Developing A Next-gen Cyber-Aware Workforce through the **IN**teractive Animated **VI**sualization and **PracTice basEd** Cybersecurity (InviteCyber) Learning Framework, Curriculum and Training

**PIs:** Xiaoli Yang¹, Quamar Niyaz¹, Ahmad Y Javaid²

**Student Researchers:** Gabriel K Aguayo¹, Abel Reyes¹, Ethan Ewoldt¹, Ramesh B Govindula¹, Sai S Sudha², Jyothirmai Kothakapu², Laxmi M Podila²

¹Purdue University Northwest, Hammond, Indiana, USA, ²The University of Toledo, Toledo, Ohio, USA

### Objectives
- Spread awareness of threats associated with smartphone & tablet usage, and inculcate interest in cybersecurity careers among high school students
- Develop a cybersecurity mindset to identify and mitigate threats by understanding the adversary’s objective
- Help students use their observational skills and become proactive and vigilant
- Develop a high school cybersecurity curriculum

### Challenges
- Select developmentally appropriate knowledge areas and offer students in a timely and age-appropriate manner
- Cybercriminals are motivated to target students, launch online assaults, cyberbully, hold ransom, and abuse
- Smartphones are widespread, without much understanding of the threats they bring to personal safety
- More time spent online may increase the likelihood of exposure to cyberattacks and related personal harm/threats

### Scientific Impact
- Smartphone apps and interactive visualizations with animations work better for teenagers
- Improved student learning from hands-on experience via engaging visualization-based cybersecurity curriculum
- Permission-Educator App to help students understand Android permissions and their implications in device safety
- Development and testing of high school cybersecurity curriculum in summer camp setting

### Developed Content
- **Use of Free MIT App Inventor**
  - Six android apps developed showcasing real attacks for hands-on experience
  - Use of free MIT App Inventor for app development exercises
  - Developed high school curriculum delivered and assessed in summer camp over 10 lecture sessions
- **Developed Curriculum**
  - **Fundamentals**
    - Intro to Internet
    - Intro to Cybersecurity
    - Cryptography
    - Security Principles
  - **Cybersecurity**
    - Internet Security
    - Web Security
    - Malicious Software
    - Cyber-Safe Practices
  - **Software Design**
    - Intro to Software Design
    - Intro to Software Security Design
    - Android Software Development
- **Related Quiz**
  - MIT App Inventor Tutorial

### Impact on Society
- Spread awareness of the risks and threats associated with the use of smartphones/tablets among school students
- Enable teenagers understand smartphone/tablet ecosystem through basic app development and information visualization of data flow between apps
- Educate youngsters on various permissions associated with the installed apps and what role they play in personal safety
- Attract youngsters to cybersecurity as a career to fulfill the national skill gap in this area

### Education and Outreach
- High schools in Hammond and Munster IN, Hoffman Estates, IL, and Toledo, OH engaged in summer camps
- Developed content made available on a public website
- Outreach through various international conference publications (total 3, another 2 in preparation)
- Enhanced cybersecurity learning by introducing visual and interactive presentation of topics
- A mix of modalities (ppt slides, Unity-based self-paced learning module, App Inventor) utilized for enhanced learning

### Learning Tool
- Framework design provides a menu categorizing and listing various topics based on difficulty level
- Tool allows self-paced learning of topics by involving user in active learning through interactive animation
- Potential tracking of user navigation may provide detailed insights on how different students learn differently
- Online + Offline usage available

### Methodology and Design
- Rapid prototyping, testing, and revision (PTR) model
- Utilize summer camps to test the developed material
- Use in-house developed + open-source frameworks

- **Framework Design – Four Sections per Module**
  - Introduction
  - Interaction
  - Explanation
  - Quiz

- **Development**
  - Data Collection
  - Data Analysis
  - Research & Revise
  - Test at Hammond (Summer Camp)
  - Test at Toledo (Summer Camp)
  - Research / Analyze / Rapid Update

- **Online + Offline usage available**
- **Quiz**
  - Concept Introduction
  - Interaction phase
  - Explanation of animation
  - Topic related quiz

### Quantify Potential Impact
- By the end of the project, roughly 60 high school students are expected to be impacted directly
- Additional teacher participation and outreach expected to impact hundreds more
- High schools in Hammond and Munster IN, Hoffman Estates, IL, and Sylvania and Toledo, OH are potential early adopters of the curriculum
- Additional conference/journal publications expected to have a nationwide reach and usage of the developed content

---

**Supported by the National Science Foundation SaTC EDU Grants # 1903419 and 1903423**

---

https://sites.google.com/pnw.edu/invitecyber/home