

## Potential Research Project Topics, Centre for Mobile Innovation – Dr. Ed Sykes

	General Area of Interest	Topic	Description
1.	Many application areas	Computer Vision – fine detail recognition	<ul style="list-style-type: none"> <li>Using Computer Vision (CV) to distinguish between objects that are quite similar (e.g., medication bottles, products with very similar packaging, etc.)</li> </ul>
2.	Smart home	Fall Detection	<ul style="list-style-type: none"> <li>Computer Vision (CV) in combination with wearable technologies (e.g., Apple Watch) determine when a person falls.</li> </ul>
3.	Smart home	Fall Prevention	<ul style="list-style-type: none"> <li>Using CV in combination with wearable technologies, create algorithms to learn and predict when a person is going to fall (e.g., gait analysis, balancing issues, speed of walking, etc.)</li> </ul>
4.	Smart home	Medicine Reminder System	<ul style="list-style-type: none"> <li>Smart reminder system:               <ul style="list-style-type: none"> <li>try to find out why the person didn't take the medication (e.g., person didn't want to, didn't hear the alarm, wasn't home, person was all out of medications, etc.)</li> </ul> </li> <li>Machine Learning / Artificial Intelligence,</li> <li>Computer Vision (CV), Facial Recognition and Analysis, Intelligent Medicine Dispensers</li> </ul>
5.	Smart home	Is the person home? Did s/he leave?	<ul style="list-style-type: none"> <li>Computer Vision</li> <li>Door open/closed sensors</li> <li>Apple Watch/iPhone GPS can be used to validate the other inputs (e.g., Computer Vision findings)</li> </ul>
6.	Smart home	How active the person is (that would help classifying people based on their activities)	<ul style="list-style-type: none"> <li>Computer Vision</li> <li>MATLAB -&gt; predicts future direction</li> <li>Wearable devices (e.g., Apple Watch / smartphone)</li> </ul>
7.	Smart home	Determining the speed a person travels while walking from one place to another (e.g., walking down the hallway, up the stairs, from room to room)	<p>Try to determine a “normal” behavioural model for the person and then identify ways to determine if the person is improving or getting worse.</p> <ul style="list-style-type: none"> <li>Computer Vision</li> <li>MATLAB -&gt; predicts future direction</li> <li>Wearable devices (e.g., Apple Watch / smartphone)</li> </ul>

	General Area of Interest	Topic	Description
8.	Smart home	Sleep analysis. Determine how well a person is sleeping (e.g., how long, number of times he wakes up during the night, snore analysis, etc.).	<ul style="list-style-type: none"> <li>• Computer Vision -- any motion detected? Is the person tossing and turning while sleeping?</li> <li>• CV -- facial analysis</li> <li>• Wearables:</li> <li>• Heart Rate</li> <li>• Temperature</li> <li>• Respiration rate (respiband)</li> <li>• Other biomedical vitals that are significant for sleep analysis</li> <li>• multiple CV feeds</li> <li>• smart pillow: <a href="https://sleeptrackers.io/zeeq-smart-pillow/">https://sleeptrackers.io/zeeq-smart-pillow/</a></li> </ul>
9.	Smart home	Zone recognition	<ul style="list-style-type: none"> <li>• Washroom, kitchen, how long did the person stay there? Did they stay there a long time?</li> <li>• multiple CV feeds targeting specific Zones (e.g., person went to the washroom and determine how long s/he is there?)</li> <li>• Door sensor</li> <li>• Computer Vision</li> </ul>
10.	Smart home	Unusual location / person is not moving	<ul style="list-style-type: none"> <li>• CV, Motion + direction, Fall detection</li> <li>• Apple Watch + iPhone</li> <li>• Multiple cameras to verify/validate situation</li> </ul>
11.	Augmented Reality	Medical Training / Medical procedure simulations	<ul style="list-style-type: none"> <li>• Microsoft HoloLens and Healthcare</li> </ul> e.g., <a href="https://www.youtube.com/watch?v=uQ5MoIP4wxI&amp;feature=youtu.be">https://www.youtube.com/watch?v=uQ5MoIP4wxI&amp;feature=youtu.be</a>  <a href="https://www.youtube.com/watch?v=ANh96hc1OfQ">https://www.youtube.com/watch?v=ANh96hc1OfQ</a>

	General Area of Interest	Topic	Description
12.	Virtual Reality	VR in children receiving medical treatments / operations	<p>VR can be used to remove the patient from the immediate physical situation (trauma, pre-, post- and during operations). Leading research has shown this effectively reduces anxieties (especially in children undergoing operations, stroke recovery, etc.)</p> <ul style="list-style-type: none"> <li>• Oculus Rift</li> <li>• HTC Vive</li> </ul> <p>References: "Virtual Reality–Augmented Rehabilitation for Patients Following Stroke"  <a href="https://academic.oup.com/ptj/article/82/9/898/2857676">https://academic.oup.com/ptj/article/82/9/898/2857676</a></p>
13.	Virtual Reality / Augmented Reality	Intravenous (IV) training / simulation	<p>View the anatomy of a patient without incisions; enable doctors and nurses to plan treatment more effectively through minimally invasive surgeries.</p> <ul style="list-style-type: none"> <li>• Microsoft Hololens</li> <li>• Oculus Rift</li> <li>• HTC Vive</li> </ul>
14.	Virtual Reality	VR in behaviour modification	<p>VR can be used to encourage specific behaviors in patients that is impossible to replicate in sterile hospital environments.            VR enables extensive patient data collection:</p> <ul style="list-style-type: none"> <li>• capture baselines, track recovery, and utilize new information to personalize treatment.</li> <li>• The doctor can analyze the information and enhance the patients care</li> </ul>
15.	Virtual Reality	VR in stress management (e.g., Post Traumatic Stress Disorder PTSD)	<p>VR can be used to encourage reduce stress in people's lives.            In this research we will create VR experiences that reduce anxiety and improve positive outlooks for patients.</p> <ul style="list-style-type: none"> <li>• capture baselines, track recovery, and utilize new information to personalize treatment.</li> <li>• "VR exposure therapy is a promising new medium for treating acute PTSD"</li> </ul> <p>References: "Virtual Reality Exposure Therapy for World Trade Center Post-traumatic Stress Disorder: A Case Report"  <a href="https://www.liebertpub.com/doi/abs/10.1089/109493102321018169">https://www.liebertpub.com/doi/abs/10.1089/109493102321018169</a></p>

	General Area of Interest	Topic	Description
16.	Wearable Computing	Data collection -> analysis -> machine learning -> personalized insights -> better healthcare outcomes.	<ul style="list-style-type: none"> <li>Wearable computing devices have the potential to provide a significant impact on workflow, quality of care, access and driving positive outcomes</li> <li>Aging demographics is a world-wide phenomenon -&gt; growing patient population that need care.</li> <li>Wearable computing can enable virtual and remote care, enable the collection of more and better data, and provide more meaningful insights to clinicians, patients and caregivers.</li> <li>Management of a large patient population will rely on strategically utilizing an overextended clinician staff, lowering patient contact hours, and managing diseases remotely.</li> <li>A crucial success factor will be to leverage data analysis and algorithms to provide the most meaningful way to manage diseases.</li> </ul> <p>References:            "AIWAC: affective interaction through wearable computing and cloud technology"  <a href="https://ieeexplore.ieee.org/abstract/document/7054715">https://ieeexplore.ieee.org/abstract/document/7054715</a></p> <p>"Sensor Mania! The Internet of Things, Wearable Computing, Objective Metrics, and the Quantified Self 2.0"  <a href="https://www.mdpi.com/2224-2708/1/3/217/htm">https://www.mdpi.com/2224-2708/1/3/217/htm</a></p>
17.	We are also open to other areas involving: Augmented Reality, Virtual Reality, Wearable Computing, and/or IoT in the healthcare area.	Data collection -> analysis -> machine learning -> personalized insights -> better healthcare outcomes.	<p>We are also open to other areas involving:</p> <ul style="list-style-type: none"> <li>Augmented Reality, Virtual Reality,</li> <li>Wearable Computing, and/or</li> <li>IoT</li> </ul> <p>in the healthcare area.</p>

For more information, please contact:

Dr. Ed Sykes, [ed.sykes@sheridanc.on.ca](mailto:ed.sykes@sheridanc.on.ca) (905) 845 9430 Ext 2490  
 Sheridan College  
 Director, Centre for Mobile Innovation  
<http://www-acad.sheridanc.on.ca/~sykes/>