

TR on power supplying scheme for wearable systems and equipment

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Existent wearable equipment and power supply

- Major existent wearable equipment is, electronic wristwatch.
- Power supply for electronic wristwatch is,
 - Primary battery
 - Secondary battery
 - Solar cell + secondary battery
 - Generator + secondary battery
- To charge the secondary battery, wired power transfer is common way, its connector is such as Micro USB or a dedicated connector.
- Wireless power transfer is rare for wristwatch, but it is applied for health band type wearable equipment that has watch function. However WPT is not applied when it is worn but applied when it is took off for charging.

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- Example: Solar cell + secondary battery wristwatch
 - Autonomous: no charging, no battery replacement, it works without maintenance if a light is provided.



From <http://citizen.jp/technology/eco.html>

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Coming wearable equipment and power supply

- Wearable equipment types are,
 - Wristwatch type
 - Eyeglasses type
 - Headphone, earphone type
 - Clothes type
 - Shoes type
 - Any other wear devices.
- Charging when worn and when took off
 - From the case of legacy wearable wristwatch, major charging must be done when it is took off.
 - In this case, charging is the same as electronic wristwatch.
 - The new application is charging when it is worn.

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Generator and charger examples

- Generator utilized human body activity, aka energy harvest
 - Types
 - Body movement
 - Piezo-electric device in shoes
 - The same in any moveable portion
 - Thermal gradient
 - Peltier element on body
 - Perspiration
 - Chemical cell
 - Interface
 - In one body, charging and data
 - Connector type
 - Cable type
 - Wearable cable type
 - BAN
 - Charger outside of body
 - Same as the case of WPT and USB connection

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- Example: Generator in shoe



- Piezo electric transducer
- MEMS generator
- Legacy generation motor with mechanism

- There are many developments and trials.
 - <http://www.memsjournal.com/2010/04/microstructured-piezoelectric-shoe-power-generator-outperforms-batteries.html#more>
 - <http://www.memsjournal.com/2015/03/wireless-health-and-wearables-huge-opportunities-for-mems-devices.html#more>
- How to connect, transmit, control could be the item of standardization.

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Possible standardization items

- Wearable equipment and charger need interoperability.
- To achieve this,
 - For all kind of generators
 - Interface specification for information, control and transmission.
 - Characteristics, protocol, connector, etc.
 - Measurement method
 - Power characteristics
 - Performance, power and efficiency are competition items, not for the standardization items.
- To initiate this standardization, make TR on **power supplying scheme for wearable systems and equipment.**