Prize Winner

Computer Programming, Apps & Robotics

Year 3-4

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A-BOT to the rescue!: An m&m sorter

Included in this submission is:
1. Cover Sheet
2. This report
3. A video of the working robot
4. A copy of the program which I created on the iPad. This is an .ev3m file. The file is called '0560-049.Cavagnaro.A-BOTtotherescue'
I downloaded the EV3 program called 'Programmer' from the Apple Store.

Aim, purpose and applications

Aim: to make a robot that sorts the blue m&m's from the other colours. This robot will sort the blue m&ms from the other colours which is important for many people because the blue m&m's have a colour called '133 brilliant blue'. This blue colour can cause behaviour issues and might cause cancer. In some countries, including France, this blue colour is banned in all food.

A robot like the one I developed, but much bigger, could also be used to sort other foods such as fruit based on colour. For example, apples could be sorted based on different variety or tomatoes based on different ripeness.

Materials and Method
Before I made this robot, I made one of the robots that was on the LEGO EV3 box. The robot was called *Tracker*. I made this with my Dad so that I could learn how the program and coding worked and how this robotics worked. I tried out the different sensors that came with the kit so that I could think about how to make my robot using LEGO EV3. I drew diagrams with my ideas and talked about my ideas with my mum and dad. After I made the robot I tried to make a chute to deliver the m&ms. I even tried making a chute with a motor to see if I could get the m&ms to go down onto the conveyor belt one at a time. These chutes did not work because too many m&ms came onto the conveyor belt at one time and the sorter did not sort properly. This is something I could keep trying to make and would be helpful if using this robotic system for larger amounts of things.

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Type of robot / device required:
- LEGO EV3 (home edition).
- iPad (I did my coding using the LEGO Programmer app on an iPad).
- m&ms (Must include all colours available)
- Two small bowls.

Instructions for using my robot:
1. Upload program '0560-049.Cavagnaro.A-BOTtotherescue' (this was the third version of my program) to the EV3 brick (this is the robot).
2. Put one of the bowls down next to but under the pinger to catch the blue m&ms that get pung out and one bowl at the end of the conveyor belt for the other coloured ones.
3. Press START to begin the program.
4. The conveyor belt will start rotating.
5. Start putting m&ms on the conveyor belt, one at a time.
6. There is an Emergency Button. If you get your finger stuck in the conveyor belt press the touch sensor to stop it from rotating. Then restart the program.

Demonstration

I have submitted a link to the video of my robot sorting the m&ms as well as a copy of my program. My program is called '0560-049.Cavagnaro.A-BOTtotherescue'

The Program and Explanation of How it Works
I programmed the robot on the iPad. I noticed this looks different from the computer LEGO app. I have shown here the program in the iPad version, and this is the one that shows what I did. I have also shown the laptop version of the coding but without the notes.

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1. If the touch sensor is bumped (true) it stops everything.

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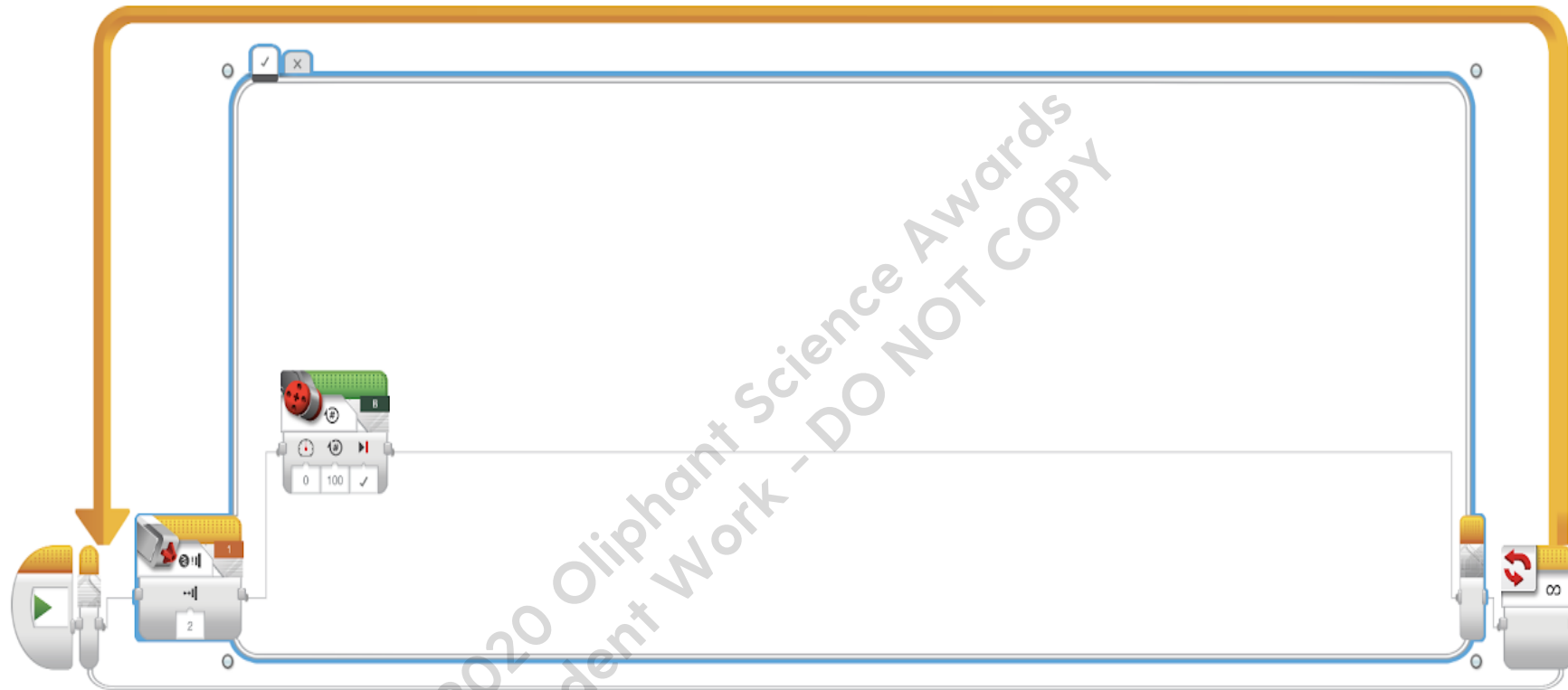
2.   If the touch sensor is not bumped (false) the program continues and checks the colour of the m&m. If the colour is not blue (false) the m&m continues down the conveyor belt and into the bowl below and the program goes back to the start.

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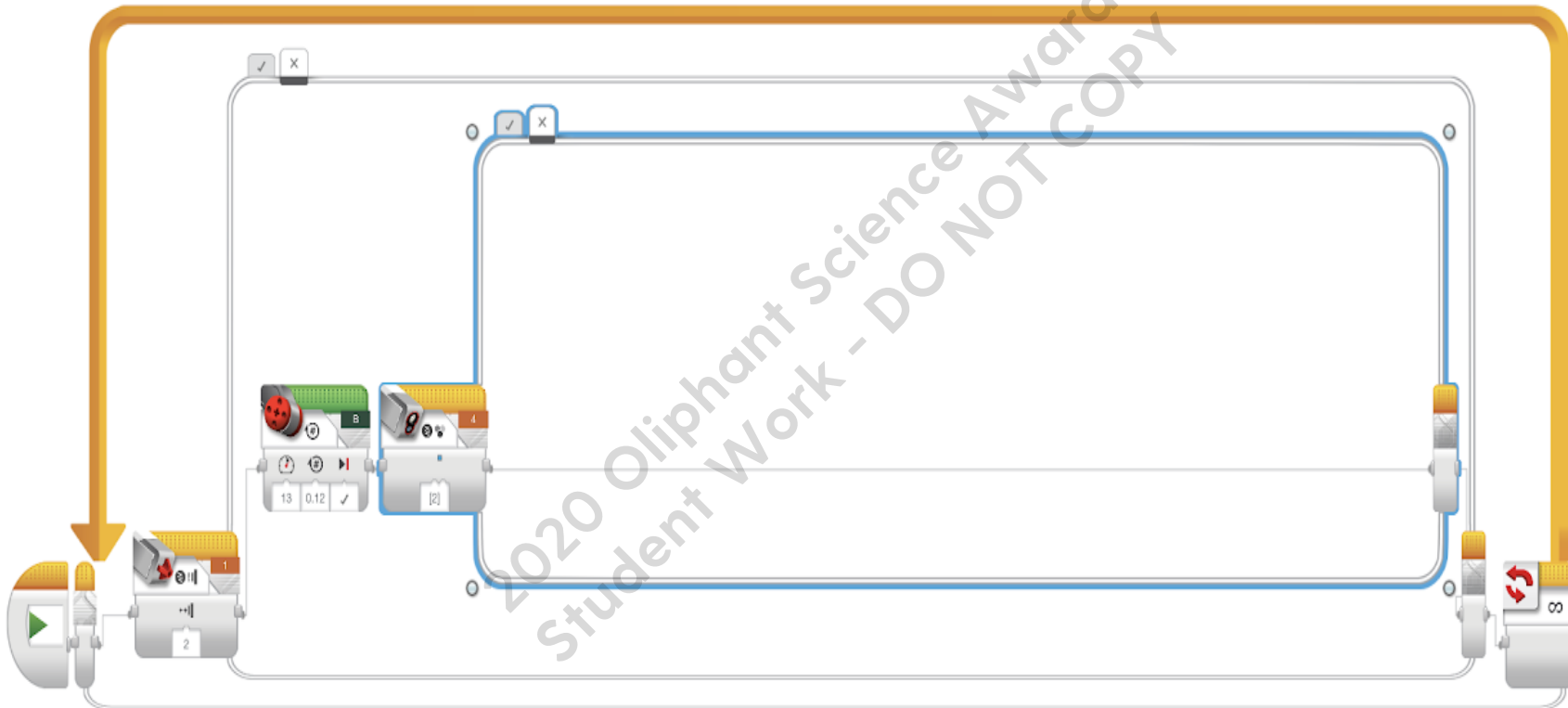
3.   If the colour is blue (true), the m&m will move along the conveyor belt and the rotating pinger will knock the blue m&m off the conveyor belt into the bowl below. The robot then beeps. The program then goes back to the start.

Between each step the program includes the emergency stop. (Please see in the methods section above).

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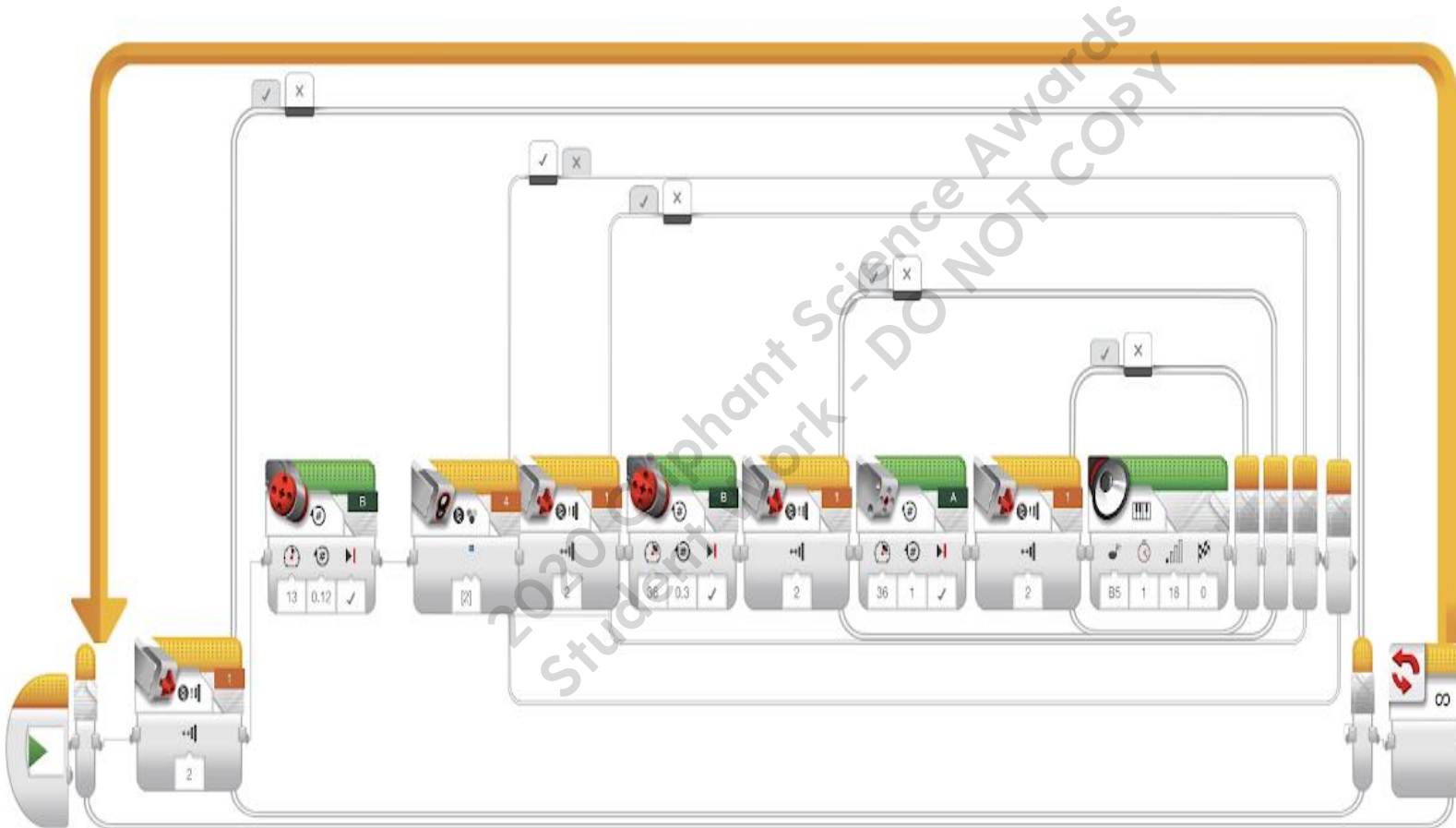
Here are the two different formats for the laptop version. It is like the program that I used at code camp last year. I used a website to convert the iPad version to the formats here. The first is from the laptop format, the second is the text version format.

1. Laptop format

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2.   Text format of the coding

```
Program
├─ StartBlock
└─ Loop(LoopCondition.Unlimited)
      └─ Switch(TouchSensor.Compare Port: 1 |
Pressed__Released_or_Bumped: Bumped)
      ├─ Case Pattern: True
      │  └─ Motor.Rotations MotorPort: B | Speed: 0 | Rotations:
100 | Brake_At_End: Brake
      └─ Case Pattern: False
            ├─ Motor.Rotations MotorPort: B | Speed: 13 |
Rotations: 0.12 | Brake_At_End: Brake
            └─ Switch(ColorSensor.CompareColor Port: 4 |
Set_of_colors: [Blue])
               ├─ Case Pattern: True
               │  └─ Switch(TouchSensor.Compare Port: 1 |
Pressed__Released_or_Bumped: Bumped)
               │     ├─ Case Pattern: True
               │     │  └─ Motor.Rotations MotorPort: B | Speed: 0 |
Rotations: 100 | Brake_At_End: Brake
               │     └─ Case Pattern: False
               │        ├─ Motor.Rotations MotorPort: B | Speed: 36 |
Rotations: 0.3 | Brake_At_End: Brake
               │        └─ Switch(TouchSensor.Compare Port: 1 |
Pressed__Released_or_Bumped: Bumped)
               │           ├─ Case Pattern: True
               │           │  └─ Motor.Rotations MotorPort: B |
Speed: 0 | Rotations: 100 | Brake_At_End: Brake
               │           └─ Case Pattern: False
               │              ├─ MediumMotor.Rotations MotorPort:
A | Speed: 36 | Rotations: 1 | Brake_At_End: Brake
               │              └─ Switch(TouchSensor.Compare Port:
1 | Pressed__Released_or_Bumped: Bumped)
               │                 ├─ Case Pattern: True
               │                 │  └─ Motor.Rotations MotorPort: B
| Speed: 0 | Rotations: 100 | Brake_At_End: Brake
               │                 └─ Case Pattern: False
               │                    └─ Sound.Note Note: 'B5' |
Duration: 1 | Volume: 18 | Play_Type: WaitForCompletion
               └─ Case Pattern: False
                  └─ (None)
```

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External help

- My Dad gave me some suggestions on how to make the robot steady, but I made the final decisions. I also had help putting in some tough LEGO pieces.
- My Dad and I worked together to make the practice robot *Tracker* from the EV3 box so that we could learn how the robotics and EV3 program worked.
- My Mum helped me with some of the spelling and formatting, but not the words.
- I got **NO** help in the coding.

Bibliography

1. https://education.lego.com/en-au/product/mindstorms-ev3
2. https://www.justgotochef.com/ingredients/food-color-133
3. https://www.foodcraft.hk/blogs/news/e951-e621-e133-the-harmful-chemicals-in-your-food-and-how-to-avoid-them
4. https://ev3treeivs.azurewebsites.net