Wireless Sensor Networks , Group Work

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1. Node and Hub Setup

In this group work we have setup a wireless network using 3 nodes, whereas, these node measures the Accelerometer and Gyroscope data in order to measure Bridge vibration. We have setup the devices as such in figure 1. Here, Hub refers to Receiver.

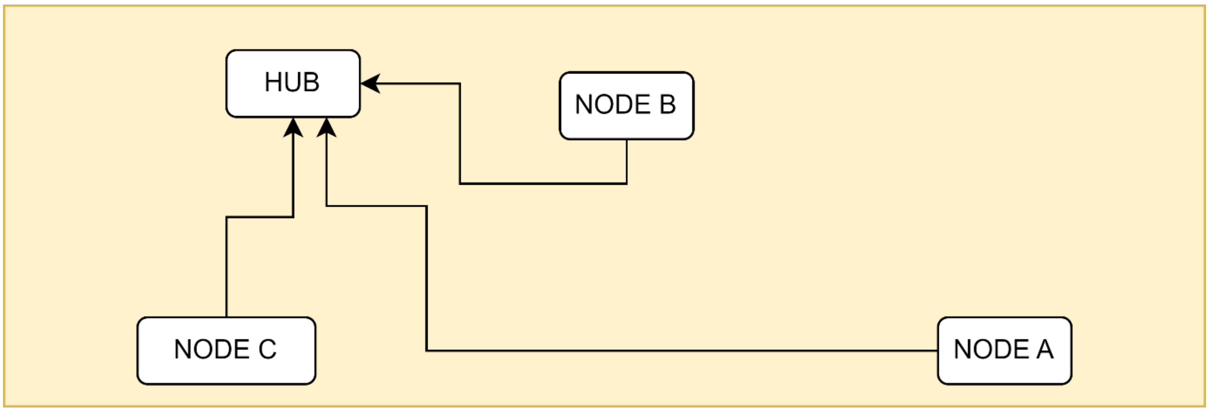


Figure 1 : Node locations relative to the Hub at the Footover bridge near Hörsaalzentrum TU Dresden.

2. Data Organisation

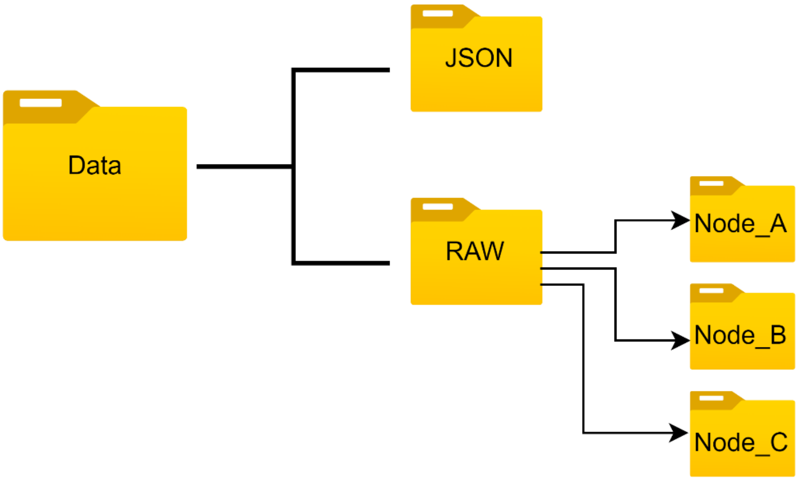


Figure 2: Results were saved in RAW and JSON folder.

Raw folder contains all the data as formatted as **`timestamp, RSSI, Packet Number, Ax, Ay, Az, Gx, Gy, Gz`** . And In JSON folder, it contain the same result but with each data nameholder.

3. Results

3.1 Raw Data format

```
timestamp, RSSI, Packet Number, Ax, Ay, Az, Gx, Gy, Gz
```

3.2 Sender code / code of NODEs

```
char formatted_data[128];
 snprintf(formatted_data, sizeof(formatted_data), "%d,%d,%d,%d,%d,%d,%d",
          packet_number,
          acceleration.val[0], acceleration.val[1], acceleration.val[2],
          gyro.val[0], gyro.val[1], gyro.val[2]);

 packet_number = packet_number + 1;
```

Values of the sensors were formatted as such, and later sent to Receiver / Hub by its address `‘fe80::dcc5:ea41:9918:4fcf’` . Required RSSI of the packet is determied at the receiver section.

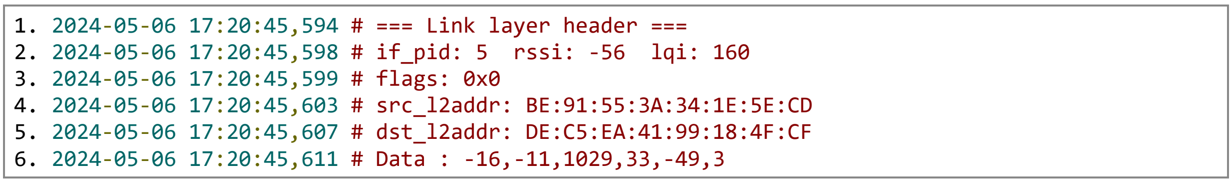
```
/* send the formatted data using send_packet */
if (send_packet(3, (char *[]){ "send", "fe80::dcc5:ea41:9918:4fcf", formatted_data }) != 0) {
    puts("Error sending packet");
    break;
}

/* wait for 1000 ms */
ztimer_periodic_wakeup(ZTIMER_MSEC, &last_wakeup, 1000 / SENSOR_FREQUENCY);
```

Data is then sent by nodes periodically at 1000ms rate.

3.3 Receiver code / code of HUB

```
/* [TASK 1: receive packet here] */
        while (1) {
        msg_t msg;

        msg_receive(&msg);
        if (msg.type == GNRC_NETAPI_MSG_TYPE_RCV) {
            gnrc_pktsnip_t *pkt = msg.content.ptr;

        if (pkt->next) {
            if (pkt->next->next) {
                puts("=== Link layer header ===");
                gnrc_netif_hdr_print(pkt->next->next->data);

            }

        }

            printf("Packet Size : %d, Data : %s \n", pkt->size, (char *)pkt->data);
            gnrc_pktbuf_release(pkt);
        }
    }
```

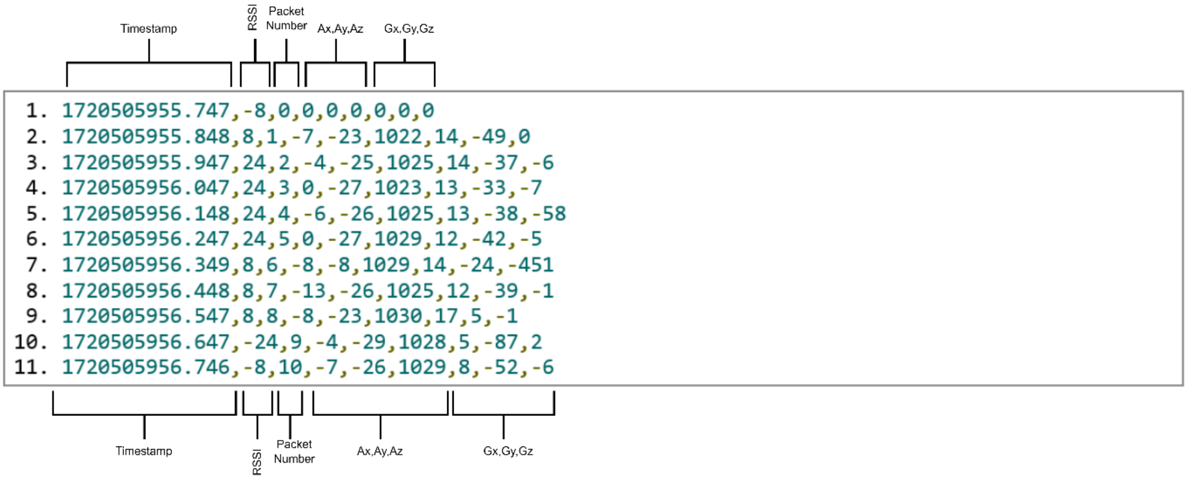
This section of the code in receiver/Hub conteneously listens to the nodes and prints out information sent by the nodes as well as information related to the received packet. According to our need, we just parse the RSSI value related to the packet received. Below it is shown,



```
2024-05-06 17:20:45,594 # === Link layer header ===
2024-05-06 17:20:45,598 # if_pid: 5  rssi: -56  lqi: 160
2024-05-06 17:20:45,599 # flags: 0x0
2024-05-06 17:20:45,603 # src_l2addr: BE:91:55:3A:34:1E:5E:CD
2024-05-06 17:20:45,607 # dst_l2addr: DE:C5:EA:41:99:18:4F:CF
2024-05-06 17:20:45,611 # Data : -16,-11,1029,33,-49,3
```

Here, we each packet received shows these information or 6 lines of information, here only neccesary if DATA that is sent by the NODEs and RSSI of the packet. We parse these data contineously at our computer using a simple python script to get the RAW data.

Result as seen in Receiver aquired from Node A, experiment no 0 : (NODE A EXP_0)



```
1720505955.747,-8,0,0,0,0,0,0,0
1720505955.848,8,1,-7,-23,1022,14,-49,0
1720505955.947,24,2,-4,-25,1025,14,-37,-6
1720505956.047,24,3,0,-27,1023,13,-33,-7
1720505956.148,24,4,-6,-26,1025,13,-38,-58
1720505956.247,24,5,0,-27,1029,12,-42,-5
1720505956.349,8,6,-8,-8,1029,14,-24,-451
1720505956.448,8,7,-13,-26,1025,12,-39,-1
1720505956.547,8,8,-8,-23,1030,17,5,-1
1720505956.647,-24,9,-4,-29,1028,5,-87,2
1720505956.746,-8,10,-7,-26,1029,8,-52,-6
```

4. Conclusion

We have successfully setup the nodes on the footover bridge near Hörsaalzentrum TU Dresden and have taken 10 experients each for nodes A, B, C. Each of the experiments contains over 10000 measurements spanned over 1 Hour. The nodes were very prone to distance, it worked fine for less than 25-30 feets. Longer than that they were disconnected from the receiver or the hub.