CS ALL Projects – Project One: Lego Robot Game (LRG)
Individual Project Portfolio (IPP)

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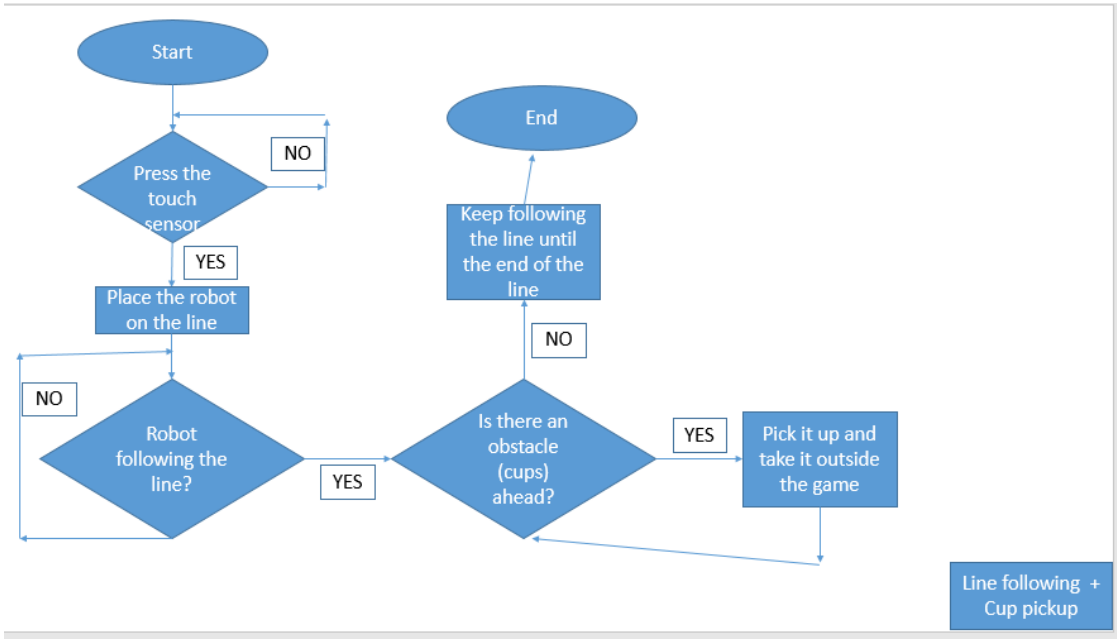
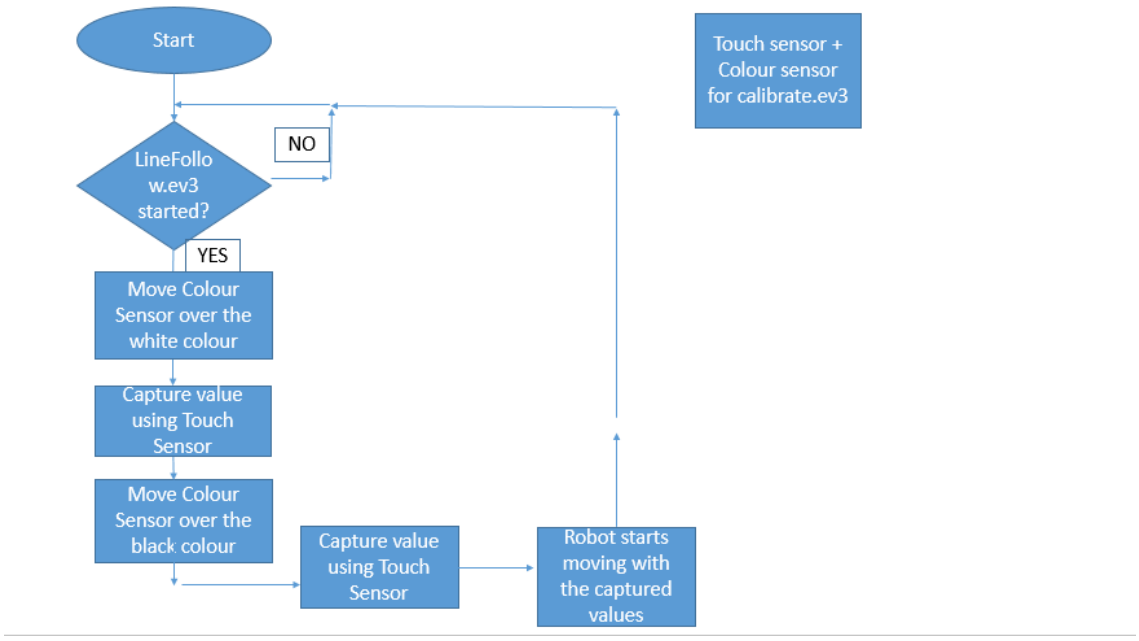
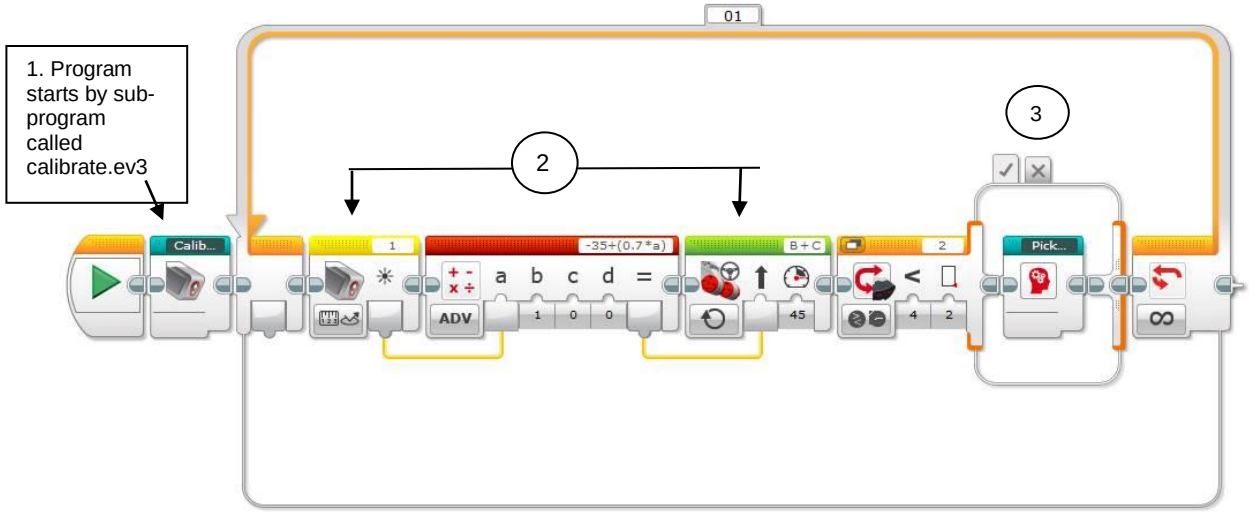
- **Program algorithm design – a flow control diagram (either in a flowchart or an activity diagram)**





- **Program implementation and testing – the screen shots of the game program developed in EV3 and the link to a YouTube video of the game**



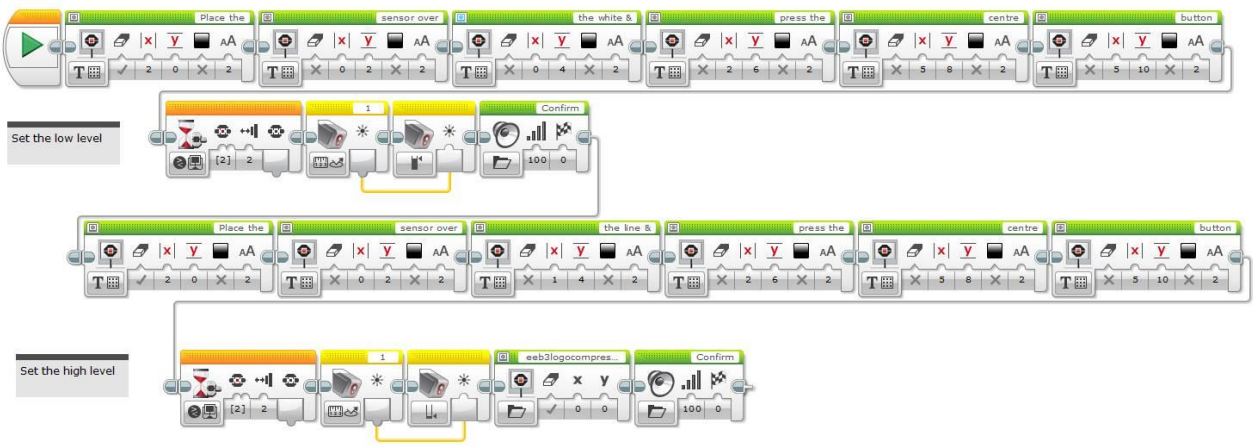
Program – Followline.ev3

1. Once sub-program calibrate.ev3 is enabled, the colour sensor measures reflected light intensity values on the map.

2. Measures the current sensor reading, then calculates steering. If the colour sensor detects the colour black, then the formula returns with -35 therefore the robot turns to the left and if the colour sensor detects the colour white, then it returns the value 35 therefore the robot turns right. If the colour sensor detects the colour grey, then the speed of the robot will be decreased allowing the robot to turn more gently.

3. If the IR sensor values goes over 2 then if picks up the cups (pickupcup.ev3). Then it loops again.

Program – Pickupcup.ev3

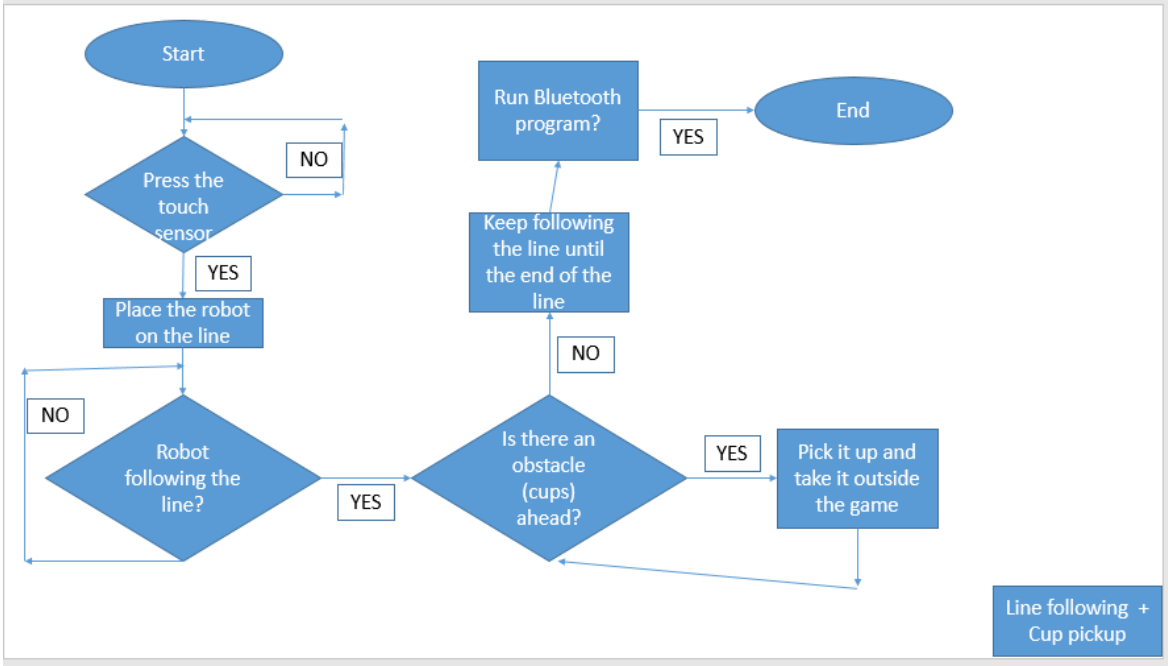


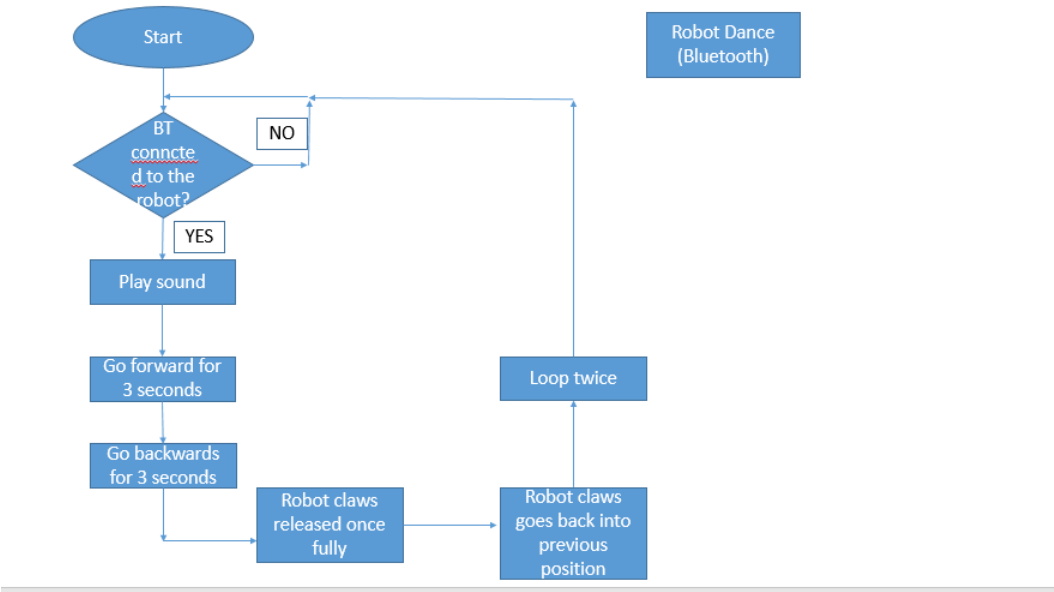
Program name – Calibrate.ev3

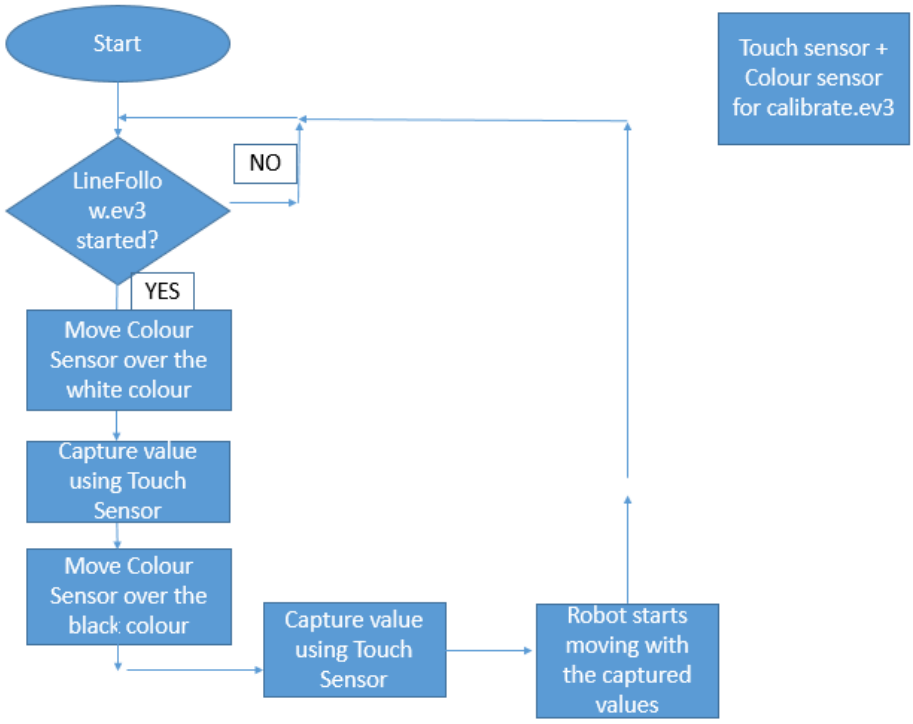
- **the link to a YouTube video of the game testing the code**

https://www.youtube.com/watch?v=w6DfQPkGNRs

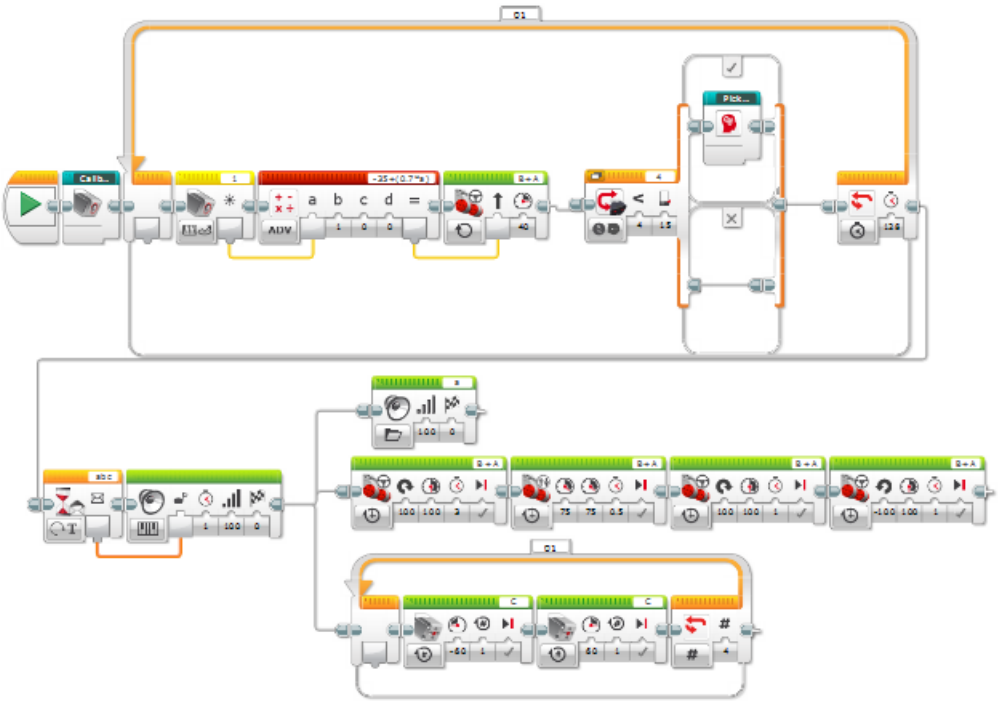
- **Revised program algorithm design with Bluetooth – the revised flow control diagram (flow chart or activity diagram)**







- **Revised Program implementation and testing – the screen shots of the game program developed in EV3 with Bluetooth**



Program name – program.ev3

Final program of the game which we implemented on the robot and used it to perform test the program on the robot.

- **the link to a YouTube video of the game**

https://www.youtube.com/watch?v=zo_zPiqqUGI

- **Up-to-date of an individual on-line Project Work Portfolio - the link to your PWP**

https://raia10coventryacuk.wordpress.com/

- **Evaluation and reflection of the LRG program development, academic/study skills and professional practices acquired from the project for personal career development – a report with a maximum of 500 words**

Looking back at the LRG program I want to be very critical of myself because I have had so many good and bad experiences. To start off personally I think the LRG program that me and my group have developed over the time of 10 weeks is appositely to the very best of our ability because each of us gave our all to make and develop the LRG program. When we started I did not have the best knowledge about programming and I struggled the first few weeks but as the weeks passed I began to talk to my group and shared ideas which made it to the final program. Also, I began to offer more to the group such as innovating a group member's idea into a bigger idea and I think this way as a group we really understood and respected each other ideas. However, the bigger the idea the more challenging was to make the program. We started off with Line following program to make use of the colour sensor however adding another program which was to make use of the IR sensor to detect the cups inside the game which the robot would take it outside the game to finish the game. My job was to take the robot home every week because I lived closest to the university and because I had the robot every week I had more opportunity to play around with program in Ev3 Mindstorm software, by doing this I began to understood and became familiar with the functionality of the program and robot each week. Finally, after few weeks we completed the final LRG program and I contributed the best of my ability to the program which helped to make the program successful.

Secondly I think that the skills and knowledge I have acquired through LRG program development are going to help me on a bigger scale than I think. I think that the skills I have achieved such as critical time management, team work, ability to decipher the program, punctuality etc. has already helped me on my personal career development as I do not think I would have achieved these skills and knowledge if I had decided only to finish college and not attend university. The journey of learning and experiencing deeper connection into programming has made me feel that it was the right decision for me to learn programming as I have also found how much I love programming and it's exciting to know that there are always much more to learn.

In conclusion, I think the LRG program development has given an enormous boost to my confidence when it comes to understanding the programming language. The complex program that I encountered learning such as making the Bluetooth program for the robot was using loops in the line following program has given me an insight into the harder and more evolved programs, which has given me the motivation to learn more and this will only help me to develop my personal career.

- **Report of computer components and processing required for the LRG game program – a report in a maximum of 500 words**

We all decided to pick the Gripp3r design because in this design we could use all the sensors. To evaluate the components and processing I have to start with the main programmable brick. The Ev3 serves as the control centre and power station for the robot. One positive about the programmable brick was that it had 4 inputs and 4 outputs ports which meant that there were enough ports for the input sensors and the motors to be placed and the data could be processed from the programmable brick to the motors to make the robot to follow the line in our game. However, one negative about the brick was that when we programming we decided to use pre-recorded audio to play between the Bluetooth program and we found out that the brick had a very small amount of memory and therefore we could only use one of our recorded sound and we had to compromise with the sounds on the brick installed. This pushed us back on our idea because we had decided to use a lot of our own sounds to make the robot dance into different sounds and perform different movements. The brick did have the ability to insert an SD Card into the brick but we were not given an SD card when we got the programmable brick. Another downside of the programmable brick was that the screen was very dim and this made it difficult for the group sometimes as the brick had to be lifted and brought up-close to see the display clearly and because of that sometimes the near parts would fall out because of the repetitive action.

Secondly, the infrared sensor. IR sensor gave me and the group very hard time as we had to reposition the IR sensor couple of times because it was not detected the cups on the line or it was detecting the cups too slow and this made the robot very confused and caused the robot to lose the direction of the line and step off the map. We fixed the problem by placing the IR sensor differently facing underneath the gripper rather than facing forward.

Thirdly, the touch sensor. The touch sensor was probably the easiest to program. All we had to do was to pick a touch sensor function on the program builder and place it at the start of all the programs which meant that the programs and the game would only start when the touch sensor was touched which was the idea/aim of the game.

Fourthly, the medium/large motor. The robot was only able to pick up cups with the help of medium/IR sensor. The downside of this was when we started programing it was fine but after we tested the cup pickup program it started to crack because the motors values were incorrect, when we found out about this we put the values in the right order and it started working correctly. The large motor worked perfectly as it helped the robot to maneuver into different directions without difficulty.

Lastly, the colour sensor. The sensor was excellent following the line on the map however sometimes if there was not enough bright light or someone stood near the colour sensor creating the shadow then the colour sensor did get confused and walked off the map few times and therefore we had to make sure that we did tests where they are enough bright light.

- **Report of a wireless communication and protocols for the LRG development via Bluetooth – a short report with a maximum of 500 words**

At the start of Week 7, we were told to implement Bluetooth technology program into our Ev3 Robot. The programmable brick supports 2.1 version of the Bluetooth technology. It enabled us to communicate to the robot using our phone however the brick also supports other platforms such tablets and PC.

[1]Bluetooth is wireless technology that is used to connect two devices together in a particular distance; It was first invented by Eriksson in 1994. Bluetooth uses a variety of protocols. It is used to send pictures, videos and music without using cables. E.g. when a user wants to share some pictures to another person in the same room, Bluetooth enables the user to do so with free of cost and instantly.

We used this technology to connect to an application called Ev3 Mailbox on an android mobile. From the android device is connected to the programmable brick using the Bluetooth technology and Bluetooth can be controlled through the application. From the app messages can be sent to the brick, the messages can be sent via string, value, logic (true/false) or as a number, however the message to be recognized by the brick, the message has to be included in the program followed the by action of the program inside the brick. [2]

We programed the brick to activate dance sequence when it gets the message 'abc' from the application. This message is sent via string. On our first try the code worked perfectly when we tested it with the Bluetooth program alone without the combination of other programs, however the dancing sequence is only to be activated when the robot finished the map/game and only then we would activate the sequence sending the string message 'abc' from the Ev3 Mailbox application. Finally, when we combined every program together, everything else seemed to work apart from the Bluetooth sequence. We did not know what was wrong; whether it was the program or the connectivity problem from Bluetooth. After working on it for hours we finally figured out the problem was that the phone was not connected to the brick because when we tested it we used an IPhone which has an IOS operating system which is very different from android and requires enabling iPhone connectivity in the brick manually for the iPhone to be able to connect to the brick and finally communicate with the brick. Once we enabled the option the problem was fixed and the test was successful on the second attempt. One downside was probably sometimes the connection gets very slow, probably because of interference from other signals outside the room when we were doing our test and few times because of slow connection between the brick and the phone, the dance sequence at the end would also be very slow. However, most of the times it worked perfectly and it stored the previously connected devices which meant that we could connect each of our phone if we wanted to do the test individually.

[1] Wikipedia. (2015, December 4). *Wikipedia*. Retrieved from Bluetooth: https://en.wikipedia.org/wiki/Bluetooth

[2] Google. (2015, December 6). *EV3 Mailbox Remote*. Retrieved from Google Play: https://play.google.com/store/apps/details?id=com.EV3.Mailbox

Bibliography

1.Google. (2015, December 6). *EV3 Mailbox Remote*. Retrieved from Google Play: https://play.google.com/store/apps/details?id=com.EV3.Mailbox

2. Wikipedia. (2015, December 4). *Wikipedia*. Retrieved from Bluetooth: https://en.wikipedia.org/wiki/Bluetooth