gForceOct 8-Channel EMG Wireless System

User Guide

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1. Trademarks and Copyrights

gForce™ is the trademark registered by OYMotion Technologies Co., Ltd.

2. gForceOct Introduction

The gForceOct EMG Wireless System is designed and manufactured by OYMotion. The wireless system contains 8 highly sensitive EMG sensor amplifiers, 9-axis IMU motion sensor, and communicates through a Bluetooth BLE 4.2 wireless chip. A 9x2 cable is used as the connection for the 8 differential EMG electrodes with 2 leads acting as a reference voltage output. Disposable stickers that connect to the cable are used as electrodes and offers less noise from outside sources. The gForceOct EMG System supports real time EMG raw data access, gesture training, model download and synchronization, real time pose data, IMU raw data access, and OTA firmware update.

3. gForceOct Models

OYM-GFO-001、OYM-GFD-001、OYM-GFJ-001

4. gForceOct Products

Model	Product Name	Features
OYM-GFO-P001	gForceOct 8-Channel EMG Wireless System	■Pose Data ■Gesture Recognition ■EMG Raw Data[1] ■Gesture Training[2] ■Color: Orange
OYM-GFD-001	gForceDongle BLE to USB Receiver	BLE to USB dongle receiver works on Windows 7 and up to pair-with and communicate with gForce Armband to get gesture index, EMG raw data, pose data.
OYM-GFJ-001	gForceJoint Adapter	BLE to UART adapter to get gesture index, pose data and forward to

		such like Arduino MCU system.

Note: 1. Max 1000Hz sample rate, configurable through SDK 2. Work with gForceApp

5. Product Details

5.1 gForceOct EMG Wireless System Hardware Components

5.2 gForceOct EMG Wireless System Size and Weight

Measurement	Value
Length	49 mm
Width	48 mm
Thickness	15 mm
Weight	21 g
Color	Orange

5.3 gForceDongle BLE to USB Receiver

The gForceDongle is only compatible with Windows 7 or newer. The gForce armband SDK for Windows works with gForceDongle only. The gForceDongle communicates wirelessly by BLE with gForce armband to send commands to and receive data from gForce

Measurement	Value
Length	35 mm
Width	20 mm
Thickness	8 mm
Weight	4 g

gForceOct

gForceDongle

OYM8CHWAVE

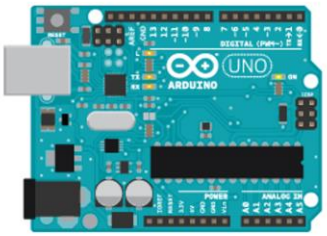
OYM8CHWAVE open source project receiving data from gForceOct through gForceDongle

5.4 gForceJoint BLE to UART Adapter

The gForceJoint will pair automatically with any nearby gForce through BLE communication and forward data received from gForce to an UART port on board the gForceJoint. The data collected are gesture indexes recognized from the 8 EMG sensors and quaternion data from the 9-axis IMU sensors. An MCU system such as Arduino can connect with the UART port and receive the gesture indexes and IMU data. The gForceJoint DOES NOT support EMG raw data forwarding.

gForceOct

gForceJoint
(BLE to UART Adapter)



Arduino

Arduino MCU receives gesture and quaternion data from gForceOct through gForceJoint BLE to UART adapter

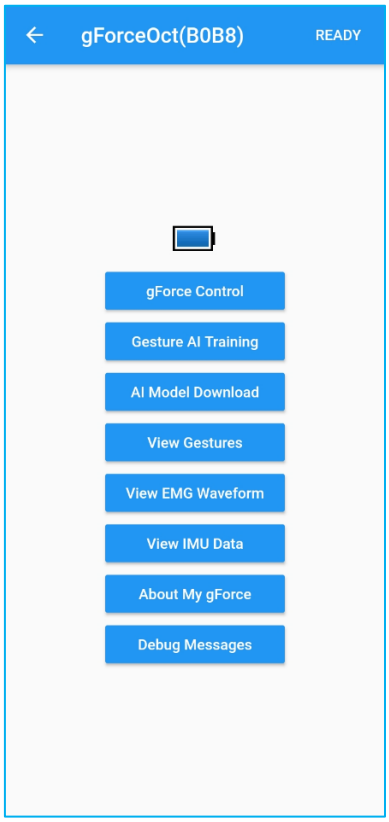
6. System and User Instructions

6.1 OS Platforms Supported by gForceOct

Platform	Features
 Windows: Win 7 / 8 / 10	• SDK for Windows • Unity3D SDK • gForceDongle BLE to USB Dongle is mandatory
 Android	• Android with BLE 4.2 and up support • Android Unity3D SDK • gForceApp Mobile APP
ARDUINO Embedded	• SDK for Arduino/Embedded • Arduino/Embedded • gForceJoint BLE to UART Adapter is mandatory

6.2 gForceApp Mobile Application

The gForceApp is a mobile application running on Android. The gForceApp is designed for gForce system to view gesture results, check pose data, view EMG data, conduct gesture training, have gForce firmware OTA update, and parameter tuning. The gForceOct EMG System supports full features of gesture training, cloud-based AI model generation, and system model synchronization. With the gForceApp, users can customize their own gestures and then update the gForceOct with the newly trained/created gesture. The new gesture will be saved within the gForceOct to replace the old one. Refer to "gForceApp User Guide" for more instructional details.



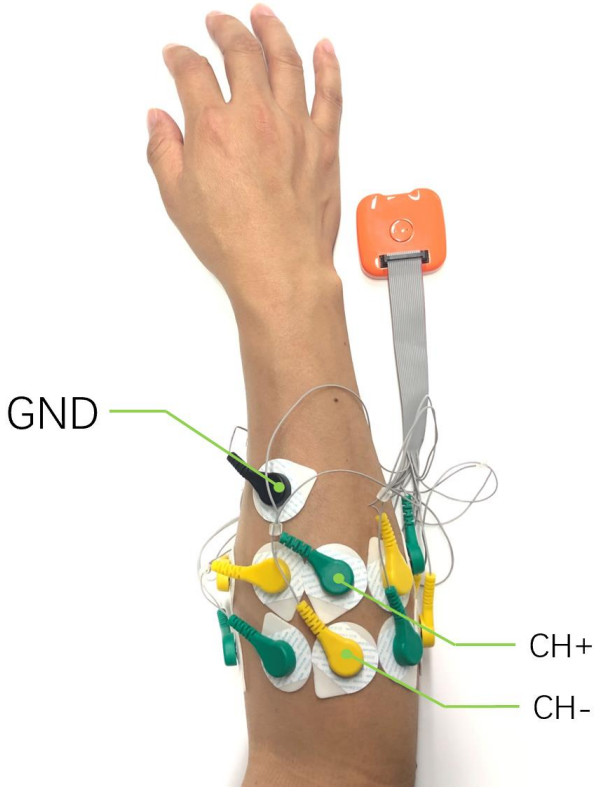
6.3 gForceOct System User Instructions

- Powering On: To turn on, press and hold the power button on gForceOct until the green LED is on then release the button. The gForceOct powers on and the green LED will flash at a 1Hz frequency, this means that the system is looking for a BLE connection. When gForceOct is connected through BLE, the green will LED stop flashing and remain on. If

the green LED flashes at a 2.5Hz frequency it, means there is data transaction.

- Firmware update mode: Press and hold the power button on gForceOct for 10 seconds to activate firmware update mode, the device name will change to gForceOct-boot. This should only be used when the system is not working properly, and the user must force a firmware update. The user must then update the firmware through the gForceApp. To switch back to normal work mode from gForceOct-boot mode, the user can turn the device off then turn on again.
- Powering off: To turn off, press and hold the power button for 5 seconds. Afterwards, the green LED will turn off indicating power off (if the internal IMU's auto calibration is successful, the green LED will flash three times first otherwise it will just turn off).
- Charging: When charging a red LED will be on until the armband finishes charging after which the led will turn off.
- Disposable Sticker Electrode: The gForceOct is designed to use disposable sticker as its electrodes, general ECG stickers are suggested. A 9x2 cable with female button snaps acts as the lead wires to electrodes. The same pair (yellow and green snaps next to each other) of electrode should stick on skin of muscle being probed and along with its direction. Besides the 8 pairs of EMG leads, 2 leads with black snaps are used as a voltage reference output. They should stick on top of skin with few muscle underneath.
- Gesture recognition: The gForceOct is not just limited to do gesture recognition rather that is a feature of the gForceApp. The gForceOct's purpose is to give developers a low-cost and high-quality way to have access to raw EMG data. As a result, developers can place the electrodes anywhere to on the body to measure different muscle groups' EMG data. However, during gesture training and gesture recognition developers must place the electrodes at consistent locations or else the recognition results will be very random.
- EMG raw data: The gForceOct is designed for developers to have a low-cost and high-quality solution to have access to raw EMG data. It is wireless and powered by batteries, so signals are less affected by cord noise. Furthermore, by using disposable stickers, signal quality is much better compared to using dry electrodes. Using the gForceOct

developers have the flexibility to probe up to 8 different muscles simultaneously with the lead cable.



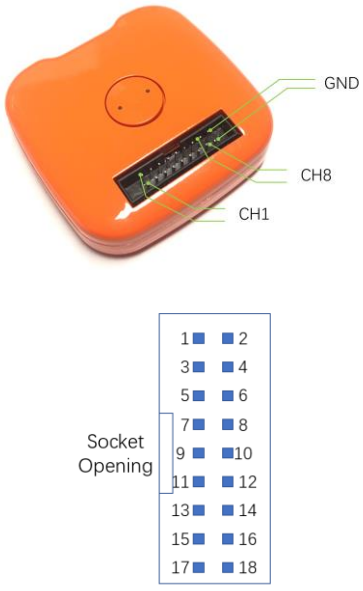
Example of gForceOct probing forearm muscles

6 Suggested Gestures

7. gForceOct EMG Wireless System Parameters

Features	Value
Communication	● BLE4.2 Standard
Distance	● 10 meters
Power Consumption	● 0.1W
Battery	● 200mAh/3.7V Li-ion
Power Input	● USB 5V
Color	● Orange
Gestures	● Up to 16 user customizable gestures (noticeable difference among gestures is mandatory)
EMG Raw Data	● Realtime EMG raw data access supported ● Sample rate：max 1000Hz ● ADC：8bit (max 1000Hz sample rate) 12bit (max 500Hz sample rate) ● Channels: 8 ● Gain: 1200 ● Filter: 20-500Hz hardware band pass filter
IMU Raw Data	● 9-axis IMU motion sensors ● Sample rate: 50Hz ● ACC, GYRO, MAG raw data access

Pose Data	● Quaternion access ● Euler access ● Rotation Matrix access ● Sample Rate: 50Hz
Software Support	● SDK For Windows ● SDK For Android ● SDK For Arduino/Embedded ● Unity3D SDK for Windows/Android ● Open Source oym8chwave Project to Capture EMG Raw Data, IMU etc ● gForceAPP Mobile APP



GND	1	2	GND
CH8-P	3	4	CH8-N
CH7-P	5	6	CH7-N
CH6-P	7	8	CH6-N
CH5-P	9	10	CH5-N
CH4-P	11	12	CH4-N
CH3-P	13	14	CH3-N
CH2-P	15	16	CH2-N
CH1-P	17	18	CH1-N

9x2 Lead Cable Connector Pin Definition

8. gForceDongle Parameters

Item	Parameter
Radio Frequency	BLE 2402-2480MHZ
Power Input	USB 5V
Radio Power	4dBm
Antenna Type	Ceramic
Antenna Gain	-0.5dBi

9. Packaging Item List

9.1 gForceOct 8-Channel EMG Wireless System

Items	Quantity
gForceOct 8-Channel EMG Wireless System	1
gForceDongle BLE to USB Dongle	1
gForceOct 9x2 Lead Cable	1
USB Cable	1
Disposable ECG Sticker (50 PCS)	1

10. Tech Support

10.1 gForceSDK For Windows

gForceSDK C++ for Windows contains the gForce SDK lib, header files, readme and sample projects for developers to start with Windows platform.

Download: https://github.com/oymotion/gForceSDKCXX
OYM8CHWAVE open source sample project to start with:
https://oymotion.github.io/APPs/oym8CHWave/

10.2 gForceSDK For Android

gForceSDK for Android contains the gForce SDK lib, header files, readme and sample projects for developers to start with Android platform.

Download: https://github.com/oymotion/gForceSDKAndroidDemo

10.3 gForceSDK For Arduino/Embedded

gForceSDK for Arduino contains the gForce SDK C source code, header files (Quaternion and Gesture indexes only, no EMG or IMU raw data access), sample project for Arduino. This SDK C source code interfaces with gForceJoint through UART and to parse the Quaternion and Gesture indexes received. Developers can port the same logic to other embedded system.

gForceSDK for Arduino works with gForceJoint only.

Download: https://github.com/oymotion/gForceSDKArduino

10.4 gForceSDK for Unity3D

gForceSDK for Unity3D contains the gForce SDK lib, header files, sample U3D projects. It supports both Windows and Android.

Download: https://github.com/oymotion/gForceSDKUnity.git

10.5 SDK Manual

Before developers start coding own projects, DO spend time going thru the SDKs manual:

https://oymotion.github.io/gForceSDK/gForceSDK/

We have outlined most of the important information at:

https://oymotion.github.io/

11. Contact US

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