**🧱 AI Steam Robot – Physical Construction (LEGO + Component Integration)**

This section outlines the detailed physical construction of the **AI Steam Robot** using LEGO Technic components, including mounting of mechanical parts, sensors, and actuators for full operational capability.

**🛠️ 1. Chassis and Differential Gear Mounting**

* Assembled using:
  + **2x LEGO Beam Module 9**
  + **Axle and Pin Connector Perpendicular 3L (with center pin hole)**
  + **2x LEGO Beam Module 3**
* These components were mounted **upside down** and attached to the **back of the differential gear** to serve as the initial framework.
* Below the differential gear:
  + **1x LEGO Beam Module 5**
  + **2x Connector Pins with Friction Ridges**
  + **1x LEGO Beam Module 9**

**🧱 2. Extended Framework and Axle Structure**

* Added support using:
  + **4x LEGO Beam Module 13**
  + **2x LEGO Beam Module 9**
  + **1x LEGO Beam Module 11**
  + **2x Connector Pins with Friction**
  + **3x LEGO Beam Module 15**
    - Two attached on **both sides of the wheels**
    - One placed **on top** for reinforcement

**🧷 3. Wheel Assembly**

* Installed **2 wheels** using:
  + **2x Axles**
  + **3x Half Bushings** and **3x Whole Bushings** on both sides
  + **Black Tire 62.4mm x 20mm** on both ends

**⚙️ 4. Motor and Body Integration**

* Placed the **ordinary motor** on top of the differential gear
* Attached **2x H-frames** on both sides to form the **main robot body**
* Placed another **horizontal H-frame** on top
* Added **O-frame** as a base for rudder placement

**🧭 5. Rudder and Steering System**

* Inserted the **rudder** between the **O-frame** and **H-frame**
* Used a **long peg** outside the H-frame to secure the rudder
* For the wheel connected to the rudder:
  + Used a **short axle** inserted into the rudder
  + Installed **3x Axle Connectors with Axle Hole**
  + Attached **Axle and Pin Connector Perpendicular (with center pin hole)**
  + Added **LEGO Beam Module 11**
  + Connected **2x Axle and Pin Connector Perpendicular**
  + Inserted a **long axle** with **2x axle connectors** on both sides
  + Used **Axle 4 with center stop** and **bushings** to lock the wheels

**⚫ 6. Grayscale Sensor Mounting (Bottom Center)**

* Mounted under the center of the robot:
  + **LEGO Beam Module 9**
  + **LEGO Beam Module 7**
* On top of those:
  + **2x LitFarm 1 x 7 Bent Beams** on both sides
* Grayscale sensor was placed on top of the bent beams

**🔦 7. Barrier Avoidance System (Front Sides)**

* Above the O-frame:
  + Stacked **2x LEGO Beam Module 7** on each side
  + Stacked **2x LitFarm 1 x 11.5** on both sides
  + Below each LitFarm beam:
    - Attached **Cross Block Beam 3 with Four Pins**
    - Mounted **barrier avoidance sensors** on both sides

**📦 8. Controller and Electronics**

* Mounted the **controller** on top of the LitFarm beams
* Behind the robot, installed the **rechargeable battery pack**

**📸 9. Camera and Light Mounting (Above Rudder)**

* On top of the rudder:
  + Inserted an **axle**
  + Attached **axle connectors with axle holes** (top and bottom)
* Below the axle:
  + Used **short axle**
  + Installed **2x Technic Wedge Belt Wheels**
  + Added **LEGO Beam Module 5**
* Above the axle:
  + Added **2x axle connectors with axle hole**
  + Inserted another **short axle**
  + Mounted an **O-frame**
  + Installed the **camera** on top of the O-frame