WEARABLE TECHNOLOGY FOR HEALTH

BY CABERLOTTO MATTEO AND SOMERO MICHELE
OVERVIEW

1. What is wearable computing
2. Old information landscape
3. New information landscape
4. Integrating wearable computing with digital health
5. Integrating several data
6. Wearable in long-term care
7. Experiment and results
8. Conclusion
WHAT IS WEARABLE TECHNOLOGY?

Wearable technology are smart electronic devices that can be worn as clothes or accessories. These devices can be bracelet, watch, socks, etc.

https://www.sportswearable.net/
THE IMPACT OF THESE DEVICES

- Low price technology
- Improve self consciousness
- Continuous tracking of parameter
- Real time data available

https://www.ha-asia.com/
OLD INFORMATION LANDSCAPE

Patient’s information are traditionally concentrated in healthcare hands

- Focused on Hospital, Specialist etc.
- Data acquired in clinical places
- These structure manage all the processes
- It increase the costs of the national system
NEW INFORMATION LANDSCAPE

- Focused on the patient
- Data acquired from independent devices
- Devices can detect disease and problem in real time
- It lower the costs of national system
INTEGRATING WEARABLE COMPUTING WITH DIGITAL HEALTH

- **Preventive medicine**: Wearables have the potential to identify many early physiological and behavioral markers of chronic diseases.

- **Clinical support**: Capturing complex clinical processes using digital data management models could improve healthcare treatment and decrease errors.

- **Monitoring and intervention**: Wearables are ideal for tracking many health-relevant behaviors, activities etc.

- **Integrating Wearable and Clinical Big Data**: Integrating data from clinical sources and wearable monitors provides the potential to yield new biomedical knowledge.
INTEGRATING BEHAVIORAL, GENOMIC, AND ENVIRONMENTAL EXPOSURE DATA

- The most powerful integration
- Study the genetic predisposition can identify individual health risks
- Study the environment and the behavior can prevent diseases
- Research on this topic is already using wearable devices to integrate all these data
WEARABLE DEVICES IN LONG-TERM CARE

Problems:
- Insufficient of nursing aids
- Costs of long-term care institution
- Costs of personal monitoring
- Slowness in transmit emergency messages

Way to solve them:
- Technology to monitor health
- Decrease of technology’s cost
- Speed in data transmission
- Real time data transmission
EXPERIMENT CONSIDERED

- **Place:**
  - Long term care institution in Changhua, Taiwan

- **Technology:**
  - Wearable devices
  - Direct transmission to caregivers
  - Real time monitoring

- **Patients:**
  - Elderly with chronic (high pressure, high blood sugar, etc)
  - Dementia elders

DATA COLLECTION AND NOTIFICATION SYSTEM ARCHITECTURE

- Data collection using wearables
- Data transfer/collection using BLE and WiFi connection (TCP)
- Data analysis in a service server
- Production of reports (graphics)
- Transmission of emergency messages if abnormal signs are found
- Specific level of threshold for abnormal is decided for each patient
- Creation of schedules and questionnaires for patients to give specific personal care
WEARABLE DEVICES

- **Smart Clothes:**
  - Four electrodes
  - Collect ECG signals
  - Comfortable design

- **Healthy Watches:**
  - Photoplethysmography signal
  - ECG signal
  - Attitude signal

- **Bodytags:**
  - Attitude signal
RESULTS OF EXPERIMENT

- Provides care notification information regularly
- System track of residents’ health status
  - Personal notification
  - Caregiver notification
- Interventions carried out in time and on notification
- Patients are motivated to move and take care of themselves
- Time of usage:
  - 93 days

<table>
<thead>
<tr>
<th>No.</th>
<th>Steps</th>
<th>Sleeping Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>E002</td>
<td>1573</td>
<td>78</td>
</tr>
<tr>
<td>E003</td>
<td>2895</td>
<td>73.25</td>
</tr>
<tr>
<td>E007</td>
<td>8339</td>
<td>78.25</td>
</tr>
<tr>
<td>E008</td>
<td>5025</td>
<td>92.25</td>
</tr>
<tr>
<td>E009</td>
<td>5957</td>
<td>89.75</td>
</tr>
<tr>
<td>E010</td>
<td>3826</td>
<td>89</td>
</tr>
<tr>
<td>E011</td>
<td>2040</td>
<td>84.75</td>
</tr>
<tr>
<td>E012</td>
<td>4148</td>
<td>79</td>
</tr>
<tr>
<td>E015</td>
<td>1735</td>
<td>90.5</td>
</tr>
<tr>
<td>E020</td>
<td>3713</td>
<td>89.5</td>
</tr>
<tr>
<td>Average</td>
<td>3925</td>
<td>84.425</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No.</th>
<th>Stay too long (frequency)</th>
<th>Most frequent location</th>
<th>Most frequent time</th>
</tr>
</thead>
<tbody>
<tr>
<td>E002</td>
<td>1.42</td>
<td>room</td>
<td>17:00 ~ 18:00</td>
</tr>
<tr>
<td>E003</td>
<td>1.19</td>
<td>lounge</td>
<td>17:00 ~ 18:00</td>
</tr>
<tr>
<td>E007</td>
<td>0.98</td>
<td>lounge</td>
<td>12:00 ~ 13:00</td>
</tr>
<tr>
<td>E008</td>
<td>0.75</td>
<td>lounge</td>
<td>8:00 ~ 9:00</td>
</tr>
<tr>
<td>E009</td>
<td>0.63</td>
<td>room</td>
<td>9:00 ~ 10:00</td>
</tr>
<tr>
<td>E010</td>
<td>0.62</td>
<td>lounge</td>
<td>14:00 ~ 15:00</td>
</tr>
<tr>
<td>E011</td>
<td>1.34</td>
<td>room</td>
<td>9:00 ~ 10:00</td>
</tr>
<tr>
<td>E012</td>
<td>0.81</td>
<td>lounge</td>
<td>8:00 ~ 9:00</td>
</tr>
<tr>
<td>E015</td>
<td>1.13</td>
<td>room</td>
<td>9:00 ~ 10:00</td>
</tr>
<tr>
<td>E020</td>
<td>0.94</td>
<td>room</td>
<td>8:00 ~ 9:00</td>
</tr>
<tr>
<td>Total</td>
<td>9.82</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Pin-Chieh Huang, Yu-Han Wang, Chung-Chih Lin, Hisang-jen Hsieh - Development of Health Care System Based on Wearable Devices
CONCLUSION

PREVENTIVE MEDICINE
PERSONALIZED PREVENTION AND CURE

REAL TIME HEALTH CONTROL

PERSONAL MONITORING

DIRECT COMMUNICATION TO DOCTORS AND CAREGIVERS

IOT ARCHITECTURE IN CAREGIVING PLACES (HOSPITALS, COMMUNITY, ETC.)

CYBERSECURITY PROBLEMS