

Day 2 Report – Simulation & Sensor Data Streaming

Objective

To simulate the smart AGV navigation system in a virtual environment, integrate multiple sensors with the Raspberry Pi Pico W, and establish real-time data communication with the ThingSpeak cloud for live monitoring and data logging.

Activities Performed

1. Simulation of AGV System in Wokwi

- The AGV prototype was simulated using the **Wokwi online platform**, which supports Raspberry Pi Pico W and common sensors.
 - A virtual hardware setup was created including:
 - **Ultrasonic Sensor (HC-SR04)** – for obstacle detection
 - **IR Sensor** – for line detection or surface variation
 - **PIR Sensor** – for motion/human detection
 - Components were wired and tested in a simulated environment, mirroring the real-world configuration.
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2. Sensor Programming and Data Acquisition

- The **Raspberry Pi Pico W** was programmed using **MicroPython**.
 - Real-time sensor readings were acquired and printed on the terminal for validation.
 - The code was modular and included:
 - GPIO initialization for each sensor
 - Measurement logic for ultrasonic echo timing
 - Signal reading for PIR and IR sensors
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3. Wi-Fi Configuration

- The Pico W was connected to a Wi-Fi network within the simulation.
 - Network parameters were defined, and connection status was monitored.
 - Successful IP assignment indicated network readiness for data transmission.
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4. Cloud Integration with ThingSpeak

- A **ThingSpeak channel** was created and configured with multiple fields.
 - Sensor data was formatted and transmitted using HTTP requests.
 - Field mappings:
 - **Field 1** – Ultrasonic distance
 - **Field 2** – IR output
 - **Field 3** – PIR output
 - Successful data uploads were verified on the **ThingSpeak dashboard** with real-time graphs and logs.
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5. Data Rate Compliance

- A **15-second delay** was added in the loop to comply with ThingSpeak's minimum update interval.
 - This prevented request throttling and ensured data integrity on the cloud.
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Output & Results

- A fully functional **virtual AGV simulation** was developed using Wokwi.
 - Real-time data from sensors was **streamed successfully to the cloud**.
 - The system demonstrated **sensor-based obstacle detection**, live **event monitoring**, and **data logging capabilities**.
 - CSV logs can now be generated from ThingSpeak for future machine learning model development or analysis.
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Conclusion

The simulation and cloud streaming phase provided a strong foundation for validating the Smart AGV concept before physical deployment. Sensor behavior was verified, network integration was successful, and remote monitoring was established via a reliable cloud platform.