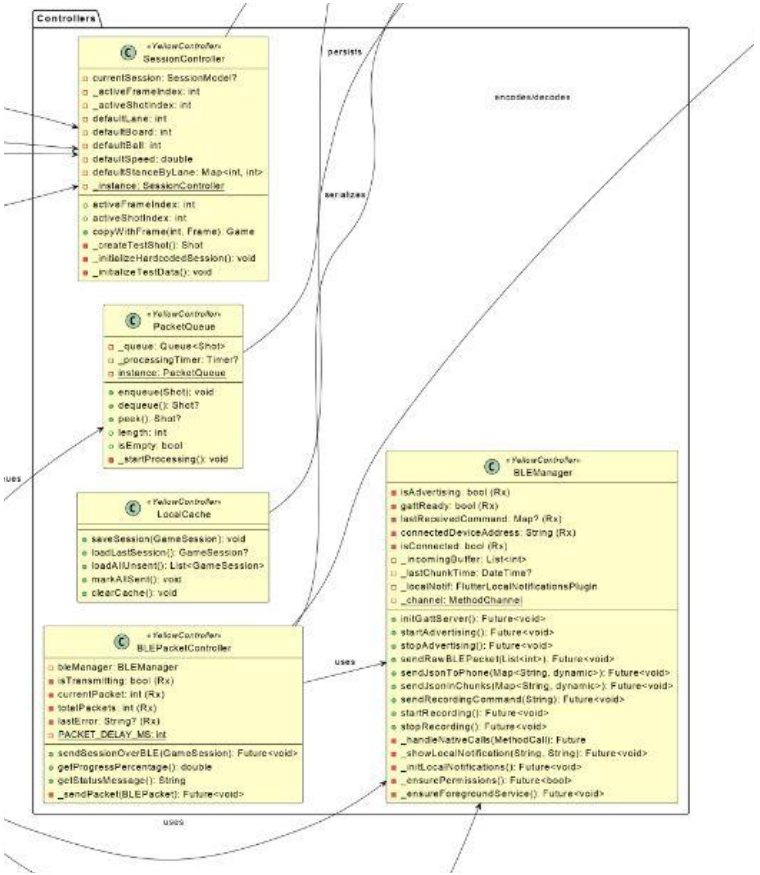
- Implement Changes to Pi Teams API Point
- Deprecate old feature
- Maintain Cloud

Smart Watch UML



Smart Watch UML (Expanded)



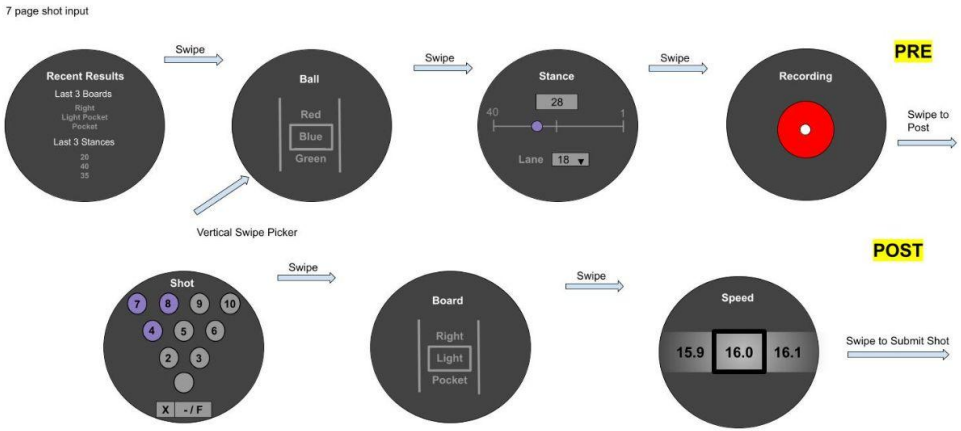


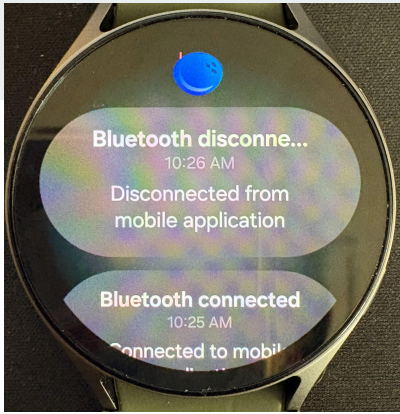
Tools and Technologies

- **Flutter** - framework
- **Dart** - programming language
- **Kotlin** - Android BLE foreground services
- **Visual Studio Code** - IDE
- **Bluetooth Low Energy** (BLE)
- **Android/IOS Launcher** - Emulator

Smart Watch (MS1 Goals)

- Update UI with requested workflow changes
- Bug fixes coming in from last semester
  - Swipe navigation
  - Strike button
  - Pins standing vs left standing
  - Coloring differences from cellular
- WatchOS notifications from app
- Plan packet handling





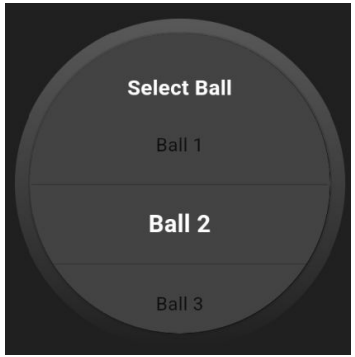
Smart Watch (MS1 Achievements pt. 1)

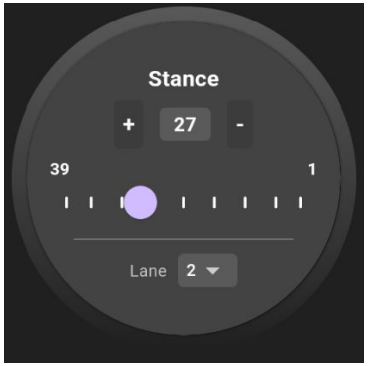
- Updated UI
  - New swipe through technique (7 pages)
  - Merged logic/common widgets from 2 phase
- Bug Fixes
  - Pins left standing
  - New coloring (frame page included)
  - Swipe and exit navigation for every page
- Watch Notifications from application
  - BLE active and connect/disconnect
- New pages
  - Home page
  - Sessions page
  - Settings page

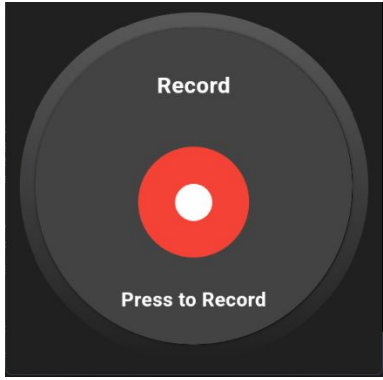
- Account data from phone on connection (testing)
  - Session Ids
  - Session names
  - Username
  - Ball information
  - Hand

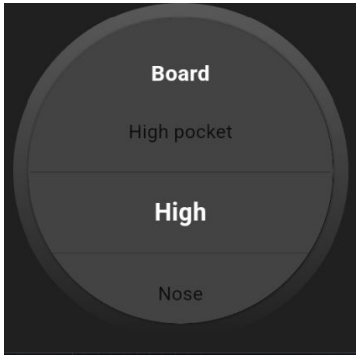
```
02-24 23:17:05.975  4894  4894 I flutter : WATCH BLE RECEIVED COMPLETE: {"cmd":"userData","username":"BigBalls","hand":"Right","sessions":[{"sessionId":1,"sessionNumber"
:1},{"sessionId":2,"sessionNumber":2},{"sessionId":3,"sessionNumber":3}],"balls":[{"ballId":2,"name":"Ballsssy"},{"ballId":3,"name":"ball free"}]}
02-24 23:17:05.979  4894  4894 I flutter : WATCH BLE Username: BigBalls
02-24 23:17:05.979  4894  4894 I flutter : WATCH BLE Hand: Right
02-24 23:17:05.999  4894  4894 I flutter : WATCH BLE Sessions: [{sessionId: 1, sessionNumber: 1}, {sessionId: 2, sessionNumber: 2}, {sessionId: 3, sessionNumber: 3}]
02-24 23:17:05.999  4894  4894 I flutter : WATCH BLE Balls: [{ballId: 2, name: Ballsssy}, {ballId: 3, name: ball free}]
```

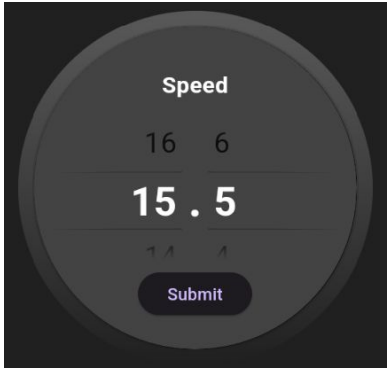
New UI









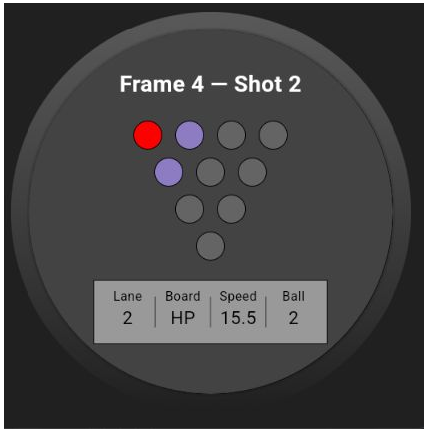


(NEW)

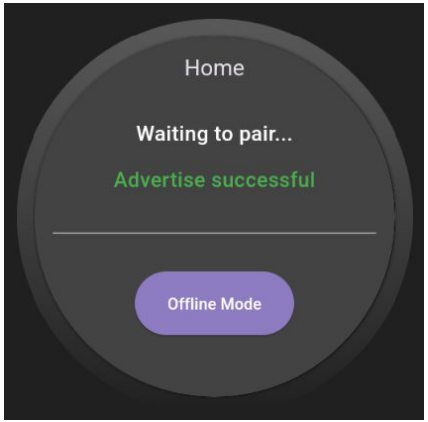
Submission of Shot

New Pages

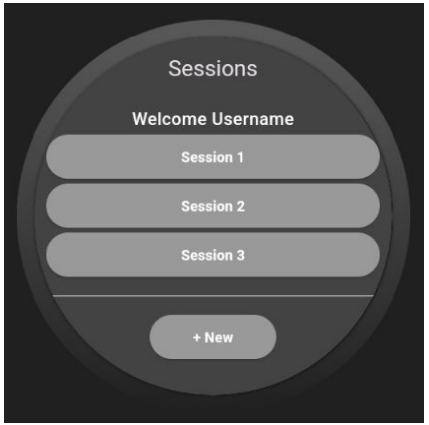
New coloring on second shot



New coloring + Info Bar

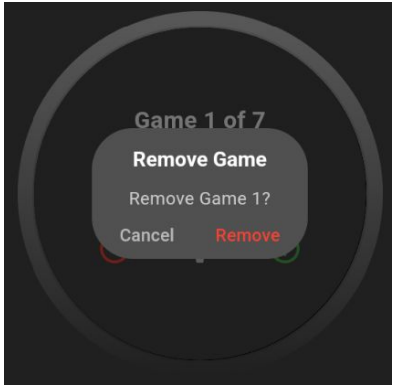


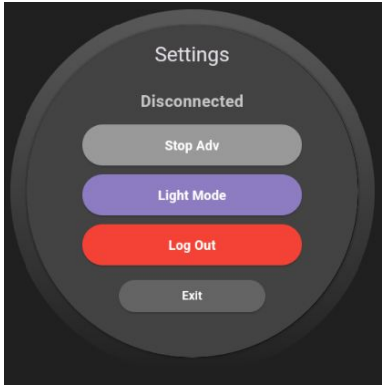
Home page



**Sessions page

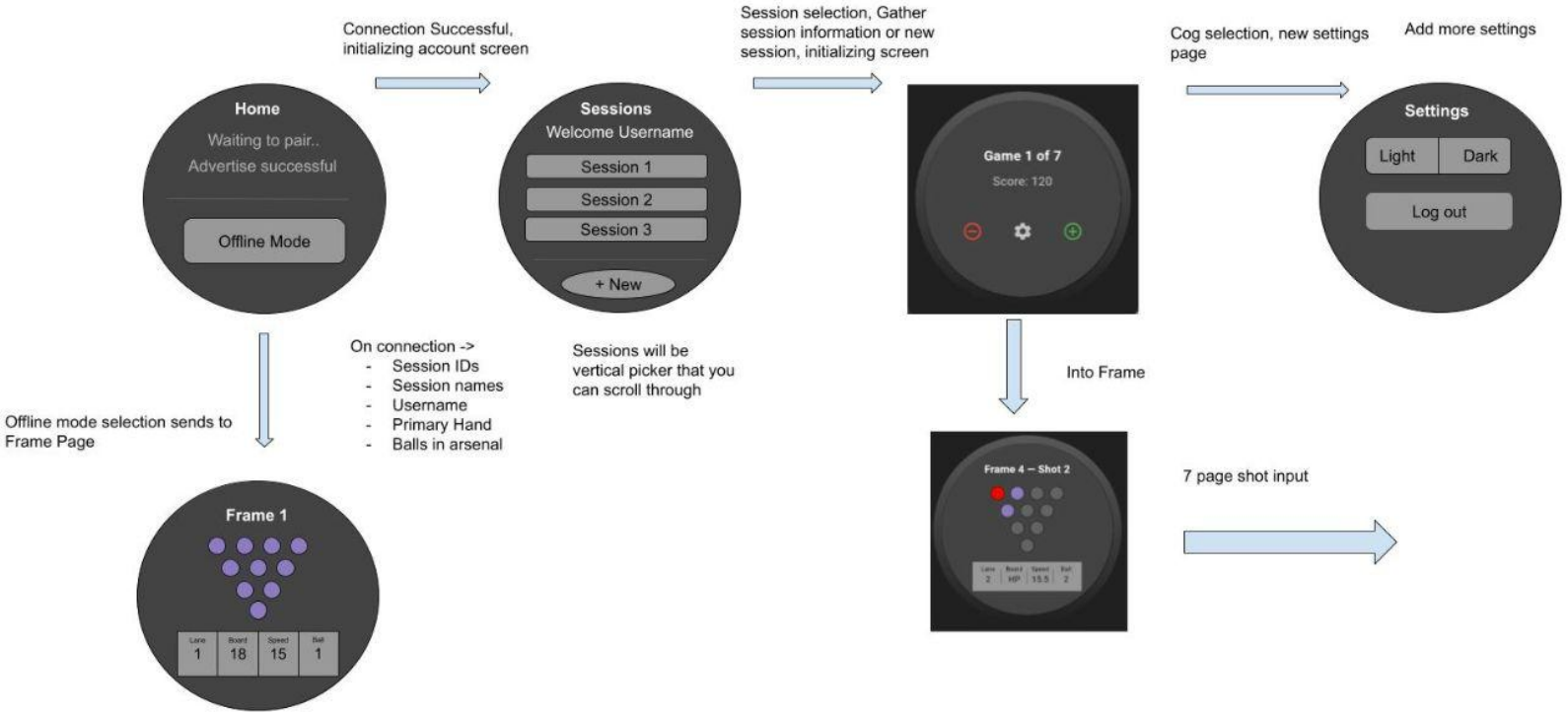
Remove confirmation





Settings page

Workflow


Connection Successful, initializing account screen
Session selection, Gather session information or new session, initializing screen
Cog selection, new settings page
Add more settings
Home
Waiting to pair..
Advertise successful
Offline Mode
Sessions
Welcome Username
Session 1
Session 2
Session 3
+ New
Game 1 of 7
Score: 120
Settings
Light
Dark
Log out
On connection ->
- Session IDs
- Session names
- Username
- Primary Hand
- Balls in arsenal
Sessions will be vertical picker that you can scroll through
Into Frame
Offline mode selection sends to Frame Page
Frame 1
Lane 1
Board 18
Speed 15
Ball 1
Frame 4 – Shot 2
7 page shot input

Smart Watch (MS1 Achievements pt. 2)

- Refactored shot model
  - Reflects new input and more closely aligns with the phone's data collection
- Basic implementation of a Bluetooth packet queue
- Shot data processing now triggered by submit
- Game page deletion confirmation

```
I/flutter ( 6706): [PacketQueue] Queue length: 1
I/flutter ( 6706): Shot submitted: {shotNumber: 7, ball: 4, numOfPinsKnocked: 6, pins: 39, board: 4, sta
nce: 18, speed: 6.7, frameNum: 5, lane: 1}
I/flutter ( 6706): [PacketQueue] Enqueued shot #7. Queue length: 2
W/WindowOnBackDispatcher( 6706): sendCancelIfRunning: isInProgress=false callback=io.flutter.embedding.a
ndroid.FlutterActivity$1@73e376e
W/WindowOnBackDispatcher( 6706): sendCancelIfRunning: isInProgress=false callback=io.flutter.embedding.a
ndroid.FlutterActivity$1@73e376e
W/WindowOnBackDispatcher( 6706): sendCancelIfRunning: isInProgress=false callback=io.flutter.embedding.a
ndroid.FlutterActivity$1@73e376e
I/flutter ( 6706): [PacketQueue] Next shot in queue: {shotNumber: 6, ball: 3, numOfPinsKnocked: 10, pins
: 0, board: 0, stance: 20, speed: 15.5, frameNum: 4, lane: 2}
I/flutter ( 6706): [PacketQueue] Queue length: 2
```

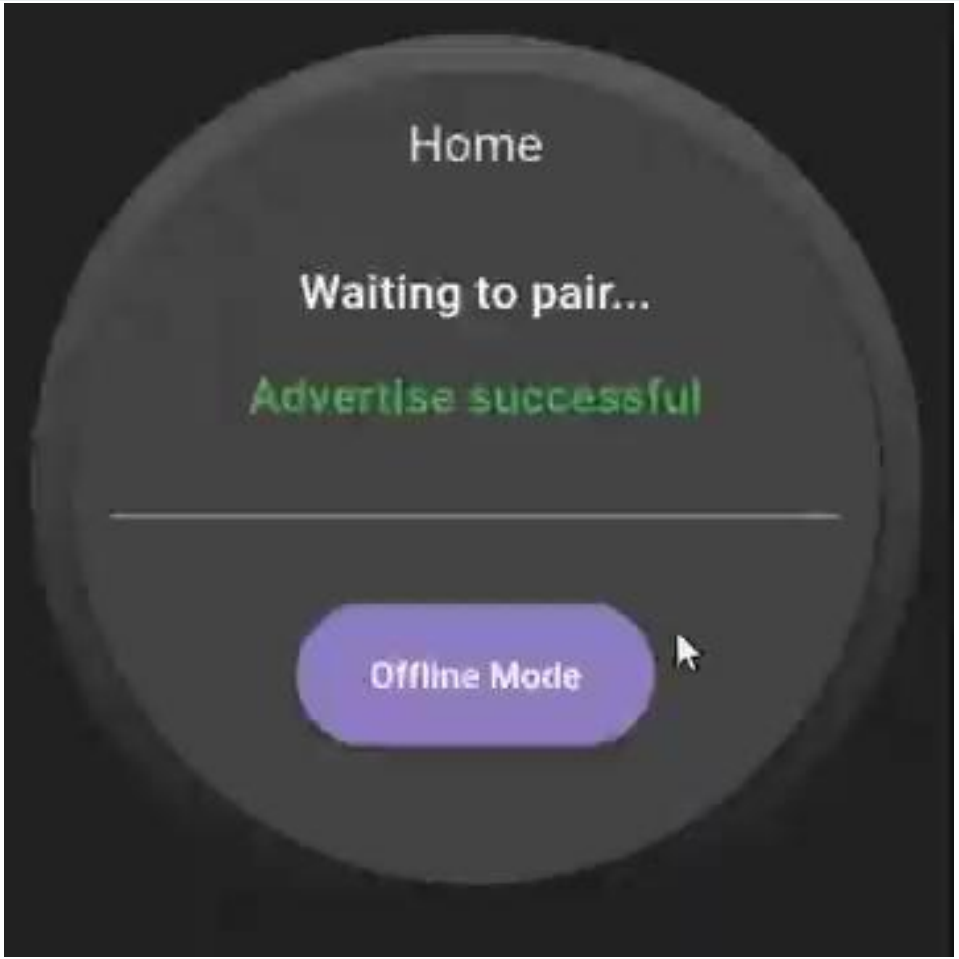
```dart
// models/shot.dart
class Shot {
  final int shotNumber;
  final int ball;
  final int numOfPinsKnocked;
  final int pins;
  final int board;
  final int stance;
  final double speed;
  final int frameNum;
  final int lane;

```

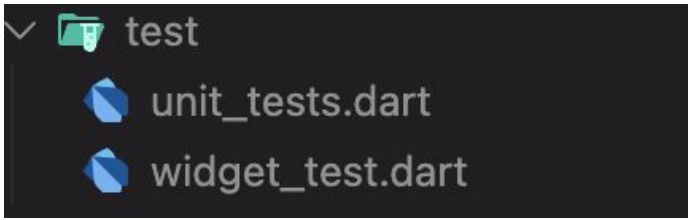
```dart
class PacketQueue {
  PacketQueue._internal();

  static final PacketQueue instance = PacketQueue._internal();

  final Queue<Shot> _queue = Queue<Shot>();

  Timer? _processingTimer;

  /// Starts the internal processing loop (called automatically by [enqueue]).
  void _startProcessing() {
    if (_processingTimer != null) return; // already running
    _processingTimer = Timer.periodic(const Duration(seconds: 10), (_) {
      if (_queue.isNotEmpty) {
        // ignore: avoid_print
        print('[PacketQueue] Next shot in queue: ${_queue.first.toJson()}\n'
            '[PacketQueue] Queue length: ${_queue.length}');
      } else {
        // Queue empty, stop the timer until another shot arrives.
        _processingTimer?.cancel();
        _processingTimer = null;
        // ignore: avoid_print
        print('[PacketQueue] Queue empty, processing loop stopped.');
      }
    }); // Timer.periodic
  }
```

Smart Watch (Future MS2)

- Solidify BLE packets
  - Different types
    - Startup/end
    - Session
    - Shot
    - Watchdog
  - Shot packet data
- Constructing Packets
  - Chunking/parsing packets
  - Both sending/receiving ends
- Expand functionality of the queue
  - Sending all packets through it
  - Hooking up to the BLE Manager
- Stance Page updates
  - New look + intervals of half a board
  - Dependent on lane
  - Flipping per hand
- Game Page updates
  - Score updating

Smartwatch Demo + Unit Tests






```
charlescarroll@DESKTOP-C7TGMLH flutter_prototype % flutter test test/unit_tests.dart
00:03 +31: All tests passed!
charlescarroll@DESKTOP-C7TGMLH flutter_prototype % flutter test ./test/widget_test.dart
00:01 +3: All tests passed!
```