2019Edition

MAKEX

ENGINEERING NOTEBOOK

THE CROSS

X160002

STARTER

CITY GUARDIAN

ABOUT MAKEX

MakeX is a robotics competition platform that promotes multidisciplinary learning within the fields of science and technology. It aims at building a world where STEAM education is highly appreciated and where young people are passionate about innovation by engaging them in exciting Robotics Competition, STEAM Carnival, etc As the core activity of MakeX, the namesake MakeX Robotics Competition provides exciting, challenging and high-level competitions in the spirit of creativity, teamwork, fun and sharing. It is committed to inspiring young people to learn Science (S), Technology (T), Engineering (E), Art (A) and Mathematics (M) and apply such knowledge in solving real-world problems.

OUR SPIRIT

Creativity

Explore new ideas and new skills, use creativity and innovative thinking to overcome real-world challenges.

Fun

Enjoy the fun and excitement in head-to-head competition and problem-solving process.

Teamwork

Have open communication with partners, work together towards a common goal and complete a task in the most efficient way for win-win development!

Sharing

Have an open mind as a “Maker”, share the joy, insights and experience with others.

MakeX spirit is the cultural cornerstone of MakeX Robotics Competition, which inspires young people to acquire new skills, improve teamwork, gain memorable experiences in the competition, share their insights and knowledge with their community so as to achieve their grand aspiration of changing the world and shaping the future!

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TEAM INFORMATION

"Changes call for innovation, and innovation leads to progress"

Name: Micah Rayven Navarette

Age: 12

I am currently a Grade 7 student in Kanaan Global School - Jakarta. Technology and Innovation are the new language of this generation. This leads us to move forward and achieve our goals. The world needs young innovators like us. Robotics helps us to develop our skills in problem-solving and team work. Looking forward to this years' more challenging tasks in MakeX Competition.

Name: Janice Natasya Gunawan

Age: 12

Hi! I am Janice, a Grade 7 student in Kanaan Global School - Jakarta. Learning coding is fun and challenging at the same time. I learn to solve various problems that we encounter during the 2018 MakeX Competition. This year will be more challenging as we compete at the secondary level.

OUR STORY

September 2018 - We started to build our robot in preparation for the competition on November 10, 2018. There were a lot of things to prepare and we are behind schedule. But thank God, after weeks practice, we learned more about coding and we did various changes in the design of our mbot. We have encountered problems and challenges in preparing for the competition, but we didn't give up. Our Mentor gave us motivation and guidance to be able to achieve our goals and be prepared for the competition last year.

During 2018 MakeX Robotics Competition - Jakarta (November 10, 2018)

On November 10, 2018, MakeX Robotics Competition national round was successfully held in Jakarta Intercultural School. We were so excited but nervous during that time because we must compete with more than 40 teams from different schools in Indonesia. We were in Primary 6 back then and as a first timer, we were so proud that we got the highest score from the elimination round. We went all the way to the championship round and as a result, we won the **Best Design Award** and became **the Champion** in Primary level. With that, we were given a chance to represent Indonesia in 2018 MakeX World Championship held in Guangzhou, China.

2018 MakeX World Championship – Guangzhou, China

On December 7th to 9th, the 2018 MakeX World Championship was successfully held at Nansha Sports Stadium in Guangzhou, China. About 350 teams from around the world participated in the finals after months of preliminary competitions in 50 or more cities worldwide. The competitors were from 20 different countries in Europe, the Americas, Asia, and Oceania.

The 2018 MakeX Robotics Competition was divided into three different tiers for different age groups: *MakeX Starter – Blue Planet, MakeX Challenge – Interstellar Exploration, and MakeX Premier – Siege and Guard.* Each theme featured exciting game content, innovative gameplay, and its own target objective.

The first 2 days of the competition was great and full of excitement as we compete and teamed-up with different nationalities around the world.

As a result, we made it to the top 5 qualifiers, and we were able to proceed to the championship match. The 3rd day of the competition was much more thrilling as we prepared for the Roadshow. It was set to present the teams' major innovation, technical breakthrough in programming and structural designs. We shared our ideas with the teams from all over the world. It was a fun and memorable experience being on stage and share your story to other people.

Awarding ceremony

Though we were not able to get the championship trophy, we were happy to receive the **Open-Source Innovation Award**. We learn a lot from this competition. As Jasen Wang, Founder & CEO of Makeblock, the initiator and sponsor of MakeX, said: "Robotics is the best way to teach kids how to code. By competing with robots, they put their thoughts, problem-solving, communication and creative skills on trial and get to know the digital world through what they code".

The **2018 MakeX World Championship** in China was one of the most memorable experience we had. We gained friends, learned a lot of new things about robotics, and helped us set our goals for this year's competition.

ACHIEVEMENTS

2018

- Champion (National Competition)
- Best Design Award
- Open-source Innovation Award
- 26th overall rank (Worldwide)

2019

- Runner-up (National Competition)
- Best Engineering Notebook Award

MAKEX CITY GUARDIAN

AUTOMATIC STAGE

INDEPENDENT MISSIONS

01 Energy-saving switch (60 pts)

To push block A to the same position as block B

02 Charging Station (60 pts)

To rotate the switch by more than 90 degrees in the specified direction

03 Aging Power Plant (60 pts)

To dismantle 3 plants inside the thermal power station

04 Chimney Dismantling (60 pts)

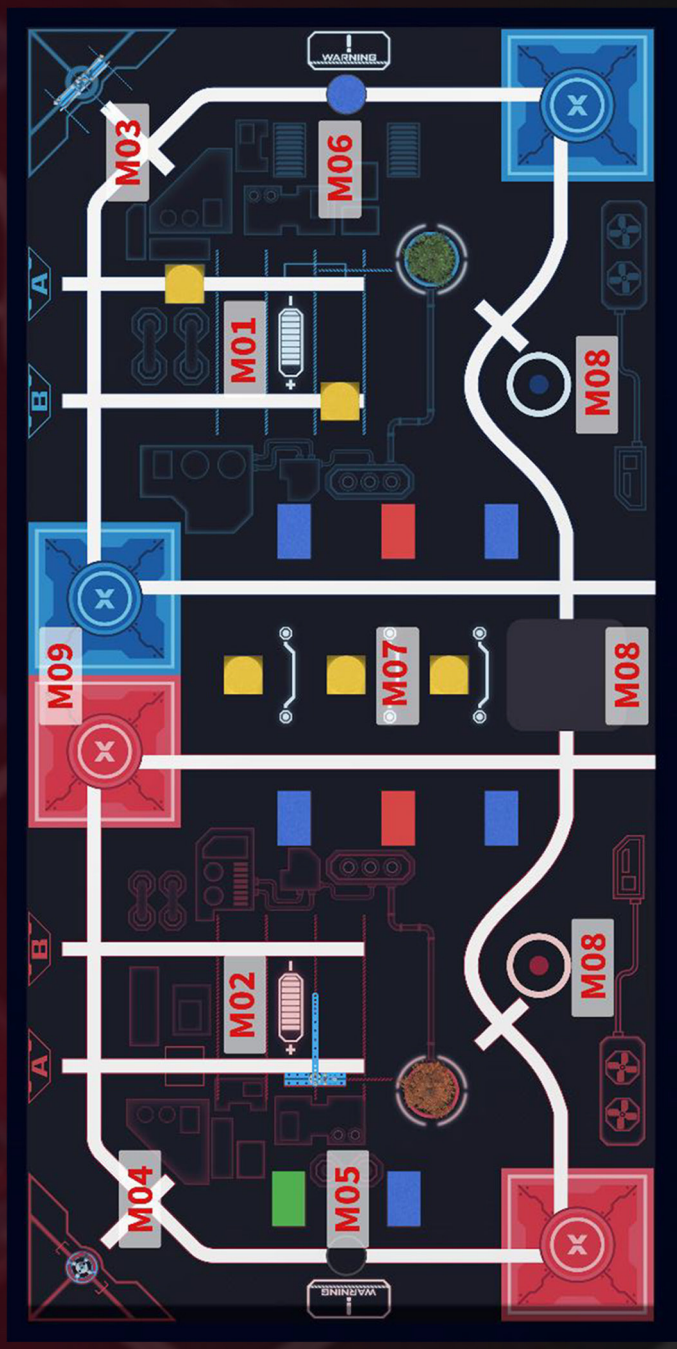
To dismantle chimney in the arena

05 Road Inspection (50 pts)

Correctly recognize the color of two cards

06 Obstacle Removal (50 pts)

To remove the obstacle completely out of the designated area



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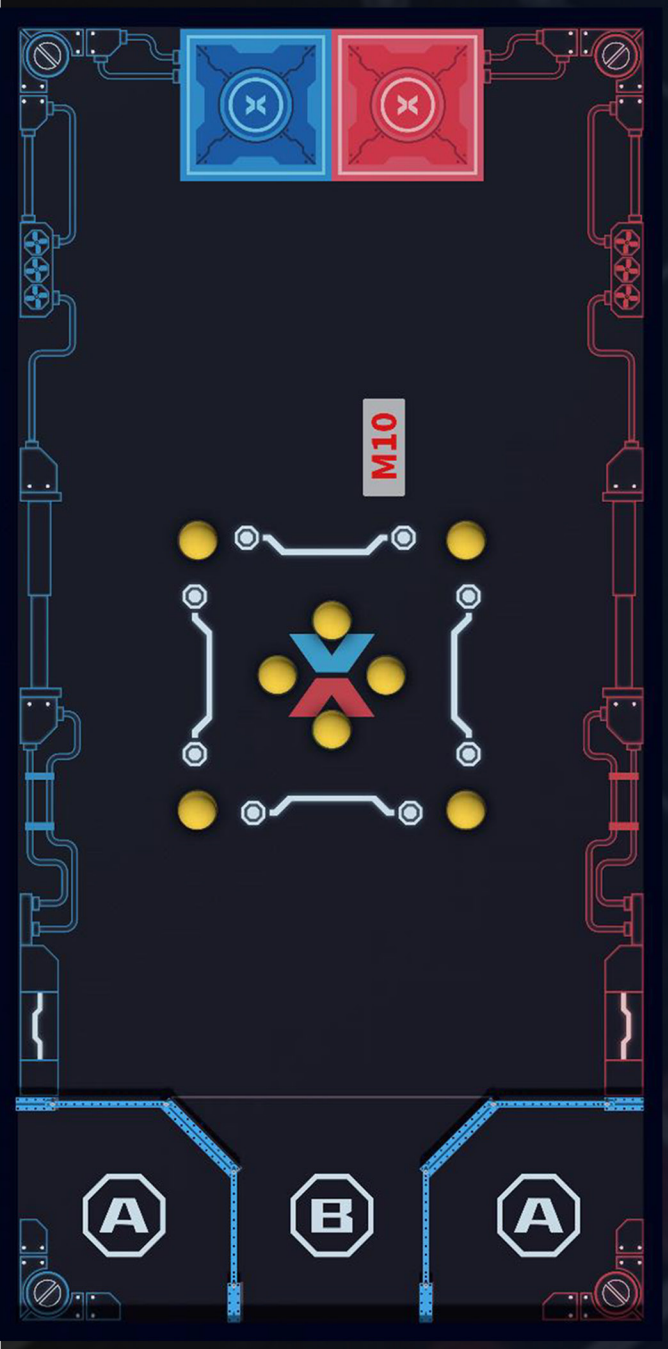
STARTER



M 01:30

AUTOMATIC STAGE

ALLIANCE MISSIONS

07 Waste Sorting (60 pts max)

To identify the color of the card and relocate the garbage in the alliance area

08 Forest Planting (60 pts max)

Transplanting Sapling

09 City Party (10 pts)

After returning to the designated starting area, the robots of both teams begin the party

MANUAL STAGE

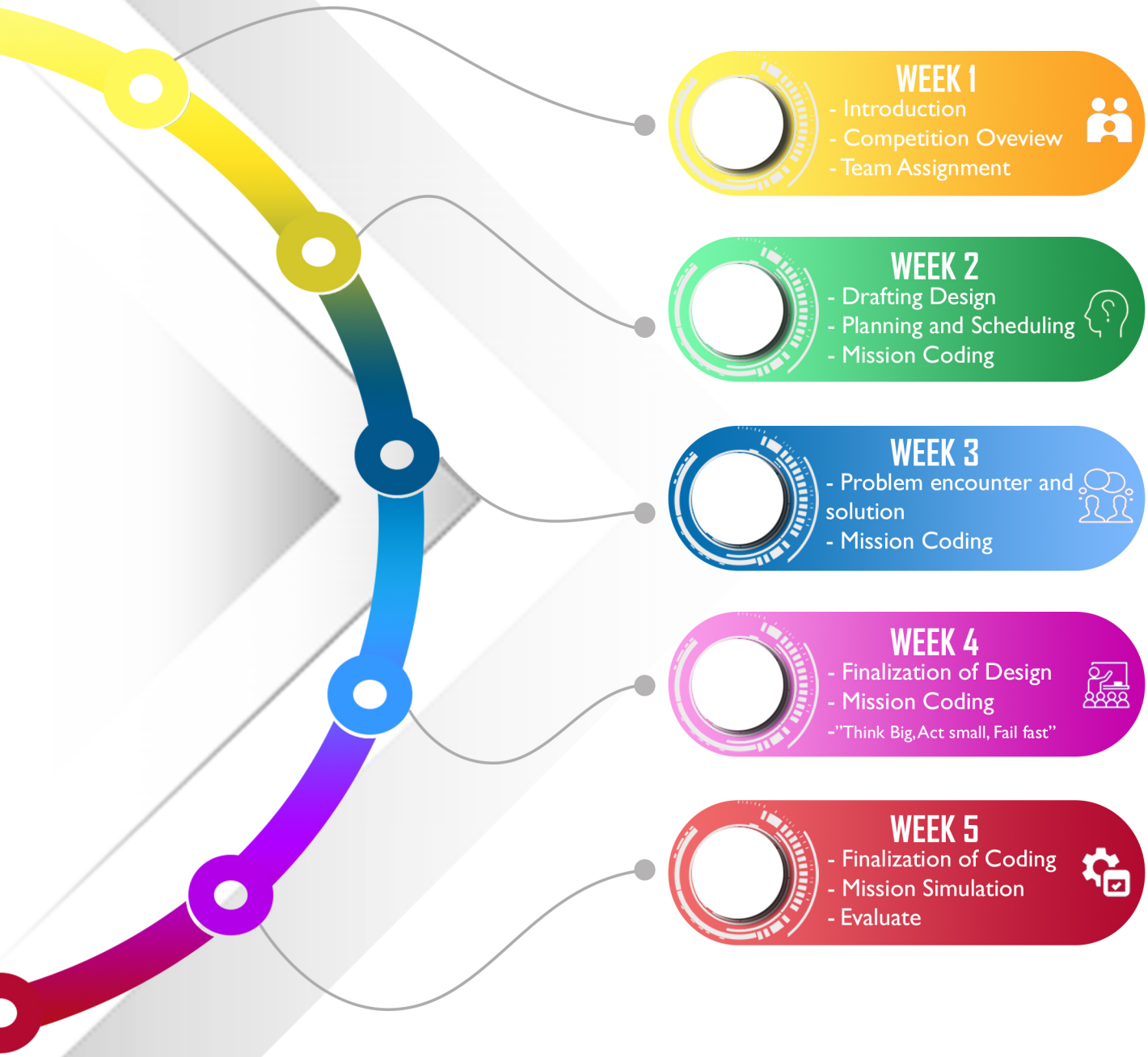
ALLIANCE MISSIONS

10 Garbage Recycling (100 pts max)

Handling Garbage

PROJECT TIMELINE

SEPTEMBER 2019



EMPATHIZE | DEFINE | IDEATE | PROTOTYPE | TEST

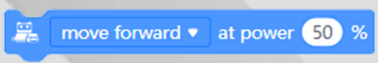
TECHNICAL Principles

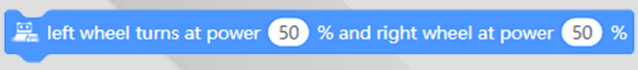
M01 TO M06

TECHNICAL Principles

Invetigating the Motors

The two blocks above have slightly different functions. Use one or other to achieve the motor control you are after.





The "move forward at power …" block controls both motors. You can tell the mBot to run forward, run backwards, or turn left or right by using the drop down box. We put a number for the speed into the space at the right-hand end of the block.

The "left wheel turn and right wheel …" block controls one motor only. The motors are called M1 and M2. You can select either motor by adding value into the right-hand end space to control the speed.

If we put a number into the space at the right hand end of these code blocks, this will make the motors move at a particular speed, but we don't know what that speed is. Is a speed of 100 really fast? Note: The maximum speed is 255.

A bit of physics

What is speed? Speed is the distance something travels in a particular time. For example a car travelling at 50km/h goes 50km in one hour.

Speed = distance÷time

How far does it travel in two hours?

Distance=Speed ×Time

Adding meaning to the Speed number

To find out what the speed numbers in our code blocks mean we will write a program to run the motors at a particular speed for a known time and then measure the distance travelled.

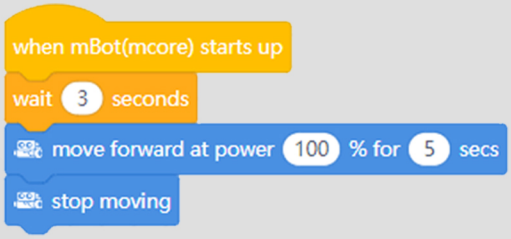
The program Program the mBot to run at a speed of 100 for five seconds (or less) and measure how far it goes.

Things to consider:

1. A delay or wait at the start of the program to give you time to put the mBot down somewhere.
2. A speed of 0 at the end of the program to stop the mBot.

Things to watch out for: Once the mBot move with one of the speed blocks, it will continue to move until it is told to do something else. This is why we use a wait block after the "run forward at speed X" block. The mBot will keep going at speed X until the time in the wait block is up. If you don't tell it to do something else (like speed 0) it will just carry on running and you will have to chase it.

The program will look something like this:



Our Results
When the mBot stops moving , measure how far it went in the time you gave it. You can get a real speed from this by using the equation;

Speed= Distance / Time
Say it went 50cm in 5 seconds, then we can say its speed was
Speed= 50 cm / 5 sec =10 cm/ s

If our speed value in the block was 100, then we know that 100 is the same speed as 10cm/s. So that is an example, use your measurements to find out what the real speed is?
So using the example above, if we want to move our mBot a particular distance (75cm for example) then we will need to run our mBot at a speed of 100 (10cm/s) for a time that we can find through a simple calculation.

Speed= Distance / Time
=75 cm / Time = 10 cm per sec

So,

Time= Distance / Speed
= 75 cm 10 cm/ s =7.5seconds

For our mBot set to a speed of 100 and travelling at 10cm/s, it will need to run for 7.5 seconds to cover a distance of 75cm.

SWOT Analysis

Strength

- Good offensive and defensive strategies
- Robot Design
- Team work
- Stable programming

Weakness

- Inconsistency result in mission 1
- Needs good operator in manual stage
- Inconsistency result in identifying color cards

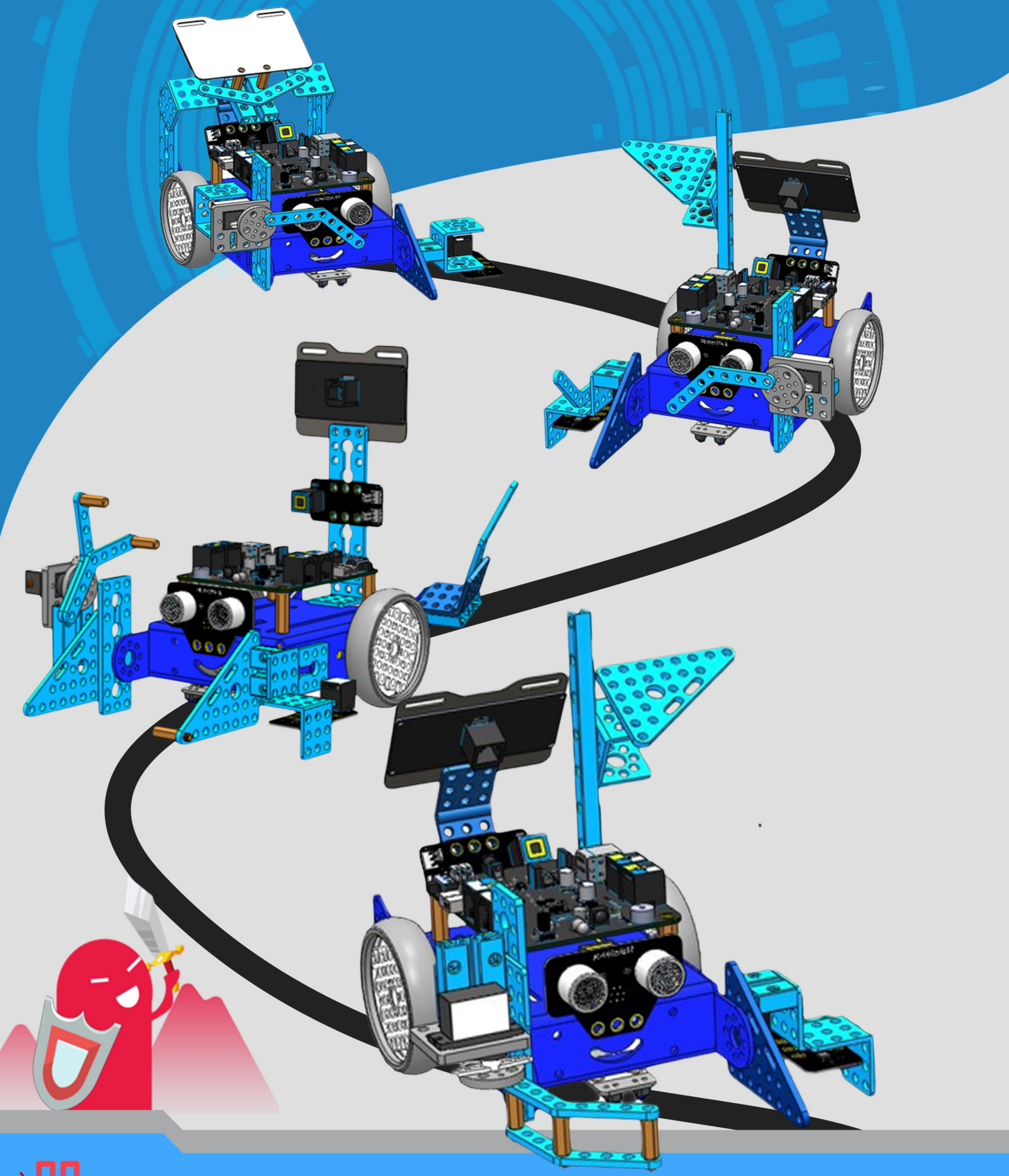
Opportunity

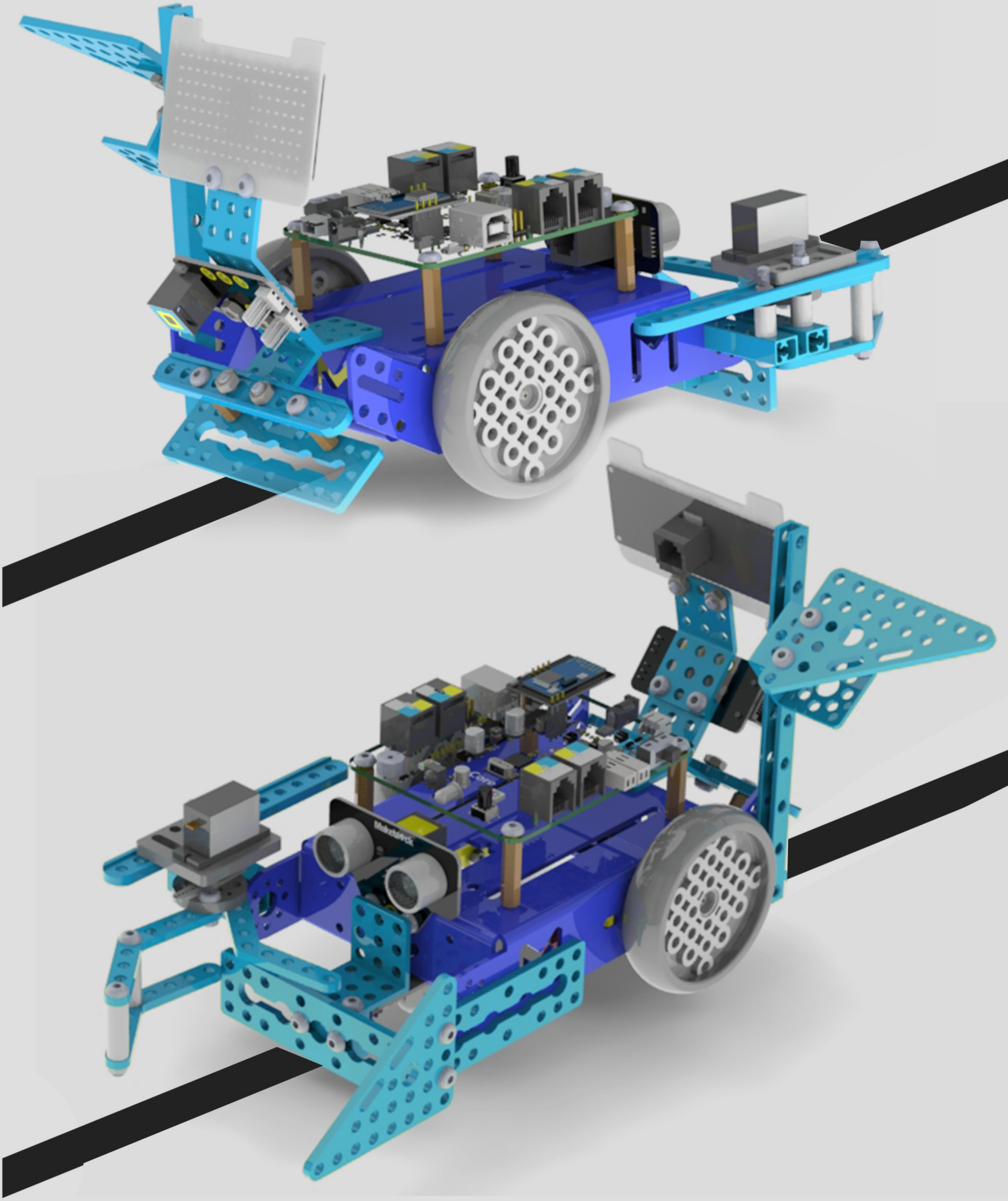
- Growth in solving problems and finding solutions
- Potential Innovators
- Promising technology

Threat

- Better ideas or strategies
- poor alliance / no cooperation with the alliance team

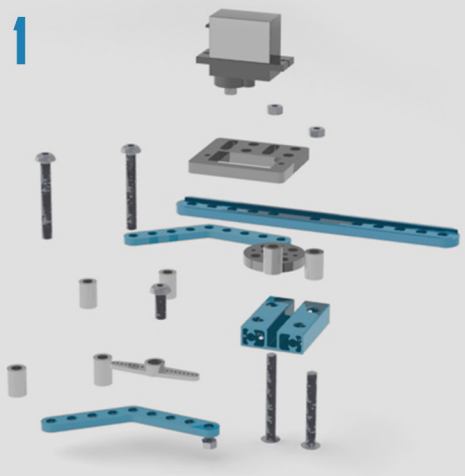
TECHNICAL INNOVATION

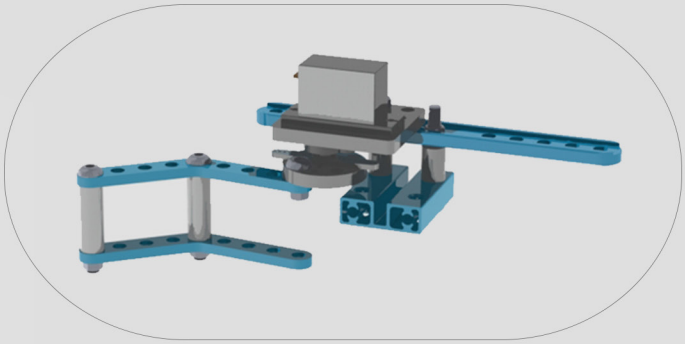




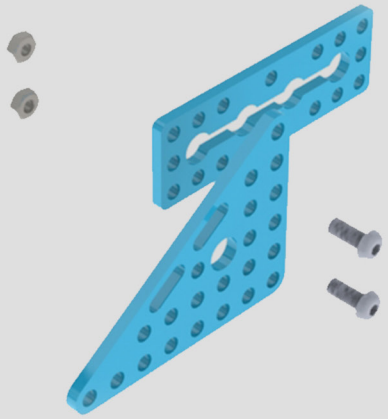
ASSEMBLING MANUAL

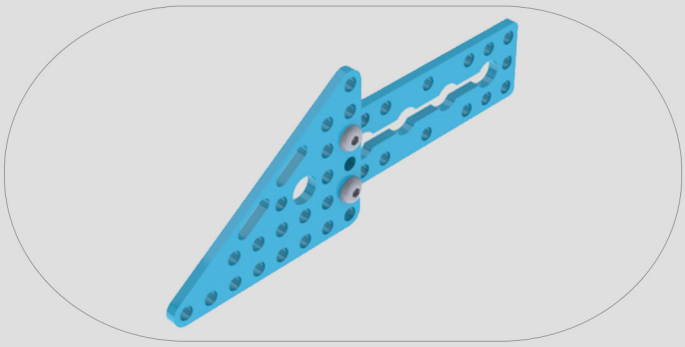
Step 1



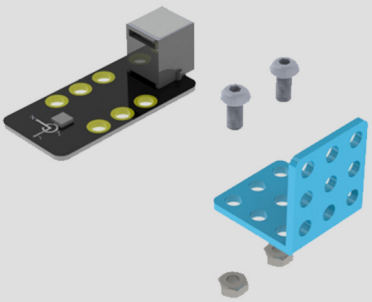


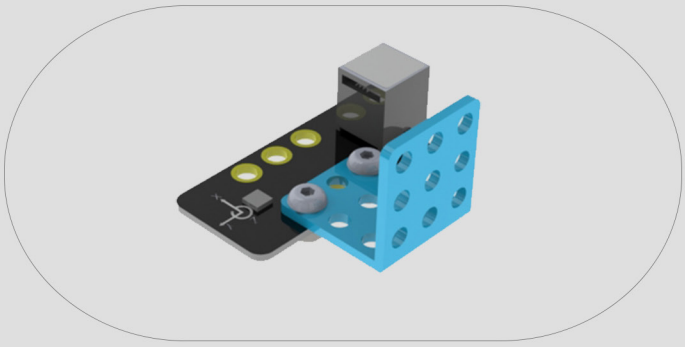
Step 2



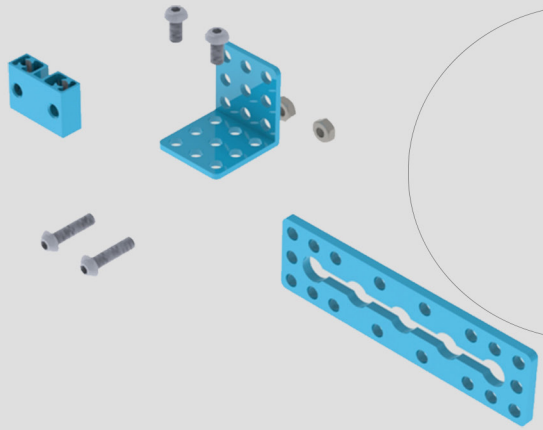


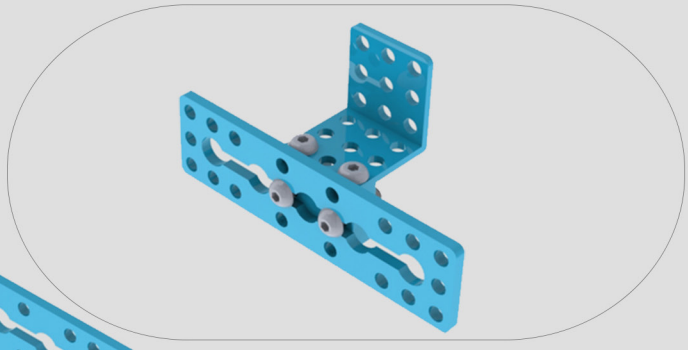
Step 3



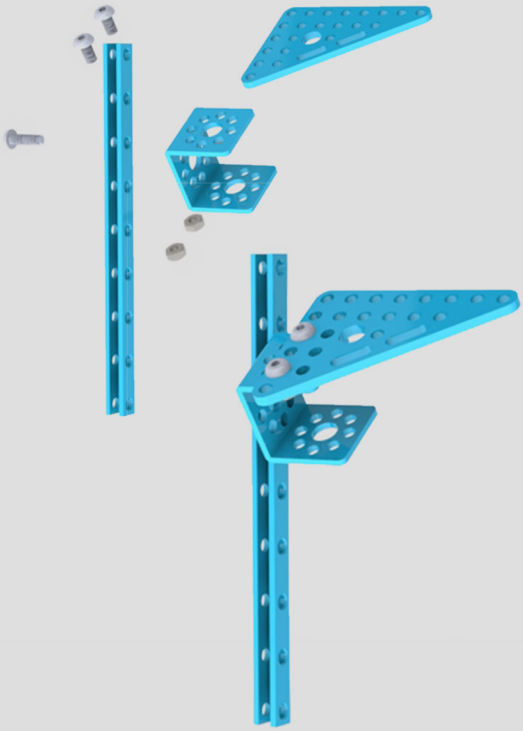


Step 4

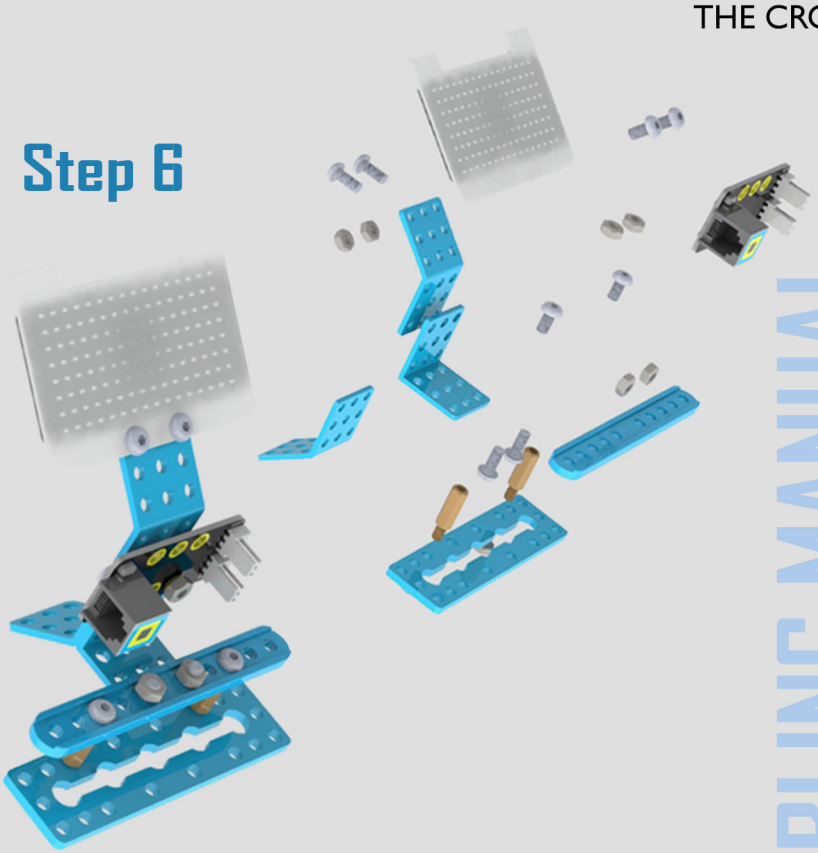




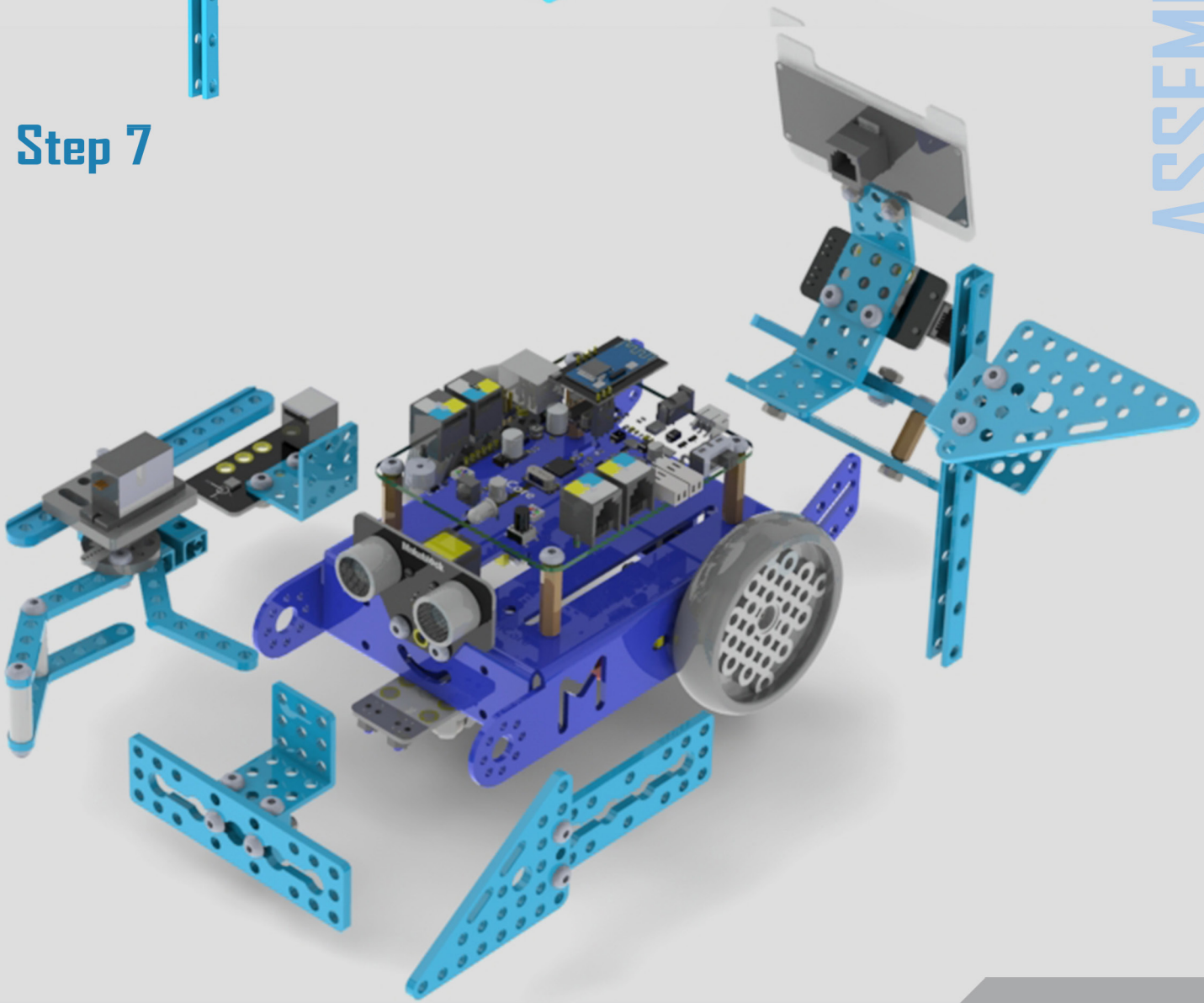
Step 5



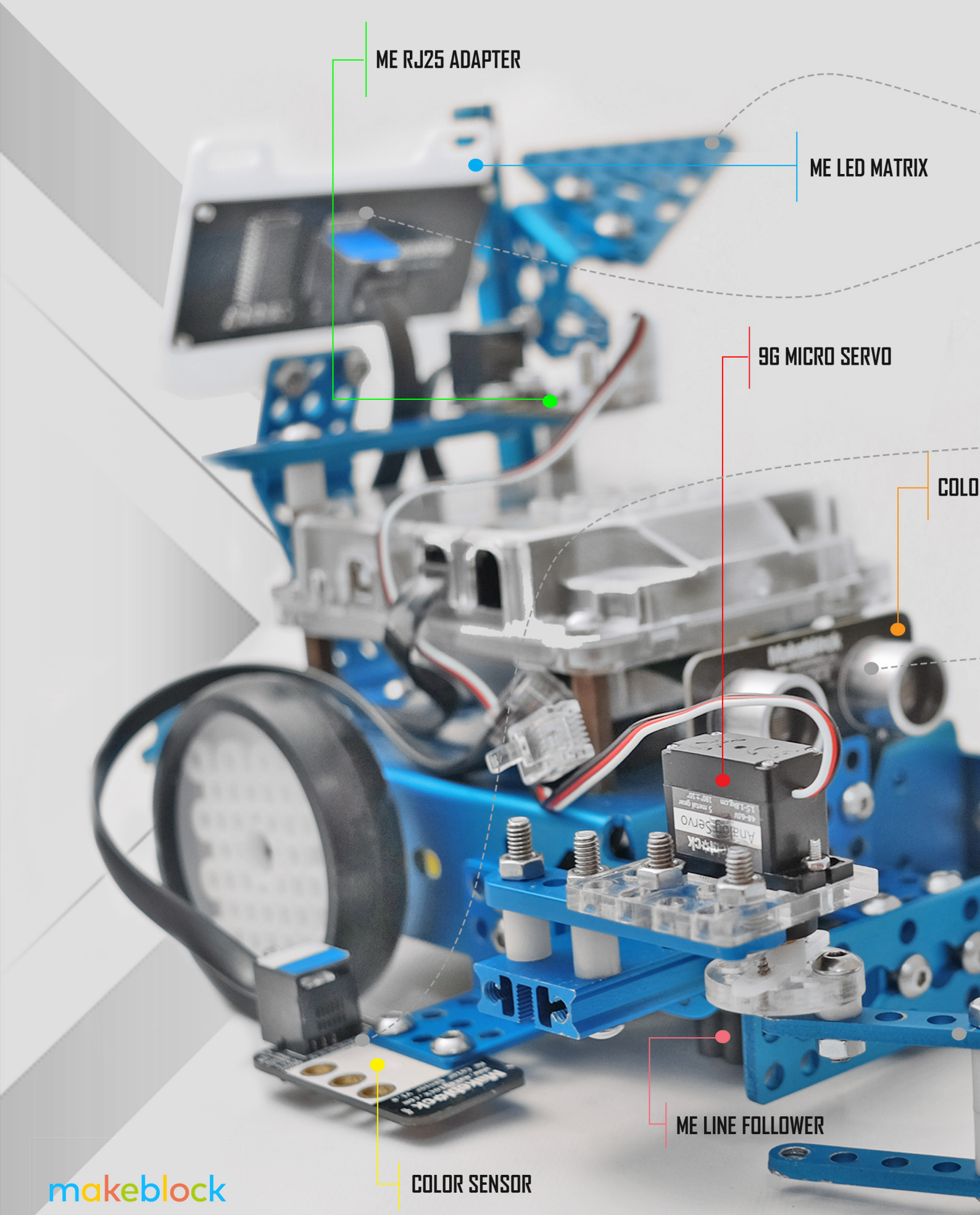
Step 6



Step 7



ASSEMBLING MANUAL


ME RJ25 ADAPTER
ME LED MATRIX
9G MICRO SERVO
COLO
ME LINE FOLLOWER
COLOR SENSOR

makeblock

FUNCTIONS

Able to dismatle the chimney and aging power plant mission in one hit.

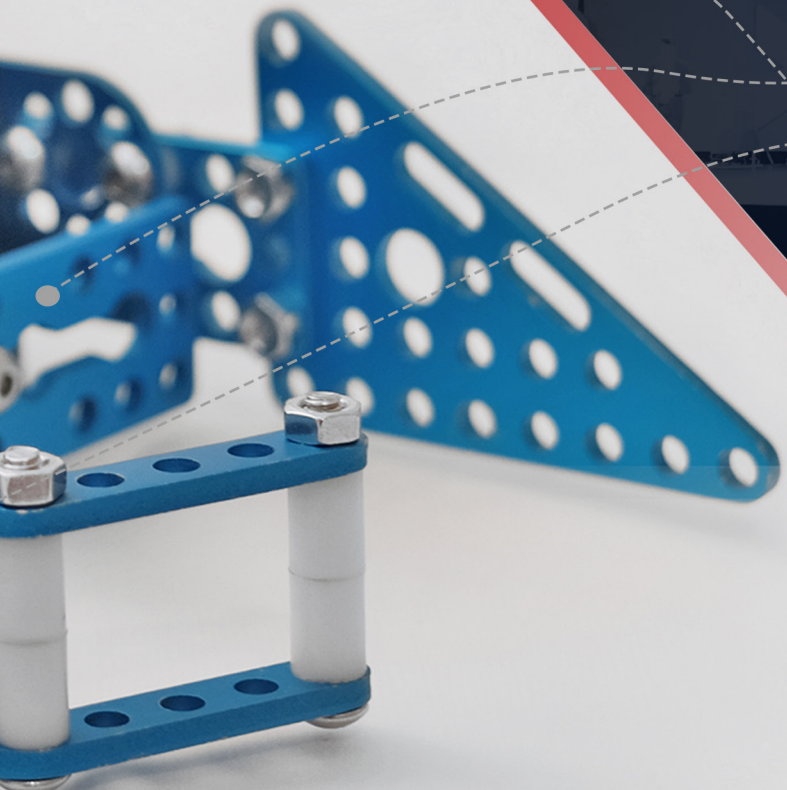
LED Matrix will show which mode is online.

Detects color cards and show it through on-board LED

R SENSOR

Covers / Protects the line follwer sensor from collition.
Advantage in Tree planting and Energy-saving switch mission.

Holds the props.



Sense and remove the obstacle

THE CROSS TEAM


TH
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Problem Encounter & Solution

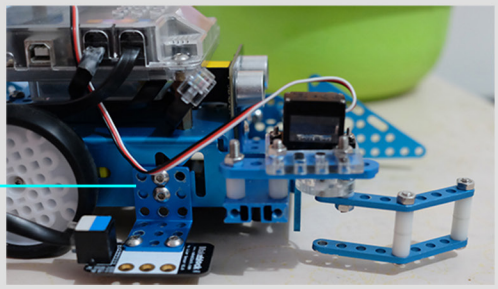
define Problem 1

The length of the mbot exceed its required specification

Max length is 280 mm

Solution

Adjust the arm distance



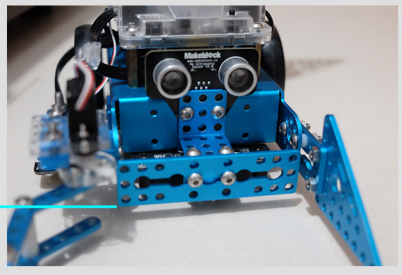
define Problem 2

RGB Line follower was stuck to the tree in Alliance mission

Forest Planting

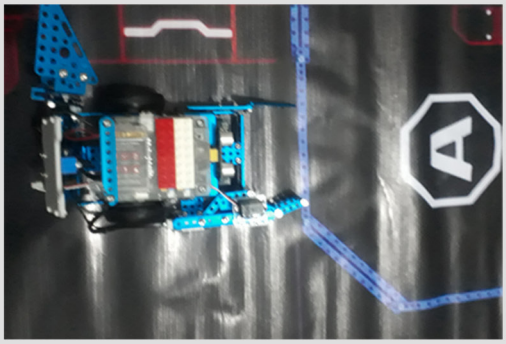
Solution

Add parts to cover the RGB Sensor



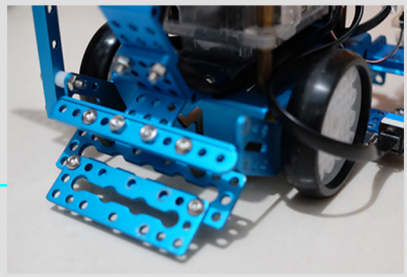
define Problem 3

Unable to insert the Circular garbage to the station frame



Solution

Added plates to be able to push the circular garbage to the garbage station

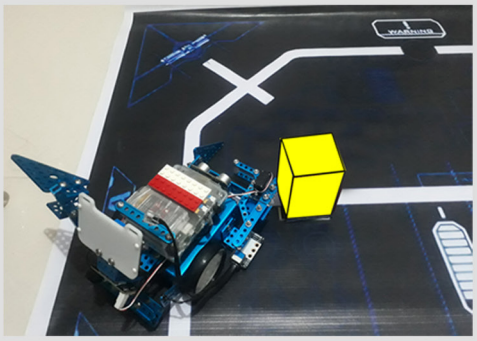


define Problem 4

forever

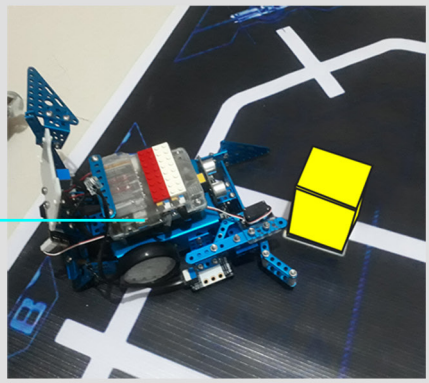
Front arm hits the block in Energy saving switch

and affects the position of the block



Solution

Adjust the turn and timing

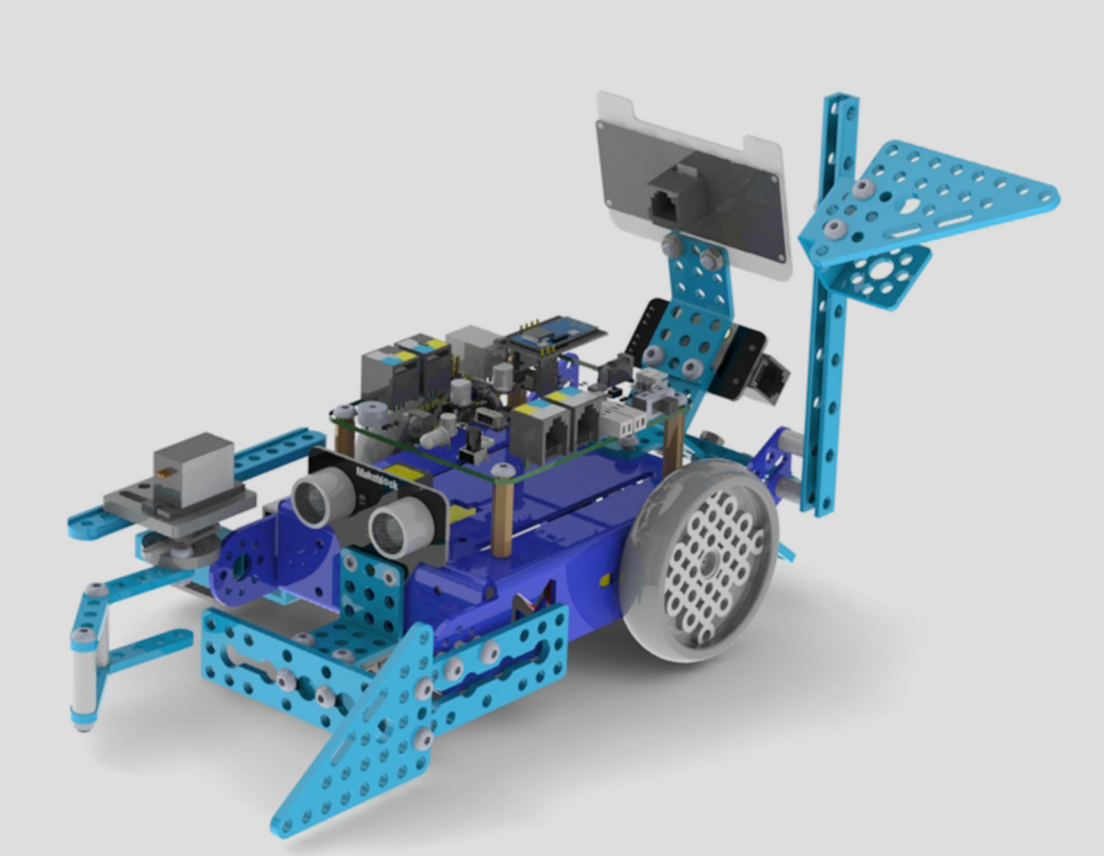


define Problem 5

The tires are sliding on the color cards when it turn in waste sorting mission

Solution

Adjust the code and position when turning



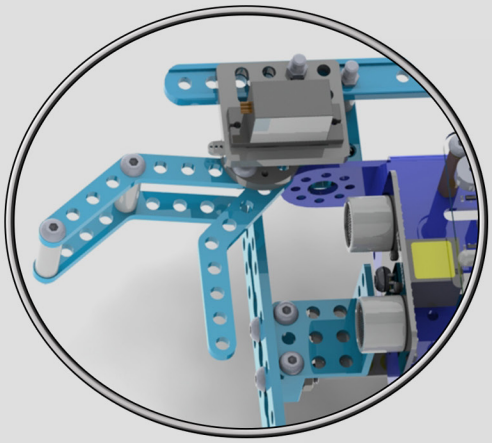
PERFORMANCE RECORD (NATIONAL)

Simulation 1

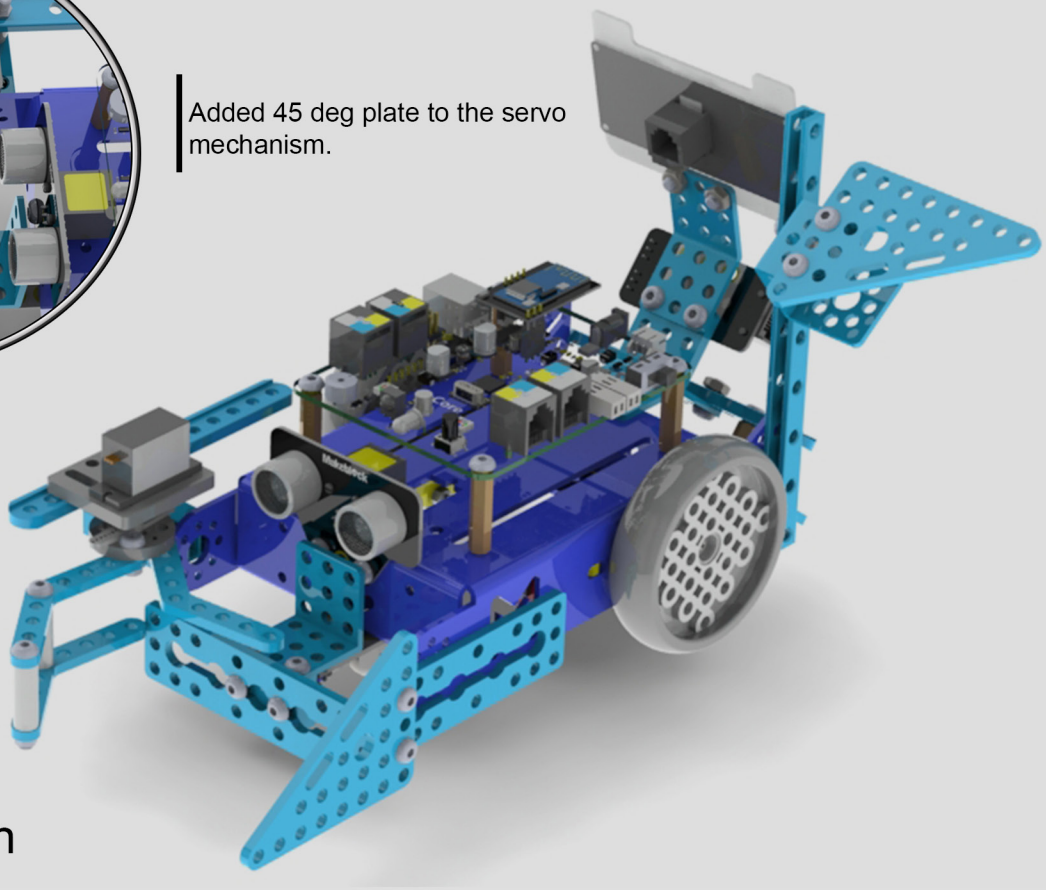
Missions	Target Time	Target Score	S1 (min)	Score	S2 (min)	Score	S3 (min)	Score	S4 (min)	Score
M01, M04, M06	2	170	2.5	110	2	170	2.25	170	2.5	120
M07, M09		70		70		60		70		70
M10 (Manual Stage)	1	100	1.5	50	1.5	80	1.5	75	1.5	55
	3	340	4	230	3.5	310	3.75	315	4	245
				68%		91%		93%		72%

Simulation 2

Missions	Target Time	Target Score	S1 (min)	Score	S2 (min)	Score	S3 (min)	Score	S4 (min)	Score
M01, M03, M05	2	170	2.5	170	2.5	170	2.5	170	2.5	170
M08, M09		70		40		70		60		60
M10 (Manual Stage)	1	100	1.5	80	1.5	65	1.5	50	1.5	70
	3	340	4	290	4	305	4	280	4	300
				85%		90%		82%		88%



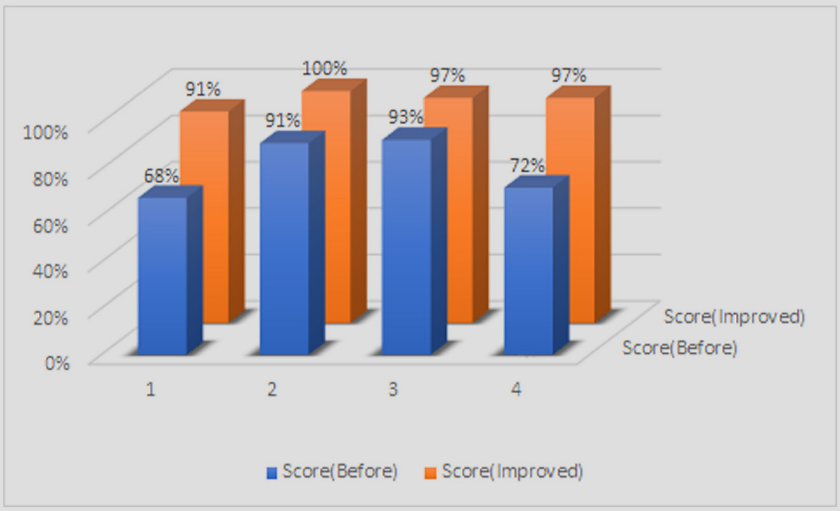
Added 45 deg plate to the servo mechanism.

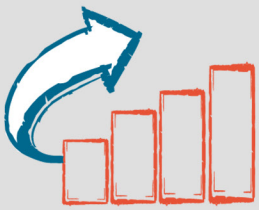


Revised Design

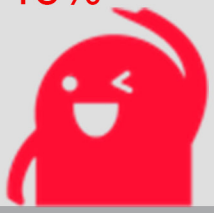
Simulation 1

Missions	Target Time	Target Score	S1 (min)	Score	S2 (min)	Score	S3 (min)	Score	S4 (min)	Score
M01, M04, M06	2	170	2.25	170	2	170	1.75	170	2	170
M07, M09		70		40		70		60		60
M10 (Manual Stage)	1	100	1.25	100	1	100	1.17	100	1.25	100
	3	340	3.5	310	3	340	2.92	330	3.25	330
				91%		100%		97%		97%
Improvement (%)			13%	24%	14%	9%	22%	4%	19%	25%





Time: -17%
Score: +15%

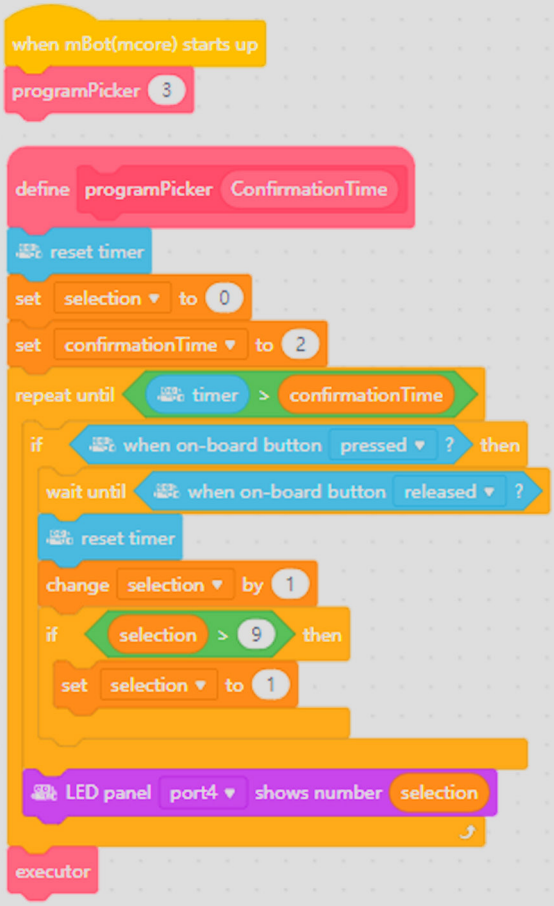


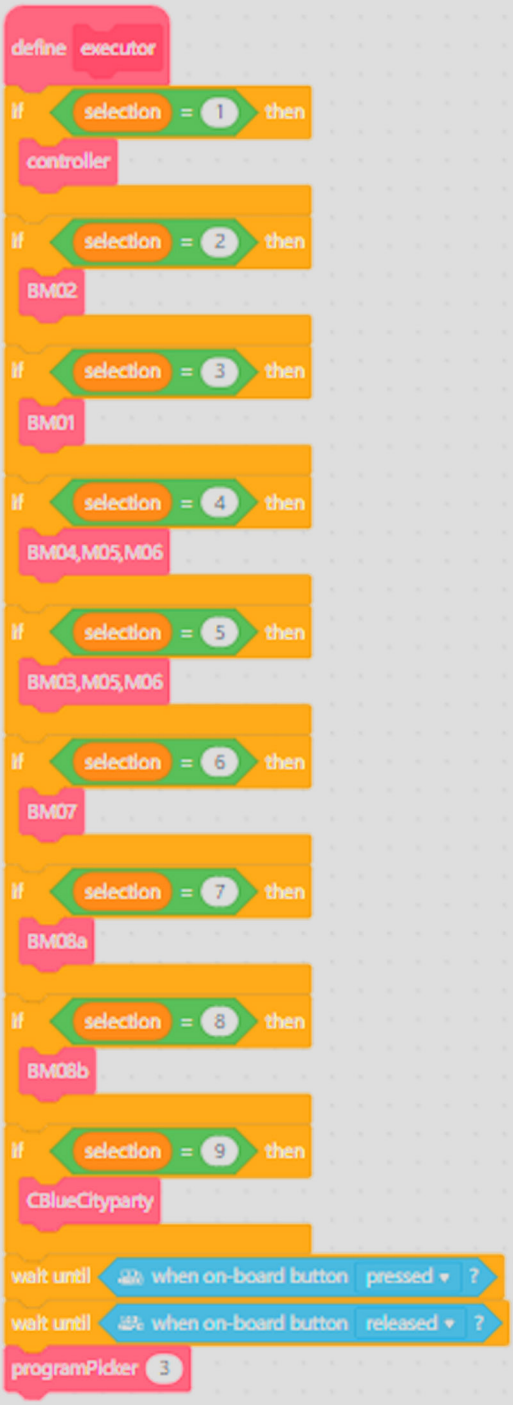
GALLERY

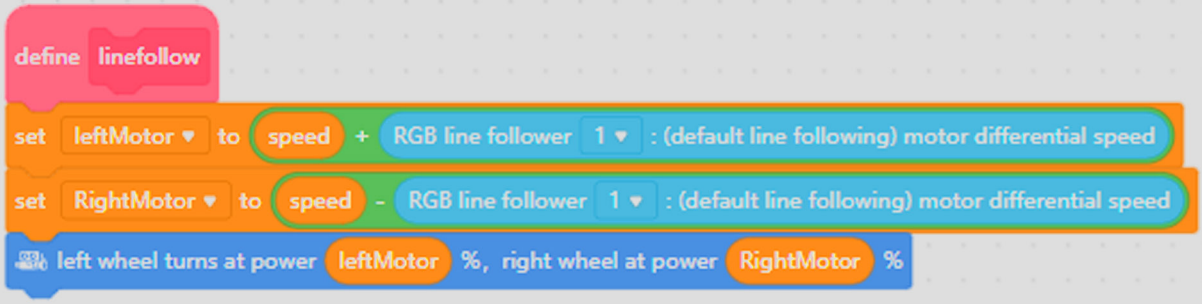
MakeX Robotitcs Competition 2019 - Jakarta Indonesia
20 - 21 November 2019


APPENDIX
Codes

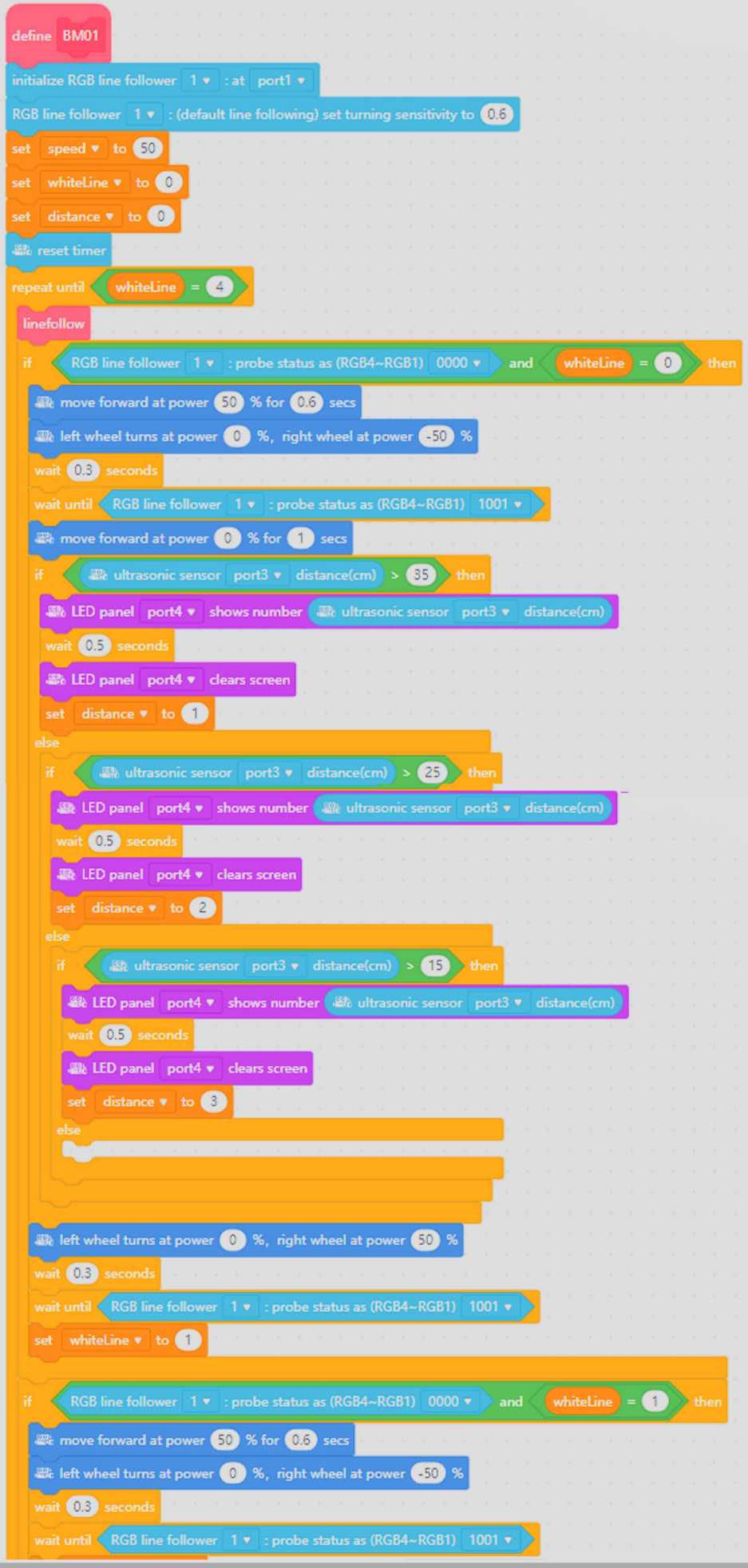
APPENDIX - CODES

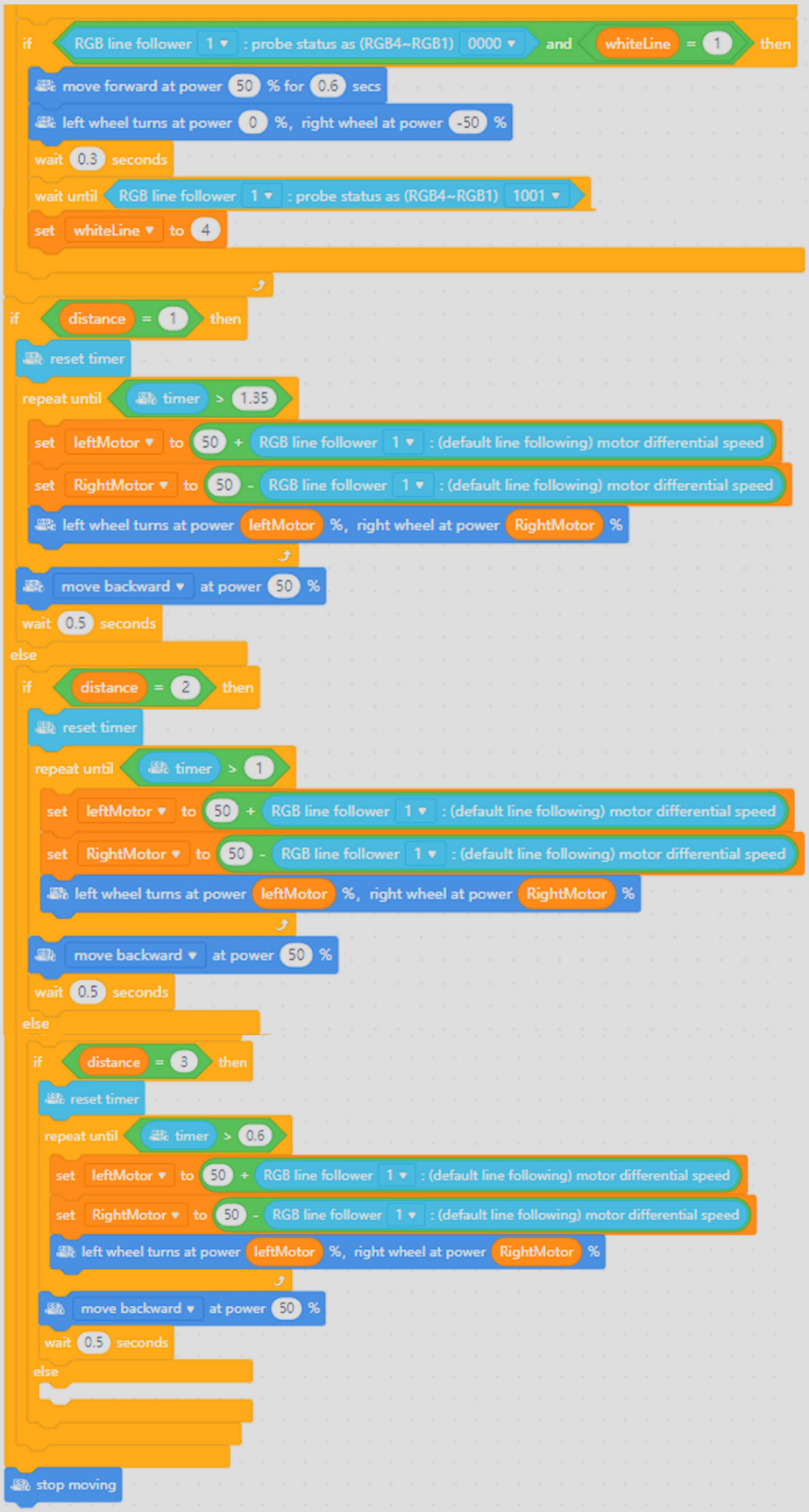






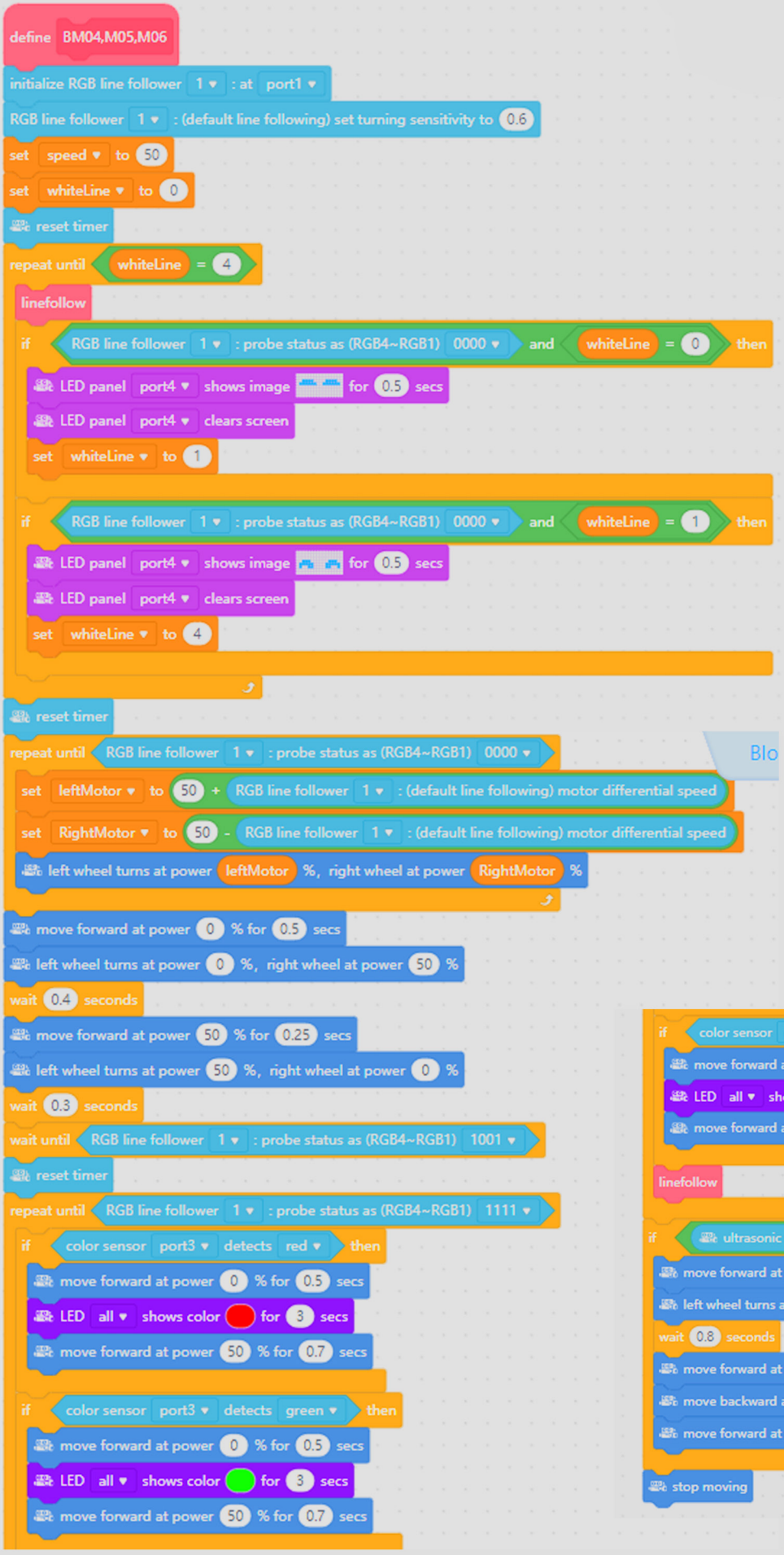
APPENDIX - CODES



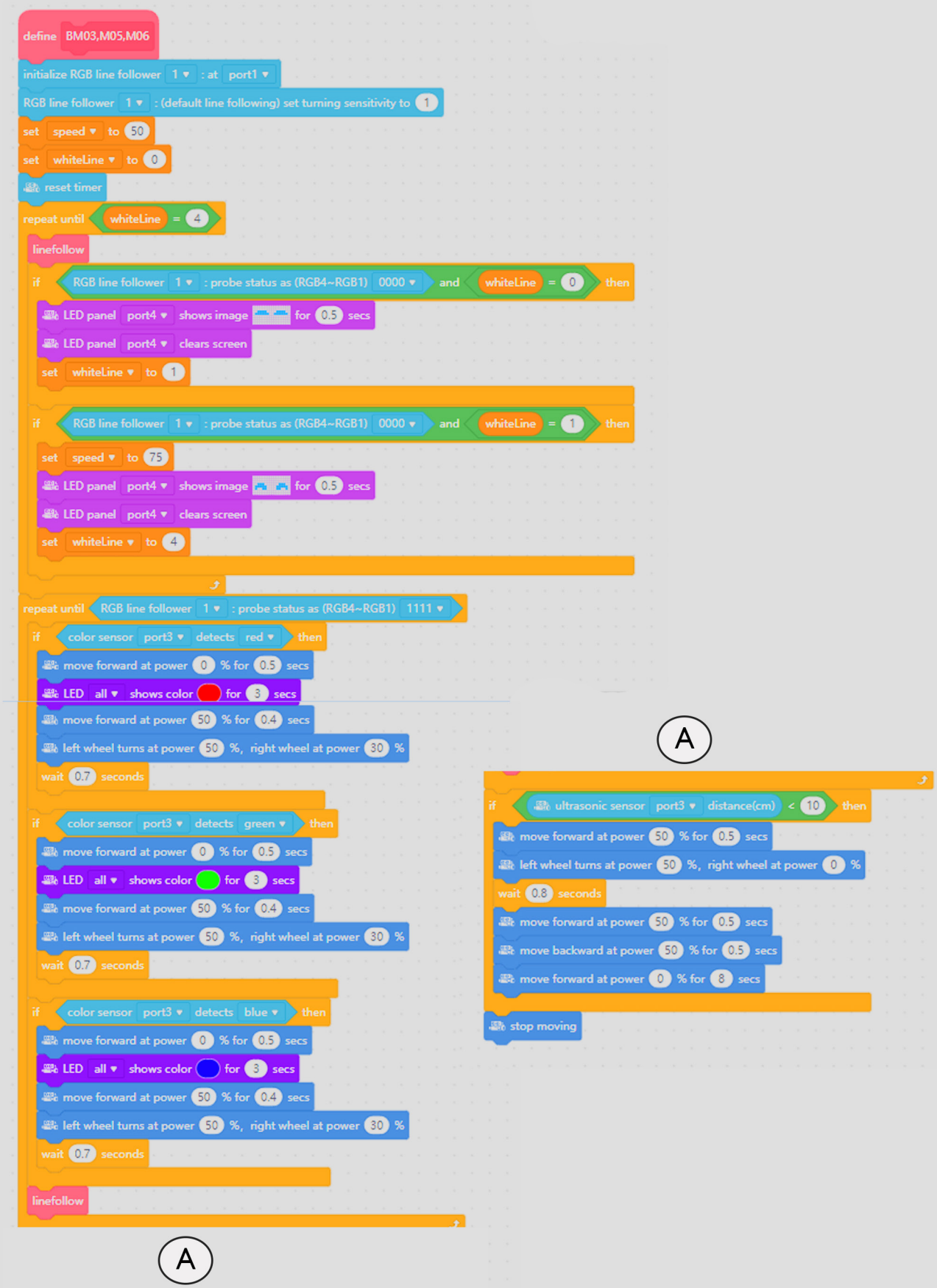


APPENDIX - CODES

APPENDIX - CODES



APPENDIX - CODES



APPENDIX - CODES

```
define BM02
initialize RGB line follower 1 : at port1
RGB line follower 1 : (default line following) set turning sensitivity to 0.6
set speed to 50
repeat until RGB line follower 1 : probe status as (RGB4~RGB1) 0000
  linefollow
  if RGB line follower 1 : probe status as (RGB4~RGB1) 0000 then
    move forward at power 0 % for 0.2 secs
    move forward at power 50 % for 0.7 secs
    left wheel turns at power 0 %, right wheel at power -50 %
    wait 0.3 seconds
    wait until RGB line follower 1 : probe status as (RGB4~RGB1) 0111
    move forward at power 0 % for 0.5 secs
    move forward at power 75 % for 1 secs
    move forward at power 0 % for 10 secs
stop moving
```

```
define BM07
initialize RGB line follower 1 : at port1
RGB line follower 1 : (default line following) set turning sensitivity to 0.8
reset timer
set speed to 50
repeat until RGB line follower 1 : probe status as (RGB4~RGB1) 0000
  linefollow
reset timer
move forward at power 0 % for 0.4 secs
move forward at power 50 % for 0.25 secs
left wheel turns at power 60 %, right wheel at power -60 %
wait 0.3 seconds
wait until RGB line follower 1 : probe status as (RGB4~RGB1) 1001
move forward at power 0 % for 0.4 secs
repeat until RGB line follower 1 : probe status as (RGB4~RGB1) 1111
  if color sensor port3 detects red then
    move forward at power 0 % for 0.5 secs
    Bluesorting
  else
    set leftMotor to 50 + RGB line follower 1 : (default line following) motor differential speed
    set RightMotor to 50 - RGB line follower 1 : (default line following) motor differential speed
    left wheel turns at power leftMotor %, right wheel at power RightMotor %
stop moving
```

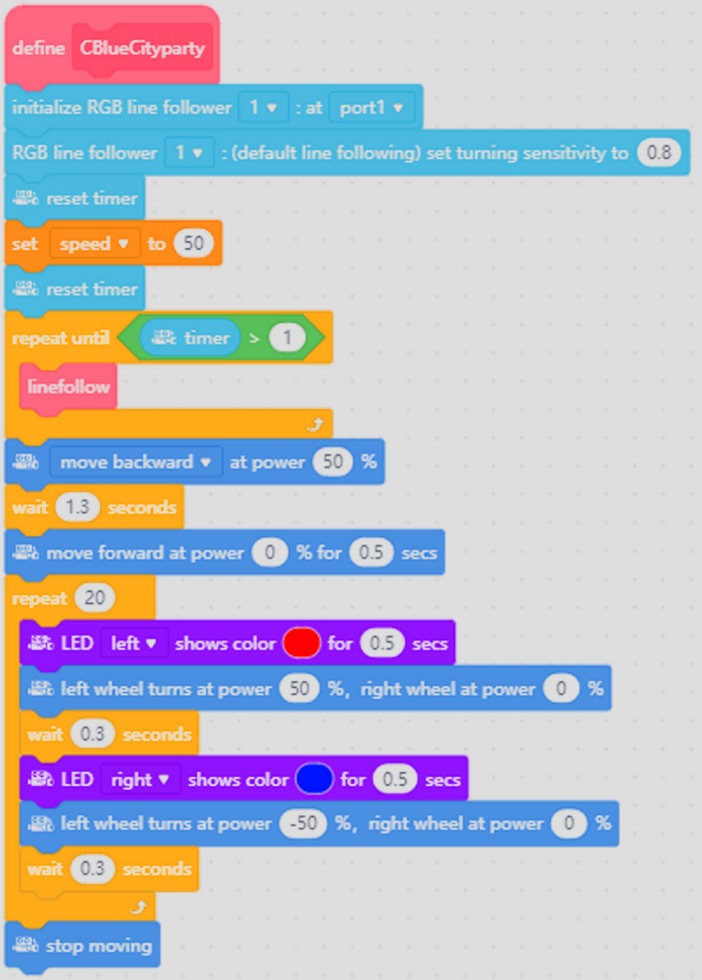
```
define Bluesorting
move forward at power 50 %
wait 0.55 seconds
left wheel turns at power 50 %, right wheel at power -50 %
wait 0.5 seconds
move backward at power 70 %
wait 1 seconds
move forward at power 50 %
wait 0.5 seconds
wait until RGB line follower 1 : probe status as (RGB4~RGB1) 0000
move forward at power 50 %
wait 0.3 seconds
left wheel turns at power -50 %, right wheel at power 50 %
wait 0.3 seconds
wait until RGB line follower 1 : probe status as (RGB4~RGB1) 1001
move forward at power 0 % for 0.3 secs
move forward at power 50 % for 0.3 secs
```

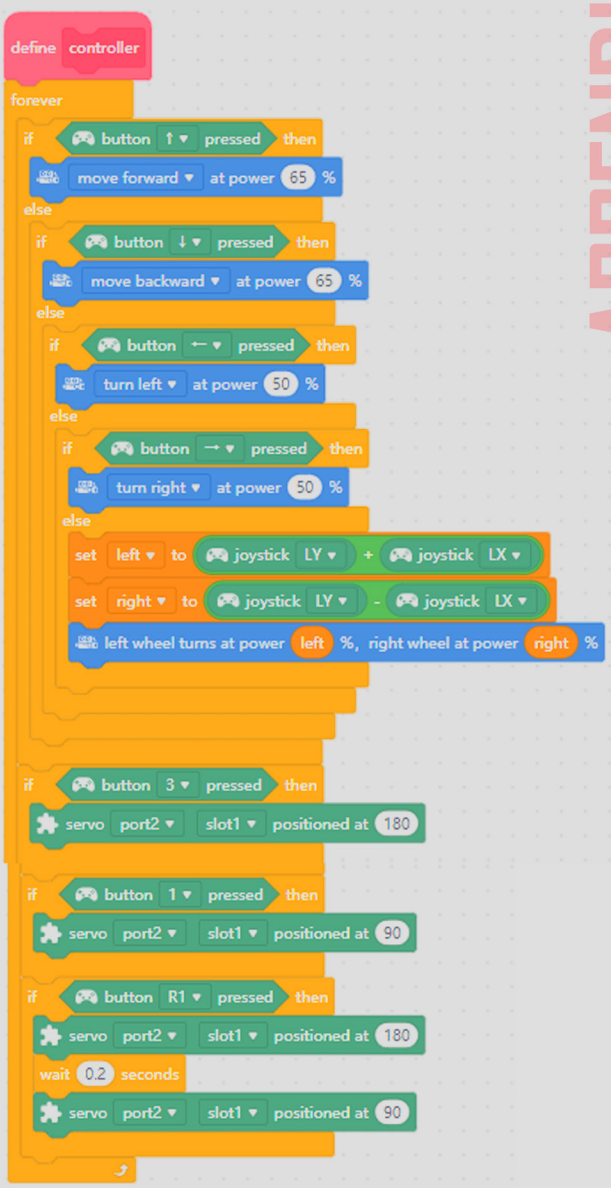
```
define BM08a
initialize RGB line follower 1 : at port1
RGB line follower 1 : (default line following) set turning sensitivity to 0.8
servo port2 slot1 positioned at 170
move forward at power 65 % for 1.2 secs
servo port2 slot1 positioned at 90
left wheel turns at power 25 %, right wheel at power 65 %
wait 0.3 seconds
wait until RGB line follower 1 : probe status as (RGB4~RGB1) 1001
reset timer
repeat until RGB line follower 1 : probe status as (RGB4~RGB1) 1111
    set leftMotor to 70 + RGB line follower 1 : (default line following) motor differential speed
    set RightMotor to 70 - RGB line follower 1 : (default line following) motor differential speed
    left wheel turns at power leftMotor %, right wheel at power RightMotor %
move forward at power 50 % for 0.3 secs
servo port2 slot1 positioned at 170
move forward at power 0 % for 0.4 secs
```

```
define BM08b
initialize RGB line follower 1 : at port1
RGB line follower 1 : (default line following) set turning sensitivity to 0.8
servo port2 slot1 positioned at 170
reset timer
repeat until RGB line follower 1 : probe status as (RGB4~RGB1) 1111
    set leftMotor to 65 + RGB line follower 1 : (default line following) motor differential speed
    set RightMotor to 65 - RGB line follower 1 : (default line following) motor differential speed
    left wheel turns at power leftMotor %, right wheel at power RightMotor %
move forward at power 65 % for 0.4 secs
move forward at power 0 % for 0.3 secs
servo port2 slot1 positioned at 90
move forward at power 0 % for 0.2 secs
left wheel turns at power 65 %, right wheel at power -65 %
wait 0.3 seconds
wait until RGB line follower 1 : probe status as (RGB4~RGB1) 0111
move forward at power 0 % for 0.3 secs
move forward at power 80 % for 1 secs
servo port2 slot1 positioned at 170
move backward at power 50 % for 0.5 secs
stop moving
```

APPENDIX - CODES

APPENDIX - CODES





APPENDIX - CODES

```
define RM03,M05,M06
initialize RGB line follower 1 : at port1
RGB line follower 1 : (default line following) set turning sensitivity to 1
servo port2 slot1 positioned at 90
set speed to 55
reset timer
repeat until timer > 0.8
  linefollow
reset timer
repeat until RGB line follower 1 : probe status as (RGB4~RGB1) 1111 or timer > 6
  linefollow
  if color sensor port3 detects red then
    move forward at power 0 % for 0.5 secs
    LED all shows color for 3 secs
    move forward at power 50 % for 0.7 secs
  if color sensor port3 detects green then
    move forward at power 0 % for 0.5 secs
    LED all shows color for 3 secs
    move forward at power 50 % for 0.7 secs
  if color sensor port3 detects blue then
    move forward at power 0 % for 0.5 secs
    LED all shows color for 3 secs
    move forward at power 50 % for 0.7 secs
  if ultrasonic sensor port2 distance(cm) < 10 then
    move forward at power 50 % for 0.5 secs
    left wheel turns at power 50 %, right wheel at power 0 %
    wait 0.6 seconds
    move forward at power 50 % for 0.5 secs
    move backward at power 50 %
    wait 0.6 seconds
    left wheel turns at power -50 %, right wheel at power 0 %
    wait 0.1 seconds
    wait until RGB line follower 1 : probe status as (RGB4~RGB1) 1001
    move forward at power speed % for 0.62 secs
  move forward at power 0 % for 0.5 secs
  reset timer
  repeat until timer > 1.5
    set leftMotor to 65 + RGB line follower 1 : (default line following) motor differential speed
    set RightMotor to 65 - RGB line follower 1 : (default line following) motor differential speed
    left wheel turns at power leftMotor %, right wheel at power RightMotor %
stop moving
```

```
define RM04,M05, M06
initialize RGB line follower 1 : at port1
RGB line follower 1 : (default line following) set turning sensitivity to 1
servo port2 slot1 positioned at 90
set speed to 55
reset timer
repeat until timer > 0.8
  linefollow
reset timer
repeat until RGB line follower 1 : probe status as (RGB4~RGB1) 1111 or timer > 7
  linefollow
  if color sensor port3 detects red then
    move forward at power 0 % for 0.5 secs
    LED all shows color for 3 secs
    move forward at power 50 % for 0.7 secs
  if color sensor port3 detects green then
    move forward at power 0 % for 0.5 secs
    LED all shows color for 3 secs
    move forward at power 50 % for 0.7 secs
  if color sensor port3 detects blue then
    move forward at power 0 % for 0.5 secs
    LED all shows color for 3 secs
    move forward at power 50 % for 0.7 secs
  if ultrasonic sensor port2 distance(cm) < 10 then
    move forward at power 50 % for 0.5 secs
    left wheel turns at power 50 %, right wheel at power 0 %
    wait 0.6 seconds
    move forward at power 50 % for 0.5 secs
    move backward at power 50 %
    wait 0.6 seconds
    left wheel turns at power -50 %, right wheel at power 0 %
    wait 0.1 seconds
    wait until RGB line follower 1 : probe status as (RGB4~RGB1) 1001
    move forward at power speed % for 0.62 secs
  repeat until RGB line follower 1 : probe status as (RGB4~RGB1) 0000
    linefollow
  move forward at power 0 % for 0.5 secs
  left wheel turns at power 0 %, right wheel at power 50 %
  wait 0.4 seconds
  move forward at power 50 % for 0.25 secs
  left wheel turns at power 50 %, right wheel at power 0 %
  wait 0.3 seconds
  wait until RGB line follower 1 : probe status as (RGB4~RGB1) 1001
  stop moving
```

Video Link

01 Open-source Innovation video 2019

https://youtu.be/Lp6ySaXd9XY

02 Dance Cover

https://youtu.be/88qK0TQyG-Y

03 Interview

https://youtu.be/X4HPJUA6Y3I

04 Preparation 01

https://youtu.be/Yba-2C_hPf4

05 Preparation 02

https://youtu.be/eUPGK6qQWgc

One of our personal goals is to help encourage more bright minds to pursue careers in engineering and technology. One of the biggest motivators is to be part of something larger than yourself.
"So dare to dream to make a real difference to improve the world.
Those are the kind of innovators we need as future leaders!"
-The Cross

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Mentor / Videographer / Editor
Graphic Design / Adviser :
Norman Navarette

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