Ministry of Science and ICT

Institute of Information & Communications Technology Planning & Evaluation

# APPLICATION FORM
# (JOINT RESEARCH)
## HIGH POTENTIAL INDIVIDUALS GLOBAL TRAINING PROGRAM)

| AGREEMENT |
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As stated above, I submit this application form to IITP that conducts "High Potential Individuals Global Training Program" supported by Ministry of Science, ICT in South Korea. IITP may disclose the information below to the public for the purpose of providing information and matching a research partnership between your institute and a Korean university.

* IITP : Institute for Information & communications Technology Planning & Evaluation

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| Printed Name of Chief of Research | Ayse Turak | Date(mm-dd-yyyy) | 01-27-2020 |
| Signature of Chief of Research | | | |

☞ ***(Note)*** *This application is to identify the willingness to participate in this research and to find a research partnership for research institutes in Korea. Therefore, in its sole discretion, it is acceptable to contain only minimal information. (max. 3 pages)*

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| **1. Research Title** | Solution deposited integrated flexible sensors for third generation smart systems | | | | | | |
| **2. Research Area** | **A.I.** | **Big Data** | **Cloud Computing** | **Block Chain** | **AR/ VR** | **ICT/SW Convergence** | **Other ICT /SW** |
| | | | | | | X | X |
| **3. Chief of research** | Title | Associate Professor | | Contact | E-mail : turaka@mcmaster.ca | | |
| | Name | Ayse Turak | | | Tel : +1-905-525-9140 x23348 | | |
| **4. Affiliation** | Name | McMaster University | | Classification | (X) University ( ) Research Institute ( ) Industry ( ) ETC. | | |
| **5. Capacity for students (5 or less)** | 2 | | **Support for students** ***(all necessary)*** | | ( X ) Visa support<br>( X ) Research Mentoring<br>( X ) Research Space<br>( X ) Accessibility to Research equipment | | |
| **6. Research Objective** | Develop new hybrid organic sensors, integrated with OLED technologies, to produce low-cost, easily integrated, flexible third generation smart systems. | | | | | | |

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| **7. Research Summary** | Third-generation smart systems combine technical "intelligence" and cognitive functions so that they can provide an interface between the virtual and the physical world. Nano-electronics together with embedded firmware, software packages and Smart Systems will result in heterogeneous integration, pushing the limits of integration towards System-in-Package functionality.<br><br>Applications such as this will demand more performance and connectivity while consuming less power and shrinking into smaller and smaller form factors on substrates made from new materials, or embedded directly into products.<br><br>One of the fundamental challenges of smart systems is the integration of various components, including sensors, command and control units, transmission elements, and action elements.<br><br>In this project, we focus on the development of a nanoparticle-based sensor, integrated with a light emitting transmission element (such as an OLED) that can interface with a microcontroller. Producing these components from solution onto a flexible substrate allows the low-cost manufacture of easily integrated components for increased functionality. The sensor will be sufficiently thin as to allow the transmission of light so that the OLED can communicate optically with the microcontroller. Using a monolithic approach, the sensor and OLED will be built in a tandem architecture, with a transparent intermediate tunnel junction electrode.<br><br>Initially we will employ a chemical sensor for volatile organic compounds (VOCs). The sensitivity and selectivity of the device will be tested with various compounds of importance in disease and environmental contamination monitoring: ammonia, acetone, isopropanol, diethylamine, and triethylamine. These analytes will be tested by the device at varying concentrations (1 ppb – 100ppm) in air at a constant flow rate of 5 mL min-1 and current changes will be measured in real time. The gas sensing parameters of these devises are its sensitivity to current changes by an analyte. The current changes in-turn will trigger the OLED device, which can optically transmit the signal to the microcontroller. This proof-of-concept smart system could then be applied to a variety of sensor types, due to the ease of integration. |
| **8. Need for funding from Korean government** | South Korea has a strong reputation in developing technological solutions. This funding would bring high potential talent from S. Korea to Canada to build skills in basic physics, chemistry and materials development. This allows the knowledge and experience gained during the joint research to build up sensor technology and products. Additionally, S. Korea is a world leader in OLED technologies, and high potential talent from a program supporting world class research would be essential in ensuring effective integration. At McMaster, we recently established the Functional Materials Research Centre as a joint Canada-S. Korea partnership. The proposed project will provide seed funding for future research. |
| **9. Request for Korean Universities** | The selection of students should be conducted after mutual consultation, with the expectation that they would share the project time between the two research groups. If applicable, possible joint supervision of the students or transfer credits for course work over the longer term should be discussed. Cooperation on the preparation for a VISA to visit labs over the project term would be beneficial. |