

Fashionable Robots for Broadening Participation in Computing

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Abstract:

According to the National Center for Education Statistics, in 2015, women earned only 18% of all computer science degrees in the nation; that percentage dips even lower for women of color. Also though females are slowly making their way toward STEM-related careers including computer science over time, the percentage of women in the computer science field, as opposed to other areas, has had little improvement when compared with decades ago.

To address this issue, we integrate fashion into robotics and computer programming by designing and implementing fashion-bots. The objective of this project is to motivate female students by improving their sense of belonging. Research has shown that relatedness plays a significant role in students' motivation to learn.

We plan to develop an introductory robotics and computing curriculum based on fashion-bot for elementary and middle school girls and investigate its impact the students motivation in robotics. The disciplines involved are: fashion, computer programming and robotics.

Introduction

According to published data, only 18% of computer science degree recipients in 2015 are female [1]. Over time, even though females are slowly making their way toward STEM-related careers including computer science, the percentage of women in the computer science field, as opposed to other areas, e.g., Medical and Law School, has had little improvement when compared with decades ago [2].

Many ideas have been proposed, including robotics, to address this issue. For example, FIRST LEGO League (FLL), a worldwide robotics competition for youths of 11-16-year-old, has involved a wide range of school districts and communities worldwide. A recent study [3] looked at the FLL robotics competition and how female students participate in these. The research shows that, while both male and female students enjoy using Mindstorms, 44% of males and only 14% of females indicated that using LEGO Mindstorms made them interested in having a computing job. Sales data of gender-neutral robots also shows a bias towards boys[4]. The robotic rovers usually resemble vehicles not human, and the activities typically are focused on competition rather than social connectivity.

According to self-determination theory [5], one of the three basic human needs is relatedness, the need to have a sense of belonging and connectedness with others. Educational robotics in its current format does not address the needs of relatedness for female students. Given the situation, we are motivated to design and implement robots that attract girls. Our idea is to integrate fashion into robotics and computer programming. We have created prototype fashion-bots and are planning to develop a curriculum centered on them.

Objective:

To develop robots and programming activities that increase female students' motivation to learn.

Vision:

To transform robotics and computing into a field with i) cultures that female students can relate to; and ii) activities that allow them to express themselves and connect.

Approach:

To address this issue, we integrate fashion into robotics and computer programming by designing and implementing fashion-bots, a low-cost and easy-to-program robot for outreach activities.



Figure 1. Fashion-Bots

Figure 1 shows our fashion-bots. Comparing to traditional robots, the advantages of fashion-bots are:

- Taking on appearances of female and allow the students to change their appearances
- Can be programmed easily by beginners.

They are implemented using micro: bit, a pocket-sized computer, that is not only low-cost (\$15), but also has a graphical programming interface that allows students to program by drag-and-drop programming blocks. A beginner can easily create a program that makes a fashion-bot move, which makes the fashion-bots excellent tools for outreach activities.

In Figure 2, we show an image of micro: bit. Figure 3 shows the Microsoft makecode [6] programming interface for micro:bit. The block-based programming interface opens a door for many students, as young as elementary school age, to computer programming and robotics.

Approach Continued :

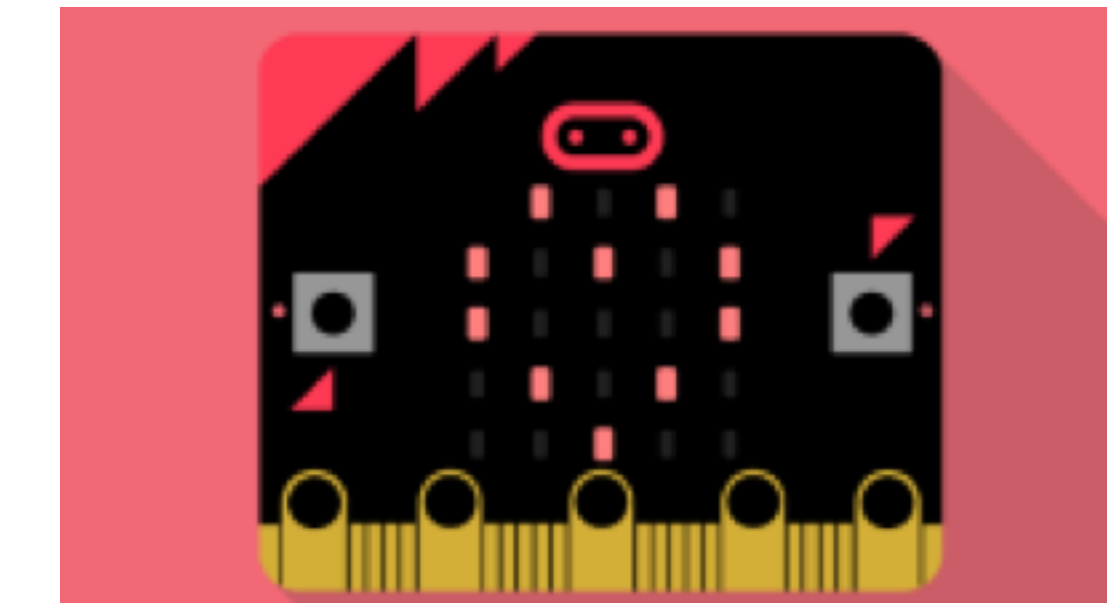


Figure 2. Micro:bit

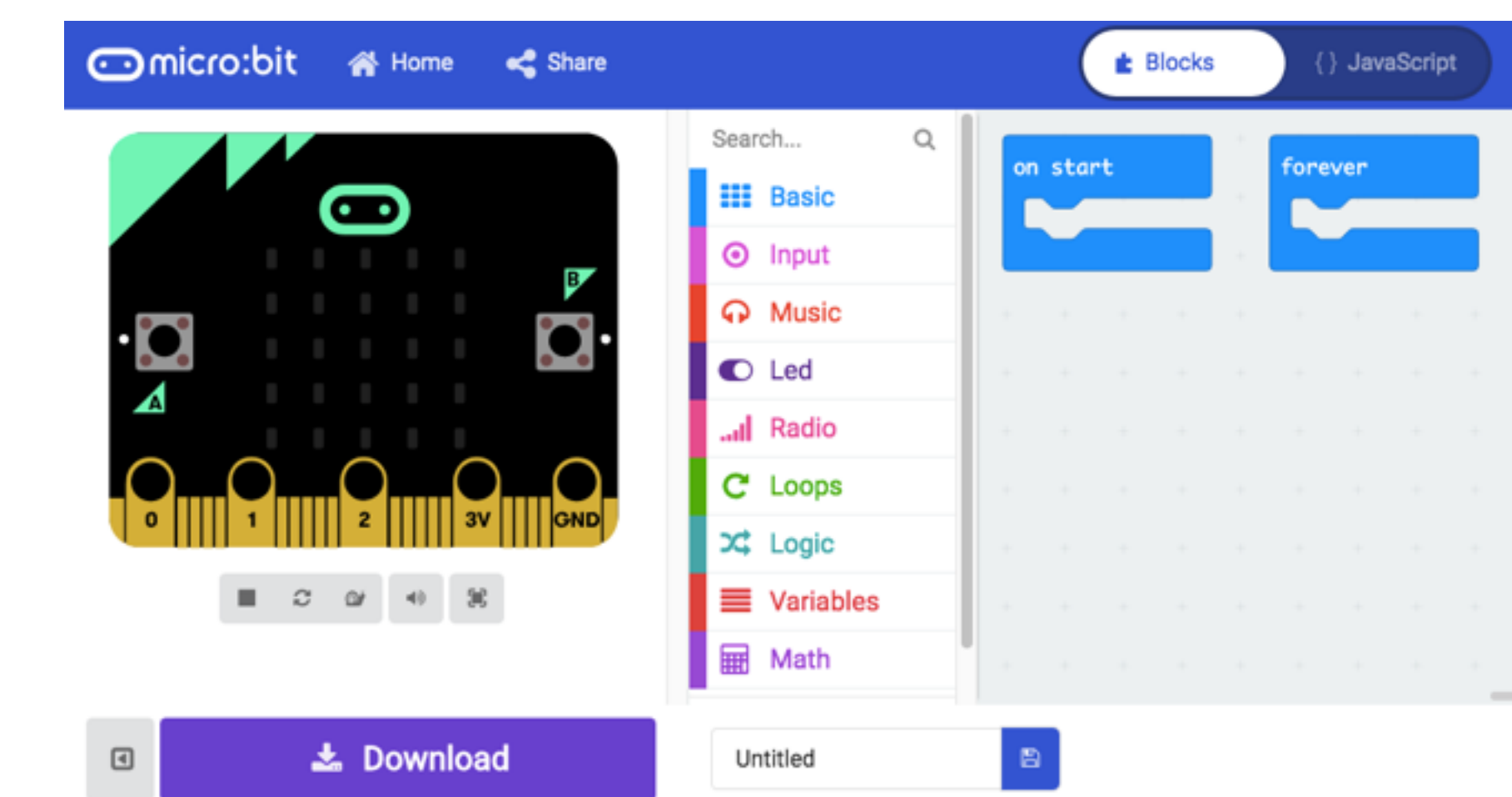


Figure 3. Microsoft Makecode Programming Interface for Micro:bit

Challenges:

To change the status quo of robotics, including its presence, scope, and activities.

Assessment:

We will assess the student relatedness and motivation with Likert scales. We will use a traditional robot rover with the appearance of a car as a comparison. An IRB protocol will be developed to investigate the robots and their associated curriculum activities on students' motivation.

Future work:

We plan to develop an introductory robotics and computing curriculum based on fashion-bots and investigate its impact on the students' motivation. We will also include i) 3-D printing programming to produce accessories, and ii) embroidery programming with turtleStich to decorate the fashion-bots.

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