**Strategic Project Grants Progress Report**

**Due Date: June 30, 2013**

**Covers the Period: September 30, 2011 to June 30, 2013**

**Is your personal information below correct? (please enter an “x” in the appropriate box)**

|  |  |
| --- | --- |
|  | **Yes** |
|  | **No** (please make the necessary corrections) |

Dr. P. Irani

Department of Computer Science

University of Manitoba

E2-445 EITC

66 CHANCELLORS CIR

WINNIPEG MB R3T 2N2

Tel.: +1 (204) 4748995

E-mail Address: irani@cs.umanitoba.ca

**Is the project information below correct?**

|  |  |
| --- | --- |
|  | **Yes** |
|  | **No** (please make the necessary corrections) |

**Project title:** Collaborative Access to Information about Physical Objects via See-Through Displays

**File Number:** STPGP 413142 - 11

**Co-investigator(s):**

**Collaborator(s):**

**Supporting Organization(s):**

M.M. Dahan, IMRIS Inc.

S.B. Borys, Winnipeg Art Gallery

C.M. Mazur, St. Vital Centre

W.K. Kwong, C3A Inc.

**1. Progress Towards Objectives/Milestones**

Using approximately 5 pages, please provide in the box below:

* a brief description of the overall objectives of the research project as awarded;
* the list of milestones as presented in the application and a description of the progress made towards each milestone/objective during the period covered by this report; and
* a description and justification for any deviations from the original objectives and a discussion of the path forward.

|  |  |  |  |
| --- | --- | --- | --- |
| Objectives:   * Understanding users’ tasks   + Observational studies   To study the way users currently interact with exhibited objects and their information we followed a two-step process: first, we analysed the way information is currently organized in physical and online exhibition environments. Second, we reviewed the existing literature on musuem visitors and users of digital public displays.  In order to understand the form of information displays for showedcased artifacts, the research team conducted an observational study of various musuems and gelleries in the city of Winnipeg. The study consisted in documenting the ways information is attached to exhibited artefacts ranging from labels and posters to interactive displays (see Figure 1). We visited galleries, collected photographs, and interviewed museum personnel. We coded the photographs and transcripst, and generated cetegories to describe different aspects of an information display. We further extended our analysis of information displays to online galleries, where we extended and refined the previous categories. Seven design dimensions emerged from our analysis: content, supportive content, supportive activity, spatial layout, metadata, label type and display type. These dimensions suggest the content, placement and role the information label plays in the exhibition. For example, a *poster* might suggest longer engament where users are expected to read the details. On the other hand, a carefully-located small legend could highlight a particular part of the exhibited object. The deisgn of a digital replacement to physical labels (as the one we envision with transparent displays) could be guided by the same dimensions.   |  |  |  | | --- | --- | --- | | E:\Projects\STim\Docs\Pictures\Manitoba Museum\IMG_0944.JPG (label) | E:\Projects\STim\Docs\Pictures\Manitoba Museum\IMG_0930.JPG  (posters) | E:\Projects\STim\Docs\Pictures\Manitoba Museum\IMG_0943.JPG  (digital poster) |   Figure : Exemplary information displays for exhibited artefacts.  In the second part, we looked at the existing studies of user interactions in musem and gallery settings and with/around public displays. Our goal was to shed light on the social aspects of technology interaction in such spaces and current state of the art. Based on an extensive review and classification of scientific publications we summarized existing research into conceptual maps as show in Figure 2 and Figure 3. The analysis of existing research highlights the goals and challenges to be addressed when digitally enhancing an exhibit. For example,    Figure : Fragment of a conceptual map on technologies for and user interactions in museum environments.    Figure : Fragment of a conceptual map on user interactions with public displays.   * + Classification of interactions   Honey-pot effect  Group interactions  Types of visitors  Visitor lifecycle: attention,   * Designing the see-through hardware system   + Single-user support   Museum Exhibit Case  tPad – Handheld Transparent Display Device   * + Multi-user support (fixed zones)   [FUTURE WORK]   * + Multi-user support (variable zones)   [FUTURE WORK]   * Multi-user interactions with see-through displays   + Input styles   Fatigue Metric for Mid-Air Interactions with Transparent Displays  Binocullar Highlights  Attention Estimator  Attention-aware Transparent Display User Interfaces   * + Display placement   Spatial Calibration   * Validation in the lab and public   + Validation of single-user   [FUTURE WORK]   * + Validation of multi-user (fixed zones)   [FUTURE WORK]   * + Validation of multi-user (variable zones)   [FUTURE WORK] |

**2. Research Team**

Please provide an overview of the participation in, and scientific contributions to, the project for each member of the research team (principal investigator, co-investigators, collaborators, company and government scientists, research associates, postdocs, students, etc.).

|  |
| --- |
| Dr. Juan David Hincapié-Ramos (Post-Doctoral Fellow)   * Coordinating the development of hardware and software technologies * Defining the specific objectives leading to reach each of the grant goals. * Coordinating the day-to-day work of master, visiting, and bachelor students. * Literature reviews and analysis of state of the art for all proposed technologies. * Technical architecture for all hardware and software technologies. * Definition of model of fatigue for mir-air interactions in transparent displays. * Experimental design and fatigue-related data analysis for transparent displays. * Definition of the calibration approach for spatial tracking in transparent displays. * Implementation strategy for real-time color correction in transparent displays. * Coordination of collaboration activities with remote collaborators. * Paper writing and scientific dissemination.   Srikanth Kirshnamachari Sridharan (Master Student)   * Profile-based color correction for transparent displays – model, implementation and experiments. * Hardware design and construction for transparent-display exhibition case.   Sophie Roscher (Visiting Master Student)   * Design research for handheld transparent display devices (user-centered design). * Integrating hand-held transparent display devices with paper documents.   Judith Faye Page (Visiting Student)   * Observational study of information display at the Manitoba Museum * Data collection for online galleries (information display)   Xiang Guo (Co-op Student)   * Model of fatigue for mid-air interactions with transparent displays, implementation, and experiment execution. * Three-dimensional spatial calibration for transparent displays. * GUI components (highlights) to handle binocullar parallax in transparent displays. * State of the art of research on the fields of “technological support for museums” and “pervasive public displays”. * Attention metric and attention-aware user-interfaces for transparent display exhibitions.   Paymahn Moghadasian (Co-op Student)   * Experiments for the model of fatiggue of mid-air interactions in transparent displays. * Artificial Inteligence-based approach to hanheld transparent display interactions.   Levko Ivanchuk (Co-op Student)   * Real-time implementations of color correction algorithms. * Model, implementation and experimentation of potential solutions to color-blending in transparent displays. |

**3. Training**

Please list **each** trainee (Undergraduate Students, Master’s Students, Doctoral Students, Postdoctoral Fellows, Research Associates, Technicians …) on a separate line in the table below providing: a) the number of years they have been on the project, b) the percentage (%) of time each type of trainee spent on this project, and c) the percentage (%) of funding from this strategic grant. If a trainee is fully paid from other sources, enter “0” in the “% of funding from this grant” column. Insert additional rows if necessary. (DO NOT INCLUDE PERSONAL NAMES.)

|  |  |  |  |
| --- | --- | --- | --- |
| **Specify type of trainee (e.g. M.Sc., Ph.D. etc)**  **(one trainee per line)** | **(a)**  **Number of calendar years on the project** | **(b)**  **% of research time spent on this project** | **(c)**  **% of salary from this grant** |
| Post-Doc Fellow (JDHR) | 1.5 | 100% | X |
| Master Student (SKS) | 1.5 | 100% | X |
| Visiting Master Student (SR) | 0.5 | 100% | X |
| Visiting Student (JFP) | 0.2 | 100% | X |
| Co-op Student (XG) | 0.8 | 100% | X |
| Co-op Student (PM) | 0.4 | 100% | X |
| Co-op Student (LI) | 0.4 | 100% | X |
|  |  |  |  |

**4. Dissemination of Research Results and Knowledge and/or Technology Transfer**

4.1 Please provide the number of publications, conference presentations, and workshops to date arising from the research project supported by the grant in the table below.

**Publications, Conference Presentations, etc.**

|  |  |
| --- | --- |
|  | None to date |

**- OR -**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Number of publications, presentations…** | | |
| **Status** | **Refereed**  **Journal Articles** | **Conference**  **Presentations/**  **Poster** | **Other (including Technical Reports, Non-Refereed**  **Articles, etc.)** |
| **Accepted/Published** |  | 1 |  |
| **Submitted** |  | 3 |  |

4.2 Please provide the bibliographical reference data for the above publications, conference presentations and workshops under the corresponding headings. For publications, specify whether submitted, accepted or published.

**Refereed Journal Articles:**

|  |
| --- |
|  |

**Conference Presentations/Poster:**

|  |
| --- |
| **[PUBLISHED]**  Sridharan, S.K., Hincapié-Ramos, J.D., Flatla, D.R. and Irani, P. 2013. **Color correction for optical see-through displays using display color profiles.** In Proceedings of the 19th ACM Symposium on Virtual Reality Software and Technology (VRST '13). ACM, New York, NY, USA, 231-240. DOI=10.1145/2503713.2503716 <http://doi.acm.org/10.1145/2503713.2503716>  **[SUBMITTED]**  Hincapié-Ramos, J.D., Roscher, S., Büschel, W., Kister, U., Dachselt, R. and Irani, P. 2014. **tPad: Rich Interaction with Transparent-Display Mobiles.** Under review for the SIGCHI Conference on Human Factors in Computing Systems (CHI '14).  Hincapié-Ramos, J.D., Guo, X., Irani, P. 2014. **Consumed Endurance: A Metric to Quantify Arm Fatigue of Mid-Air Interactions.** Under review for the SIGCHI Conference on Human Factors in Computing Systems (CHI '14). |

**Other (Including Technical Reports, Non-Refereed Articles, etc.):**

|  |
| --- |
|  |

* 1. **Patents and Licences**

Please provide in the table below the **number** of patents (filed and issued) and licences to date arising from the research project supported by the grant in the table below. (Provide details in 4.4.)

|  |  |
| --- | --- |
|  | Not applicable |

**- OR -**

|  |  |
| --- | --- |
|  | None Yet Filed/Issued |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Number of Patents** | | | | |
| **Description** | **Canada** | **U.S.** | **EP** | **Other** | **Totals** |
| **# of Patent Applications Filed** | 1 |  |  |  |  |
| **# of Patents Issued** |  |  |  |  |  |

|  |  |  |
| --- | --- | --- |
| **# of Licences** |  | **(Provide details in 4.4.)** |

4.4 Please provide details (titles, patent application number, patent number…) about the above listed patent applications, patents, and licences under the corresponding headings.

**Patent Applications Filed:**

|  |
| --- |
| **Serial Number:** 61/887,039 **Title:** Color Correction for Optical See-Through Displays Using Display Color Proﬁles |

**Patents Issued:**

|  |
| --- |
|  |

**Licences: (licencees, exclusive/non-exclusive…)**

|  |
| --- |
|  |

4.5 Describe how the results achieved to date are being transferred to the user sector and the prospects for their commercial/industrial exploitation or their use by other sectors (e.g., revising or formulating policy or regulations).

**Prospects for the Transfer of the Results to the User Sector**

|  |
| --- |
|  |

**5. Problems Encountered**

Identify the main problems encountered during this instalment of the grant from the list below (select all that apply):

|  |  |  |
| --- | --- | --- |
| X | Technical or scientific problems | |
|  | Problems with direction of research or findings | |
|  | Equipment and facilities | |
|  | Staffing issues (including students) | |
|  | Funding problems | |
| X | Partner withdrew from project | |
| X | Partner interaction issues | |
|  | Other (specify) |  | |

**- OR -**

|  |  |
| --- | --- |
|  | No problems occurred during this instalment of the grant |

Briefly describe the main problems identified above and the steps taken to resolve each one.

|  |
| --- |
|  |

1. **Collaboration with Supporting Organizations**

6.1 Who initiated this strategic project?

|  |  |  |
| --- | --- | --- |
|  | The university researcher | |
|  | The industry partner (if applicable) | |
|  | The government partner (if applicable) | |
|  | Other (specify) |  | |

6.2 In what way were the partners directly involved in the project (select all that apply)?

|  |  |
| --- | --- |
|  | Partners were not involved in the project apart from their financial and/or in-kind contributions |
|  | Partners were available for consultation |
|  | Partners provided facilities |
|  | Partners participated in the training |
|  | Partners received training from university personnel |
|  | Partners discussed the project regularly with the university team |
|  | Number of meetings during the period covered by this report:\_\_ \_ |
|  | Partners were involved in the research |

6.3 Describe the partner’s involvement and comment on the collaboration.

|  |
| --- |
|  |

6.4 Was any cash committed to this project?

|  |  |
| --- | --- |
|  | Yes |
|  | No |

6.5 Was any in-kind committed to this project?

|  |  |
| --- | --- |
|  | Yes |
|  | No |

6.6 If any cash or in-kind was committed, please enter the amounts below, along with the amount of cash and in-kind that has been received (if any) to date. If no cash or in-kind was received, please enter “0”. Where cash or in-kind was not committed enter “n/a”.

|  |  |  |
| --- | --- | --- |
|  | **Amount Committed** | **Total Amount Received to Date** |
| **Cash** |  |  |
| **In-Kind** |  |  |

6.7 Describe the in-kind received and explain variations between commitment and actual cash and in-kind contribution if applicable.

|  |
| --- |
|  |

**7. Financial Information**

The purpose of this section is to provide additional project-specific detail; it cannot be substituted with a Statement of Account (Form 300).

Please provide the following financial information:

|  |
| --- |
| **$** |

Amount remaining in grant account as of June 30th:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Budget Item | Budget for Year 1 | Actual Expenditures | Budget for Year 2 | Actual Expenditures to date in current grant year | Projections from now to September 30 (current year) | Planned Expenditures for the Next year of Support |
| **Salaries and Benefits** | | | | | | |
| Students |  |  |  |  |  |  |
| Postdoctoral fellows |  |  |  |  |  |  |
| Technical/professional assistants |  |  |  |  |  |  |
| Other (specify) |  |  |  |  |  |  |
| **Equipment or Facility** | | | | | | |
| Purchase or rental |  |  |  |  |  |  |
| Operation and maintenance costs |  |  |  |  |  |  |
| User fees |  |  |  |  |  |  |
| **Materials and Supplies** | | | | | | |
| Materials and supplies |  |  |  |  |  |  |
| **Travel** | | | | | | |
| Conferences |  |  |  |  |  |  |
| Field work |  |  |  |  |  |  |
| Collaboration/consultation |  |  |  |  |  |  |
| **Dissemination Costs** | | | | | | |
| Publication costs |  |  |  |  |  |  |
| Other (specify) |  |  |  |  |  |  |
| **Other (specify)** | | | | | | |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **Totals** |  |  |  |  |  |  |

Please provide detailed explanations for any deviation in the current period and in the budget for the coming year. (Note that deviations from the budget of greater than 20 per cent require pre-approval from NSERC.)

|  |
| --- |
|  |