



PSI3541 2023

SISTEMAS EMBARCADOS DISTRIBUIDOS

AULA 06 17/04/2023

ATIVIDADE 7.1 SMART HOME SIM, MODBUS, NODE-RED E IOT CENTRAL

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OBJETIVOS

- IMPLEMENTAR UMA CASA INTELIGENTE USANDO O NODE-RED COMO IOT EDGE/GATEWAY E O AZURE IOT CENTRAL

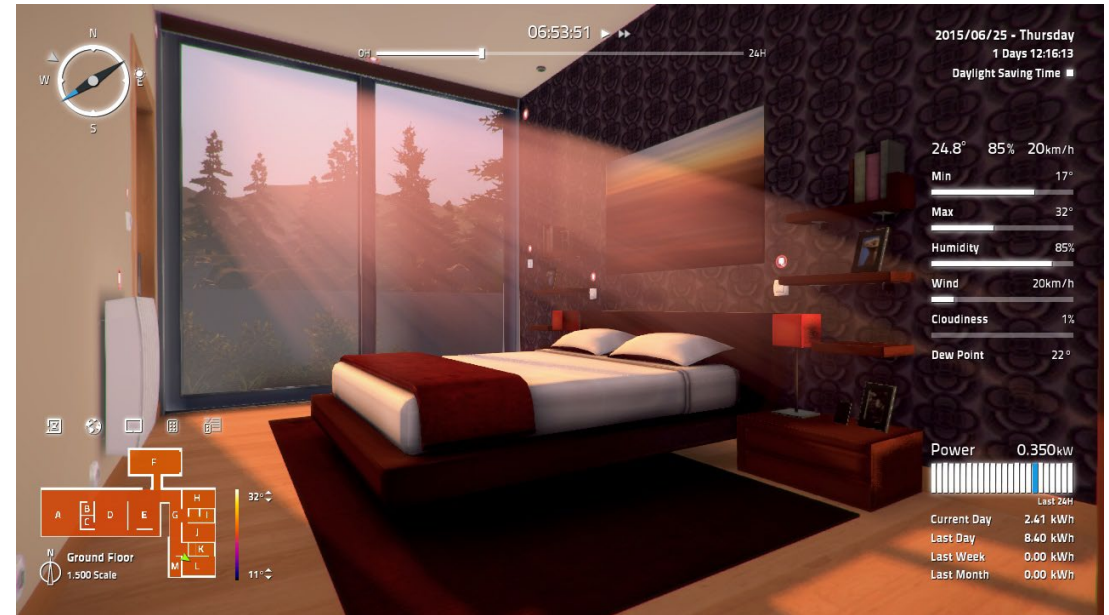
ATIVIDADES

- ATIVIDADE 7.1 IMPLEMENTAÇÃO DE UM CONTROLADOR DE ILUMINAÇÃO UTILIZANDO BLOCOS DO CONNECT I/O
- ATIVIDADE 7.2 IMPLEMENTAÇÃO DE UM CONTROLADOR DE CORTINA UTILIZANDO BLOCOS DO CONNECT I/O
- ATIVIDADE 7.3 IMPLEMENTAÇÃO DE UM CONTROLADOR DE ILUMINAÇÃO UTILIZANDO BLOCOS DO CONNECT I/O E O NODE-RED
- ATIVIDADE 7.2 IMPLEMENTAÇÃO DE UM CONTROLADOR DE CORTINA UTILIZANDO BLOCOS DO CONNECT I/O E O NODE-RED

HOME I/O

HOME I/O

- SOFTWARE DE SIMULAÇÃO DE CASA INTELIGENTE
 - <https://realgames.co/home-io/>

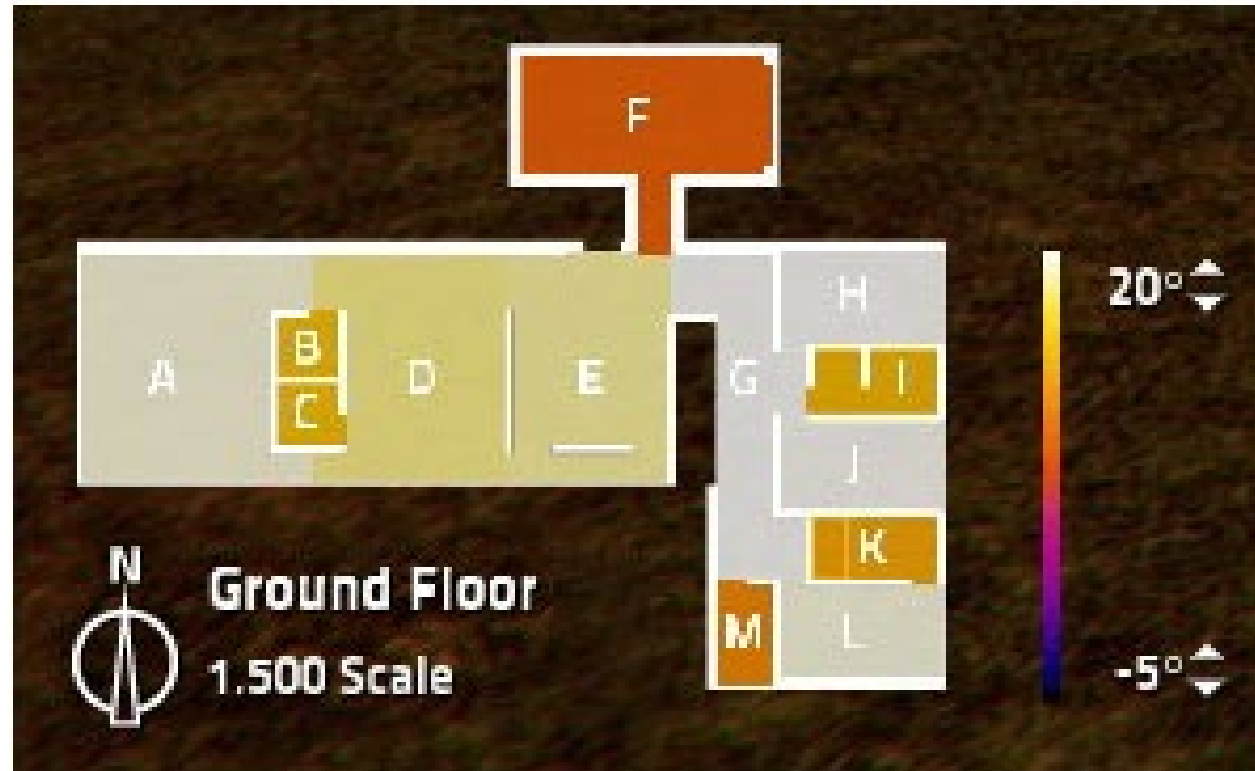


HOME I/O



1. Compass
2. Time Slider
3. Time Panel
4. Weather Panel
5. Power Panel
6. Minimap
7. Toolbar

MINIMAP



PERMITE NAVEGAR DIRETAMENTE AO CÔMODO OU ÁREA EXTERNA COM O BOTÃO DIREITO DO MOUSE

DISPOSITIVOS – MODOS DE OPERAÇÃO



MODO CABEADO



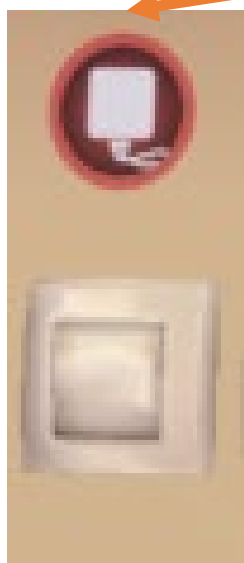
MODO SEM FIO



MODO EXTERNO

ILUMINAÇÃO

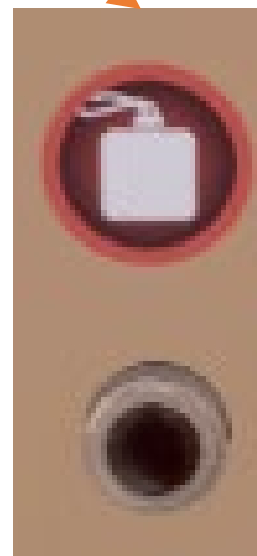
CONTROLE DO MODO DE OPERAÇÃO



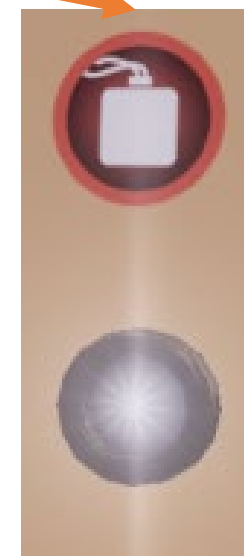
CHAVE SIMPLES



DIMMER



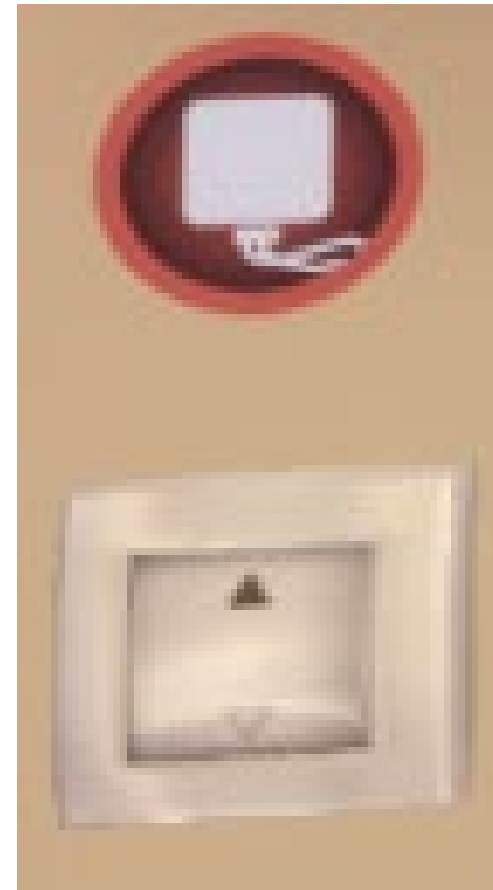
SENSOR DE LUZ



LÂMPADA

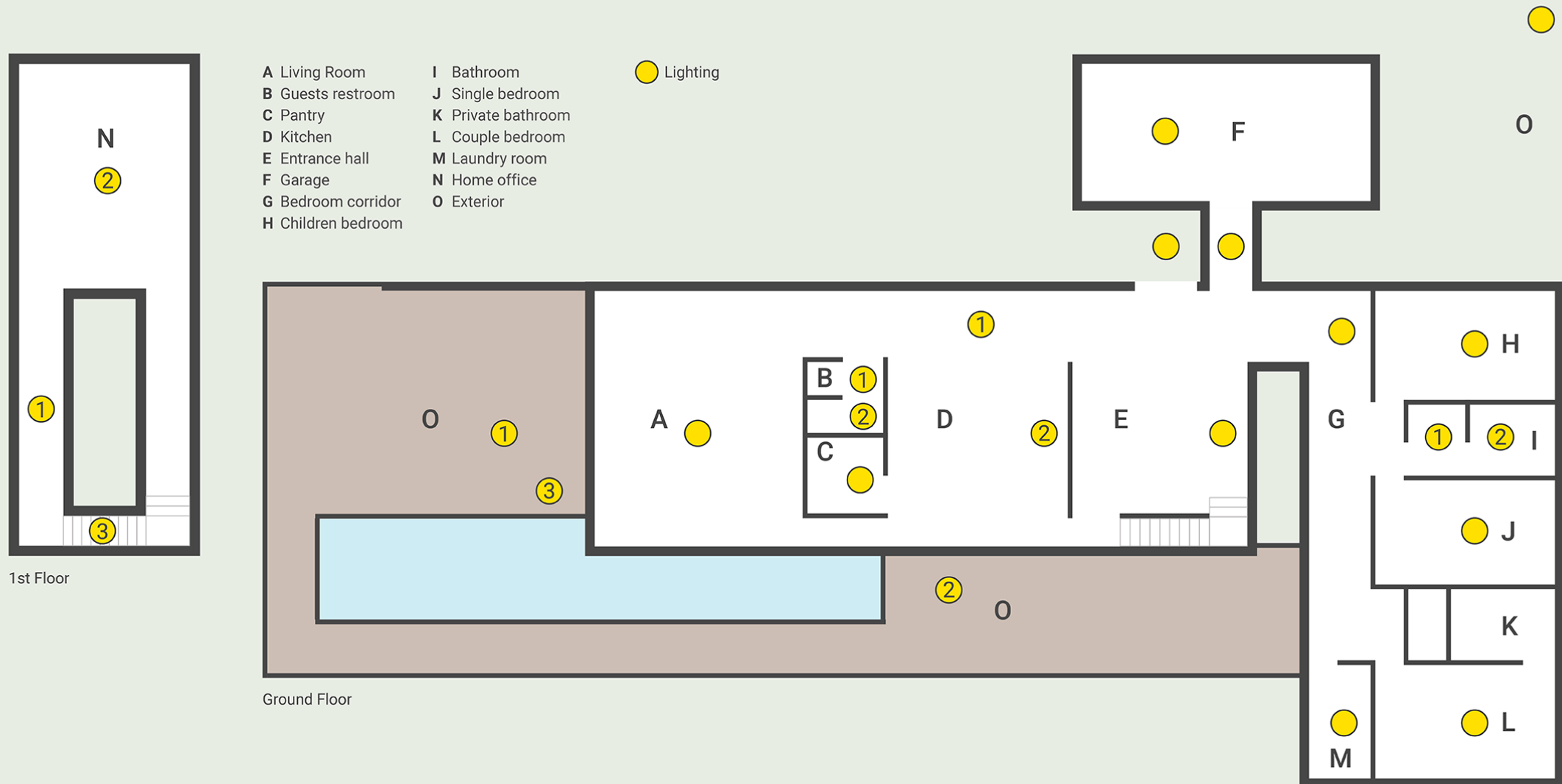
CORTINA

CONTROLE DO MODO DE OPERAÇÃO DA CORTINA

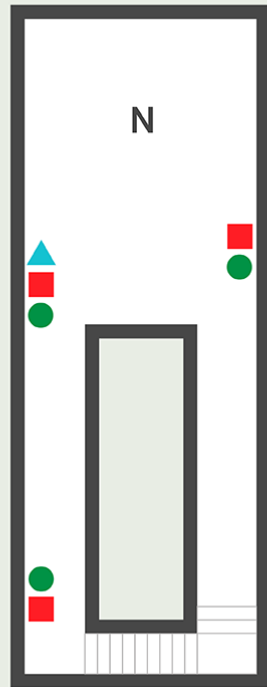


CHAVE DE ABERTURA/FECHAMENTO DA CORTINA

LOCALIZAÇÃO DISPOSITIVOS - LÂMPADAS



LOCALIZAÇÃO DISPOSITIVOS - CHAVES DE LUZ

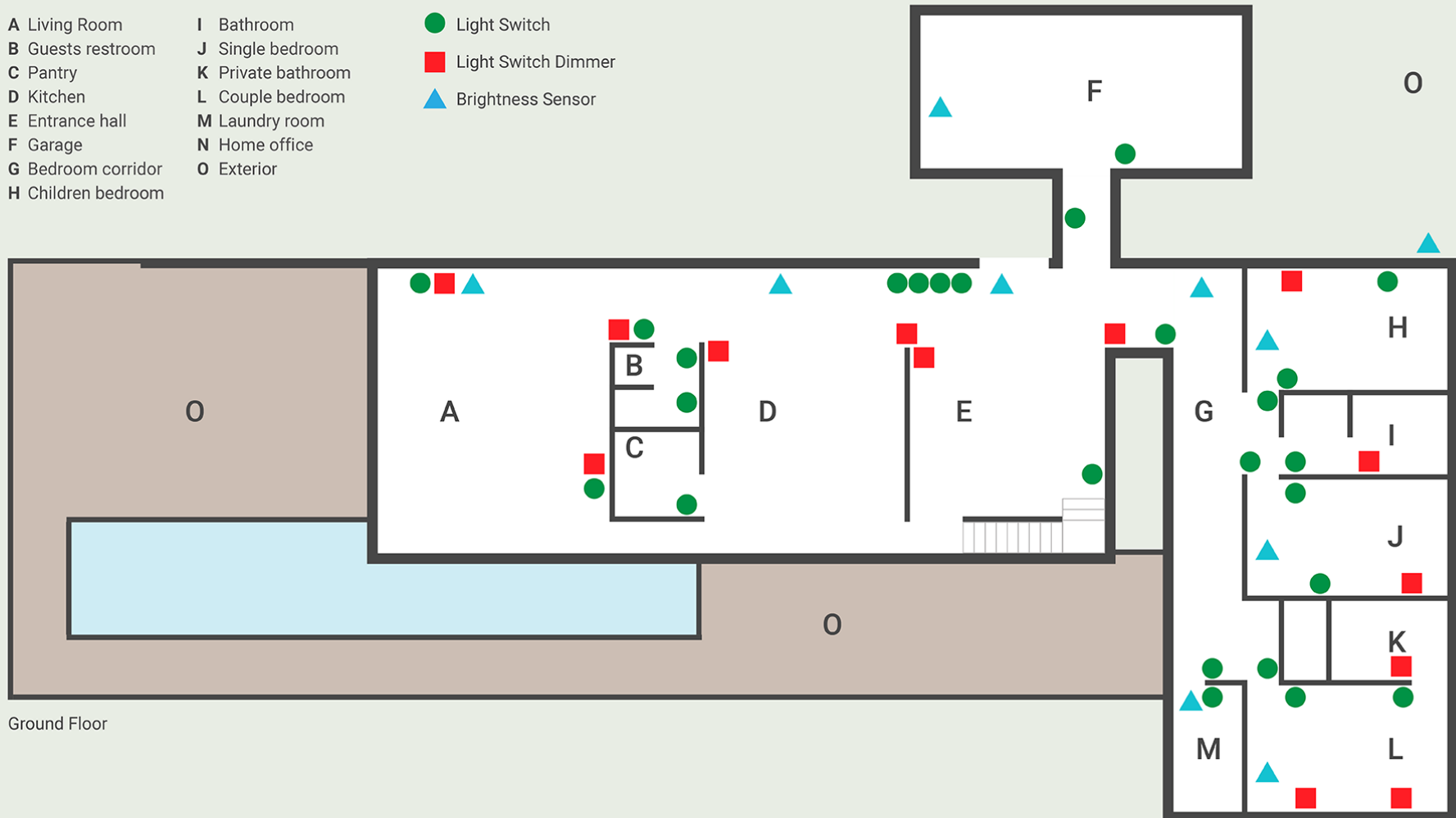


1st Floor

- A Living Room
- B Guests restroom
- C Pantry
- D Kitchen
- E Entrance hall
- F Garage
- G Bedroom corridor
- H Children bedroom

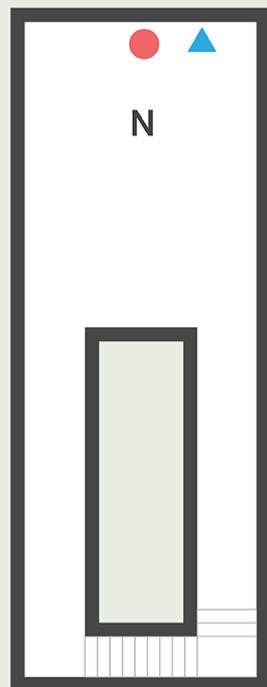
- I Bathroom
- J Single bedroom
- K Private bathroom
- L Couple bedroom
- M Laundry room
- N Home office
- O Exterior

- Light Switch
- Light Switch Dimmer
- ▲ Brightness Sensor



Ground Floor

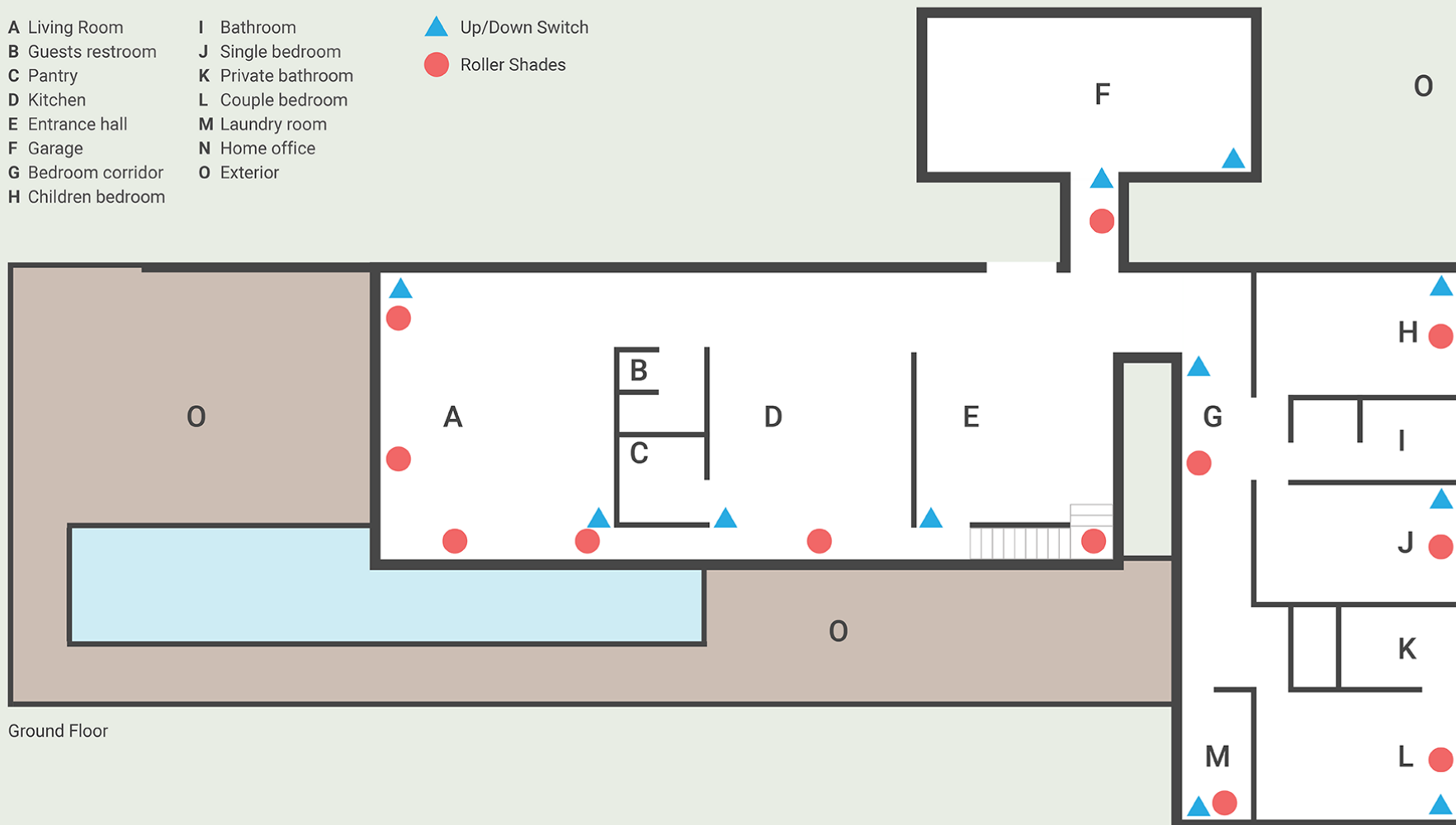
LOCALIZAÇÃO DISPOSITIVOS - CORTINAS E CHAVES UP/DOWN



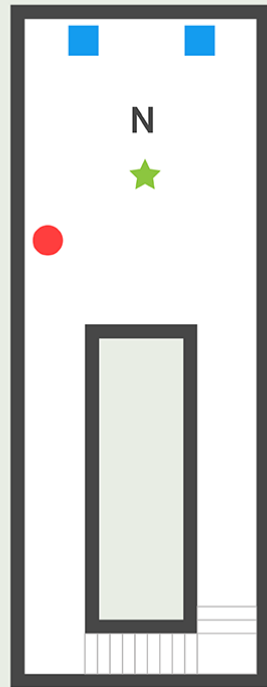
- A Living Room
- B Guests restroom
- C Pantry
- D Kitchen
- E Entrance hall
- F Garage
- G Bedroom corridor
- H Children bedroom

- I Bathroom
- J Single bedroom
- K Private bathroom
- L Couple bedroom
- M Laundry room
- N Home office
- O Exterior

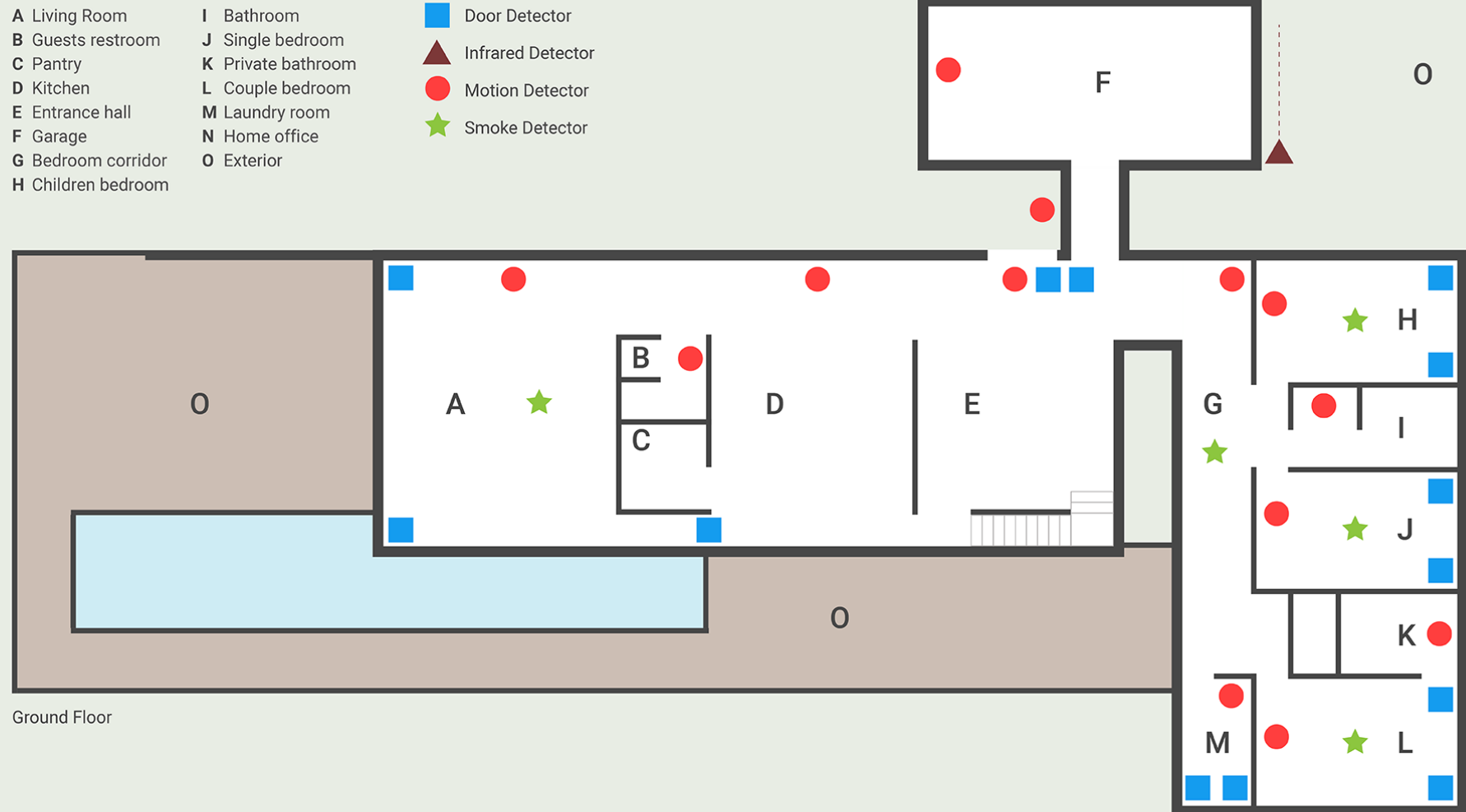
- ▲ Up/Down Switch
- Roller Shades



LOCALIZAÇÃO DISPOSITIVOS - DETETORES



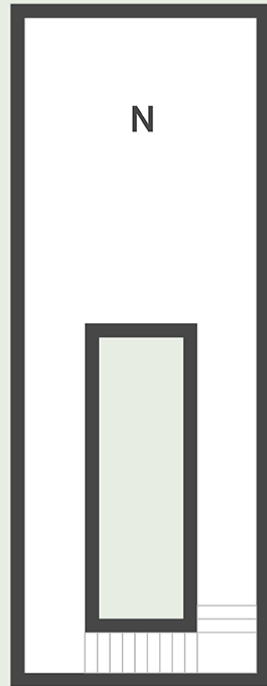
1st Floor



Ground Floor

- | | | |
|--------------------|--------------------|---------------------|
| A Living Room | I Bathroom | ■ Door Detector |
| B Guests restroom | J Single bedroom | ▲ Infrared Detector |
| C Pantry | K Private bathroom | ● Motion Detector |
| D Kitchen | L Couple bedroom | ★ Smoke Detector |
| E Entrance hall | M Laundry room | |
| F Garage | N Home office | |
| G Bedroom corridor | O Exterior | |
| H Children bedroom | | |

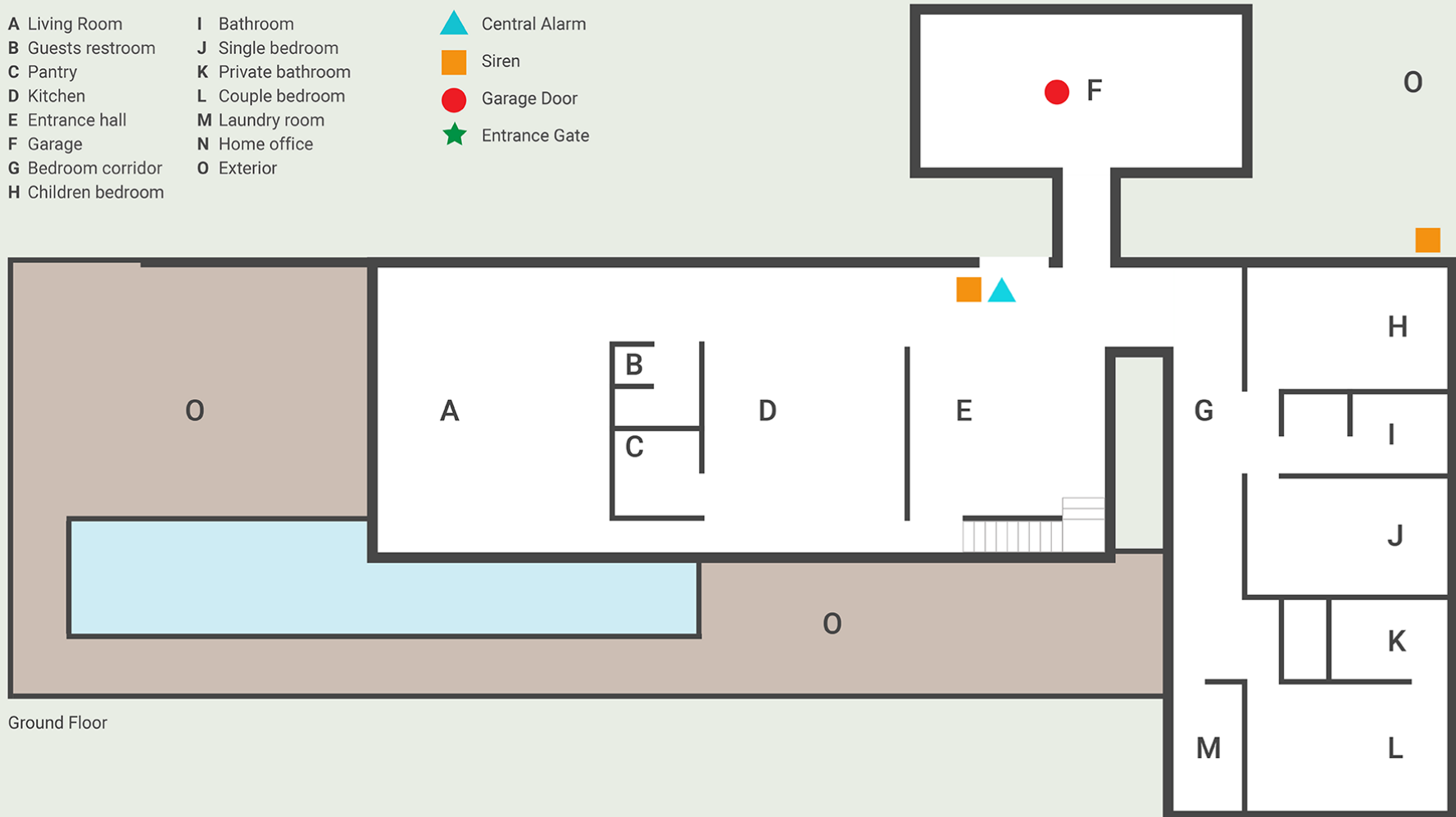
LOCALIZAÇÃO OUTROS DISPOSITIVOS



- A Living Room
- B Guests restroom
- C Pantry
- D Kitchen
- E Entrance hall
- F Garage
- G Bedroom corridor
- H Children bedroom

- I Bathroom
- J Single bedroom
- K Private bathroom
- L Couple bedroom
- M Laundry room
- N Home office
- O Exterior

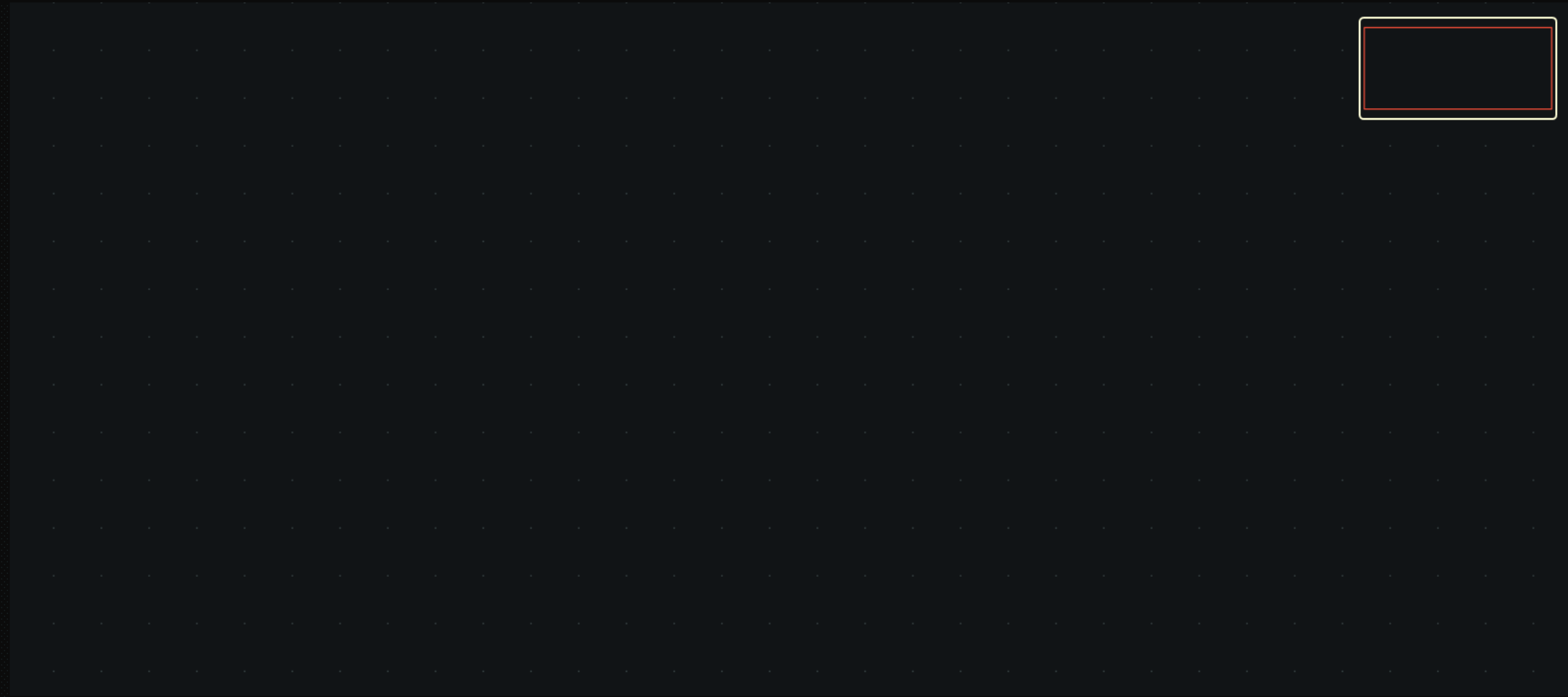
- ▲ Central Alarm
- Siren
- Garage Door
- ★ Entrance Gate



CONNECT I/O

CONNECT I/O

- INPUTS ▲
- OUTPUTS ▲
- MEMORIES ▲
- SOURCES ▲
- TAGS ▲
- PLUGINS ▲
- UTILS ▲
- SETTINGS ▲



PROPERTIES

LOGGER

```
2023-04-24 20:11:35: Key bindings...OK
2023-04-24 20:11:35: Live Graph...OK
2023-04-24 20:11:35: MHJ-Software...OK
2023-04-24 20:11:35: Modbus TCP-IP...OK
2023-04-24 20:11:35: OPC Client...OK
2023-04-24 20:11:35: Picaxe...OK
2023-04-24 20:11:35: S7-PLCSIM...OK
2023-04-24 20:11:35: Siemens TCP-IP...OK
2023-04-24 20:11:35: Done.
```

BLOCOS DE ENTRADA, SAIDA, MEMÓRIA, FONTES E FUNÇÕES

The screenshot displays the CONNECT I/O Beta v1.2 software interface. The main window shows a dark-themed workspace with a grid. On the left, there is a vertical sidebar with several categories of function blocks, each with a list of data types. Yellow arrows point from the title 'BLOCOS DE ENTRADA, SAIDA, MEMÓRIA, FONTES E FUNÇÕES' to the 'INPUTS', 'OUTPUTS', 'MEMORIES', 'SOURCES', and 'FUNCTION BLOCKS' sections. At the bottom, there are two tabs: 'PROPERTIES' and 'LOGGER'. The 'LOGGER' tab is active, showing a list of log entries with timestamps and status messages.

FILE EDIT VIEW HELP

C:\Users\stf\Documents\Connect IO\Diagram1.CONNECTIO

INPUTS

- BIT
- BYTE
- SHORT
- INT
- LONG
- FLOAT
- DOUBLE
- STRING
- DATETIME
- TIMESPAN

OUTPUTS

- BIT
- BYTE
- SHORT
- INT
- LONG
- FLOAT
- DOUBLE
- STRING
- DATETIME
- TIMESPAN

MEMORIES

- BIT
- BYTE
- SHORT
- INT
- LONG
- FLOAT
- DOUBLE
- STRING
- DATETIME
- TIMESPAN

SOURCES

- BIT
- NUMERICAL
- STRING
- DATETIME
- SYSTEM TIME
- CYCLE TIME

TAGS

PLUGINS

PROPERTIES **LOGGER**

2023-04-24 20:11:35: Key bindings...OK
2023-04-24 20:11:35: Live Graph...OK
2023-04-24 20:11:35: MHJ-Software...OK
2023-04-24 20:11:35: Modbus TCP-IP...OK
2023-04-24 20:11:35: OPC Client...OK
2023-04-24 20:11:35: Picaxe...OK
2023-04-24 20:11:35: S7-PLCSIM...OK
2023-04-24 20:11:35: Siemens TCP-IP...OK
2023-04-24 20:11:35: Done.

FUNCTION BLOCKS

- ▶ ARITHMETIC
- ▶ BIT
- ▶ COMPARISON
- ▶ COUNTERS
- ▶ EXTRA
- ▶ TIMERS

BLOCOS DE TAGS (DISPOSITIVOS DO HOME I/O)

The screenshot displays the CONNECT I/O Beta v1.2 software interface. On the left side, there is a sidebar with a tree view containing the following categories: INPUTS, OUTPUTS, MEMORIES, SOURCES, TAGS, PLUGINS, UTILS, and SETTINGS. The TAGS category is expanded, showing a list of tags: A - Roller Shades 1 (Down), A - Roller Shades 1 (Openness), A - Roller Shades 1 (Up), A - Up/Down Switch 1 (Down), A - Up/Down Switch 1 (Up), and Date and Time. A yellow arrow points from the top of the image to the TAGS list. The main workspace on the right is a dark grid with a red rectangular box in the upper right corner. At the bottom of the interface, there are two tabs: PROPERTIES and LOGGER. The LOGGER tab is active, displaying a list of log entries with timestamps and status messages.

FILE EDIT VIEW

▶ || ↺ ↻

C:\Users\stkof\Documents\Connect IO\Diagram1.CONNECTIO

- INPUTS ▲
- OUTPUTS ▲
- MEMORIES ▲
- SOURCES ▲
- TAGS ▼
 - A - Roller Shades 1 (Down)
 - A - Roller Shades 1 (Openness)
 - A - Roller Shades 1 (Up)
 - A - Up/Down Switch 1 (Down)
 - A - Up/Down Switch 1 (Up)
 - Date and Time
- PLUGINS ▲
- UTILS ▲
- SETTINGS ▲

PROPERTIES LOGGER

```
2023-04-24 20:11:35: Key bindings...OK
2023-04-24 20:11:35: Live Graph...OK
2023-04-24 20:11:35: MHJ-Software...OK
2023-04-24 20:11:35: Modbus TCP-IP...OK
2023-04-24 20:11:35: OPC Client...OK
2023-04-24 20:11:35: Picaxe...OK
2023-04-24 20:11:35: S7-PLCSIM...OK
2023-04-24 20:11:35: Siemens TCP-IP...OK
2023-04-24 20:11:35: Done.
```


INTERFACE MODBUS TC SERVER

CONNECT I/O Beta v1.2.7 - Real Games



FILE EDIT VIEW HELP



C:\Users\stkof\Documents\Connect IO\Diagram1.CONNECTIO*

INPUTS

OUTPUTS

- BIT
- BYTE
- SHORT
- INT
- LONG
- FLOAT
- DOUBLE
- STRING
- DATETIME
- TIMESPAN

MEMORIES

SOURCES

- BIT
- NUMERICAL
- STRING
- DATETIME
- SYSTEM TIME
- CYCLE TIME

TAGS

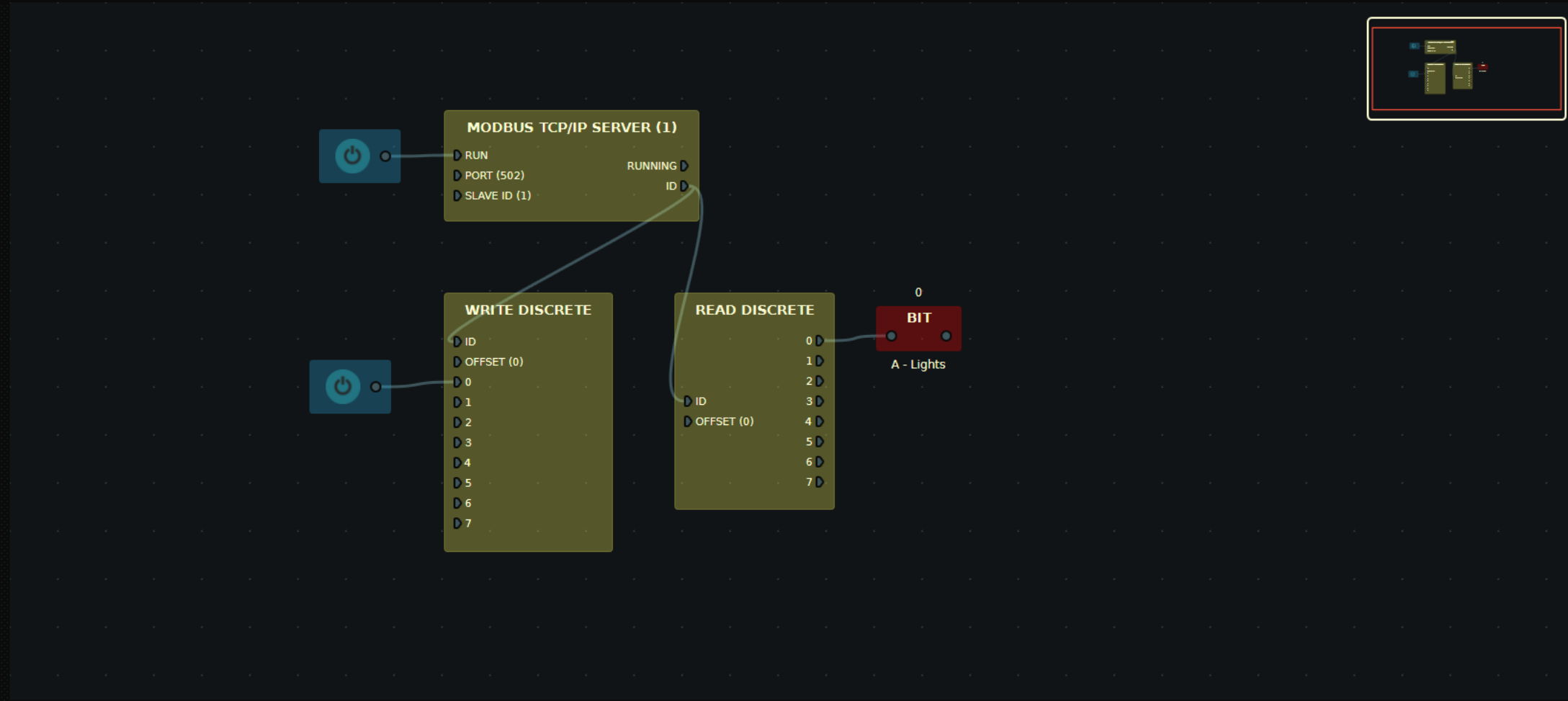
- A - Light Switch 1
- A - Lights
- A - Lights (Analog)
- Date and Time

PLUGINS

- ADVANTECH
- AUTOMGEN
- FUNCTION BLOCKS
- KEY BINDINGS
- DATA ANALYSIS
- MHJ-SOFTWARE
- MODBUS
 - INPUTS
 - WRITE DISCRETE
 - WRITE REGISTER
 - MODBUS TCP/IP CLIENT
 - MODBUS TCP/IP SERVER
 - OUTPUTS
 - READ DISCRETE
 - READ REGISTER
- OPC
- PICAXE
- SIEMENS

UTILS

SETTINGS



PROPERTIES LOGGER

CLIENTES MODBUS NO NODE-RED

NODE-RED - CLIENTES MODBUS

The screenshot displays the Node-RED web interface. The main workspace shows a flow named 'Flow 4' with the following nodes and connections:

- A **timestamp** node is connected to a **teste** node.
- The **teste** node is connected to a **debug 9** node.
- A **0** node and a **3** node are both connected to a **teste-write** node.
- The **teste-write** node is connected to a **debug 10** node.

The **teste** node is currently active, and the **teste-write** node shows a status of 'reconnecting after 2000 msec.'.

On the right side, there is an **info** panel for the selected **teste** node:

Node	"fb70186cb6e1dc1c"
Type	modbus-getter

Below the info panel, there is a notification for a new post from DUST and a list of flows (Flow 1 to Flow 4). At the bottom of the info panel, there is a message: 'Dragging a node onto a wire will splice it into the link'.

CLIENTE MODBUS GETTER

The image shows the Node-RED web interface. On the left, the 'common' and 'function' node palettes are visible. The main workspace contains a flow with three nodes: a 'timestamp' node, a 'teste' node (with an 'active' status), and a 'debug' node. Below this, another flow is partially visible with a '0' node, a 'teste-write' node (with an 'initialize' status), and a 'debug' node. The right side of the interface is dominated by the 'Edit Modbus-Getter node' dialog box.

Edit Modbus-Getter node

Buttons: Delete, Cancel, Done

Properties

Settings | Optionals

Name: teste

Unit-Id: 0

FC: FC 2: Read Input Status

Address: 1

Quantity: 1

Delay to activate input:

Server: connect-io

Node: teste

Node	"fb70186cb6e1dc1c"
Type	modbus-getter

Hold down **ctrl** when you **click** on a node to add or remove it from the current selection

CLIENTE MODBUS WRITE

The image shows the Node-RED web interface. On the left, a sidebar contains various nodes categorized into 'common' and 'function'. The main workspace displays a flow with three flows (Flow 1, Flow 2, Flow 3) and several nodes connected. A 'teste' node is active, and a 'teste-write' node is initialized. The 'Edit Modbus-Write node' dialog is open, showing the following configuration:

- Name: teste-write
- Unit-Id: 0
- FC: FC 5: Force Single Coil
- Address: 0
- Delay to activate input:
- Server: connect-io

The right sidebar shows the 'info' panel for the selected 'teste-write' node, displaying its Node ID as '777129d267aadb8' and its Type as 'modbus-write'. A message at the bottom of the sidebar indicates that pressing 'ctrl-space' will toggle the view of this sidebar.

CONFIGURAÇÃO DO SERVIDOR MODBUS

Node-RED

Filter nodes

Flow 1 Flow 2 Flow 3

common

- inject
- debug
- complete
- catch
- status
- link in
- link call
- link out
- comment

function

- function
- switch
- change
- range
- template
- delay
- trigger
- exec

timestamp → teste (active) → debug

0 → teste-write (initialize) → debug

3

Edit Modbus-Write node > Edit modbus-client node

Delete Cancel Update

Properties

Settings Queues Optionals

Name: connect-io

Type: TCP

Host: 192.168.15.7

Port: 502

TCP Type: DEFAULT

Unit-Id: 1

Timeout (ms): 1000

Reconnect on timeout:

Reconnect timeout (ms): 2000

connect-io

Node	"206889a365a1fdc8"
Type	modbus-client

Import a flow by dragging its JSON into the editor, or with `ctrl-i`

Enabled 2 nodes use this config On all flows

ATIVIDADE 7.1

CONTROLE DE LÂMPADA

ATIVIDADE 7.1

- COLOCAR A LÂMPADA (ATUADOR) E A CHAVE (SENSOR) NO MODO EXTERNO
- VERIFICAR O FUNCIONAMENTO DA INTERFACE HOME I/O -> CONNECT I/O
 - COMUTAR A CHAVE NO HOME I/O E VERIFICAR A MUDANÇA DE ESTADO NO CONNECT I/O
 - ACENDER E APAGAR A LÂMPADA MANUALMENTE
- PROJETAR UM CIRCUITO LÓGICO PARA CONECTAR A LÂMPADA À CHAVE
- Enviar copias de tela e arquivo do Connect I/O

SALA

COLOCAR A LÂMPADA NO MODO EXTERNO

EVALUATION

COLOCAR A CHAVE NO MODO EXTERNO

15.7° 85% 20km/h
Min 10°
Max 18°
Humidity 85%
Wind 20km/h
Cloudiness 10
Dew Point 13.0°

Power 0.000kW

Last Day
Current Day 0.00 kWh
Last Day 0.00 kWh
Last Week 0.00 kWh
Last Month 0.00 kWh





CONNECT I/O Beta v1.2.7 - Real Games

FILE EDIT VIEW HELP

▶ || ⏪ ⏩

C:\Users\stkof\Documents\Connect I/O\Diagram1.CONNECTIO*

INPUTS

- BIT
- BYTE
- SHORT
- INT
- LONG
- FLOAT
- DOUBLE
- STRING
- DATETIME
- TIMESPAN

OUTPUTS

- BIT
- BYTE
- SHORT
- INT
- LONG
- FLOAT
- DOUBLE
- STRING
- DATETIME
- TIMESPAN

MEMORIES

SOURCES

- BIT
- NUMERICAL
- STRING
- DATETIME
- SYSTEM TIME
- CYCLE TIME

TAGS

- A - Light Switch 1
- A - Lights
- A - Lights (Analog)
- Date and Time

PLUGINS

UTILS

SETTINGS

0 1
BIT **BIT**
A - Light Switch 1

0
BIT
A - Lights

PROPERTIES **LOGGER**

DESCRIPTION

ATIVIDADE 7.2

CONTROLE DE CORTINA

ATIVIDADE 7.2

- COLOCAR A CORTINA (ATUADOR) E A CHAVE (SENSOR) NO MODO EXTERNO
- VERIFICAR O FUNCIONAMENTO DA INTERFACE HOME I/O -> CONNECT I/O
 - COMUTAR A CHAVE NO HOME I/O E VERIFICAR A MUDANÇA DE ESTADO NO CONNECT I/O
 - SUBIR E DESCER A CORTINA MANUALMENTE
- PROJETAR UM CIRCUITO LÓGICO PARA CONECTAR A CORTINA À CHAVE
- Enviar copias de tela e arquivo do Connect I/O

CONTROLE DE LÂMPADA PELO NODE-RED

ATIVIDADE 7.3

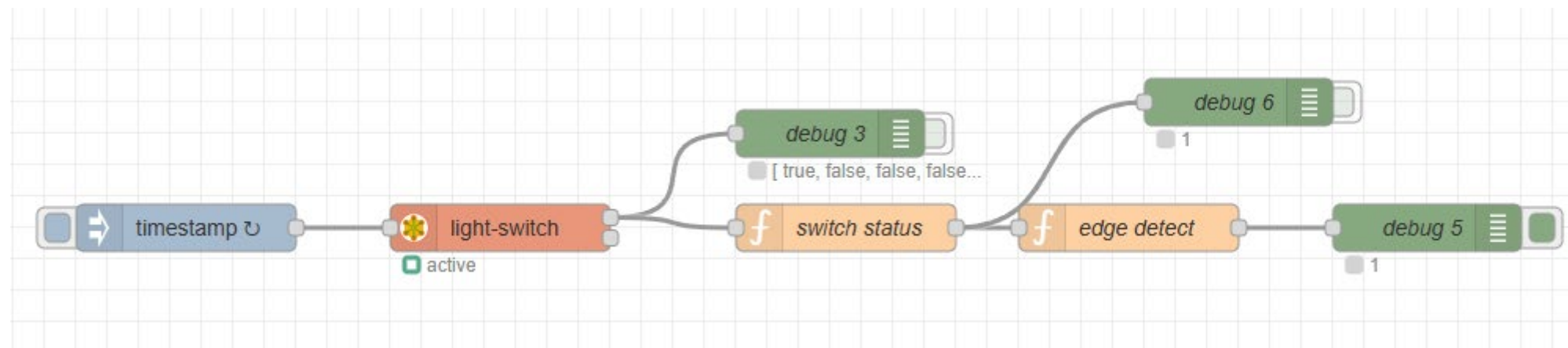
- HOME I/O: COLOCAR A LÂMPADA (ATUADOR) E A CHAVE (SENSOR) NO MODO EXTERNO
- CONNECT I/O: IMPLEMENTAR O CIRCUITO DE INTERFACE MODBUS SERVER, CONECTANDO OS TAGS REFERENTES À CHAVE E À LÂMPADA
- NODE-RED: IMPLEMENTAR O FLUXO NODE-RED PARA LEITURA DA CHAVE, BIESTÁVEL DE CONTROLE DA LÂMPADA E ENVIO DE COMANDO À LÂMPADA
- Enviar copias de tela e arquivos do Connect I/O e fluxo Node-Red

BIESTÁVEL RS NO NODE-RED

The image shows the Node-RED web interface. On the left, a sidebar contains a search bar and two categories of nodes: 'common' and 'function'. The 'common' category includes nodes like inject, debug, complete, catch, status, link in, link call, link out, and comment. The 'function' category includes a 'function' node. In the main workspace, a flow is visible with three tabs: 'Flow 1', 'Flow 2', and 'Flow 3'. The 'Flow 1' tab is active, showing a function node named 'BIESTÁVEL' connected to two 'SET:timestamp' nodes and one 'RESET:timestamp' node. The right-hand panel is titled 'Edit function node' and shows the configuration for the 'BIESTÁVEL' node. It includes a 'Name' field with the value 'BIESTÁVEL', a 'Setup' tab, and a code editor with the following JavaScript code:

```
1 var estado = context.get('stateff') || 0;
2 if(estado==1){
3     if(msg.topic=="SET")return null
4     else estado=0;
5 }
6 else {
7     if(msg.topic=="RESET")return null
8     else estado=1;
9 }
10
11 context.set("stateff", estado);
12 msg.payload = estado;
13
14 return msg
```

Leitura do Estado da Chave (Luz)



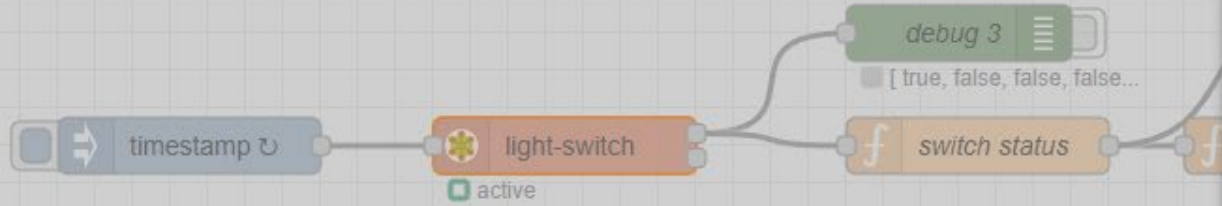
Lost connection to server, reconnecting in 33s. Try now

Flow 1

Flow 2

Flow 1

Flow 3



Edit Modbus-Getter node

Delete

Cancel

Done

Properties

Settings

Optionals

Name

Unit-Id

FC

Address

Quantity

Delay to activate input

Server

Lost connection to server, reconnecting in 2s. Try now

Flow 1

Flow 2

Flow 1

Flow 3



Edit function node

Delete

Cancel

Done

Properties

Name

switch status

Setup

On Start

On Message

On Stop

```
1 if (msg.payload[0]==false) msg.payload=0;
2 else msg.payload=1;
3 return msg;
```

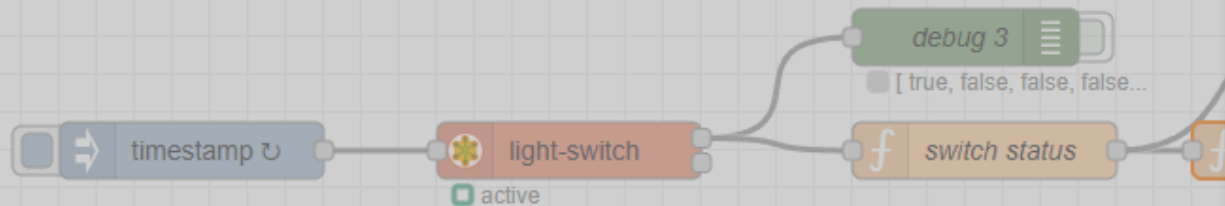
Lost connection to server, reconnecting in 35s. Try now

Flow 1

Flow 2

Flow 1

Flow 3



Edit function node

Delete

Cancel

Done

Properties

Name

edge detect

Setup

On Start

On Message

On Stop

```
1 var state1 = context.get('state1') || 0;
2 var input;
3
4 input = msg.payload;
5 if (state1 == 0) {
6   if (input == 0) return null;
7   else {
8     state1 = 1;
9   }
10 }
11 else {
12   if (input == 1) return null;
13   else {
14     state1 = 0;
15     context.set('state1', state1);
16     return null;
17   }
18 }
19
20 context.set('state1', state1);
21 msg.payload = state1;
22 return msg;
```

CONTROLE DE CORTINA PELO NODE-RED

ATIVIDADE 7.4

- HOME I/O: COLOCAR A CORTINA (ATUADOR) E A CHAVE (SENSOR) NO MODO EXTERNO
- CONNECT I/O: IMPLEMENTAR O CIRCUITO DE INTERFACE MODBUS SERVER, CONECTANDO OS TAGS REFERENTES À CHAVE E À CORTINA
- NODE-RED: IMPLEMENTAR O FLUXO NODE-RED PARA LEITURA DA CHAVE, BIESTÁVEL DE CONTROLE DA CORTINA E ENVIO DE COMANDO À CORTINA
- Enviar copias de tela e arquivos do Connect I/O e fluxo Node-Red

DÚVIDAS?

KOFUJI@USP.BR