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To Dr. Sand and reviewers,

The often-cited talent shortage issue in the cybersecurity industry has raised concern that a lack of appropriately skilled digital defenders will have disastrous security consequences. The Florida government has responded to this workforce challenge by allocating millions of dollars to strengthen cybersecurity training and education programs across the state, including several projects within USF's network. A critical component of filling worldwide cyber vacancies lies squarely in the recruitment of women, who although make up nearly half of the total labor force, account for only 25% of the cybersecurity workforce [1]. We believe that the gap in the cybersecurity workforce would be substantially addressed if women were proportionately represented in the industry. By getting girls interested in STEM, particularly cybersecurity, early on, we can begin to achieve gender parity in the cyber industry. Our game would help close that gap by coordinating with one of our nation's most successful organizers for building women leaders in STEM, Girl Scouts of the USA (GSUSA). By targeting one of the most relevant audiences that need to develop cybersecurity skills - girls interested in STEM - we aim towards a positive ripple effect of greater gender equality for the next cohort of women leaders and innovators.

Our proposed project is an educational game called CyberScouts (*this title may change, depending on the creative sense of the developers*) for the K-12 Girl Scout cybersecurity curriculum [See here]. CyberScouts addresses security awareness, cryptography, network and web security, and other cybersecurity topics among **K-12** girl scouts (ages 5-18). The game's purpose is to introduce complex cybersecurity concepts and enhance engagement through playful interactions in a **browser or mobile application**. Girl Scout volunteers run activities with limited technological resources, so direct access to hardware capable of running desktop software is not guaranteed. For this reason, we're anticipating that a browser-based or mobile game would be most appropriate, given that we want our game to be as accessible and deployable on a large scale as possible. Built-in accessibility features, such as voiceovers with text and translation into Spanish, would ideally be available so that we may reach and support a wider audience of the 1.7 mil existing girls in GSUSA. Studies have pointed to a lack of cybersecurity educational materials for different K-12 grade levels, particularly for underrepresented and underserved student populations [2]. With a large majority of educators lacking the necessary experience and technical knowledge to effectively teach students about cybersecurity, coupled with limited PD and training opportunities, there is a great need for our game. Girl Scout volunteers and program facilitators would be able to use CyberScouts as an easy-to-facilitate educational tool while simultaneously serving the underrepresented population of women.

The main goals of our project are to:

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- Encourage girls to pursue work in fields like IT and cybersecurity, and fill the STEM jobs pipeline;
- Cultivate an early interest in cybersecurity and technology among girls;
- Introduce cybersecurity concepts to all levels of girl scouts, beginning as early as Kindergarten;
- Supplement Girl Scout's existing cybersecurity badge curriculum with gamification for continuing use and integration;
- Produce proof of concept that supports serious games and cybersecurity education;
- Provide girls with a sense of community and belonging;
- Reach, and have an impact on, the audience of 1.7 mil girl scouts.

We envision CyberScouts as a single-player, browser-based game with puzzle and minigame elements, with the objective being to advance your progress to earn virtual scout badges. Each level of Girl Scouts (Daisies to Ambassadors) has three badges to complete, making for a possible total of 18 badges and accompanying challenges to develop. At the beginning of the game, players must specify their scout level which will determine the in-game activities they will complete. During these learning activities, players would explore basic cybersecurity concepts, all the way from how to connect to the internet (Daisies) to cyberwarfare strategies (Ambassadors). While there is no planned narrative running throughout the game, thematics conveyed with bright, colorful visuals and a brief "backstory" should be sufficient. Players' retainment of the knowledge they've collected is reinforced by context and story [3] – therefore, we visualize that Cyberscouts would incorporate Girl Scout history, minutiae, and material (such as sash and badge design for character design, corresponding scout level colors, the Girl Scout brand colorway, etc.). Though discussions are currently happening, at this stage, we have not yet obtained permission from GSUSA to use their logotype, colorway, or any other copyrighted materials. Our next step is filing a permission request with GSUSA to use their curriculum and branding.

Example activity ideas by Girl Scout level:

Daisies (ages 5-7)
    Learning objective: Find out how a computer works; students will learn about important individual components of a computer
    Gameplay: Drag-and-drop parts of a computer into the correct place in an empty PC case.

Brownies (ages 7-9)
    Learning objective: Learn how a computer virus spreads
    Gameplay: Clear a virus before it spreads by fighting infected nodes

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Juniors (ages 9-11)

Learning objective: Discover how networks work
Gameplay: Play as a routing algorithm and find the shortest path between different randomly generated, start/end point nodes, taking into account distance before making a hop

Cadettes (ages 11-14)

Learning objective: Crack a code
Gameplay: Complete puzzles to decrypt encrypted messages.

Seniors (ages 14-16)

Learning objective: Design a layered defense system
Gameplay: Fortify your base (a computer system) by using different defense mechanisms (firewalls, antivirus software, etc.) to defend yourself from attackers (hackers).

Ambassadors (ages 16-18)

Learning objective: Explore careers in cybersecurity
Gameplay: Match career cards by title and job description with the fewest tries and as quickly as possible.

The designed activities within CyberScouts should incorporate a pedagogically sound, research-informed curriculum that best supports students' learning and retention. SMEs will be available every week to work closely with FIEA students to construct appropriate tasks that meet learning objectives and align with Girl Scouts' existing badge requirements. To ensure that learning outcomes are being met, instructional material should be carefully organized and embedded into gameplay. For presenting complex topics such as cybersecurity, research has shown that serious games should present sub-tasks and rewards to encourage players to persist in finding solutions [4]. Other studies have indicated that, in order to teach cybersecurity effectively to K-12 students, serious games should begin with the most basic aspects of cybersecurity, followed by a gradual introduction to more complex concepts [5].

We would like to clarify that this proposal is a guiding document, rather than an absolute determiner, for how we envision our game. Although there are a total of 18 activities that could be created for the badges, the scope of the game may demand that these activities be reduced. Dependent on the needs or limitations of developers, other game details may also be tweaked or discarded. Correspondence with Girl Scout representatives is still in the initial stages; more work needs to be done. Notwithstanding these considerations, our hope is that CyberScouts will have a significant impact and reach within the Girl Scout network (and perhaps beyond, in other K-12 STEM arenas), and that this document has provided a clear outlook into project feasibility and development.

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We look forward to hearing from you soon. Best regards,

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