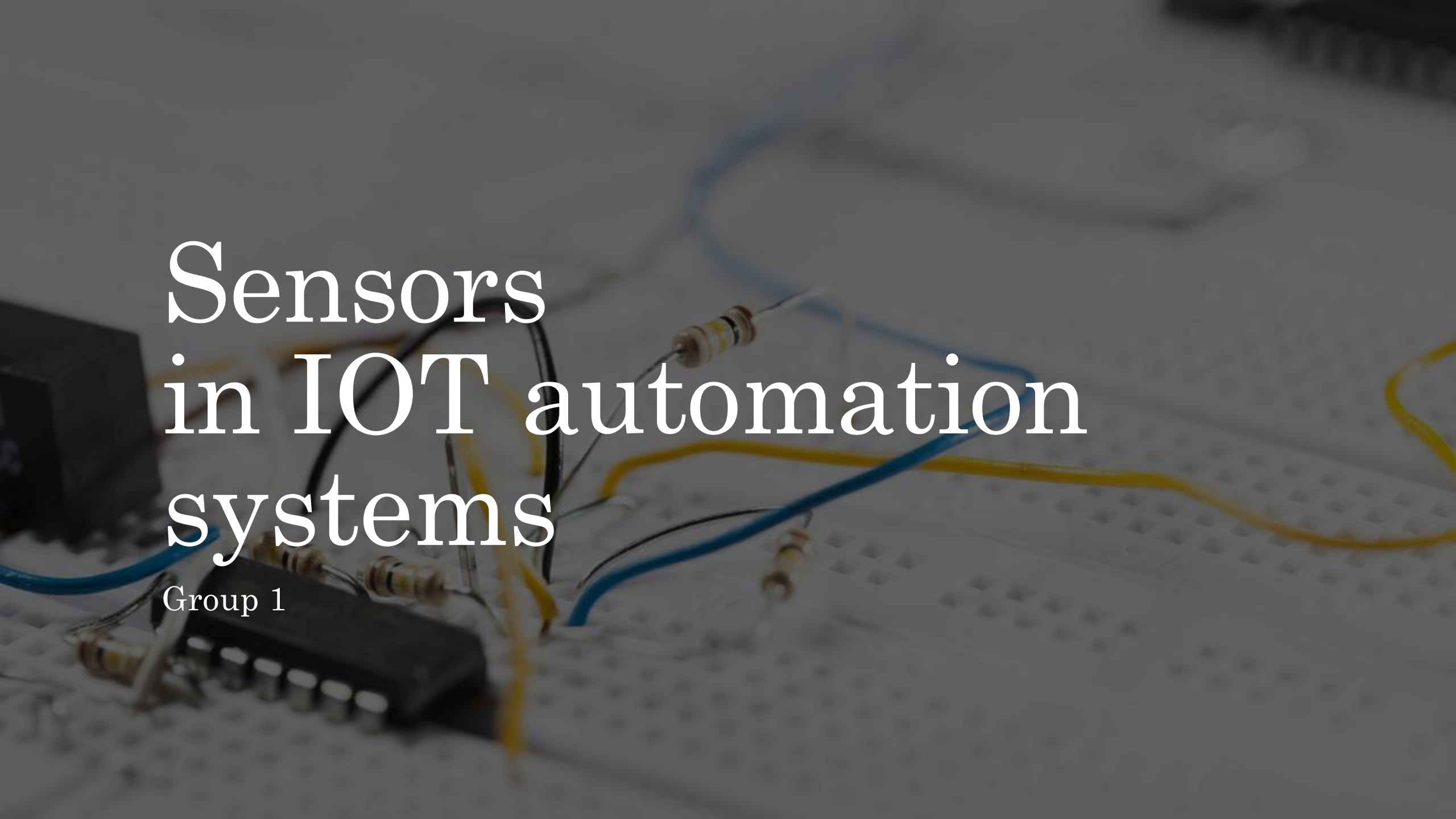


# Sensors in IOT automation systems

Group 1

# Automatic system

What?

- System that can operate independently, without the need for human intervention
- Integration of various systems to **control** and **monitor**

Why?

- Energy efficiency
- User comfort
- Safety
- Maintenance optimization

# Sensors in automation and their role

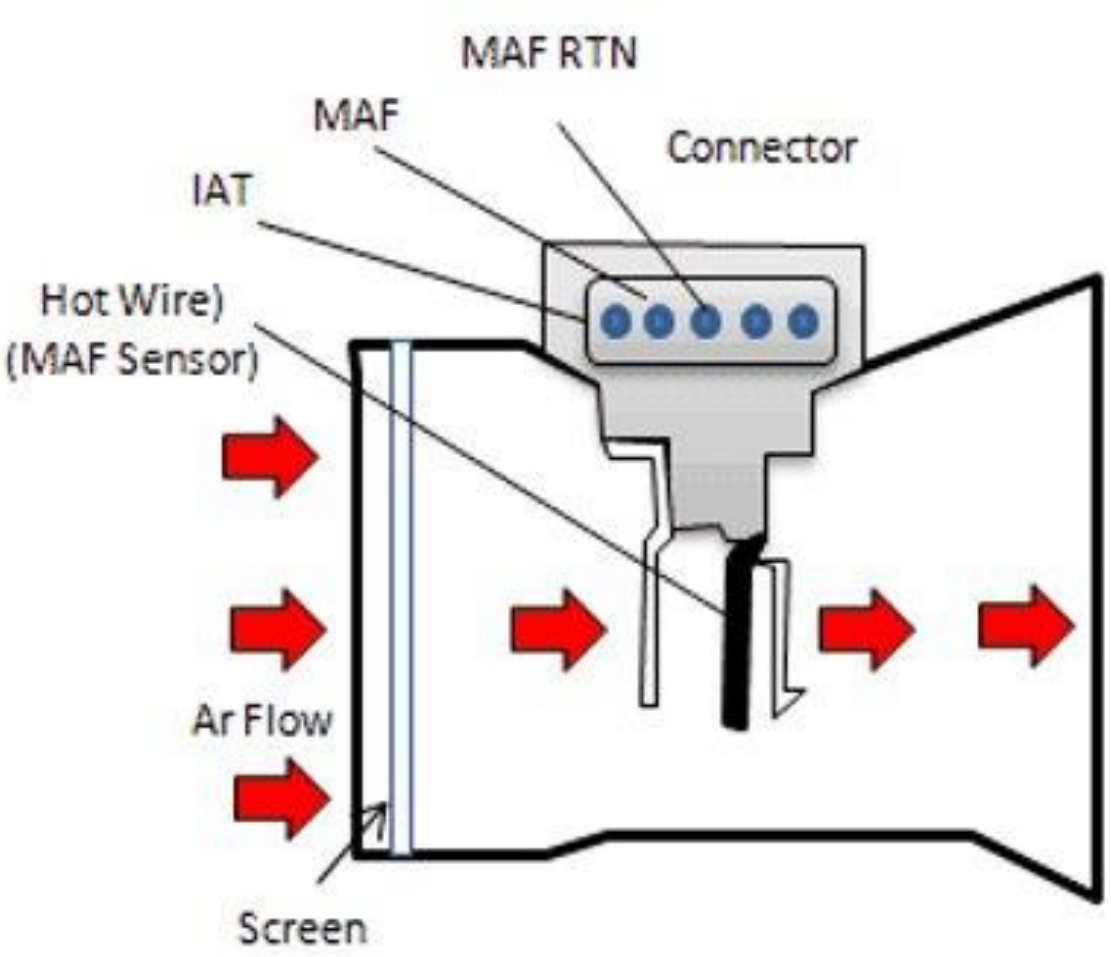
- Collect data and information about the system and its environment
- Send that information to the system's controller or network
- Link the real world to the digital one
- Mass-production

- temperature sensors
- humidity sensors
- magnetic field sensors
- motion sensors
- sound sensors
- force sensors

# Interesting IOT Sensor examples

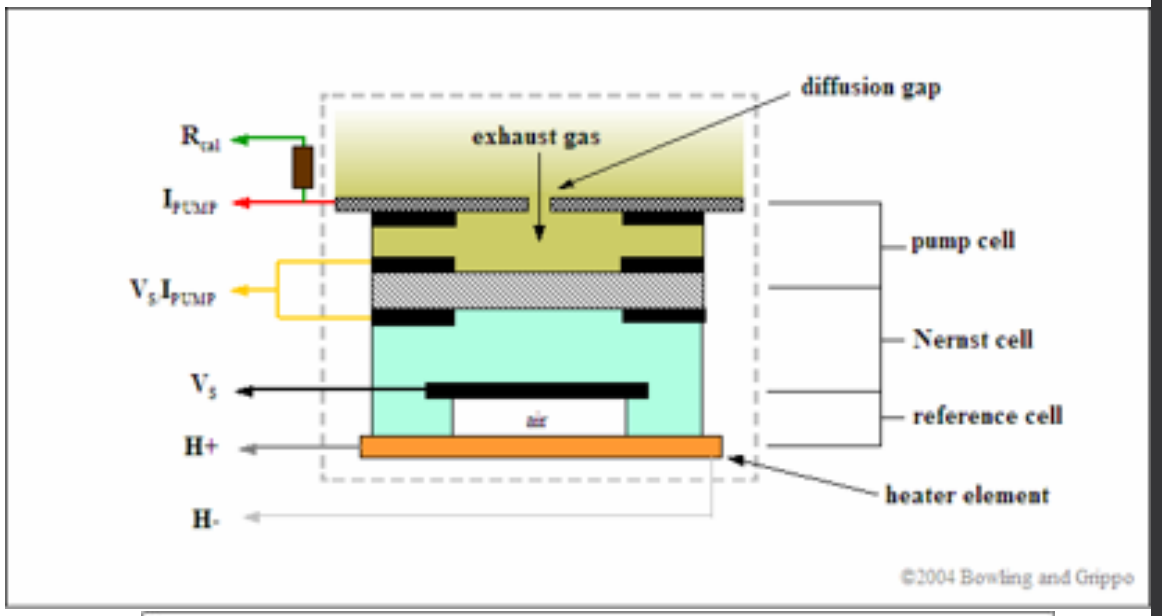
# MAF - Sensor

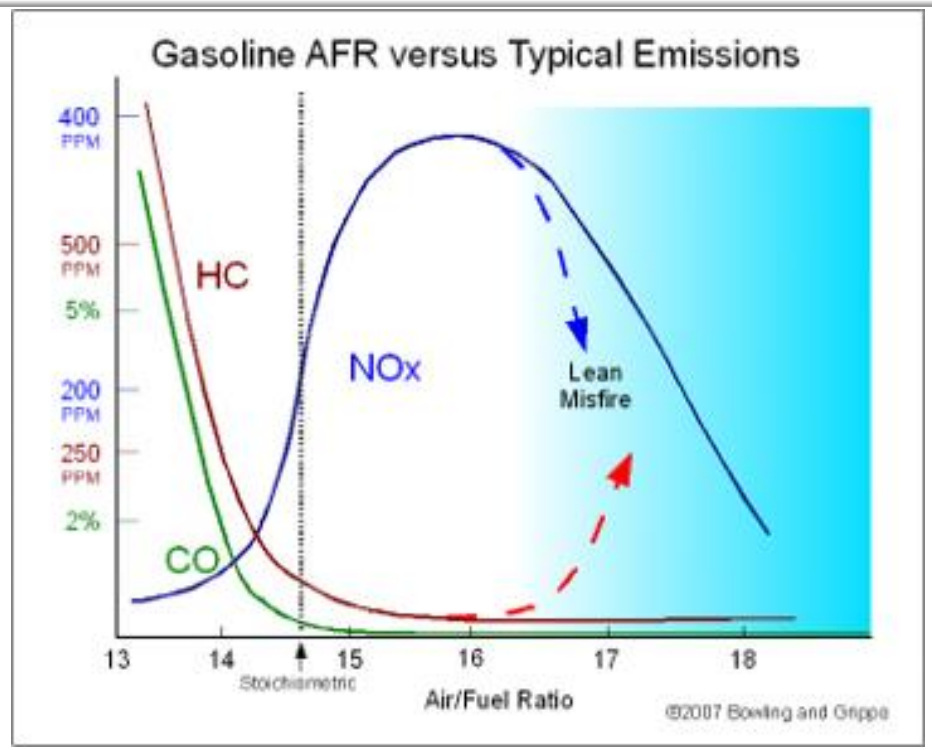
- Mass Air Flow – Sensor
- Measures the mass of air going through the sensor
- Two main types in automotive industry, Hot wire and Hot film
- Both works on the same main principles
  - Utilize high temperature coefficient metal
  - Tungsten, platinum, platinum-rhodium etc.
  - Small change in temperature results in measurable change in resistance
  - Can precisely calculate the mass because of Ohms law



# O2 - Sensor

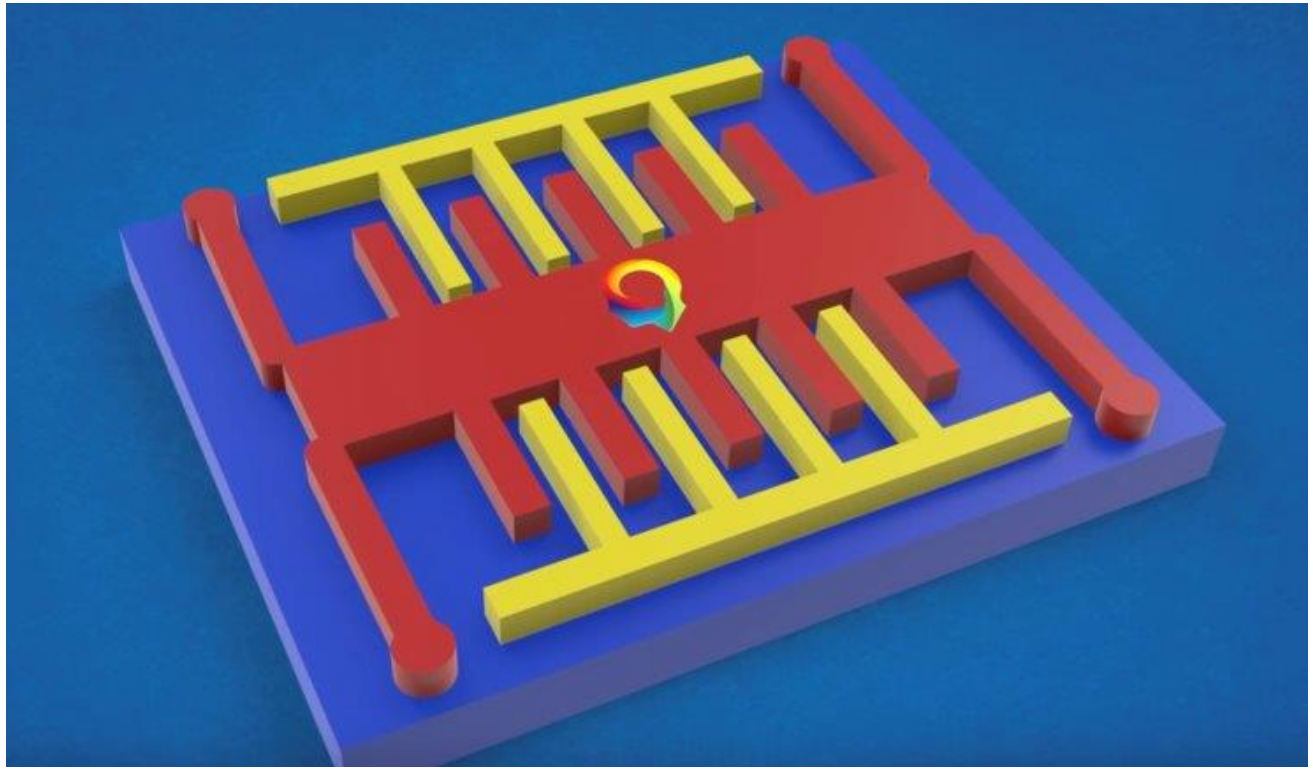
- Oxygen Sensor
- Two main types, Wide band and Narrow band
- Used in all modern internal combustion engines
- Consists of a Nernst reference cell and an oxygen pump cell as well as heater
- Works because every atom is conserved trough the combustion process – directly linked to AFR
- The Nernst cell and oxygen pump cell are wired together in such a way that it takes a certain amount of current to maintain a balanced oxygen level in the diffusion gap. Measuring this current flow allows the Precision Wideband Controller to determine the exact air/fuel ratio the engine is operating at.
- Measurment in Lamda



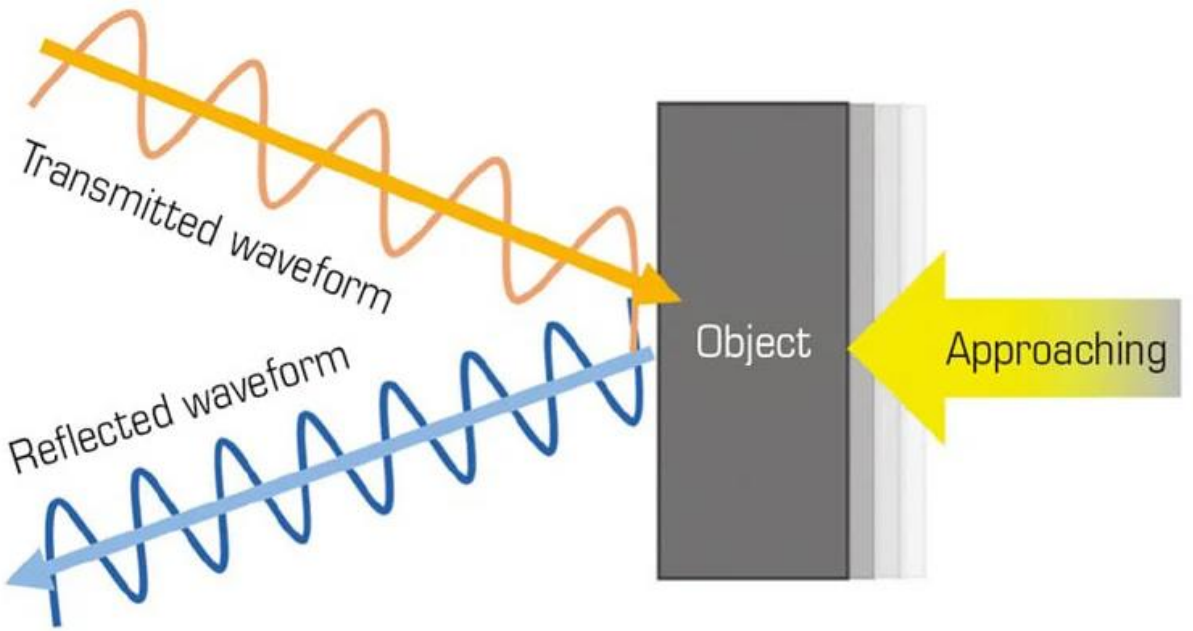
# Accelerometers

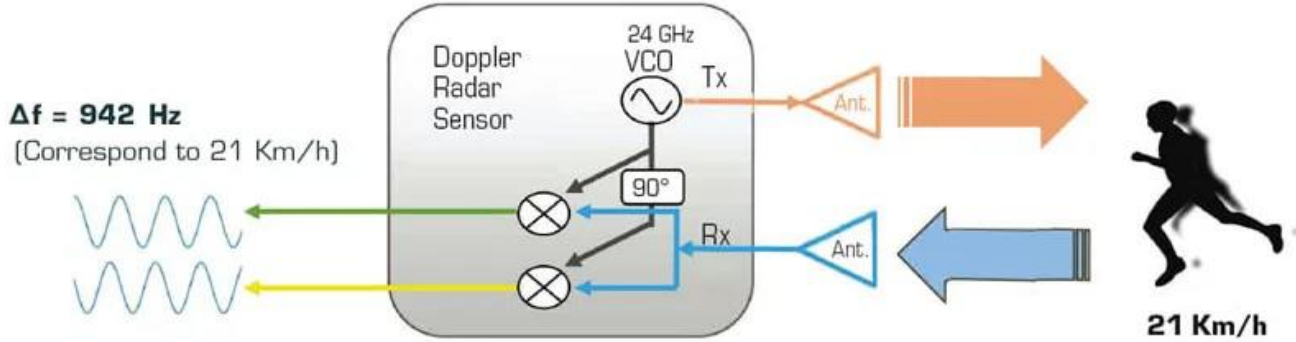
- Microelectromechanical system (MEMS)
- Interesting: both electronic and mechanical!
  - Differential capacitance
  - Manufacturing difficulty
- Airbags were groundbreaking
- Cheap and ubiquitous
  - Used in most forms of motion detection



# Doppler radar sensors

- Detect movement by measuring the frequency shift of reflected radar waves
  - The radar sensor emits a beam of radio waves, which reflect off of humans moving within its range
  - By analyzing the frequency shift of these reflected waves, the sensor can determine the distance, speed, and direction of the detected object
- Application in home security, industrial automation, and healthcare
  - Use to track movement, count people, and trigger alarms



# Benefits of sensor-driven automation systems

- Energy efficiency: sensors can be used to optimize heating and cooling systems, lighting, and water usage, resulting in significant energy savings
- Cost savings: more efficient use of resources and reduced maintenance costs can lead to significant cost savings over time
- Improved user comfort: sensors can be used to automatically monitor and adjust without the appearance of user

# Challenges and Considerations

# Challenges and considerations in implementing

- Cost: sensors and other components can be expensive, and retrofitting existing facilities can be challenging and expensive
- Interoperability: different systems from different manufacturers may not communicate effectively with each other, leading to compatibility issues
- Data privacy and security: collecting and sharing data from users raises concerns about privacy and security

# Conclusions

- Sensors play a critical role in automation IOT systems, allowing for the collection of data and real-time adjustment to optimize resources
- By leveraging this data, engineers can make more informed decisions, improve operational efficiency, reduce costs
- The future of sensors in IoT systems is exciting, with the potential to revolutionize industries, improve quality of life, and drive new levels of innovation and efficiency


Q&A