

# 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:

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## 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.

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## 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:
  - **Pin:**
    - Select **D2** (this matches your wiring).
  - **Sample time:**
    - Set to 0.1 seconds (same as Ultrasonic Sensor for simplicity).
  - **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.

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### 3. Distance Threshold – Compare To Constant Block

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

1. From the Simulink Library:
  - 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:
  - **Operator:**
    - Set to `<`
  - **Constant value:**
    - For example: 0.30 (meters) → object is “near” if within 30 cm.
  - **Output data type:**
    - Select **boolean** if available.
3. Wire:
  - The **input** of this block ← **output** of the Ultrasonic Sensor block.

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

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### 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:
  - Simulink ► Logic and Bit Operations ► Logical Operator

2. Double-click the **Logical Operator** block and set:
  - **Operator:** AND
  - **Number of input ports:** 2
3. Wire:
  - Input 1 ← `isNear` (output of Compare To Constant)
  - Input 2 ← `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**:
  - Logical Operator block
2. Double-click it and set:
  - **Operator:** NOT
3. Wire:
  - Input ← `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** → D9
- **Red LED** → D10

## 5.1 Green LED – Digital Output

1. Drag in:
  - Simulink Support Package for Arduino Hardware ► Common ► Digital Output
2. Double-click the **Digital Output** block and set:
  - **Pin:** D9
  - **Initial value:** 0 (LED off at start)
  - **Sample time:** 0.1 (match other blocks)
3. Wire:
  - Input ← `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.