

## CONTENTS

1		
2		
3	FOREWORD.....	2
4	INTRODUCTION.....	4
5	1 Scope.....	5
6	2 Normative references.....	5
7	3 Terms and definitions .....	5
8	4 System model.....	5
9	4.1 Existent model .....	5
10	4.2 The system model of wearable equipment.....	6
11	4.2.1 Wearable equipment types .....	6
12	4.2.2 Charging .....	6
13	4.2.3 Generator utilized human body activity, aka energy harvest.....	7
14	4.2.4 Interface .....	7
15	5 Use case .....	7
16	5.1 In each TC100 model .....	7
17	5.2 In IoT .....	7
18	5.3 In other functionalities .....	7
19	5.4 Use case examples .....	7
20	5.4.1 Generator in shoe .....	7
21	5.4.2 Surface micromachined arcade thermopile.....	8
22	5.4.3 Animal tracking .....	8
23	6 Interface.....	8
24	7 Measurement method .....	9
25	Bibliography .....	10
26		
27	Figure 1 – Solar cell with second battery wristwatch .....	6
28	Figure 2 – Generator with second battery .....	6
29		
30	Table 1 – Table title .....	エラー! ブックマークが定義されていません。
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INTERNATIONAL ELECTROTECHNICAL COMMISSION



**POWER SUPPLYING SCHEME FOR WEARABLE SYSTEM AND EQUIPMENT**

**FOREWORD**

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IEC/TR XXX, which is a technical report, has been prepared by IEC technical committee 100: Audio, video and multimedia systems and equipment:

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
XX/XX/DTR	XX/XX/RVC

Full information on the voting for the approval of this technical report can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

87 The committee has decided that the contents of this publication will remain unchanged until  
88 the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data  
89 related to the specific publication. At this date, the publication will be

- 90 • reconfirmed,
- 91 • withdrawn,
- 92 • replaced by a revised edition, or
- 93 • amended.

94

95 The National Committees are requested to note that for this publication the stability date  
96 is 2018.

97 THIS TEXT IS INCLUDED FOR THE INFORMATION OF THE NATIONAL COMMITTEES AND WILL BE  
98 DELETED AT THE PUBLICATION STAGE.

99

## INTRODUCTION

100 Wearable devices are introducing to the market, each device employs each power charging  
101 method and power source device. Wearable devices are used for supporting human life and  
102 health for their active living. The duration and life of power source and easy charging or  
103 replace of power source is very important factor because wearable devices are primary  
104 powered by batteries. The power generator is one solution of this power duration or life, it  
105 provides power from user activities or nature sources. Also compatibility of power and data  
106 transmission is important.

107 This Technical Report initiate to solve these issues.

108 **POWER SUPPLYING SCHEME FOR WEARABLE SYSTEM AND EQUIPMENT**  
109  
110

111 **1 Scope**

112 This Technical Report provides models and frameworks for the power supplying scheme for  
113 wearable systems and equipment.

114 **2 Normative references**

115 The following documents, in whole or in part, are normatively referenced in this document and  
116 are indispensable for its application. For dated references, only the edition cited applies. For  
117 undated references, the latest edition of the referenced document (including any  
118 amendments) applies.

119

120 **3 Terms and definitions**

121 For the purposes of this document, the following terms and definitions apply.

122 **3.1**  
123

124 **4 System model**

125 **4.1 Existent model**

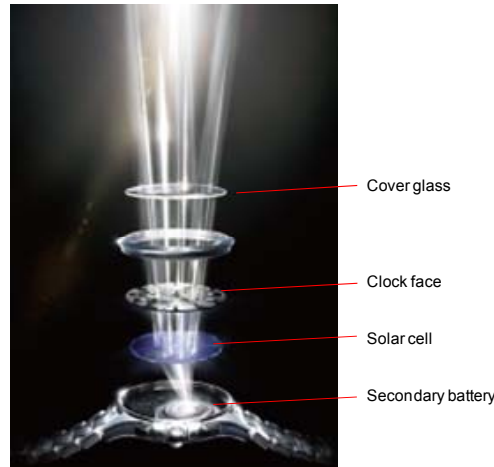
126 A major existent model of wearable equipment and power supply is electronic wristwatch.  
127 Power supply methods for electronic wristwatch are;

- 128 – Primary battery,
- 129 – Secondary battery,
- 130 – Solar cell + secondary battery,
- 131 – Generator + secondary battery.

132 To charge the secondary battery, wired power transfer is common method, its connector is  
133 such as Micro USB or a dedicated connector.

134 Wireless power transfer is rare method for wristwatch, but it is applied for health band type  
135 wearable equipment that has watch function. However WPT is not applied when a wristwatch  
136 is worn but applied when it is took off for charging.

137 Figure 1 shows the example of solar cell with second battery.

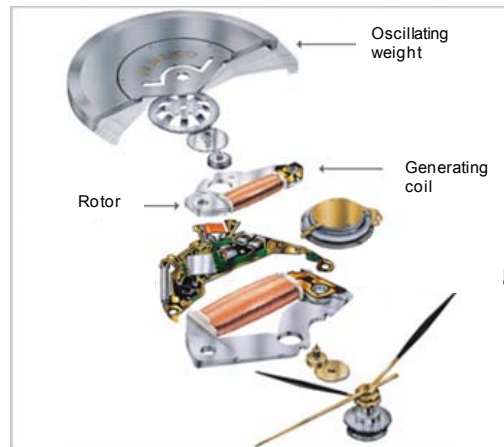


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**Figure 1 – Solar cell with second battery wristwatch**

140 Figure 2 shows the example of generator with second battery,



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**Figure 2 – Generator with second battery**

## 143 4.2 The system model of wearable equipment

### 144 4.2.1 Wearable equipment types

145 Types are;

- 146 • Wristwatch type
- 147 • Eyeglasses type
- 148 • Headphone, earphone type
- 149 • Clothes type
- 150 • Shoes type
- 151 • Any other wear devices

### 152 4.2.2 Charging

153 Charging is required, it is done when a wearable device is worn and when it is took off. From  
154 the case of legacy wearable wristwatch, major charging must be done when it is took off.

155 In this case, charging is the same as electronic wristwatch. The new application is charging  
156 when it is worn.

157 ...

### 158 **4.2.3 Generator utilized human body activity, aka energy harvest**

159 There are types of generators.

- 160 • Body movement
- 161 • Piezo-electric device in shoes
- 162 • The same in any moveable portion
- 163 • Thermal gradient
- 164 • Peltier element on body
- 165 • Perspiration
- 166 • Chemical cell
- 167 • Light
- 168 • Solar cell

169

### 170 **4.2.4 Interface**

171 In one body, a interface for charging and data needs standard for these;

- 172 • Connector type
- 173 • Cable type
- 174 • Wearable cable type
- 175 • BAN specification
- 176 • Charger outside of body

177 These are the same as the case of WPT and USB connection.

178 ....

## 179 **5 Use case**

### 180 **5.1 In each TC100 model**

181 (Car, home, mobile model, etc.)

### 182 **5.2 In IoT**

183 (Sensor, big data application, AAL, etc.)

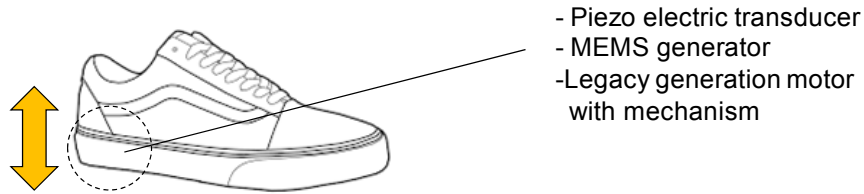
### 184 **5.3 In other functionalities**

185 (sensor, UI device)

### 186 **5.4 Use case examples**

#### 187 **5.4.1 Generator in shoe**

188 How to connect, transmit, control could be the items of standardization.

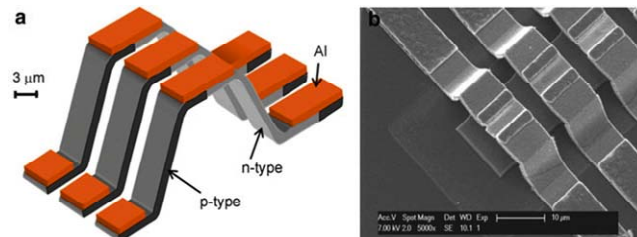


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191 **5.4.2 Surface micromachined arcade thermopile**

192 Embedded in fabrics or wear materials, this kind of small generator or sensor is used.

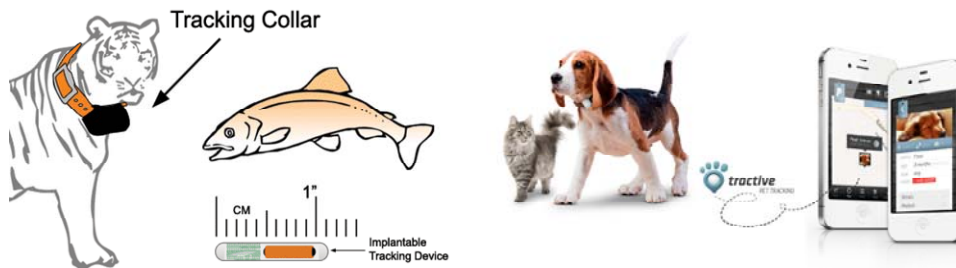


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195 **5.4.3 Animal tracking**

196 Not for human but for animals, wearable devices can be used for their life support.



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198 **6 Interface**

199 Interface specification for information, control and transmission should be standardized. Items  
200 are;

- 201 • Power control
- 202 • Characteristics
- 203 • Providing Power characteristics
- 204 • Protocol
- 205 • Format
- 206 • Connector, connection
- 207 • Transmission

208

209



**210 7 Measurement method**

211 Measurement method for power characteristics needs to be specified. Items are;

- 212 • Generation power
- 213 • Generation characteristics
- 214 • Duration
- 215 • Life
- 216 • Power efficiency

217

218 Bibliography

219

220 Wearable Monitoring Systems, Annalisa Bonfiglio, Danilo De Rossi, ISBN: 978-1-4419-7383-2  
221 Chapter 2 Energy Harvesting for Self-Powered Wearable Devices

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