TJASS, a smart board for augmenting card game playing and learning

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ABSTRACT
This paper presents TJass, a smart board that extends regular card playing with computational supports, without modifying players' habits. The article first presents the functionalities, in particular the learning by trial assistant, and architecture of TJass and further details the hardware implementation and problems encountered. The article concludes with users' satisfaction comments.

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General terms: Experimentation, Human Factors, Algorithms

Keywords: Tangible Interfaces, Interaction/Collaboration, Augmented Reality, RFID, Card Game

INTRODUCTION
Recent years have pointed out that tangible user interfaces, a type of human-machine interaction which uses physical objects to interact with digital information, are a promising alternative to classical graphical interfaces. The tangible interfaces have shown in particular an elevate potential to support interaction and collaboration.

The goal of this project is to extend card game playing with computational aids in a non intrusive and transparent way to support both beginners and expert players and lead them towards a more elevated and agreeable gaming experience. In comparison to another similar system mentioned in [1], which uses TFT display, the output devices in Tjass have been designed for a maximum transparency and a minimum intrusiveness. Furthermore, while help is provided by a relative unpractical PDA in the Smart Playing Cards project [1], Tjass beginner's assistance is directly available on the game board.

In the traditional jass card game the players have to count and notate manually the scores. As well they need to observe continuously the status of the score to determine the winner team. In addition the rules of jass are complex and require keeping in mind the overview of all played and remaining cards. Therefore beginners often have difficulties to learn the game. Tjass will disburden the players of these tasks by (1) counting and displaying the score automatically in real time and (2) putting at beginner's disposal a decision assistance to teach them the game.

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TJASS FUNCTIONALITIES AND ARCHITECTURE
TJass avoids the use of mouse, keyboard and monitor, in order to preserve card players' habits and guarantee non-intrusiveness. Instead an augmented game board and real cards are preferred. Tjass design has been guided by this motto, augmenting gaming experience without modifying players' traditions.

Each card is marked by an RFID tag that identifies it uniquely (Fig. 1d). An RFID reader is then used for card identification and game observation. Physical devices built using Phidgets [2] are used for additional interaction during the game. Fig. 1a illustrates the setup of Tjass. On each side of the table resides a player. Each of the 4 players is supported by one antenna which is attached under the table right in front of him (Fig. 1c). The card detection zones for the players are marked in Fig. 1a as rectangles in front of them. The playing zone is the square in the middle of the table. To get into that zone each card passes through the sensor field of an antenna. This feature guarantees habitual playing comportment like in the traditional jass.

To help the players know who shall play, the yellow led in front of the active player will blink. If a played card is valid according to the rules of jass, the green led lights up and a discrete sound is played. If the card is not valid, the red light will blink and the player should play another card. This prevents mistakes and denounces cheating attempts. Other sonorous outputs acknowledge for several events like announces, end of game or trump selection. Another RFID reader, a single tag short distance reader, allows users to define the trump color in a tangible way by putting trump tokens on the antenna.

When a round is finished, the points are calculated and added to the score. The round points and the global score are then shown on each player's LCD (Figure 1a). In addition, to provide a constant score overview, the score needle

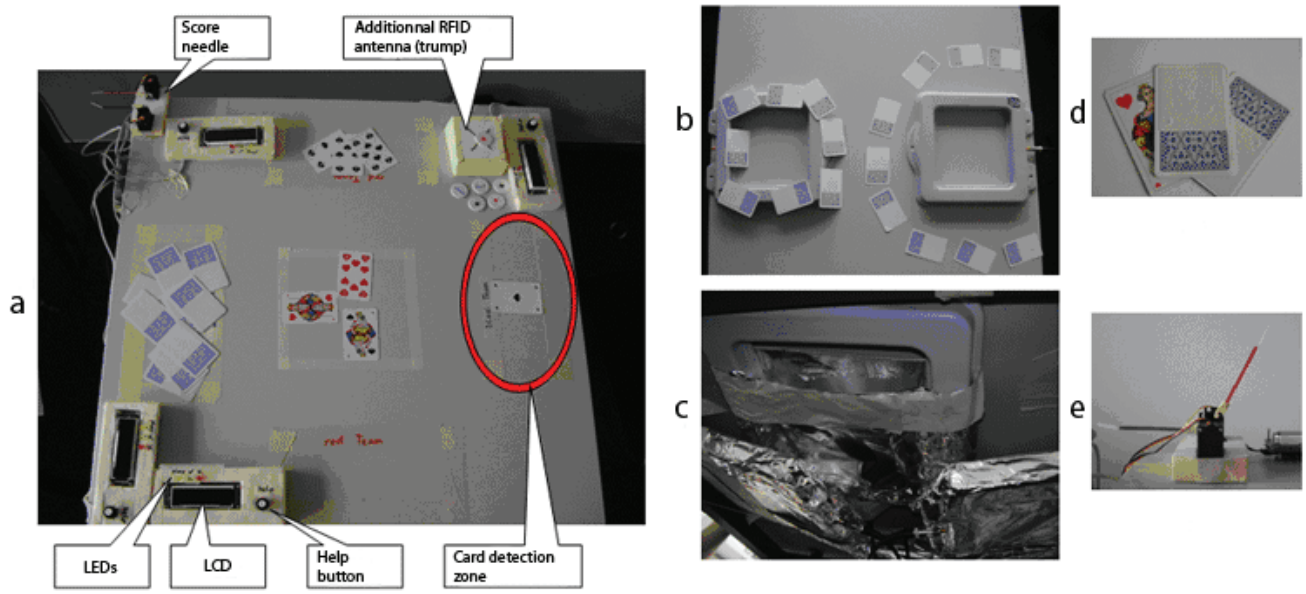

Figure 1: a) Overview of Tjass game board; b) Antenna positions and field jumping; c) Field reduction using Faraday cage; d) Tagged cards; e) The score needles.

(Figure 1e) of each team, animated by motors, increases in real time to give a tangible visual output.

Decision support can be obtained pressing the help button (Fig. 1a). The button is useful to check if a card is optimal, good, miserable or denied to play, which is indicated by a multicolor led. For this, the button has to be pressed while the card to be tested is passed over the sensor field. Thus the game can be learned by playing the game itself, following a "trial and error" concept.

Finally, the system is modular and thus allows rapid prototyping of card games (poker, Bridge, etc.) since it is based upon a framework that manages input and output interfaces, e.g. phidgets, RFID readers, sounds, etc.

RFID HARDWARE AND RELATED PROBLEMS

The Tagsys Medio L200 RFID Reader [4] middle range reader is designed for 3D and volume detection applications. The reader is able to read a high number of tags simultaneously. At the distribution phase, the timesharing between the four antennas is done by tickets which correspond to missing cards. The more tickets an antenna owns, the longer time it is active. At the playing phase, the active player's antenna has a higher reading priority than the others, which optimizes tag reading performance. The multi-card detection works well except if the cards are stacked one onto each other. There is no hardware solution to that problem, but experience has shown that it appears rarely in a real gaming situation. Moreover, the detection field is not precisely predictable. Indeed the metal framing of the table creates interferences, blocking sometimes the card detection or enforcing the field towards a certain direction. This and other sources of errors are illustrated in details in [3]. Another problem is that the antennas are not conceived to operate so close to each other. The detection field of an antenna is jumping across the others, as shown in Fig. 1b where the cards are placed along the bounds of the detection field of the right antenna. The figure illustrates that the field jumps over the left disconnected antenna. Because of this coupling, it is neither possible to say which antenna is detecting which card in his detection field, nor to differentiate zones and common zones. To overcome this, it has been decided to reduce the original detection field capacity of the antennas by covering them to three-quarter with aluminum foil to create a sort of partial Faraday cage (Fig. 1c).

CONCLUSION

This paper presents Tjass, a system that support real card playing with computational functionalities such as score counting, winner determination, and decision assistance. A recent user satisfaction test has shown that Tjass satisfies players because of its usability and playability. Furthermore, it has appeared to be a suitable solution for beginners to learn card games in real context and to take decisions by their own, without disturbing the other players, who can't see the learner's cards.

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