



# ALGOSNAP

## Sample Dataset

Description and Detailed Protocol

User's Reference Document

2/10/2016



## Sample Dataset

### The Data Collection Platform

The sample dataset was collected using the CrowdSignals Platform by AlgoSnap. The CrowdSignals Platform was created to enable researchers and developers in Industry and Academia collect the data they need to solve critical problems in a fraction of the time. The CrowdSignals Platform is in alpha and has not yet been released to the general public. We are presently evolving the platform in collaboration with key partners. If you are interested in having early access please contact us at [info@AlgoSnap.com](mailto:info@AlgoSnap.com)

### The Sample Dataset Overview

The sample dataset consists of data collected by two participants wearing a smartwatch on the dominant wrist and a smartphone placed inside the right-front pant pocket. Each session was recorded continuously over about 2.5 hours from 20 sensors while the participants labeled examples of eight activities. This dataset does not represent completely naturalistic behavior as the participants were following a data collection script.

### Ethics and Privacy

The data was collected from participants using best practices for ethics and privacy. Please refer to document “*AlgoSnap CrowdSignals Ethics and IRB Reference.pdf*” for detailed information on AlgoSnap’s ethical data collection practices.

### The Dataset Format

The data is provided in two formats: (1) A set of files in the Avro format (see <https://avro.apache.org>) compressed using the GZIP utility and (2) a set of files in the comma separated format CSV supported by Excel and many other editors.

### The Devices

The sample dataset was collected from four different devices. **Table 1** presents a description of the different devices used in the data collection.

Device	Description
Sony 3 Smartwatch	Sony Smartwatch 3 5736, running Android wear version 1.1.1.1929530, Google Play Services 8.4.89, and Android OS 5.1.1
Google Nexus 5 Smartwatch	LG Smartphone running Android version 6.0.1, Build number MMB29K
Samsung Gear Smartwatch	Samsung Gear Live E7A0, running Android wear version 1.3.0.2160025, Google Play Services 8.4.89, Android OS 5.1.1
Samsung S5 Active Smartphone	Samsung-SM-G870A running Android version 5.0, Build Number LRX21T.G870AUCU2BOF3

**Table 1: List of Devices Used in the Data Collection**



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## The Sensors

The sample dataset consists on the data recorded from 20 sensors. [Table 2](#) presents the list of sensors from which data was recorded during the data collection. For a detailed description on the format of the data recorded from each sensor, please refer to the document "[AlgoSnap Sensor Data Types Description.pdf](#)"

Device Type	Sensor Type	Sampling Parameters
Smartwatch	Accelerometer	Sensor delay: SensorManager.SENSOR_DELAY_FASTEST
Smartwatch	Gyroscope	Sensor delay: SensorManager.SENSOR_DELAY_FASTEST
Smartwatch	Magnetometer	Sensor delay: SensorManager.SENSOR_DELAY_FASTEST
Smartwatch	Heart Rate (participant one only)	Sensor delay: SensorManager.SENSOR_DELAY_FASTEST
Smartwatch	Battery	Listening cycle: 30 seconds on, 60 seconds off
Smartphone	SensorMetadata	One reading on start-up
Smartphone	Accelerometer	Sensor delay: SensorManager.SENSOR_DELAY_FASTEST
Smartphone	Gyroscope	Sensor delay: SensorManager.SENSOR_DELAY_FASTEST
Smartphone	Magnetometer	Sensor delay: SensorManager.SENSOR_DELAY_FASTEST
Smartphone	Light	Sensor delay: SensorManager.SENSOR_DELAY_FASTEST
Smartphone	Pressure	Sensor delay: SensorManager.SENSOR_DELAY_FASTEST
Smartphone	Proximity	Sensor delay: SensorManager.SENSOR_DELAY_FASTEST
Smartphone	Battery	Listening cycle: 30 seconds on, 60 seconds off
Smartphone	Bluetooth	Listening cycle: 90 seconds on, 30 seconds off
Smartphone	GSM (Participant one only)	Listening cycle: 1 seconds on, 10 seconds off
Smartphone	WLAN	Listening cycle: 30 seconds on, 10 seconds off
Smartphone	Location	Always on, minimum 10 seconds between updates, 1 m min distance
Smartphone	PhoneState	Always on, listening for changes
Smartphone	Connectivity	Always on, listening for changes
Smartphone	Screen	Always on, listening for changes
Smartphone	SMS (Participant one only)	Always on, listening for new message events
Smartphone	IntervalLabel	Labels are explicitly initiated by participants
Smartphone	Audio	Note: audio data collected but not released. Inquire for access to it.

**Table 2: List of Sensors Turned On During the Data Collection**

## The Labels

The participants recorded data continuously for about 2.5 hours while they performed and labeled a set of eight activities. [Table 3](#) presents the activities labeled during the data collection and a description of these activities. Later sections will contain more detail on more specific information for each of the recorded sessions.

Label	Description
On Table	Smartphone and Smartwatch placed on a table sitting undisturbed.
Eating	Eating soup with a spoon.
Washing Hands	Washing hands in the public restroom.
Sitting	Sitting on a bench or chair
Standing	Standing
Walking	Walking
Running	Running
Driving	Driving in various types of traffic.

**Table 3: List of Activities Labeled During the Data Collection**



## Participant One: Session Details

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### Overview:

The data was collected from one male participant who collected data continuously for about 2.5 hours while wearing a Samsung Gear Live smartwatch on his dominant wrist (right) and carrying a Samsung S5 Active smartphone in his right-front pants pocket. He wore a sweater, a polyester jacket, pants made of sweat material, and casual, slip-on shoes. The data collection started at a café in Issaquah, WA and ended at another nearby café after several walks, a drive, and a visit to a grocery.

### The Participant

The data was collected from a 36 year old male participants with a height of 5'6" feet and a body weight of 150 pounds.

### The Labeling Process

The participant used a smartphone Android app to label the start and end times associated with each activity performed. Consequently, the smartphone was manipulated at the beginning and end of each activity which introduced a "motion" artifact that sometimes is not consistent with the activity (e.g. devices "On Table" resting). Consequently, the labels need to be manually modified to remove these labeling artifacts and this is something that has not been done in this dataset.

### Differences with Participant Two Session

The participant one data collection session *does* include smartwatch heart rate data as well as GSM, SMS and location data.

### Data Collection Protocol

Table 4 describes the data collection protocol followed by participant one. Sections labeled "Transition" were not labeled and are included as notes for researchers analyzing the data.



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Label	Date	Start Time	End Time	Notes
On Table	02/08/2016	10:28:52	10:32:46	Smartwatch and smartphone devices sitting undisturbed on a table in a café. When labeling start and stop times, smartphone had to be used since the labeling GUI was on an Android app.
On Table	02/08/2016	10:33:13	10:36:18	
On Table	02/08/2016	10:36:48	10:40:13	
Sitting	02/08/2016	10:41:34	10:44:52	Sitting on a table bench in a café. Smartphone was placed in right pants pocket with a different orientation for each label and efforts were made to collect a variety of sitting positions (hands, feet, fidgeting slightly, etc).
Sitting	02/08/2016	10:46:11	10:51:10	
Sitting	02/08/2016	10:51:31	10:54:37	
Washing Hands	02/08/2016	10:57:49	10:58:36	Washing hands and then drying hands in the restroom of a café. Faucet had a handle that needed to be pulled up to release the water. Participant was standing.
Walking	02/08/2016	10:59:39	11:04:55	Walking in the somewhat busy parking lot of a shopping plaza, near an interstate highway.
Standing	02/08/2016	11:05:37	11:09:42	Standing on the corner of a sidewalk at a busy parking lot in a shopping plaza.
Walking	02/08/2016	11:09:51	11:13:52	Walking in the somewhat busy parking lot of a shopping plaza, near an interstate highway.
Driving	02/08/2016	11:14:41	11:18:24	Driving around the busy parking lot of a shopping plaza. The windows were shut and the radio was off.
Driving	02/08/2016	11:18:28	11:21:47	Driving from the busy parking lot of the shopping plaza, through busy suburban traffic to the parking lot of a supermarket. The windows were shut and the radio was off.
Walking	02/08/2016	11:22:17	11:25:14	Walking from the parking lot of the supermarket into the supermarket, and around the inside of the supermarket.
Washing Hands	02/08/2016	11:25:29	11:26:20	Washing hands and then drying hands in the restroom of a supermarket. Faucet had a handle that needed to be pulled up to release the water. Participant was standing.
Washing Hands	02/08/2016	11:26:33	11:27:31	
Standing	02/08/2016	11:29:43	11:30:33	Standing in line at the supermarket check-out.
Eating	02/08/2016	11:31:23	11:34:06	Eating soup with the dominant hand (right hand) using a spoon and soup located in a bowl. There were only eating and no drinking events. Participant was sitting on a stool inside the supermarket while eating.
Eating	02/08/2016	11:34:30	11:38:10	
Eating	02/08/2016	11:38:32	11:41:10	
Driving	02/08/2016	11:44:02	11:53:27	Driving from the supermarket parking lot, through busy suburban traffic to an interstate highway, then on the highway a few miles to an exit to more suburban traffic and a parking lot to another shopping plaza.
Standing	02/08/2016	11:56:13	11:57:59	Standing on the corner of a street with semi-busy suburban traffic.
Walking	02/08/2016	11:58:05	12:02:45	Walking on a sidewalk next to a street with semi-busy suburban traffic.
Standing	02/08/2016	12:03:17	12:06:14	Standing at an empty and quiet bus stop in a bus station.
Running	02/08/2016	12:07:50	12:12:52	Running up a sidewalk and around a few blocks near streets with semi-busy traffic.
Walking	02/08/2016	12:23:05	12:25:43	Walking through a parking lot and across a semi-busy street to a café.

Table 4: Data Collection Protocol Followed by Participant One



## The Sensors Metadata

Table 5 presents a list of the metadata of sensors embedded in the Samsung S5 Active Smartphone used by participant one.

Sensor Name	Vendor	Sensor Type	FIFO max events	Max delay	Min delay	Max Range	Power	Resolution	Wake Up Sensor
MPU6500 Acceleration	Invensense	android.sensor.accelerometer	150	200000	5000	19.6133	0.25	5.99E-04	FALSE
MPU6500 Gyroscope	Invensense	android.sensor.gyroscope	30	200000	5000	8.726646	6.1	2.66E-04	FALSE
MPU6500 Uncalibrated Gyroscope	Invensense	android.sensor.gyroscope_uncalibrated	0	200000	5000	8.726646	6.1	2.66E-04	FALSE
AK09911C Magnetic field	Asahi Kasei Microdevices	android.sensor.magnetic_field	0	200000	10000	2000	6	0.06	FALSE
AK09911C Magnetic UnCalibrated	Asahi Kasei Microdevices	android.sensor.magnetic_field_uncalibrated	0	200000	10000	1200	6	0.06	FALSE
Barometer	STM	android.sensor.pressure	50	180000	180000	1013.25	1	1	FALSE
TMG399X Proximity	AMS; Inc.	android.sensor.proximity	0	0	0	8	0.75	8	TRUE
TMG399X RGB	AMS; Inc.	android.sensor.light	0	200000	200000	60000	0.75	1	FALSE
MPL Rotation Vector	Invensense	android.sensor.rotation_vector	0	200000	10000	1	6	5.96E-08	FALSE
MPL Game Rotation Vector	Invensense	android.sensor.game_rotation_vector	334	200000	10000	1	6	5.96E-08	FALSE
SAMSUNG Step Detector	Samsung Inc.	android.sensor.step_detector	334	0	0	1	0.3	1	FALSE
SAMSUNG Step Counter	Samsung Inc.	android.sensor.step_counter	0	0	0	4.29E+09	0.3	1	FALSE
SAMSUNG Significant Motion	Samsung Inc.	android.sensor.significant_motion	0	0	-1	1	0.3	1	TRUE
HeartRate	MAXIM	android.sensor.heart_rate	0	1000000	1000000	200	1	1	FALSE
Screen Orientation	Samsung Electronics		0	0	0	255	0.25	255	FALSE
Orientation	Samsung Electronics	android.sensor.orientation	0	0	10000	360	6	0.00390625	FALSE
Gravity	Samsung Electronics	android.sensor.gravity	0	0	10000	19.6133	6	5.96E-08	FALSE
Linear Acceleration	Samsung Electronics	android.sensor.linear_acceleration	0	0	10000	19.6133	6	5.96E-08	FALSE

Table 5: Metadata of Sensors in Samsung Smartphone Used by Participant One



Table 6 presents a list of the metadata of sensors embedded in the Samsung Gear Live smartwatch used by participant one.

Name	Vendor	Sensor Type	FIFO max events	Max delay	Min delay	Max Range	Power	Resolution	Wake Up Sensor
MPU6515 Acceleration Sensor	Invensense	android.sensor.accelerometer	150	200000	5000	19.6133	0.25	0.0023942017	FALSE
MPU6515 Gyroscope Sensor	Invensense	android.sensor.gyroscope	0	200000	5000	8.726646	6.1	2.663161E-4	FALSE
AK8963C Magnetic field Sensor	Asahi Kasei Microdevices	android.sensor.magnetic_field	0	200000	10000	2000.0	6.0	0.15	FALSE
AK8963C Magnetic Sensor UnCalibrated	Asahi Kasei Microdevices	android.sensor.magnetic_field_uncalibrated	0	200000	10000	1200.0	6.0	0.15	FALSE
SAMSUNG Step Detector Sensor	Samsung Inc.	android.sensor.step_detector	150	0	0	1.0	0.3	1.0	FALSE
SAMSUNG Step Counter Sensor	Samsung Inc.	android.sensor.step_counter	0	0	0	100000.0	0.3	1.0	FALSE
SAMSUNG Significant Motion Sensor	Samsung Inc.	android.sensor.significant_motion	0	0	-1	1.0	0.3	1.0	TRUE
SAMSUNG Game Rotation Vector	Samsung Inc.	android.sensor.game_rotation_vector	150	200000	10000	8.726646	6.1	2.663161E-4	FALSE
ADPD142 HRM Sensor Lib	ADI	android.sensor.heart_rate	0	0	0	1.0	0.3	1.0	FALSE
SAMSUNG Tilt Wake Sensor	Samsung Inc.	android.sensor.wrist_tilt_gesture	0	0	5000	19.6133	0.25	0.0023942017	TRUE
MPL Rotation Vector	Invensense	android.sensor.rotation_vector	0	200000	10000	1200.0	6.0	0.15	FALSE
MPL Orientation	Invensense	android.sensor.orientation	0	200000	10000	1200.0	6.0	0.15	FALSE
MPL Gravity	Invensense	android.sensor.gravity	0	200000	10000	1200.0	6.0	0.15	FALSE
MPL Linear Acceleration	Invensense	android.sensor.linear_acceleration	0	200000	10000	1200.0	6.0	0.15	FALSE
ADPD142 HRM Sensor Lib2	ADI	com.samsung.android_wear.sam.heart_rate	0	0	100000	1.0	0.3	1.0	FALSE

Table 6: Metadata in Sensors of Samsung Smartwatch Used by Participant One



## Participant Two: Session Details

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### Overview:

The data was collected from one male participant who collected data continuously for about 2.5 hours while wearing the Sony smartwatch 3 on his dominant wrist (right) and carrying a Google Nexus 5 smartphone in his right-front pants pocket. He wore a hooded sweatshirt, loose fitting track pants, and sneakers. The data collection started at a public park in Newark, CA and ended at a nearby convenience store.

### The Participant

The data was collected from a 38 year old male participants with a height of 6 feet and a body weight of 230 pounds.

### The Labeling Process

The participant used a smartphone Android app to label the start and end times associated with each activity performed. Consequently, the smartphone was manipulated at the beginning and end of each activity which introduced a “motion” artifact that sometimes is not consistent with the activity (e.g. devices “On Table” resting). Consequently, the labels need to be manually modified to remove these labeling artifacts and this is something that has not been done in this dataset.

### Differences with Participant One Session

The participant two data collection session does not include smartwatch heart rate data because the Sony Smartwatch 3 does not include a PPG heart rate sensor. The participant two session also does not include GSM, SMS, or location data.

### Data Collection Protocol

Table 7 describes the data collection protocol followed by participant two. Sections labeled “Transition” were not labeled and are included as notes for researchers analyzing the data.





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Label	Date	Start Time	End Time	Notes
On Table	02/02/2016	16:15:53	16:19:16	Smartwatch and smartphone devices sitting undisturbed on a table in a public park. When labeling start and stop times, smartphone had to be used since the labeling GUI was on an Android app.
On Table	02/02/2016	16:19:40	16:22:5	
On Table	02/02/2016	16:23:20	16:26:22	
Sitting	02/02/2016	16:27:37	16:32:37	Sitting on a table bench in a public park. Smartphone was placed in right pants pocket with a different orientation for each label and efforts were made to collect a variety of sitting positions (hands, feet, fidgeting slightly, etc).
Sitting	02/02/2016	16:32:56	16:36:21	
Sitting	02/02/2016	16:36:36	16:40:51	
Eating	02/02/2016	16:41:35	16:44:16	Eating soup with the dominant hand (right hand) using a spoon and soup located in a bowl. There were only eating and no drinking events. Participant was sitting on a public park bench while eating.
Eating	02/02/2016	16:44:34	16:48:21	
Eating	02/02/2016	16:48:43	16:52:26	
Transition				Participant transitioned from sitting on the bench to standing nearby to record the "Standing" event. No significant walking activity performed during this transition.
Standing	02/02/2016	16:55:58	16:59:22	Standing in a semi-quiet part of a public park.
Transition				Participant walked from the park table to a semi-busy nearby street.
Standing	02/02/2016	17:00:41	17:04:17	Standing in a semi-quiet part of a public park.
Standing	02/02/2016	17:04:41	17:08:30	Standing near a semi-busy street with good car flow.
Transition				Participant walked to a nearby car where he spent few minutes, and then to a nearby public restroom.
Washing Hands	02/02/2016	17:18:10	17:20:37	Washing hands in the restroom of a public park. Faucet had a button that needed to be pressed to release the water. Participant was standing.
Washing Hands	02/02/2016	17:20:55	17:23:16	
Washing Hands	02/02/2016	17:23:26	17:25:40	
Transition				Participant walked from the public restroom to the start place of the Running activity.
Running	02/02/2016	17:26:11	17:29:15	Running inside a public park and by a semi-busy street.
Walking	02/02/2016	17:29:27	17:33:00	Walking inside a public park.
Running	02/02/2016	17:33:11	17:36:54	Running inside a public park and by a semi-busy street.
Walking	02/02/2016	17:37:38	17:39:39	Walking inside a public park.
Running	02/02/2016	17:40:14	17:42:47	Running inside a public park and by a semi-busy street.
Transition				Participant walked to his car to start the driving activity.
Driving	02/02/2016	17:45:44	18:02:16	Driving from a public park to a nearby convenience store. Car windows were open at times, closed at other times. Driving occurred in the city (no freeway driving) at semi-busy traffic conditions.
Transition				Participant walked from the car to the outside of the entry door of the convenience store to start the walking activity.
Walking	02/02/2016	18:03:57	18:09:48	Walking on semi-busy street from a convenience store to a nearby High School and back to the convenience store.

Table 7: Data Collection Protocol Followed by Participant two.



## The Sensors Metadata

Table 8 presents a list of the metadata of sensors embedded in the Samsung S5 Active Smartphone used by participant two.

Name	Vendor	Sensor Type	FIFO max events	Max delay	Min delay	Max Range	Power	Resolution	Wake Up Sensor
MPU6515 Accelerometer	InvenSense	android.sensor.accelerometer	10000	1000000	5000	19.613297	0.4	5.95E-04	FALSE
AK8963 Magnetometer	AKM	android.sensor.magnetic_field	1500	1000000	20000	4911.9995	5	0.14953613	FALSE
AK8963 Magnetometer Uncalibrated	AKM	android.sensor.magnetic_field_uncalibrated	1500	1000000	20000	4911.9995	5	0.14953613	FALSE
MPU6515 Gyroscope	InvenSense	android.sensor.gyroscope	2400	1000000	5000	34.906586	3.2	0.001068115	FALSE
MPU6515 Gyroscope Uncalibrated	InvenSense	android.sensor.gyroscope_uncalibrated	2400	1000000	5000	34.906586	3.2	0.001068115	FALSE
APDS-9930/QPDS-T930 Proximity & Light	Avago	android.sensor.proximity	0	0	0	5	12.675	0	TRUE
APDS-9930/QPDS-T930 Proximity & Light	Avago	android.sensor.light	240	0	0	10000	0.175	0.009994507	FALSE
BMP280 Barometer	BOSCH	android.sensor.pressure	1500	1000000	33333	1100	0.004	0.009994507	FALSE
Gravity	QTI	android.sensor.gravity	2850	60014652	5000	19.613297	3.599990	5.95E-04	FALSE
Linear Acceleration	QTI	android.sensor.linear_acceleration	2850	60014652	5000	19.613297	3.599990	5.95E-04	FALSE
Rotation Vector	QTI	android.sensor.rotation_vector	4450	60014652	5000	1	8.599991	5.96E-08	FALSE
Step Detector	QTI	android.sensor.step_detector	4900	0	0	1	0.399993	1	FALSE
Step Counter	QTI	android.sensor.step_counter	4900	0	0	1	0.399993	1	FALSE
Significant Motion Detector	QTI	android.sensor.significant_motion	0	0	-1	1	0.399993	1	TRUE
Game Rotation Vector	QTI	android.sensor.game_rotation_vector	4450	60014652	5000	1	3.599990	5.96E-08	FALSE
GeoMagnetic Rotation Vector	QTI	android.sensor.geomagnetic_rotation_vector	2100	60014652	20000	1	5.399994	5.96E-08	FALSE
Orientation	QTI	android.sensor.orientation	4450	60014652	5000	360	8.599991	0.1	FALSE
Tilt Detector	QTI	android.sensor.tilt_detector	5000	0	0	1	0.399993	1	TRUE
MPU6515 Game Rotation Vector Secondary	InvenSense	android.sensor.game_rotation_vector	2400	1000000	5000	1	4	1	FALSE
AMD	QTI	(Blank field)	0	0	0	1	0.399993	1	FALSE
RMD	QTI	(Blank field)	0	0	0	1	0.399993	1	FALSE
Basic Gestures	QTI	(Blank field)	0	0	0	7	0.399993	1	FALSE
Tap	QTI	(Blank field)	0	0	0	6	0.399993	1	FALSE
Facing	QTI	(Blank field)	0	0	0	3	0.399993	1	FALSE
Tilt	QTI	(Blank field)	0	60014652	10000	180	3.199997	0.1	FALSE
Pedometer	QTI	(Blank field)	4900	0	0	1	0.399993	1	FALSE
PEDESTRIAN-ACTIVITY-MONITOR	QTI	(Blank field)	0	0	0	65535	0.399993	1	FALSE

Table 8: Metadata of Sensors in Samsung Smartphone Used by Participant Two



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Table 9 presents a list of the metadata of sensors embedded in the Samsung S5 Active Smartphone used by participant two.

Name	Vendor	Sensor Type	FIFO max events	Max delay	Min delay	Max Range	Power	Resolution	Wake Up Sensor
BH1721 Ambient light sensor	Rohm	android.sensor.light,	0	10000000	0	10240.0	0.14	10.0	FALSE
em8170 accelerometer	EM Micro	android.sensor.accelerometer,	184	62500	5000	156.96	0.13	0.1,	FALSE
em8170 magnetic field sensor	EM Micro	android.sensor.magnetic_field,	0	1000000	10000	4915.2	2.4	0.0305	FALSE
em8170 gyroscope	EM Micro	android.sensor.gyroscope,	0	10000	5000	34.9	5.0	0.00266	FALSE
em8170 quaternion	EM Micro	android.sensor.rotation_vector,	0	1000000	5000	1.0	5.0	5.96E-8	FALSE
em8170 orientation	EM Micro	android.sensor.orientation,	0	1000000	5000	360.0	5.0	1.0	FALSE
em8170 any motion detector	EM Micro	(Left blank)	0	0	0	0.0	0.13	1	TRUE
em8170 step counter	EM Micro	android.sensor.step_counter,	0	16000	0	0	0.13	1	FALSE
em8170 step detector	EM Micro	android.sensor.step_detector,	0	16000	0	0	0.13	1	FALSE
em8170 tilt sensor	EM Micro	android.sensor.wrist_tilt_gesture,	0	100000	0	0	0.13	1	TRUE
Gravity Sensor	AOSP	android.sensor.gravity,	0	0	5000	19.6133	7.53	0.1	FALSE
Linear Acceleration Sensor	AOSP	android.sensor.linear_acceleration	0	0	5000	19.6133	7.53	0.1	FALSE

Table 9: Metadata of Sensors in Sony Smartwatch 3 Used by Participant Two