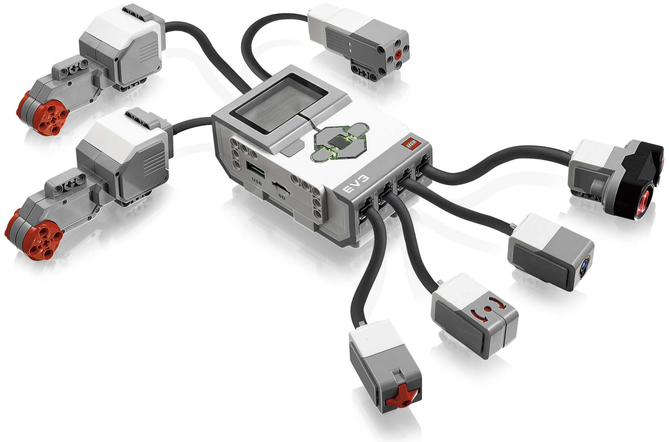
EV3 Programming in Java

Robotics Group Project – 2016

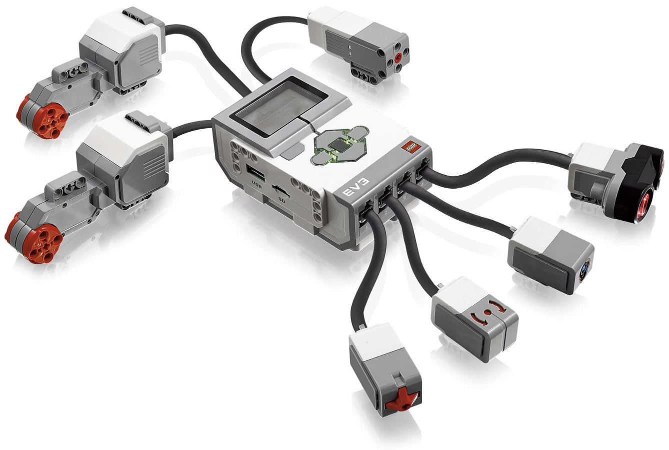
Programming

- EV3 runs Linux with Java Runtime Environment (JRE7)



Programming

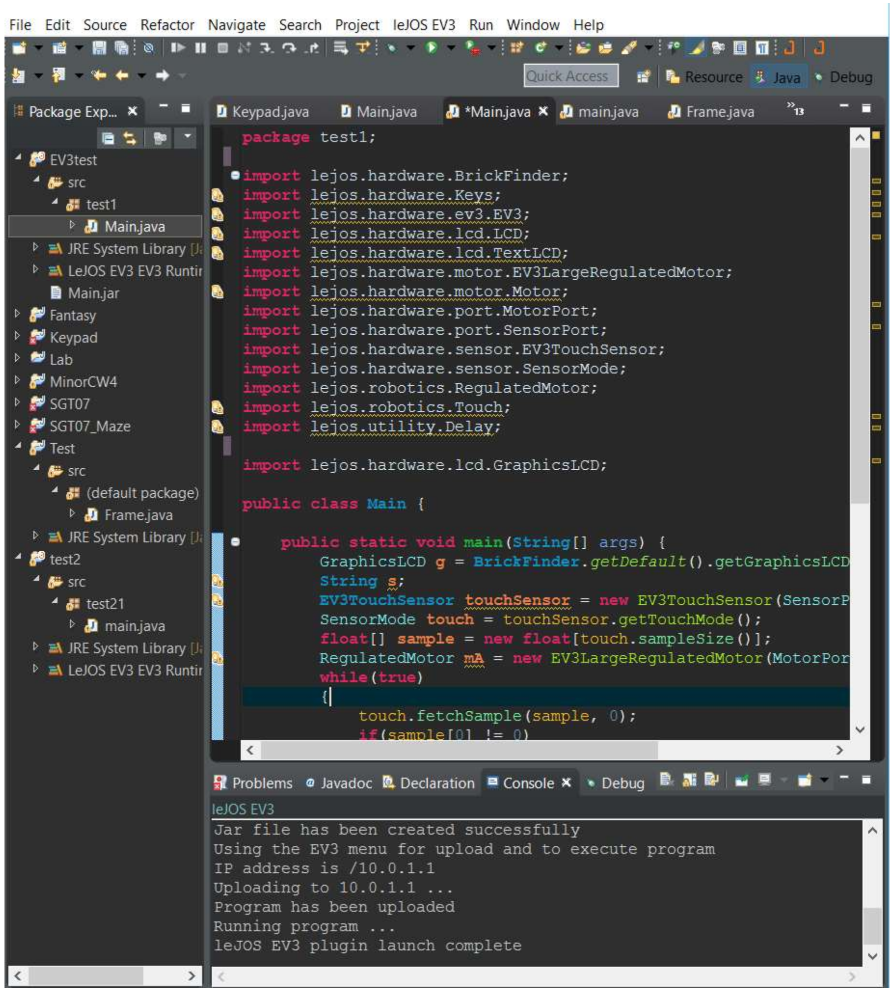
- EV3 runs Linux with Java Runtime Environment (JRE7)
- EV3 connects to PC through virtual network (USB)



http://www.lejos.org/

https://sourceforge.net/p/lejos/wiki/Home/

Programming



```
package test1;

import lejos.hardware.BrickFinder;
import lejos.hardware.Keys;
import lejos.hardware.ev3.EV3;
import lejos.hardware.lcd.LCD;
import lejos.hardware.lcd.TextLCD;
import lejos.hardware.motor.EV3LargeRegulatedMotor;
import lejos.hardware.motor.Motor;
import lejos.hardware.port.MotorPort;
import lejos.hardware.port.SensorPort;
import lejos.hardware.sensor.EV3TouchSensor;
import lejos.hardware.sensor.SensorMode;
import lejos.robotics.RegulatedMotor;
import lejos.robotics.Touch;
import lejos.utility.Delay;

import lejos.hardware.lcd.GraphicsLCD;

public class Main {

    public static void main(String[] args) {
        GraphicsLCD g = BrickFinder.getDefault().getGraphicsLCD
        String s;
        EV3TouchSensor touchSensor = new EV3TouchSensor(SensorP
        SensorMode touch = touchSensor.getTouchMode();
        float[] sample = new float[touch.sampleSize()];
        RegulatedMotor mA = new EV3LargeRegulatedMotor(MotorPor
        while(true)
        {
            touch.fetchSample(sample, 0);
            if(sample[0] != 0)
```

```
Jar file has been created successfully
Using the EV3 menu for upload and to execute program
IP address is /10.0.1.1
Uploading to 10.0.1.1 ...
Program has been uploaded
Running program ...
leJOS EV3 plugin launch complete
```

- EV3 runs Linux with Java Runtime Environment (JRE7)
- EV3 connects to PC through virtual network (USB)
- Eclipse Mars.2 IDE used to compile and download Java programs to EV3

IDE

- Eclipse run leJOS plugin – provides access to Java packages and EV3 communication

http://www.lejos.org/

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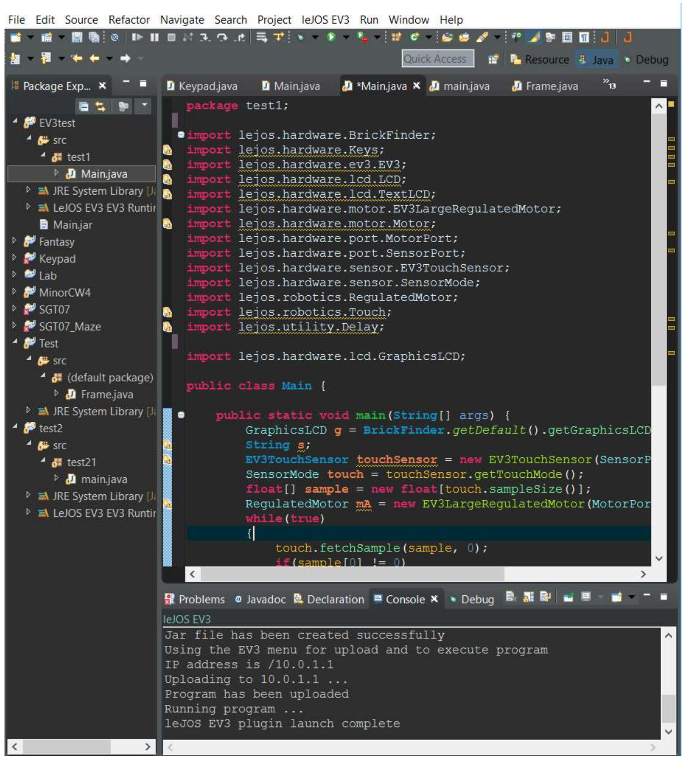

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import lejos.hardware.motor.Motor;
import lejos.hardware.port.MotorPort;
import lejos.hardware.port.SensorPort;
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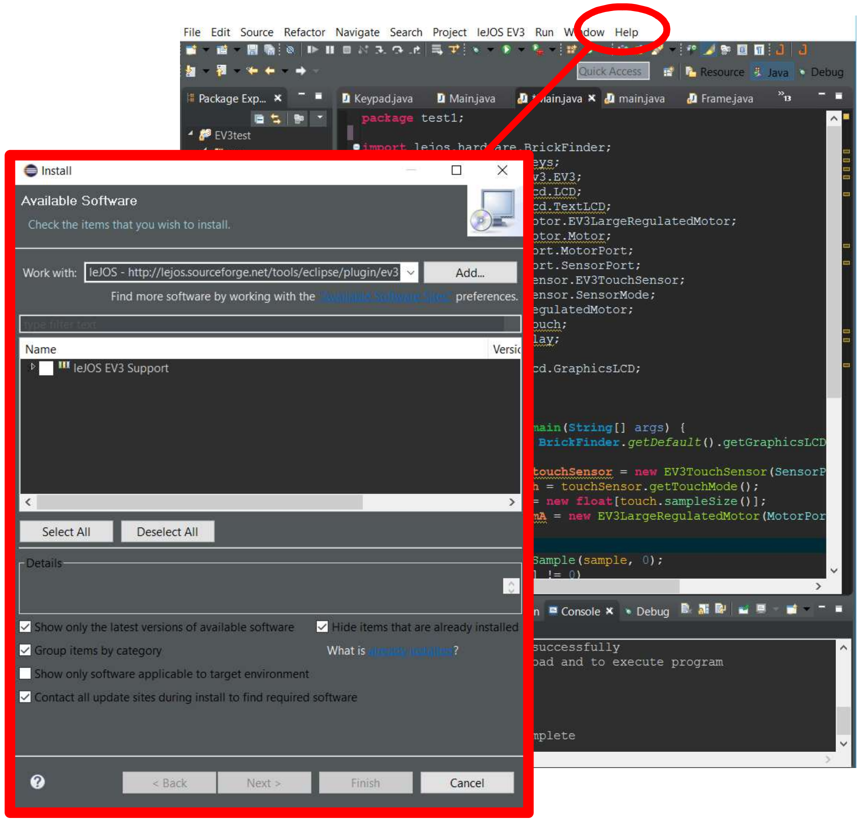
IDE

- Eclipse run leJOS plugin – provides access to Java packages and EV3 communication (libraries need to be installed separately)
- Installed through internal package manager



Install

Available Software

Check the items that you wish to install.

Work with: leJOS - http://lejos.sourceforge.net/tools/eclipse/plugin/ev3 [Add...]

Find more software by working with the "Available Software Sites" preferences.

Name	Versio
□ leJOS EV3 Support	

[Select All] [Deselect All]

Details

☑ Show only the latest versions of available software ☑ Hide items that are already installed

☑ Group items by category What is already installed?

□ Show only software applicable to target environment

☑ Contact all update sites during install to find required software

[< Back] [Next >] [Finish] [Cancel]

```
package test1;

import lejos.hardware.BrickFinder;
eys;
v3.EV3;
cd.LCD;
cd.TextLCD;
otor.EV3LargeRegulatedMotor;
otor.Motor;
ort.MotorPort;
ort.SensorPort;
ensor.EV3TouchSensor;
ensor.SensorMode;
egulatedMotor;
ouch;
lay;

cd.GraphicsLCD;


main(String[] args) {
 BrickFinder.getDefault().getGraphicsLCD

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IDE

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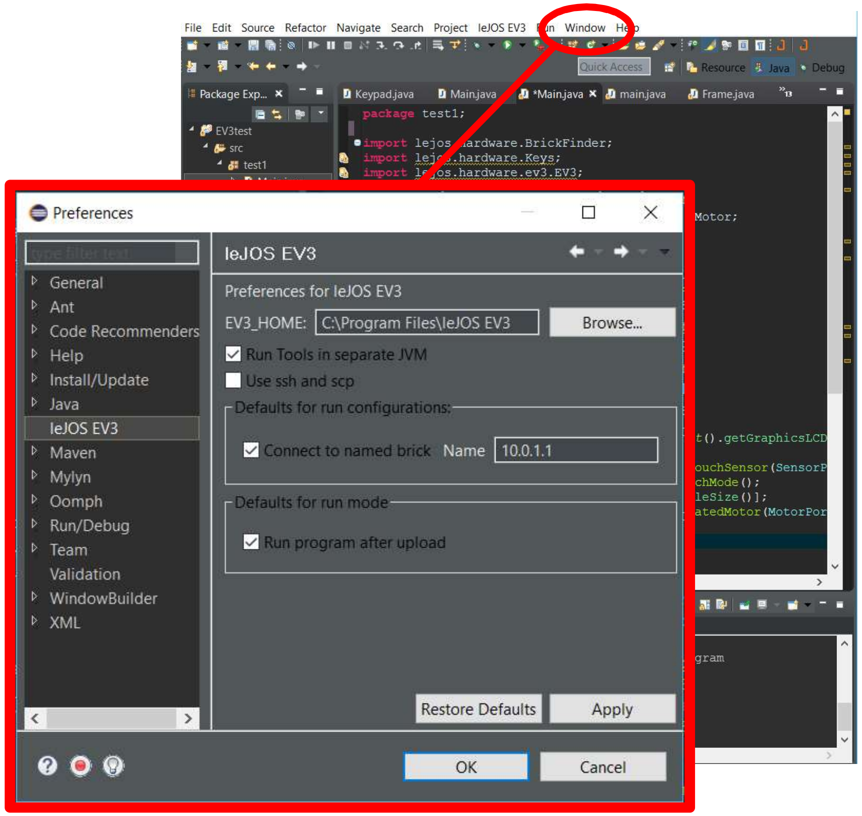
- Installed through internal package manager

- Settings can be accessed to configure plugin (including EV3 "Name" / IP address)



```
package test1;

import lejos.hardware.BrickFinder;
import lejos.hardware.Keys;
import lejos.hardware.ev3.EV3;
```

leJOS EV3

Preferences for leJOS EV3

EV3_HOME: C:\Program Files\leJOS EV3

☑ Run Tools in separate JVM

☐ Use ssh and scp

Defaults for run configurations:

☑ Connect to named brick Name 10.0.1.1

Defaults for run mode

☑ Run program after upload

IDE

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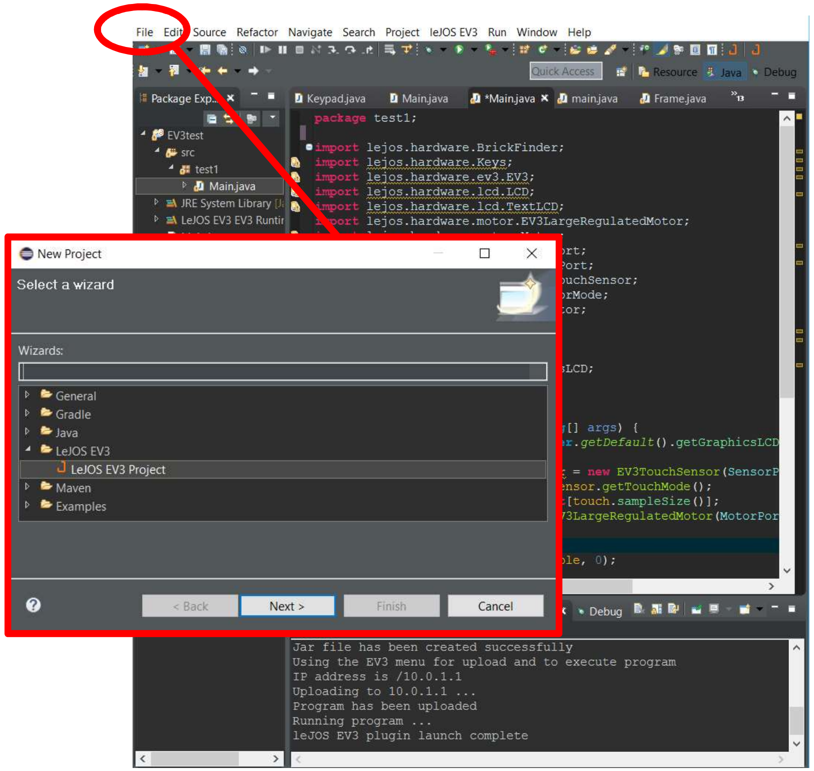
- Settings can be accessed to configure plugin (including EV3 "Name" / IP address)
- New projects can be created using leJOS template (Project – Package – Class)



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IDE

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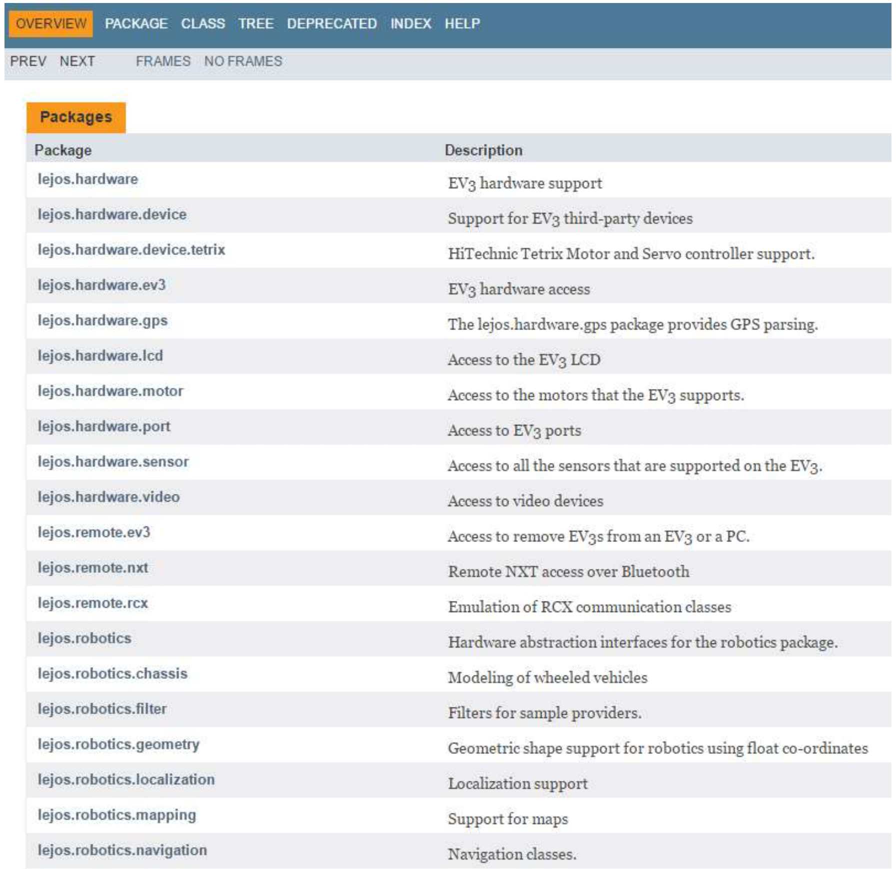
- Installed through internal package manager
- Settings can be accessed to configure plugin (including EV3 “Name” / IP address)
- New projects can be created using leJOS template (Project – Package – Class)
- Detailed description of API can be accessed online: *http://www.lejos.org/ev3/docs/*



Packages

Package	Description
lejos.hardware	EV3 hardware support
lejos.hardware.device	Support for EV3 third-party devices
lejos.hardware.device.tetrix	HiTechnic Tetrix Motor and Servo controller support.
lejos.hardware.ev3	EV3 hardware access
lejos.hardware.gps	The lejos.hardware.gps package provides GPS parsing.
lejos.hardware.lcd	Access to the EV3 LCD
lejos.hardware.motor	Access to the motors that the EV3 supports.
lejos.hardware.port	Access to EV3 ports
lejos.hardware.sensor	Access to all the sensors that are supported on the EV3.
lejos.hardware.video	Access to video devices
lejos.remote.ev3	Access to remove EV3s from an EV3 or a PC.
lejos.remote.nxt	Remote NXT access over Bluetooth
lejos.remote.rcx	Emulation of RCX communication classes
lejos.robotics	Hardware abstraction interfaces for the robotics package.
lejos.robotics.chassis	Modeling of wheeled vehicles
lejos.robotics.filter	Filters for sample providers.
lejos.robotics.geometry	Geometric shape support for robotics using float co-ordinates
lejos.robotics.localization	Localization support
lejos.robotics.mapping	Support for maps
lejos.robotics.navigation	Navigation classes.

Example: Large Servo Motor

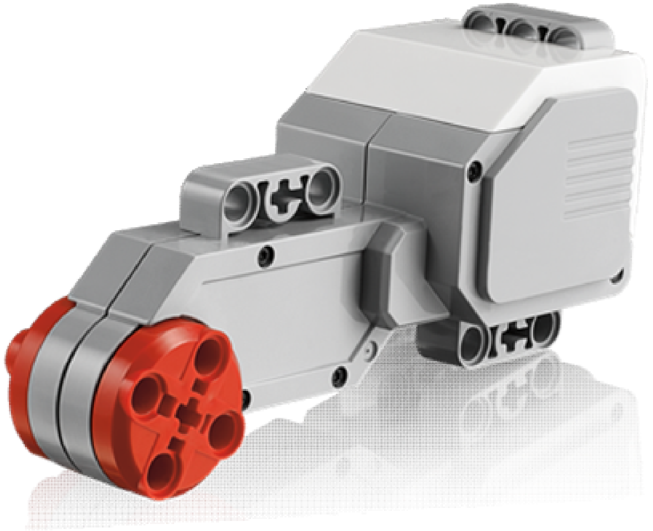
Class EV3LargeRegulatedMotor extends BaseRegulatedMotor

- **void forward()**
  lets motor run until stop() is invoked

- **void stop()**
  stops the running motor

- **boolean isMoving()**
  returns whether motor is moving or not

- **void rotate(int angle)**
  rotates motor to angle specified in argument

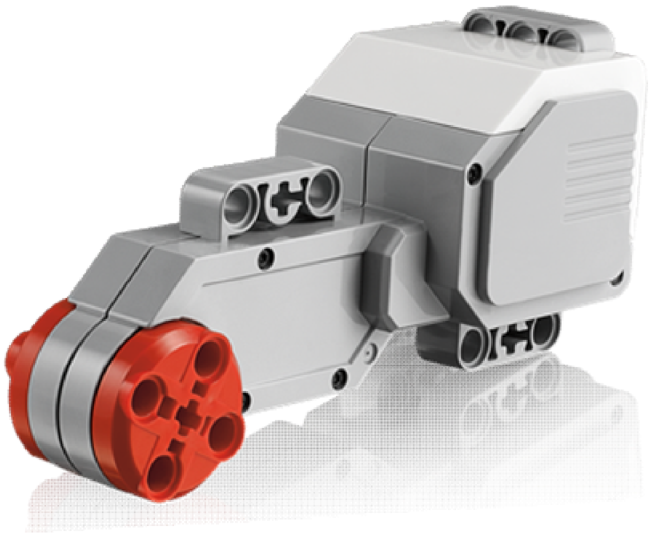


Example: Large Servo Motor

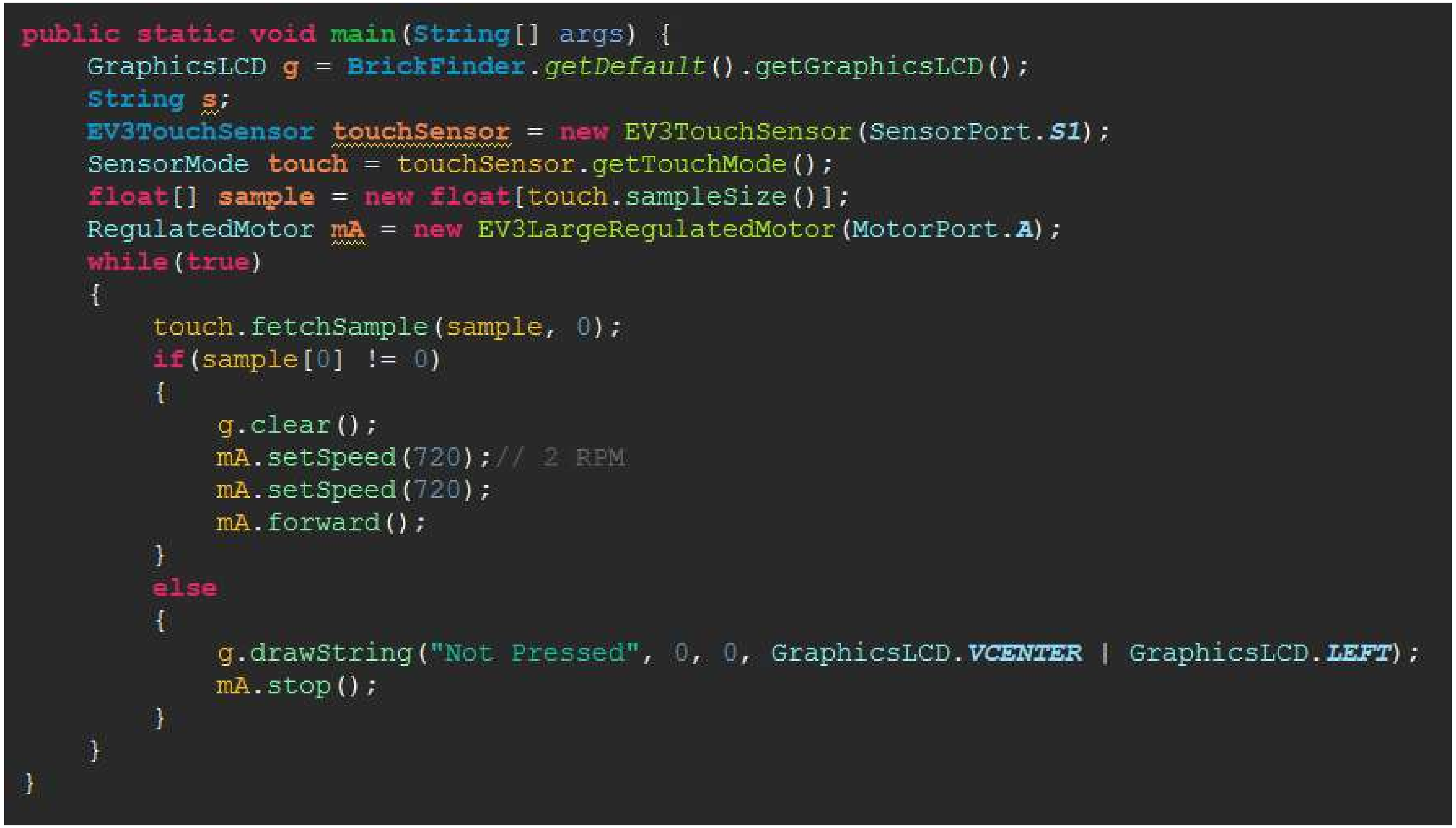
Example program

```
int goal = 270                          //degrees

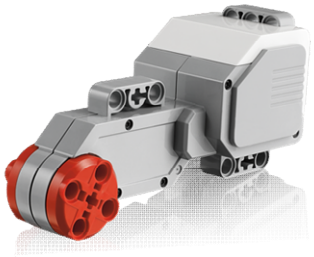
if (!Motor.A.isMoving)
{
        Motor.A.rotate(goal);           // servoing to goal angle
}
else
{
        Motor.A.stop();
        Motor.A.forward();
        Delay();
        Motor.A.backward();
        Delay();
        Motor.A.stop();
}
```



Example: Motor control with button

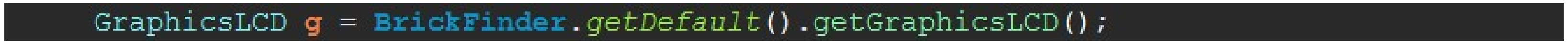


```java
public static void main(String[] args) {
    GraphicsLCD g = BrickFinder.getDefault().getGraphicsLCD();
    String s;
    EV3TouchSensor touchSensor = new EV3TouchSensor(SensorPort.S1);
    SensorMode touch = touchSensor.getTouchMode();
    float[] sample = new float[touch.sampleSize()];
    RegulatedMotor mA = new EV3LargeRegulatedMotor(MotorPort.A);
    while(true)
    {
        touch.fetchSample(sample, 0);
        if(sample[0] != 0)
        {
            g.clear();
            mA.setSpeed(720);// 2 RPM
            mA.setSpeed(720);
            mA.forward();
        }
        else
        {
            g.drawString("Not Pressed", 0, 0, GraphicsLCD.VCENTER | GraphicsLCD.LEFT);
            mA.stop();
        }
    }
}
```

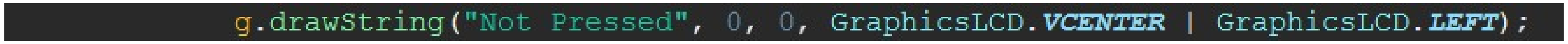


Example: Motor control with button

Handle to LCD on Brick

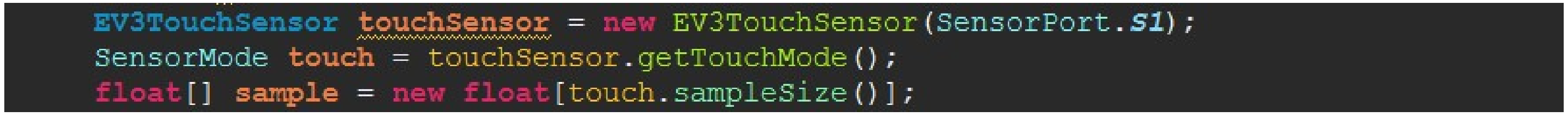


```
GraphicsLCD g = BrickFinder.getDefault().getGraphicsLCD();
```

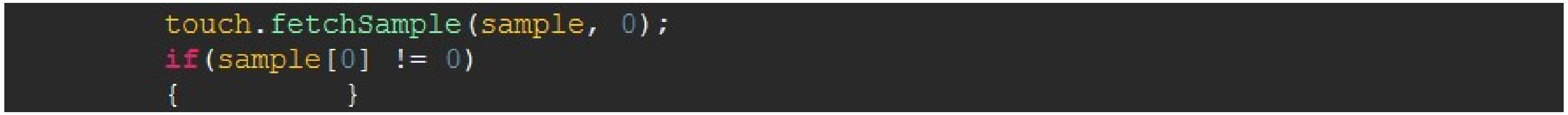


```
g.drawString("Not Pressed", 0, 0, GraphicsLCD.VCENTER | GraphicsLCD.LEFT);
```

Access to touch sensor through sample array



```
EV3TouchSensor touchSensor = new EV3TouchSensor(SensorPort.S1);
SensorMode touch = touchSensor.getTouchMode();
float[] sample = new float[touch.sampleSize()];
```



```
touch.fetchSample(sample, 0);
if(sample[0] != 0)
{            }
```

Motor control

- As in previous example

Further notes

- Programs are stored on brick and executed upon successful compilation
  - *If stuck in endless loop, running program can be terminated pressing centre and down buttons simultaneously*

- All sensors and motors can be accessed and tested via the EV3 brick menu

- Sensors are plugged into the numbered slots and motors in the alphabetical ones