This computer science research project focuses on the implementation of Tor Browser into MediaQ[1], a geo-location based service developed by USC. Social media today allows us to post photos and videos ranging from family and friends to governmental conspiracies and unfair punishment. When it comes to mobile devices equipped with positioning capabilities, the users’ location must not be disclosed when using a Location Based Service (an application that uses location features as its primary function), so that they do not become targets of government or other organizations. An anonymity browser named Tor provides possibilities to maintain privacy.

Working in the computer science lab with Dr. Cyrus Shahabi and Dr. Seon Ho Kim, my responsibility was to measure data transmission times (that is, the uploading time) of a video sent from a client to a server using both USC’s Wi-fi and Tor Browser’s connection. This piece of information will be used to determine the differences in upload speed when using or not using Tor.

**Objectives & Impact of Research**

- The overall objective of this research is to integrate Tor Browser with MediaQ. If this is achieved, sharing photos and videos over MediaQ will become significantly safer for those who wish to maintain their anonymity.
- In some Third World countries, citizens may wish to show proof of government oppression, so they record videos and distribute them to media sources around the world.
- Sometimes, however, these citizens are caught because their IP addresses are often left as traces.
  - Solution: Implement anonymous browser such as Tor with social media applications such as MediaQ.
  - If this is achieved, then sharing photos and videos over social media will become safer because an anonymous browser will hide identity.

**What is MediaQ?**

- An application that allows for the organization, collection, and sharing of videos and then displaying them on a map. The videos are organized frame by frame according to when, where, what (keywords seen in the video), and who (who is seen in the video).

**What is Tor?**

- A browser that allows one to search the web anonymously through a series of encryptions.

The code of the MediaQ application was modified by integrating a built-in stopwatch in order to measure how long a smartphone takes to upload videos with lengths of 5, 10, 30, 60, and 120 seconds, the first time without Tor running through MediaQ, and the second time with Tor running through MediaQ. I then repeated this trial under multiple conditions. The results of one trial are shown below:

![Graph showing upload times with and without Tor](graph.png)

This graph demonstrates the tradeoff between privacy and performance. The difference in performance becomes clear after 60 seconds of video: the longer the video, the worse the performance becomes. A table format of this graph is shown below:

<table>
<thead>
<tr>
<th>Length of Video</th>
<th>Without Tor</th>
<th>With Tor</th>
<th>Performance difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 s</td>
<td>8.47</td>
<td>13.30</td>
<td>1.5 X slower</td>
</tr>
<tr>
<td>10 s</td>
<td>26.61</td>
<td>25.61</td>
<td>1.04 X faster</td>
</tr>
<tr>
<td>30 s</td>
<td>71.38</td>
<td>118.32</td>
<td>1.66 X slower</td>
</tr>
<tr>
<td>60 s</td>
<td>147.45</td>
<td>222.92</td>
<td>1.51 X slower</td>
</tr>
<tr>
<td>120 s</td>
<td>274.01</td>
<td>567.44</td>
<td>2.07 X slower</td>
</tr>
</tbody>
</table>

**How This Relates to my STEM Coursework**

Computer science is rapidly becoming a huge part of our daily lives. Software development has contributed to a huge part in engineering. In most branches of science and engineering today, computer programming skills are required to perform certain tasks and simulations. Before this course, I did not have much formal training in computer science, mainly due to the reason our high school does not teach the course; however, STEM is rapidly evolving as computer work is becoming a more important part of our education.

**Next Steps for You OR Advice for Future SHINE students**

- The most daunting task of this project was getting two applications to interact with each other.
- I would suggest future SHINE students working with this project to have a good understanding of how MediaQ and the Tor application works.
- I wish to utilize computer science and integrate the skills I learned here to other STEM fields.

**Acknowledgements**

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