Explore - Impact of Computing Innovations

Written Response Submission Template

Please see [Assessment Overview and Performance Task Directions](https://apcentral.collegeboard.org/pdf/ap-csp-student-task-directions.pdf?course=ap-computer-science-principles) for Student for the task directions and recommended word counts.

**Computational Artifact**

Response 2a.

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| The computing innovation I have selected is Radio Frequency Identification (RFID), which is designed to transmit and store data. RFID tags, which contain small computer chips and antennae, have unique identification numbers that can be tracked using electronic readers with decoding software. The tags are used for product tracking, and used on pets and Alzheimer patients to monitor their safety and location within a specified area. They are also used for certain payment systems, such as FasTrak [9].  My artifact illustrates how an RFID tag transmits information and provides multiple examples of the applications of RFID technology. |

Response 2b.

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| I created my artifact using Google Slides. I used the Shape tool to create icons depicting devices involved in RFID, such as the RFID tag and reader. I added text boxes to identify the icons and lines to clarify the flow of information from one device to the next. I also added images of various devices that use RFID technology, such as the FasTrak toll tag, to show possible applications of the innovation. I used the Resize and Crop tools to ensure that the photos fit on the slide and aligned. |

Response 2c.

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| One benefit of RFID technology is that it enables remote tracking of objects, which could have a major impact on the business industry. RFID tags can be attached to merchandise, providing security against theft and allowing retailers to track their products, so they know when to restock. It also reduces the time taken by manual inventory processes by 85% [7]. At a hospitality organization, check-in times dropped from 8 minutes to 75 seconds after the introduction of RFID. The Turku City Library System “$1,000,000 per year in labor costs alone” by implementing RFID [10]. However, reduction in labor could also harm the economy, by reducing the number of jobs needed. Employees working in “warehouses, distribution centers and the backs of stores” are at the greatest risk of losing their jobs [11].    RFID chip implants have also been proposed as an alternative to prison for low-level offenders, which would enable monitoring of their locations, while reducing the prison population and therefore costs and overcrowding [12]. This could have a huge beneficial impact on the prison system and it would help criminals reintegrate into society, while changing the way our society deals with crime [3]. However, many also see this as a breach of privacy rights, because implanting chips in people infringes on their bodily rights [2]. Requiring RFID implants for sex-offenders and other criminals could change how privacy is regarded in society. |

Response 2d.

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| RFID chips can be factory programmed to set identification information, and field programmed to change its memory based on location and other factors [4]. RFID chips store small amounts of data in hexadecimal form, and when activated by an RFID reader, they transmit radio signals, using modulation in amplitude or frequency to convey the data [6]. Those signals are read by a reader or scanner and decoding software demodulates the data, converting it into readable format like text or base-10 numbers. Then, that data is often added to a database that can be accessed to determine a chip’s most recent location.  One problem is that RFID data is not very secure; anyone with a strong enough scanner can read data from RFID tags [1]. This means that competitors could figure out information concerning the products of another business, and gain a competitive advantage. Additionally, scanners sometimes misread RFID chips, and inaccurate data could lead companies to change their inventory without need, resulting in a loss of revenue. Another major privacy and security concern is that people could read data off others’ passports without their consent/knowledge, which could lead to identity theft through the creation of fake passport copies [1].  Additionally, the tags do not use encryption and are vulnerable to damage. They could be harmed by “water, static discharge or high-powered magnetic surges”, causing loss of data, or jammed by interrupting signals [8]. |

Response 2e.

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| **Sources**   1. Ahson, Syed A., and Mohammad Ilyas. RFID Handbook: Applications, Technology, Security, and Privacy. CRC Press, 2008. Google Books, doi:10.1201/9781420055009. Accessed 6 Nov. 2018. 2. Ali, Mohamed. "How Fair Is Installing Tracking Microchips to Criminals? Does This Violate Human Rights?" Criminal Lawyer Group, Blanch Law Firm, www.criminallawyergroup.com/how-fair-is-installing-tracking-microchips-to-criminals-does-this-violate-human-rights/. Accessed 15 Nov. 2018. 3. Brady, Brian. "Prisoners 'To Be Chipped like Dogs.'" The Independent, 13 Jan. 2008. The Independent, www.independent.co.uk/news/uk/politics/prisoners-to-be-chipped-like-dogs-769977.html. Accessed 15 Nov. 2018. 4. "Field Programming." Technovelgy.com, Technovelgy, www.technovelgy.com/ct/Technology-Article.asp?ArtNum=40. Accessed 15 Nov. 2018. 5. Marino, Ron. "Robust RFID Tags Track Firearms." Microwaves & RF, Informa, 20 June 2018, www.mwrf.com/components/robust-rfid-tags-track-firearms. Accessed 6 Nov. 2018. 6. "Modulation." Technovelgy.com, Technovelgy, www.technovelgy.com/ct/Technology-Article.asp?ArtNum=46. Accessed 15 Nov. 2018. 7. Morimoto, Rand. "Enterprise IoT: Business Uses for RFID Technology." Network World, IDG Communications, 6 Mar. 2018, www.networkworld.com/article/3260684/internet-of-things/enterprise-iot-business-uses-for-rfid-technology.html. Accessed 8 Nov. 2018. 8. Pontius, Nicole. "What Are RFID Tags? Learn How RFID Tags Work, What They’re Used For, and Some of the Disadvantages of RFID Technology." Asset Tag & UID Label Blog - Camcode, Horizons, 28 June 2018, www.camcode.com/asset-tags/what-are-rfid-tags/. Accessed 5 Nov. 2018. 9. "RFID Applications." RFID, www.u.arizona.edu/~obaca/rfid/uses.html. Accessed 15 Nov. 2018. 10. "RFID System Saves Business $1M in One Year." Advanced Mobile Group, 15 Aug. 2016, www.advancedmobilegroup.com/blog/the-truth-about-rfid-system-cost. Accessed 8 Nov. 2018. 11. Roberti, Mark. "RFID's Impact on Employment." RFID Journal, 9 Aug. 2010, www.rfidjournal.com/articles/view?7795. Accessed 8 Nov. 2018. 12. Slowik, B. "The Electronic Accountability Act." RFID Journal, Emerald Expositions, 18 Mar. 2006, www.rfidjournal.com/discussions/thread?1457/1457. Accessed 8 Nov. 2018.     **Images**   1. RFID Card. IndiaMART, www.indiamart.com/proddetail/rfid-card-16544615897.html. Accessed 6 Nov. 2018. 2. Smart Security Rfid Tags, Apparel Rfid Tags Clothes Retail Inventory. Rich RFID, RFID Label Tags, www.rfidlabeltags.com/sale-8276898-smart-security-rfid-tags-apparel-rfid-tags-clothes-retail-inventory.html. Accessed 6 Nov. 2018. 3. The Standard FasTrak Toll Tag. The FasTrak Flex Toll Tag, FasTrak, www.bayareafastrak.org/en/guide/doINeedFlex.shtml. Accessed 6 Nov. 2018. 4. US passport with RFID chip exposed. Swift Passport & Visa Services, www.swiftpassportservices.com/blog/the-things-you-may-not-know-about-the-microchip-in-your-passport/. Accessed 6 Nov. 2018. |