

# M-BLOCK ROBOTICS PROGRAMMING

## OUTREACH PROGRAM LESSON PLAN II



Working To Advance STEM Education for African Girls

WAAW Foundation is an international non-profit organization dedicated to bringing hands-on STEM education to girls all over Africa.

**Our Mission:** To increase the pipeline of African women in Science, Technology, Engineering and Math (STEM) disciplines and to ensure this talent is engaged in African innovation.

**Our Vision:** To eradicate poverty in Africa through female education and science and technology innovation.

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# M-Block Robotics Programming

## **CLASS DESCRIPTION:**

M-Block is an all-in-one solution to enjoy the hands-on experience of programming, electronics, and robotics. This easy-to-assemble M-Block provides infinite possibilities for you to learn STEM (Science, Technology, Engineering, and Mathematics). This class is a sequel to the first lesson plan, designed to help students and STEM teachers start exploring Robotics.

**TOTAL CLASS TIME: 1 hour 30 minutes**

## **CLASS OUTCOMES:**

- Students will understand the basics of programming Robotics.
- They will be able to identify the Infra-Red Sensor and how to program the Robot to follow the line.
- They will be able to connect this programming lesson to the Arduino IDE.
- They will be able to create their own codes that would help to solve problems.

## **LIST OF MATERIALS:**

- M-Block parts coupled to form the Robot (please refer to Lesson plan 1)
- M-Block programming software (can be downloaded from <http://www.mblock.cc/edu/>)
- White Floor-Mat with straight or curvy black lines
- Black tape

## **PRE-CLASS PREPARATION AND SET-UP:**

- Ensure you have gone through the first lesson plan of this curriculum
- You must have taught lessons on Scratch and Arduino Programming before this lesson (please refer to the lesson plans provided).
- Arrange the classroom to ensure ease of movement when facilitating
- Ensure the students work in teams of 2-4 students per kit.

# INTRODUCTION (15 minutes)

Ask the students – What do you know about Robots?

The fundamental way to make robots carry out instructions is by “programming”. There are various ways that we can program robots to carry out instructions.

The various Programming Languages for Controlling Robots includes:

- C++
- Java
- Python
- Robotics NXT
- Microsoft Robotics Developer studio... and so on.

Others have been developed to create an Integrated Development Environment (IDE) to enhance programming and make it easier to learn. They include:

- Scratch
- Arduino
- M-Block
- Eclipse
- NetBeans.....and so on.

One of the simplest ways of programming robots is done using the M-block, which works based on Scratch programming integrated with the Arduino (IDE).

This is what we are going to explore today.  
Who has seen a Robot before?

A robot is a machine capable of carrying out a complex series of actions automatically when programmed with a computer.

Let the students list the programming languages they know.

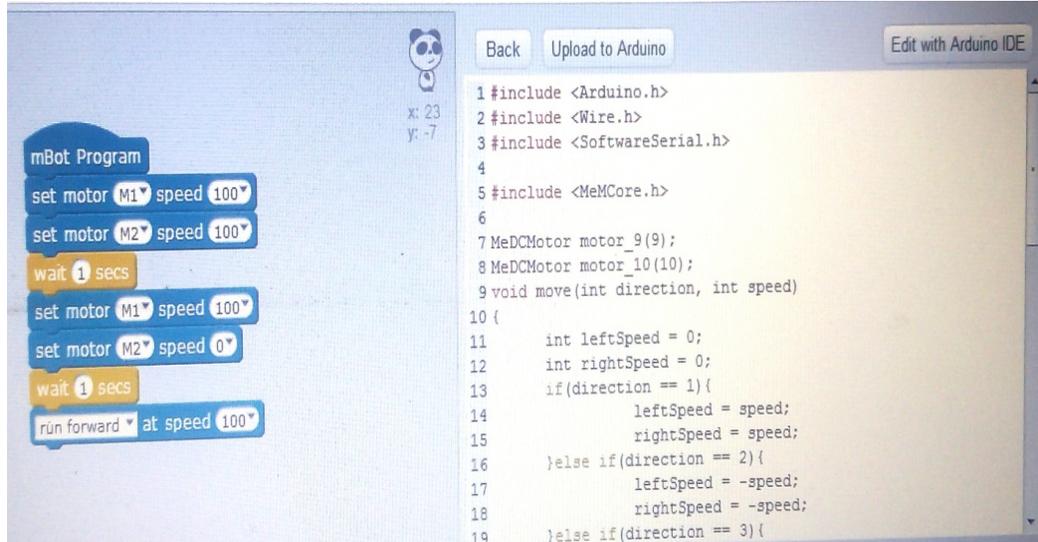
**Note that:** they should have learned Scratch and Arduino Programming for better understanding

They should be able to mention robots they have seen in movies or show them videos of robots in motion.

This is to ensure they create a visual-picture in their minds for better understanding.

## PROJECT 1 (30 minutes):

**Task:** Program your robot to move forward at a “particular speed and time” and make it turn left.



### Procedure:

- Drag and Drop the codes as shown in the picture above.
- Each block shows lines of codes on the Arduino IDE on the right-side of the programming interface.
- Connect your robot to the computer and upload the program.
- To Connect Your Robot through 2.4G Modules
  - Connect with USB cable
  - Upgrade Firmware
  - Close Program
  - Turn off m-Robot
  - Open Program
  - Turn On Robot
  - Connect with 2.4G
- Test the robot to ensure it works exactly how it was programmed.
- Let the students add codes that will make the robot turn left.
- Let them keep exploring different speeds, time and directions.

Ensure the students go through the Engineering Design process:

ASK



IMAGINE



PLAN



DESIGN



BUILD/CREATE



TEST



RE-DESIGN



IMPROVE

## PROJECT 2 (30 minutes)

**Task:** Program your robot to “follow the line” on an elementary track as shown in the picture below:



Line follower is comprised of 2 digital sensors reporting out of 5 cases.

Case # =  
Left\_Right

Case 0 =  
Black\_Black

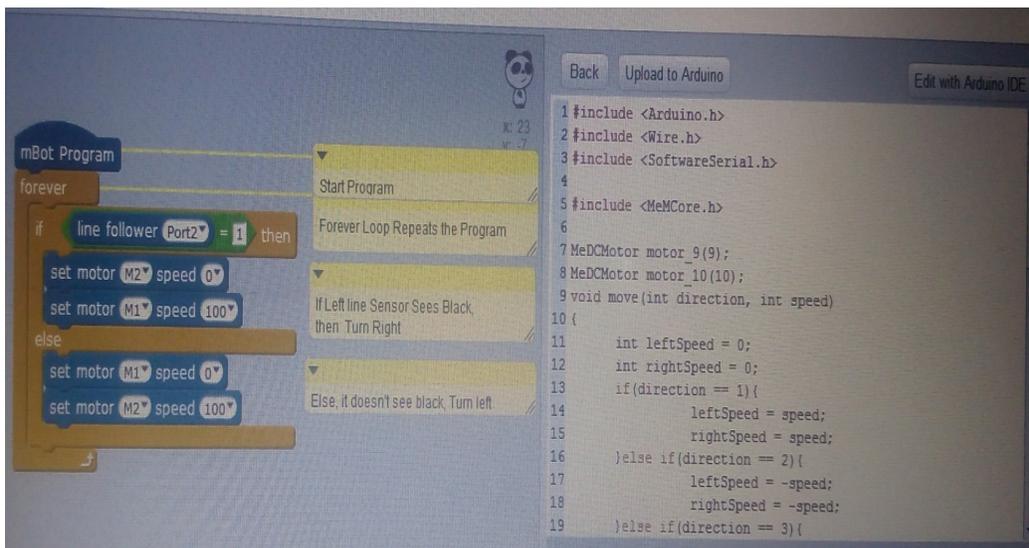
Case 1 =  
Black\_White

Case 2 =  
White\_Black

Case 3 =  
White\_White

### Procedure:

- Drag and Drop the codes as shown in the picture below.
- Each block shows lines of codes on the Arduino IDE on the right-side of the programming interface.
- Connect your robot to the computer and upload the program. (as described in Activity 1)
- Test the robot to ensure it works exactly how it was programmed.
- Let them keep exploring different speeds, time and directions.



## CONCLUSION (15 minutes)

### What did you observe?

- The movement of the Robot is dependent on what codes are used.
- The infra-Red sensor is a rectangular prism with 2 black opening.
- This sensor is sensitive to low and High infrared colors, making it move according to the instruction.
- Identifying white and black colors makes it move on the line. This is the Trick!

### EXPLORE, PLAY & SHARE!

- Can you make it go faster?
- This program produces a “Wiggle” motion. So can you make this robot follow the line smoother?
- Can you make the Robot follow the other side of the line?
- Have you tried opening the lines of codes with the Arduino IDE?
- What are the real-world applications of this lesson?

Ensure the students discuss their observations.

Let them state various ways this robot can solve problems.

Relate this lesson to various Real-world Applications.

The Key here is **problem solving**.

“Today’s Play is tomorrow’s Pay”

# REFERENCES

To learn more, check out these sites:

<http://www.mblock.cc/edu/>

<http://web.eng.fiu.edu/~arellano/1002/mblock/m-block.pdf>

M-block Robotics Programming Lesson Plan 1

Instructors should always make more research to stay updated and become more proficient.