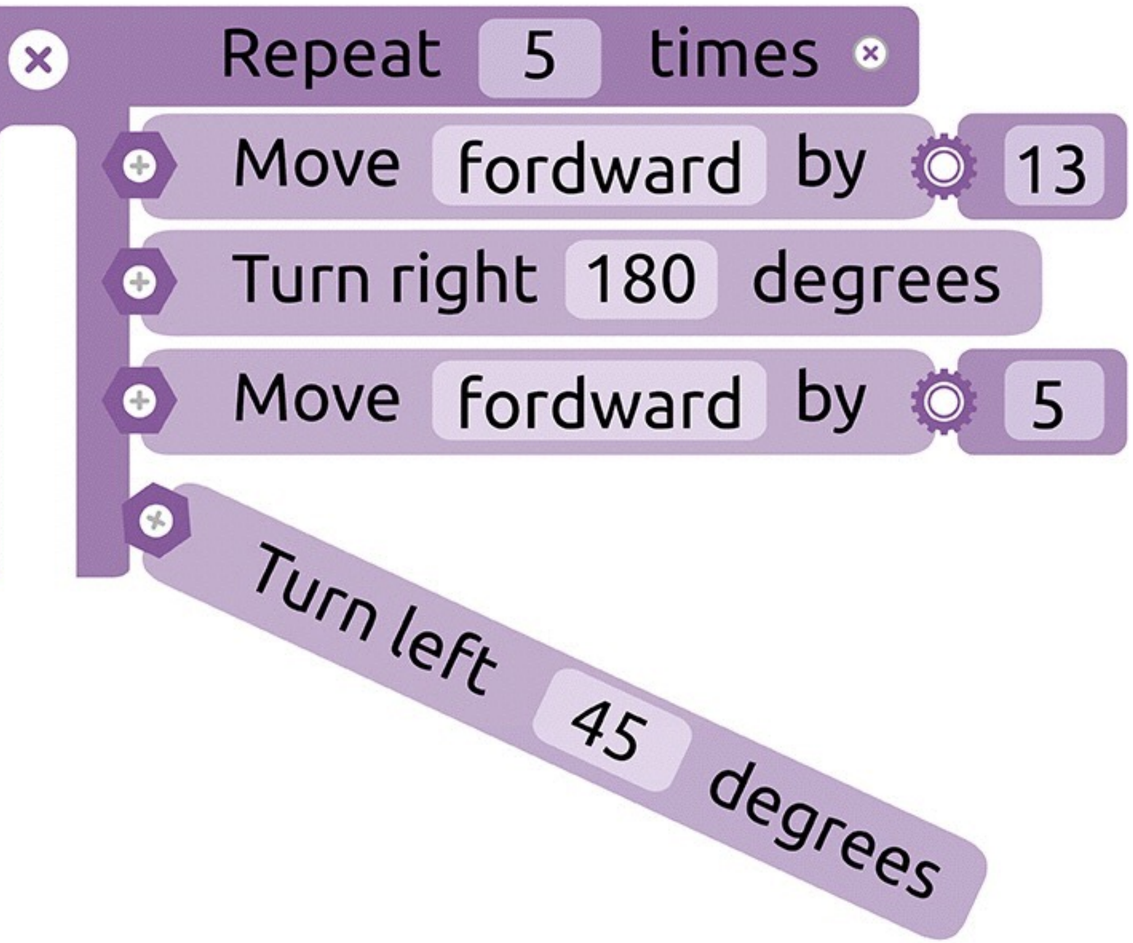
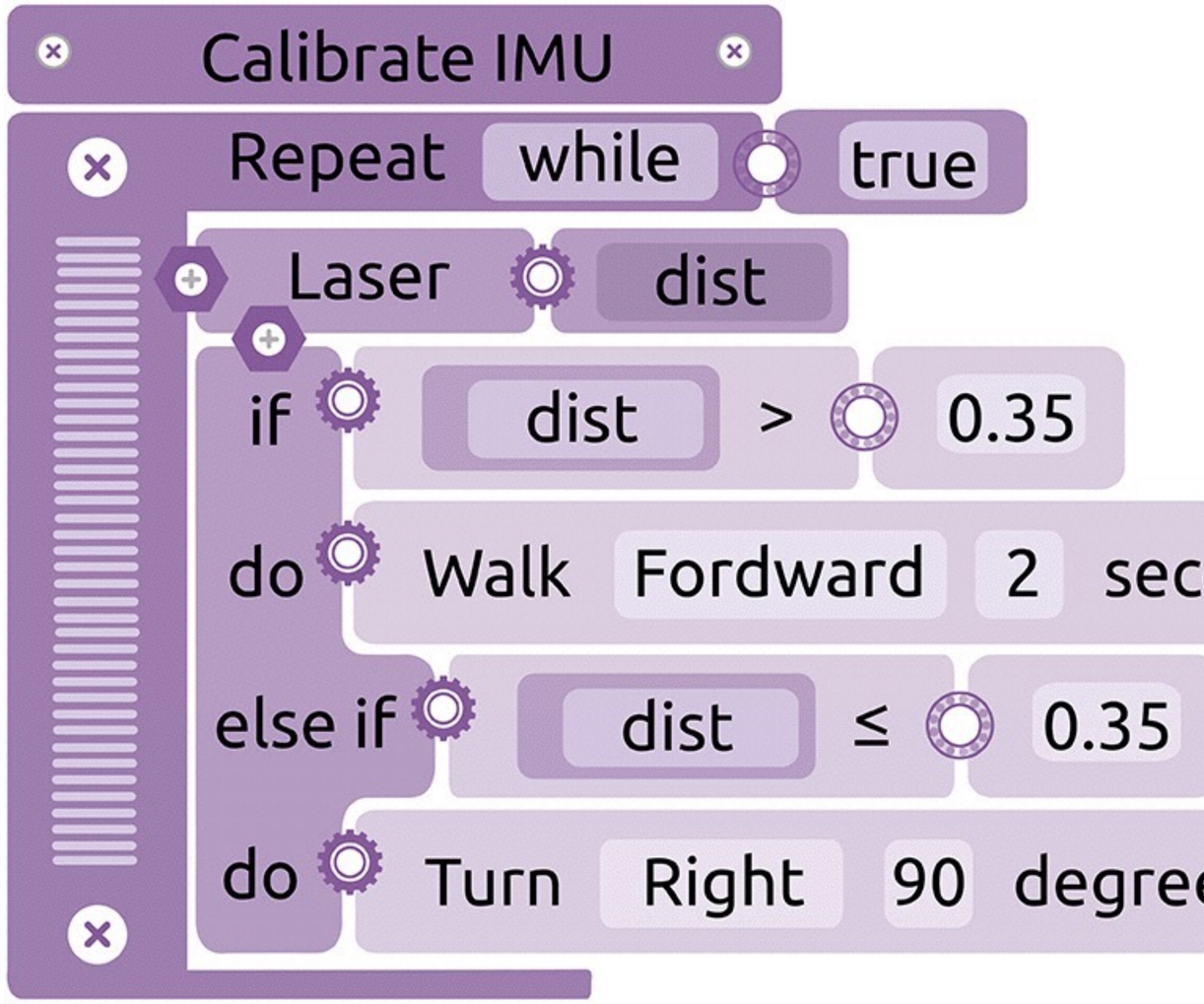
The robot_blockly package: programming ROS with blocks

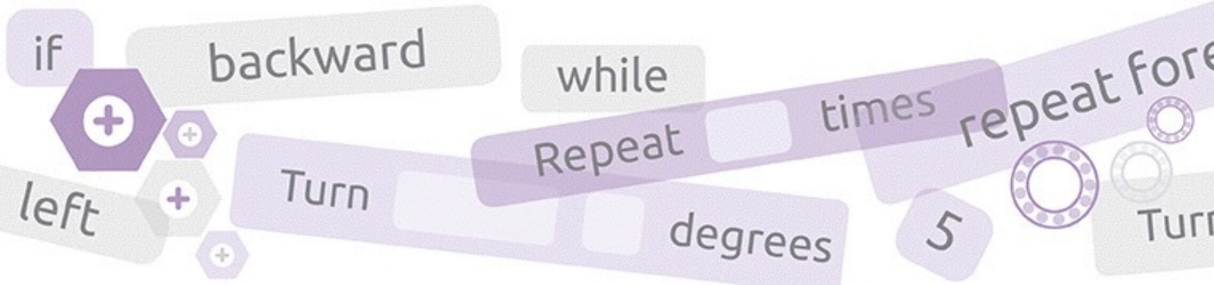
Erle Robotics

Alejandro Hernández


Repeat 5 times
Move fordward by 13
Turn right 180 degrees
Move fordward by 5
Turn left 45 degrees


Calibrate IMU
Repeat while true
Laser dist
if dist > 0.35
do Walk Fordward 2 sec
else if dist ≤ 0.35
do Turn Right 90 degree


fordward
repeat forever
GPS
right
fordward
Turn
degrees
Stand Up/Down
while


if
backward
while
Repeat
times
repeat fore
left
Turn
degrees
5

What is Scratch?

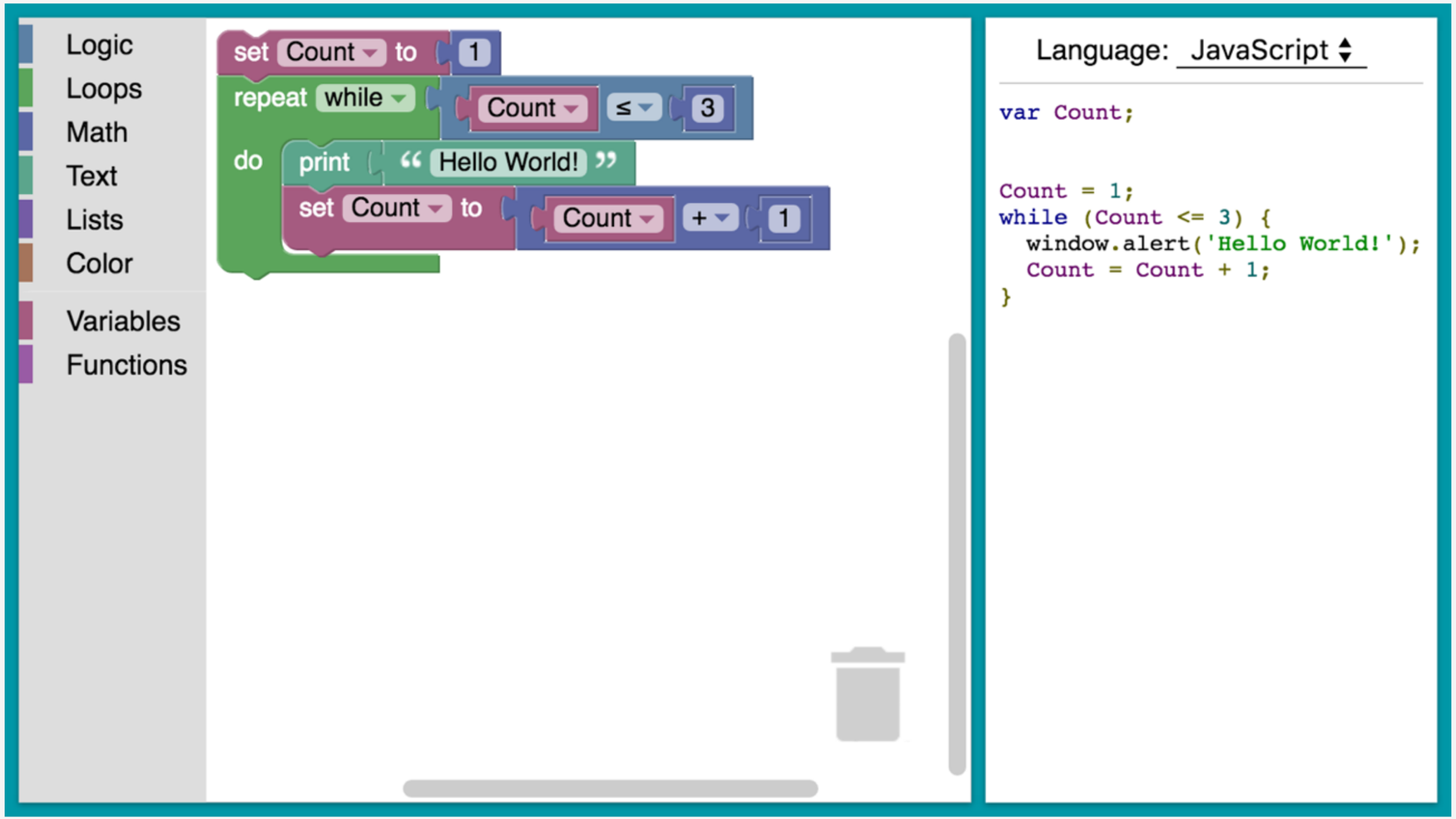
Scratch is a visual programming language

Scratch was created in 2003 as an educational programming language by MIT that allows learning to program using blocks.

Scratch is primarily designed for 8 to 16 year olds, it is also used by people of all ages, including younger children with their parents.

Initiated in 2003, has received generous support from the National Science Foundation (grants 0325828, 1002713, 1027848, 1019396), Intel Foundation, Microsoft, MacArthur Foundation, LEGO Foundation, Code-to-Learn Foundation, Google, Dell, Fastly, Inversoft, and MIT Media Lab research consortia

Blockly

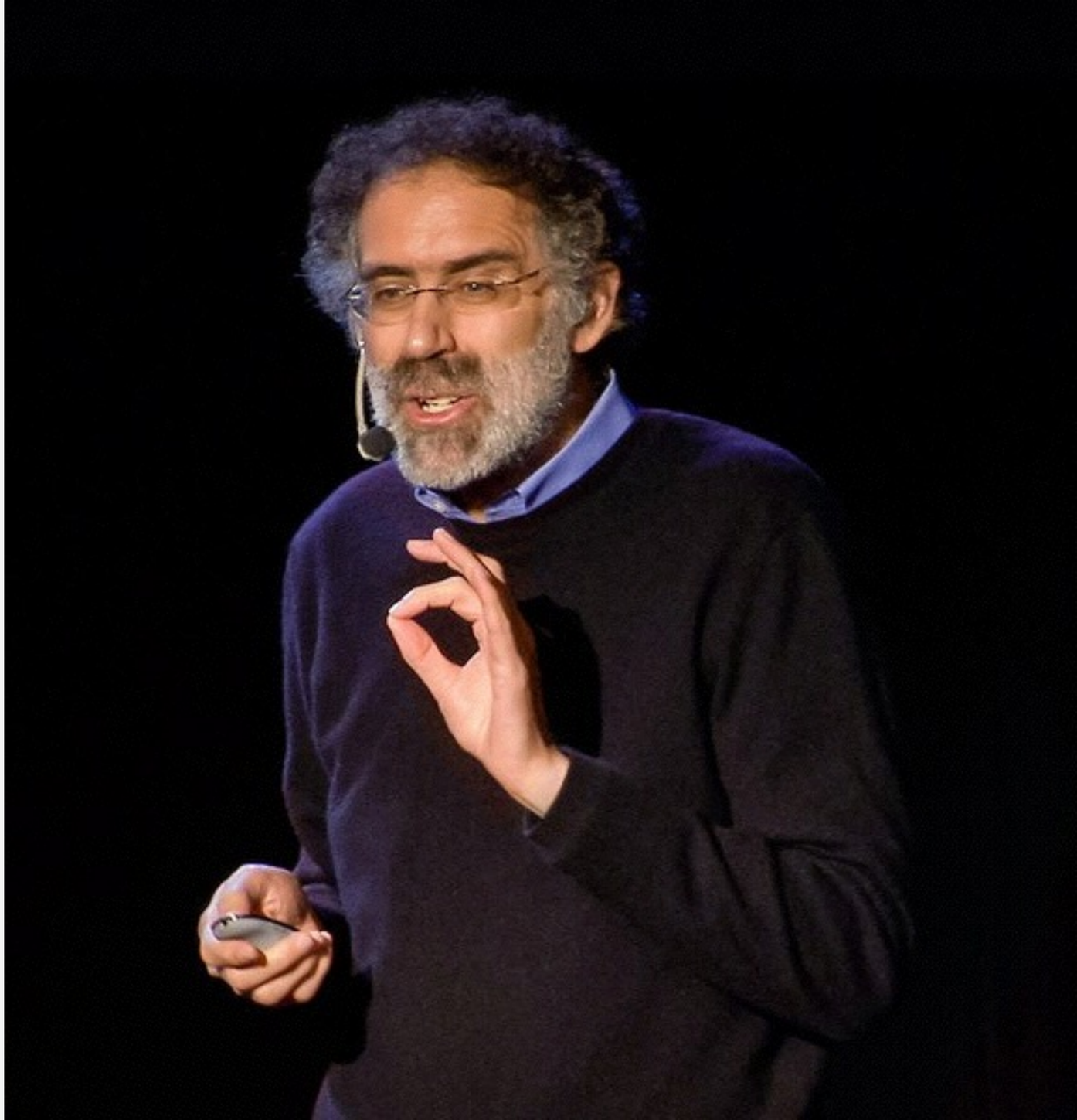


https://github.com/google/blockly

Mitch Resnick

“We shouldn’t think about young people as digital natives”

Mitch Resnick. Director of the Lifelong Kindergarten group at the MIT Media Lab.



Young people have a lot experience at interacting with new technologies but **lot less at creating** and expressing themselves **with new technologies**.

Mitch Resnick

… it’s almost as if they could
read but not write

Mitch Resnick

The third language

Should Computer Coding Be Considered A Foreign Language in School? Some Say Yes

by ALLISON SLATER TATE

Why Estonia Has Started Teaching Its First-Graders To Code

Parmy Olson, FORBES STAFF

I cover agitators and innovators in mobile.

FULL BIO

New York Mayor Michael Bloomberg takes coding course

8 March 2012 | Technology

New York Mayor Michael Bloomberg has resolved to take an online computer coding course.

The mayor is joining more than 180,000 people currently taking part in Code Year, a campaign to encourage more people to programme.

"My New Year's resolution is to learn to code with Codecademy in 2012!" he

New York Mayor Michael Bloomberg is learning to code

```
var iiObject = Class.create({
    initialize: function(pos, y){
        if (typeof(y) == 'undefined')
            this.pos = pos || new iiVec2();
        else this.pos = new iiVec2(pos,y);
        this.drawCenter = true;
    },
    setPos: function(v,y){
        if(typeof(y) == 'undefined')
            this.pos = v;
        else {
            this.pos.x = v;
            this.pos.y = y;
        }
    },
    move: function(v,y){
        this.pos.add(v,y);
    },
    draw: function(ctx){
        if (this.drawCenter){
            //draw middle dot
            ctx.fillStyle = '#fff';
            ctx.fillRect(this.pos.x-2, this.pos.y-2, 4, 4);
        }
    }
});

var iiShape = Class.create(iiObject, {
    initialize: function($super, pos, y, vel, velY){
        $super(pos, y);
        if (typeof(velY) == 'undefined')
            this.vel = vel || new iiVec2();
        else this.vel = new iiVec2(vel,velY);
    },
    update: function($super, dt){
        if (typeof(this.drawables) != 'undefined')
            for (var i=0;i<this.drawables.length;i++)
                if (typeof(this.drawables[i].update) != 'undefined')
                    if(!this.drawables[i].update())
                        return false;
        this.move(new iiVec2(this.vel.x*dt, this.vel.y*dt));
        if (typeof(this.torque) != 'undefined') this.rotation+=this.torque;
        if (this.bounds != null && ((this.bounds.top != null && this.pos.y <
            this.bounds.top) || (this.bounds.right != null && this.pos.x > this
            .bounds.right) || (this.bounds.bottom != null && this.pos.y > this.
            bounds.bottom) || (this.bounds.left != null && this.pos.x < this.
            bounds.left)))
            return false;
        return true;
    },
    draw: function($super, ctx){
        if (typeof(this.drawables) != 'undefined'){
            ctx.save();
            ctx.translate(this.pos.x, this.pos.y);
            if (typeof(this.rotation) != 'undefined')
                ctx.rotate(this.rotation);
            for (var i=0; i<this.drawables.length; i++)
                this.drawables[i].draw(ctx, this.pos);
            ctx.restore();
        }
        if (this.drawBox){
            //draw outside border
            ctx.strokeStyle = '#fff';
            ctx.strokeRect(this.left(), this.top(), this.width, this.height);
        }
        $super(ctx);
    },
    addDrawable: function(drawable){
        if (typeof(this.drawables) == 'undefined')
            this.drawables = [];
        var i=this.drawables.length;
        this.drawables[i] = drawable;
```

```
function SpaceShooter(){
    var player;
    var playerHSpeed = 9;
    var playerVSpeed = 8;
    var playerMove = [0,0,0,0,0];
    var spaceDown = false;
    var backgroundSpeed = 18;

    var asteroidHealth = 4;

    var playerBullets = [];
    var asteroids = [];

    var score = 0;
    var scoreText;

    var backgroundSrcs = ['img/png/Background/starBig.png', '
        img/png/Background/starSmall.png', 'img/png/Background/speedLine.png',
        'img/png/Background/nebula.png'];

    var asteroidSrcs = ['img/png/meteorBig.png', 'img/png/meteorSmall.png'];

    var iio;
    this.init = function(iioController){
        iio = iioController;
        iio.setBGPattern('img/png/Background/backgroundColor.png');
        iio.createGroup('asteroids', 0);
        iio.createGroup('stars', -30);
        iio.createGroup('nebulas', -20);
        iio.createGroup('player', 10);
        iio.createGroup('player bullets', 10);
        iio.createGroup('lasor flashes', 15);
        iio.runDebugger();

        var srcs = ['img/png/playerLeft.png','img/png/player.png','
            img/png/playerRight.png'];
        player = new iiBox(iio.canvas.width/2, iio.canvas.height-200, 0,0);
        player.addDrawable(new iiAnim(srcs, 0, 0, 1), true);
        iio.addToGroup('player', player, 10);
        //player.drawBox = true;

        runBgCreator(0, iio.canvas.height);

        iio.createGroup('UI', 30);

        scoreText = iio.addToGroup('UI', new iiText('Score: '+score, "30px
            Arial", 'black', iio.canvas.width-180, 40));

        setCollisionCallbacks();
    }
    this.resize = function(){
        scoreText.setPos(iio.canvas.width-180, 40);
    }
    var shootTimer = 20;
    var shootCount = 0;
    this.update = function(dt){
        updateBackground();
        updatePlayer();
        if (spaceDown && shootCount < 0){
            createBullet(player.left()+10, player.pos.y);
            createBullet(player.right()-8, player.pos.y);
            shootCount = shootTimer;
        }
        if (spaceDown) shootCount--;
        else shootCount-=4;
    }

    function setCollisionCallbacks(){
        iio.setCollisionCallback('player bullets', 'asteroids', function(bullet
            , asteroid){
            iio.addToGroup('lasor flashes', new iiBox((bullet.pos.x+asteroid.
                pos.x)/2, (bullet.pos.y+asteroid.pos.y)/2, asteroid.vel.x,
```

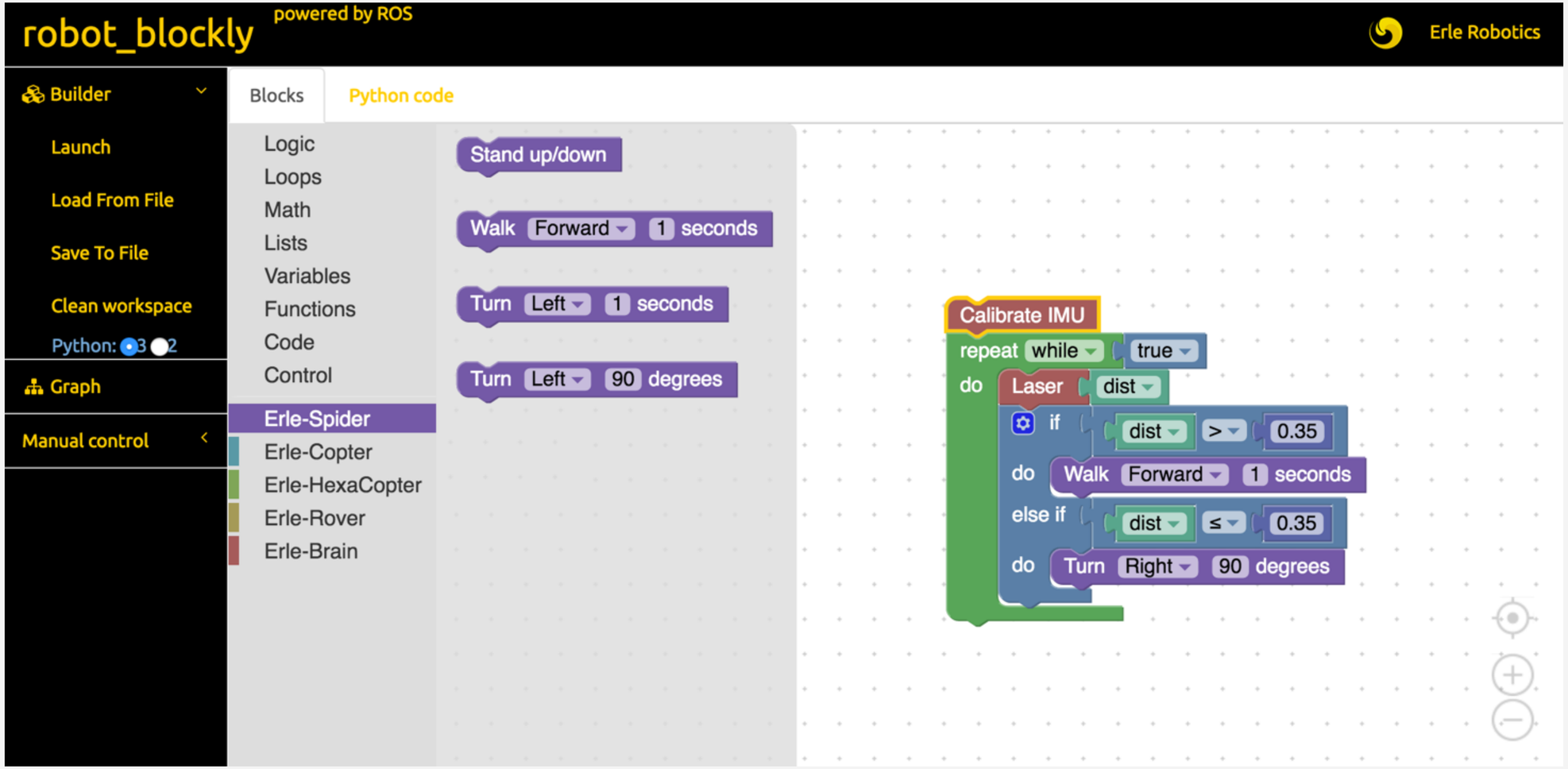
```
var iiImage = Class.create(iiObject, {
  initialize: function($super, src, pos, y, size, h) {
    $super(pos, y);
    if (src instanceof Image) {
        this.img = src;
        this.width=size||this.img.width||0;
        this.height=h||size||this.img.height||0;
    }
    else{
        this.img = new Image();
        this.img.src = src;
        this.img.onload = function(){
            this.width=size||this.img.width||0;
            this.height=h||size||this.img.height||0;
        }.bind(this);
    }
  },
  draw: function(ctx, origin){
    ctx.save();
    ctx.translate(this.pos.x, this.pos.y);
    if (typeof(this.rotation) != 'undefined')
        ctx.rotate(this.rotation);
    ctx.translate(-this.width/2,-this.height/2);
    if (typeof(this.img) != 'undefined')
        ctx.drawImage(this.img, 0, 0, this.width, this.height);
    ctx.restore();
  },
  setSize: function(w,h){ this.width = w; this.height = h; }
});

var iiAnim = Class.create(iiImage, {
    initialize: function($super, srcs, pos, y, aIndex, w, h){
        aIndex = aIndex || 0;
        if (arguments.length > 0 && srcs instanceof Array)
            $super(srcs[aIndex], pos, y, w, h);
        else throw new Error('invalid image source array');
        this.imgs = [];
        for (var i=0;i<srcs.length;i++){
            this.imgs[i]=new Image();
            this.imgs[i].src=srcs[i];
        }
        this.imgIndex = aIndex;
    },
    update: function(dt){
        if (this.shrinking > 0)
            this.setSize(this.width*(1-this.shrinking), this.height*(1-this.
                shrinking));
        if (this.width > 0 && this.width < .1)
            return false;
        return true;
    },
    getWidth: function(i){
        if (typeof(i) == 'undefined')
            return this.imgs[this.imgIndex].width;
        else return this.imgs[i].width;
    },
    getHeight: function(i){
        if (typeof(i) == 'undefined')
            return this.imgs[this.imgIndex].height;
        else return this.imgs[i].height;
    },
    setImgIndex: function(i){
        this.imgIndex = i;
        this.img = this.imgs[i];
    },
    updateSize: function(w, h){
        switch(arguments.length){
            case 0: this.width = this.imgs[this.imgIndex].width;
                    this.height = this.imgs[this.imgIndex].height;
                    break;
            case 1: if (w instanceof iiVec2){
                        this.width = w.x
```

By using **scratch**, people are able to become **fluent with new technologies**..., they are able to express their ideas with them by **programming**.

Mitch Resnick

robot_blockly



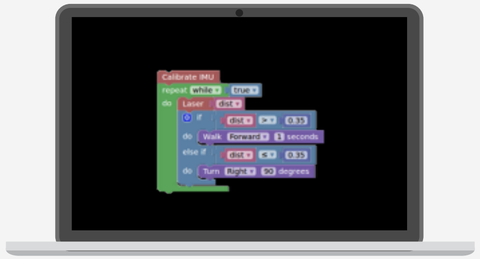
https://github.com/erlerobot/robot_blockly

Architecture

Client-side

Network

Backend



Logic

Blocks

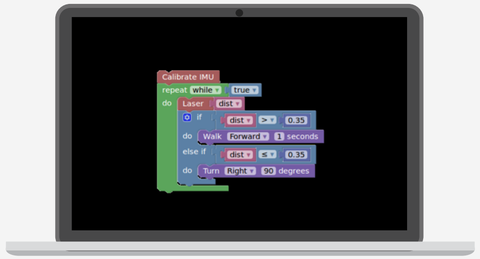
Generators

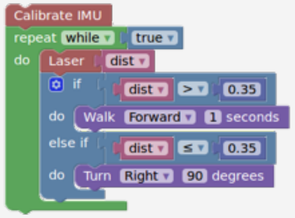
Architecture

Client-side

Network

Backend





Logic

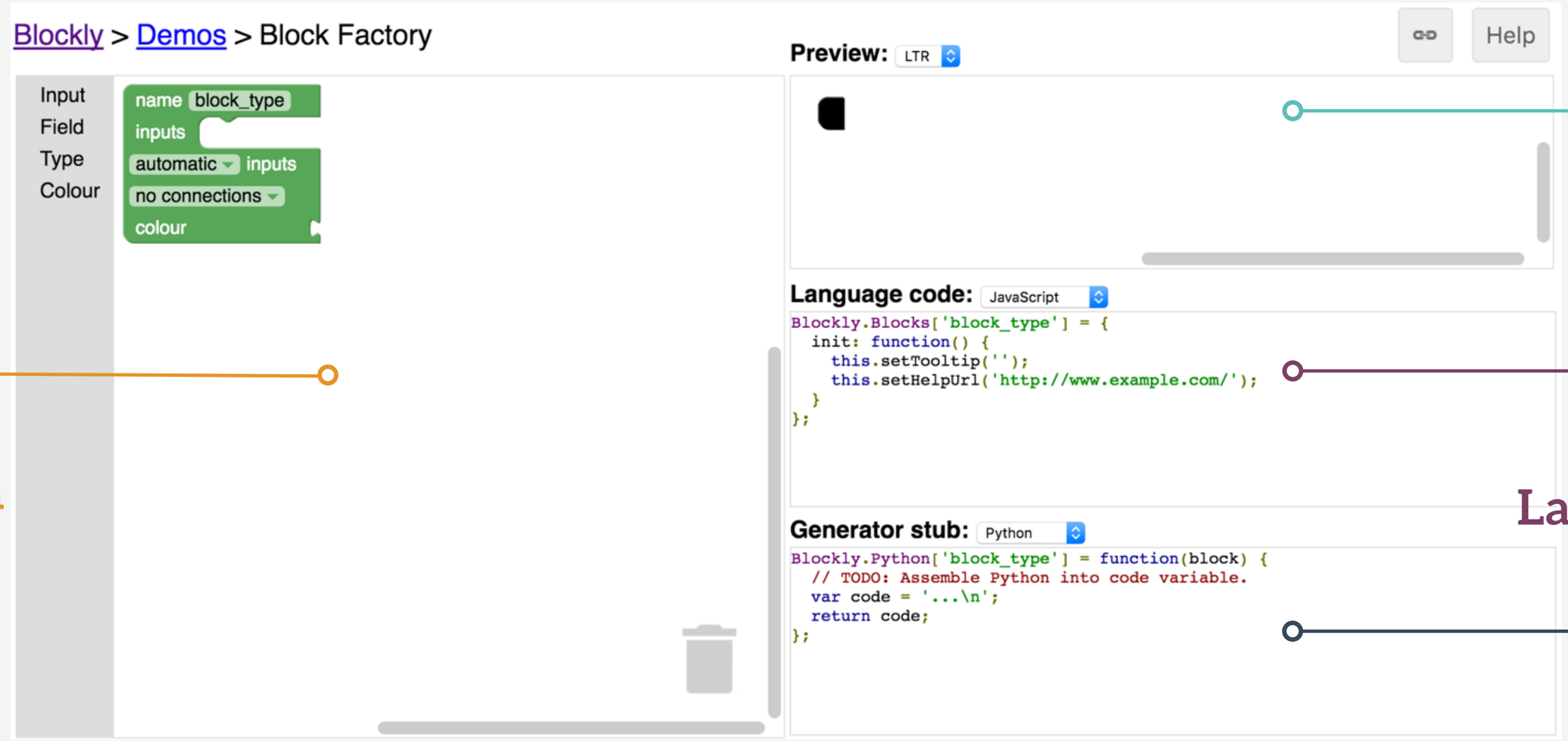
Feedback

Blocks

Generators

Structure

Create custom blocks



Definition

Preview

Language code

Generator

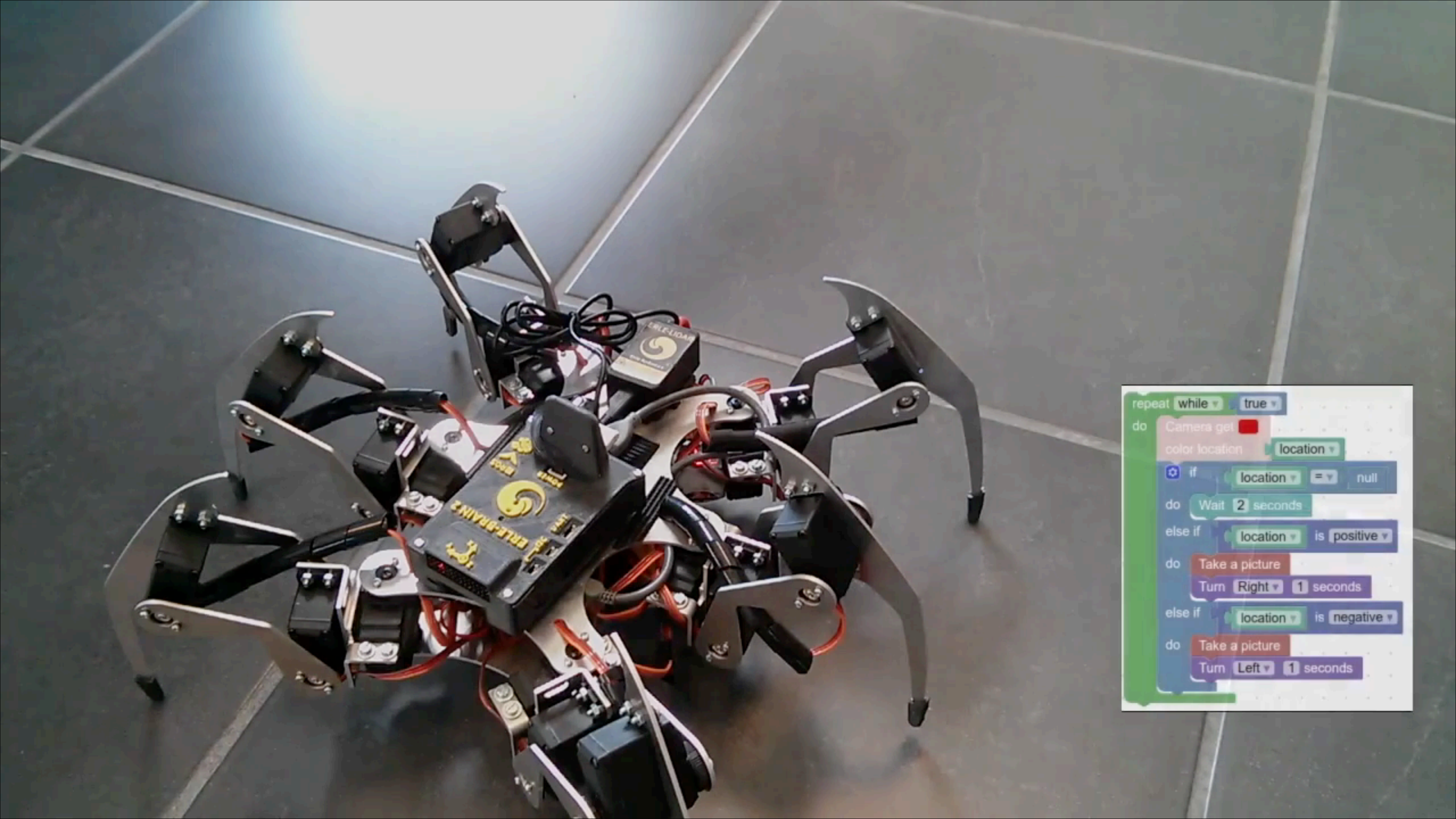
Recommendations

Use **rospy.wait_for_message()** Be sure that you have received the data from a publisher in the code block.

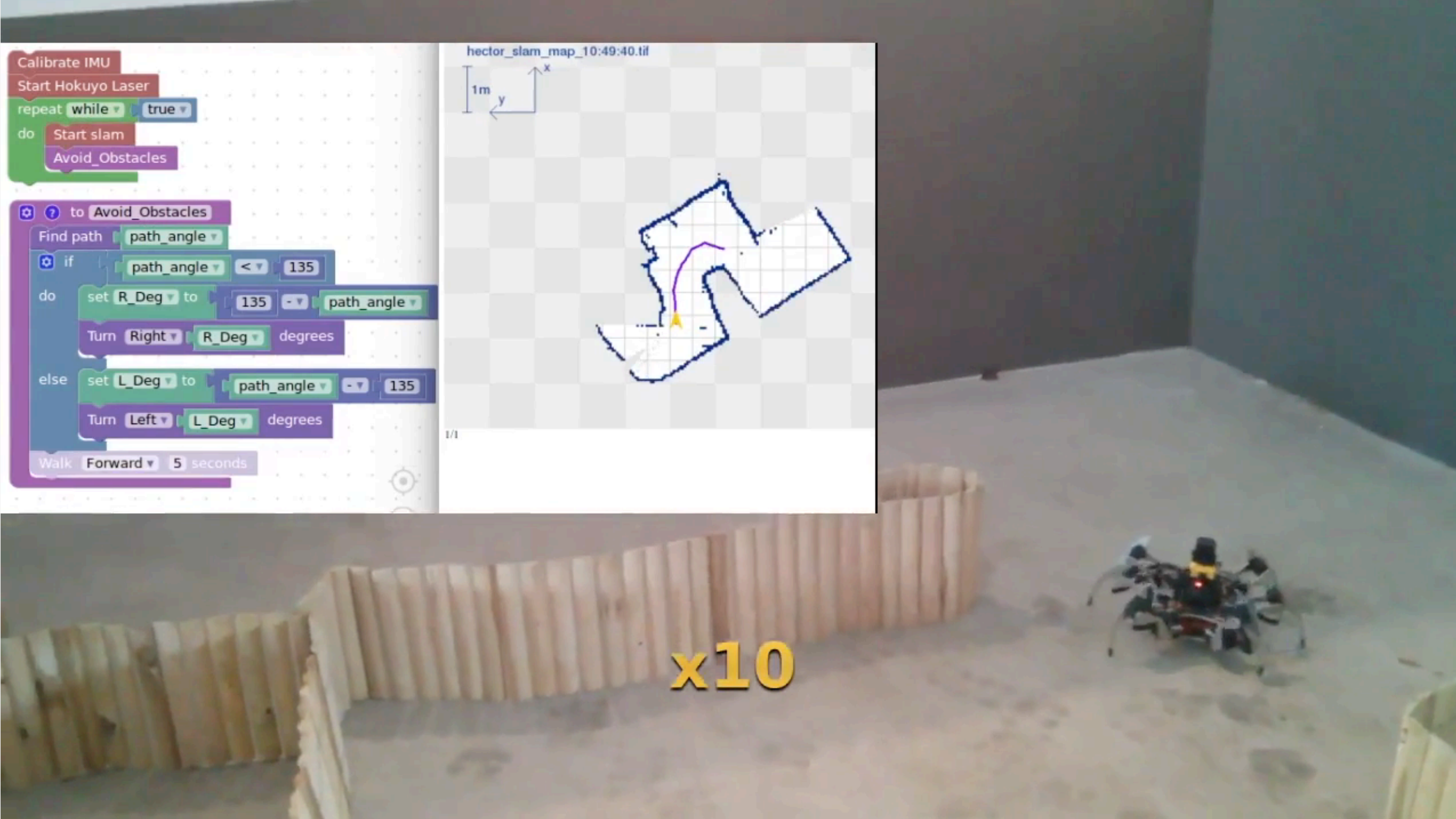
Check if the ROS packages are launched

```
import rospy
import subprocess
import rosnode
import rospkg
from sensor_msgs.msg import Range
ros_nodes = rosnode.get_node_names()
if not '/lrm30_node' in ros_nodes:
    rospack = rospkg.RosPack()
    command = rospack.get_path('lrm30_ros').replace('share', 'lib') + '/lrm30'
    process = subprocess.Popen(command, shell=True, stdout=subprocess.PIPE)
msg_laser = rospy.wait_for_message('/lrm30_data', Range, timeout=1)
```

Demos


repeat while true
do Camera get
color location location
if location = null
do Wait 2 seconds
else if location is positive
do Take a picture
Turn Right 1 seconds
else if location is negative
do Take a picture
Turn Left 1 seconds


Calibrate IMU
Start Hokuyo Laser
repeat while true
do Find path path_angle
if path_angle < 135
do set R_Deg to 135 - path_angle
Turn Right R_Deg degrees
else set L_Deg to path_angle - 135
Turn Left L_Deg degrees
Walk Forward 5 seconds


Calibrate IMU
Start Hokuyo Laser
repeat while true
do Start slam
Avoid_Obstacles
to Avoid_Obstacles
Find path path_angle
if path_angle < 135
do set R_Deg to 135 - path_angle
Turn Right R_Deg degrees
else set L_Deg to path_angle - 135
Turn Left L_Deg degrees
Walk Forward 5 seconds
hector_slam_map_10:49:40.tif
1m
x
y
1/1
x10

Conclusions

- This kind of package makes easy how to teach robotics
- Makes accesible robotics without “programming skills”
- Labview or Simulink are not easily extensible
- Companies using robot_blockly
- Open Source GPLv3

Ready to jump into robotics?

Contact

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