MIT APP INVENTOR

SHOTGUARD

Qiushi Han, Qianhao Han

SUMMER APPATHON

OVERVIEW

- **App Name:** **Shotguard**
- **App Description:** a mobile APP and sensing device that not only alerts but also prevents concussions.
- **Track:** Youth Team
- **Category:** Mental health & wellbeing

THEME

Concussions

Concussions , a serious concern in hockey, especially for our **young players**. An issue that's been troubling parents, coaches, and players alike. Each year, between **1.7 and 3 million** concussions occur due to sports.

Concussions can be difficult to identify and diagnose, especially in the heat of a game or practice. Young players may not recognize the symptoms or fail to communicate with coaches and parents leading to serious long-term effects on a player's **mental health and well-being**.

SOLUTION – APP & SENSOR

Shotguard

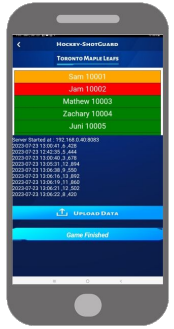
A **mobile APP** and **sensing device** that not only alerts but also **prevents** concussions.

- an inexpensive, compact **IoT** accelerometer sensor attached securely to a player's hockey helmet
- A mobile app developed in **MIT App Inventor**

SOLUTION - CONTINUOUS TRACKING

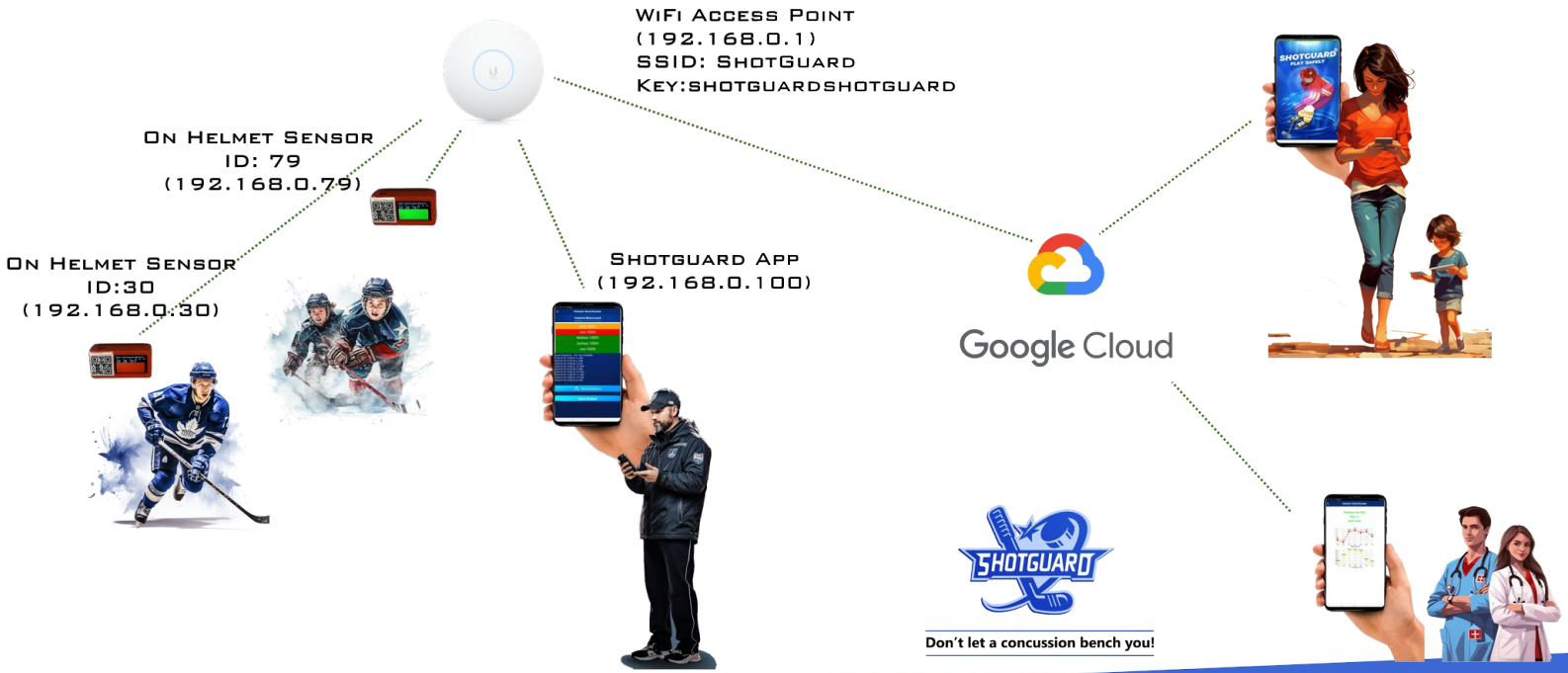
Monitoring

- Constantly monitor the player and track both current and historical motion data
- Alert the user either when a single shock or accumulated shocks reach pre-set thresholds
- The app analyzes this information, identifying patterns that could indicate an increased concussion risk
- Issue immediate alerts about potential hazards and anticipated risks based on the player's data history

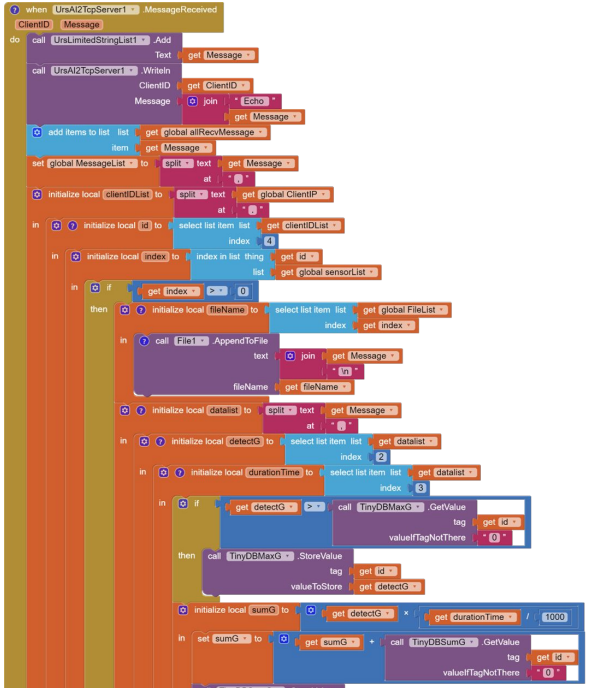


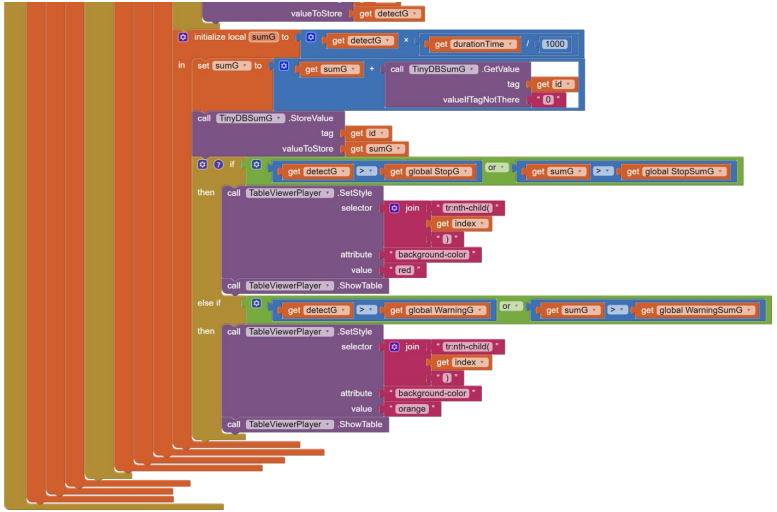
SOLUTION - ARCHITECTURE

Networked APP, Sensors & Data Center



MIT APP INVENTOR

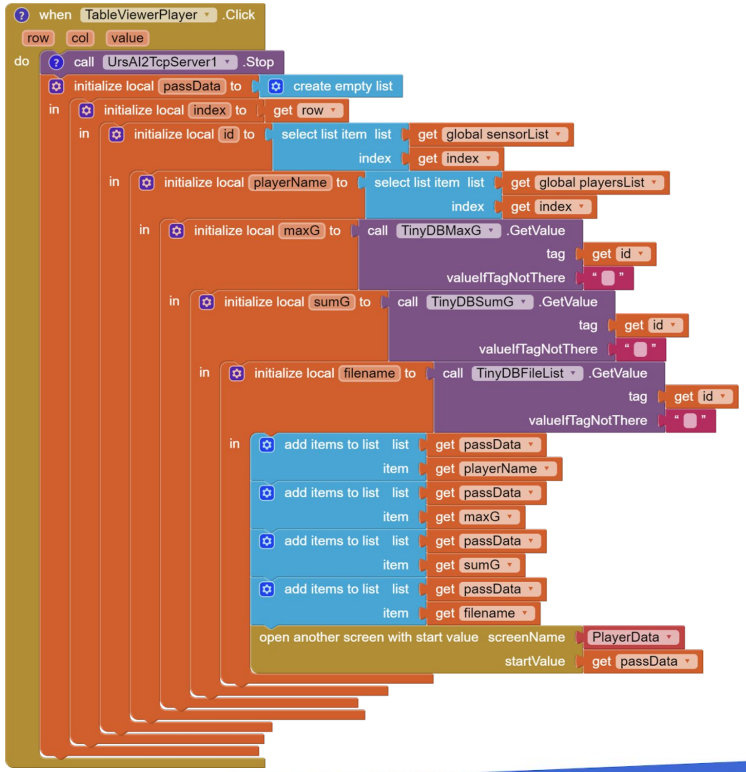




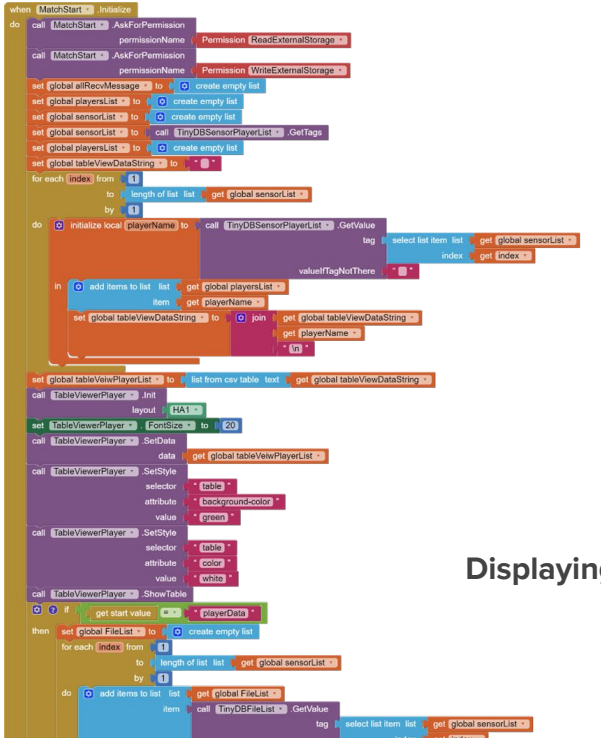
Dada Collection

MIT APP INVENTOR

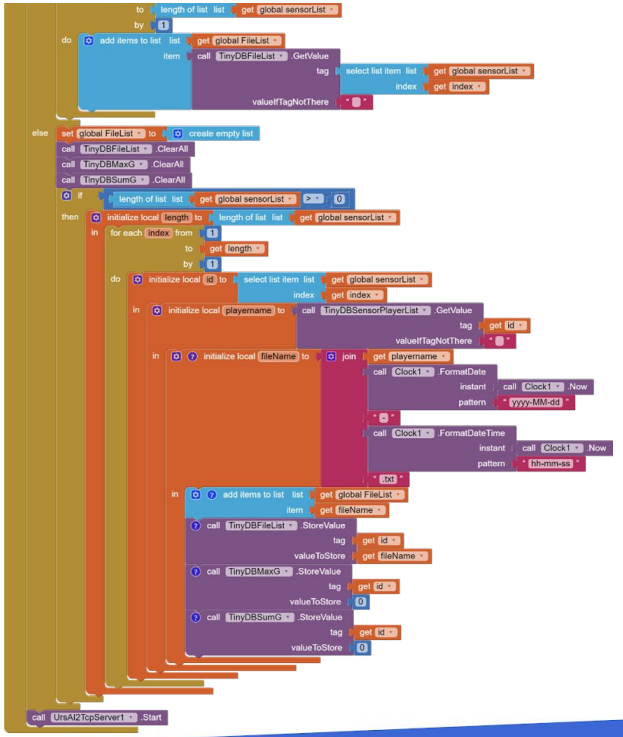
Retrieve Player's Information



MIT APP INVENTOR

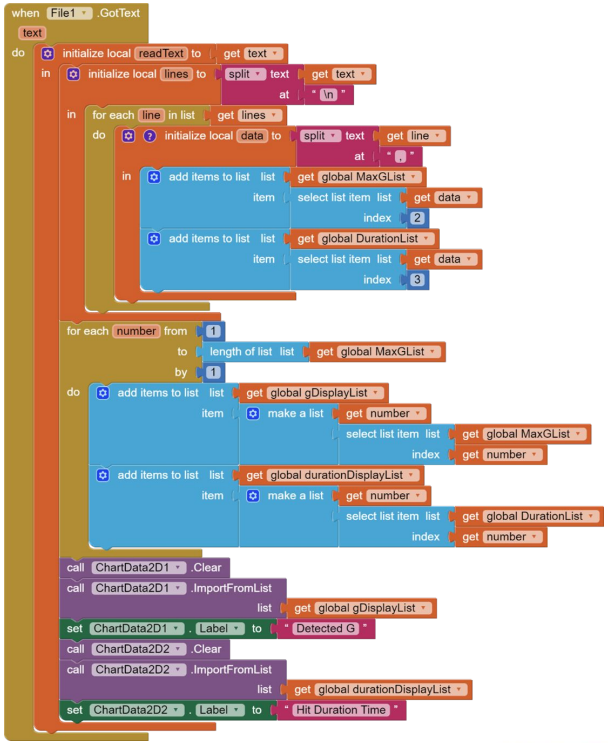


Displaying Players & Info



MIT APP INVENTOR

Charting Historical Motion Data



MIT APP INVENTOR

Uploading Data to Google Cloud Data Center

INSTRUCTIONS

Demo Hardware Setup and Preparation

Step 1: Establish a local WiFi network for testing with the fixed IP address “192.168.0.1”. Use "ShotGuard" for the SSID and "shotguardshotguard" for the key.

Step 2: Download the Shotguard App onto your Android phone. Ensure the phone's fixed IP is set to 192.168.0.100, and connect your phone to the test WiFi network established in Step 1.

Step 3: Using the Arduino IDE, open the sketch named M5StickCPlus_IMU_ShotGuard_WiFi.ino. Change the IP address in the sketch to 192.168.0.xx (for this example, we use 192.168.0.33). Then, download this sketch onto the Shotguard IoT sensor (specifically, the M5StickC PLUS ESP32-PICO Mini IoT Development Board). This board can be acquired from www.robotshop.ca.

Step 4: Generate and print a QR code that corresponds to the number "xx" from Step 3. For instance, if the IP address is 192.168.0.33, the QR code should read "33".

33

INSTRUCTIONS

Demo Hardware Setup and Preparation

Step 5: Generate and print a QR code for each player. The code should be formatted as "name xxxx". For example, "Sam 10001".

Step 6: Repeat Steps 3 through 5 for every additional sensor you need. Make sure to prepare corresponding QR codes for both the sensors and the players.

By carefully executing these steps, you'll ensure that each player and sensor has a unique QR code for identification during the demonstration.

Sam 10001

INSTRUCTIONS

Using the Shotguard APP

Step 1: Launch the Shotguard App and press the "Attach Sensor" button to begin the registration process for the Shotguard sensor.

Step 2: Scan the QR code on the sensor (e.g., 33 in our example).

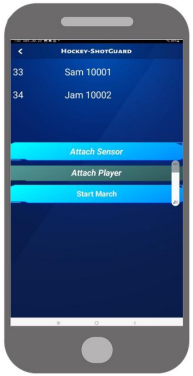
Step 3: Press the "Attach Player" button and scan the QR code of the player you're registering (e.g., "Sam 10001").

INSTRUCTIONS

Using the Shotguard APP

Step 4: Secure the sensor onto the helmet using the provided pouch.

Step 5: Repeat Steps 2-4 until you've registered all sensors and players on the team.

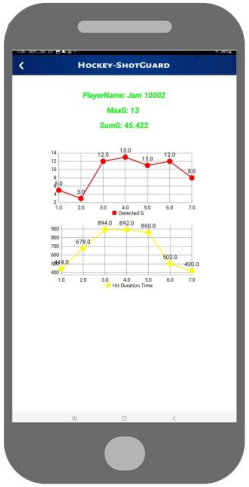


Step 6: Press the "Start Match" button when you're ready to begin the game.

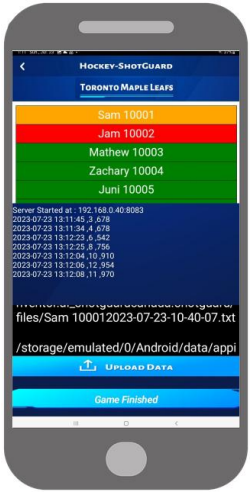
INSTRUCTIONS

Using the Shotguard APP

Step 7: As the game progresses, alerts will be displayed on the app, color-coded in yellow or red for varying levels of severity.



Step 8: By clicking on a player's name, you can access a detailed view of their historic motion and shock data.



Step 9: Once the match concludes, press "Upload Data" to transfer the collected data to the Google Cloud Data Center for safe storage and future reference. This data can be accessed at any time by authorized users like parents or medical professionals.

FUTURE DEVELOPMENTS

in short future...

- Transition from WiFi to Bluetooth for enhanced device connectivity, thereby eliminating the need for a WiFi access point.
- Implement a robust data storage system to maintain and provide access to historical data, not just from each game, but also long-term player trends.
- Develop a more precise, medically approved concussion alert model, potentially integrating advanced AI modeling, to ensure utmost accuracy in predicting and alerting potential concussions.

LIMITATIONS

Currently, Shotguard is in the early stages of prototyping

- For sensor and app communication, we are using WiFi, but we plan to transition to a Bluetooth connection for future developments. Our IoT sensors are currently set up with fixed IP addresses (e.g., 192.168.0.xxx), where 'xxx' corresponds to the device ID.
- The Android device used must be connected to the same WiFi network and has a fixed IP address of "192.168.0.100". Please note, the device needs to be linked to a Google account as it will upload data files to Google Drive for further processing.
- The thresholds for sensor alerts and warnings are set for demonstration purposes at this time. For real-world applications, these values will need to be refined through extensive studies and clinical trials conducted with professionals in the field.

CONCLUSION

“Shotguard could become a game-changer in preventing concussions. ”

-Adam Henrich, former NHL hocket player and head coach of North York Rangers Jr Hockey team

SHOTGUARD

Don't let a concussion bench you!

ACKNOWLEDGEMENTS

We would like to express our deepest appreciation to the following individuals for their invaluable contributions:

- **Adam Henrich**, former NHL hockey player and current head coach of the North York Rangers Jr Hockey team. He generously shared his first-hand knowledge on the impact of concussions on young hockey players' mental health and development, as well as the role of shocks in leading to these concussions.
- **Dr. Serdar Kalaycioughu**, a Research Fellow at the Toronto Metropolitan University. His professional guidance on both hardware and software development played a pivotal role in our project.
- **Bo Wei**, a Senior Engineer at Dr Robot Inc. His expert advice on developing the IoT sensor sketch/program greatly enhanced our technical capabilities.

MIT
APP INVENTOR

APPENDIX

SUMMER APPATHON

SHOTGUARD IOT SENSOR

Shotguard IoT Sensor is purchased from www.robotshop.ca

"M5StickC PLUS ESP32-PICO Mini IoT Development Board"

Arduino Sketch/Program: M5StickCPlus_IMU_ShotGuard_WiFi.ino