

# 可穿戴产品杀手级应用场景 功耗精度瓶颈的解决方法



**frizz** [Motion Engine & Sensor-HUB IC]



**PDR library for frizz**  
[Pedestrian Dead Reckoning Software library]

March 2014 Confidential, Preliminary

**MegaChips Corporation**

## Profile

<b>Company Name</b>	<b>MegaChips Corporation ( <a href="http://www.megachips.co.jp">http://www.megachips.co.jp</a> )</b>
<b>Head Office</b>	<b>1-1-1 Miyahara, Yodogawa-ku, Osaka 532-0003</b>
<b>Tokyo Office</b>	<b>17-6 Ichibancho, Chiyoda-ku, Tokyo 102-0082</b>
<b>Makuhari Office</b>	<b>1-3 Nakase, Mihama-ku, Chiba 261-8501</b>
<b>Establishment</b>	<b>April 4, 1990</b>
<b>Listing</b>	<b>First Section of TSE (Code No. 6875)</b>
<b>Capital</b>	<b>4,840 million yen</b>
<b>Employees</b>	<b>739 (as of March 31, 2014 on a consolidated basis )</b>
<b>Business Activities</b>	<b>Design, development, manufacturing (outsourcing) and sales of system LSIs, and electronic devices and systems products with LSIs manufactured by the Company</b>
<b>Net sales</b>	<b>58,469 million yen (FY 14/3)</b>
<b>Operating income</b>	<b>4,173 million yen (FY 14/3)</b>

# Indoor Navigation

- PDR + Beacon for accurate indoor navigation

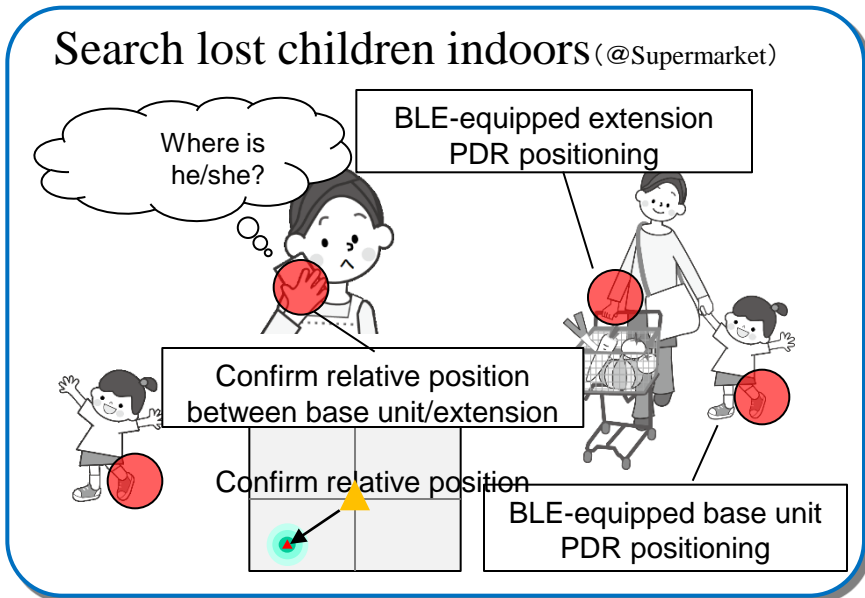
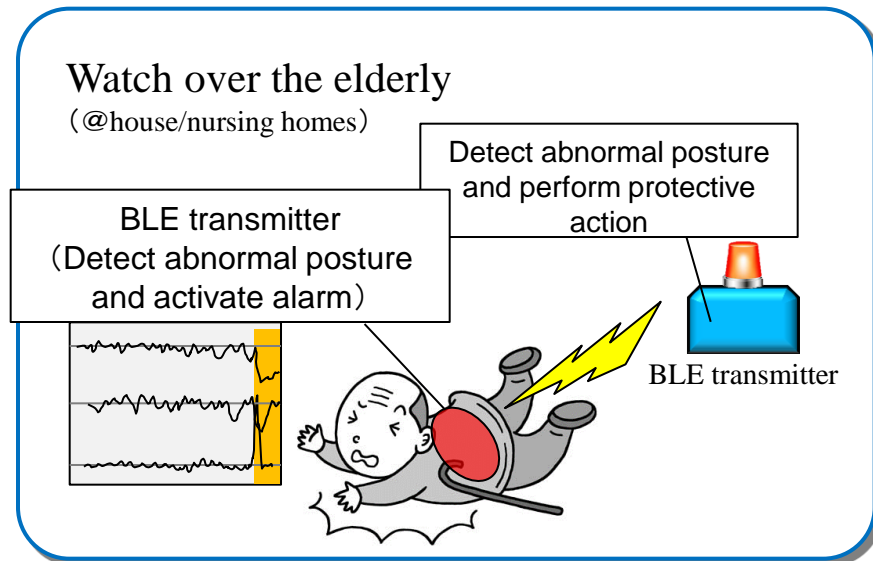
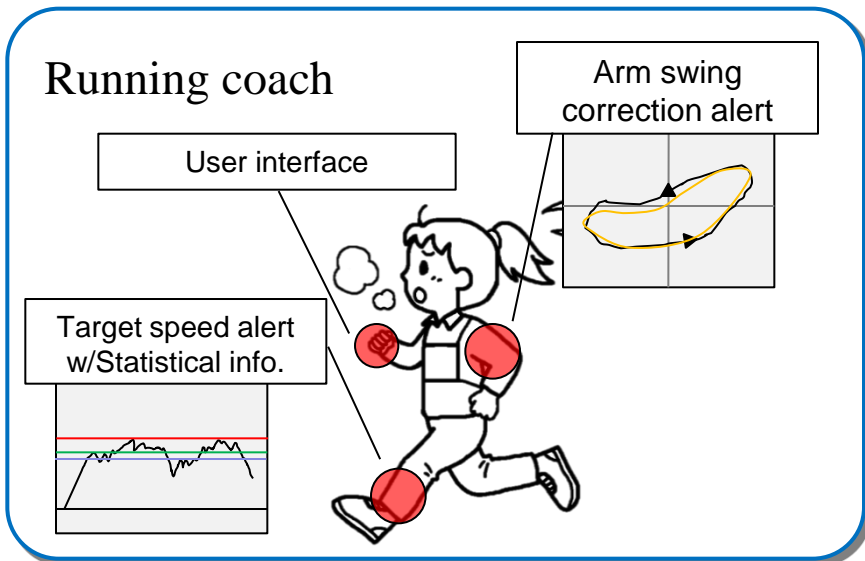
In the case of using PDR alone for indoor navigation, relative error will accumulate over time. If PDR is applied together with “Beacon”, which sends absolute position, and “Map matching technology, the accuracy of indoor navigation system can be greatly improved.

\*Beacon is a information supplying system, which is supported from iOS7, applying “Bluetooth Low Energy” technology.

Cite from: EstimoteBeacon (<http://estimote.com/>)、Aplix ([http://www.aplix.co.jp/?page\\_id=7593](http://www.aplix.co.jp/?page_id=7593))



# Application example 3



# Power Consumption Accuracy

Megachips TorchSUN Solution →

## ■ PDR library application example 1 (Motion recognition)

- By using elemental technology of PDR library, It is possible to recognize human activity.



Walking



Running



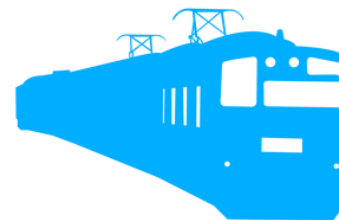
Up or down  
stairway



Riding bicycle



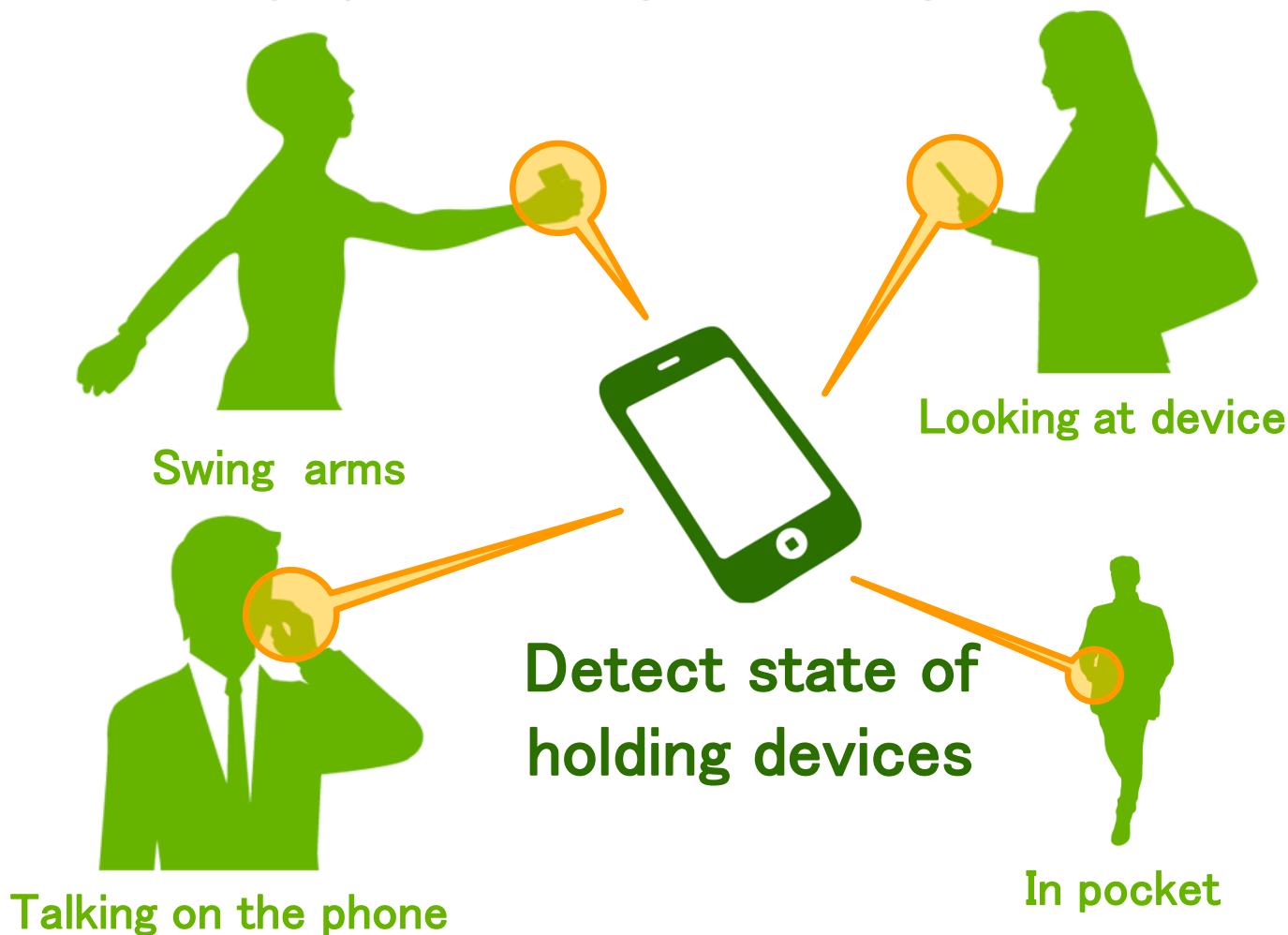
In a car



On a train

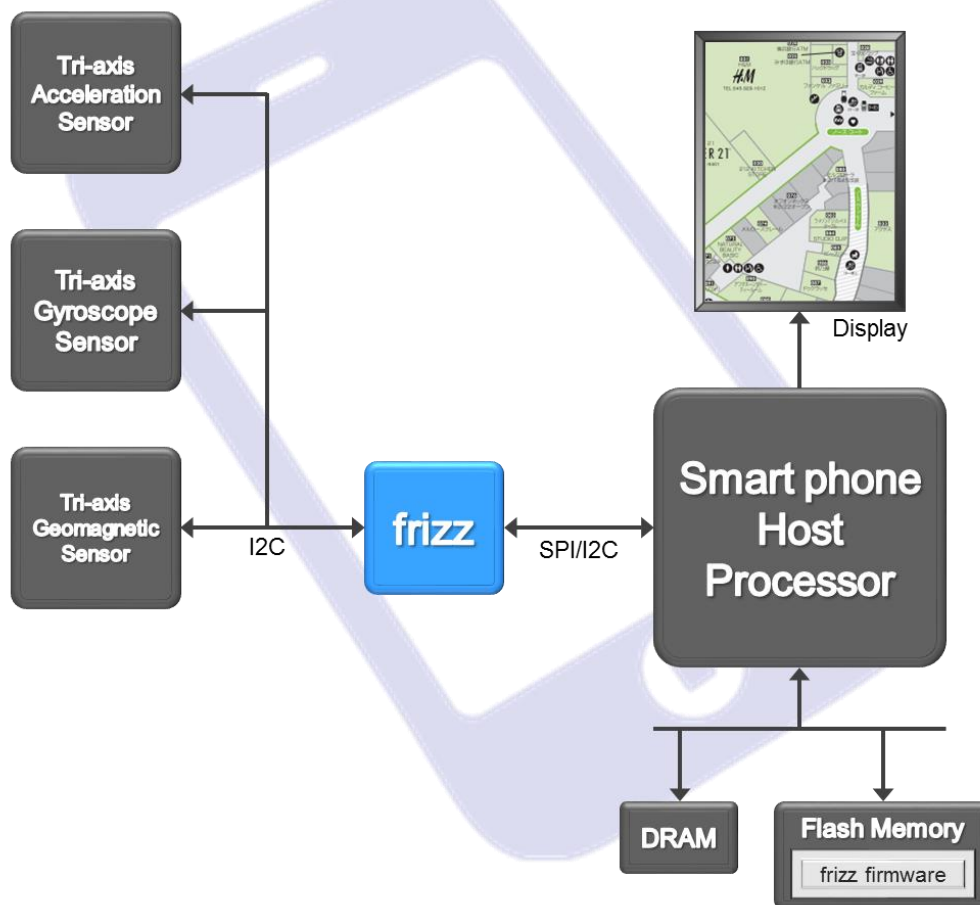
## ■ PDR library application example2 (Context awareness )

- Estimate what target person is doing while walking.



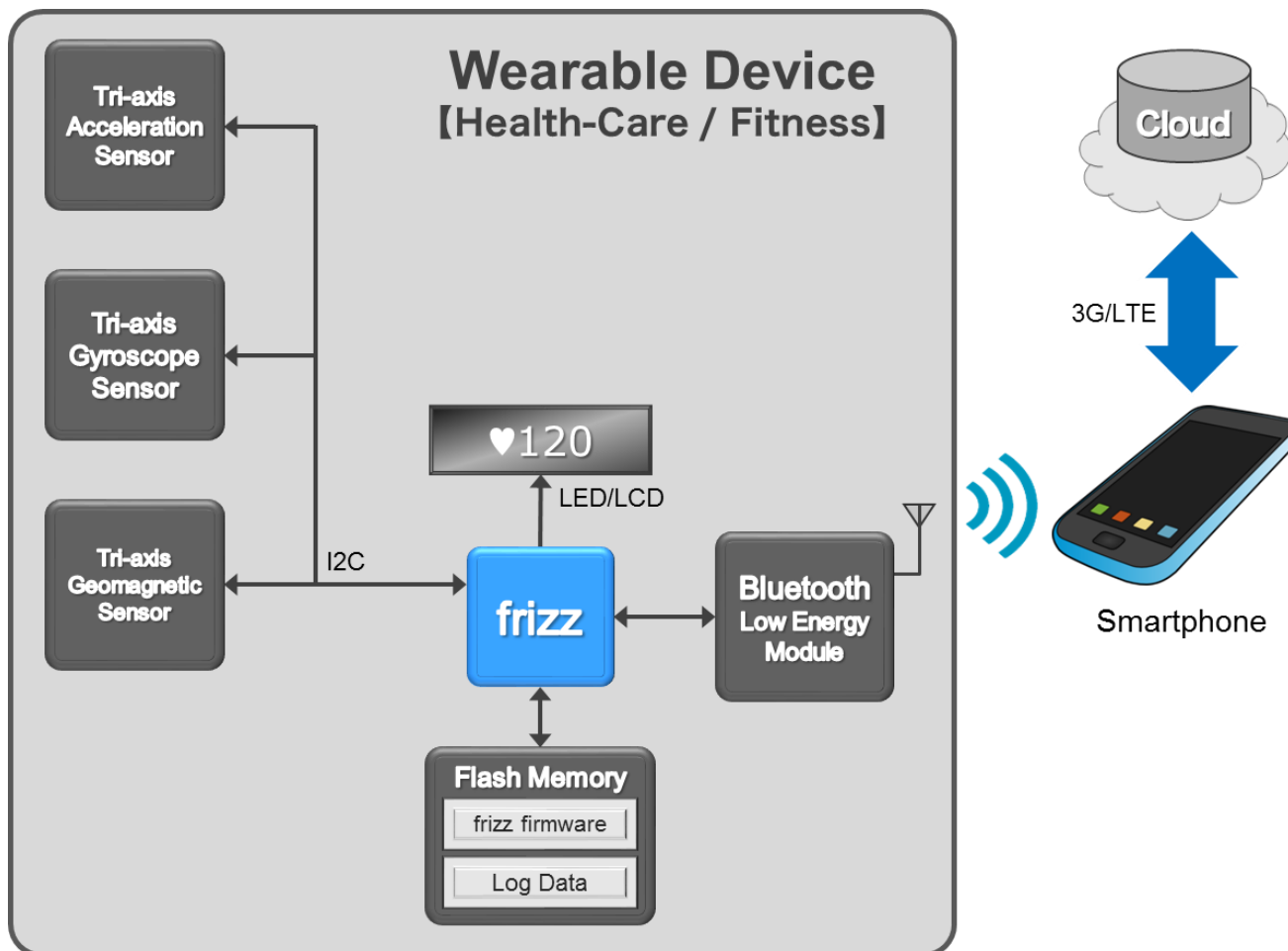
## Application example [Smartphone]

- frizz can take over the functions of sensor calibration, and data buffering from the host processor, thereby saving power, or freeing up the host processor to perform other functions.
- frizz and its software library for **PDR, Context awareness and Activity monitoring** provide the foundation to create new applications.



## ■ Application example [Wearable devices]

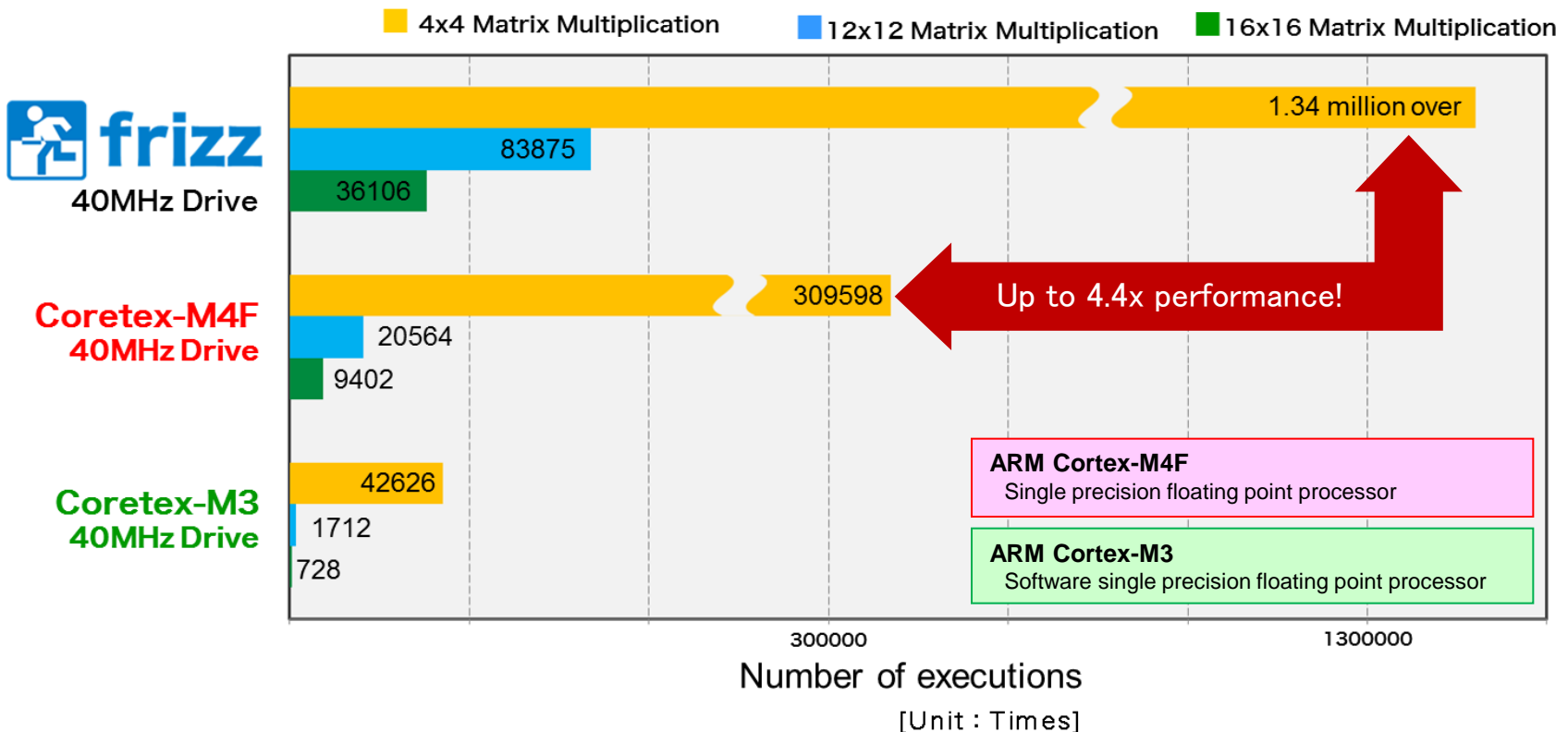
- Frizz can recognize a person's status such as walking, or running,, estimate walking speed and calculate distance traveled. These are all the essential functions to make wearable devices stand out.






## Performance comparison with competitors

- The chart below compares the ability of the IP cores to perform **matrix operation (from 4x4 to 16x16)**, which is used extensively for PDR, at the same **40MHz frequency**.
- Frizz, with its support for floating point 4way SIMD instruction, can achieve over **4.4x performance** when compared with Cortex-M4F based controller.



## ■ Comparison with other IC 【FFT arithmetic processing benchmark】

The followings are the comparison data of frizz with ARM Cortex-M4 on FFT (1024point) arithmetic capacity used for analytical processing, voice processing and noise rejection processing for bio-sensing in frequency domain of sensor data.

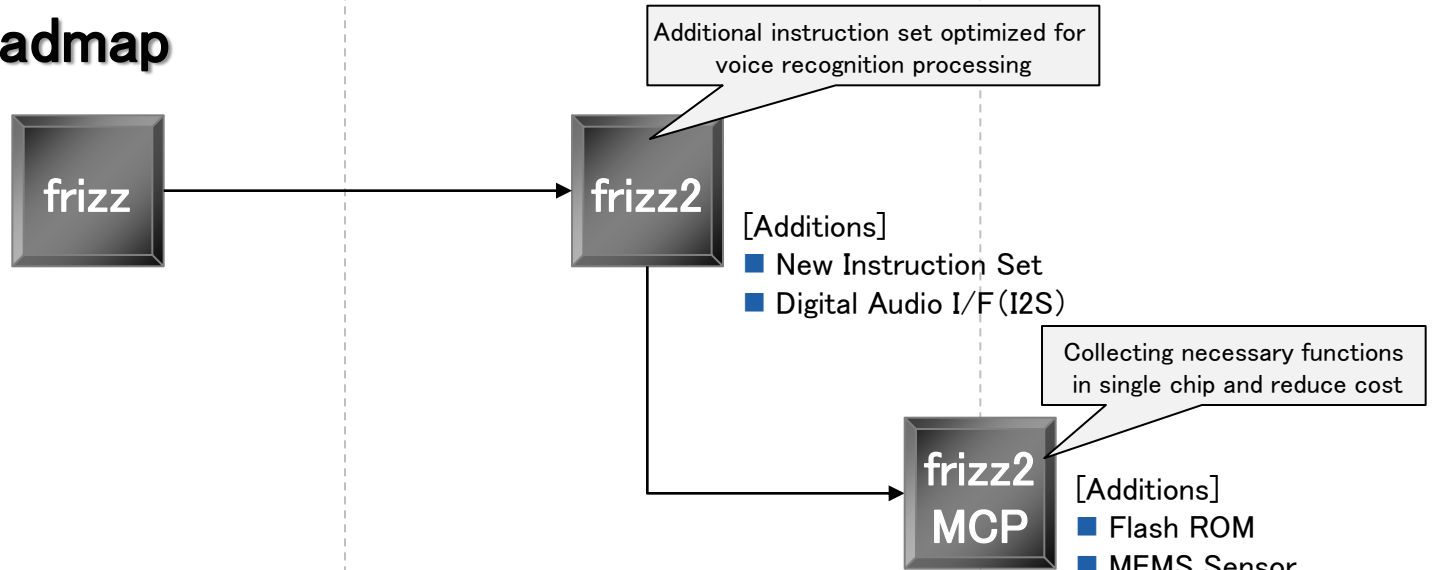
	Execution cycle	Power consumption per one time execution
ARM Cortex-M4	133.6K	57.1 $\mu$ W
 frizz	54.6K	14.2 $\mu$ W

**75% decrease** in power consumption compared to ARM Cortex-M4!

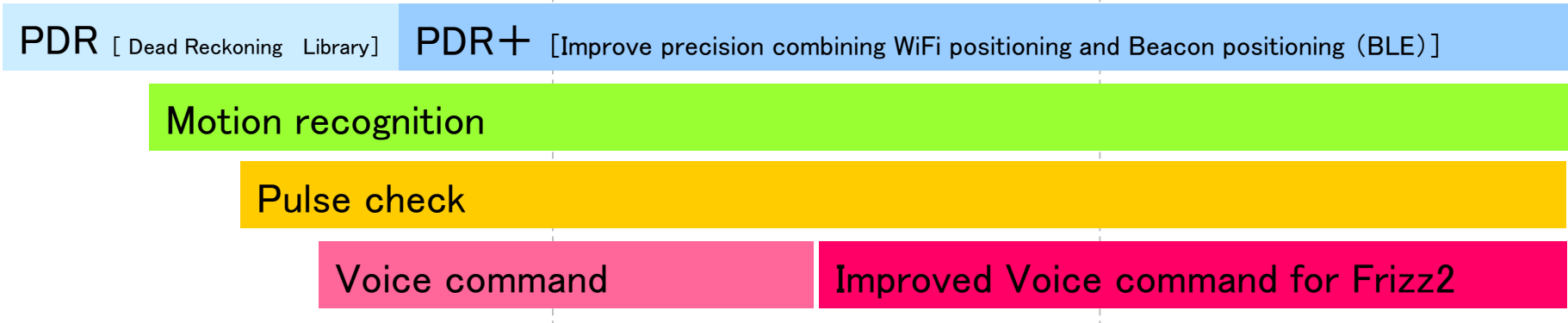
# Roadmap plan

Year 2014	Year 2015	Year 2016
-----------	-----------	-----------

## frizz Roadmap



## Software Roadmap





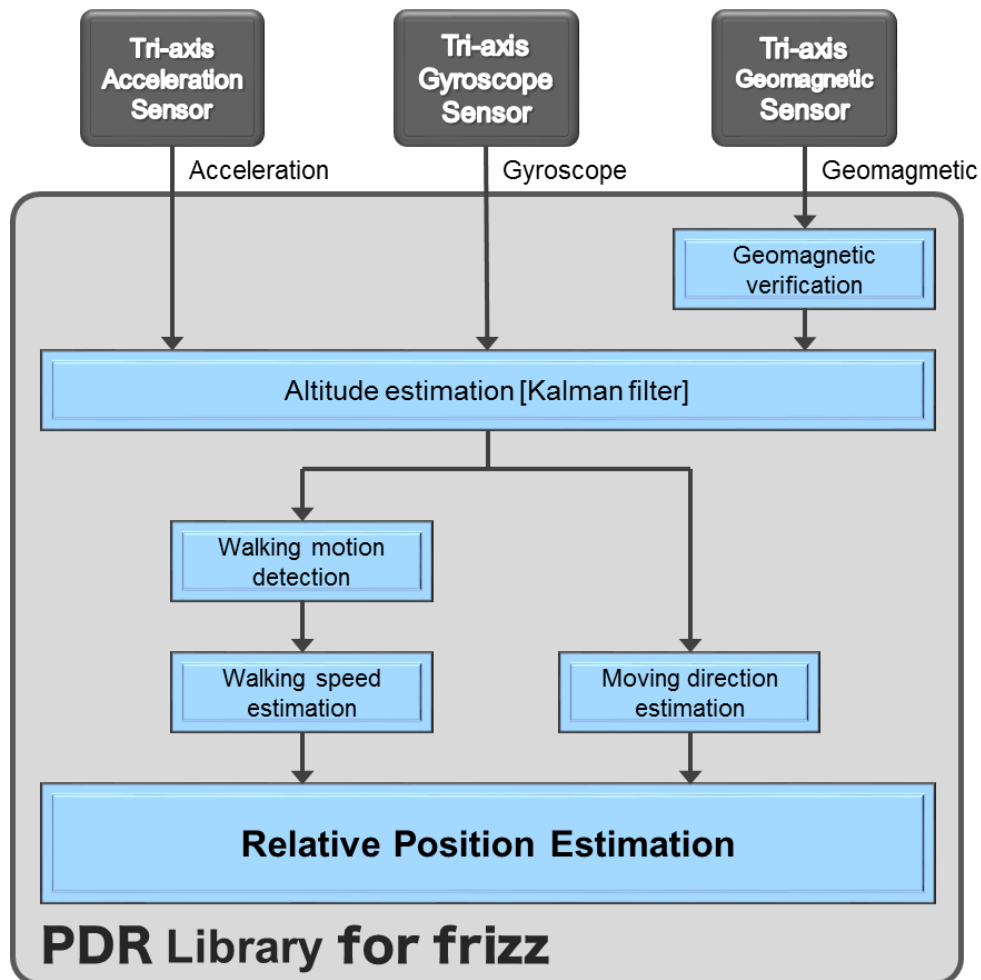
## PDR library for frizz

【Pedestrian Dead Reckoning Software library】

- The requirement for indoor positioning, where GPS signals can not reach, is becoming more important for users, retailers, and app developers alike.
- Smartphone and wearable devices are in need of technology that can estimate relative position, and monitor activities with context awareness by processing data from Accelerometer, Gyroscope and Geomagnetic sensors.
- MegaChips developed PDR (PDR: Pedestrian Dead-Reckoning) library for frizz based on high precision algorithm developed by AIST (National Institute of Advanced Industrial Science and Technology)
- MegaChips PDR library for frizz realizes advanced algorithm calculation in high speed with ultra low power consumption. The performance can help clients to develop applications such as indoor navigation or create new portable devices.



# ■ PDR library architecture and elemental technology



## Elemental technologies

### Altitude estimation

High precision estimation for altitude of target device by using Kalman filter.

### Walking motion detection

Judge walking motion from relationship between vertical and moving direction's acceleration.

### Walking speed estimation

Estimate walking speed from vertical acceleration.

### Moving direction estimation

Estimate moving direction from geomagnetic.

### Geomagnetic verification

Judge reliability of geomagnetic sensor.

## ■ What is PDR (Pedestrian Dead Reckoning)?

- PDR is a system which estimates “Speed”, and “Direction” as well as position of target person by using relative movement data of inertial sensors such as acceleration, gyroscope and geomagnetic sensors.
- PDR is used for indoor navigation system, where GPS signals are unreliable or non-existent.

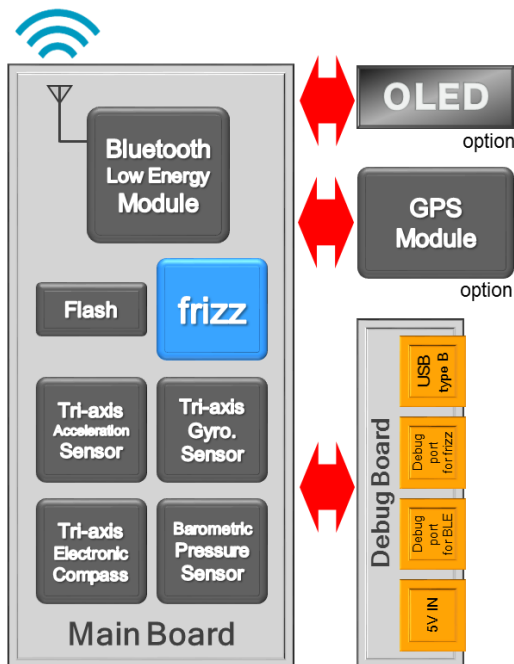


## ■ Evaluation system 2

### ● “Chignon” Evaluation board for wearable devices



- Small external size (10x20mm) for wearable devices [Tentative]
- Battery operation for demonstration and field test.
- OLED (Organic LED) can be connected [Option]
- GPS module can be connected [Option]
- Debug board for software development is ready



#### ■ Sensor

Accelerometer, Gyro : Invensense MPU-6500  
 Magnetometer : MMC3416  
 Barometer : BMP280

#### ■ Bluetooth Low Energy Module

MBH7BLZ02

#### ■ GPS Module [Option : TBD]

GP-2106

#### ■ OLED Module [Option : TBD]

DD-12832YW-1A

# TorchSUN – Partner in China

- ❑ **Trade Name: TorchSUN Technology Co., Ltd**
  - ❑ **Establishment: April 2011**
  - ❑ **Sherry Yang**
  - ❑ **Japan:**
    - **Address: 801 Sanbankan Clio, Odori Park 45-1, 5-chome  
Yayoi-cho, Naka-ku, Yokohama-shi, Kanagawa, 231-0058 Japan**
    - **Capital: 5 Million JPY**
    - **Staff: 4**
  - ❑ **Great China:**
    - **Address: RM616, Block B, East Asia Wang Jing Center,  
Chaoyang District, Beijing, 100102 China**
    - **Capital: 1 Million RMB (15 Million JPY)**
    - **Staff: 10**
  - ❑ **Business: Sensor IC, Software, Module Solution; Smart Phone, Tablet, Wearable, Smart Remote, Windows, Android Sensor Hub, Marketing, Technical Support, Consultant;**
- ◆ **Sensor Hub**
  - ◆ **Sensor Fusion**
  - ◆ **iBeacon**
  - ◆ **Magnetometer**
  - ◆ **Gyroscope**
  - ◆ **Accelerometer**
  - ◆ **Barometer**



## Contact Window

### Great China

Sunny Yang

[Yang.gx@torchsun.com](mailto:Yang.gx@torchsun.com)

微信: yangguoxin1977



### Japan

Robin Lin

[robin@torchsun.com](mailto:robin@torchsun.com)

微信: robin-sensor

