Understanding the Taiwan Judo Referee Decision Support System
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Abstract
This case study is aimed to understand how the information system support decision-making of Judo referees and the possibilities to develop a sustainable local Judo judgment support system in Taiwan. The growing popularity of Judo competitions and the ubiquitous use of instant replay Decision Support Systems (DSSs) in those events have brought increasing pressure on the referees in making convincing decisions. Further, requirements of the expertise in balancing the agile rhythm of the game and the scrutiny of the rendered decisions remain constant. In this paper, we conduct interviews with a Judo referee who participated in major Taiwan Judo competition events to collect qualitative and quantitative data and compile lessons learned. To conclude, the advantages of the DSS are threefold: (1) helps the organizer to reduce erroneous scoring; (2) helps the referee render better possible decisions by means of replacing the missed motion; (3) helps improve the timing control. In the future, we hope that Judo competition systems could not only be generating data for balloting and weighting athletes before the game as its present usage, but also provide an integrated information of the competition results, as well as real-time analytical technical data to help athletes or coaches react responsively during the game.

Keywords: Decision Support System, Taiwan Judo Competition, Judo Referee, Judo Information System

I. Introduction
With high development in information technology (IT), various industries apply IT systems to enhance product efficiency (Drnevich & Croson, 2013), including Sport fields. In Judo competition, relative issues for IT applications are mainly in the wireless sensor design (which embed in competition equipment), software analysis, visualize system and motion detection (Lopes-Itaru et al., 2014; Marcon, Franchini, Jardim, & Barros Neto, 2010; Marka, Hayashida, Jilo, Calmet, & Franchini, 2011; Piras, Pernottotti, & Squatrito, 2014). Nevertheless, in Taiwan, there are not much relative researches towards IT system in Judo competition. Only one study is about developing an evaluation and training system for supporting multiple sports referre to make judgments (Chen & Chou, 2011). Which means the system is design for multiple targets (combine different sports together) but not focuses on Judo specifically. Therefore, this phenomenon is interesting for us and rising our research motivation. Throughout this study we would like to understand more about how information system can support Judo referee in decision making. The specific aims in this study are:

1. To understand how DSS works in Taiwan Judo competition
2. The future development for DSS in the Taiwan Judo competition

II. Methodology

2.1 Research Purpose
The main purpose of this study is to understand how information system can support Judo referees doing decision/judgment and the possibilities to develop a sustainable local Judo judgment support system. 2.2 Data Collection Procedures
Interviews are a widely used tool to access people’s experiences and their inner perceptions, attitudes, and feelings of reality. Based on the degree of structuring, interviews can be divided into three categories: structured interviews, semi-structured interviews, and unstructured interviews (Fontana & Frey, 2005; Rose, 1994). In this study, unstructured and semi-structured interviews conduct to investigate how Judo judgment system supports Judo referees to make judgments in the competition. Three sections of interviews are made (summarize in table1), and we invited Kai-Feng Chang who is the referee in Judo competition to share her professional experiences and knowledge. Unstructured interview was design in the first section to probe into how Judo DSSs work in the Taiwan Judo competitions via telephone conversation. Secondly, the section of interview was focus on the effect of DSS in Judo competition with semi-structured style. The final section of interview was also conducting in semi-structured and aiming to capture the opinion of future prediction in Judo DSS.

III. Results and Findings
The respondent also provides the system sample. Based on interview result, there are mainly three types of DSS used in Taiwan Judo Competitions (see Table 2). These systems are functioned as scoring and timing control, grouping athletes and some special monitors. Figure 2 is the system screen shot in Type1 system. On the top half is the countdown function, and the red and white which is represented as “R” and “W” separately stand for two different athletes with different judgment points. However, in figure 3, which is invented by foreign authority (International Kurash Federation), the language and the system integrity are main difficult reason for Taiwan local user to operate during in the competition. Therefore, this system is not popular among most of the Taiwan Judo competitions.

In the Type 2 system, the software provides options list to select match rules athlete registration, grouping, and drawing the competition schedule (see Figure 4-5).

IV. Conclusions & Future Research
The limitation in this paper is the data only collect by one interviewer. On the other hand, field study is recommended to gain more evidences by joining directly in the Taiwan Judo competitions. The suggestion for future research could design a long-term study to investigate system quality and technology acceptance from the view of system users. In the next future, the function for Judo competition system could be not only generating data for balloting and weighting athletes before the game, but also providing the integrated competition result information and technical data analysis during the game. What’s more, with the authorized referee and recorder’s account, which can access to make the connection for systematical result list and personal analyzed data output. However, Judo DSS cannot replace the work of human judgment, but the criteria for supporting scoring and revising error will become more important. Even this system can be an important tool for selecting the Judo referee, because the system is used to evaluate the judgment which gets more error rate from the judgment can be recorded in the system. Therefore, these systems are valuable tools to evaluate Judo referee, and to eliminate not suitable one. To summarize, DSS can help the organizer to reduce error judgment in games also help the referee to give the best decision for giving the score based on slow motion also can improve the timing control for every games.

V. Acknowledgement
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<table>
<thead>
<tr>
<th>Session</th>
<th>Theme</th>
<th>Data</th>
<th>Tool</th>
<th>Participants</th>
<th>Style</th>
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</thead>
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<tr>
<td>1</td>
<td>Taiwan Judo DSS Introduction</td>
<td>Dec 10th, 2015 19:00-19:15</td>
<td>Via telephone</td>
<td>Tsu-Lin &amp; Kai-Feng</td>
<td>Unstructured</td>
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Table 2. DSS for Judo Competition

<table>
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<tr>
<th>Type</th>
<th>Main Feature</th>
<th>Developer</th>
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<tbody>
<tr>
<td>Type 1</td>
<td>Scoring and timing control</td>
<td>Local university &amp; International Kurash Federation</td>
</tr>
<tr>
<td>Type 2</td>
<td>Grouping athletes</td>
<td>Local university</td>
</tr>
</tbody>
</table>

Source: Arranging from the author interviews

Figure 2. Type 1 System Screen (developed by Local University)
Figure 3. Type 1 System Screen (developed by International Kurash Federation)
Figure 4. Type 2 System Screen Shot-1
Figure 5. Type 2 System Screen Shot-2