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A Sensor System of Seat Sensor Network for Adaptive Aircraft Passenger Seat System

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I. Abstract

Air travel is becoming increasingly more accessible to people both through the availability of cheap flights and because the airlines are now able to cater for individuals of all ages and disabilities. Air travels, especially for long haul, may cause both physiological and psychological discomfort to passenger. Passenger comfort is clearly a main factor in user's acceptance of transportation systems. In order to reduce the sitting discomfort during air travel, an adaptive system is developed to integrate into the aircraft passenger seat. The paper describes the adaptive seat framework and development of sensor system to monitor passenger sitting comfort during air travel.

II. Adaptive Aircraft Passenger Seat System Framework

Fig. 1 presents the adaptive framework for aircraft passenger seat. As shown in figure, the framework starts by setting the passenger's target sitting comfortable states. Then, the system observing the current passenger's sitting posture preference that he/she wishes to control. The action creates an internal representation of the passenger's posture situation. After that, the adaptive inference engine will determine (1) whether the passenger is in the target state or not; and (2) if the passenger is not in the target state then optimized sitting services are recommended based on user sitting preference.

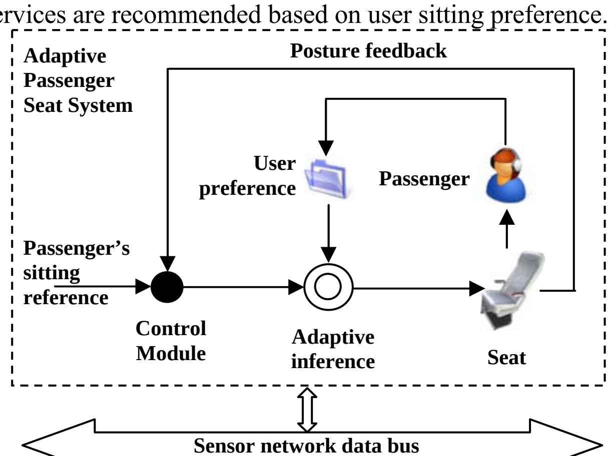

Fig. 1. An adaptive economy class aircraft seat framework.

The sensor network bus acts as mechanism for communication between adaptive seat system and central processing unit. An optimized action list to transfer the passenger from the current physical state S_i to the target S_m can be computed with the Bellman equation:

$$v(Po_i) = \max_{a \in A} \{F(po_i, po_i) + r \sum_{s_j \in S} P_a(s_i, s_j) v(s_j)\}$$

Where r is the reduce rate and satisfied $0 < r \leq 1$. For the passenger to transfer from current state s_i to the target state s_m with minimum intermediate states r could be turned smaller or *r* could be turned toward 1.

III. Seat Sensor System

An experiment was conducted to measure and validate the seat sensor networks. The experiment was implemented in the aircraft cabin simulator. The experiment was conducted for each individual separately. The position and physiological condition of test subject was measured with Max and microcontroller. Force sensing resistor (FSR) was used for passenger sitting comfort monitoring. Fig. 2 shows the attachment of sensor systems at upper seat area.

Fig. 2. FSR sensors on head rest area

IV. Conclusions

The aircraft passenger seat plays an important role in providing sitting comfort. In this paper, we described the adaptive framework and sensor system of seat sensor network for aircraft passenger seat. The adaptive seat system can adapt to passenger sitting condition by context aware and personalized sitting service. Based on the passenger sitting behaviour, it can learn and adapt to the passenger's preferences.