

Undergraduate Thesis Prospectus

**L.A.N.G.P.A.D.: Expanding communication  
with the touch of a screen**  
(Technical research project in Electrical Engineering)

**Technology and Immigration in the U.S.**  
(Sociotechnical research project)

by

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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## **General research problem**

*How can digital devices promote inclusivity and equity?*

Innovations in communications technology can have paradoxical effects. Systems that offer new means of connection and inclusion can become divisive and exclusive. Early optimism about the internet, inspired by its decentralization and its peer-to-peer connectivity, receded as commercialism, extremism, and polarization pervaded much of it (Weinberger, 2015). Yet the internet has retained its constructive capacities, and innovation can develop them further.

## **L.A.N.G.P.A.D.: Expanding communication with the touch of a screen**

*How can US engineers provide users, of all economic backgrounds, an effective way to use characters beyond the English Language?*

With a MSP430 microcontroller, a Liquid-Crystal Display (LCD), rotary encoder, and buzzer, my team (Rawan Osman, Rohan Chandra, Emory Ducote, Chris Hamilton and I, Pedro Rodriguez) will design a PCB (Printed Circuit Board) that allows access to non-English characters for more effective writing. This project is supervised by Harris Powell and Todd Delong, from the Electrical and Computer Engineering department at the university of Virginia.

Technology reflects societal needs. Japan developed the fastest trains in the world (H., E., 2016). Norway the best infrastructure of electric cars (Klesty, V., 2021). The United State the best medical research (FreeOp, 2020). Therefore, immigrating to a new culture is a daunting act. One society may not fulfill the needs provided from the immigrant initial society. For example, computer keyboards are designed specifically to satisfy the societal language designed for (Brightmeasurement, 2013). So how can immigrants be facilitated to write in their native language if that language does not feel their new society needs?

For this Capstone project, my team hopes to facilitate the nuances of writing in different languages on all computers, similarly to how Apple does with the iPhone touchscreen keyboard. Furthermore, this product will improve on Apple current work by allowing special characters, like mathematical symbols used by engineer's professionals.

This project has led the team to boundaries never touched before. The two main components, the MSP microcontroller and the LCD, were chosen thank to the abundance of code libraries that will allow the team to program the devices within the time budget. This called was profitable since, due to conflicts with the components shopping order, the components arrived later than expected, leaving us with less time for testing

While Apple have work to include non-English characters (Apple Support, 2021), and Windows have followed through (Microsoft, 2021), users still require to learn all the commands to accentuate one letter. Moreover, this method doesn't cover all the special characters worldwide. A second method is to copy the character online and paste it into the document, which is time consuming and tedious. The LANGPAD is looking to facilitate the process.

For the hardware, a board from scratch will be designed using Multisim and Ultiboard for schematic and Layout respectively. For the Software, coding will be done using C++. The code will focus on communicating the MSP to the LCD through SPI communication, and it will send voltages to the audio subsystem every time an input is pressed for audio feedback. Once the prototype is finished, an easy to plug expansion for the keyboard will be then available for the public to test on the Capstone official presentation. Depending on the public criticism of the device, the idea to re-design the product for mass production will be considered.

## **Technology and Immigration Advocacy in the U.S.**

*In the U.S., how have immigrant rights advocacies used technology to help immigrants secure legal residency?*

In the U.S., immigration is controversial. El Mercado Común del Sur (Mercosur) strives to help South Americans in the US (del Real, 2021), while major tech companies like Amazon, Microsoft and Salesforce sells software to the Federal Immigration Agencies that constraint immigrants to access the country resources, and lead to deportation (Ghaffary, 2019). This is not exclusive to major techs. The UCLA School Law pays online research service to Westlaw and LexisNexis, which then sell the data to U.S. Immigration and Customs Enforcement (ICE). The university has stated that it does not support these companies' actions. However, many argue that the university actions are no different than directly being involved (Jung, 2020). Another key player is the Immigration and Naturalization Service (INS), which encourages immigrants on the process of legal immigration. Inda (2005) contends INS's detentions of illegal immigration are so severe that they have given a bad reputation to legal immigrants, discouraging them from pursuing legal immigration processes (Inda, 2005).

Immigration is a process that requires a lot of information; information that is scattered. The lack of centralized information often discourages candidates, and applications go awry due to important papers missing. In a 2018 report, Organización Internacional para las Migraciones (International Organization for Migration: OIM) concluded that immigrants rely on social media, where misinformation is rife (OIM, 2018). OIM therefore designed "MigApp" to "bring answers for the most frequent questions and needs ... before, during and after the process," while ensuring anonymity (ORCNC, 2019). OIM hopes to amass information of the host society (language, religion, weather, etc.) to decrease the risks of immigrants turning back to their country of origin.

What about technology on the process itself? Barata et al. proves the effects of inadequate technology exposing the US overwhelming reliance DNA test as ineffective on the special cases of non-blood related family whose legal documents are inaccessible (Barata et al., 2015). To this date, DNA tests remain the same. Additionally, on a 2015 interview, the U.S. Digital Service admitted that the immigration process was predominately paper-based, “requiring documents to change hands and locations among various federal actors at least six times for some petitions” (Hickey, 2015). On the age computers, a paper-based method was used for one of the most important legal documents in the United States. Fortunately, in 2019 the U.S. Citizenship and Immigration Services (USCIS) implemented “eProcessing”, which digitalizes the process to reduce application time and increase transparency (USCIS, 2019)

What happens when technology is not directly correlated to immigration policies? Chander et al. says high investment in technology relative to investment in education stimulates demand for skilled immigrants; consistent with 1990s US economic growth that had high education investment and fast implementation of new technology. This led the 1990 Immigration Act. By 1992, “nearly 110,000 visas were allowed for skilled immigrants” (Chander et al., 2003). Advocates of immigrants claim that inclusion of cultures innovates one’s society, pointing that the US growth comes from ingraining offshore cultures. Doughnuts, hamburgers, the telephone, and Google are just a few examples (Iversen, 2017). Carballo Huerta points that in 2007 “the rise of 10% of foreign students with a degree reflected de growth of patents applications by 4.8%, the increase of patents to universities by 6% and an increase of patents for commercial firms by 6.4%” inquiring that “the presence of foreign student impulse innovation” (Carballo, 2007). The most noticeable sectors affected by immigrants are: Medical Inventions, accounting 1% of all US patents; chemicals, accounting 13.9%, and electricity, accounting for 12.6%. (Akcigit, 2017).

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