

Final Project – Simulink Model Setup

Here's how to fill out the “**Block-by-block settings**” section in Simulink, updated for your *actual wiring*:

- **Ultrasonic Trigger → D11**
- **Ultrasonic Echo → D12**
- **PIR Motion Sensor → D2**

I'll walk you through each block:

1. Ultrasonic Sensor Block

Goal: Convert time-of-flight to distance (meters).

1. In your model, drag in:
 - Simulink Support Package for Arduino Hardware ▶ Common ▶ Ultrasonic Sensor
2. Double-click the **Ultrasonic Sensor** block and set:
 - **Trigger pin:**
 - Change from the original D3 to **D11**
 - In the dropdown/list, choose **D11** (or 11 depending on UI).
 - **Echo pin:**
 - Change from the original D4 to **D12**
 - Choose **D12**.
 - **Sample time:**
 - Set to 0.1 seconds (10 Hz sampling is fine for this project).
3. Click **OK**.

Output: A signal in **meters** (type `double`) representing the measured distance.

2. PIR Motion Sensor – Digital Input Block

Goal: Read HIGH/LOW from the PIR on D2.

1. Drag in:
 - Simulink Support Package for Arduino Hardware ▶ Common ▶ Digital Input

2. Double-click the **Digital Input** block and set:
 - o **Pin:**
 - Select **D2** (this matches your wiring).
 - o **Sample time:**
 - Set to **0.1** seconds (same as Ultrasonic Sensor for simplicity).
 - o **Output data type:**
 - Choose **boolean** if available.
 - If **boolean** is not an option, use **uint8** and treat **0 = no motion, 1 = motion**.
3. Click **OK**.

Output: `motion` signal: **1** (true) when PIR detects motion, **0** (false) otherwise.

3. Distance Threshold – Compare To Constant Block

Goal: Turn distance into a simple TRUE/FALSE for “is object near?”

1. From the Simulink Library:
 - o **Simulink ▶ Relational Operators ▶ Compare To Constant**
(or use Relational Operator with a Constant block; but Compare To Constant is easier.)
2. Double-click **Compare To Constant** and configure:
 - o **Operator:**
 - Set to **<**
 - o **Constant value:**
 - For example: **0.30** (meters) → object is “near” if within 30 cm.
 - o **Output data type:**
 - Select **boolean** if available.
3. Wire:
 - o The **input** of this block ← **output** of the Ultrasonic Sensor block.

Output: Call this signal **isNear** (TRUE when distance < 0.3 m).

4. Logical Combination Blocks (AND + NOT)

We combine “object is near” with “motion detected” to decide LEDs.

4.1 Logical AND (greenCondition)

1. Drag in:
 - o **Simulink ▶ Logic and Bit Operations ▶ Logical Operator**

2. Double-click the **Logical Operator** block and set:
 - o **Operator:** AND
 - o **Number of input ports:** 2
3. Wire:
 - o Input 1 \leftarrow isNear (output of Compare To Constant)
 - o Input 2 \leftarrow motion (output of Digital Input block)

Output: Call this signal `greenCondition`

- TRUE when **(object is near) AND (motion detected)**

4.2 Logical NOT (redCondition)

1. Drag in **another**:
 - o Logical Operator block
2. Double-click it and set:
 - o **Operator:** NOT
3. Wire:
 - o Input \leftarrow greenCondition

Output: Call this signal `redCondition`

- TRUE when **not greenCondition** (i.e., object is far OR no motion).
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5. LED Outputs – Digital Output Blocks

We'll keep LEDs wired as in the guide:

- **Green LED \rightarrow D9**
- **Red LED \rightarrow D10**

5.1 Green LED – Digital Output

1. Drag in:
 - o Simulink Support Package for Arduino Hardware \triangleright Common \triangleright Digital Output
2. Double-click the **Digital Output** block and set:
 - o **Pin:** D9
 - o **Initial value:** 0 (LED off at start)
 - o **Sample time:** 0.1 (match other blocks)
3. Wire:
 - o Input \leftarrow greenCondition (output of Logical AND block)

Behavior:

- When `greenCondition = 1` → D9 = HIGH → **Green LED ON**
- When `greenCondition = 0` → D9 = LOW → **Green LED OFF**

5.2 Red LED – Digital Output

1. Add another **Digital Output** block.
2. Double-click and set:
 - **Pin:** D10
 - **Initial value:** 0
 - **Sample time:** 0.1
3. Wire:
 - Input ← `redCondition` (output of Logical NOT block)

Behavior:

- When `redCondition = 1` → D10 = HIGH → **Red LED ON**
 - When `redCondition = 0` → D10 = LOW → **Red LED OFF**
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6. Quick Checklist (with Your Real Pins)

Make sure your **block settings** match both the PDF logic and your updated wiring:

- **Ultrasonic Sensor block**
 - Trigger pin: **D11**
 - Echo pin: **D12**
 - Sample time: 0.1
- **PIR Digital Input block**
 - Pin: **D2**
 - Sample time: 0.1
- **Compare To Constant block**
 - Operator: <
 - Constant: 0.3 (or your chosen distance in meters)
 - Output type: boolean
- **Logical Operator (AND)**
 - Operator: AND
 - Inputs: `isNear`, `motion`
- **Logical Operator (NOT)**
 - Operator: NOT
 - Input: `greenCondition`
- **Digital Output – Green LED**
 - Pin: **D9**

- Sample time: 0.1
- Input: greenCondition
- **Digital Output – Red LED**
 - Pin: D10
 - Sample time: 0.1
 - Input: redCondition

If you want, I can next draw you a text-based (ASCII) block diagram with exact signal names so you can literally mirror it in Simulink.