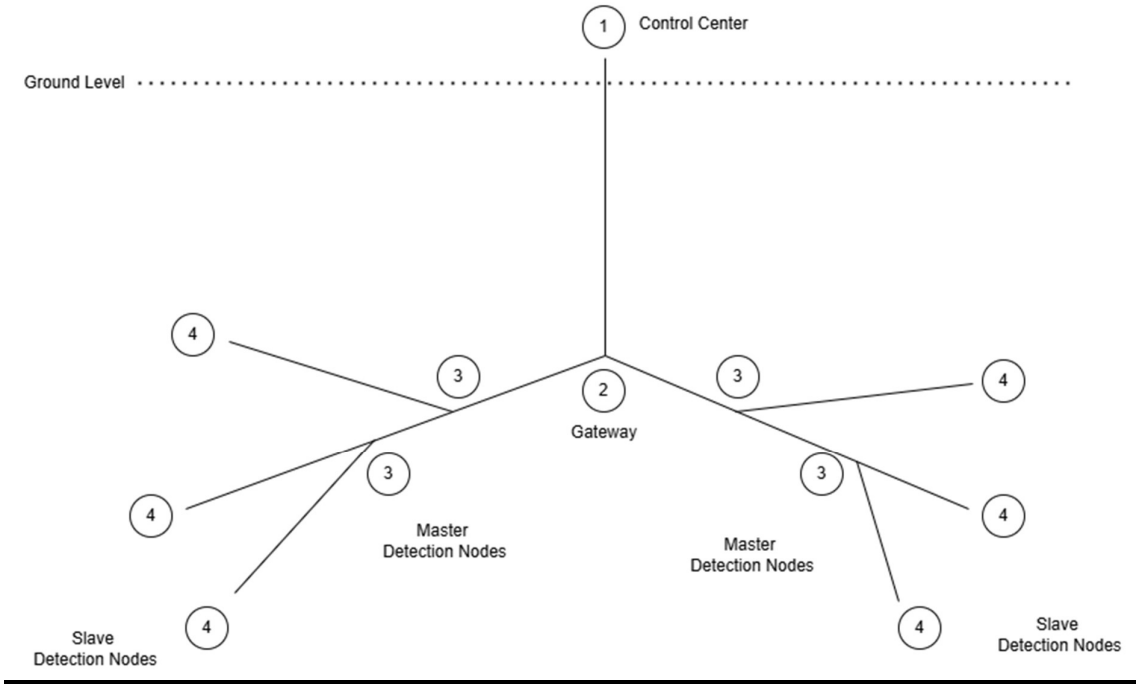
Communication Architecture

A sample Underground coalmine:-



(1) Control Centre:

Sends signal for starting the gas detection and receives signals from Gateway (2) of the various gases.

(2) Gateway:

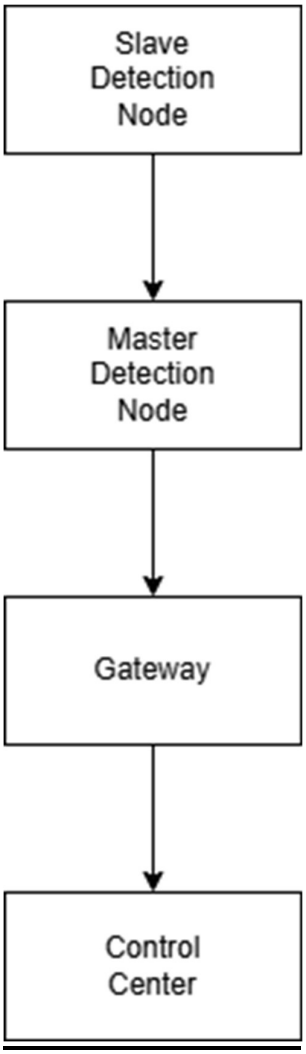
Receives signals from all the nodes inside the mine and sends it to control center & vice-versa.

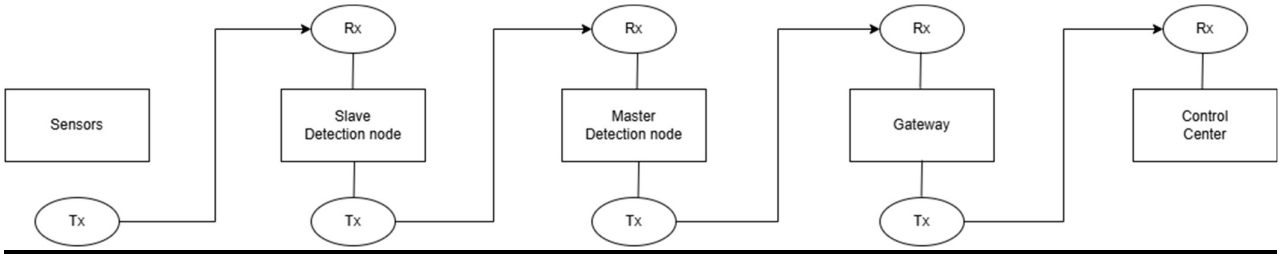
(3 & 4) Detection Nodes:

Works on detection of gases using various gas sensors. (3) is Master & (4) is Slave device.

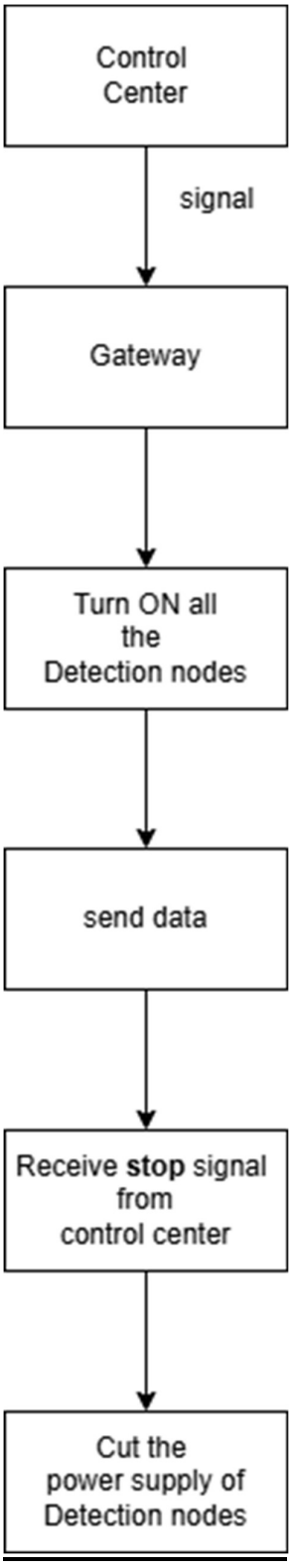
Technology used:- **ESP_NOW (Bluetooth Low Energy)**

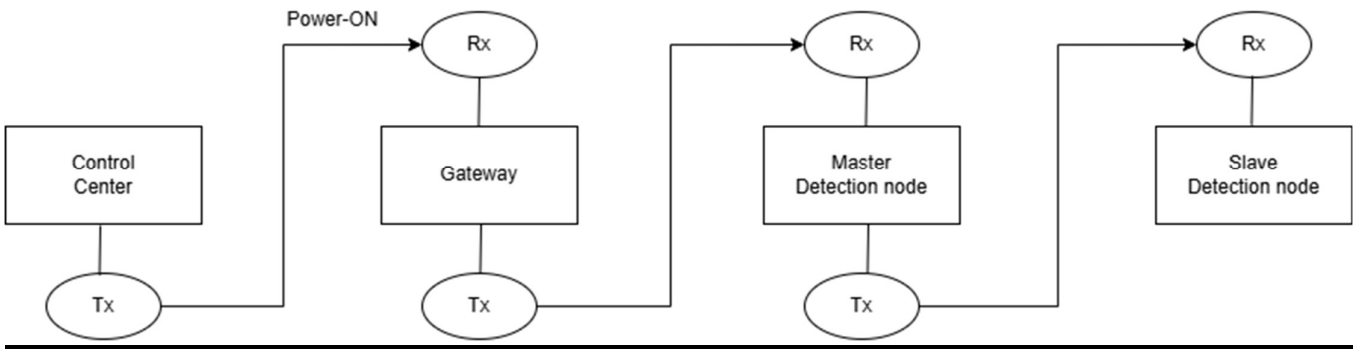
Flow of sensor Data:-





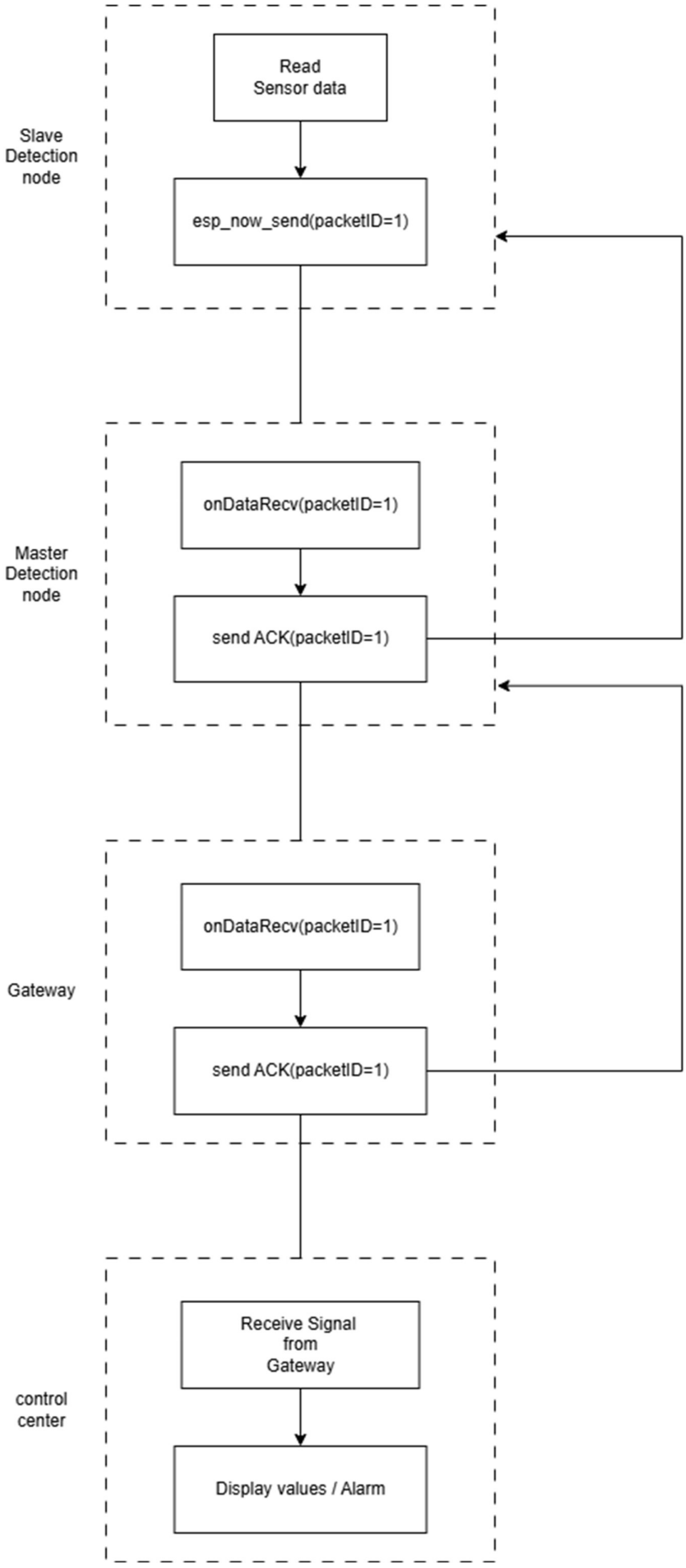
How will gas detection start?





How will Switching take place?

- To switch to Transmit mode → ***esp_now_send()***
- To switch to Receive mode → ***esp_now_register_recv_cb()***
- To check if data was successfully delivered or not, we use ***onDataSent()*** callback function.
- The callback function that runs whenever a packet is received from another ESP-NOW peer is: ***onDataRecv()***
- We can use ACK (Acknowledgment) signal to switch between Tx and Rx modes.


Slave
Detection
node
Read
Sensor data
esp_now_send(packetID=1)
Master
Detection
node
onDataRecv(packetID=1)
send ACK(packetID=1)
Gateway
onDataRecv(packetID=1)
send ACK(packetID=1)
control
center
Receive Signal
from
Gateway
Display values / Alarm

Key functions:-.

- ***esp_now_init()*** → Start ESP-Now
- ***esp_now_add_peer()*** → Register peers
- ***esp_now_send()*** → Transmit data
- ***esp_now_register_send_cb(OnDataSent)*** → Know what is sending is finished.
- ***esp_now_register_recv_cb(OnDataRecv)*** → Handle received packets

What if ACK is not received?

Provisions:

1. Using Timeout (for some seconds, usually 20-50ms.)
2. Retry for some fixed no. of times(3-4 times).
3. If ACK fails, then store it in buffer and retry next time by sending it with other packets. {**NOTE:** Add packet ID to each message}