An Input Support System for Customized Scouting Charts of Baseball Games

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Abstract: In physical education, it is important for students to learn how to observe, record, and analyze their activities. Ryukoku University Baseball Team developed a customized scouting chart and records the type and course of every individual pitch thrown by all the pitchers in the team and their rivals. However, it is not easy to record the pitching data by using pens and paper. To solve this problem, we developed an input support system for customized scouting charts of baseball games in Unity and C#. In preliminary experiments, our system enables users to create pitch combination records easily and improves the readability of them.

1 INTRODUCTION

In physical education, it is important for students to learn not only how to do physical exercises but how to

- observe,
- record, and
- analyze their activities.

Many sports players and coaching staff observed and recorded their games and analyzed their activities. Take baseball for example. Baseball players and coaching staff record baseball games by using baseball scorebooks. Figure 1 shows an example of baseball scorebook records. From the record in Figure 1, we can read the leadoff hitter's activities in the first inning: Uchiki, the leadoff hitter, hit a single to left-center field with the count one ball and two strikes. Then, he stole second base and moved to third on a sacrifice bunt by the next batter, Suzuki. Finally, he reached home on Matsui's single to center.

This record helps the baseball players and coaching staff to look back on their activities in the game, refine their training plans, and set up new tactics to win games. Furthermore, some other information is recorded in baseball scorebooks: date, place, weather, wind speed and direction, umpires' names, and so on. However, information recorded in scorebooks is usually limited and not enough to set up new tactics to win games. For example, we cannot read the course and type of the pitch that Uchiki hit to left-center in the first inning. In order to set up new tactics to win games, it is important to collect the following kinds of information.

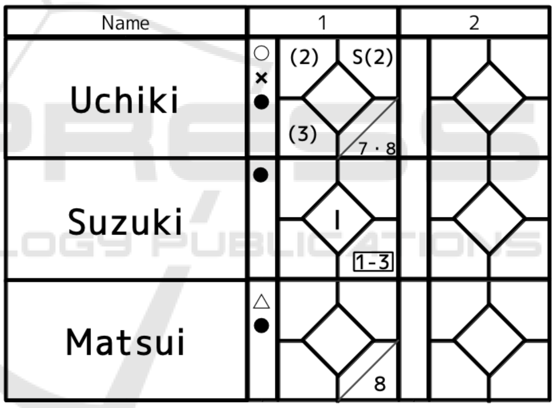

Figure 1: An example of baseball scorebook records.

- What kinds of pitches can opposing team's pitchers throw.
- What courses and types of pitches opposing team's batters are good at hitting.

To solve this problem, the Major League Baseball (MLB) records the type and course of every pitch thrown by any pitchers in the MLB and provides the data in the MLB website (http://www.mlb.com). Detailed records are important to analyze players and teams statistically and set up new tactics to win games. For example, Uehara and Arai proposed a model of tactical decisions for pitching based on the MLB pitching data (Uehara and Arai, 2013). As a result, our university baseball team (Ryukoku Univer-

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sity Baseball Team) records pitching data similar to the MLB pitching data. However, it is not easy to record the type and course of every pitch thrown by all the pitchers in our team and rivals because the data is recorded by using pens and paper. In order to reduce the burden of data recording, we developed an input support system for customized scouting charts of baseball games. We developed our system in Unity and C# because Unity provides an integrated development environment that enables computer programming beginners to develop user friendly interfaces as they want.

2 RELATED WORKS

In order to reduce the burden of recording data on baseball scorebook, Terasawa et al. attempted to develop input support system for baseball scorebook, but not yet (Terasawa et al., 2013). On the other hand, Komatsu and Kuwabara developed an input support system for baseball scorebook using iPad (Komatsu and Kuwabara, 2013). When we have score data in baseball scorebooks, we can analyze players and teams statistically from various viewpoints. Maruyama et al. developed a system that calculate pitchers' annual salaries of next year by using Nippon (Japan) Professional Baseball Organization (NPB) score data (Maruyama et al., 2010). Turocy and Kira and Inakawa reported that the values of the game (the equilibrium winning percentages for both teams) could be solved with high accuracy by using MLB score data and NPB score data, respectively (Turocy, 2008) (Kira and Inakawa, 2014). When we have more detailed data than baseball scorebook records, we can analyzed players and teams more widely and closely. In order to collect more detailed data, the MLB installed PITCHf/x systems in every MLB stadium and records the type and course of every individual pitch thrown by any pitchers in the MLB. Hamilton et al. and Hoang et al. applied classification methods to PITCHf/x data and extend the classification tasks to pitch prediction (Hamilton et al., 2014) (Hoang et al., 2015). In order to set up new tactics to win games, Ryukoku University Baseball Team has recorded pitching data similar to the MLB pitching data. However, it is not easy to record the type and course of every individual pitch thrown by all the pitchers in our team and rivals because the data is recorded by using pens and paper. In order to record pitching data quickly and precisely, our university baseball team developed a customized baseball game scouting chart, *pitch combination chart*.

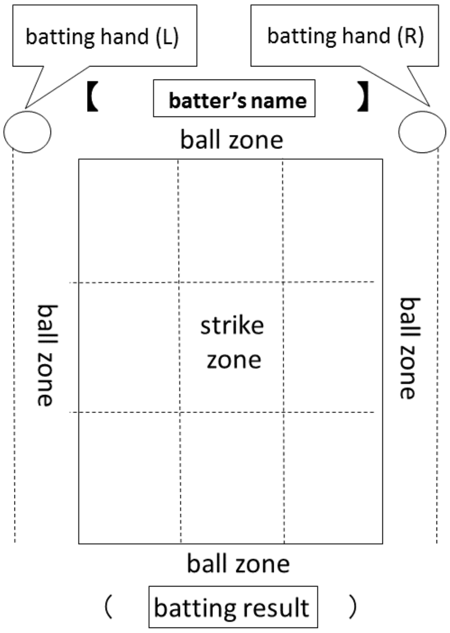


Figure 2: The structure of a pitch combination chart.

3 PITCH COMBINATION CHARTS OF RYUKOKU UNIVERSITY BASEBALL TEAM

In order to record pitching data quickly and precisely, Ryukoku University baseball team developed pitch combination charts. Figure 2 shows the structure of a pitch combination chart. A pitch combination chart consists of

1. batter's name column,
2. batting hand marker,
3. batting result column, and
4. the strike zone and the ball zone viewed from a pitcher.

The strike zone is divided into 3 × 3 boxes.

Figure 3 shows an example of a pitch combination record described on a pitch combination chart. The record shows the pitch combination to Uchiki in the first inning. The record is more informative than the record in the scorebook shown in Figure 1. A pitch combination record is described in the next way.

1. A recorder fills in the batter's name column and paints over one of the batting hand markers, right or left, with black. Figure 3 shows Uchiki is a left handed batter because the left batting hand marker is painted over with black.

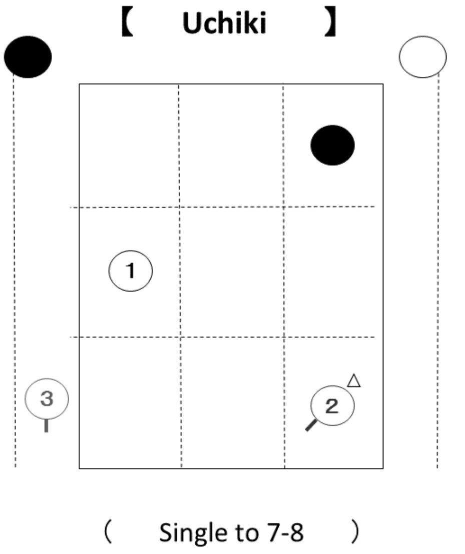


Figure 3: An example of a pitch combination record described on the pitch combination chart.

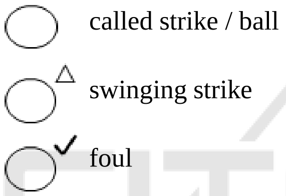


Figure 4: Symbols for indicating umpire's decisions.

2. The recorder describes the ordinal number, location, type, moving direction (in case of a breaking ball), and umpire's decision of each individual pitch by using circles in the strike and ball zones. In Figure 3, numbers in circles are the ordinal numbers of pitches. The circle painted over with black means the last pitch. The locations of the circles indicate the locations where the catcher received the pitches. Circles that connected to lines indicate breaking balls. The directions of lines connected to circles are the moving directions of breaking balls. Superscripts to the right of circles indicate umpire's decisions: swinging strike, called strike, ball, and foul. Figure 4 shows symbols for indicating umpire's decisions. Figure 3 shows the first pitch to Uchiki was a straight, middle and inside, and a called strike. The second pitch was a breaking ball moving toward inside and downward, low and outside, and a swinging strike. The third pitch was a breaking ball moving downward, low and inside, and a ball. The fourth pitch, the last pitch to Uchiki, was a straight, and high and outside.

3. The recorder fills in the batting result column. Figure 3 shows Uchiki's batting result is a single to left-center field.

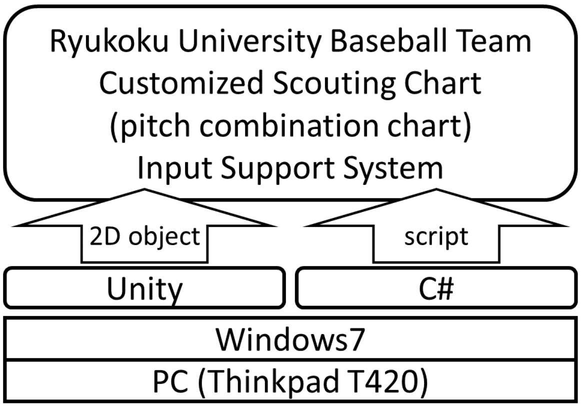

Ryukoku University Baseball Team
Customized Scouting Chart
(pitch combination chart)
Input Support System
2D object
script
Unity
C#
Windows7
PC (Thinkpad T420)

Figure 5: The overview of our system.

It is not easy to record pitch combination data by using pens and paper. This is because baseball games often go rapidly and recorders have short time to record information about every individual pitch. As a result,

- information about pitches, and
- readability

are limited. For example,

- the detailed types of breaking balls are not recorded, and
- umpire's decisions are indicated only by symbols that are often misinterpreted.

As a result, it is important to support recorders in creating informative and readable pitch combination charts easily and quickly.

4 INPUT SUPPORT SYSTEM FOR PITCH COMBINATION CHARTS

In order to support users in recording pitch combination data easily and quickly, we developed an input support system for pitch combination charts in Unity and C#. Unity provides an integrated development environment that enables computer programming beginners to develop user friendly interfaces as they want. In our system, it is important whether the interface is designed as users want. This is because users have to record pitch combination data quickly and precisely in games. Our system works on Thinkpad T420 under Windows 7. Figure 5 shows the overview of our system. Our system not only reduces the burden of data

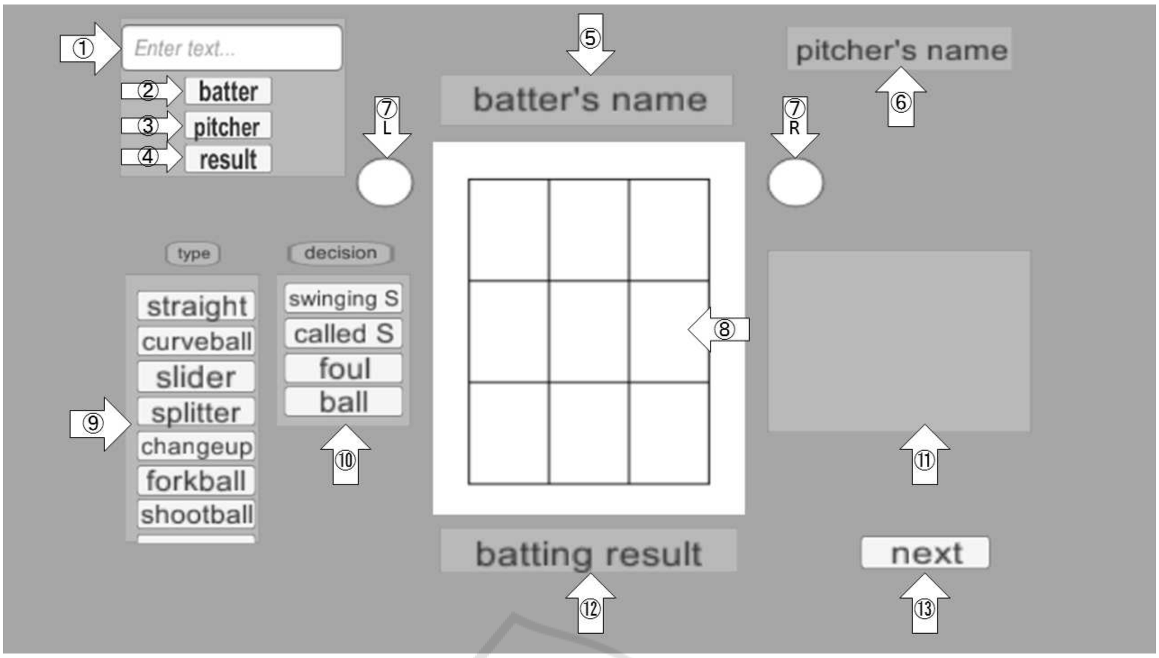


Figure 6: The user interface of our system.

recording but enriches information on pitch combination charts and improves the readability of them. For example, our system enables users to record

- pitcher's name and
- the detailed types of breaking balls (curveball, slider, forkball, and so on)

on the pitch combination charts. Also, our system enables users to read information about umpire's decisions expressed in words, not in symbols.

Figure 6 shows the user interface of our system. As shown in Figure 6, the user interface consists of the following components:

1. a text input field for entering batter's name, pitcher's name, and a batting result (① in Figure 6).
2. a button for submitting batter's name (②).
3. a button for submitting pitcher's name (③).
4. a button for submitting a batting result (④).
5. a text output field for displaying batter's name (⑤).
6. a text output field for displaying pitcher's name (⑥).
7. two markers for displaying batter's batting hand, left or right (⑦ L and ⑦ R).
8. the strike zone (divided into 3 × 3 boxes) and ball zone (⑧).
9. buttons for submitting the type of a pitch (⑨).

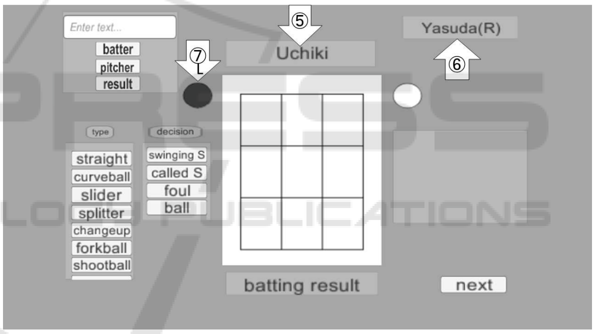
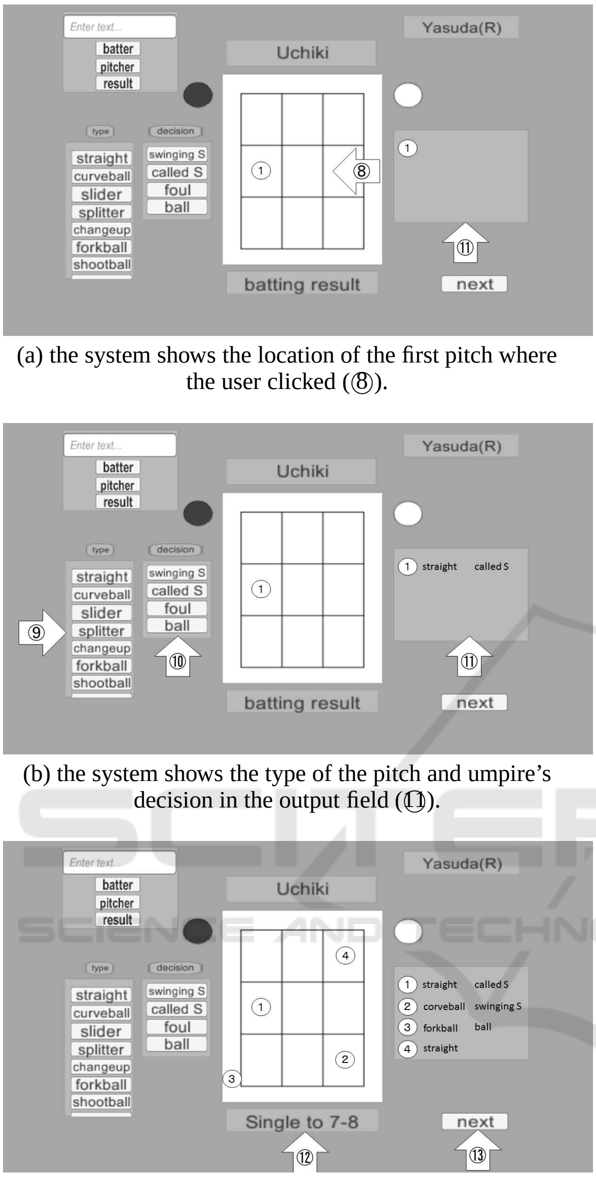


Figure 7: Information about batter's name, pitcher's name, and batter's batting hand is input to our system.

10. four buttons for submitting umpire's decision (⑩).
11. an output field for displaying the types of pitches and umpire's decisions (⑪).
12. a text output field for displaying a batting result (⑫).
13. a button for creating next batter's pitch combination chart (⑬).

Next, we tell how to use our system.

First, a user inputs batter's name, pitcher's name, and batter's batting hand to the system in the next way: the user enters batter's name to the text input field (① in Figure 6) and push the button for submitting batter's name (②). Then, the user enters pitcher's name to the text input field (①) and push the button for submitting pitcher's name (③). Finally, the user



1 straight called S
2 corveball swinging S
3 forkball ball
4 straight

(a) the system shows the location of the first pitch where the user clicked (⑧).

(b) the system shows the type of the pitch and umpire's decision in the output field (⑪).

(c) the system shows the batting result of Uchiki in the text output field (⑫).

Figure 8: Information about the locations, types, umpire's decisions of the pitches is input to our system.

selects one of the batting hand marker (⑦ L or ⑦ R) for indicating batter's batting hand, left or right. As shown in Figure 7, batter's name, pitcher's name, and batter's batting hand are displayed in the text output field (⑤), the text output field (⑥), and the batting hand marker (L) (⑦ L) , respectively.

Next, the user inputs the location, type, and umpire's decision of each pitch to the system in the next way. First, the user clicks or touches the location in the strike or ball zone (⑧) where the catcher receives the pitch. Then, as shown in Figure 8 (a), the system displays two circles with the same ordinal number in the strike or ball zone (⑧) where the user clicked or touched, and in the output field (⑪). Next, the user clicks or touches one of the buttons of pitch types (⑨) and one of the buttons of umpire's decisions (⑩). Then, as shown in Figure 8 (b), the system shows the type of the pitch and umpire's decision in the output field (⑪). The user continues to input the locations, types, and umpire's decisions of the pitches until the batting result is confirmed.

Finally, a user inputs the batting result to the system in the next way: the user enters the batting result to the text input field (①) and push the button for submitting a batting result (④). Then, the batting result is displayed in the text output field (⑫). Figure 8 (c) shows the pitch combination chart of Uchiki in the first inning. When the user push the button (⑬), the system creates a new pitch combination chart.

In preliminary experiments, members in Ryukoku University Baseball Team reported that data recording is easier and more quickly by using our system than by using pens and paper. Furthermore, they reported that pitch combination charts created by our system are more readable than those created by using pens and paper. In the experiment, we used one video of an at bat with four pitches. The video was one minute and 30 seconds long. It started with the scene where the umpire called "Play" and ended with the scene where the pitcher got the batter to ground out on the forth pitch. We showed the video to 10 members in Ryukoku University Baseball Team. All of them were experienced in using pitch combination charts. When 13 seconds passed from the start of the video, the catcher received the first pitch. It was at the moment that they started recording pitching data. They took on average one minute and 38 seconds to record pitching data when they used pens and paper. On the other hand, they took on average one minute and 23 seconds when they used our system. This time lag is important because the next batter walked into the batter's box within one minute or less.

5 CONCLUSION

In order to set up new tactics to win games, our university baseball team developed customized scouting charts and records the type and course of every individual pitch thrown by all the pitchers in our team and rivals. However, it is not easy to record the pitching data by using pens and paper. To solve this problem, we developed an input support system for customized scouting charts of baseball games in Unity and C#. In preliminary experiments, data recording is easier and more quickly by using our system than by using pens and paper. Furthermore, pitch combination records created by our system are more informative and readable than those created by using pens and paper.

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