Catalog of Publications per Educational Stage

Open-Source Hardware in Education: a Systematic Mapping Study

October 11, 2018

AdultEducation

- [1] S. Aaron, A. Blackwell, and P. Burnard. The development of sonic pi and its use in educational partnerships: Co-creating pedagogies for learning computer programming. *Journal of Music, Technology and Education*, 9(1):75–94, 2016.
- [2] S. Aaron and A. F. Blackwell. From sonic pi to overtone: Creative musical experiences with domain-specific and functional languages. In *First ACM SIG-PLAN Workshop on Functional Art, Music, Modeling & Design*, FARM '13, pages 35–46, New York, NY, USA, 2013. ACM.
- [3] Abhas, A. Shukla, A. Borah, R. Singh, and A. Gehlot. Arduino and Rx/Tx based low cost class monitoring system. In *2016 3rd International Conference on Computing for Sustainable Global Development (INDIACom)*, pages 2785–2790, Mar. 2016.
- [4] M. Adusei and D. Lee. "clicks" appressory for visually impaired children. In *Conference on Human Factors in Computing Systems*, CHI EA '17, pages 19–25, New York, NY, USA, 2017.
- [5] F. Agatolio and M. Moro. A workshop to promote arduino-based robots aswide spectrum learning support tools. *Advances in Intelligent Systems and Computing*, 457:113–125, 2017.
- [6] M. Akbal, S. Zehle, and M. Schmitz. From technomania to the school of things: Taking control of your own game. In *Proceedings of the 2014 Workshops on Advances in Computer Entertainment Conference*, ACE '14 Workshops, pages 12:1–12:8, New York, NY, USA, 2014. ACM.

- [7] K. Allen, N. Hollinworth, F. Hwang, A. Minnion, G. Kwiatkowska, T. Lowe, and N. Weldin. Interactive sensory objects for improving access to heritage. In *CHI '13 Extended Abstracts on Human Factors in Computing Systems*, CHI EA '13, pages 2899–2902, New York, NY, USA, 2013. ACM.
- [8] S. Arakliotis, D. G. Nikolos, and E. Kalligeros. Lawris: A rule-based arduino programming system for young students. In *5th International Conference on Modern Circuits and Systems Technologies (MOCAST)*, pages 1–4, May 2016.
- [9] N. Arora, N. Agarwal, and S. R. N. Reddy. Funpi: An interactive learning experience using story narration. In *Proceedings of the Sixth International Conference on Computer and Communication Technology 2015*, ICCCT '15, pages 398–402, New York, NY, USA, 2015. ACM.
- [10] D. Assante, C. Fornario, A. E. Sayed, and S. A. Salem. Edutronics: Gamification for introducing kids to electronics. In *IEEE Global Engineering Education Conference (EDUCON)*, pages 905–908, Apr. 2016.
- [11] R. Avanzato. Multi-robot communication for education and research. In *ASEE Annual Conference and Exposition*, 2013.
- [12] E. Baafi and A. Millner. A toolkit for tinkering with tangibles & connecting communities. In *Fifth International Conference on Tangible, Embedded, and Embodied Interaction*, TEI '11, pages 349–352, New York, NY, USA, 2011. ACM.
- [13] M. Bajzek, H. Bort, O. Hunpatin, L. Mivshek, T. Much, C. O'Hare, and D. Brylow. Muzecs: Embedded blocks for exploring computer science. In *IEEE Blocks and Beyond Workshop (Blocks and Beyond)*, pages 127–132, Oct. 2015.
- [14] D. Bar-El and O. Zuckerman. Maketec: A makerspace as a third place for children. In *10th International Conference on Tangible, Embedded, and Embodied Interaction*, TEI '16, pages 380–385, New York, NY, USA, 2016. ACM.
- [15] L. Benotti, M. Gomez, and C. Martinez. UNC++Duino: A kit for learning to program robots in python and C++ starting from blocks. *Advances in Intelligent Systems and Computing*, 457:181–192, 2017.
- [16] L. Bertelli, F. Bovo, L. Grespan, S. Galvan, and P. Fiorini. Eddy: An open hardware robot for education. In *Autonomous Minirobots for Research and Edutainment, 4th International AMIRE Symposium*, volume 216, pages 47–54, 2007.
- [17] N. Bird. Use of the arduino platform for a junior-level undergraduate microprocessors course. In *ASEE Annual Conference and Exposition*, 2011.
- [18] C. Brady, K. Orton, D. Weintrop, G. Anton, S. Rodriguez, and U. Wilensky. All roads lead to computing: Making, participatory simulations, and social computing as pathways to computer science. *IEEE Transactions on Education*, 60(1):59–66, Feb. 2017.

- [19] M. Brinkmeier and D. Kalbreyer. A case study of physical computing in computer science education. In *11th Workshop in Primary and Secondary Computing Education*, WiPSCE '16, pages 54–59, New York, NY, USA, 2016. ACM.
- [20] L. Buechley and M. Eisenberg. Boda blocks: A collaborative tool for exploring tangible three-dimensional cellular automata. In *8th International Conference on Computer Supported Collaborative Learning*, CSCL'07, pages 102–104. International Society of the Learning Sciences, 2007.
- [21] L. Buechley, M. Eisenberg, J. Catchen, and A. Crockett. The lilypad arduino: Using computational textiles to investigate engagement, aesthetics, and diversity in computer science education. In *SIGCHI Conference on Human Factors in Computing Systems*, CHI '08, pages 423–432, New York, NY, USA, 2008. ACM.
- [22] L. Buechley, M. Eisenberg, and N. Elumeze. Towards a curriculum for electronic textiles in the high school classroom. *SIGCSE Bulletin*, 39(3):28–32, June 2007.
- [23] J. R. Byrne, L. Fisher, and B. Tangney. Computer science teacher reactions towards raspberry pi continuing professional development (cpd) workshops using the bridge21 model. In *2015 10th International Conference on Computer Science Education (ICCSE)*, pages 267–272, July 2015.
- [24] G. Carro, M. Castro, E. Sancristobal, G. Diaz, F. Mur, M. Latorre, M. Chaparro, A. Lopez-Rey, C. Salzmann, and D. Gillet. The color of the light: A remote laboratory that uses a smart device that connects teachers and students. In *2014 IEEE Global Engineering Education Conference (EDUCON)*, pages 854–860, Apr. 2014.
- [25] D. G. Carvalho and W. C. B. Lins. Labduino: An open source tool for science education. In *IEEE Frontiers in Education Conference (FIE)*, pages 1–5, Erie, PA, USA, USA, Oct. 2016.
- [26] P. Carvalho and M. Hahn. A simple experimental setup for teaching additive colors with arduino. *Physics Teacher*, 54(4):244–245, 2016.
- [27] M. Cerovac. Shaping australian secondary students attitudes to stem. In *Proceedings of the International Astronautical Congress, IAC*, volume 12, pages 9532–9541, 2013.
- [28] R. C. Chang, S. N. Chen, H. J. Lin, and H. M. Yu. Duira: An interactive learning platform for mixed reality. In *2010 IEEE International Conference on Multime-dia and Expo*, pages 1152–1153, July 2010.
- [29] S. Cheong, I. Chai, and R. Logeswaran. Tap-to-learn paradigm for t-learning via near field communication-enabled raspberry pi. *Advanced Science Letters*, 21(7):2205–2209, 2015.

- [30] H. Choi and J. Park. New creativity examined with e-textiles: Bridging arts craft and programming. *Proceedings of International Conference of the Learning Sciences, ICLS*, 2:1181–1182, 2016.
- [31] S. Colombo, F. Garzotto, M. Gelsomini, M. Melli, and F. Clasadonte. Dolphin sam: A smart pet for children with intellectual disability. In *Proceedings of the International Working Conference on Advanced Visual Interfaces*, AVI '16, pages 352–353, New York, NY, USA, 2016. ACM.
- [32] G. Corbett, G. Ryall, S. Palmer, I. Collier, J. Adams, and R. Appleyard. Public outreach at ral: Engaging the next generation of scientists and engineers. *Journal of Physics: Conference Series*, 664(5), 2015.
- [33] N. Correll, C. Wailes, and S. Slaby. A one-hour curriculum to engage middle school students in robotics and computer science using cubelets. *Springer Tracts in Advanced Robotics*, 104:165–176, 2014.
- [34] D. Cuartielles. Opensource hardware and education. *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, 9083, 2015.
- [35] M. d. C. Curras-Francos, J. Diz-Bugarin, J. R. Garcia-Vila, and A. Orte-Caballero. Cooperative development of an arduino-compatible building automation system for the practical teaching of electronics. *IEEE Revista Iberoamericana de Tecnologias del Aprendizaje*, 9(3):91–97, Aug. 2014.
- [36] J. B. da Silva, W. Rochadel, R. Marcelino, and V. Gruber. Integrating remote laboratory environment for m-learning for use in secondary education. In 2014 11th International Conference on Remote Engineering and Virtual Instrumentation (REV), pages 70–74, Feb. 2014.
- [37] W. Dams, M. Roggemans, P. Pelgrims, T. Tierens, and D. Pauwels. Open hardware platform helps students getting started in analog and digital design. In *IEEE International Conference on Microelectronic Systems Education (MSE'07)*, pages 133–134, June 2007.
- [38] M. R. Daros, J. P. C. de Lima, W. Rochadel, J. B. Silva, and J. S. Simño. Remote experimentation in basic education using an architecture with raspberry pi. In *2015 3rd Experiment International Conference (exp.at'15)*, pages 75–78, June 2015.
- [39] R. Davis, Y. Kafai, V. Vasudevan, and E. Lee. The education arcade: Crafting, remixing, and playing with controllers for scratch games. In *12th International Conference on Interaction Design and Children*, IDC '13, pages 439–442, New York, NY, USA, 2013. ACM.

- [40] J. P. C. de Lima, W. Rochadel, A. M. Silva, J. P. S. Simño, J. B. da Silva, and J. B. M. Alves. Application of remote experiments in basic education through mobile devices. In *2014 IEEE Global Engineering Education Conference (EDUCON)*, pages 1093–1096, Apr. 2014.
- [41] R. M. de Melo, F. D. de Oliveira Feliciano, J. A. Brito, I. J. de Melo Filho, R. S. Carvalho, and A. S. Gomes. Using arduino as pedagogical strategy in learning logic programming. In *2014 9th Iberian Conference on Information Systems and Technologies (CISTI)*, pages 1–5, June 2014.
- [42] A. De Morais Bertoldi, P. Gessini, C. Polito, and I. Ishioka. Rocket models as motivator agent in teaching sciences and mathematics. In *International Astronautical Congress, IAC*, volume 11, pages 8261–8269, 2014.
- [43] J. Deich, M. Markert, J. Geelhaar, M. Schied, J. Hammerschmidt, and G. Rausch. Form & function toolkit: Printed electronics for unconventional interface. In 8th International Conference on Tangible, Embedded and Embodied Interaction, TEI '14, pages 365–368, New York, NY, USA, 2013. ACM.
- [44] M. Dias, L. Bezerra, D. Morais, C. Gabi, and A. Perkusich. An embedded asterisk platform instructional design to teach voice over ip in information technology undergraduate courses: Using raspberry pi and asterisk to build an embedded portable didactic tool. In *CSEDU 2015 7th International Conference on Computer Supported Education, Proceedings*, volume 1, pages 461–466, 2015.
- [45] N. Dittert and H. Schelhowe. Techsportiv: Using a smart textile toolkit to approach young people's physical education. In *9th International Conference on Interaction Design and Children*, IDC '10, pages 186–189, New York, NY, USA, 2010. ACM.
- [46] O. L. dos Santos, D. Cury, J. Rafalski, and P. D. N. Silveira. An iot computational robotics learning laboratory in vila velha, espirito santo. In *2016 XI Latin American Conference on Learning Objects and Technology (LACLO)*, pages 1–6, Oct. 2016.
- [47] A. Ebbage. Teacher don't leave those kits alone. *Engineering and Technology*, 9(9):37–39, 2014.
- [48] G. C. Fernandez, E. S. Ruiz, M. C. Gil, and F. M. Perez. From RGB led laboratory to servomotor control with websockets and IoT as educational tool. In *12th International Conference on Remote Engineering and Virtual Instrumentation (REV)*, pages 32–36, Feb. 2015.
- [49] D. Fields, Y. Kafai, and K. Searle. Functional aesthetics for learning: Creative tensions in youth e-textile designs. In *10th International Conference of the Learning Sciences: The Future of Learning, ICLS 2012*, volume 1, pages 196–203, 2012.

- [50] E. Fokides. Students learning to program by developing games: Results of a year-long project in primary school settings. *Journal of Information Technology Education: Research*, 16(1):475–505, 2017. cited By 0.
- [51] J. Fujima. Auto-connection mechanisms for educational virtual laboratory. In *IET International Conference on Frontier Computing. Theory, Technologies and Applications*, pages 396–401, Aug. 2010.
- [52] F. J. García-Peñalvo and J. Cruz-Benito. Computational thinking in pre-university education. In *Proceedings of the Fourth International Conference on Technological Ecosystems for Enhancing Multiculturality*, pages 13–17. ACM, 2016.
- [53] F. Geth, J. Verveckken, N. Leemput, J. V. Roy, J. Beerten, P. Tielens, V. D. Smedt, S. Iacovella, B. Hunyadi, N. Koolen, H. D. Clercq, G. Gielen, R. Puers, S. V. Huffel, R. Belmans, G. Deconinck, W. Dehaene, and J. Driesen. Development of an open-source smart energy house for k-12 education. In *IEEE Power Energy Society General Meeting*, pages 1–5, July 2013.
- [54] M. Geyer. Mole pi: Using new technology to teach the magnitude of a mole. *Journal of Chemical Education*, 91(11):2005–2006, 2014.
- [55] M. Giannakos, L. Jaccheri, and I. Leftheriotis. Happy girls engaging with technology: Assessing emotions and engagement related to programming activities. *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, 8523 LNCS(PART 1):398–409, 2014.
- [56] M. N. Giannakos and L. Jaccheri. What motivates children to become creators of digital enriched artifacts? In *9th ACM Conference on Creativity & Cognition*, C&C '13, pages 104–113, New York, NY, USA, 2013. ACM.
- [57] J. Gilreath and C. BouSaba. An advanced streaming internet radio player with raspberry pi. In *ASEE Annual Conference and Exposition, Conference Proceedings*, volume 12, 2015.
- [58] J. Griffin, E. Kaplan, and Q. Burke. Debug'ems and other deconstruction kits for stem learning. In *IEEE 2nd Integrated STEM Education Conference, ISEC 2012*, 2012.
- [59] R. Grover, S. Krishnan, T. Shoup, and M. Khanbaghi. A competition-based approach for undergraduate mechatronics education using the arduino platform. In *Fourth Interdisciplinary Engineering Design Education Conference*, pages 78–83, Mar. 2014.
- [60] N. Gupta, N. Tejovanth, and P. Murthy. Learning by creating: Interactive programming for indian high schools. In *2012 IEEE International Conference on Technology Enhanced Education (ICTEE)*, pages 1–3, Jan. 2012.

- [61] N. F. Gutierrez, M. A. Calvo, J. J. Ramirez, and F. A. Olarte. Work-in-progress: Engineering and project-based learning as the focus of technology education in colombian high schools. In *2014 International Conference on Interactive Collaborative Learning (ICL)*, pages 897–900, Dec. 2014.
- [62] R. h. Chang and L. Y. Chung. A study on augmented reality application in situational simulation learning. In *2014 7th International Conference on Ubi-Media Computing and Workshops*, pages 115–120, July 2014.
- [63] V. S. Harini, M. Dharani, K. P. Balaji, and S. R. Pandian. Robots for the bottom of the pyramid: Mobile robot racing over the internet. In *2016 IEEE Region 10 Conference (TENCON)*, pages 751–755, Nov. 2016.
- [64] L. M. Herger and M. Bodarky. Engaging students with open source technologies and arduino. In *2015 IEEE Integrated STEM Education Conference*, pages 27–32, Mar. 2015.
- [65] D. Honess and O. Quinlan. Astro pi: Running your code aboard the international space station. *Acta Astronautica*, 138:43–52, 2017.
- [66] Y. Hori and H. Sato. Development of the framework for students who programming is not good: When students made "tamakorogashi" for children's workshop. In *2015 International Conference on Computer Application Technologies, CCATS 2015*, pages 144–147, 2016.
- [67] B. Huang. Open-source hardware microcontrollers and physics education integrating diy sensors and data acquisition with arduino. In *ASEE Annual Conference and Exposition*, 2015.
- [68] Y. Huang and M. Eisenberg. Steps toward child-designed interactive stuffed toys. In *10th International Conference on Interaction Design and Children*, IDC '11, pages 165–168, New York, NY, USA, 2011. ACM.
- [69] Y. Huang and M. Eisenberg. Plushbot: An introduction to computer science. In *CHI '12 Extended Abstracts on Human Factors in Computing Systems*, CHI EA '12, pages 1457–1458, New York, NY, USA, 2012. ACM.
- [70] O. Hunpatin, C. O'Hare, R. Thomas, and D. Brylow. A browser-based ide for the MUzECS platform. In *DMS 2016: 22nd International Conference on Distributed Multimedia Systems*, pages 112–118, 2016.
- [71] S. Ilie, A. Mitrica, A. Sperila, C. Totolin, M. Neghina, and M. Marian. Fostering engineering ingenuity and self-determination in computer science undergraduate students. In *CEUR Workshop Proceedings*, volume 1427, pages 19–24, 2015.
- [72] S. P. Imberman, D. Sturm, and M. Q. Azhar. Computational thinking: Expanding the toolkit. *J. Comput. Sci. Coll.*, 29(6):39–46, June 2014.

- [73] N. K. Ioannou, G. S. Ioannidis, G. D. Papadopoulos, and A. E. Tapeinos. A novel educational platform, based on the raspberry-pi: Optimised to assist the teaching and learning of younger students. In *2014 International Conference on Interactive Collaborative Learning (ICL)*, pages 517–524, Dec. 2014.
- [74] P. Jamieson and J. Herdtner. More missing the boat– arduino, raspberry pi, and small prototyping boards and engineering education needs them. In *2015 IEEE Frontiers in Education Conference (FIE)*, pages 1–6, Oct. 2015.
- [75] Y. Jang, W. Lee, and J. Kim. Assessing the usefulness of object-based programming education using arduino. *Indian Journal of Science and Technology*, 8:89–96, 2015.
- [76] F. Jiuqiang. Teaching method research based on arduino platform. In 2015 Sixth International Conference on Intelligent Systems Design and Engineering Applications (ISDEA), pages 798–801, Aug. 2015.
- [77] M. F. Jung, N. Martelaro, H. Hoster, and C. Nass. Participatory materials: Having a reflective conversation with an artifact in the making. In *Proceedings of the 2014 Conference on Designing Interactive Systems*, DIS '14, pages 25–34, New York, NY, USA, 2014. ACM.
- [78] S. Junk and R. Matt. Workshop rapid prototyping a new approach to introduce digital manufacturing in engineering education. In *2015 International Conference on Information Technology Based Higher Education and Training (ITHET)*, pages 1–6, June 2015.
- [79] Y. Kafai, D. Fields, and K. Searle. Making technology visible: Connecting the learning of crafts, circuitry and coding in youth e-textile designs. In *10th International Conference of the Learning Sciences: The Future of Learning, ICLS 2012*, volume 1, pages 188–195, 2012.
- [80] Y. Kafai, K. Searle, C. Martinez, and B. Brayboy. Ethnocomputing with electronic textiles: Culturally responsive open design to broaden participation in computing in american indian youth and communities. In *Proceedings of the 45th ACM Technical Symposium on Computer Science Education*, SIGCSE '14, pages 241–246, New York, NY, USA, 2014. ACM.
- [81] Y. B. Kafai, D. A. Fields, and K. A. Searle. Everyday creativity in novice e-textile designs. In *8th ACM Conference on Creativity and Cognition*, C&C '11, pages 353–354, New York, NY, USA, 2011. ACM.
- [82] Y. B. Kafai, E. Lee, K. Searle, D. Fields, E. Kaplan, and D. Lui. A crafts-oriented approach to computing in high school: Introducing computational concepts, practices, and perspectives with electronic textiles. *ACM Transactions on Computing Education*, 14(1):1:1–1:20, Mar. 2014.

- [83] Y. B. Kafai, K. A. Peppler, Q. Burke, M. Moore, and D. Glosson. Fröbel's forgotten gift: Textile construction kits as pathways into play, design and computation. In *9th International Conference on Interaction Design and Children*, IDC '10, pages 214–217, New York, NY, USA, 2010. ACM.
- [84] Y. B. Kafai, K. Searle, E. Kaplan, D. Fields, E. Lee, and D. Lui. Cupcake cushions, scooby doo shirts, and soft boomboxes: E-textiles in high school to promote computational concepts, practices, and perceptions. In *44th ACM Technical Symposium on Computer Science Education*, SIGCSE '13, pages 311–316, New York, NY, USA, 2013. ACM.
- [85] E.-S. Katterfeldt, D. Cuartielles, D. Spikol, and N. Ehrenberg. Talkoo: A new paradigm for physical computing at school. In *Proceedings of the The 15th International Conference on Interaction Design and Children*, IDC '16, pages 512–517, New York, NY, USA, 2016. ACM.
- [86] E.-S. Katterfeldt, N. Dittert, and H. Schelhowe. Eduwear: Smart textiles as ways of relating computing technology to everyday life. In *International Conference on Interaction Design and Children*, IDC '09, pages 9–17, New York, NY, USA, 2009. ACM.
- [87] E.-S. Katterfeldt, N. Dittert, and H. Schelhowe. Designing digital fabrication learning environments for bildung: Implications from ten years of physical computing workshops. *International Journal of Child-Computer Interaction*, 5:3–10, 2015.
- [88] J. Kawash, A. Kuipers, L. Manzara, and R. Collier. Undergraduate assembly language instruction sweetened with the raspberry pi. In *Proceedings of the 47th ACM Technical Symposium on Computing Science Education*, SIGCSE '16, pages 498–503, New York, NY, USA, 2016. ACM.
- [89] M. Kazemitabaar, J. McPeak, A. Jiao, L. He, T. Outing, and J. E. Froehlich. Makerwear: A tangible approach to interactive wearable creation for children. In *Conference on Human Factors in Computing Systems*, CHI '17, pages 133–145, New York, NY, USA, 2017. ACM.
- [90] J. Keshwani, B. Barker, G. Nugent, and N. Grandgenett. Weartec: Empowering youth to create wearable technologies. In *2016 IEEE 16th International Conference on Advanced Learning Technologies (ICALT)*, pages 498–500, July 2016.
- [91] Y. Kim, W. Lee, and J. Kim. Development and application of teaching-learning method for learning object-oriented concepts using arduino and physical etoys. *International Journal of Applied Engineering Research*, 9(21):8271–8282, 2014.
- [92] A. Kobeissi, A. Sidoti, F. Bellotti, R. Berta, and A. De Gloria. Building a tangible serious game framework for elementary spatial and geometry concepts. In

- *IEEE 17th International Conference on Advanced Learning Technologies, ICALT 2017*, pages 173–177, 2017.
- [93] M. Kochlan and M. Hodon. Open hardware modular educational robotic platform - yrobot. In *2014 23rd International Conference on Robotics in Alpe-Adria-Danube Region (RAAD)*, pages 1–6, Sept. 2014.
- [94] J. Kojmane and A. Aboutajeddine. Enjoyeering junior: A hands-on activity to enhance technological learning in an engineering dynamics course. In *2016 International Conference on Information Technology for Organizations Development (IT4OD)*, pages 1–6, Mar. 2016.
- [95] C. Kopic and K. Gohlke. Inflatibits: A modular soft robotic construction kit for children. In *Proceedings of the TEI '16: Tenth International Conference on Tangible, Embedded, and Embodied Interaction*, TEI '16, pages 723–728, New York, NY, USA, 2016. ACM.
- [96] S. P. Krishnamoorthy and V. Kapila. Using a visual programming environment and custom robots to learn c programming and k-12 stem concepts. In *Proceedings of the 6th Annual Conference on Creativity and Fabrication in Education*, FabLearn '16, pages 41–48, New York, NY, USA, 2016. ACM.
- [97] H. Kwon. The design focused engineering outreach to a middle school using arduino projects. In *ASME Design Engineering Technical Conference*, volume 3, 2017.
- [98] F. La Paglia, B. Caci, D. La Barbera, and M. Cardaci. Using robotics construction kits as metacognitive tools: A research in an italian primary school. In *Studies in Health Technology and Informatics*, volume 154, pages 110–114, 2010.
- [99] G. Lastovicka-Medin and M. Petric. Embedded lab: Arduino projects in science lessons. In *2015 4th Mediterranean Conference on Embedded Computing (MECO)*, pages 284–289, June 2015.
- [100] Y. Lee. Integrated information and communication learning model for raspberry pi environment. *ARPN Journal of Engineering and Applied Sciences*, 12(17):5088–5093, 2017.
- [101] B. Litts, Y. Kafai, D. Lui, J. Walker, and S. Widman. Stitching codeable circuits: High school students \(\text{i}_i\) learning about circuitry and coding with electronic textiles. *Journal of Science Education and Technology*, 26(5):494–507, 2017.
- [102] B. Litts, Y. Kafai, D. Lui, J. Walker, and S. Widman. Understanding high school students' reading, remixing, and writing codeable circuits for electronic textiles. In *Conference on Integrating Technology into Computer Science Education, ITiCSE*, pages 381–386, 2017.

- [103] E. Lovell and L. Buechley. An e-sewing tutorial for diy learning. In *9th International Conference on Interaction Design and Children*, IDC '10, pages 230–233, New York, NY, USA, 2010. ACM.
- [104] D. Lui, B. K. Litts, S. Widman, J. T. Walker, and Y. B. Kafai. Collaborative maker activities in the classroom: Case studies of high school student pairs' interactions in designing electronic textiles. In *Proceedings of the 6th Annual Conference on Creativity and Fabrication in Education*, FabLearn '16, pages 74–77, New York, NY, USA, 2016. ACM.
- [105] A. Mahamad, M. Robian, and S. Saon. Development of e-abacus. *ARPN Journal of Engineering and Applied Sciences*, 10(19):8516–8519, 2015.
- [106] P. Martin-Ramos, M. Lopes, M. Lima da Silva, P. Gomes, P. Pereira da Silva, J. Domingues, and M. Ramos Silva. First exposure to arduino through peer-coaching: Impact on students' attitudes towards programming. *Computers in Human Behavior*, 76:51–58, 2017.
- [107] M. Martinez, J. Campion, T. Gholami, M. Rittikaidachar, A. Barron, and A. Okamura. Open source, modular, customizable, 3-d printed kinesthetic haptic devices. In *2017 IEEE World Haptics Conference, WHC 2017*, pages 142–147, 2017.
- [108] R. McClain. Construction of a photometer as an instructional tool for electronics and instrumentation. *Journal of Chemical Education*, 91(5):747–750, 2014.
- [109] R. Meintjes and H. Schelhowe. Inclusive interactives: The transformative potential of making and using craft-tech social objects together in an after-school centre. In *Proceedings of the The 15th International Conference on Interaction Design and Children*, IDC '16, pages 89–100, New York, NY, USA, 2016. ACM.
- [110] P. Mellodge and I. Russell. Using the arduino platform to enhance student learning experiences. In *18th ACM Conference on Innovation and Technology in Computer Science Education*, ITiCSE '13, pages 338–338, New York, NY, USA, 2013. ACM.
- [111] P. P. Merino, E. S. Ruiz, G. C. Fernandez, and M. C. Gil. Robotic educational tool to engage students on engineering. In *2016 IEEE Frontiers in Education Conference (FIE)*, pages 1–4, Oct. 2016.
- [112] A. Merkouris and K. Chorianopoulos. Introducing computer programming to children through robotic and wearable devices. In *Proceedings of the Workshop in Primary and Secondary Computing Education*, WiPSCE '15, pages 69–72, New York, NY, USA, 2015. ACM.

- [113] J. Micek, O. Karpiñ, and M. Kochlñn. Audio-communication subsystem module for yrobot a modular educational robotic platform. In *2014 6th European Embedded Design in Education and Research Conference (EDERC)*, pages 60-64, Sept. 2014.
- [114] A. Millner and E. Baafi. Modkit: Blending and extending approachable platforms for creating computer programs and interactive objects. In *10th International Conference on Interaction Design and Children*, IDC '11, pages 250–253, New York, NY, USA, 2011. ACM.
- [115] A. Minuto, F. Pittarello, and A. Nijholt. A smart material interfaces learning experience. In *DMS 2015: 21st International Conference on Distributed Multimedia Systems*, pages 131–140, 2015.
- [116] F. Mondada, M. Bonani, F. Riedo, M. Briod, L. Pereyre, P. Retornaz, and S. Magnenat. Bringing robotics to formal education: The thymio open-source hardware robot. *IEEE Robotics Automation Magazine*, 24(1):77–85, Mar. 2017.
- [117] N. Navarathinam, D. Liddle, D. Honess, J. Bell, L. Howarth, P. Colligan, L. Jackson, J. Curtis, J. Chinner, S. Eves, T. Lyons, D. Gibbs, P. Norris, A. Hansom, R. Elliot, T. Tinsley, C. Holmes, and A. Powell. Astro pi: Launch your code into space. In *International Astronautical Congress, IAC*, volume 13, pages 9992–10003, 2015.
- [118] G. Ngai, S. C. Chan, J. C. Cheung, and W. W. Lau. The teeboard: An education-friendly construction platform for e-textiles and wearable computing. In *SIGCHI Conference on Human Factors in Computing Systems*, CHI '09, pages 249–258, New York, NY, USA, 2009. ACM.
- [119] G. Ngai, S. C. Chan, V. T. Ng, J. C. Cheung, S. S. Choy, W. W. Lau, and J. T. Tse. I*catch: A scalable plug-n-play wearable computing framework for novices and children. In *SIGCHI Conference on Human Factors in Computing Systems*, CHI '10, pages 443–452, New York, NY, USA, 2010. ACM.
- [120] P. C. Nicolete, J. B. da Silva, J. P. S. Simño, W. Rochadel, M. A. da Silva Cristiano, J. P. C. de Lima, S. M. S. Bilessimo, and J. B. da Mota Alves. Mobile remote experimentation applied to basic education. In *2015 3rd Experiment International Conference (exp.at'15)*, pages 266–271, June 2015.
- [121] J. Noble. Livecoding the synthkit: Little bits as an embodied programming language. In *2014 Second IEEE Working Conference on Software Visualization*, pages 40–44, Sept. 2014.
- [122] B. O'connell. Paperbots, an inexpensive means for engineering education. In *ASEE Annual Conference and Exposition*, Atlanta, Georgia, US, 2013.

- [123] Y. Ota, M. Komiyama, R. Egusa, S. Inagaki, F. Kusunoki, M. Sugimoto, and H. Mizoguchi. Development of experiential learning system based on the connection between object models and their digital contents: Collaboration between tangible interface and computer interaction. In *CSEDU 2017 9th International Conference on Computer Supported Education*, volume 2, pages 154–159, 2017.
- [124] T. Page. Should open-source technology be used in design education? *International Journal of Open Source Software and Processes*, 6(1):17–30, 2015.
- [125] S. Papavlasopoulou, M. N. Giannakos, and L. Jaccheri. Creative programming experiences for teenagers: Attitudes, performance and gender differences. In *Proceedings of the The 15th International Conference on Interaction Design and Children*, IDC '16, pages 565–570, New York, NY, USA, 2016. ACM.
- [126] C. Parikh. Autonomous robot: An intellectual way of infusing microcontroller fundamentals into sophomore students. In *2015 IEEE Frontiers in Education Conference (FIE)*, pages 1–4, Oct. 2015.
- [127] K. Pattanashetty, K. P. Balaji, and S. R. Pandian. Educational outdoor mobile robot for trash pickup. In *2016 IEEE Global Humanitarian Technology Conference (GHTC)*, pages 342–351, Oct. 2016.
- [128] M. Pattichis, S. Celedon-Pattichis, and C. Lopezleiva. Teaching image and video processing using middle-school mathematics and the raspberry pi. In *ICASSP, IEEE International Conference on Acoustics, Speech and Signal Processing*, pages 6349–6353, 2017.
- [129] K. Peppler. Steam-powered computing education: Using e-textiles to integrate the arts and stem. *Computer*, 46(9):38–43, Sept. 2013.
- [130] K. Peppler and D. Glosson. Stitching circuits: Learning about circuitry through e-textile materials. *Journal of Science Education and Technology*, 22(5):751–763, 2013.
- [131] J. Post. An arduino-based summer camp experience for high school students. In *ASEE Annual Conference and Exposition*, 2016.
- [132] E. Prima, S. Karim, S. Utari, R. Ramdani, E. Putri, and S. Darmawati. Heat transfer lab kit using temperature sensor based arduinotm for educational purpose. In *Procedia Engineering*, volume 170, pages 536–540, 2017.
- [133] P. Pruet, C. Ang, and D. Farzin. Learning iot without the "i"-educational internet of things in a developing context. In *DIYNetworking 2015 Workshop on Do-it-Yourself Networking: An Interdisciplinary Approach*, pages 11–13, 2015.
- [134] P. Putjorn, C. S. Ang, and D. Farzin. Learning iot without the "i"- educational internet of things in a developing context. In *Proceedings of the 2015 Workshop*

- *on Do-it-yourself Networking: An Interdisciplinary Approach*, DIYNetworking '15, pages 11–13, New York, NY, USA, 2015. ACM.
- [135] B. Qian and H. Cheng. C-stem studio: A solution for learning computing and stem topics with robotics and embedded systems. In *ASME Design Engineering Technical Conference*, volume 9, 2017.
- [136] K. Qiu, L. Buechley, E. Baafi, and W. Dubow. A curriculum for teaching computer science through computational textiles. In *12th International Conference on Interaction Design and Children*, IDC '13, pages 20–27, New York, NY, USA, 2013. ACM.
- [137] R. Rahul, A. Whitchurch, and M. Rao. An open source graphical robot programming environment in introductory programming curriculum for undergraduates. In *2014 IEEE International Conference on MOOC, Innovation and Technology in Education (MITE)*, pages 96–100, Dec. 2014.
- [138] R. Reck. BYOE: Affordable and portable laboratory kit for controls courses. In *ASEE Annual Conference and Exposition, Conference Proceedings*, 2015.
- [139] R. Reck and R. Sreenivas. Developing an affordable laboratory kit for undergraduate controls education. In *ASME 2014 Dynamic Systems and Control Conference, DSCC 2014*, volume 1, 2014.
- [140] R. M. Reck and R. S. Sreenivas. Developing a new affordable dc motor laboratory kit for an existing undergraduate controls course. In *2015 American Control Conference (ACC)*, pages 2801–2806, July 2015.
- [141] M. Reichel and H. Schelhowe. Living labs: Driving innovation through civic involvement. In *7th International Conference on Interaction Design and Children*, IDC '08, pages 141–144, New York, NY, USA, 2008. ACM.
- [142] M. Resnick. All I Really Need to Know (About Creative Thinking) I Learned (by Studying How Children Learn) in Kindergarten. In *6th ACM SIGCHI Conference on Creativity & Cognition*, C&C '07, pages 1–6, New York, NY, USA, 2007. ACM.
- [143] A. Ribeiro, D. Barone, and L. Mizusaki. Robo+edu: Project and implementation of educational robitics in brazillian public schools. *Advances in Intelligent Systems and Computing*, 345:495–503, 2015.
- [144] G. T. Richard and Y. B. Kafai. "maker innovators": A workshop for youth creating responsive and wearable game interfaces with tangible and digital construction toolkits (abstract only). In *Proceedings of the 46th ACM Technical Symposium on Computer Science Education*, SIGCSE '15, pages 682–682, New York, NY, USA, 2015. ACM.
- [145] G. T. Richard and Y. B. Kafai. Making physical and digital games with e-textiles: A workshop for youth making responsive wearable games and controllers. In

- *Proceedings of the 14th International Conference on Interaction Design and Children*, IDC '15, pages 399-402, New York, NY, USA, 2015. ACM.
- [146] J. F. Roscoe, S. Fearn, and E. Posey. Teaching computational thinking by playing games and building robots. In *2014 International Conference on Interactive Technologies and Games*, pages 9–12, Oct. 2014.
- [147] M. A. Rubio, R. Romero-Zaliz, C. Mañoso, and A. P. de Madrid. Enhancing an introductory programming course with physical computing modules. In *2014 IEEE Frontiers in Education Conference (FIE) Proceedings*, pages 1–8, Oct. 2014.
- [148] I. Russell, K. H. Jin, and M. Sabin. Make and learn: A cs principles course based on the arduino platform. In *Proceedings of the 2016 ACM Conference on Innovation and Technology in Computer Science Education*, ITiCSE '16, pages 366–366, New York, NY, USA, 2016. ACM.
- [149] J. Sadler, K. Durfee, L. Shluzas, and P. Blikstein. Bloctopus: A novice modular sensor system for playful prototyping. In *Proceedings of the Ninth International Conference on Tangible, Embedded, and Embodied Interaction*, TEI '15, pages 347–354, New York, NY, USA, 2015. ACM.
- [150] J.-M. Saez-Lopez and M.-L. Sevillano-Garcia. Sensors, programming and devices in art education sessions. one case in the context of primary education [sensores, programacion y dispositivos en sesiones de educacion artistica. un caso en el contexto de educacion primaria]. *Cultura y Educacion*, 29(2):350–384, 2017.
- [151] N. Salzman and S. Loo. Connecting hardware and software in a middle school engineering outreach effort-rtp. In *ASEE Annual Conference and Exposition*, 2016.
- [152] R. Sanfelice, G. Campa, and M. Robles. A system for sketching in hardware: Do-it-yourself interfaces for sound and music computing. In *ASEE Annual Conference and Exposition*, 2012.
- [153] A. Sarao, M. Clocchiatti, C. Barnaba, and D. Zuliani. Using an arduino seismograph to raise awareness of earthquake hazard through a multidisciplinary approach. *Seismological Research Letters*, 87(1):186–192, 2016.
- [154] E. Schweikardt. Modular robotics as tools for design. In *6th ACM SIGCHI Conference on Creativity & Cognition*, C&C'07, pages 298–298, New York, NY, USA, 2007. ACM.
- [155] E. Schweikardt, N. Elumeze, M. Eisenberg, and M. D. Gross. A tangible construction kit for exploring graph theory. In *3rd International Conference on Tangible and Embedded Interaction*, TEI '09, pages 373–376, New York, NY, USA, 2009. ACM.

- [156] E. Schweikardt and M. D. Gross. roblocks: A robotic construction kit for mathematics and science education. In *International Conference on Multimodal Interfaces*, ICMI '06, pages 72–75, New York, NY, USA, 2006. ACM.
- [157] E. Schweikardt and M. D. Gross. A brief survey of distributed computational toys. In *First IEEE International Workshop on Digital Game and Intelligent Toy Enhanced Learning (DIGITEL'07)*, pages 57–64, Mar. 2007.
- [158] E. Schweikardt and M. D. Gross. Learning about complexity with modular robots. In *Second IEEE International Conference on Digital Game and Intelligent Toy Enhanced Learning*, pages 116–123, Nov. 2008.
- [159] E. Schweikardt and M. D. Gross. Experiments in design synthesis when behavior is determined by shape. *Personal Ubiquitous Computing*, 15(2):123–132, Feb. 2011.
- [160] K. A. Searle, C. Tofel-Grehl, and V. Allan. The e-textiles bracelet hack: Bringing making to middle school classrooms. In *Proceedings of the 6th Annual Conference on Creativity and Fabrication in Education*, FabLearn '16, pages 107–110, New York, NY, USA, 2016. ACM.
- [161] J. S. Seehra, A. Verma, and K. Ramani. Chirobot: Modularrobotic manipulation via spatial hand gestures. In *Proceedings of the 2014 Conference on Interaction Design and Children*, IDC '14, pages 209–212, New York, NY, USA, 2014. ACM.
- [162] T. Sharpe, G. Qin, and G. Recktenwald. A compact device for inductive instruction in general physics. In *ASEE Annual Conference and Exposition*, 2015.
- [163] A. Sipitakiat and P. Blikstein. Think globally, build locally: A technological platform for low-cost, open-source, locally-assembled programmable bricks for education. In *Fourth International Conference on Tangible, Embedded, and Embodied Interaction*, TEI '10, pages 231–232, New York, NY, USA, 2010. ACM.
- [164] A. Sipitakiat and P. Blikstein. Interaction design and physical computing in the era of miniature embedded computers. In *12th International Conference on Interaction Design and Children*, IDC '13, pages 515–518, New York, NY, USA, 2013. ACM.
- [165] T. Sklirou. Programming in secondary education: Applications, new trends and challenges. In *IEEE Global Engineering Education Conference, EDUCON*, pages 580–585, 2017.
- [166] W. Slany. Catroid: A mobile visual programming system for children. In *11th International Conference on Interaction Design and Children*, IDC '12, pages 300–303, New York, NY, USA, 2012. ACM.

- [167] W.-S. Sohn. A study on the programming education model using arduino. *International Journal of Applied Engineering Research*, 9(24):29793–29809, 2014.
- [168] A. Soleimani, K. Smith, J. Zeng, K. E. Green, D. Herro, J. Santiago, S. Sharma, M. Tonapi, A. Vijaykumar, I. Walker, and C. Gardner-McCune. Learning with cyberplayce, a cyber-physical learning environment for elementary students promoting computational expression. In *CHI '14 Extended Abstracts on Human Factors in Computing Systems*, CHI EA '14, pages 165–166, New York, NY, USA, 2014. ACM.
- [169] S. Somanath, L. Oehlberg, J. Hughes, E. Sharlin, and M. C. Sousa. 'maker' within constraints: Exploratory study of young learners using arduino at a high school in india. In *Conference on Human Factors in Computing Systems*, CHI '17, pages 96–108, New York, NY, USA, 2017. ACM.
- [170] M. Stergiopoulou, A. Karatrantou, and C. Panagiotakopoulos. Educational robotics and STEM education in primary education: A pilot study using the H&S electronic systems platform. *Advances in Intelligent Systems and Computing*, 560:88–103, 2017.
- [171] B. Tabuenca, D. Brner, M. Kalz, and M. Specht. User-modelled ambient feedback for self-regulated learning. *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, 9307:535–539, 2015.
- [172] A. Takemura. E-learning system for learning virtual circuit making with a microcontroller and programming to control a robot. In *Proceedings of the 12th International Conference on Cognition and Exploratory Learning in the Digital Age, CELDA 2015*, pages 313–318, 2015.
- [173] A. Tamilias, T. Themelis, T. Karvounidis, Z. Garofalaki, and D. Kallergis. B@SE: Blocks for @rduino in the students' educational process. In *IEEE Global Engineering Education Conference, EDUCON*, pages 910–915, 2017.
- [174] M. Tasnim, F. Zaman, H. S. Ferdous, and S. M. S. Galib. Towards ubiquitous learning tools for computer aided classroom in developing regions. In *Computer and Information Technology (ICCIT)*, 2013 16th International Conference on, pages 320–325, Mar. 2014.
- [175] K. Tenra. Practice of the programming education using arduino and the class support system. In *22nd International Conference on Computers in Education, ICCE 2014*, pages 969–974, 2014.
- [176] L. Tkáĉ, M. Kostelníkovã, and M. Ožvoldová. The characteristics of dc source as a part of integrated e-learning in electricity. In *2013 International Conference on Interactive Collaborative Learning (ICL)*, pages 246–250, Sept. 2013.

- [177] G. Tremberger Jr., R. Armendariz, H. Takai, T. Holden, S. Austin, L. Johnson, P. Marchese, D. Lieberman, and T. Cheung. Applications of arduino microcontroller in student projects in a community college. In *ASEE Annual Conference and Exposition*, 2012.
- [178] T. Tseng, R. Hemsley, and M. Resnick. Replay: A self-documenting construction kit. In *11th International Conference on Interaction Design and Children*, IDC '12, pages 320–322, New York, NY, USA, 2012. ACM.
- [179] C. Turley and M. Alessandra Montironi. Programming arduino boards with the c/c++ interpreter ch. In *ASME Design Engineering Technical Conference*, volume 9, 2015. cited By 0.
- [180] D. Ursutiu, C. Samoila, and J. Bergmans. TEMPUS ico-op, new trends in Lab-VIEW - MOODLE integration. In *2014 International Conference on Interactive Collaborative Learning, ICL 2014*, pages 685–688, 2015.
- [181] D. Ursutiu, C. Samoila, and V. Jinga. Creative developments in LabVIEW student training: (creativity laboratory LabVIEW academy). In *4th Experiment at International Conference: Online Experimentation, exp. at 2017*, pages 309–312, 2017.
- [182] F. A. Vaz, J. L. d. S. Silva, and R. S. d. Santos. Kinardcar: Auxiliary game in formation of young drivers, utilizing kinect and arduino integration. In *2014 XVI Symposium on Virtual and Augmented Reality*, pages 139–142, May 2014.
- [183] J. Verveckken, F. Geth, B. Hunyadi, J. Beerten, N. Leemput, J. V. Roy, P. Tielens, V. D. Smedt, S. Iacovella, N. Koolen, H. D. Clercq, J. Driesen, G. Gielen, R. Puers, J. Vandewalle, S. V. Huffel, R. Belmans, G. Deconinck, and W. Dehaene. Developing engineering-oriented educational workshops within a student branch. In *Eurocon 2013*, pages 933–940, July 2013.
- [184] M. Virnes. Robotics in special needs education. In *7th International Conference on Interaction Design and Children*, IDC '08, pages 29–32, New York, NY, USA, 2008. ACM.
- [185] M. Vizner and A. Strawhacker. Curious construction kit: A programmable building kit for early childhood. In *Proceedings of the 6th Annual Conference on Creativity and Fabrication in Education*, FabLearn '16, pages 90–93, New York, NY, USA, 2016. ACM.
- [186] W. Walter and T. Southerton. Teaching robotics by building autonomous mobile robots using the arduino. In *ASEE Annual Conference and Exposition*, 2014.
- [187] D. Wang, L. Zhang, Y. Qi, and F. Sun. A tui-based programming tool for children. In *Proceedings of the 2015 ACM Conference on Innovation and Technol-*

- *ogy in Computer Science Education*, ITiCSE '15, pages 219–224, New York, NY, USA, 2015. ACM.
- [188] M. P. Weller, E. Y.-L. Do, and M. D. Gross. Escape machine: Teaching computational thinking with a tangible state machine game. In *7th International Conference on Interaction Design and Children*, IDC '08, pages 282–289, New York, NY, USA, 2008. ACM.
- [189] M. P. Weller, E. Y.-L. Do, and M. D. Gross. Posey: Instrumenting a poseable hub and strut construction toy. In *2nd International Conference on Tangible and Embedded Interaction*, TEI '08, pages 39–46, New York, NY, USA, 2008. ACM.
- [190] M. P. Weller, E. Y.-L. Do, and M. D. Gross. State machines are child's play: Observing children ages 9 to 11 playing escape machine. In *8th International Conference on Interaction Design and Children*, IDC '09, pages 170–173, New York, NY, USA, 2009. ACM.
- [191] K.-J. Wu, M. D. Gross, and M. Baskinger. Giffi: A gift for future inventors. In *Sixth International Conference on Tangible, Embedded and Embodied Interaction*, TEI '12, pages 335–336, New York, NY, USA, 2012. ACM.
- [192] W. S. Yoo, S. R. Pattaparla, and S. A. Shaik. Curriculum development for computing education academy to enhance high school students' interest in computing. In *2016 IEEE Integrated STEM Education Conference (ISEC)*, pages 282–284, Mar. 2016.
- [193] B. Yulianto, R. Layona, and L. Dewi. A low-cost wireless multi-presentation on single screen in classroom using raspberry pi. *International Journal of Web-Based Learning and Teaching Technologies*, 12(3):23–33, 2017.
- [194] K. Zachariadou, K. Yiasemides, and N. Trougkakos. A low-cost computer-controlled arduino-based educational laboratory system for teaching the fundamentals of photovoltaic cells. *European Journal of Physics*, 33(6):1599–1610, 2012.
- [195] S. Ziaeefard, B. Page, L. Knop, G. Ribeiro, M. Miller, M. Rastgaar, and N. Mahmoudian. GUPPIE program a hands-on STEM learning experience for middle school students. In *Frontiers in Education Conference, FIE*, volume 2017-October, pages 1–8, 2017.
- [196] K. R. Zodrow, V. H. Coulter, E. Shaulsky, and M. Elimelech. Low flow data logger in membrane distillation: An interdisciplinary laboratory in process control. In *Fourth Interdisciplinary Engineering Design Education Conference*, pages 70–73, Mar. 2014.
- [197] I. A. Zualkernan. Infocoral: Open-source hardware for low-cost, high-density concurrent simple response ubiquitous systems. In *11th IEEE International Conference on Advanced Learning Technologies*, pages 638–639, July 2011.

K12

- [198] M. Abdelrahman, M. Salem, and M. Nijim. Towards an integrated Hardware And SOftware Book (HASOB). In *ASEE Annual Conference and Exposition, Conference Proceedings*, volume 12, 2015.
- [199] L. Abrams, J. Altschuld, B. Lilly, and D. Mendelsohn. Introduction to mechanical engineering: A course in progress. In *ASEE Annual Conference and Exposition*, volume 9, pages 25.833–25.852, 2012.
- [200] M. Ali, J. H. A. Vlaskamp, N. N. Eddin, B. Falconer, and C. Oram. Technical development and socioeconomic implications of the Raspberry Pi as a learning tool in developing countries. In *5th Computer Science and Electronic Engineering Conference (CEEC)*, pages 103–108, Sept. 2013.
- [201] D. Amaxilatis and V. Georgitzikis. *Using Codebender and Arduino in science and education*. Springer International, 2014.
- [202] K. Asato, K. Asato, T. Nagado, and S. Tamaki. Development of low cost educational material for learning fundamentals of mechatronics. In *International Conference on Intelligent Informatics and Biomedical Sciences (ICIIBMS)*, pages 454–456, Nov. 2015.
- [203] T. Baden, A. M. Chagas, G. Gage, T. Marzullo, L. L. Prieto-Godino, and T. Euler. Open Labware: 3-D Printing Your Own Lab Equipment. *PLOS Biology*, 13(5):1–12, 2015.
- [204] S. Baker, S. Dekov, F. Fakih, J. Medvesek, V. Shum, and D. Mohamedally. Supporting Situated STEM Learning: TouchDevelop Integration of the UCL Engduino over Bluetooth. In *Proceedings of the 2Nd Workshop on Programming for Mobile and Touch*, PROMOTO '14, pages 17–20, New York, NY, USA, 2014. ACM.
- [205] E. Brunvand, J. G. R. Alford, and P. Stout. Drawing machines: Exploring embedded system programming and hardware with an artistic flair (abstract only). In 44th ACM Technical Symposium on Computer Science Education, SIGCSE '13, pages 766–766, New York, NY, USA, 2013. ACM.
- [206] L. Buechley. Lilypad arduino: Rethinking the materials and cultures of educational technology. In *9th International Conference of the Learning Sciences Volume 2*, ICLS '10, pages 127–128. International Society of the Learning Sciences, 2010.
- [207] L. Buechley and B. M. Hill. Lilypad in the wild: How hardware's long tail is supporting new engineering and design communities. In *8th ACM Conference*

- on Designing Interactive Systems, DIS '10, pages 199–207, New York, NY, USA, 2010. ACM.
- [208] R. Burbaite and K. Bespalova. Model-driven processes and tools to design glo for cs education. In *2014 International Symposium on Computers in Education (SIIE)*, pages 139–144, Nov. 2014.
- [209] R. Burbaite, K. Bespalova, R. Damaevicius, and V. tuikys. Context-aware generative learning objects for teaching computer science. *International Journal of Engineering Education*, 30(4):929–936, 2014.
- [210] A. Calderon, J. Griffin, and J. Zagal. Beammaker: An open hardware high-resolution digital fabricator for the masses. *Rapid Prototyping Journal*, 20(3):245–255, 2014.
- [211] S. Chaklader, J. Alam, M. Islam, and A. S. Sabbir. Bridging digital divide: Village wireless lan, a low cost network infrastructure solution for digital communication, information dissemination amp; education in rural bangladesh. In *2nd International Conference on Advances in Electrical Engineering (ICAEE)*, pages 277–281, Dec. 2013.
- [212] B. Chowdhury, S. Blanchard, K. Cameron, and A. Johri. SeeMore: An interactive kinetic sculpture designed to teach parallel computational thinking. In *ASEE Annual Conference and Exposition*, volume 12, 2015.
- [213] S. M. Cisar, R. Pinter, V. Vojnic, V. Tumbas, and P. Cisar. Smartphone application for tracking students' class attendance. In *2016 IEEE 14th International Symposium on Intelligent Systems and Informatics (SISY)*, pages 227–232, Aug. 2016.
- [214] F. Cuomo, E. Mibuari, K. Weldemariam, and O. Stewart. Leveraging raspberry pi for interactive education. In *4th Annual Symposium on Computing for Development*, ACM DEV-4 '13, pages 16:1–16:2, 2013.
- [215] B. De Carolis, S. Ferilli, and G. Mallardi. Learning and recognizing routines and activities in sofia. *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, 8850:191–204, 2014.
- [216] J. de Lima, L. Carlos, J. Schardosim Simão, J. Pereira, P. Mafra, and J. da Silva. Design and implementation of a remote lab for teaching programming and robotics. *IFAC-PapersOnLine*, 49(30):86–91, 2016.
- [217] F. H. T. Destro, R. Costa, and F. Iaione. A low-cost system for experiments with digital circuits. In *2015 IEEE Frontiers in Education Conference (FIE)*, pages 1–6, Oct. 2015.

- [218] N. Dittert. Techsportiv: Constructing objects-to-think-with for physical education. In *Proceedings of the 8th Nordic Conference on Human-Computer Interaction: Fun, Fast, Foundational*, NordiCHI '14, pages 569–577, New York, NY, USA, 2014. ACM.
- [219] G. Drayer and A. Howard. Evaluation of an introductory embedded systems programming tutorial using hands-on learning methods. In *ASEE Annual Conference and Exposition, Conference Proceedings*, 2014.
- [220] C. Fernando, J. Rod, D. S. Eisner, and M. Cordero. Ikimo: Open entry-level robotics platform. In *ACM SIGGRAPH 2012 Posters*, SIGGRAPH '12, pages 41:1–41:1, New York, NY, USA, 2012. ACM.
- [221] R. Ferreira, J. Nacif, S. Magalhaes, T. de Almeida, and R. Pacifico. Be a simulator developer and go beyond in computing engineering. In *2015 IEEE Frontiers in Education Conference (FIE)*, pages 1–8, Oct. 2015.
- [222] V. D. Gadhave and S. N. Kore. Portable attendance system integrated with learning management system like moodle. In *2016 IEEE International Conference on Recent Trends in Electronics, Information Communication Technology (RTEICT)*, pages 2042–2046, May 2016.
- [223] A. A. Galadima. Arduino as a learning tool. In 2014 11th International Conference on Electronics, Computer and Computation (ICECCO), pages 1-4, Sept. 2014.
- [224] C. Galeriu. An arduino-controlled photogate. *Physics Teacher*, 51(3):156–158, 2013.
- [225] C. Galeriu, S. Edwards, and G. Esper. An arduino investigation of simple harmonic motion. *Physics Teacher*, 52(3):157–159, 2014.
- [226] M. M. Garcillanosa, N. T. K. Apuyan, A. M. Arro, and G. G. Ascan. Audio-assisted standalone microcontroller-based braille system tutor for grade 1 braille symbols. In *2016 IEEE Advanced Information Management, Communicates, Electronic and Automation Control Conference (IMCEC)*, pages 439–442, Oct. 2016.
- [227] A. Garrigos, D. Marroqui, J. Blanes, R. Gutierrez, I. Blanquer, and M. Canto. Designing arduino electronic shields: Experiences from secondary and university courses. In *IEEE Global Engineering Education Conference, EDUCON*, pages 934–937, 2017.
- [228] W. Gay. Mastering the raspberry pi. Apress, 2014.
- [229] M. Goadrich. Incorporating tangible computing devices into cs1. *J. Comput. Sci. Coll.*, 29(5):23–31, May 2014.

- [230] C. Gregg, R. Duvall, and K. Wasynczuk. A modern wearable devices course for computer science undergraduates. In *ACM SIGCSE Technical Symposium on Computer Science Education*, SIGCSE '17, pages 255–260, New York, NY, USA, 2017. ACM.
- [231] S. D. Guler and M. E. Rule. Invent-abling: Enabling inventiveness through craft. In *12th International Conference on Interaction Design and Children*, IDC '13, pages 368–371, 2013.
- [232] V. Harini, M. Dharani, K. Balaji, and S. Pandian. Robots for the bottom of the pyramid: Mobile robot racing over the internet. In *IEEE Region 10 Annual International Conference, Proceedings/TENCON*, pages 751–755, 2017.
- [233] A. Hassan, U. Ghani, F. Riaz, S. Rehman, M. Jochumsen, D. Taylor, and I. Niazi. Using a portable device for online single-trial mrcp detection and classification. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), 9375:527–534, 2015.
- [234] X. Henry, L. Zhang, A. Nagchaudhuri, M. Mitra, C. Hartman, C. Toney, and A. Ayokunle. Experiential learning framework for design and development of environmental data acquisition system enhances student learning in undergraduate engineering courses. In *ASEE Annual Conference and Exposition*, 2015.
- [235] A. Hernandez-Barrera. Teaching introduction to robotics: Using a blend of problem- and project-based learning approaches. In *IEEE SOUTHEASTCON 2014*, pages 1–5, Mar. 2014.
- [236] L. Hill and S. Ciccarelli. Using a low-cost open source hardware development platform in teaching young students programming skills. In *14th Annual ACM SIGITE Conference on Information Technology Education*, SIGITE '13, pages 63–68, New York, NY, USA, 2013. ACM.
- [237] G. Hloupis, V. Bimpikas, I. Stavrakas, K. Moutzouris, C. Stergiopoulos, and D. Triantis. Developing open source dataloggers for inquiry learning. In *CSEDU 2014 -6th International Conference on Computer Supported Education*, volume 1, pages 555–562, 2014.
- [238] J. Holz, T. Leonhardt, and U. Schroeder. Using smartphones to motivate secondary school students for informatics. In 11th Koli Calling International Conference on Computing Education Research, Koli Calling '11, pages 89–94, New York, NY, USA, 2011. ACM.
- [239] J. J. Y. Hwan, W. C. Chia, L. S. Yeong, and S. I. Ch'ng. Online and offline electronic question and answer system: Quick question. In *2016 11th International Conference on Computer Science Education (ICCSE)*, pages 228–233, Aug. 2016.

- [240] Y. Kato. Splish: A visual programming environment for arduino to accelerate physical computing experiences. In *Eighth International Conference on Creating, Connecting and Collaborating through Computing*, pages 3–10, Jan. 2010.
- [241] G. Kim and B. Lee. A study on the interaction globe system using physical computing. In *IEEE International Conference on Consumer Electronics, Berlin*, pages 124–126, Sept. 2011.
- [242] M. Kovalčik, R. Vápeník, P. Fecil'ak, and F. Jakab. Smart home control module as IOT/IOE learning. In *2015 13th International Conference on Emerging eLearning Technologies and Applications (ICETA)*, pages 1–6, Nov. 2015.
- [243] K. Kozak. Creating ideas into reality: Spaces and programs that open up the imagination. In *ASEE Annual Conference and Exposition, Conference Proceedings*, 2017.
- [244] J. P. C. Lima, J. P. S. Simño, I. N. Silva, P. C. Nicolete, J. B. Silva, and J. B. M. Alves. An inclined plane remote lab. In *2016 13th International Conference on Remote Engineering and Virtual Instrumentation (REV)*, pages 7–9, Feb. 2016.
- [245] C. Lindsay, R. Lee, M. Lindsay, M. Edwards, M. Rognstad, and H. Lindsay. Submersible hawaiian aquatic research camera system: Stem initiatives fostering the study of hawaiis marine biota using underwater time-lapse photography. *Marine Technology Society Journal*, 49(4):119–125, 2015.
- [246] E. Lovell and L. Buechley. Lilypond: An online community for sharing e-textile projects. In *8th ACM Conference on Creativity and Cognition*, C&C '11, pages 365–366, New York, NY, USA, 2011. ACM.
- [247] W. Lumpkins and S. Giertz. The evil goat (arduino project) [maker projects]. *IEEE Consumer Electronics Magazine*, 4(3):102–103, 2015.
- [248] K. McCullen. Teaching embedded systems using the raspberry pi and sense hat. *J. Comput. Sci. Coll.*, 32(6):200–202, June 2017.
- [249] J. McDonagh, D. Barker, and R. Alderson. Bringing computational science to the public. *SpringerPlus*, 5(1), 2016.
- [250] M. Mirino, A. Kolodziejczyk, H. Vos, M. Harasymczuk, M. Krainski, and B. Foing. Moon/mars astronauts analogue simulation: Educational project for university and high school. volume 17, pages 11356–11365, 2017. cited By 0.
- [251] P. Molins-Ruano, C. Gonzalez-Sacristan, and C. Garcia-Saura. Phogo: A low cost, free and "maker" revisit to logo. *Computers in Human Behavior*, 2017.

- [252] C. Montero and I. Jormanainen. Theater meets robot Ű toward inclusive STEAM education. *Advances in Intelligent Systems and Computing*, 560:34-40, 2017.
- [253] T. K. Morimoto, P. Blikstein, and A. M. Okamura. [d81] hapkit: An openhardware haptic device for online education. In *2014 IEEE Haptics Symposium* (*HAPTICS*), pages 1–1, Feb. 2014.
- [254] F. A. Mujica, W. J. Esposito, A. Gonzalez, C. R. Qi, C. Vassos, M. Wieman, R. Wilcox, G. T. A. Kovacs, and R. W. Schafer. Teaching digital signal processing with stanford's lab-in-a-box. In *2015 IEEE Signal Processing and Signal Processing Education Workshop (SP/SPE)*, pages 307–312, Aug. 2015.
- [255] G. Mullett. Smart, connected, and autonomous automobiles the impact on two-year college technical education. In *ASEE Annual Conference and Exposition*, volume June, 2017.
- [256] N. Muthupalaniappan, A. Maruthupandi, S. Pandian, A. J. P. Antony, and S. R. Pandian. A low-cost web-based learning platform for cnc machining education. In *2014 Sixth International Conference on Advanced Computing (ICoAC)*, pages 91–96, Dec. 2014.
- [257] D. Overholt and N. D. Møbius. Embedded audio without beeps: Synthesis and sound effects from cheap to steep. In *8th International Conference on Tangible, Embedded and Embodied Interaction*, TEI '14, pages 361–364, New York, NY, USA, 2013. ACM.
- [258] T. Page and K. Badni. An evaluation of learning resources in support of integrated interaction and electronic product design. In *12th International Conference on Engineering and Product Design Education*, pages 160–165, 2010.
- [259] S.-H. Park, W.-H. Kim, and S.-H. Seo. Development of the educational arduino module using the helium gas airship. *Modern Physics Letters B*, 29(6-7), 2015.
- [260] A. J. Parkes, H. S. Raffle, and H. Ishii. Topobo in the wild: Longitudinal evaluations of educators appropriating a tangible interface. In *SIGCHI Conference on Human Factors in Computing Systems*, CHI '08, pages 1129–1138, New York, NY, USA, 2008. ACM.
- [261] N. Pereira. Measuring the rc time constant with arduino. *Physics Education*, 51(6), 2016.
- [262] F. Philipp and M. Glesner. High-level abstraction for teaching smart systems design with modular hardware. In *10th European Workshop on Microelectronics Education (EWME)*, pages 146–150, May 2014.
- [263] A. J. Pigford. alphabot workshop: Constructing robots, translating language. In ACM SIGGRAPH 2014 Studio, SIGGRAPH '14, pages 28:1–28:2, New York, NY, USA, 2014. ACM.

- [264] B. Pirtle, C. Davis, and J. Ruyle. Innovative engineering outreach: Capacitive touch sensor workshop. In *ASEE Annual Conference and Exposition*, 2014.
- [265] J. Post. A near-space research experience for high school students. In *ASEE Annual Conference and Exposition*, volume June, 2017.
- [266] G. Real, L. Raviola, M. F. Jaure, and A. O. Vitali. Data acquisition system for didactic laboratories based on open-source hardware and free software. In 2015 XVI Workshop on Information Processing and Control (RPIC), pages 1–6, Oct. 2015.
- [267] D. Reimann. *Smart textile as a creative environment to engage girls in technology.* IGI Global, 2015.
- [268] M. Repka, R. Danel, and Z. Neustupa. Use of the bioloid robotic kit in the teaching of automation and programming languages. In 12th International Multidisciplinary Scientific GeoConference and EXPO Modern Management of Mine Producing, Geology and Environmental Protection, SGEM 2012, volume 3, pages 1229–1236, 2012.
- [269] W. Rochadel, S. P. da Silva, J. B. da Silva, T. D. Luz, and G. R. Alves. Utilization of remote experimentation in mobile devices for education. In *2012 IEEE Global Engineering Education Conference (EDUCON)*, pages 1–6, Apr. 2012.
- [270] C. Salis, F. Murgia, M. F. Wilson, and A. Mameli. Iot-desir: A case study on a cooperative learning experiment in sardinia. In *2015 International Conference on Interactive Collaborative Learning (ICL)*, pages 785–792, Sept. 2015.
- [271] C. Santos, D. Ferreira, M. De Souza, and A. Martins. Robotics and programming: Attracting girls to technology. In *International Conference on Advances in Computing, Communications and Informatics, ICACCI 2016*, pages 2052–2056, 2016.
- [272] O. C. Santos, R. Uria-Rivas, M. C. Rodriguez-Sanchez, and J. G. Boticario. An open sensing and acting platform for context-aware affective support in ambient intelligent educational settings. *IEEE Sensors Journal*, 16(10):3865–3874, May 2016.
- [273] R. R. Santos. Open hardware platforms in a first course of the computer engineering undergraduate program. In *2014 IEEE Frontiers in Education Conference (FIE) Proceedings*, pages 1–7, Oct. 2014.
- [274] C. Schelly, G. Anzalone, B. Wijnen, and J. Pearce. Open-source 3-d printing technologies for education: Bringing additive manufacturing to the classroom. *Journal of Visual Languages and Computing*, 28:226–237, 2015.
- [275] D. Sharma, D. Verma, and P. Khetarpal. Labview based sign language trainer cum portable display unit for the speech impaired. In *2015 Annual IEEE India Conference (INDICON)*, pages 1–6, Dec. 2015.

- [276] R. Sheh, H. Komsuoglu, and A. Jacoff. The open academic robot kit: Lowering the barrier of entry for research into response robotics. In *2014 IEEE International Symposium on Safety, Security, and Rescue Robotics (2014)*, pages 1–6, Oct. 2014.
- [277] S. Shrestha, J. P. T. Moore, and J. Abdelnour-Nocera. Offline mobile learning: Open platforms for ict4d. In *10th IEEE International Conference on Advanced Learning Technologies*, pages 703–704, July 2010.
- [278] I. Sieber, G. Perner, and U. Gengenbach. Concept and set-up of an ir-gas sensor construction kit. In *SPIE The International Society for Optical Engineering*, volume 9793, 2015.
- [279] S. Silva, S. Soares, A. Valente, and S. T. Marcelino. Digital sound processing using arduino and matlab. In *2015 Science and Information Conference (SAI)*, pages 1184–1191, July 2015.
- [280] J. P. S. Simao, J. P. C. Lima, C. Heck, K. Coelho, L. M. Carlos, S. M. S. Bilessimo, and J. B. Silva. A remote lab for teaching mechanics. In *2016 13th International Conference on Remote Engineering and Virtual Instrumentation (REV)*, pages 176–182, Feb. 2016.
- [281] D. Sirkin, N. Martelaro, and W. Ju. Make this!: Introduction to electronics prototyping using arduino. In *Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems*, CHI EA '16, pages 980–983, New York, NY, USA, 2016. ACM.
- [282] A. Soriano, L. Marin, M. Valles, A. Valera, and P. Albertos. Low cost platform for automatic control education based on open hardware. In *IFAC Proceedings Volumes (IFAC-PapersOnline)*, volume 19, pages 9044–9050, 2014.
- [283] C. Speed, L. Pschetz, J. Oberlander, and A. Papadopoulos-Korfiatis. Dancing robots. In *8th International Conference on Tangible, Embedded and Embodied Interaction*, TEI '14, pages 353–356, New York, NY, USA, 2013. ACM.
- [284] G. Spivey. The chirps prototyping system. In *ASEE Annual Conference and Exposition*, 2011.
- [285] N. Sprague. Arduino as a platform for a computer organization course. *J. Comput. Sci. Coll.*, 28(3):53–60, Jan. 2013.
- [286] T. Suzuki, M. Kobayashi, and Y. Nagashima. Vibration ring device which supports deaf students to learn how to use illustrator szcat: Synchronized click action transmitter. *Communications in Computer and Information Science*, 713:192–197, 2017.
- [287] T. Szepe, S. Toth, and Z. Gingl. Compact flexible router based remote experimenting system. In *36th International Convention on Information and*

- Communication Technology, Electronics and Microelectronics (MIPRO), pages 671-675, May 2013.
- [288] S. L. Toral, F. Barrero, F. Cortñs, J. M. Hionojo, and D. G. Reina. A new systemic methodology for lab learning based on a cooperative learning project. In *IEEE EDUCON Conference*, pages 317–320, Apr. 2010.
- [289] Y. Torroja, A. López, J. Portilla, and T. Riesgo. A serial port based debugging tool to improve learning with arduino. In *2015 Conference on Design of Circuits and Integrated Systems (DCIS)*, pages 1-4, Nov. 2015.
- [290] M. Turner and T. Cooley. A low-cost and flexible open-source inverted pendulum for feedback control laboratory courses. In *ASEE Annual Conference and Exposition*, 2015.
- [291] H. Vasquez and A. Fuentes. Integration of sensors and low-cost microcontrollers into the undergraduate mechanical engineering design sequence. In *ASEE Annual Conference and Exposition*, 2013.
- [292] J. Vervaeke, J. Ameye, S. van Esch, J. Saldien, and S. Verstockt. Arcaid interactive archery assistant. In *2015 7th International Conference on Intelligent Technologies for Interactive Entertainment (INTETAIN)*, pages 4–8, June 2015.
- [293] J. Vihervaara and T. Alapaholuoma. Internet of Things: Opportunities for vocational education and training: Presentation of the pilot project. In *International Conference on Computer Supported Education, CSEDU*, volume 1, pages 476–480, 2017.
- [294] M. Vona and S. NH. Teaching robotics software with the open hardware mobile manipulator. *IEEE Transactions on Education*, 56(1):42–47, Feb. 2013.
- [295] K. Watanabe and N. Iguchi. Development of equipment for experimental studying of networking technologies for junior and senior high schools. In 2014 Eighth International Conference on Complex, Intelligent and Software Intensive Systems, pages 628–630, July 2014.
- [296] E. Weilemann, P. Brune, and D. Meyer. Geek toys for non-techies? using robots in introductory programming courses for computer science non-majors. In *2016 49th Hawaii International Conference on System Sciences (HICSS)*, pages 31–40, Jan. 2016.
- [297] J. West, N. Vadiee, A. McMahon, K. Lake, B. Ray, and T. Billie. From classroom arduinos to missions on mars: Making stem education accessible and effective through remotely operated robotics. In *IEEE Integrated STEM Education Conference (ISEC)*, pages 88–95, Mar. 2017.

- [298] T. Winkler, M. Ide, C. Wolters, and M. Herczeg. Wewrite: 'on-the-fly' interactive writing on electronic textiles with mobile phones. In *8th International Conference on Interaction Design and Children*, IDC '09, pages 226–229, New York, NY, USA, 2009. ACM.
- [299] N. Wong and H. H. Cheng. Cpsbot: A low-cost reconfigurable and 3d-printable robotics kit for education and research on cyber-physical systems. In *2016* 12th IEEE/ASME International Conference on Mechatronic and Embedded Systems and Applications (MESA), pages 1–6, Aug. 2016.
- [300] B. Yang, M. Patsavas, R. Byrne, and J. Ma. Seawater ph measurements in the field: A diy photometer with 0.01 unit ph accuracy. *Marine Chemistry*, 160:75–81, 2014.
- [301] M. C. Yip and J. Forsslund. Spurring innovation in spatial haptics: How open-source hardware can turn creativity loose. *IEEE Robotics Automation Magazine*, 24(1):65–76, Mar. 2017.

K12-University

- [302] A. Abouhilal, A. Taj, M. Mejdal, and A. Malaoui. Design of a remote experience for electrical engineering using embedded systems. In *ACM International Conference Proceeding Series*, 2017.
- [303] F. Adamo, F. Attivissimo, G. Cavone, C. G. C. n. Carducci, and A. M. L. Lanzolla. New technologies and perspectives for laboratory practices in measurement science. In *2015 IEEE International Instrumentation and Measurement Technology Conference (I2MTC) Proceedings*, pages 1–6, May 2015.
- [304] A. M. Al-Busaidi. Development of an educational environment for online control of a biped robot using matlab and arduino. In *Mechatronics (MECATRONICS)*, 2012 9th France-Japan 7th Europe-Asia Congress on Research and Education in Mechatronics (REM), 2012 13th Int'l Workshop on, pages 337–344, Nov. 2012.
- [305] A. Albayrak, M. Albayrak, and R. Bayir. Design of matlab/simulink based development board for fuzzy logic education. In *2015 IEEE International Conference on Fuzzy Systems (FUZZ-IEEE)*, pages 1–7, Aug. 2015.
- [306] J. Albo-Canals, M. Garcia-Casulleras, D. de Cordoba, X. Canaleta, and E. Gonzalez-Dachs. The educational robotic platform Ismaker ev1: Standardization vs customization. In *2014 9th Iberian Conference on Information Systems and Technologies (CISTI)*, pages 1–5, June 2014.

- [307] M. Ali, N. Azlan, and K. Safian. Development of low-cost robotic hands for introduction to mechatronics engineering courses. *ARPN Journal of Engineering and Applied Sciences*, 11(10):6222–6227, 2016.
- [308] O. Alsos. Teaching product design students how to make everyday things interactive with arduino. In *CEUR Workshop Proceedings*, volume 1450, pages 7–14, 2015.
- [309] A. Altadmri, N. C. Brown, and M. Kölling. Using bluej to code java on the raspberry pi. In *Proceedings of the 46th ACM Technical Symposium on Computer Science Education*, SIGCSE '15, pages 178–178, New York, NY, USA, 2015. ACM.
- [310] S. Analytis, J. Sadler, and M. Cutkosky. Paper robot: A design activity to increase beginner's prototyping confidence with microcontrollers. In *3rd International Conference on Design Creativity, Indian Institute of Science, Bangalore*, pages 200–208, 2015.
- [311] S. Analytis, J. Sadler, and M. Cutkosky. Creating paper robots increases designers' confidence to prototype with microcontrollers and electronics. *International Journal of Design Creativity and Innovation*, 5(1-2):48–59, 2017.
- [312] G. C. Anzalone, A. G. Glover, and J. M. Pearce. Open-source colorimeter. *Sensors*, 13(4):5338–5346, 2013.
- [313] W. Aprile and A. Van Der Helm. Interactive technology design at the delft university of technology a course about how to design interactive products. In *13th International Conference on Engineering and Product Design Education*, pages 553–558, 2011.
- [314] P. Aradi. Offline and online thermostat experiment with labview and arduino. In 2016 International Symposium on Small-scale Intelligent Manufacturing Systems (SIMS), pages 127–131, June 2016.
- [315] A. Araujo, D. Portugal, M. S. Couceiro, and R. P. Rocha. Integrating arduino-based educational mobile robots in ros. In *13th International Conference on Autonomous Robot Systems*, pages 1–6, Apr. 2013.
- [316] J. A. Ariza. A proposal for teaching programming languages through open hardware tools. In *IEEE 8th International Conference on Engineering Education (ICEED)*, pages 202–207, Dec. 2016.
- [317] J. Arrizabalaga, A. Simmons, and M. Nollert. Fabrication of an Economical Arduino-Based Uniaxial Tensile Tester. *Journal of Chemical Education*, 94(4):530–533, 2017.
- [318] H. Asraf, K. Nur Dalila, A. Muhammad Hakim, and R. Muhammad Faizzuan Hon. Development of experimental simulator via arduino-based pid temperature control system using labview. *Journal of Telecommunication, Electronic and Computer Engineering*, 9(1-5):53–57, 2017.

- [319] D. Assante and C. Fornaro. Involving graduating engineers in applying a commercial brain computer interface to motorized wheelchair driving. In *2015 IEEE Global Engineering Education Conference (EDUCON)*, pages 446–452, Mar. 2015.
- [320] D. Assante and M. Tronconi. Photovoltaic system as a remote didactic laboratory for electrical engineering courses. *International Journal of Interactive Mobile Technologies*, 11(4):39–46, 2015.
- [321] D. Assante and M. Tronconi. A remotely accessible photovoltaic system as didactic laboratory for electrical engineering courses. In *2015 IEEE Global Engineering Education Conference (EDUCON)*, pages 479–485, Mar. 2015.
- [322] A. Atabekov, J. He, and P. O. Bobbie. Internet of things-based framework to facilitate indoor localization education. In *IEEE 40th Annual Computer Software and Applications Conference (COMPSAC)*, volume 2, pages 269–274, June 2016.
- [323] R. Balasubramanian, Z. York, M. Doran, A. Biswas, T. Girgin, and K. Sankaralingam. Hands-on introduction to computer science at the freshman level. In *Proceedings of the 45th ACM Technical Symposium on Computer Science Education*, SIGCSE '14, pages 235–240, New York, NY, USA, 2014. ACM.
- [324] P. Bansal, R. Latinovich, T. Lazar, P. McGee, and D. Brylow. Xinupi3: Teaching multicore concepts using embedded xinu. pages 20–25, 2017. cited By 0.
- [325] E. Barba and S. Chancellor. Tangible media approaches to introductory computer science. In *Proceedings of the 2015 ACM Conference on Innovation and Technology in Computer Science Education*, ITiCSE '15, pages 207–212, New York, NY, USA, 2015. ACM.
- [326] M. Barbulescu, M. Marinescu, V. Marinescu, O. Grigoriu, G. Neculoiu, V. Sandulescu, and I. Halcu. Gnu gpl in studying programs from the systems engineering field. In *RoEduNet International Conference 10th Edition: Networking in Education and Research*, pages 1–4, June 2011.
- [327] C. I. C. Bareno. Teaching/learning methods for embedded systems using copyleft hardware. *IEEE Latin America Transactions*, 9(4):503–509, July 2011.
- [328] S. Barrett, J. Anderson, and M. Love. Robots! introduction to engineering and computer science. In *ASEE Annual Conference and Exposition*, New Orleans, LA, USA, 2016.
- [329] L. Baumstark. A combat robotics course: Programming meets computer-aided design and fabrication (abstract only). In *44th ACM Technical Symposium on Computer Science Education*, SIGCSE '13, pages 729–729, New York, NY, USA, 2013. ACM.

- [330] C. J. Bay and B. P. Rasmussen. Exploring controls education: A re-configurable ball and plate platform kit. In *American Control Conference (ACC)*, pages 6652–6657, Boston, MA, USA, July 2016.
- [331] E. Bear, T. Maxwell, T. Anglea, D. Raval, I. Buckley, and Y. Wang. An undergraduate research platform for cooperative control and swarm robotics. In *IEEE 11th Conference on Industrial Electronics and Applications (ICIEA)*, pages 1876–1879, Hefei, China, June 2016.
- [332] G. Berisch, H. Donath, F. Heinrich, I. Huebener, T. Lipke, T. Mende, M. Schriefer, H. Schulte, and M. Zajac. Design and development of a low cost rapid control prototyping system applied to an air suspension system. In *IFAC Proceedings Volumes (IFAC-PapersOnline)*, volume 9, pages 194–199, 2012.
- [333] J. Bermudez-Ortega, E. Besada-Portas, J. Lpez-Orozco, J. Bonache-Seco, and J. Cruz. Remote web-based control laboratory for mobile devices based on ejss, raspberry pi and node.js. *IFAC-PapersOnLine*, 48(29):158–163, 2015.
- [334] C. Berry, D. Chang, and C. Miller. From lego to arduino: Enhancement of ece freshman design with practical applications. In *ASEE Annual Conference and Exposition*, volume 2016-June, New Orleans, LA, USA, 2016.
- [335] J. Bishop. BYOE: A low-cost material testing machine to increase engagement in a materials science lab course. In *ASEE Annual Conference and Exposition, Conference Proceedings*, volume June, 2017.
- [336] M. Black. Export to arduino: A tool to teach processor design on real hardware. *Journal of Computer Science and Technology*, 31(6):21–26, June 2016.
- [337] Z. Bogdanovic, K. Simic, M. Milutinovic, B. Radenkovic, and M. Despotovic-Zrakic. A platform for learning internet of things. In *Proceedings of the International Conference e-Learning 2014 Part of the Multi Conference on Computer Science and Information Systems, MCCSIS 2014*, pages 259–266, 2014.
- [338] D. Bolanakis, A. Rachioti, and E. Glavas. Nowadays trends in microcontroller education: Do we educate engineers or electronic hobbyists? recommendation on a multi-platform method and system for lab training activities. In *IEEE Global Engineering Education Conference, EDUCON*, pages 73–77, 2017.
- [339] K. Bougot-Robin, J. Paget, S. Atkins, and J. Edel. Optimization and design of an absorbance spectrometer controlled using a raspberry pi to improve analytical skills. *Journal of Chemical Education*, 93(7):1232–1240, 2016.
- [340] F. Bouquet, J. Bobroff, M. Fuchs-Gallezot, and L. Maurines. Project-based physics labs using low-cost open-source hardware. *American Journal of Physics*, 85(3):216–222, 2017. cited By 3.

- [341] C. BouSaba, T. Kazar, and W. Pizio. Wireless network security using raspberry pi. In *ASEE Annual Conference and Exposition*, volume 2016-June, New Orleans, LA, 2016.
- [342] C. Brady, D. Weintrop, K. Gracey, G. Anton, and U. Wilensky. The ccl-parallax programmable badge: Learning with low-cost, communicative wearable computers. In *Proceedings of the 16th Annual Conference on Information Technology Education*, SIGITE '15, pages 139–144, New York, NY, USA, 2015. ACM.
- [343] F. Braghin and S. Cinquemani. Mechatronics capacity building in tanzania. *International Journal of Engineering Research and Technology*, 10(2):165–176, 2017. cited By 0.
- [344] E. A. Brand, W. L. Honig, and M. Wojtowicz. Intelligent systems development in a non engineering curriculum. In *16th Annual Joint Conference on Innovation and Technology in Computer Science Education*, ITiCSE '11, pages 48–52, New York, NY, USA, 2011. ACM.
- [345] J. Brey, D. Mizzy, and R. Goldberg. A maker-in-residence program to build a community of makers. In *ASEE Annual Conference and Exposition*, volume 14, 2017.
- [346] J. D. Brock and R. F. Bruce. Sensing the world with a raspberry pi. *J. Comput. Sci. Coll.*, 30(2):174–175, Dec. 2014.
- [347] J. D. Brock, R. F. Bruce, and S. L. Reiser. Using arduino for introductory programming courses. *J. Comput. Sci. Coll.*, 25(2):129–130, Dec. 2009.
- [348] P. Brox, G. Huertas-Sñnchez, A. Lñpez Angulo, M. ñlvarez Mora, and I. Haya. Design of sensory systems using the platform arduino by undergraduate physics students. In *Technologies Applied to Electronics Teaching (TAEE)*, pages 1–6, Seville, Spain, June 2016.
- [349] R. F. Bruce, J. D. Brock, and S. L. Reiser. Make space for the pi. In *IEEE SoutheastCon 2015*, pages 1–6, Fort Lauderdale, Florida, USA, Apr. 2015.
- [350] D. D. Buhl-Brown. Developing a robotics education platform using android based cellbots. In *Proceedings of the 46th ACM Technical Symposium on Computer Science Education*, SIGCSE '15, pages 714–714, New York, NY, USA, 2015. ACM.
- [351] P. Burdziakowski. Evaluation of open drone map toolkit for geodetic grade aerial drone mapping & case study. In *International Multidisciplinary Scientific GeoConference Surveying Geology and Mining Ecology Management, SGEM*, volume 17(23), pages 101–110, 2017.
- [352] A. Butterfield and K. Branch. Results & lessons learned from a chemical engineering freshman design laboratory. In *ASEE Annual Conference and Exposition*, Seattle, WA, USA, 2015.

- [353] J. Byrne, L. Fisher, and B. Tangney. A 21st century teaching and learning approach to computer science education: Teacher reactions. *Communications in Computer and Information Science*, 583:523–540, 2016.
- [354] D. Calinoiu, R. Ionel, M. Lascu, and A. Cioabla. Arduino and labview in educational remote monitoring applications. In *2014 IEEE Frontiers in Education Conference (FIE) Proceedings*, pages 1–5, Oct. 2014.
- [355] F. A. Candelas, G. Garcia, S. Puente, J. Pomares, C. Jara, J. Perez, D. Mira, and F. Torres. Experiences on using arduino for laboratory experiments of automatic control and robotics. *IFAC-PapersOnLine*, 48(29):105–110, 2015.
- [356] F. A. Candelas, S. T. Puente, and F. Torres. Competition benchmarking to design and program mobile robots. In *2016 IEEE Conference on Control Applications (CCA)*, pages 839–844, Sept. 2016.
- [357] J. J. Castañeda, A. F. Ruiz-Olaya, W. Acuña, and A. Molano. A low-cost matlabbased educational platform for teaching robotics. In *2016 IEEE Colombian Conference on Robotics and Automation (CCRA)*, pages 1–6, Sept. 2016.
- [358] M. Cata. Smart university, a new concept in the internet of things. In 2015 14th RoEduNet International Conference Networking in Education and Research (RoEduNet NER), pages 195–197, Sept. 2015.
- [359] R. Chacon, D. Codony, and A. Toledo. From physical to digital in structural engineering classrooms using digital fabrication. *Computer Applications in Engineering Education*, 25(6):927–937, 2017.
- [360] R. Chacon and S. Oller. Designing experiments using digital fabrication in structural dynamics. *Journal of Professional Issues in Engineering Education and Practice*, 143(3), 2017.
- [361] R. Chancharoen, A. Sripakagorn, and K. Maneeratana. An arduino kit for learning mechatronics and its scalability in semester projects. In *2014 IEEE International Conference on Teaching, Assessment and Learning for Engineering (TALE)*, pages 505–510, Dec. 2014.
- [362] C. Chang, Y. Yang, and Y. Tsai. Exploring the engagement effects of visual programming language for data structure courses. *Education for Information*, 33(3):187–200, 2017. cited By 0.
- [363] S. Cheong, I. Chai, and R. Logeswaran. Quick response multimodal learning system with raspberry pi. *Asian Journal of Information Technology*, 15(16):2737–2742, 2016.
- [364] R. Chiou, Y. Ertekin, and T.-L. Tseng. MAKER: Autonomous solar-powered vehicle as a learning tool in robotics and green energy. In *ASEE Annual Conference and Exposition, Conference Proceedings*, volume 13, 2016.

- [365] D. Christensen, J. Larsen, and K. Stoy. Fault-tolerant gait learning and morphology optimization of a polymorphic walking robot. *Evolving Systems*, 5(1):21–32, 2014.
- [366] C. Chui, H.-H. So, and N. Khaing. Wastewater treatment in myanmar: A multidisciplinary learning experience for engineering and science students from two countries. In *2017 ASEE International Forum*, 2017.
- [367] M. F. Cloutier, C. Paradis, and V. M. Weaver. Design and analysis of a 32-bit embedded high-performance cluster optimized for energy and performance. In *Proceedings of the 1st International Workshop on Hardware-Software Co-Design for High Performance Computing*, Co-HPC '14, pages 1–8, Piscataway, NJ, USA, 2014. IEEE Press.
- [368] C. Cohenour. A low-cost control system experiment for engineering technology students. In *ASEE Annual Conference and Exposition, Conference Proceedings*, volume 14, 2017.
- [369] D. Connors, K. Dunn, and R. Bueter. Pycomparch: Python-based modules for exploring computer architecture concepts. In *Proceedings of the Workshop on Computer Architecture Education*, WCAE '15, pages 4:1–4:6, New York, NY, USA, 2015. ACM.
- [370] K. Coonley, K. Manturuk, J. Miles, G. Lipp, C. Lorch, C. Woodard, and M. Brooke. Massive open online laboratories? ongoing work with microelectronics experiments performed outside of the traditional laboratory. In *ASEE Annual Conference and Exposition, Conference Proceedings*, volume 13, 2016.
- [371] A. Coucci, M. Grandinetti, T. Leandro, J. McCusker, and S. Williamson. The design build go universal power hub. In *ASME International Mechanical Engineering Congress and Exposition, Proceedings (IMECE)*, volume 5-2015, 2015.
- [372] G. A. Covington, G. Gibb, J. Naous, J. W. Lockwood, and N. McKeown. Encouraging reusable network hardware design. In *2009 IEEE International Conference on Microelectronic Systems Education*, pages 29–32, July 2009.
- [373] S. Cox, J. Cox, R. Boardman, S. Johnston, M. Scott, and N. O'Brien. Iridis-pi: A low-cost, compact demonstration cluster. *Cluster Computing*, 17(2):349–358, 2014.
- [374] B. G. P. Cunha, S. T. Mendes, P. M. Dutra, T. V. Rodrigues, L. M. Nunes, F. M. F. Machado, and C. A. P. da Silva Martins. Didactronic: A low-cost and portable didactic lab for electronics: Kit for digital and analog electronic circuits. In 2016 IEEE Global Humanitarian Technology Conference (GHTC), pages 296–303, Oct. 2016.

- [375] D. Cuperman and I. Verner. Learning through creating robotic models of biological systems. *International Journal of Technology and Design Education*, 23(4):849–866, 2013.
- [376] V. Cvjetkovic and U. Stankovic. Arduino based physics and engineering remote laboratory. *International Journal of Online Engineering*, 13(1):87–105, 2017.
- [377] G. G. da Silva and C. A. Petry. Teaching ac-ac converters using voltage regulators. In 2015 IEEE 13th Brazilian Power Electronics Conference and 1st Southern Power Electronics Conference (COBEP/SPEC), pages 1-6, Nov. 2015.
- [378] A. Danowitz, B. Benson, and J. Edmonds. Teaching systems and robotics in a four-week summer short course. In *ASEE Annual Conference and Exposition, Conference Proceedings*, volume 14, 2017.
- [379] A. Dasios, D. Gavalas, G. Pantziou, and C. Konstantopoulos. Wireless sensor network deployment for remote elderly care monitoring. In *Proceedings of the 8th ACM International Conference on PErvasive Technologies Related to Assistive Environments*, PETRA '15, pages 61:1–61:4, New York, NY, USA, 2015. ACM.
- [380] G. De Grande, C. Baelus, D. De Roeck, and L. Van Campenhout. Designing experienceable systems by using microcontroller based platforms. In *15th International Conference on Engineering and Product Design Education: Design Education Growing Our Future, EPDE*, pages 504–509, 2013.
- [381] G. de Haan. A hands-on approach to making in the internet of things and creative technology. In *Proceedings of the European Conference on Cognitive Ergonomics*, ECCE '16, pages 1:1–1:4, New York, NY, USA, 2016. ACM.
- [382] L. de la Torre, M. Guinaldo, R. Heradio, and S. Dormido. The Ball and Beam System: A Case Study of Virtual and Remote Lab Enhancement With Moodle. *IEEE Transactions on Industrial Informatics*, 11(4):934–945, Aug 2015.
- [383] P. Di Giamberardino and M. Temperini. Adaptive access to robotic learning experiences in a remote laboratory setting. In *18th International Carpathian Control Conference, ICCC 2017*, pages 565–570, 2017.
- [384] S. Dickerson. A comprehensive approach to educating students about the internet-of-things. volume 2017-October, pages 1–7, 2017. cited By 1.
- [385] H. Dillon, N. Schmedake, K. Eifler, T. Doughty, and K. Lulay. Design of a curriculum-spanning mechanical engineering laboratory experiment. In *ASEE Annual Conference and Exposition, Conference Proceedings*, volume 13, 2016.
- [386] B. Dixon. Code isolation for accurate performance scoring using raspberry pis. *J. Comput. Sci. Coll.*, 31(4):94–99, Apr. 2016.

- [387] D. Dobrilovic, Z. Stojanov, V. Brtka, Z. Covic, and N. Bilinac. Software application for analyzing zigbee network performance in university courses. In *2014 IEEE 12th International Symposium on Intelligent Systems and Informatics (SISY)*, pages 73–77, Sept. 2014.
- [388] D. Dobrilovic, Z. Stojanov, and B. Odadzic. Teaching application development for RFID/ZigBee networks using open source hardware. In *X International Symposium on Telecommunications (BIHTEL)*, pages 1–6, Oct. 2014.
- [389] D. Dobrilovic, Z. Stojanov, B. Odadzic, and V. Sinik. Platform for teaching communication systems based on open-source hardware. In *2015 IEEE Global Engineering Education Conference (EDUCON)*, pages 737–741, Mar. 2015.
- [390] D. Dobrilovic and S. Zeljko. Design of open-source platform for introducing internet of things in university curricula. In *SACI 2016 11th IEEE International Symposium on Applied Computational Intelligence and Informatics*, pages 273–276, 2016.
- [391] K. Doucet and J. Zhang. Learning cluster computing by creating a raspberry pi cluster. In *Proceedings of the SouthEast Conference, ACMSE 2017*, pages 191–194, 2017.
- [392] A. Eliasz. Not just "teaching robotics" but "teaching through robotics". *Communications in Computer and Information Science*, 44:214–223, 2009.
- [393] W. J. Esposito, F. A. Mujica, D. G. Garcia, and G. T. A. Kovacs. The lab-in-a-box project: An arduino compatible signals and electronics teaching system. In *2015 IEEE Signal Processing and Signal Processing Education Workshop (SP/SPE)*, pages 301–306, Aug. 2015.
- [394] J. Fainguelernt, G. Reith, and R. Sikora. An integrated environment for developing real-time dsp applications. In *IEEE International Conference on Acoustics, Speech and Signal Processing*, pages 2653–2656, Mar. 2008.
- [395] P. Fajri, N. Lotfi, M. Ferdowsi, and R. G. Landers. Development of an educational small scale hybrid electric vehicle (hev) setup. In *IEEE International Electric Vehicle Conference (IEVC)*, pages 1–6, Oct. 2013.
- [396] T. Fan, G.-J. Liao, C.-P. Yeh, C.-T. Wu, and J.-M. Chen. Lane keeping system by visual technology. In *ASEE Annual Conference and Exposition, Conference Proceedings*, volume 14, 2017.
- [397] O. Farook, J. Agrawal, A. Ahmed, A. Kulatunga, N. Koyi, H. Alibrahim, and M. Almenaies. Embedded system design based on beaglebone black with embedded linux. In *ASEE Annual Conference and Exposition, Conference Proceedings*, volume 13, 2016.

- [398] O. Farook, J. Agrawal, A. Kulatunga, A. Ahmed, W. Yu, Y. Lee, and H. Alibrahim. Freshman experience course in electrical and computer engineering technology emphasizing computation, simulation, mathematical modeling, and measurements. In *ASEE Annual Conference and Exposition, Conference Proceedings*, volume 14, 2017.
- [399] Y. Fathi and S. Benhlima. Development of an embedded multi-agent software for autonomous robots. In *2014 Third IEEE International Colloquium in Information Science and Technology (CIST)*, pages 24–29, Oct. 2014.
- [400] J. Fernandez, W. Gemin, R. Rivera, M. Revuelta, M. Kuzman, and R. Hidalgo. Digital filter design with arduino due and matlab. In *2015 XVI Workshop on Information Processing and Control (RPIC)*, pages 1–6, Oct. 2015.
- [401] D. A. Fields, K. A. Searle, and Y. B. Kafai. Deconstruction kits for learning: Students' collaborative debugging of electronic textile designs. In *Proceedings of the 6th Annual Conference on Creativity and Fabrication in Education*, FabLearn 16, pages 82–85, New York, NY, USA, 2016. ACM.
- [402] A. Filho, C. Resende, C. Iglesias, J. Mayworm, M. Jardim, R. Paiva, and R. Toledo. Agile software development learning through open hardware project. In *6th Brazilian Workshop on Agile Methods, WBMA 2015*, pages 40–47, 2017.
- [403] C. B. Foltz. Network administration with the raspberry pi. *Journal of Computing Sciences in Colleges*, 29(5):66–67, May 2014.
- [404] K. Fox, W. Mongan, and J. Popyack. Raspberry hadoopi: A low-cost, hands-on laboratory in big data and analytics. In *Proceedings of the 46th ACM Technical Symposium on Computer Science Education*, SIGCSE '15, pages 687–687, New York, NY, USA, 2015. ACM.
- [405] L. Fratamico, C. Conati, S. Kardan, and I. Roll. Applying a framework for student modeling in exploratory learning environments: Comparing data representation granularity to handle environment complexity. *International Journal of Artificial Intelligence in Education*, 27(2):320–352, 2017. cited By 2.
- [406] C. Frederickson. Introducing coding in freshman physics laboratories using arduinos. In *ASEE Annual Conference and Exposition, Conference Proceedings*, volume 14, 2017.
- [407] J. Fritz, M. Matthews, T. Wulf, J. Scott, and J. Fritz. University of cincinnati and saint ursula academy partnership: Introducing female high school students to the field of information technology, year 2. In *Proceedings of the 17th Annual Conference on Information Technology Education*, SIGITE '16, pages 109–109, New York, NY, USA, 2016. ACM.
- [408] C. Gajewski. Interactions you already know: Smart artifacts. *Design Principles and Practices*, 5(5):369–376, 2011.

- [409] N. Gala, A. Menon, R. Bodduna, G. S. Madhusudan, and V. Kamakoti. Shakti processors: An open-source hardware initiative. In *2016 29th International Conference on VLSI Design and 2016 15th International Conference on Embedded Systems (VLSID)*, pages 7–8, Jan. 2016.
- [410] A. Ghedi, E. Donarini, R. Lamera, G. Sgroi, L. Turati, and C. Ercole. 3d vs 2d laparoscopic systems: Development of a performance quantitative validation model. In 2015 37th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), pages 6884–6887, Aug. 2015.
- [411] K. Ghoulam, B. Bouikhalene, Z. Harmouch, and H. Mouncif. The implementation of a cloud system for electronics learning in a moroccan public university. *International Journal on Smart Sensing and Intelligent Systems*, 9(4):2051–2068, 2016.
- [412] E. Gibney. 'open-hardware' pioneers push for low-cost lab kit. *Nature*, 531(7593):147–148, 2016.
- [413] J. J. Gil, I. Diaz, X. Justo, and P. Ciñurriz. Educational haptic controller based on arduino platform. In *2014 XI Tecnologias Aplicadas a la Ensenanza de la Electronica (Technologies Applied to Electronics Teaching) (TAEE)*, pages 1–7, June 2014.
- [414] S. Gokceli, H. B. Tugrel, S. Pisirgen, G. K. Kurt, and B. ñrs. A building automation system demonstration. In *2015 9th International Conference on Electrical and Electronics Engineering (ELECO)*, pages 56–60, Nov. 2015.
- [415] L. Gomes and A. Costa. Cloud based development framework using iopt petri nets for embedded systems teaching. In *2014 IEEE 23rd International Symposium on Industrial Electronics (ISIE)*, pages 2202–2206, June 2014.
- [416] A. Gomes Filho, C. De Resende, P. Gazaneo, V. Bittencourt, R. Paiva, and R. De Toledo. Validation board: Invalidating ideas and discovering the problems that must be solved. *Communications in Computer and Information Science*, 680:85–97, 2017. cited By 0.
- [417] T. Goncalves, J. Machado, and J. Esteves. Aero-stabilizer workbenches for the teaching of pid control. *Romanian Review Precision Mechanics, Optics and Mechatronics*, 2016(49):10–14, 2016.
- [418] C. Gonzalez, I. Alvarado, and D. Pena. Low cost two-wheels self-balancing robot for control education. *IFAC-PapersOnLine*, 50(1):9174–9179, 2017.
- [419] P. Gonzalez-Nalda, I. Etxeberria-Agiriano, and I. Calvo. Flexible, modular, standard, free and affordable model for cps control applied to mobile robotics. In 2015 10th Iberian Conference on Information Systems and Technologies (CISTI), pages 1–6, June 2015.

- [420] P. Gozalez-Nalda, I. Etxeberria-Agiriano, and I. Calvo. Towards a generic architecture for building modular cps as applied to mobile robotics. *International Journal of Interactive Mobile Technologies*, 12(1):4–8, 2016.
- [421] B. Graham and K. Turkoglu. Design, build and integration of a low-cost self-erecting inverted pendulum mechanism. In *AIAA Modeling and Simulation Technologies Conference*, 2017, 2017.
- [422] T. Grandahl, G. Biondi, and C. Hochgraf. An open hardware, open source electronic load bank and data acquisition system for expanding the number of schools and students researching battery energy storage. In *ASEE Annual Conference and Exposition*, 2011.
- [423] O. H. Graven and J. Bjork. The use of an arduino pocket lab to increase motivation in electrical engineering students for programming. In *2016 IEEE International Conference on Teaching, Assessment, and Learning for Engineering (TALE)*, pages 239–243, Dec. 2016.
- [424] W. Grega and A. Pilat. Real-time control teaching using LEGO MINDSTORMS NXT robot. In *International Multiconference on Computer Science and Information Technology*, pages 625–628, Oct. 2008.
- [425] J. Grinias, J. Whitfield, E. Guetschow, and R. Kennedy. An inexpensive, open-source usb arduino data acquisition device for chemical instrumentation. *Journal of Chemical Education*, 93(7):1316–1319, 2016.
- [426] S. Gross and D. Weida. Multipurpose low-cost hardware laboratory setups in engineering education. In *43rd SEFI Annual Conference 2015 Diversity in Engineering Education: An Opportunity to Face the New Trends of Engineering*, 2015.
- [427] H. Guerra, A. Cardoso, V. Sousa, and L. Gomes. Remote experiments as an asset for learning programming in python. *International Journal of Online Engineering*, 12(4):71–73, 2016.
- [428] H. Guerra, A. Cardoso, V. Sousa, J. Leitño, V. Graveto, and L. M. Gomes. Demonstration of programming in python using a remote lab with raspberry pi. In 2015 3rd Experiment International Conference (exp.at'15), pages 101–102, June 2015.
- [429] J. Guerra Guerra and A. Fermin Peréz. Implementation of a robotics and iot laboratory for undergraduate research in computer science courses. In *Proceedings of the 2016 ACM Conference on Innovation and Technology in Computer Science Education*, ITiCSE '16, pages 369–369, New York, NY, USA, 2016. ACM.

- [430] J. Guerrero, A. GonzÃalez, J. Vega, and L. Tovar. Instrumentation of an array of ultrasonic sensors and data processing for unmanned aerial vehicle (UAV) for teaching the application of the kalman filter. In *Procedia Computer Science*, volume 75, pages 375–380, 2015.
- [431] E. Guizzo and E. Ackerman. The turtlebot3 teacher: Learn the ros platform with this robot kit. *IEEE Spectrum*, 54(8):19–20, 2017.
- [432] F. Güldenpfennig, F. Nunes, O. Subasi, and M. Urbanek. Ubikit: Learning to prototype for tangible and ubiquitous computing. volume 2017-July, 2017. cited By 0.
- [433] S. Guvercin, R. Suliyev, and G. Tolebi. Design of automatic engraving machine controlled via computer. In *2015 Twelve International Conference on Electronics Computer and Computation (ICECCO)*, pages 1–3, Sept. 2015.
- [434] K. Hajdarevic and S. Konjicija. A low energy computer infrastructure for radio voip supported communication and sdr aprs in education and disaster relief situations. In 2015 38th International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO), pages 556–561, May 2015.
- [435] K. Hajdarevic, S. Konjicija, and A. Subasi. Svxlink voip implementation using raspberry pi in education and disaster relief situations. In *2014 X International Symposium on Telecommunications (BIHTEL)*, pages 1–6, Oct. 2014.
- [436] D. Hammerstrom and M. Butts. Teaching electric vehicles as an application of embedded computing. In *2012 IEEE International Electric Vehicle Conference*, pages 1–6, Mar. 2012.
- [437] T. Hamrick and R. Hensel. Putting the fun in programming fundamentals robots make programs tangible. In *ASEE Annual Conference and Exposition*, 2013.
- [438] H. Hassan, J. M. Martinez-Rubio, A. Perles, J. V. Capella, C. Dominguez, and J. Albaladejo. Smartphone-Based Industrial Informatics Projects and Laboratories. *IEEE Transactions on Industrial Informatics*, 9(1):557–566, Feb 2013.
- [439] S. M. Haynes. Using the atmel avr (arduino microcontroller) as the foundation of beginning computer organization course (abstract only). In *44th ACM Technical Symposium on Computer Science Education*, SIGCSE '13, pages 737–737, New York, NY, USA, 2013. ACM.
- [440] J. He, S. Ji, and P. Bobbie. Internet of things (IoT)-based learning framework to facilitate STEM undergraduate education. In *Proceedings of the SouthEast Conference, ACMSE 2017*, pages 88–94, 2017.

- [441] J. He, D.-T. Lo, Y. Xie, and J. Lartigue. Integrating internet of things (IoT) into STEM undergraduate education: Case study of a modern technology infused courseware for embedded system course. In *Frontiers in Education Conference*, FIE, 2016.
- [442] N. He, Y. Qian, and H. w. Huang. Experience of teaching embedded systems design with beaglebone black board. In *2016 IEEE International Conference on Electro Information Technology (EIT)*, pages 0217–0220, May 2016.
- [443] R. Helps. Teaching IT concepts is enhanced by including hardware in experiential learning. In *ASEE Annual Conference and Exposition*, 2015.
- [444] X. Henry, M. Mitra, A. Nagchaudhuri, and L. Zhang. Automated multiparameter water monitoring system as an experiential learning platform for undergraduate STEM majors. In *ASEE Annual Conference and Exposition*, 2016.
- [445] A. Hernandez-Delgado, A. Vega-Gonzalez, and J. Gomez-Gonzalez. Educative ecg platform for undergraduate courses in bme. volume 60, pages 401–404, 2017. cited By 0.
- [446] P. E. Hertzog and A. J. Swart. Arduino enabling engineering students to obtain academic success in a design-based module. In *2016 IEEE Global Engineering Education Conference (EDUCON)*, pages 66–73, Apr. 2016.
- [447] R. C. Hill. Hardware-based activities for flipping the system dynamics and control curriculum. In *2015 American Control Conference (ACC)*, pages 2777–2782, July 2015.
- [448] A. Hoyo, J. L. Guzmán, J. C. Moreno, and M. Berenguel. Teaching control engineering concepts using open source tools on a raspberry pi board. *IFAC-PapersOnLine*, 48(29):99–104, 2015.
- [449] G. Hristov, P. Zahariev, S. Borisov, and D. Kyuchukova. An educational system for real-time monitoring and evaluation of the parameters of electric vehicles. In *2016 15th International Conference on Information Technology Based Higher Education and Training (ITHET)*, pages 1–5, Sept. 2016.
- [450] H.-H. Huang, C.-Y. Liu, M.-C. Huang, I.-C. Ko, and J.-M. Lee. Digital i/o training kit development for arduino platforms. *Applied Mechanics and Materials*, 214:649–653, 2012.
- [451] T. Huba and M. Huba. Experimenting with a nonlinear thermo-opto-mechanical system tom1a. *IFAC-PapersOnLine*, 48(29):188–193, 2015.
- [452] N. Husseini and I. Kaszubski. Incorporating the raspberry pi into laboratory experiments in an introductory MATLAB course. In *ASEE Annual Conference and Exposition, Conference Proceedings*, 2017.

- [453] E. Irigoyen, E. Larzabal, and R. Priego. Low-cost platforms used in control education: An educational case study. In *IFAC Proceedings Volumes (IFAC-PapersOnline)*, volume 10, pages 256–261, 2013.
- [454] G. Isaakidis, A. Spiropoulos, and M. Drakaki. An educational purpose built three dimensional printer. In 6th International Conference on Modern Circuits and Systems Technologies, MOCAST 2017, 2017.
- [455] M. Ishikawa and I. Maruta. Rapid prototyping for control education using arduino and open-source technologies. *IFAC Proceedings Volumes (IFAC-PapersOnline)*, 8(1):317–321, 2009.
- [456] T. U. Islamgozhayev, S. S. Mazhitov, A. K. Zholmyrzayev, and E. T. Toishybek. IICT-bot: Educational robotic platform using omni-directional wheels with open source code and architecture. In *2015 International Siberian Conference on Control and Communications (SIBCON)*, pages 1–3, May 2015.
- [457] I. Ivan, C. Petit, I. Gurgu, and R. Toscano. Afm nanoeye development of an education oriented high resolution profilometer. *IFAC-PapersOnLine*, 50(1):2385–2390, 2017.
- [458] H. Jack. Using the parallax propeller for mechatronics education. In *ASEE Annual Conference and Exposition*, 2013.
- [459] Y. Jang, J. Kim, and W. Lee. Development and application of internet of things educational tool based on peer to peer network. *Peer-to-Peer Networking and Applications*, pages 1–13, 2017.
- [460] P. Jennings and D. Castro. Constructs toolkit: 802.15.4 wireless construction kit. In *2nd International Conference on Computational Creativity, ICCC 2011*, page 164, 2011.
- [461] B. Jeon and J. Park. Implementation of a modular robotic construction kit that fully supports science, technology, engineering, art, and mathematics education. *Advanced Science Letters*, 22(11):3413–3417, 2016.
- [462] C. Joochim, R. Phadungthin, and S. Srikitsuwan. Design and development of a remotely operated underwater vehicle. In *2015 16th International Conference on Research and Education in Mechatronics (REM)*, pages 148–153, Nov. 2015.
- [463] A. Juhong and C. Pintavirooj. Simulated ct scanner for educational purpose. In 2016 9th Biomedical Engineering International Conference (BMEiCON), pages 1–4, Dec. 2016.
- [464] M. Karimi, A. Ahmadi, P. Kavandi, and S. S. Ghidary. Weemik: A low-cost omnidirectional swarm platform for outreach, research and education. In *2016 4th International Conference on Robotics and Mechatronics (ICROM)*, pages 26–31, Oct. 2016.

- [465] S. Karthik, N. Srividya, L. Swetha, and S. Balaji. E-vlsi lab using raspberry pi. *International Journal of Control Theory and Applications*, 9(15):7105–7110, 2016.
- [466] M. Karunaratne. Self-driving car project in embedded systems class. In *ASEE Annual Conference and Exposition, Conference Proceedings*, 2017.
- [467] W. Keeler and J. Wolfer. A raspberry pi cluster and geiger counter supporting random number acquisition in the cs operating systems class. In *13th International Conference on Remote Engineering and Virtual Instrumentation, REV 2016*, pages 353–354, 2016.
- [468] L. Kehinde, O. Ayodele, O. Akintade, and K. Olawale. Development of a module to teach basic concepts of interfacing and connectivity in internet of things. In *ASEE Annual Conference and Exposition, Conference Proceedings*, 2016.
- [469] Y.-J. Kim, S.-J. Park, and Y.-H. Seo. Script-based simple programming toolkit for open source hardware. *International Journal of Software Engineering and its Applications*, 10(2):1–8, 2016.
- [470] S. V. Kiran, R. Prasad, J. Thriveni, K. R. Venugopal, and L. M. Patnaik. Cloud enabled 3D tablet design for medical applications. In *2014 9th International Conference on Industrial and Information Systems (ICIIS)*, pages 1–6, Dec. 2014.
- [471] T. Klinger and C. Madritsch. Collaborative learning using pocket labs. In 2015 International Conference on Interactive Mobile Communication Technologies and Learning (IMCL), pages 185–189, Nov. 2015.
- [472] J. Kojmane and A. Aboutajeddine. Strengthening engineering design skills of first-year university students under resources constraints. *International Journal of Mechanical Engineering Education*, 44(2):148–164, 2016.
- [473] R. Krauss. Evaluation of a low-cost microcontroller for real-time control education and prototyping. In *ASME 2014 Dynamic Systems and Control Conference, DSCC 2014*, volume 1, 2014.
- [474] R. Krauss and C. VanderRoest. MAKER: A 3d printed balancing robot for teaching dynamic systems and control. In *ASEE Annual Conference and Exposition, Conference Proceedings*, 2017.
- [475] D. Kumar, K. Achuthan, B. Nair, and S. Diwakar. Online bio-robotics labs: Open hardware models and architecture. In *International Conference on Robotics and Automation for Humanitarian Applications, RAHA 2016*, 2017.
- [476] S. Kurkovsky and C. Williams. Raspberry pi as a platform for the internet of things projects: Experiences and lessons. In *Annual Conference on Innovation and Technology in Computer Science Education, ITiCSE*, pages 64–69, 2017.

- [477] D. Kyuchukova, G. Hristov, P. Zahariev, and S. Borisov. A study on the possibility to use raspberry pi as a console server for remote access to devices in virtual learning environments. In 2015 International Conference on Information Technology Based Higher Education and Training (ITHET), pages 1-4, June 2015.
- [478] N. Langhoff, E. Schiorring, E. Dunmire, T. Rebold, and T. Huang. Developing a comprehensive online transfer engineering curriculum: Designing an online introduction to engineering course. In *ASEE Annual Conference and Exposition, Conference Proceedings*, 2016.
- [479] C. A. Lara-Niño, C. Torres-Huitzil, and J. H. Barron-Zambrano. Versatile educational and research robotic platform based on reconfigurable hardware. In *2014 International Conference on ReConFigurable Computing and FPGAs (ReConFig14)*, pages 1–6, Dec. 2014.
- [480] M. Latif, H. Md Yusof, and S. Toha. Mathematical modelling and development of a monoball robot for educational purpose. *Malaysian Journal of Mathematical Sciences*, 10:265–275, 2016.
- [481] W. Lawson, S. Secules, S. Bhattacharyya, and A. Gupta. An application-based learning approach to c programming concepts and methods for engineers. In *ASEE Annual Conference and Exposition, Conference Proceedings*, 2016.
- [482] R. S. Lawyer. Student driven digital signage. In *Proceedings of the 2015 ACM Annual Conference on SIGUCCS*, SIGUCCS '15, pages 133–135, New York, NY, USA, 2015. ACM.
- [483] M. Leblanc-Latour, C. Bryan, and A. Pelling. Utilizing social media and video games to control diy microscopes. *PeerJ Computer Science*, 2017(12), 2017. cited By 0.
- [484] V. Lee and D. Fields. A rubric for describing competences in the areas of circuitry, computation, and crafting after a course using e-textiles. *International Journal of Information and Learning Technology*, 34(5):372–384, 2017.
- [485] Z. Lee and P. Hines. Droop control in a mechanical power grid simulator. In *2016 IEEE Power and Energy Society General Meeting (PESGM)*, pages 1–5, July 2016.
- [486] T. Leeuw, E. Boss, and D. Wright. In situ measurements of phytoplankton fluorescence using low cost electronics. *Sensors (Switzerland)*, 13(6):7872–7883, 2013.
- [487] K. Lefeuvre, S. Totzauer, A. Bischof, A. Kurze, M. Storz, L. Ullmann, and A. Berger. Loaded dice: Exploring the design space of connected devices with blind and visually impaired people. In *Proceedings of the 9th Nordic Conference on*

- *Human-Computer Interaction*, NordiCHI '16, pages 31:1–31:10, New York, NY, USA, 2016. ACM.
- [488] S. Li, E. Freije, and P. Yearling. Monitoring 3d printer performance using internet of things (iot) application. In *ASEE Annual Conference and Exposition, Conference Proceedings*, 2017.
- [489] B. Lilly, L. Abrams, M. Neal, K. Srinivasan, and D. Mendelsohn. Developing an effective platform for introducing mechanical engineering in a large public university. In *ASME International Mechanical Engineering Congress and Exposition*, volume 5, pages 517–522, 2012.
- [490] S. Lohmann, J. Yosinski, E. Gold, J. Clune, J. Blum, and H. Lipson. Aracna: An open-source quadruped platform for evolutionary robotics. In *Artificial Life 13: International Conference on the Simulation and Synthesis of Living Systems, ALIFE*, pages 387–392, 2012.
- [491] A. Lorente-Leal, J. . n. Fernnndez Rodrigues, and J. M. Montero. Development of a wiimote-based gesture recognizer in a microprocessor laboratory course. In *IEEE EDUCON Conference*, pages 451–455, Apr. 2010.
- [492] R. Luff, M. ZÃd'hringer, W. Harms, M. Bleher, B. Prommer, and U. StÃúhlker. Open-source hardware and software and web application for gamma dose rate network operation. *Radiation Protection Dosimetry*, 160(4):252–258, 2014.
- [493] G. Mabbott. Teaching electronics and laboratory automation using microcontroller boards. *Journal of Chemical Education*, 91(9):1458–1463, 2014.
- [494] M. M. Macias, J. E. Agudo, C. J. G. Orellana, H. M. G. Velasco, and A. G. Manso. The "mbed" platform for teaching electronics applied to product design. In 2014 XI Tecnologias Aplicadas a la Ensenanza de la Electronica (Technologies Applied to Electronics Teaching) (TAEE), pages 1–6, June 2014.
- [495] C. Madritsch, T. Klinger, A. Pester, and W. Schwab. Work in progress: Using pocket labs in master degree programs. *Advances in Intelligent Systems and Computing*, 545:54–59, 2017.
- [496] A. Magana, J. Ortega-Alvarez, R. Lovan, D. Gomez, J. Marulanda, and S. Dyke. Virtual, local and remote laboratories for conceptual understanding of dynamic systems. *International Journal of Engineering Education*, 33(1):91–105, 2017. cited By 2.
- [497] Q. H. Mahmoud, D. Qendri, and M. Lescisin. The sensorian shield: Transforming the raspberry pi into an iot platform. In *Proceedings of the 47th ACM Technical Symposium on Computing Science Education*, SIGCSE '16, pages 162–162, New York, NY, USA, 2016. ACM.

- [498] J. Mahoney and R. Nathan. Mechanical vibrations modal analysis project with arduinos. *Computers in Education Journal*, 8(4), 2017. cited By 0.
- [499] A. Maia Chagas, L. Prieto-Godino, A. Arrenberg, and T. Baden. The e100 lab: A 3d-printable open-source platform for fluorescence microscopy, optogenetics, and accurate temperature control during behaviour of zebrafish, drosophila, and caenorhabditis elegans. *PLoS Biology*, 15(7), 2017.
- [500] A. Malaoui. Low cost pedagogic device for practical works using embedded system. In 2015 IEEE/ACS 12th International Conference of Computer Systems and Applications (AICCSA), pages 1–8, Nov. 2015.
- [501] R. Marcelino, J. Silva, V. Gruber, and M. Bilessimo. Immersive learning environment using 3d virtual worlds and integrated remote experimentation. *International Journal of Online Engineering*, 9(SPECIAL ISSUE):31–34, 2012.
- [502] R. Marcelino, J. B. Silva, V. Gruber, and M. S. Bilessimo. 3D virtual worlds using open source platform and integrated remote experimentation. In *9th International Conference on Remote Engineering and Virtual Instrumentation (REV)*, pages 1–2, July 2012.
- [503] S. Marichal, E. Bakala, A. Rosales, F. Perilli, G. Sansone, J. Blat, and A. Pires. CETA: Open, affordable and portable mixed-reality environment for low-cost tablets. In 19th International Conference on Human-Computer Interaction with Mobile Devices and Services, MobileHCI 2017, 2017.
- [504] C. Martin, J. Hughes, and J. Richards. Learning experiences in programming: The motivating effect of a physical interface. In *CSEDU 2017 9th International Conference on Computer Supported Education*, volume 1, pages 162–172, 2017.
- [505] P. Martín-Ramos, M. M. L. da Silva, M. J. a. Lopes, and M. R. Silva. Student2student: Arduino project-based learning. In *Proceedings of the Fourth International Conference on Technological Ecosystems for Enhancing Multiculturality*, TEEM '16, pages 79–84, New York, NY, USA, 2016. ACM.
- [506] D. Mascaro and S. Mascaro. An integrated project-driven course in computer programming for mechanical engineering students. In *ASEE Annual Conference and Exposition*, 2015.
- [507] D. L. McPherson, A. R. Ofoli, and T. D. Loveless. Basketballbot: Developing an intelligent controls teaching platform using labview, matlab, and arduino. In *SoutheastCon 2015*, pages 1–8, Apr. 2015.
- [508] R. K. Megalingam, N. Saboo, N. Ajithkumar, S. Unny, and D. Menon. Kinect based gesture controlled robotic arm: A research work at hut labs. In *IEEE International Conference in MOOC, Innovation and Technology in Education (MITE)*, pages 294–299, Dec. 2013.

- [509] C. Mercer and D. Leech. Inexpensive miniature programmable magnetic stirrer from reconfigured computer parts. *Journal of Chemical Education*, 94(6):816–818, 2017.
- [510] E. Meyer and B. Ulrey. Sensing angular kinematics by embedding an open-source electronics design project into a required biomechanics course. In *ASEE Annual Conference and Exposition*, 2016.
- [511] L. Miao, J. Farzidayeri, W. Boles, and A. Nasab. An indoor bocce game played by autonomous robots. In *ASEE Annual Conference and Exposition, Conference Proceedings*, 2017.
- [512] L. Michels, L. Schaeffer, V. Gruber, R. Marcelino, and L. Casagrande. Remote compression test machine for experimental teaching of mechanical forming. *International Journal of Online Engineering*, 12(4):20–22, 2016.
- [513] L. B. Michels, Y. Crotti, L. C. Casagrande, V. Gruber, R. Marcelino, and L. Schaeffer. Educational compression testing machine for teleoperated teaching of the metals flow curves. In *2015 3rd Experiment International Conference (exp.at'15)*, pages 163–164, June 2015.
- [514] L. B. Michels, V. Gruber, L. Schaeffer, R. Marcelino, J. B. da Silva, and S. de Resende Guerra. Using remote experimentation for study on engineering concepts through a didactic press. In *2nd Experiment@ International Conference (exp.at'13)*, pages 209–211, Sept. 2013.
- [515] D. Mikesell and J.-D. Yoder. Introducing mechanical engineers to microprocessors with arduino tank robots. In *ASEE Annual Conference and Exposition*, 2015.
- [516] A. Minaie and R. Sanati-Mehrizy. Capstone projects in a computer engineering program using arduino. In *ASEE Annual Conference and Exposition*, 2016.
- [517] A. Minuto, F. Pittarello, and A. Nijholt. New materials = new expressive powers: Smart material interfaces and arts, an interactive experience made possible thanks to smart materials. In *Proceedings of the 2014 International Working Conference on Advanced Visual Interfaces*, AVI '14, pages 141–144, New York, NY, USA, 2014. ACM.
- [518] L. Miranda Cordero, A. Arenas Gonzalez, and E. Salazar Guerrero. Experiences at faculty of engineering, unam, applying pbl, collaborative learning and pedagogical robotics in the teaching-learning process. In *IMSCI 2016 10th International Multi-Conference on Society, Cybernetics and Informatics, Proceedings*, pages 251–255, 2016.
- [519] S. Mischie. On teaching raspberry pi for undergraduate university programmes. In *2016 12th IEEE International Symposium on Electronics and Telecommunications (ISETC)*, pages 149–153, Oct. 2016.

- [520] Y. Mita and Y. Kawahara. 15-year educational experience on autonomous electronic information devices by flipped classroom and try-by-yourself methods. *IET Circuits, Devices and Systems*, 11(4):321–329, 2017.
- [521] N. Mitsunaga. An interpreted language with debugging interface for a micro controller. In *The 1st IEEE Global Conference on Consumer Electronics 2012*, pages 115–119, Oct. 2012.
- [522] R. Monfredo, D. Schinsing, J. Alkins, and T. Olsen. BYOE: Student-built versatile platforms integrate solar-powered microprocessor and sensors for chemical engineering data acquisition. In *ASEE Annual Conference and Exposition*, 2017.
- [523] M. Montironi, B. Qian, and H. Cheng. Development and application of the charduino toolkit for teaching how to program arduino boards through the c/c++ interpreter ch. *Computer Applications in Engineering Education*, 25(6):1053–1065, 2017.
- [524] A. Mora, H. Yagama, D. Zorro, and L. F. R. Jimñnez. Speed digital control for scale car via bluetooth and android. In *2015 CHILEAN Conference on Electrical, Electronics Engineering, Information and Communication Technologies (CHILECON)*, pages 129–134, Oct. 2015.
- [525] H. Mostefaoui and A. Benachenhou. Design of a remote electronic laboratory. In *2015 International Conference on Interactive Mobile Communication Technologies and Learning (IMCL)*, pages 160–162, Nov. 2015.
- [526] H. Mostefaoui, A. Benachenhou, and A. Benattia. Design of a low cost remote electronic laboratory suitable for low bandwidth connection. *Computer Applications in Engineering Education*, 25(3):480–488, 2017.
- [527] L. Muller, M. Mohammed, and J. W. Kimball. Using the arduino uno to teach digital control of power electronics. In *2015 IEEE 16th Workshop on Control and Modeling for Power Electronics (COMPEL)*, pages 1–8, July 2015.
- [528] P. Musik. Development of computer-based experiment set on simple harmonic motion of mass on springs. *Turkish Online Journal of Educational Technology*, 16(4):1–11, 2017.
- [529] K. Muterspaw, T. Urner, R. Lewis, I. Babic, D. Srinath, C. Peck, D. Cerda-Granados, P. Lemiszki, M. Sánchez-Miranda, M. Mayorga-Méndez, O. Petursson, and B. Smith. Multidisciplinary research and education with open tools: Metagenomic analysis of 16s rrna using arduino, android, mothur and xsede. In *Proceedings of the 2015 XSEDE Conference: Scientific Advancements Enabled by Enhanced Cyberinfrastructure*, XSEDE '15, pages 22:1–22:8, New York, NY, USA, 2015. ACM.

- [530] C. Nam and S. Danielson. Development of a small uav with real-time video surveillance. In *ASEE Annual Conference and Exposition*, 2011.
- [531] V. Narayan. Technology as a creative partner: Unlocking learner potential and learning. In *30th Annual conference on Australian Society for Computers in Learning in Tertiary Education, ASCILITE 2013*, pages 612–621, 2013.
- [532] J. Nestor. From microelectronics to making: Incorporating microelectronics in a first-year engineering course. In *IEEE International Conference on Microelectronic Systems Education, MSE*, pages 27–30, 2017.
- [533] J. M. Neto, S. Paladini, C. E. Pereira, and R. Marcelino. Remote educational experiment applied to electrical engineering. In *9th International Conference on Remote Engineering and Virtual Instrumentation (REV)*, pages 1–5, July 2012.
- [534] G. Ngai, S. C. Chan, H. V. Leong, and V. T. Ng. Designing i*catch: A multipurpose, education-friendly construction kit for physical and wearable computing. *Trans. Comput. Educ.*, 13(2):7:1–7:30, July 2013.
- [535] T. Oda, K. Matsuo, L. Barolli, M. Yamada, and Y. Liu. Design and implementation of an iot-based e-learning testbed. *International Journal of Web and Grid Services*, 13(2):228–241, 2017.
- [536] H. Ogawa, B. Oguntoyinbo, K. Tochi, and N. Naoe. Electric vehicle project for introduction to engineering creation experiment iii. In *3rd International Congress on Engineering Education (ICEED)*, pages 28–31, Dec. 2011.
- [537] P. Ogrutan. Increasing students' interest by encouraging them to create original lab projects. *TEM Journal*, 6(4):653–659, 2017.
- [538] M. Oishi, V. Svihla, and V. Law. Improved learning through collaborative, scenario-based quizzes in an undergraduate control theory course. In *ASEE Annual Conference and Exposition*, volume June, 2017.
- [539] C. C. Oliveira, D. C. Oliveira, J. a. C. Gonçalves, and J. T. Kuniwake. Pratical introduction to internet of things: Practice using arduino and node.js. In *Proceedings of the 22Nd Brazilian Symposium on Multimedia and the Web*, Webmedia '16, pages 17–18, New York, NY, USA, 2016. ACM.
- [540] H. Omar. Enhancing automatic control learning through arduino-based projects. *European Journal of Engineering Education*, pages 1–12, 2017.
- [541] O. Ortiz and P. Leiffer. A radio controlled race car project to evaluate student learning in electronics. In *ASEE Annual Conference and Exposition*, 2016.
- [542] P. Papazoglou and D. Karras. A hardware based novel educational methodology for teaching microprocessor architectures using object oriented approach. *International Review on Computers and Software*, 10(10):1071–1079, 2015.

- [543] P. Papazoglou and A. Moschos. OpenHardSim: An open source hardware based simulator for learning microprocessors. In *IEEE Global Engineering Education Conference, EDUCON*, pages 157–160, 2017.
- [544] G. Pasolini, A. Bazzi, and F. Zabini. A raspberry pi-based platform for signal processing education [sp education]. *IEEE Signal Processing Magazine*, 34(4):151–158, 2017.
- [545] S. S. Patil, S. Katwe, U. Mudengudi, R. B. Shettar, and P. Kumar. Open ended approach to empirical learning of iot with raspberry pi in modeling and simulation lab. In *2016 IEEE Eighth International Conference on Technology for Education (T4E)*, pages 258–259, Dec. 2016.
- [546] L. Paull, J. Tani, H. Ahn, J. Alonso-Mora, L. Carlone, M. Cap, Y. Chen, C. Choi, J. Dusek, Y. Fang, D. Hoehener, S.-Y. Liu, M. Novitzky, I. Okuyama, J. Pazis, G. Rosman, V. Varricchio, H.-C. Wang, D. Yershov, H. Zhao, M. Benjamin, C. Carr, M. Zuber, S. Karaman, E. Frazzoli, D. Del Vecchio, D. Rus, J. How, J. Leonard, and A. Censi. Duckietown: An open, inexpensive and flexible platform for autonomy education and research. In *IEEE International Conference on Robotics and Automation*, pages 1497–1504, 2017.
- [547] K. Peppler and K. Wohlwend. Theorizing the nexus of steam practice. *Arts Education Policy Review*, pages 1–12, 2017.
- [548] A. Pereira, M. Atri, P. Rogalla, T. Huynh, and M. OMalley. Assessment of feasibility of running rsnas mirc on a raspberry pi: a cost-effective solution for teaching files in radiology. *International Journal of Computer Assisted Radiology and Surgery*, 10(11):1793–1801, 2014.
- [549] C. A. Petry, F. S. Pacheco, D. Lohmann, G. A. Correa, and P. Moura. Project teaching beyond physics: Integrating arduino to the laboratory. In *2016 Technologies Applied to Electronics Teaching (TAEE)*, pages 1–6, June 2016.
- [550] G. Phanomchoeng, R. Chancharoen, S. Kwanmuang, and K. Maneeratana. Successive build up lab for learning mechatronics. In *2016 IEEE International Conference on Teaching, Assessment, and Learning for Engineering (TALE)*, pages 93–100, Dec. 2016.
- [551] P. Plaza, E. Sancristobal, G. Fernandez, M. Castro, and C. Pñrez. Collaborative robotic educational tool based on programmable logic and arduino. In *2016 Technologies Applied to Electronics Teaching (TAEE)*, pages 1–8, June 2016.
- [552] M. Prada, P. Reguera, S. Alonso, A. Moran, J. Fuertes, and M. Dominguez. Communication with resource-constrained devices through MQTT for control education. *IFAC-PapersOnLine*, 49(6):150–155, 2016.
- [553] S. Puente, A. Ubeda, and F. Torres. e-health: Biomedical instrumentation with arduino. *IFAC-PapersOnLine*, 50(1):9156–9161, 2017.

- [554] H. Qi and H. Jack. A scalable course project to accommodate academic variation. In *ASEE Annual Conference and Exposition*, 2016.
- [555] J. Qi, A. b. Huang, and J. Paradiso. Crafting technology with circuit stickers. In *Proceedings of the 14th International Conference on Interaction Design and Children*, IDC '15, pages 438–441, New York, NY, USA, 2015. ACM.
- [556] N. Radzi, A. Ismail, S. Karunanithi, L. Weng, K. Jern, G. Hock, J. Jamaluddin, and P. Krishnan. Integrating programming with beaglebone black for undergraduate's "programming for engineers" syllabus. In *IEEE 8th International Conference on Engineering Education: Enhancing Engineering Education Through Academia-Industry Collaboration, ICEED 2016*, pages 12–15, 2017.
- [557] F. Raffaeli and S. Awad. Portable low-cost platform for embedded speech analysis and synthesis. In *12th International Computer Engineering Conference, ICENCO 2016: Boundless Smart Societies*, pages 117–122, 2017.
- [558] S. Rai, J. Simonelli, K. Chu, H. Chang, C. Kang, C. Lim, R. Shaefer, and T.-C. Tsao. Mechatronics pedagogy in mechanical engineering capstone design. In *American Control Conference*, pages 5343–5348, 2017.
- [559] M. M. Raikar, P. Desai, and J. G. Naragund. Active learning explored in open elective course: Internet of things (iot). In *2016 IEEE Eighth International Conference on Technology for Education (T4E)*, pages 15–18, Dec. 2016.
- [560] H. Rashtian and J. Ouyang. A new application-oriented electronic circuits course for non-electrical engineering students using arduino and ni virtual bench. In *ASEE Annual Conference and Exposition*, 2017.
- [561] S. Ray and A. Al Dhaheri. Using single board computers in university education: A case study. *Advances in Intelligent Systems and Computing*, 571:371–377, 2017.
- [562] T. Rebold, A. Enriquez, E. Dunmire, and N. Langhoff. Toward a comprehensive online transfer engineering curriculum: Assessing the effectiveness of an online engineering circuits laboratory course. In *ASEE Annual Conference and Exposition*, 2016.
- [563] R. Reck and R. Sreenivas. Developing an affordable and portable control systems laboratory kit with a raspberry pi. *Electronics (Switzerland)*, 5(3), 2016.
- [564] G. Recktenwald. BYOE: A desktop apparatus for demonstrating convective heat transfer. In *ASEE Annual Conference and Exposition*, 2016.
- [565] G. Recktenwald and D. Hall. Using arduino as a platform for programming, design and measurement in a freshman engineering course. In *ASEE Annual Conference and Exposition, Conference Proceedings*, 2011.

- [566] P. Reguera, S. Alonso, M. Dominguez, M. Prada, A. Moran, and J. Fuertes. Using Low-Cost Open Source Hardware To Control Puma 560 Motors. *IFAC-PapersOnLine*, 50(1):9180–9185, 2017.
- [567] P. Reguera, D. Garcia, M. Dominguez, M. Prada, and S. Alonso. A low-cost open source hardware in control education. case study: Arduino-feedback ms-150. *IFAC-PapersOnLine*, 48(29):117–122, 2015.
- [568] J. Reitinger, P. Balda, and M. Schlegel. Steam turbine hardware in the loop simulation. In *21st International Conference on Process Control, PC 2017*, pages 380–385, 2017.
- [569] J. Reitinger, M. Cech, M. Schlegel, and P. Balda. New tools for teaching vibration damping concepts: Contlab.eu. In *IFAC Proceedings Volumes (IFAC-PapersOnline)*, volume 19, pages 10580–10585, 2014.
- [570] D. Retz and D. Derickson. Empowering non-engineers with a 'microcontrollers for everyone' philosophy. In *ASEE Annual Conference and Exposition*, 2016.
- [571] G. T. Richard, Y. B. Kafai, B. Adleberg, and O. Telhan. Stitchfest: Diversifying a college hackathon to broaden participation and perceptions in computing. In *Proceedings of the 46th ACM Technical Symposium on Computer Science Education*, SIGCSE '15, pages 114–119, New York, NY, USA, 2015. ACM.
- [572] J. Riofrio, R. Gettens, A. Santamaria, T. Keyser, R. Musiak, and H. Spotts. Innovation to entrepreneurship in the first year engineering experience. In *ASEE Annual Conference and Exposition*, 2015.
- [573] J. Riofrio and S. Northrup. Teaching undergraduate introductory course to mechatronics in the mechanical engineering curriculum using arduino. In *ASEE Annual Conference and Exposition*, 2013.
- [574] A. S. Rodriguez, D. M. Molina, and J. G. Alfaro. Laboratorio experimental: Lessons learned after two years encouraging undergraduate research in computer engineering. In *2016 XLII Latin American Computing Conference (CLEI)*, pages 1–7, Oct. 2016.
- [575] M. C. Rodriguez-Sanchez, A. Torrado-Carvajal, J. Vaquero, S. Borromeo, and J. A. Hernandez-Tamames. An embedded systems course for engineering students using open-source platforms in wireless scenarios. *IEEE Transactions on Education*, 59(4):248–254, Nov. 2016.
- [576] A. S. Rondon and S. S. Guillermo. Platform proposal for control systems practices with smart mobile devices. In *Latin American Robotics Symposium and Competition*, pages 71–76, Oct. 2013.
- [577] W. Rosen, Y. Ertekin, and M. Carr. An autonomous arduino-based racecar for first-year engineering technology students. In *ASEE Annual Conference and Exposition*, 2014.

- [578] D. Rosner, M. Catuneanu, R. Tataroiu, C. Safta, and M. Bucicoiu. Experiencing renewable energy: Design and implementation of a mobile educational laboratory. *UPB Scientific Bulletin, Series C: Electrical Engineering and Computer Science*, 76(3):197–206, 2014.
- [579] A. Rowe, A. Bonham, R. White, M. Zimmer, R. Yadgar, T. Hobza, J. Honea, I. Ben-Yaacov, and K. Plaxco. Cheapstat: An open-source, "do-it-yourself" potentiostat for analytical and educational applications. *PLoS ONE*, 6(9), 2011.
- [580] W. Runathong, W. Wongthai, and S. Panithansuwan. A system for classroom environment monitoring using the Internet of Things and cloud computing. *Lecture Notes in Electrical Engineering*, 424:732–742, 2017.
- [581] L. Ruvalcaba, C. Vázquez, and A. Rojo. Hybrid virtual reality integrated manufacturing cell for education and training. In *13th IASTED International Conference on Computers and Advanced Technology in Education, CATE*, pages 94–99, 2010.
- [582] J. Saenz, J. Chacon, L. D. L. Torre, A. Visioli, and S. Dormido. Open and low-cost virtual and remote labs on control engineering. *IEEE Access*, 3:805–814, 2015.
- [583] R. Santos, L. Ordinez, and G. Eggly. El enfoque de cajas negra y blanca para la ensenanza de sistemas embebidos. In *IEEE Biennial Congress of Argentina, ARGENCON 2016*, 2016.
- [584] N. Saparkhojayev and A. Kurymbayev. Implementation of RFID based computer access system (CAS) for kazakhstani university. In 5th International Workshop on Computer Science and Engineering: Information Processing and Control Engineering, WCSE 2015-IPCE, 2015.
- [585] J. Sarik and I. Kymissis. Lab kits using the arduino prototyping platform. In *2010 IEEE Frontiers in Education Conference (FIE)*, pages T3C-1-T3C-5, Oct. 2010.
- [586] J. Schaeffer and R. Lindell. Arduino in museum exhibition: Lessons learned when working with design students inexperienced in coding. In *Proceedings* of the Ninth International Conference on Tangible, Embedded, and Embodied Interaction, TEI '15, pages 715–720, New York, NY, USA, 2015. ACM.
- [587] J. Schaeffer and R. Lindell. It could just as well have been in greek: Experiences from introducing code as a design material to exhibition design students. In *Proceedings of the TEI '16: Tenth International Conference on Tangible, Embedded, and Embodied Interaction*, TEI '16, pages 126–132, New York, NY, USA, 2016. ACM.

- [588] S. E. Schausberger, R. Kaltseis, M. Drack, U. D. Cakmak, Z. Major, and S. Bauer. Cost-efficient open source desktop size radial stretching system with force sensor. *IEEE Access*, 3:556–561, 2015.
- [589] C. Scholz, A. Sack, M. Heckel, and T. Poschel. Inexpensive mie scattering experiment for the classroom manufactured by 3d printing. *European Journal of Physics*, 37(5), 2016.
- [590] T. Schubert, B. Völker, M. Pfeifer, and B. Becker. The smart miniFab: An industrial IoT demonstrator anywhere at any time. *Smart Innovation, Systems and Technologies*, 75:253–262, 2017.
- [591] K. Schultz. Phase-sensitive detection in the undergraduate lab using a low-cost microcontroller. *American Journal of Physics*, 84(7):557–561, 2016.
- [592] S. Sendari, D. Lestari, C. Kusumohadi, F. Wibowo, and K. Anam. Integrating embedded color vision to bioloid robot for playing soccer. In *International Conference on Signals and Systems, ICSigSys 2017*, pages 297–302, 2017.
- [593] D. Sendoya-Losada, P. Silva, and H. Waltero. Automatic wiring system applied to the training module m2ci. *ARPN Journal of Engineering and Applied Sciences*, 11(19):11503–11513, 2016.
- [594] T. Shepard, J. Choi, T. Holmes, and B. Carlin. The effect of project constraints and choice on first-year microcontroller projects. In *ASEE Annual Conference and Exposition*, 2015.
- [595] H. Shin, K. Kon, H. Igarashi, Y. Anbe, K. Kim, S. Hanamoto, R. Yamasaki, S. Toyoshima, N. Sato, T. Kamegawa, and F. Matsuno. Hardware-software integration of a practical mobile robot platform. In *IEEE/SICE International Symposium on System Integration (SII)*, pages 1263–1268, Dec. 2011.
- [596] S. Shrestha, J. Moore, and J. Nocera. Evaluation of a hands-on approach to learning mobile and embedded programming. *International Journal of Mobile Learning and Organisation*, 5(3-4):327–344, 2011.
- [597] P. H. O. Silva, E. G. Nepomuceno, A. Vitorino, and S. A. M. Martins. A visual chaotic system simulation in arduino platform controlled by android app. In *2017 IEEE World Engineering Education Conference (EDUNINE)*, pages 62–66, Mar. 2017.
- [598] S. Silva, A. Valente, S. Soares, M. J. C. S. Reis, J. Paiva, and P. Bartolomeu. Morse code translator using the arduino platform: Crafting the future of microcontrollers. In *2016 SAI Computing Conference (SAI)*, pages 675–680, July 2016.
- [599] A. Skraba, V. Stanovov, E. Semenkin, A. Kolozvari, R. Stojanovic, and D. Kofjac. Putting cloud 9 ide on the wheels for programming cyber-physical / internet of things platforms: Providing educational prototypes. In *ICINCO 2016 13th*

- *International Conference on Informatics in Control, Automation and Robotics*, volume 2, pages 428-435, 2016.
- [600] P. Skrabanek, P. Vodicka, and S. Yildirim-Yayilgan. Control system of a semi-autonomous mobile robot. *IFAC-PapersOnLine*, 49(25):460–469, 2016.
- [601] K. Slattsveen, M. Steinert, and K. Aasland. Increasing student confidence and motivation in a projectbased machine construction and mechatronics course. In *NordDesign 2016*, volume 2, 2016.
- [602] J. Sobota, R. Pisl, P. Balda, and M. Schlegel. Raspberry pi and arduino boards in control education. In *IFAC Proceedings Volumes (IFAC-PapersOnline)*, volume 10, pages 7–12, 2013.
- [603] A. Soetedjo and I. K. Somawirata. Implementation of face detection and tracking on a low cost embedded system using fusion technique. In *2016 11th International Conference on Computer Science Education (ICCSE)*, pages 209–213, Aug. 2016.
- [604] J. Song and D. Dow. Project-based learning for electrical engineering lower-level courses. In *ASEE Annual Conference and Exposition*, 2016.
- [605] Y. L. Soon, K. B. Gan, and M. Abdullah. Development of very low frequency (vlf) data acquisition system using raspberry pi. In *2015 International Conference on Space Science and Communication (IconSpace)*, pages 485–488, Aug. 2015.
- [606] M. A. Souza, J. R. M. Costa, R. G. Pontes, and A. G. Costa. Perimeter monitoring system using zigbee as result of using pbl in the electronic instrumentation course. In *2016 IEEE Biennial Congress of Argentina (ARGENCON)*, pages 1–6, June 2016.
- [607] M. R. S. B. Souza, J. J. P. Z. Tavares, J. F. Ribeiro, and R. R. Rocha. Design, manufacture and construction of a wireless robotic arm for educational purposes. In 2015 12th Latin American Robotics Symposium and 2015 3rd Brazilian Symposium on Robotics (LARS-SBR), pages 376–380, Oct. 2015.
- [608] N. Spolaor and F. Benitti. Robotics applications grounded in learning theories on tertiary education: A systematic review. *Computers and Education*, 112:97–107, 2017.
- [609] A. Srivastava and S. Dawle. Mudra: A multimodal interface for braille teaching. In *Proceedings of the 6th Augmented Human International Conference*, AH '15, pages 169–170, New York, NY, USA, 2015. ACM.
- [610] J. D. Steinmeyer. Designing and deploying eecs hardware grading in online automated teaching platforms. In *IEEE Integrated STEM Education Conference (ISEC)*, pages 127–130, Mar. 2017.

- [611] J. Straub. Consideration of the versatility of the open prototype for educational nanosats cubesat design. In *2016 IEEE International Conference on Electro Information Technology (EIT)*, pages 0586–0591, May 2016.
- [612] D. Sullivan, W. Chen, and A. Pandya. Design of remote control of home appliances via bluetooth and android smart phones. In *IEEE International Conference on Consumer Electronics Taiwan, ICCE-TW 2017*, pages 371–372, 2017.
- [613] N. Suwondo and D. Sulisworo. Hands-on learning activity using an apparatus for transient phenomena in rc circuit based on arduino uno r3-linx-labview. *International Journal of Online Engineering*, 13(1):116–124, 2017.
- [614] M. Tan, Y. Yang, and P. Yu. The influence of the maker movement on engineering and technology education. *World Transactions on Engineering and Technology Education*, 14(1):89–94, 2016.
- [615] D. Tarnoff. Integrating the arm-based raspberry pi into an architecture course. *Journal of Computing Sciences in Colleges*, 30(5):67–73, 2015.
- [616] P. Teikari, R. Najjar, H. Malkki, K. Knoblauch, D. Dumortier, C. Gronfier, and H. Cooper. An inexpensive arduino-based led stimulator system for vision research. *Journal of Neuroscience Methods*, 211(2):227–236, 2012.
- [617] I. Tejado, J. Serrano, E. Prez, D. Torres, and B. Vinagre. Low-cost hardware-in-the-loop testbed of a mobile robot to support learning in automatic control and robotics. *IFAC-PapersOnLine*, 49(6):242–247, 2016.
- [618] G. Tewolde. Effective active learning tools for an embedded systems course. In *Frontiers in Education Conference, FIE*, volume 2017-October, pages 1–5, 2017.
- [619] J. Tian. A design approach in an introduction to engineering course. In *ASEE Annual Conference and Exposition*, 2014.
- [620] B. Trowbridge, F. Calas, Z. Weingarten, J. Husinger, V. Fomitchev, and R. Integlia. Protomesh, a wireless solution and platform for embedded education and raspberry pi workshops. In *EDUNINE 2017 IEEE World Engineering Education Conference: Engineering Education Balancing Generalist and Specialist Formation in Technological Carriers: A Current Challenge, Proceedings*, pages 90–94, 2017.
- [621] V. Łtuikys, R. Burbaite, T. Blađauskas, D. Barisas, and M. Binkis. Model for introducing stem into high school computer science education. *International Journal of Engineering Education*, 33(5):1684–1698, 2017.
- [622] P. Turton and T. F. Turton. Pibrain a cost-effective supercomputer for educational use. In *5th Brunei International Conference on Engineering and Technology (BICET 2014)*, pages 1-4, Nov. 2014.

- [623] M. Tvaruzka, M. Kotyrba, and E. Volna. Unconventional methodology for slow motion control using the arduino platform. *Journal of Telecommunication, Electronic and Computer Engineering*, 8(3):25–30, 2016.
- [624] B. Ulrich. A modern, versatile and low cost educational system for teaching DC/DC converter control with analog, digital and mixed-signal methods. In *International Conference on Research and Education in Mechatronics, REM*, 2017.
- [625] D. Ursutiu, C. Samoila, and J. Bergmans. Tempus ico-op, new trends in labview moodle integration. In *2014 International Conference on Interactive Collaborative Learning (ICL)*, pages 685–688, Dec. 2014.
- [626] M. Varanis, A. Silva, P. Brunetto, and R. Gregolin. Instrumentation for mechanical vibrations analysis in the time domain and frequency domain using the arduino platform. *Revista Brasileira de Ensino de Fisica*, 38(1), 2016.
- [627] A. Vasilchenko, D. Green, H. Qarabash, A. Preston, T. Bartindale, and M. Balaam. Media literacy as a by-product of collaborative video production by cs students. In *Annual Conference on Innovation and Technology in Computer Science Education, ITiCSE*, pages 58–63, 2017.
- [628] S. Vechet, J. Krejsa, M. Ruzicka, and P. Masek. Building a scaled model of autonomous convoy powered by arm mbed microcontrollers. In *Proceedings* of the 16th International Conference on Mechatronics Mechatronika 2014, pages 711–714, Dec. 2014.
- [629] A. Vostrukhin, E. Vakhtina, and S. Bondar. Using assembler for microcontroller study on arduino-based platform. In *Engineering for Rural Development*, volume 16, pages 581–587, 2017.
- [630] C. wa Maina, A. Muhia, and J. Opondo. A low cost laboratory for enhanced electrical engineering education. In *2016 IST-Africa Week Conference*, pages 1–8, May 2016.
- [631] M. Walzik, V. Vollmar, T. Lachnit, H. Dietz, S. Haug, H. Bachmann, M. Fath, D. Aschenbrenner, S. Abolpour Mofrad, O. Friedrich, and D. Gilbert. A portable low-cost long-term live-cell imaging platform for biomedical research and education. *Biosensors and Bioelectronics*, 64:639–649, 2014.
- [632] H. Wang, C. Zhou, and Y. Wu. Smart cup, wisdom creation: A project-based learning initiative for maker education. In *2016 IEEE 16th International Conference on Advanced Learning Technologies (ICALT)*, pages 486–488, July 2016.
- [633] H. Z. Wang, X. L. Zhang, W. Li, P. Q. Yang, C. Liu, and C. H. Ren. The application research on mini-type magnetic resonance imaging instrument. In 2007

- *IEEE/ICME International Conference on Complex Medical Engineering*, pages 1996–1999, May 2007.
- [634] G. Wetzstein, R. Konrad, H. Ikoma, and N. Padmanaban. Build your own vr system an introduction to vr displays and cameras for hobbyists and educators. In *ACM SIGGRAPH 2017 Courses*, 2017.
- [635] M. A. Wickert. Real-time dsp basics using arduino and the analog shield sar codec board. In *2015 IEEE Signal Processing and Signal Processing Education Workshop (SP/SPE)*, pages 59–64, Aug. 2015.
- [636] M. Wiech, J. Bollhoff, and J. Metternich. Development of an optical object detection solution for defect prevention in a learning factory. *Procedia Manufacturing*, 9:190–197, 2017.
- [637] C. Wille, D. Hess, J. Levin, A. Nimunkar, and J. Puccinelli. Impact of a sophomore BME design fundamentals course on student outcome performance and professional development. In *ASEE Annual Conference and Exposition*, 2017.
- [638] M. Wirth and J. McCuaig. Making programs with the raspberry pi. In *Proceedings of the Western Canadian Conference on Computing Education*, WCCCE '14, pages 17:1–17:5, New York, NY, USA, 2014. ACM.
- [639] J. Wolfer. A heterogeneous supercomputer model for high-performance parallel computing pedagogy. In *2015 IEEE Global Engineering Education Conference (EDUCON)*, pages 799–805, Mar. 2015.
- [640] J. Wolfer and W. Keeler. From geiger-counters to file systems: Remote hardware access for the operating systems course. *International Journal of Online Engineering*, 12(9):26–31, 2016.
- [641] W. Xiang, F. Sotiropoulos, and S. Liu. xradio: An novel software defined radio (sdr) platform and its exemplar application to vehicle-to-vehicle communications. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), 9143:404-415, 2015.
- [642] P. I. Yakimov. Open-source platforms application in introductory embedded systems teaching. In *2016 XXV International Scientific Conference Electronics* (*ET*), pages 1–4, Sept. 2016.
- [643] M. Yamada, M. Cuka, Y. Liu, T. Oda, K. Matsuo, and L. Barolli. Performance evaluation of an IoT-Based E-Learning Testbed Using Mean-shift Clustering Approach Considering Delta Type of Brain Waves. In 31st IEEE International Conference on Advanced Information Networking and Applications Workshops, WAINA 2017, pages 265–270, 2017.

- [644] M. Yamada, T. Oda, Y. Liu, M. Hiyama, K. Matsuo, and L. Barolli. Performance Evaluation of an IoT-based e-Learning Testbed Considering OLSR and WEP Protocols. In 2016 10th International Conference on Innovative Mobile and Internet Services in Ubiquitous Computing (IMIS), pages 335–341, July 2016.
- [645] M. Yamada, T. Oda, K. Matsuo, and L. Barolli. Design of an IoT-Based E-learning Testbed. In 2016 30th International Conference on Advanced Information Networking and Applications Workshops (WAINA), pages 720–724, Mar. 2016.
- [646] D. Yeo and D. Paley. The AUSS FIREfly: A distributed sensing and coordination platform for first-year engineering education. In *AIAA SciTech Forum AIAA Aerospace Sciences Meeting*, 2017.
- [647] K. Yoshihara, K. Watanabe, and N. Iguchi. New educational equipments for networking study by physical visualizations and physical direct manipurations. In *2016 IEEE 30th International Conference on Advanced Information Networking and Applications (AINA)*, pages 227–230, Mar. 2016.
- [648] A. Yousuf, W. Lehman, M. Mustafa, and M. Hayder. Low-cost robot arms for the robotic operating system (ros) and moveit. In *ASEE Annual Conference and Exposition*, 2016.
- [649] W. Yu, O. Farook, J. Agrawal, and A. Ahmed. Teaching microcontrollers with emphasis on control applications in the undergraduate engineering technology program. In *ASEE Annual Conference and Exposition*, 2017.
- [650] M. Zakaria. Arrow-bot: A teaching tool for real-time embedded system course. In *MATEC Web of Conferences*, volume 87, 2017.
- [651] Q. Zhang, L. Brode, T. Cao, and J. Thompson. Learning laboratory chemistry through electronic sensors, a microprocessor, and student enabling software: A preliminary demonstration. *Journal of Chemical Education*, 94(10):1562–1566, 2017.
- [652] X. Zhong and Y. Liang. Raspberry pi: An effective vehicle in teaching the internet of things in computer science and engineering. *Electronics (Switzerland)*, 5(3), 2016.
- [653] W. Zhu. Teaching assembly programming for ARM-based microcontrollers in a professional development kit. In *IEEE International Conference on Microelectronic Systems Education, MSE*, pages 23–26, 2017.
- [654] E. Zouganeli, V. Tysso, B. Feng, K. Arnesen, and N. Kapetanovic. Project-based learning in programming classes the effect of open project scope on student motivation and learning outcome. In *IFAC Proceedings Volumes (IFAC-PapersOnline)*, volume 19, pages 12232–12236, 2014.

- [655] I. A. Zualkernan. A course for teaching integrated system design to computer engineering students. In *2014 IEEE Global Engineering Education Conference (EDUCON)*, pages 470–474, Apr. 2014.
- [656] S. A. Zulkifli, F. N. F. Ramli, and S. Razali. Undergraduate student experience in development of zvs power converter for voltage control with low cost microcontroller. In *2016 IEEE International Conference on Automatic Control and Intelligent Systems (I2CACIS)*, pages 55–60, Oct. 2016.

University

- [657] R. Bardaji and J. Piera. Low-cost moored instrumentation for citizens' education and participation in environmental stewardship. In *MTS/IEEE OCEANS Bergen*, pages 1–3, June 2013.
- [658] E. Berdahl and Q. Llimona. Tangible embedded linux. In *7th International Conference on Tangible, Embedded and Embodied Interaction*, TEI '13, pages 407–410, New York, NY, USA, 2013. ACM.
- [659] T. Bewley, J. Strawson, and C. Briggs. Leveraging open standards and creditcard-sized linux computers in embedded control & robotics education. In ASEE Annual Conference and Exposition, Seattle, WA, USA, 2015.
- [660] K. Chorianopoulos, L. Jaccheri, and A. S. Nossum. Creative and open software engineering practices and tools in maker community projects. In *4th ACM SIGCHI Symposium on Engineering Interactive Computing Systems*, EICS '12, pages 333–334, New York, NY, USA, 2012. ACM.
- [661] D. Holman. Glassblowing: Forming a computational glass material. In *Sixth International Conference on Tangible, Embedded and Embodied Interaction*, TEI '12, pages 379–380, New York, NY, USA, 2012. ACM.
- [662] M. L. Kronemann and V. V. Hafner. Lumibots: Making emergence graspable in a swarm of robots. In *8th ACM Conference on Designing Interactive Systems*, DIS '10, pages 408–411, New York, NY, USA, 2010. ACM.
- [663] B. Li, J. Mooring, S. Blanchard, A. Johri, M. Leko, and K. Cameron. Seemore: A kinetic parallel computer sculpture for educating broad audiences on parallel computation. *Journal of Parallel and Distributed Computing*, 105:183-199, 2017.
- [664] D. A. Mellis and L. Buechley. Scaffolding creativity with open-source hardware. In *8th ACM Conference on Creativity and Cognition*, pages 373–374, New York, NY, USA, 2011. ACM.

- [665] D. A. Mellis and L. Buechley. Case studies in the personal fabrication of electronic products. In *Designing Interactive Systems Conference*, DIS '12, pages 268–277, New York, NY, USA, 2012. ACM.
- [666] J. A. A. Pauta, E. P. Vélez, and L. Serpa-Andrade. Braille teaching electronic prototype. In *2016 IEEE International Autumn Meeting on Power, Electronics and Computing (ROPEC)*, pages 1–7, Nov. 2016.
- [667] O. K. Richards. Exploring the empowerment of older adult creative groups using maker technology. In *Conference on Human Factors in Computing Systems*, pages 166–171, New York, NY, USA, 2017. ACM.
- [668] E. Rios, A. Khan, and D. Padgett. A senior design project: Heating and cooling system for car's interior. In *ASEE Annual Conference and Exposition*, 2014.
- [669] E. Rosenbaum, E. Eastmond, and D. Mellis. Empowering programmability for tangibles. In *Fourth International Conference on Tangible, Embedded, and Embodied Interaction*, TEI '10, pages 357–360, New York, NY, USA, 2010. ACM.
- [670] M. Srinivasan, B. Anand, A. J. Antony Venus, V. Arun Neol, M. Narayanan, S. P. Sree Rakshaa, and V. Vijayaraghavan. GreenEduComp: Low cost green computing system for education in rural india: A scheme for sustainable development through education. In *IEEE Global Humanitarian Technology Conference* (*GHTC*), pages 102–107, Oct. 2013.
- [671] A. Sripakagorn, R. Chancharoen, K. Maneeratana, and K. Panyajirakul. An implementation of CDIO/design thinking in mechatronics projects. In *2014 IEEE International Conference on Teaching, Assessment and Learning for Engineering (TALE)*, pages 516–521, Dec. 2014.
- [672] D. Trivedi and J. Pearce. Open source 3-d printed nutating mixer. *Applied Sciences (Switzerland)*, 7(9), 2017.
- [673] J. Vicuna, F. Castillo, F. Urgiles, and J. Rios. Raspberry analysis in the teaching of computer sciences. *International Journal of Applied Engineering Research*, 12(7):1182–1189, 2017.
- [674] P. Wang, R. K. Koh, C. G. Boucharenc, and C.-C. Yen. Lights out: An interactive tangible game for training of post-stroke reaching. In *Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems*, CHI EA '16, pages 1937–1944, New York, NY, USA, 2016. ACM.
- [675] X. Wang, S. Jiang, X. Xu, Z. Wu, and Y. Tao. A Raspberry Pi and LXC based distributed computing testbed. In *International Conference on Digital Home, ICDH 2016*, pages 170–174, 2017.
- [676] Y. C. Yang, S. T. Wang, Y. J. Tseng, and H. C. K. Lin. Light up! creating an interactive digital artwork based on arduino and Max/MSP design. In *International Computer Symposium (ICS)*, pages 258–263, Dec. 2010.