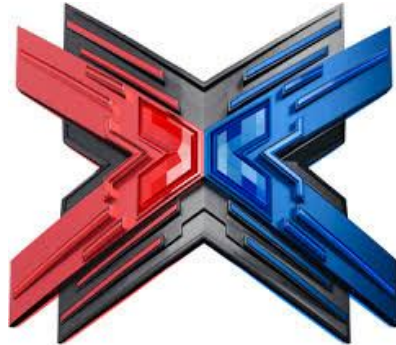


**2019 MakeX Robotics Competition - Zagreb, Croatia**



**ENGINEERING NOTEBOOK**

**TEAM: MM**

**TEAM NUMBER: XE035040**

**COMPETITION PROGRAM: City Guardian | Intermediate Group (12-16 years old)**



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## **1. Team introduction**

Team MM represents the King Tomislav Elementary school Našice. We met mBot robots in 2016 and since then robotics is an extracurricular activity for interested students.

The team has four members. Two contestants (students): Mate Knežević and Martin Kuric, and two coaches (mentors) Marija Ivanković and Vedrana Orešković. We are participating in MakeX for the first time.

### **1.1. Našice on the world map**

Našice is a small town in eastern Slavonia. The favorable geographic location and abundance of natural resources were recognized by the Templars long ago. In the 12<sup>th</sup> century, they built town's prominent landmark, the church of St Martin. Hundred years later the Franciscans arrived to this area. In the early 18<sup>th</sup> century, Našice greeted the noble Pejačević family. The fact that two members of the noble family, count Ladislav and count Teodor Pejačević, earned the title of ban (viceroy) says a lot about their great reputation. They built two beautiful manor houses, a mausoleum, landscaped the big park around the manor houses and built quite big fishponds in the vicinity of the town.

Our town has always been a prominent center of culture, economy, crafts, trade, education, health care, sports, administration and transportation.

There are three schools in the town. Two elementary schools and a high school.

## **1.2. King Tomislav Elementary school Našice**

Our school is attended by 631 students and 70 teachers. We advocate creativity, curiousness, innovation, teamwork, fun, sharing, sport, humanity... Our students are successful in various fields.

## **1.3. Brief biography of each team member**

### **contestant Mate Knežević**

“My name is Mate Knežević. I am 14 years old. I live near a town called Našice. In my spare time I play videogames and football.”

### **contestant Martin Kuric**

“My name is Martin Kuric. I live in a small town called Našice. In my spare time I play videogames and football. I am 14 years old.”

### **mentor Marija Ivanković**

“My name is Marija Ivanković. I work at King Tomislav Elementary school in Našice. I teach mathematics and computer science. For several years I’ve been mentoring students in leagues and robotics competitions. In my spare time I like to sing, dance and bake cookies”

### **mentor Vedrana Orešković**

“My name is Vedrana Orešković. I work at Isidor Kršnjavi high school in Našice. I teach electro technical group of subjects. I love innovations and elegant solutions to problems.”

## 2. Process records

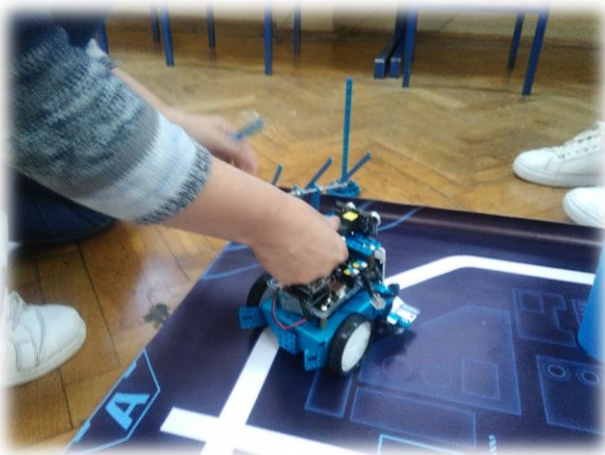
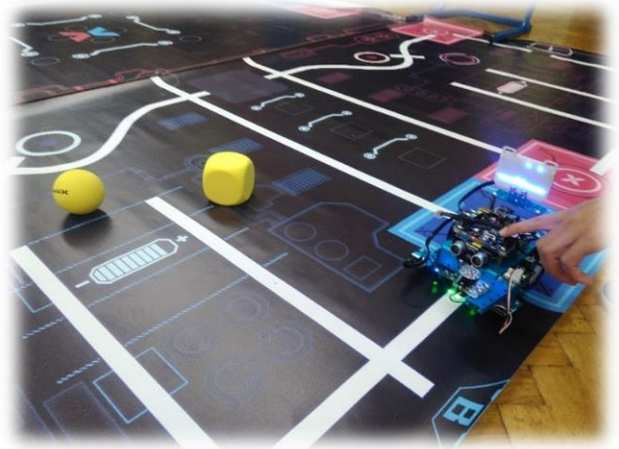
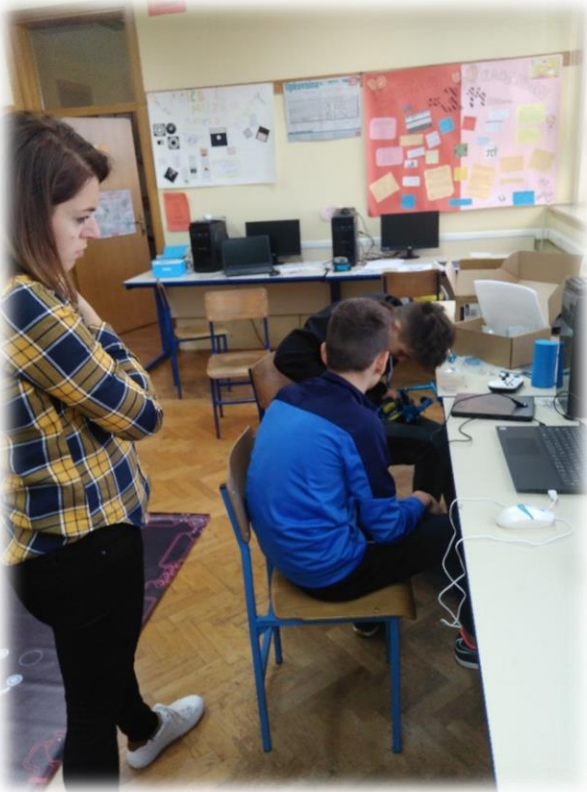
In the next few pages there are some pictures of robot construction, programming and some screenshots of solved programs for competition.

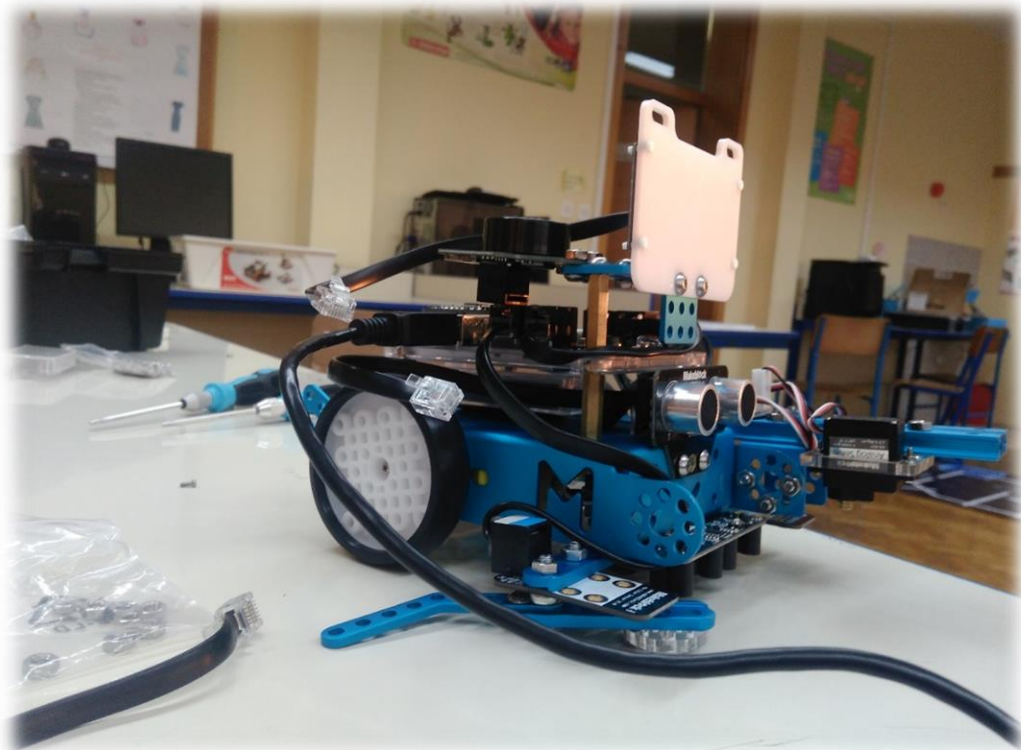
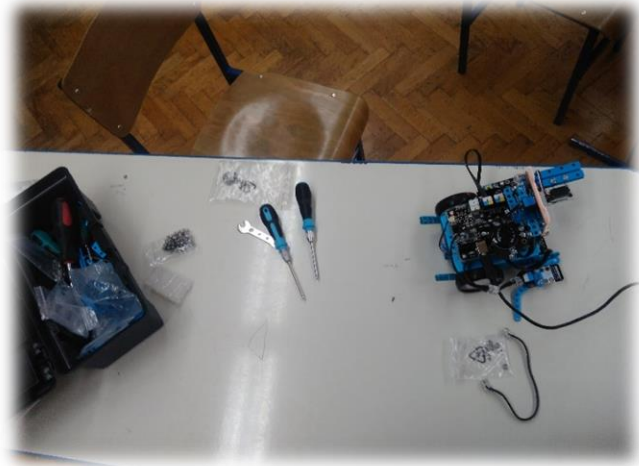
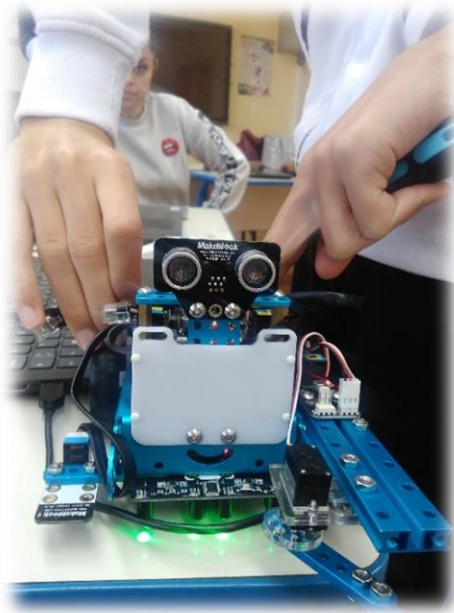
```
when mBot(mcore) starts up
  forever
    if IR remote A pressed? then
      turn right at power 50 % for 0.5 secs
      turn left at power 50 % for 0.5 secs
      wait 0.25 seconds
      turn right at power 50 % for 0.5 secs
      turn left at power 50 % for 0.5 secs
      wait 0.25 seconds
      turn right at power 50 % for 0.5 secs
      turn left at power 50 % for 0.5 secs
      wait 0.25 seconds
      turn right at power 50 % for 0.5 secs
      turn left at power 50 % for 0.5 secs
      wait 0.25 seconds
      turn right at power 50 % for 0.5 secs
      turn left at power 50 % for 0.5 secs
      wait 0.25 seconds
      stop moving
    else
      if IR remote B pressed? then
        initialize audio player at: any white port (I2C)
        audio player: play the audio file named T003
        wait until IR remote C pressed?
        audio player: stop playing
```

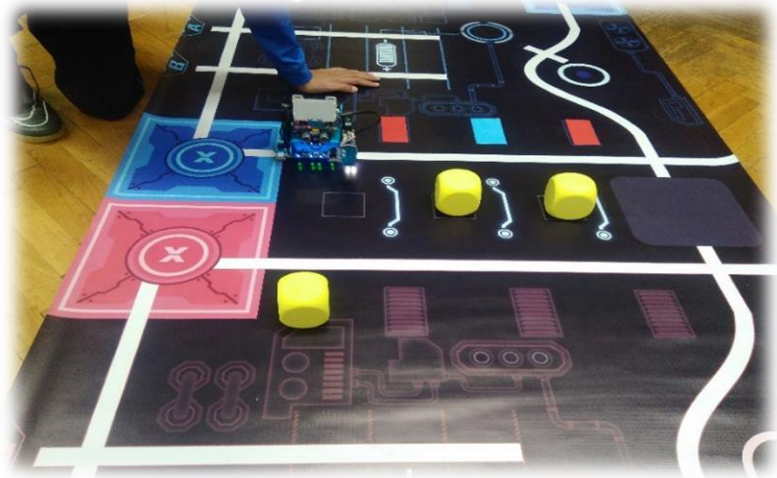
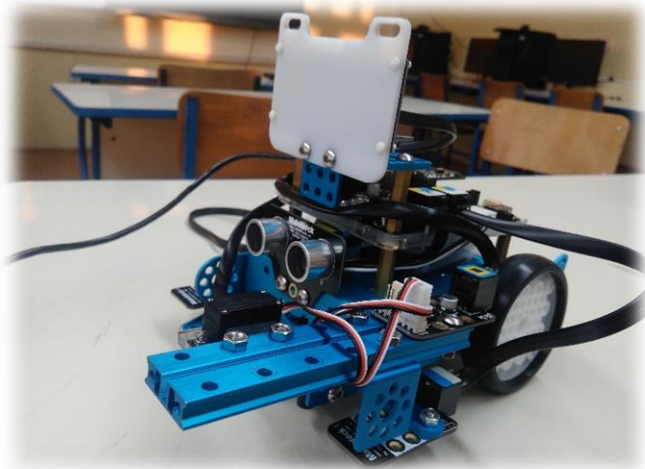
```
when mBot(mcore) starts up
  set unit RGB line follower 1 + at port2 +
  RGB line follower 1 + set target color and fit light to: green +
  RGB line follower 1 + (default line following) set turning sensitivity to: 0.5
  react time
  set speed + to: 40
  react time
  react time
  repeat until RGB line follower 1 + probe status as (RGB4-RGB1) 0000 +
    set powerleft + to: speed + RGB line follower 1 + (default line following) motor differential speed
    set powerright + to: speed + RGB line follower 1 + (default line following) motor differential speed
    left wheel turns at power powerleft %, right wheel at power powerright %
  move forward at power: 20 % for 0.2 secs
  repeat until RGB line follower 1 + probe status as (RGB4-RGB1) 0000 +
    set powerleft + to: speed + RGB line follower 1 + (default line following) motor differential speed
    set powerright + to: speed + RGB line follower 1 + (default line following) motor differential speed
    left wheel turns at power powerleft %, right wheel at power powerright %
  move forward at power: 20 % for 0.15 secs
  turn right at power: 20 % for 0.2 secs
  repeat until RGB line follower 1 + probe status as (RGB4-RGB1) 1001 +
    turn right at power 20 % for 0.05 secs
  repeat until RGB line follower 1 + probe status as (RGB4-RGB1) 1111 +
    set powerleft + to: speed + RGB line follower 1 + (default line following) motor differential speed
    set powerright + to: speed + RGB line follower 1 + (default line following) motor differential speed
    left wheel turns at power powerleft %, right wheel at power powerright %
  turn left at power 20 % for 0.2 secs
  repeat until RGB line follower 1 + probe status as (RGB4-RGB1) 1001 +
    turn left at power 20 % for 0.05 secs
  repeat until RGB line follower 1 + probe status as (RGB4-RGB1) 0000 +
    set powerleft + to: speed + RGB line follower 1 + (default line following) motor differential speed
    set powerright + to: speed + RGB line follower 1 + (default line following) motor differential speed
    left wheel turns at power powerleft %, right wheel at power powerright %
  move forward at power: 20 % for 0.15 secs
  turn right at power: 20 % for 0.2 secs
  repeat until RGB line follower 1 + probe status as (RGB4-RGB1) 1001 +
    turn right at power 20 % for 0.05 secs
  set speed + to: 20
  repeat until ultrasonic sensor port1 + distance(cm) < 10
    set powerleft + to: speed + RGB line follower 1 + (default line following) motor differential speed
    set powerright + to: speed + RGB line follower 1 + (default line following) motor differential speed
    left wheel turns at power powerleft %, right wheel at power powerright %
  stop moving
  servo port3 slot1 + positioned at 0
  wait 1 seconds
  servo port3 slot1 + positioned at 180
  wait 2 seconds
  repeat until RGB line follower 1 + probe status as (RGB4-RGB1) 1111 +
    set powerleft + to: speed + RGB line follower 1 + (default line following) motor differential speed
    set powerright + to: speed + RGB line follower 1 + (default line following) motor differential speed
    left wheel turns at power powerleft %, right wheel at power powerright %
  repeat until RGB line follower 1 + probe status as (RGB4-RGB1) 1001 +
    move forward at power: 20 % for 0.05 secs
  set speed + to: 20
  if RGB line follower 1 + probe status as (RGB4-RGB1) 1101 + or RGB line follower 1 + probe status as (RGB4-RGB1) 1011 +
    set powerleft + to: speed + RGB line follower 1 + (default line following) motor differential speed
    set powerright + to: speed + RGB line follower 1 + (default line following) motor differential speed
    left wheel turns at power powerleft %, right wheel at power powerright %
  stop moving
```

Our first solution for M09. CityParty and M01. Energy – saving Switch & M03 Aging Power Plant

Here are the photos of preparation for MakeX.









```

when mBot(micro) starts up
wait until on-board button pressed
initialize RGB line follower 1 at port2
RGB line follower 1: set target color and fill light to green
RGB line follower 1: (default line following) set turning sensitivity to 0.6
reset timer
set speed to 30
reset timer
move forward at power 30 % for 0.8 secs
repeat until RGB line follower 1: probe status as (RGB4--RGB1) 0000
set powerleft to speed + RGB line follower 1: (default line following) motor differential speed
set powerright to speed - RGB line follower 1: (default line following) motor differential speed
left wheel turns at power powerleft %, right wheel at power powerright %
move forward at power 30 % for 0.3 secs
turn right at power 50 % for 0.5 secs
repeat until RGB line follower 1: probe status as (RGB4--RGB1) 1001
turn right at power 50 % for 0.05 secs
LED panel port1 shows number ultrasonic sensor port3 distance(cm)
if ultrasonic sensor port3 distance(cm) < 19 then
set nista to 1
if ultrasonic sensor port3 distance(cm) > 20 and ultrasonic sensor port3 distance(cm) < 33 then
set nista to 2
if ultrasonic sensor port3 distance(cm) > 33 then
set nista to 3
turn left at power 30 % for 0.5 secs
repeat until RGB line follower 1: probe status as (RGB4--RGB1) 1001
turn left at power 30 % for 0.05 secs
move forward at power 30 % for 0.2 secs
repeat until RGB line follower 1: probe status as (RGB4--RGB1) 0000
set powerleft to speed + RGB line follower 1: (default line following) motor differential speed
set powerright to speed - RGB line follower 1: (default line following) motor differential speed
left wheel turns at power powerleft %, right wheel at power powerright %
move forward at power 30 % for 0.4 secs
turn right at power 30 % for 0.4 secs
repeat until RGB line follower 1: probe status as (RGB4--RGB1) 1001
turn right at power 30 % for 0.05 secs
if nista = 1 then
move forward at power 50 % for 0.5 secs
wait 2 seconds
move backward at power 50 % for 0.5 secs
if nista = 2 then
move forward at power 50 % for 0.8 secs
wait 2 seconds
move backward at power 50 % for 0.8 secs
if nista = 3 then
move forward at power 50 % for 1.05 secs
wait 2 seconds
move backward at power 50 % for 1.05 secs
turn left at power 50 % for 0.4 secs
repeat until RGB line follower 1: probe status as (RGB4--RGB1) 1001
turn left at power 50 % for 0.05 secs
stop moving

```

Final resolution for M01. Energy – saving Switch

```

when mBot(mcore) starts up
wait until when on-board button pressed ?
initialize RGB line follower 1 : at port2
RGB line follower 1 : set target color and fill light to green
RGB line follower 1 : (default line following) set turning sensitivity to 0.6
reset timer
set speed to 35
repeat until color sensor port1 detects green or color sensor port1 detects red or color sensor port1 detects blue
  set powerleft to speed + RGB line follower 1 : (default line following) motor differential speed
  set powerright to speed - RGB line follower 1 : (default line following) motor differential speed
  left wheel turns at power powerleft %, right wheel at power powerright %
stop moving
if color sensor port1 detects red then
  LED all shows color red
  wait 2 seconds
if color sensor port1 detects green then
  LED all shows color green
  wait 2 seconds
if color sensor port1 detects blue then
  LED all shows color blue
  wait 2 seconds
color sensor port1 set fill light LED to off
move forward at power 50 % for 0.2 secs
color sensor port1 set fill light LED to on
repeat until color sensor port1 detects green or color sensor port1 detects red or color sensor port1 detects blue
  move forward at power 50 % for 0.05 secs
stop moving
if color sensor port1 detects red then
  LED all shows color red
  wait 2 seconds
if color sensor port1 detects green then
  LED all shows color green
  wait 2 seconds
if color sensor port1 detects blue then
  LED all shows color blue
  wait 2 seconds

```

Our solution for M05. Road Inspection

```

when mBot(mcore) starts up
  wait until [mBot] when on-board button pressed ?
  initialize RGB line follower 1 : at port2
  color sensor port1 set fill light LED to on
  RGB line follower 1 : (default line following) set turning sensitivity to 0.3
  repeat 3
    repeat until [color sensor port1 detects blue] or [color sensor port1 detects red]
      [mBot] move forward at power 30 % for 0.05 secs
    if [color sensor port1 detects red] then
      [mBot] move backward at power 30 % for 0.45 secs
      [mBot] turn right at power 30 % for 1 secs
      [mBot] move forward at power 30 % for 1 secs
      repeat until [RGB line follower 1 : probe status as (RGB4~RGB1) 0000]
      [mBot] move forward at power 30 % for 0.05 secs
      [mBot] move forward at power 30 % for 0.3 secs
      [mBot] move backward at power 30 % for 1.2 secs
      repeat until [RGB line follower 1 : probe status as (RGB4~RGB1) 0000]
      [mBot] move backward at power 30 % for 0.05 secs
      [mBot] move forward at power 30 % for 0.5 secs
      repeat until [RGB line follower 1 : probe status as (RGB4~RGB1) 1001]
      [mBot] turn left at power 30 % for 0.05 secs
      [color sensor port1 set fill light LED to off]
      [mBot] move forward at power 30 % for 1.5 secs
      [color sensor port1 set fill light LED to on]
    else
      [mBot] stop moving
  [mBot] stop moving

```

Our solution for M07. Waste Sorting

```
when mBot(mcore) starts up
  initialize RGB line follower 1 : at port2
  RGB line follower 1 : (default line following) set turning sensitivity to 0.4
  wait until when on-board button pressed ?
  move forward at power 30 % for 1 secs
  set basep to 25
  reset timer
  repeat until timer > 7
    set pleft to basep + RGB line follower 1 : (default line following) motor differential speed
    set pright to basep - RGB line follower 1 : (default line following) motor differential speed
    left wheel turns at power pleft %, right wheel at power pright %
  stop moving
  servo port4 slot1 positioned at -180
  wait 3 seconds
  turn left at power 50 % for 1 secs
  move forward at power 50 % for 1 secs
  stop moving
```

Part of the solution for M08. Forest Planting

### 3. Project summary

We had a lot of problems during the programming. But it was interesting and funny. We changed robot's structure many times, and at the end we learned many things and we did it! We are very satisfied with our solutions and hope to have a great race at the final competition.

### 4. Suggestions for competition

We suggest more flexibility in the rules and at least some points for individual situations.

We are ready to compete! 😊

**M&M**

