Prognostic & Health Management (PHM) Tool for Robot Operating System (ROS)

USE CASE SCENARIO

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1. Introduction

In this report PHM package for Mobile Robot is developed to show the effectiveness of PHM tool. This tool is responsible for managing / monitoring robots' health, RUL, probability of task completion (PoTC) etc. User is able to configure this tool according to his / her own robot. This generic PHM tool could be used with any kind of robot (mobile, arm, drone etc.).

In a mobile robot (OTA), the health of the subsystems is important in terms of autonomy and acceptance of the given mission. In an industrial environment, when a mission is given to the OTA, high level controller must ideally check that the given mission can be completed with the current health state. If there is a failure or high possibility of failure in a subsystem, the possible outcomes must be considered. The types and the order of importance of the failure of a subsystem must be known by the OTA, so it can rearrange its autonomous behaviour to be on the safe side, report the failure to the operation centre or do not accept the given mission. Failure can be a communication failure, out of limit failure, estimation from model-based methods etc. Some failures are detected after they occurred, however some of them, or at least it's possibility can be estimated using model-based methods and data fusion before. Those estimations can be very helpful to plan the service times before failures.

In this document, PHM tool mobile robot use-case scenario is described and steps are given. Main steps are;

- Robot design with PHM tool
- Robot configuration
- Data acquisition from Mobile Robot
- Hazard Rate analysis in real time
- Reliability analysis in real time
- Task completion analysis

In this use-case, firstly data acquisition system is developed and instrumented to the OTA. With this DAQ system, sensory data is gathered from OTA and recorded to the bag files. Various sensors on OTA are gathered to analyze the effect of the data from the environment (temperature, humidity, vibration, voltage, current etc.) on OTA. Data from these sensors are published from ROS topics and subscribed to these topics via the PHM Tool to calculate the impact of sensor data on system failure rate and reliability.After that, PHM tool is used for designing and configuring the OTA for reliability and probability of task completion analysis. For this purpose, reliability and nominal hazard rate data of components are taken from the developed mobile robot (OTA). Additionally, usage time of components are measured from given missions and system architecture (series or parallel) are configured by the user. Updated hazard rate is calculated with the knowledge of all above. Since PHM Tool is a modular tool, each of the modules, submodules and components in OTA must be added in this tool. OTA design is done by adding modules, submodules and components in PHM Tool. OTA should be configured by making physical arrangements of these added parts according to each other. As a result of the design and configuration of OTA in the PHM Tool, the hazard rate and failure rate values of the system are calculated. As an example, the failure rate of mechanical bearings is significantly affected by operating conditions such as temperature, rotational speed, and load. In this scenario, the updated hazard rate is be extrapolated over a range of temperature and nominal conditions by using simulation and recorded data. GAZEBOsim is used for task completion analysis and SMACH tool is used as finite state machine for controlling high-level behavior of OTA.

In the following section, designed and developed data acquisition system for mobile robot (OTA) is introduced. Also, data descriptions and hardware specifications for DAQ system is given in this section. After that, use-case scenario is implemented by using PHM tool. In this section all PHM tool interfaces which are Robot Design and Configuration and Monitoring and Analysis pages are used. Lastly, tutorials for PHM tool is given. PHM package for Mobile robots contains nodes, launch files, formulas, special robot configuration file, rosbag files for sensory information of mobile robot.

2. Obtaining Sensor Data for OTA

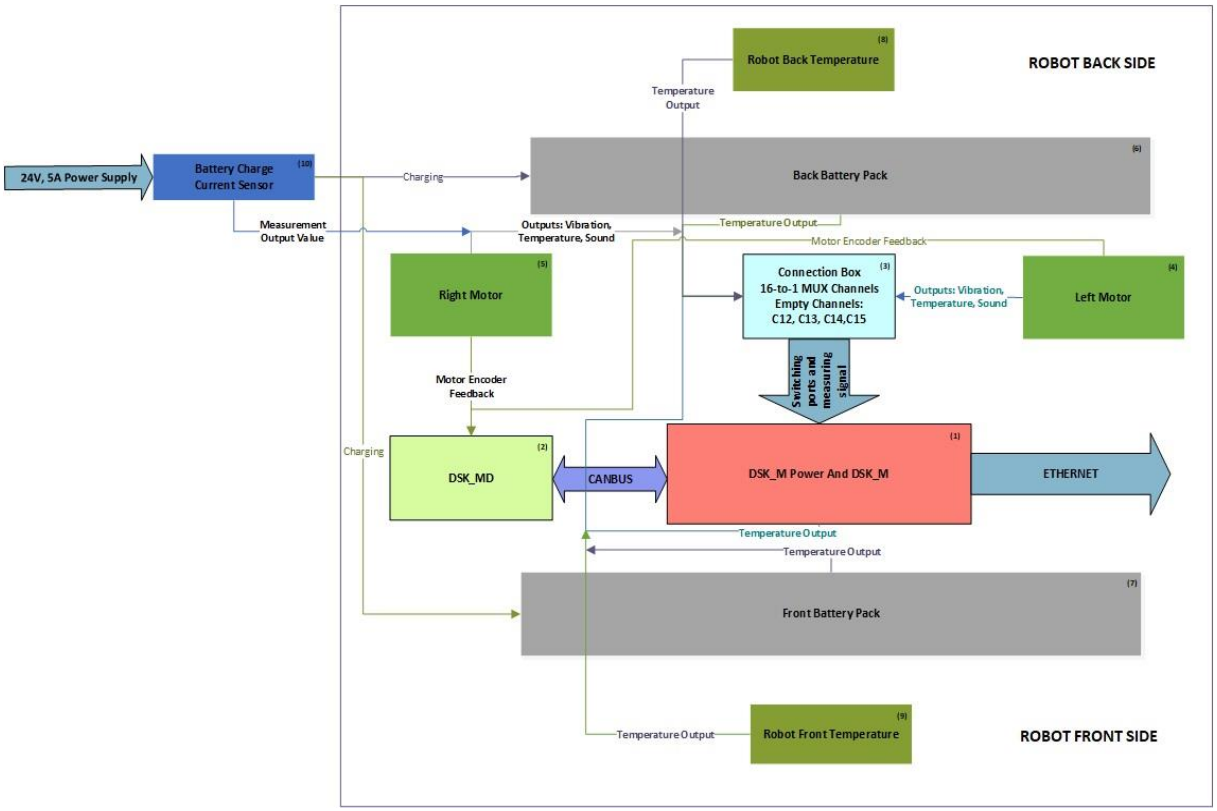

Figure 1 General Scheme of Data Gathering

2.1. Low Level Design

Low level design includes motor controller, system power supply board from battery (DSK_M Power) and Low-level controller center board (DSK_M Board). So, motor controller is controlling the brushed motor via CANBUS, DSK_M Board is gathering the measurements and send via ETHERNET TCP/IP.

2.1.1. Board Specialities

2.1.1.1. DSK_M Power And DSK_M Board (1)

The Robot is gathered all measurements with DSK_M Board. Then, the board is sent these datas with Ethernet TCP/IP. The designed boards is given in Figure 2.

The DSK_M Power board specialities is given Table 1.

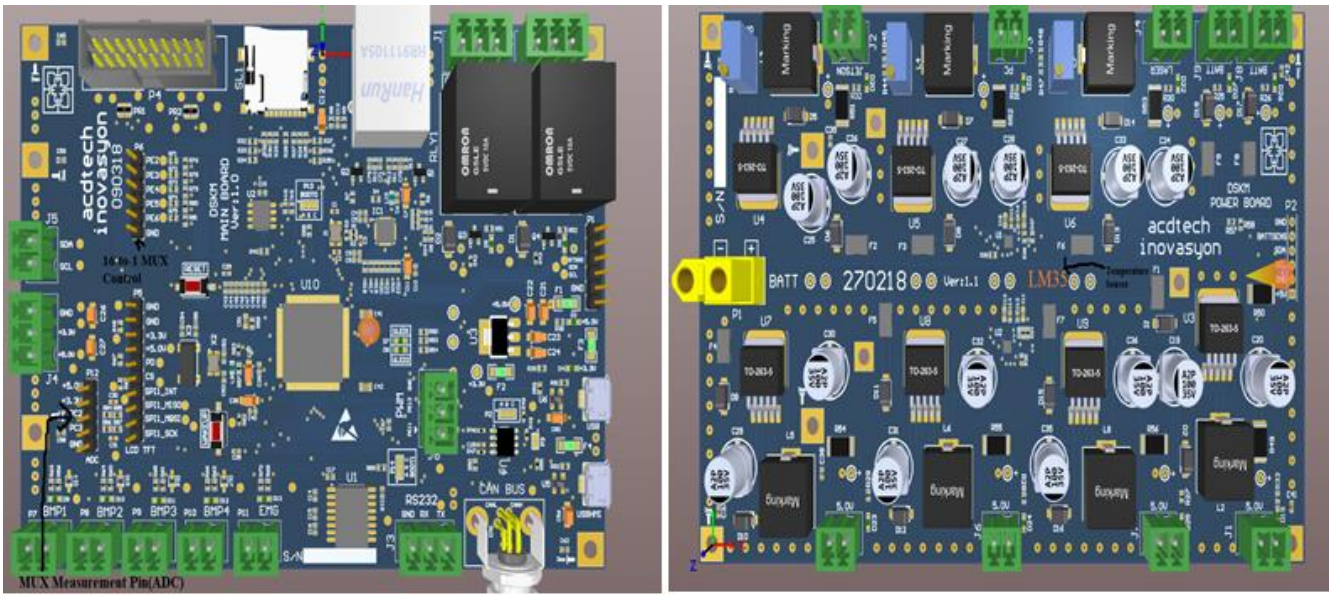

Figure 2 DSK_M Board (Left) and DSK_M Power Board (Right)

Connector Name	Output Voltage	Output Current	Test Solution	IC	Supplied System
J1	5V	3A	There is no risk within 2A. After 2A heatsink needs.	LM2596-5V	DSK_M Board And DSK_MD
J2	19V	3A	There is no risk within 2A. After 2A heatsink needs.	LM2596-Adj	
J3	12V	3A	There is no risk within 2A. After 2A heatsink needs.	LM2596-Adj	
J4	20V	3A	There is no risk within 2A. After 2A heatsink needs.	LM2596-Adj	
J5	5V	3A	There is no risk within 2A. After 2A heatsink needs.	LM2596-5V	
J6	5V	3A	There is no risk within	LM2596-5V	

			2A. After 2A heatsink needs.		
J7	5V	3A	There is no risk within 2A. After 2A heatsink needs.	LM2596-5V	
J8	Battery Voltage(24V)	5A	There is no risk within 5A.	CDBA540	
J9	Battery Voltage(24V)	5A	There is no risk within 5A.	CDBA540	

Table 1: *DSK_M Power board specialities*

DSK_M Board board specialities is given below:

- Ethernet 10/100 Mbit
- Stm32f407 Microcontroller (168 Mhz)
- SD Card Slot
- I2C external connector
- AT24C128 EEPROM
- GPIO Pins
- RS-232
- CAN BUS
- USB And USB-HMI
- Two 10A Relay
- SPI

Implemented board is given in Figure 3 on the robot:

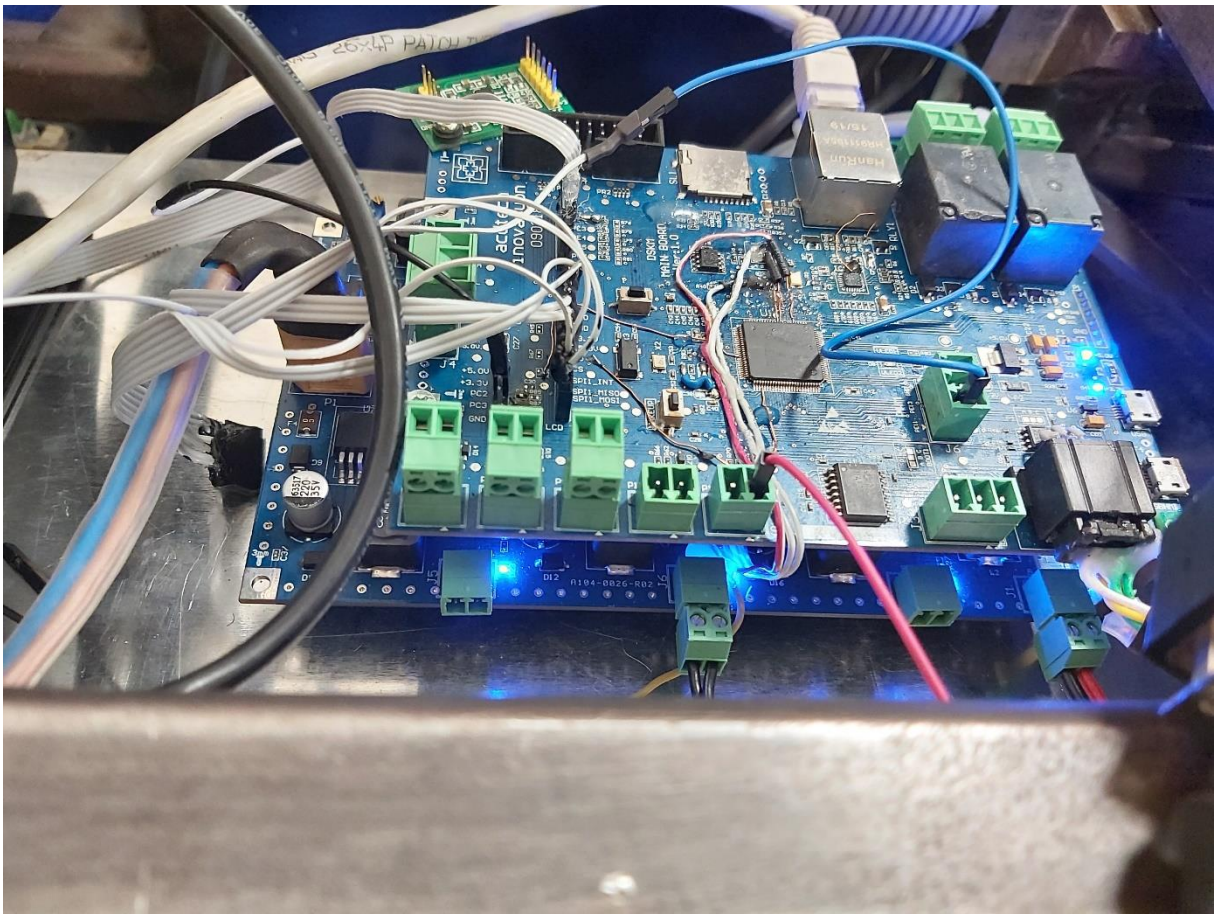

Figure 3 Implemented DSK_M Power (Bottom) And DSK_M Board (Upper)

There are measurements that eight temperature points, motors energy monitoring, system power monitoring, charging current, environment quality, motors vibration and sound.

For the power monitoring is happening with two PAC1934 on the DSK_M Power Board. The ICs is given Figure 2 as seen U1 and U2. Moreover, the ICs is measuring instantaneously four channel voltage, current and power. So, U1 is measuring J2, J3, J4, J1 and U2 is measuring J5, J6, J7, J1 respectively. Consequently, measured datas is gathering type is float.

DSK_M board is gathering all datas from ADC, CANBUS, I2C etc. These datas is sent from ETHERNET TCP/IP every second within 16-to-1 MUX measurements and DSK_MD measurement datas.

The Ethernet datas is sending with circumstances as second:

First: C8 channel measurement (12480 sample)

Second: C8 channel measurement (another 12480 sample)

Third: C9 channel measurement (12480 sample)

Fourth: C9 channel measurement (another 12480 sample)

Fifth: C10 channel measurement (12480 sample)

Seventh: C10 channel measurement (another 12480 sample)

Eighth: C11 channel measurement (12480 sample)

Ninth: C11 channel measurement (another 12480 sample)

If the measurement datas is given between 0 to 4095, we can use the Equation 1 for the conversion to 0 – 3.26V value:

$$MeasuredVoltage = \frac{Data}{4095} * 3.26 \quad (1)$$

2.1.1.2. DSK_MD (2)

The DSK_MD main purpose is controlling the two DC Motors. This board has temperature sensor (DS1775) temperature sensor and energy monitoring (PAC1934) is measuring instantaneously each motor voltage, current, power values. These datas is sent via CAN BUS to DSK_M Board.

Measuring motor speed is getting from incremental encoder. The encoder values and timestamp is sending via CANBUS to PC or DSK_M Board. The designed board is given in Figure 4 and Figure 5.

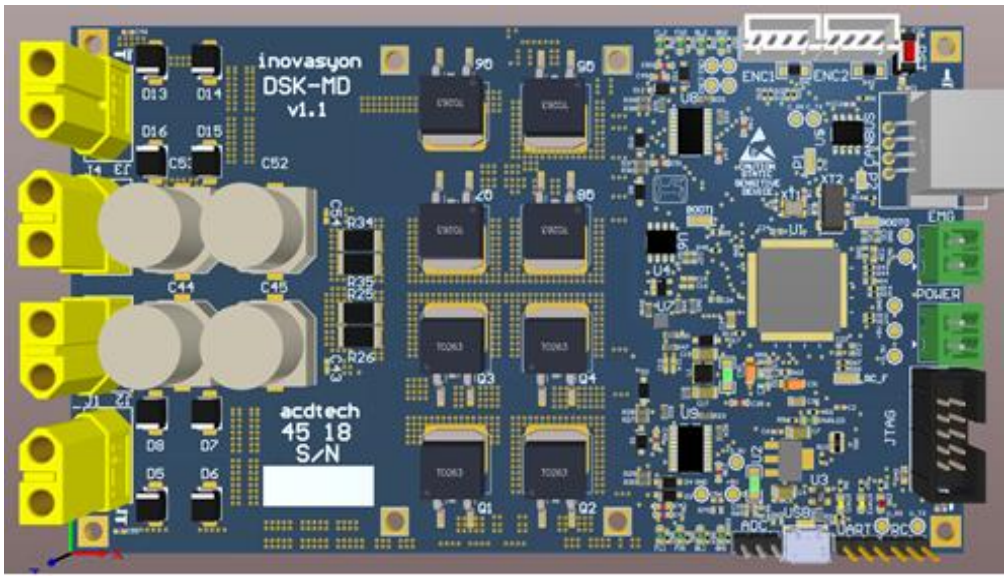

Figure 4 DSK_MD Board For Driven two 24V/60A Brushed DC Motors

In Figure 4, U7 is PAC1934 energy monitor IC and U4 is DS1775 Temperature sensor, U6 is the AT24C128 EEPROM.

Implemented Board is given in Figure 5.

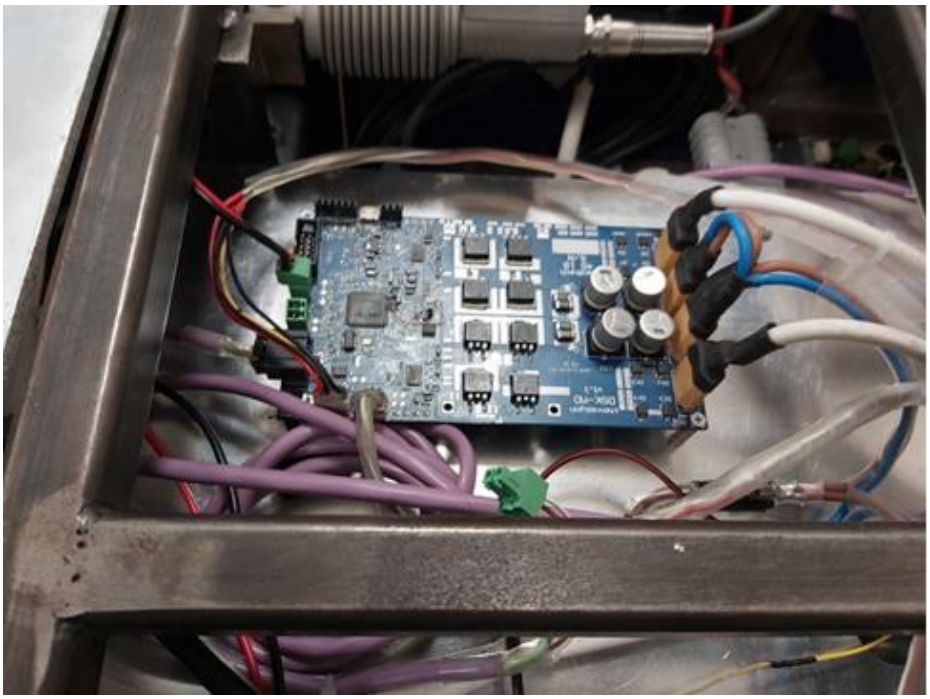

Figure 5 DSK_MD Motor Controller Implemented Board

2.1.1.3. Implemented Boards

The Implemented System with Connection Box, DSK_MD and DSK_M Board is given in Figure 6.

Figure 6 Impelementation System

The controlled for the integrated circuit, we need to use the truth table for the switching measurement channels. The output of the MUX is connected to the analog signal measurement of DSK_M Board.

As a result, DKM_Board is gathering all datas from ADC, CANBUS, I2C etc. These datas is sent from ETHERNET every second with 16-to-1 MUX measurements and DSK_MD measurement datas.

The Implemented Connection Box is given in Figure 7.

Figure 7 Implemented Conenction Box

The Ethernet TCP/IP datas is sending with circumtance as second:

- **First:** C8 channel measurement (12480 sample)
- **Second:** C8 channel measurement (another 12480 sample)
- **Third:** C9 channel measurement (12480 sample)
- **Fourth:** C9 channel measurement (another 12480 sample)
- **Fifth:** C10 channel measurement (12480 sample)
- **Seventh:** C10 channel measurement (another 12480 sample)
- **Eighth:** C11 channel measurement (12480 sample)
- **Ninth:** C11 channel measurement (another 12480 sample)
- The datas is sending JSON format from Ethernet TCP/IP.

C8, C9, C10 and C11 channels is sending as the same JSON format.

The Ethernet format example is given Appendix 1.

2.1.2. Sensors

2.1.2.1. Connection Box (3)

16-to-1 MUX (CD74HC4067) is controlled with five GPIOs (Figure 2) and measurement signal with ADC (PC2). Therefore, the board switching speed is approximately 100 us. That is why, the board is used to control with given below truth table (Table 2) to pay attention switching time.

S0	**S1**	**S2**	**S3**	**~EN**	**SELECTED CHANNELS**
X	X	X	X	1	None
0	0	0	0	0	C0
1	0	0	0	0	C1
0	1	0	0	0	C2
1	1	0	0	0	C3
0	0	1	0	0	C4
1	0	1	0	0	C5

0	1	1	0	0	C6
1	1	1	0	0	C7
0	0	0	1	0	C8
1	0	0	1	0	C9
0	1	0	1	0	C10
1	1	0	1	0	C11
0	0	1	1	0	C12
1	0	1	1	0	C13
0	1	1	1	0	C14
1	1	1	1	0	C15

Table 2: *Truth table*

According to upper truth table, Connection channel table is given in Table 3.

CHANNEL	**Measurement Point**	**Data Value**	**Frequency**	**Data Number And Sensor**	**Accuracy**
C0	DSK_M Power Temperature	0 – 3.3 V	1 Hz	1 LM35	(+/-) 0.4 °C
C1	Robot Back Temperature	0 – 3.3V	1Hz	1 LM35	(+/-) 0.4 °C
C2	Back Battery Pack	0 – 3.3 V	1 Hz	1 LM35	(+/-) 0.4 °C
C3	Right Motor Temperature	0 – 3.3V	1Hz	1 LM35	(+/-) 0.4 °C
C4	Front Battery Pack	0 – 3.3 V	1 Hz	1 LM35	(+/-) 0.4 °C
C5	Robot Front Temperature	0 – 3.3V	1Hz	1 LM35	(+/-) 0.4 °C
C6	Left Motor Temperature	0 – 3.3V	1Hz	1 LM35	(+/-) 0.4 °C
C7	Battery charging current	0 – 3.3V	1Hz	1 ACS714	0.185 V/A (Vcc = 5V)
C8	Left Motor Sound	0 – 3.3V	0.1Hz	25620 LMV324	-
C9	Left Motor Vibration	0 – 3.3V	0.1Hz	25620 Piezo Disk	-

C10	Right Motor Sound	0 – 3.3V	0.1Hz	25620 LMV324	-
C11	Right Motor Vibration	0 – 3.3V	0.1Hz	25620 Piezo Disk	-
C12	Empty Slot	-	-	-	-
C13	Empty Slot	-	-	-	-
C14	Empty Slot	-	-	-	-
C15	Empty Slot	-	-	-	-

Table 3: *Connection channel table*

2.1.2.2. Sensors Implementation

Implemented sensors are given in Figure 8, Figure 9, Figure 10, Figure 11, Figure 12, Figure 13, Figure 14, Figure 15 and Figure 16.

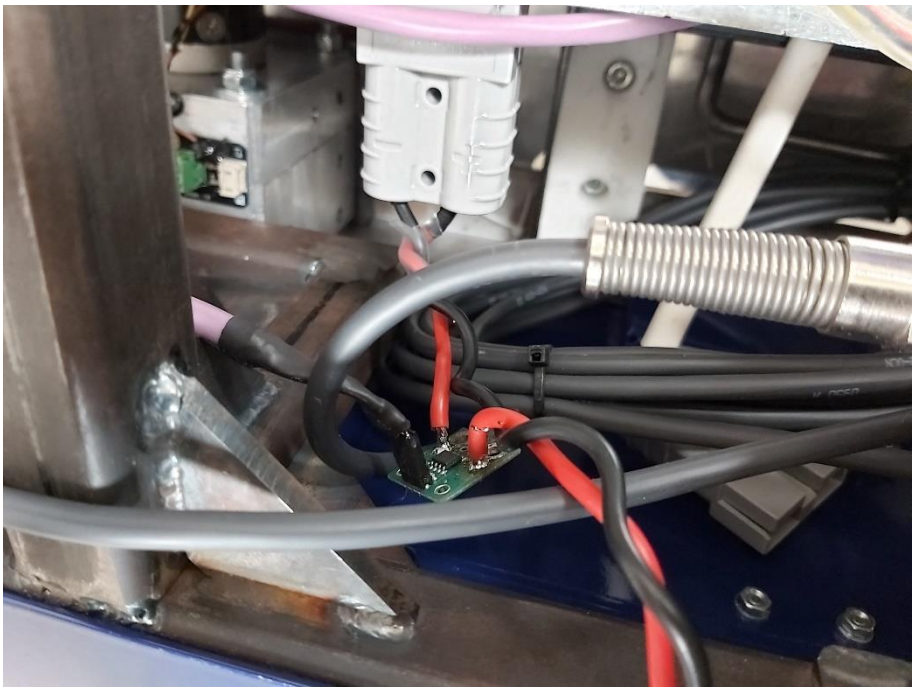

Figure 8 Channel 7 Battery Charge Current Sensor Implementation

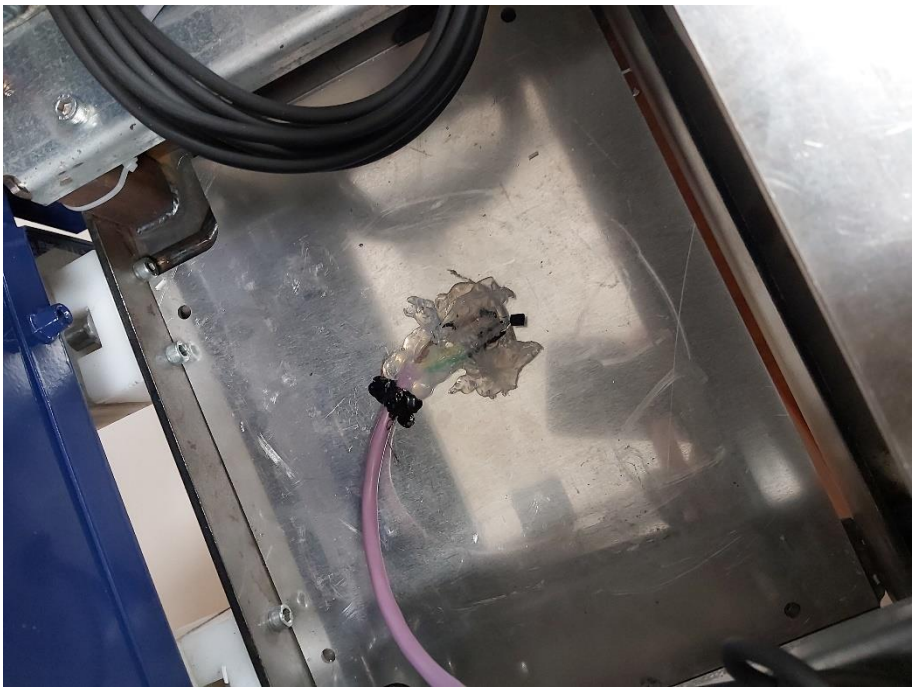

Figure 9 Channel 1 Robot Back Temperature Sensor Implementation

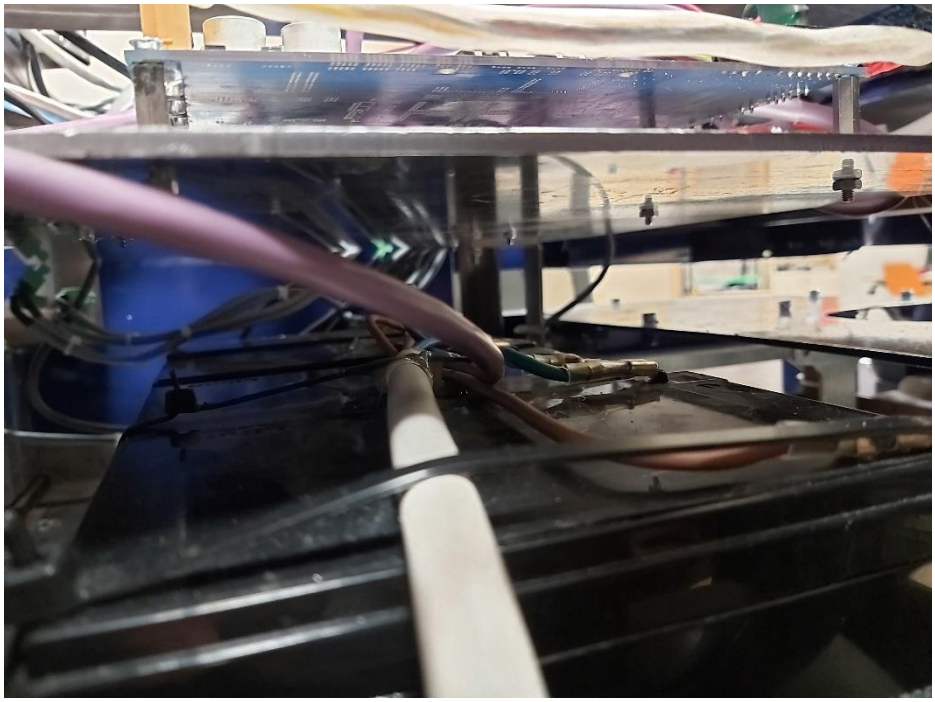

Figure 10 Channel 4 Robot Front Battery Pack Temperature Sensor Implementation

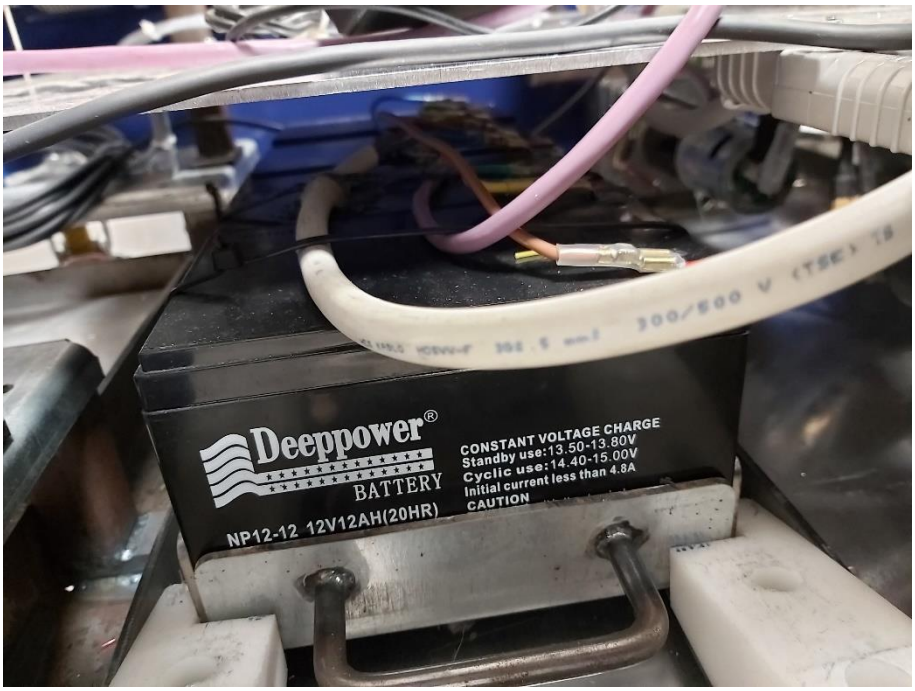

Figure 11 Channel 2 Back Battery Pack Temperature Sensor Implementation

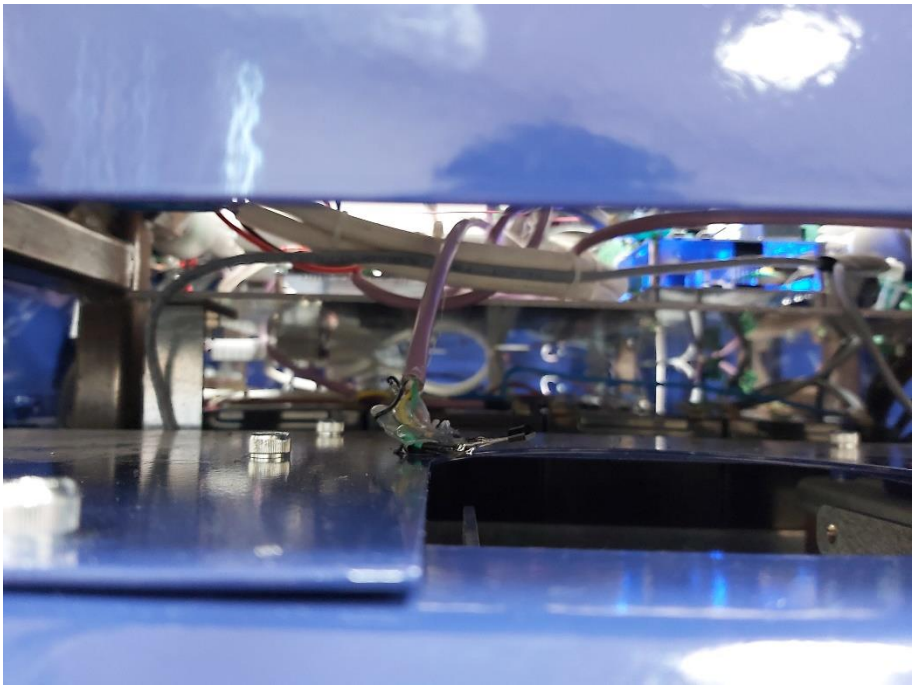

Figure 12 Channel 5 Robot Front Temperature Sensor Implementation

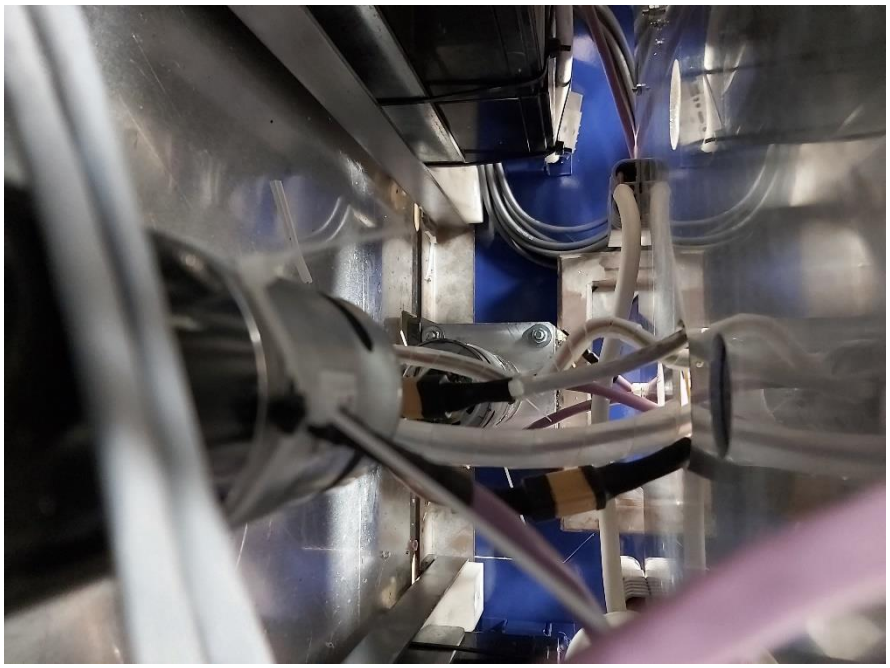

Figure 13 Channel 3 Right Motor Temperature Sensor Implementation

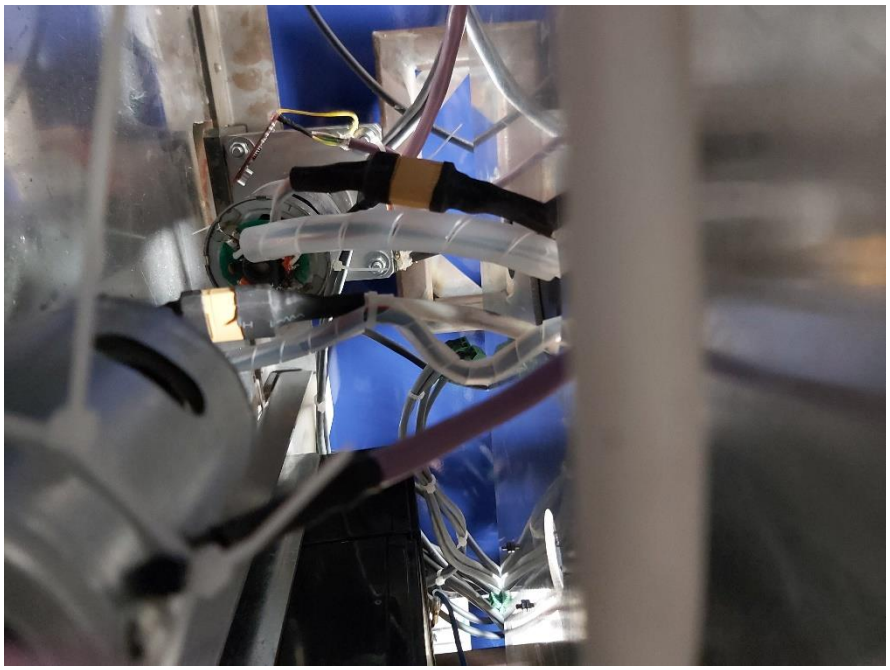

Figure 14 Channel 6 Left Motor Temperature Sensor Implementation

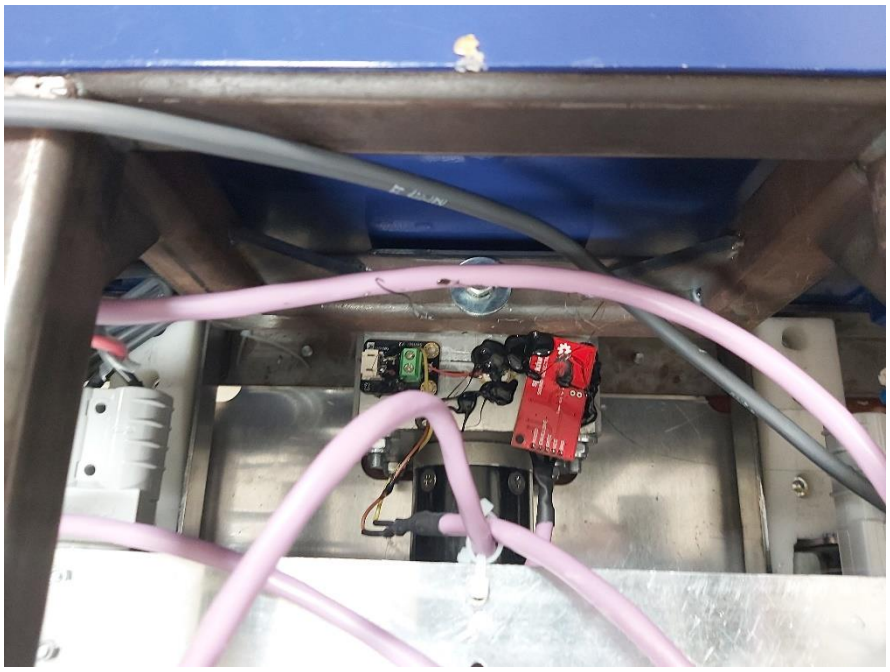

Figure 15 Channel 10(Sound Red Board) And Channel 11(Vibration Black Board) Right Motor Measurement Sensor Implementation

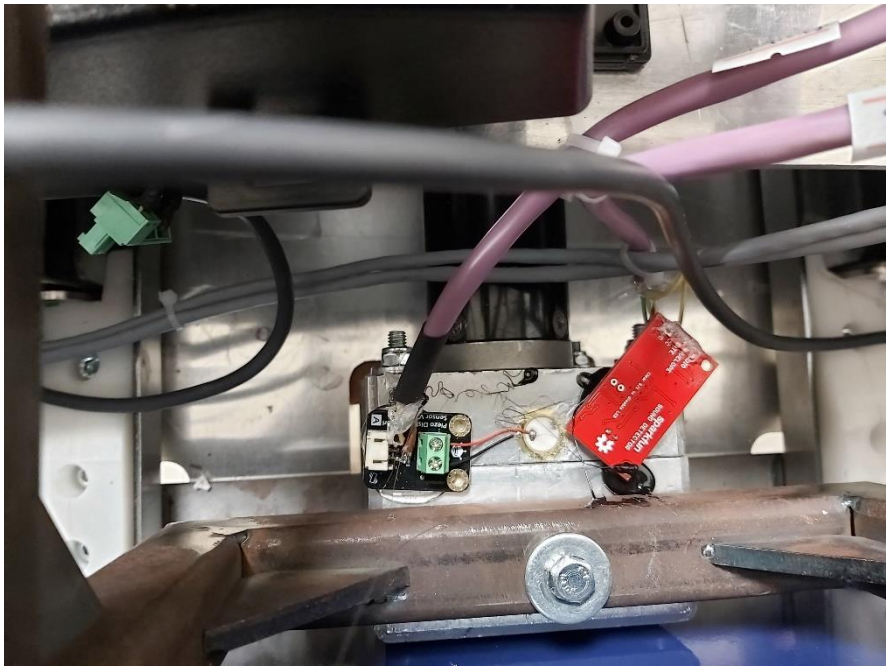

Figure 16 Channel 8(Sound Red Board) And Channel 9(Vibration Black Board) Left Motor Measurement Sensor Implementation

2.1.2.3. BME680 Environment Sensor

BME680 sensor is controlling via SPI protocol. The sensor figure is given in Figure 17.

Figure 17 BME680 Environment Sensor

BME680 measures environment quality that Temperature (-40°C – 80°C, accuracy: +/- 1°C), Humidity (0 – 100 %R.H., accuracy: +/- 3% R.H.), Pressure (300 – 1100 hPa, accuracy: +/- 0.6 hPa) and direct indoor air quality (IAQ) (0 – 500). The IAQ means is given in Table 4.

IAQ Index	**Air Quality**
0 – 50	Good
51 - 100	Average
101 - 150	Little bad
151 - 200	Bad
201 - 300	Worse
301 - 500	Very bad

Table 4: *The IAQ means*

2.1.3. High Level Controller Implementation

An Industrial PC is using as a High-Level Controller. This PC (Figure 18) has Ubuntu 16.04 as an operation system and ROS Kinetic as a robotic middleware. Low level controller data is publishing from ROS topics with using ROS middleware to the High-level controller system. High level and low level communicate with using two communication protocols. They are Ethernet Communication Protocol and CANBUS Protocol.

Figure 18 High level controller Industrial PC Inselberg Pro2000

Kvaser Leaf HS v2 USB CAN interface (Figure 19) is using between high level and low level. CANBUS communication protocol used for encoder data and reference velocity commands.

Figure 19 Kvaser Leaf HS v2 USB CAN interface

Low level CANBUS communication data is given in Table 5 with Can id and data.

Can Id	Data
702	Rigt Encoder, Left Encoder, Robot Time

Table 5: *Low level CANBUS communication data*

Encoder data is publishing from "/robot_low" topic. It use agv_msgs/Robot Low message type (see Table 6).

Message Type	Message	High Level Data
agv_msgs/RobotLow	int16 encoder_left	Left encoder
	int16 encoder_right	Right encoder
	uint16 robot_counter	Robot time

Table 6: *agv_msgs/RobotLow Message information*

High level controller calculates positioning and applied velocities from this encoder data. And it save and publish positioning and applied velocities from "/odom" topic. Calculations are given below.

$$displacement = \frac{\big((t) - (t-1)\big) * 2 * pi}{1892} * wheelradius$$

$$wheeldisplacement = \frac{\big(encoder(t) - encoder(t-1)\big) * 2 * pi}{1892} * wheelradius$$

$$\left((t) - encoder\,\frac{(t-1) * 2 * pi}{1892}\right) - \left((t) - \frac{(t-1) * 2 * pi}{1892}\right) * wheelradius$$

$$\underset{atan}{Headingangledisplacement} = \frac{}{wheelseparation}$$

$$Centredisplacement = \frac{displacement + wheeldisplacement}{2}$$

$$Xdisplacement = Centredisplacement * cos\big(headingangle(t-1)\big)$$

$$Ydisplacement = Centredisplacement * sin\big(headingangle(t-1)\big)$$

$$X(t) = Xdisplacement + X(t-1)$$

$$Y(t) = Ydisplacement + Y(t-1)$$

$$Headingangle(t) = Headingangledisplacement + Headingangle(t-1)$$

$$Quaternionz = sin(Headingangle(t) * 0.5)$$

$$Quaternionw = cos(Headingangle(t) * 0.5)$$

$$linearvelocity(t) = \frac{displacement}{\left(\frac{robottime(t) - robottime(t-1)}{1000000}\right)}$$

$$wheellinearvelocity(t) = \frac{wheeldisplacement}{\left(\frac{robottime(t) - robottime(t-1)}{1000000}\right)}$$

$$Filteredlinearvelocity(t) = \frac{b1}{a1} + linearvelocity(t) + \frac{b2}{a1} * linearvelocity(t-1) - \frac{a2}{a1} * linearvelocity(t-1)$$

$$Filteredwheellinearvelocity(t) = \frac{b1}{a1} + wheellinearvelocity(t) + \frac{b2}{a1} * wheellinearvelocity(t-1) - \frac{a2}{a1} * wheellinearvelocity(t-1)$$

$$Linearvelocity(t) = \frac{Filteredlinearvelocity + Filtered wheellinearvelocity}{2}$$

$$Angularvelocity(t) = \frac{Filtered wheellinearvelocity - Filteredlinearvelocity}{wheelseparation}$$

ROS Odometry data has nav_msgs/Odometry message type (see Table 7).

Message Type	**Message**	**High Level Data**
nav_msgs/Odometry	header uint32 seq	

	time stamp	Ros time
	string frame_id	odom
	string child_frame_id	
	pose	
	pose	
	position	
	float64 x	X
	float64 y	Y
	float64 z	0
	orientation	
	float64 x	0
	float64 y	0
	float64 z	Quaternion z
	float64 w	Quaternion w
	float64[36] covariance	
	twist	
	twist	
	linear	
	float64 x	linear veolcity
	float64 y	0
	float64 z	0
	angular	
	float64 x	0
	float64 y	0
	float64 z	Angular velocity
	float64[36] covariance	

Table 7: *nav_msgs/Odometry Message information*

Odometry data is saving to /home/probook/data/ directory on PC. Every time when robot is on, a csv document created on this directory. While creating csv document, document named as Year-month-day hour_minute_second-odometry.csv. Document includes ros time, right and left encoder data, x position of robot, y position of robot, heading angle of robot, linear velocity that robot applied, angular velocity that robot applied and saving data time as PC time (see Figure 20).

ROS TIME	Right Encoder	Left Encoder	X	Y	Heading Angle	Linear Velocity	Angular Velocity	Time
1575287615-991045719	719	1895	5.352209	0.8621	1.5697248849	0.0166268036	-0.3242380969	12:23:48.

Figure 20 Odometry data csv example

Velocity commands are publishing from "/cmd_vel" topic.

Message Type	Message	High Level Data
geometry_msgs/Twist	linear	
	float64 x	Reference Linear Velocity
	float64 y	
	float64 z	
	angular	
	float64 x	
	float64 y	
	float64 z	Reference Angular Velocity

Table 8: *geometry_msgs/Twist Message Informaiton*

High level controller PC is publishing limit parameters and reference velocity commands via CANBUS communication protocol. Can id and data are given in Table 9.

Can Id	Data
201	Max linear velocity limit, Max angularvelocity limit, System Reset, Max temperature limit, Operation continue temperature limit
205	Reference Linear Velocity
215	Reference Angular Velocity

Table 9: *CAN ID Data*

Other sensor data is publishing via Ethernet Communication. Ethernet communication Ip and Port is set to 192.168.3.1 and 4555. All data is sent in json format.

DSKM power temperature, robot back temperature, robot front temperature, battery back temperature, battery front temperature, motor right temperature, motor left temperature, DMD temperature, right motor voltage, current, power data, left motor voltage, current, power data, battery current, c12 channel voltage, c13 channel voltage, c14 voltage, c15 voltage are on same json.

{"C0":0.293758,"C1":0.238032,"C2":0.226090,"C3":0.249973,"C4":0.232459,"C5":0.233255
,"C6":0.266691,"C7":0.531790,"C12":0.819179,"C13":0.822364,"C14":0.822364,"C15":0.82
3160,"DMD_Temp":28.875000,"DMD_V_M1":24.392000,"DMD_I_M1":0.000000,"DMD_
P_M1":0.000000,"DMD_V_M2":24.389999,"DMD_I_M2":0.000000,"DMD_P_M2":0.0000
00}

Figure 21 Robot data json example

This data is saving to /home/probook/data/ directory on PC. Every time when robot is on, a csv document created on this directory. While creating csv document, document named as Year-month-day hour_minute_second_all.csv.

DMD_V_M1	DMD_P_M2	DMD_Temp	DMD_P_M1	DMD_I_M1	C13	DMD_V_M2	DMD_I_M2	C14	C15	C12	C3	C2	C1	C0	C7	C6	C5	C4	Time
24.378	0	29.125	0	0	0.82	24.375	0	0.82	0.82	0.819	0.2	0.2	0.24	0.32	0.5	0.3	0.2	0.2	11:01:54.3

Figure 22 Robot data csv example

Each json object at Figure 21 publishes at ROS with a topic name. Each json object and its topic name are given in Table 10.

Json Object Name	Topic name	Message Type
C0	DSKM_power_temperature	sensor_msgs/Temperature
C1	robot_back_temperature	sensor_msgs/Temperature
C5	robot_front_temperature	sensor_msgs/Temperature
C2	battery_back_temperature	sensor_msgs/Temperature
C4	battery_front_temperature	sensor_msgs/Temperature
C3	motor_right_temperature	sensor_msgs/Temperature
C6	motor_left_temperature	sensor_msgs/Temperature
DMD_Temp	DMD_temperature	sensor_msgs/Temperature
DMD_V_M1 DMD_I_M1 DMD_P_M1	motor_right_data	agv_msgs/TotalData
DMD_V_M2 DMD_I_M2 DMD_P_M2	motor_left_data	agv_msgs/TotalData
C7	battery_current	agv_msgs/CurrentData
C12	c12_voltage	agv_msgs/VoltageData
C13	c13_voltage	agv_msgs/VoltageData
C14	c14_voltage	agv_msgs/VoltageData
C15	c15_voltage	agv_msgs/VoltageData

Table 10: *JSON Object and their topic names*

Robot's left voice, right voice, left vibration and right vibration sensor data is publishing via Ethernet and they are continuous data. Each sensor data is collected and send as 30 array data.

{"C8":{"60":[67,77,58,89,79,72,73,77,108,72,64,74,64,71,70,84,73,100,84,63,59,64,76,74,80
,77,69,73,67,69]}}

{"C8":{"90":[64,74,77,65,73,77,82,75,67,70,64,69,74,85,75,94,93,58,65,68,73,69,74,78,72,8
0,73,75,58,88]}}

Figure 23 Robot left voice sensor data example

Figure 23 is left voice json data. C8 is its object name, it means the json data belongs to left voice sensor. 60 and 90 objects are array's row. This can continuous to 12780. Then reset to 0 again and 12780 rows of data are sent again. This is the same for right voice data, left vibration and right vibration. Each sensor data is saving to /home/probook/data/ directory on PC. Every time when robot is on, a csv document created on this directory. While creating csv document, document named as Year-month-day hour_minute_second_c8.csv, Year-month-day hour_minute_second_c9.csv, Year-month-day hour_minute_second_c10.csv, Year-month-day hour_minute_second_c11.csv.

C8 Data Row Value	Data 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Time
0	78	74	91	87	79	75	50	76	72	71	76	61	73	77	76	59	70	93	80	59	66	64	70	72	80	76	76	76	82	70	11:02:39.4

Figure 24 Robot left voice data csv example

C9 Data Row Value	Data 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Time
0	119	121	119	135	140	139	120	124	144	140	144	130	144	138	149	141	133	136	153	139	132	136	148	147	144	150	116	174	145	148	12:04:22

Figure 25 Robot left vibration data csv example

C10 Data Row Value	Data 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Time
0	73	84	81	81	90	94	86	78	68	84	81	90	81	78	88	59	85	82	79	81	82	81	80	81	84	79	78	91	53	91	12:04:25

Figure 26 Robot right voice data csv example

C11 Data Row Value	Data 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Time
0	122	144	125	97	150	140	136	138	125	115	137	124	134	131	152	145	141	138	133	134	134	142	144	140	137	151	148	136	133	153	12:04:16.

Figure 27 Robot right vibration data csv example

Json object names and meanings are given in Table 11.

Json Object Name	**Topic name**	**Message Type**
C8	robot_left_voice	std_msgs/String
C10	robot_right_voice	std_msgs/String
C9	robot_left_vibration	std_msgs/String
C11	robot_right_vibration	std_msgs/String

Table 11: *Json object names and meanings*

Message types and its contents are given in Table 12.

Message Name	**Message Data**	**High Level Data**
sensor_msgs/Temperature	header uint32 seq time stamp string frame_id float64 temperature float64 variance	 Ros time Temperature data
std_msgs/String	string data	Array Data as string
agv_msgs/TotalData	time stamp float32 voltage_data float32 current_data float32 power_data	Ros time Voltage data Current data Power data
agv_msgs/CurrentData	time stamp float32 current_data	Ros time Current data
agv_msgs/VoltageData	time stamp float32 voltage_data	Ros time Voltage data

Table 12: *Message types and contents*

2.2. PHM Tool and Sensor Data

Various sensors on OTA are used to analyze the effect of the data from the environment (temperature, humidity, vibration, voltage, current etc.) on OTA. Data from these sensors are published from ROS topics and subscribed to these topics via the PHM Tool to calculate the impact of sensor data on system failure rate and reliability.

Subscribing to the sensor data broadcasted in real time over OTA and using this data is explained in the video in the PHM Tool - Monitoring & Analysis link.

The sensor types on the OTA and their ROS equivalent are included in Table 13.

ROS Topic Name	ROS Message Type
power_card_temperature	sensor_msgs/Temperature
robot_back_temperature	sensor_msgs/Temperature
robot_front_temperature	sensor_msgs/Temperature
battery_back_temperature	sensor_msgs/Temperature
battery_front_temperature	sensor_msgs/Temperature
motor_right_temperature	sensor_msgs/Temperature
motor_left_temperature	sensor_msgs/Temperature
motor_controller_temperature	sensor_msgs/Temperature
motor_right_information	agv_msgs/TotalData
motor_left_information	agv_msgs/TotalData
battery_current	agv_msgs/CurrentData
c12_voltage	agv_msgs/VoltageData
c13_voltage	agv_msgs/VoltageData
c14_voltage	agv_msgs/VoltageData
c15_voltage	agv_msgs/VoltageData
environment_information	agv_msgs/EnvironmentData

robot_left_voice	std_msgs/String
robot_right_voice	std_msgs/String
robot_left_vibration	std_msgs/String
robot_right_vibration	std_msgs/String

Table 13: *ROS Equivalents of Sensor Types in OTA*

The sensors in Table 13 are located in different modules on OTA.

- Data from the sensors in the power module are obtained by subscribe to the topics "/battery_back_temperature", "/battery_front_temperature" and "/power_card_temperature". The process of adding these sensors to the power module is shown in Figure 28.

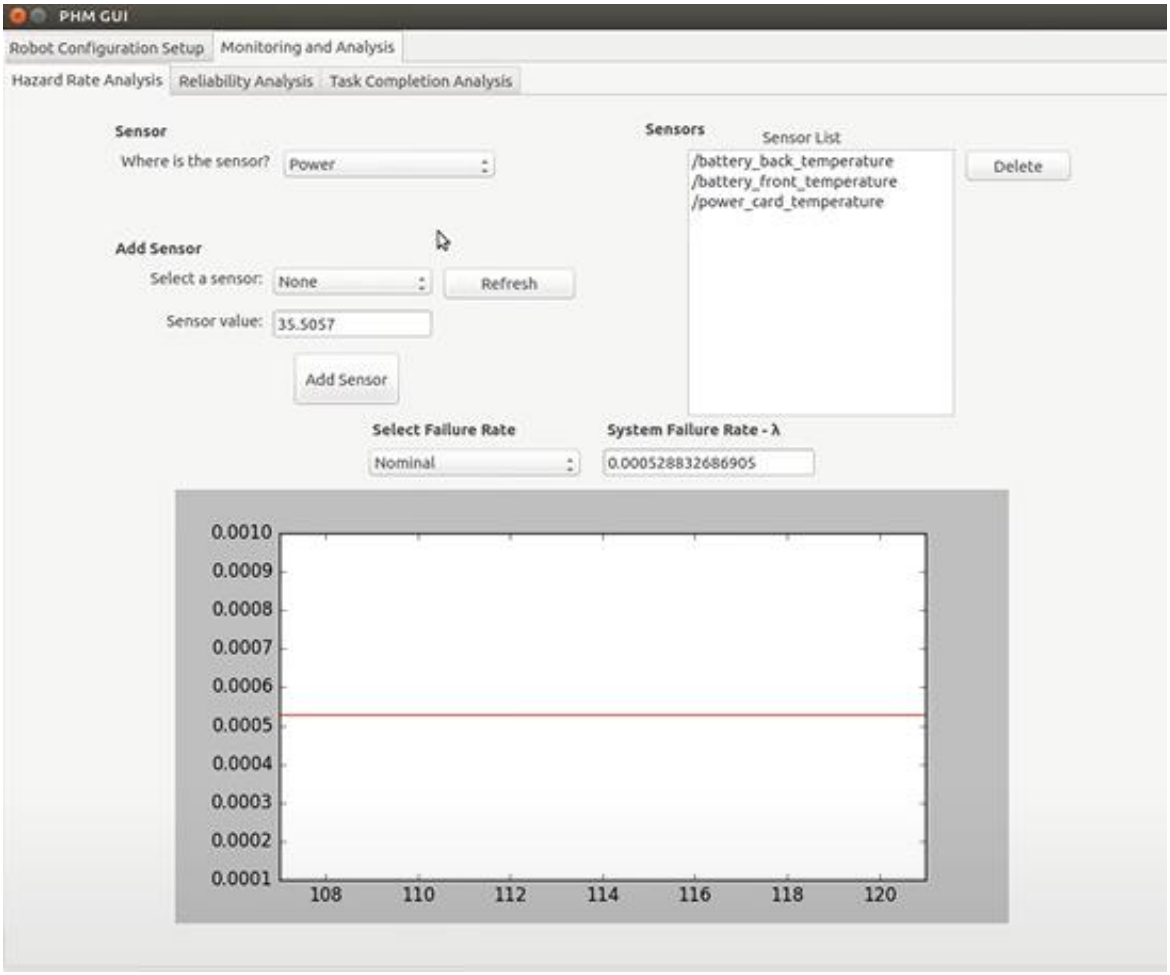

Figure 28 Adding sensors into the Power module

- Data from the sensors in the mobility module are obtained by subscribe to the topics "/motor_left_temperature " and "/motor_right_temperature ". The process of adding these sensors to the mobility module is shown in Figure 29.

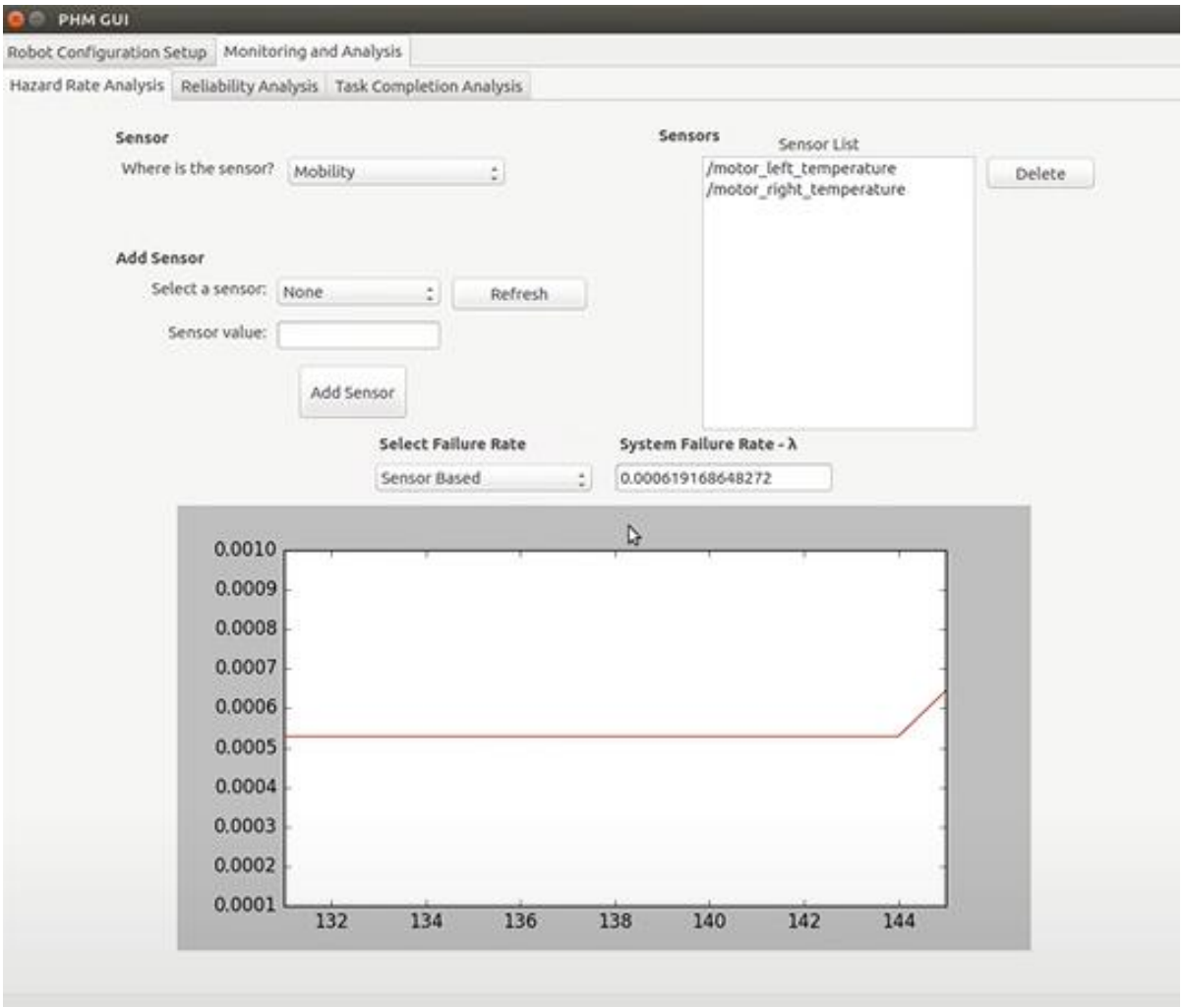

Figure 29 Adding sensors into the Mobility module

- The data from the sensor in the communication module is obtained by subscribe to the "/motor_controller_temperature" topic. The process of adding this sensor to the communication module is shown in Figure 30.

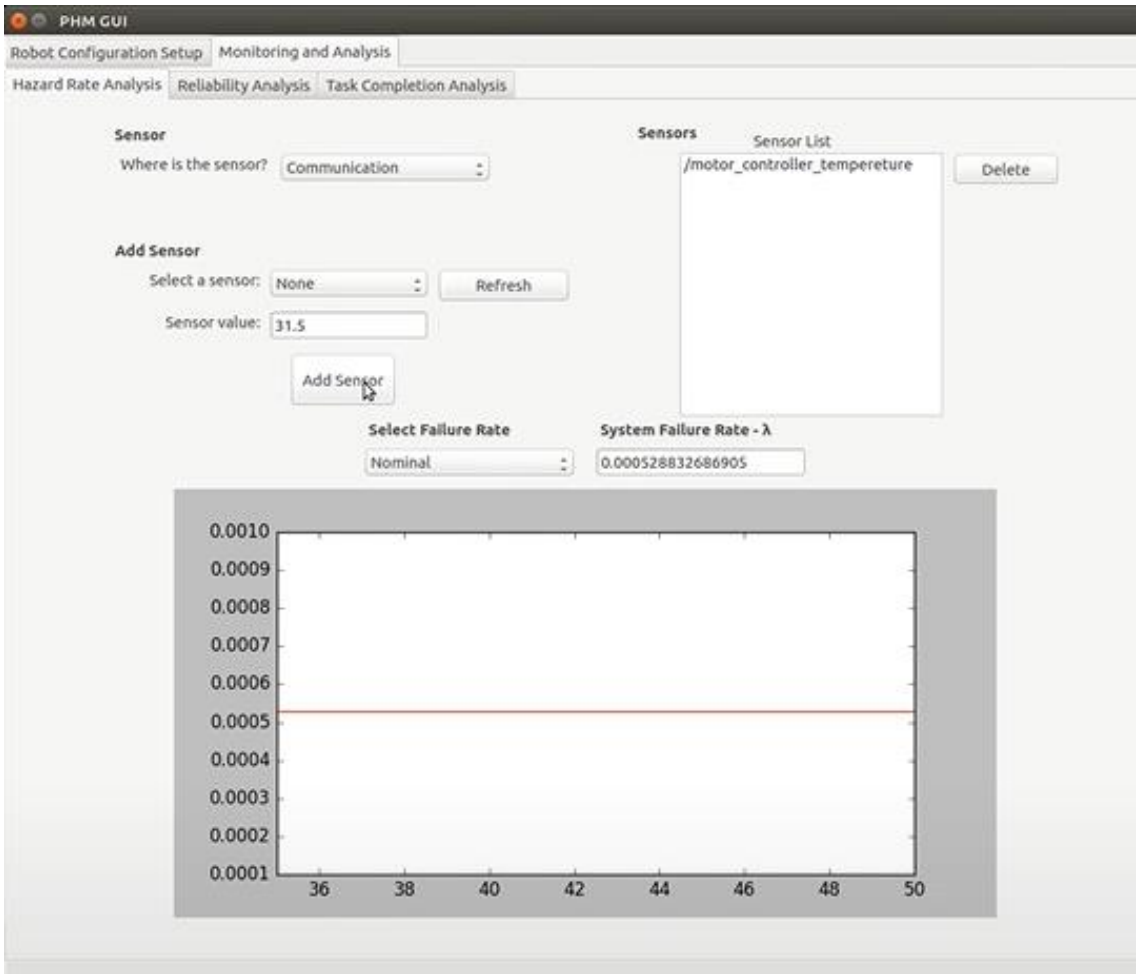

Figure 30 Adding sensors into the Communication module

- The data from the sensor in the Sensing module is obtained by subscribe to the "/robot_front_temperature" topic. The process of adding this sensor to the Sensing module is shown in Figure 31.

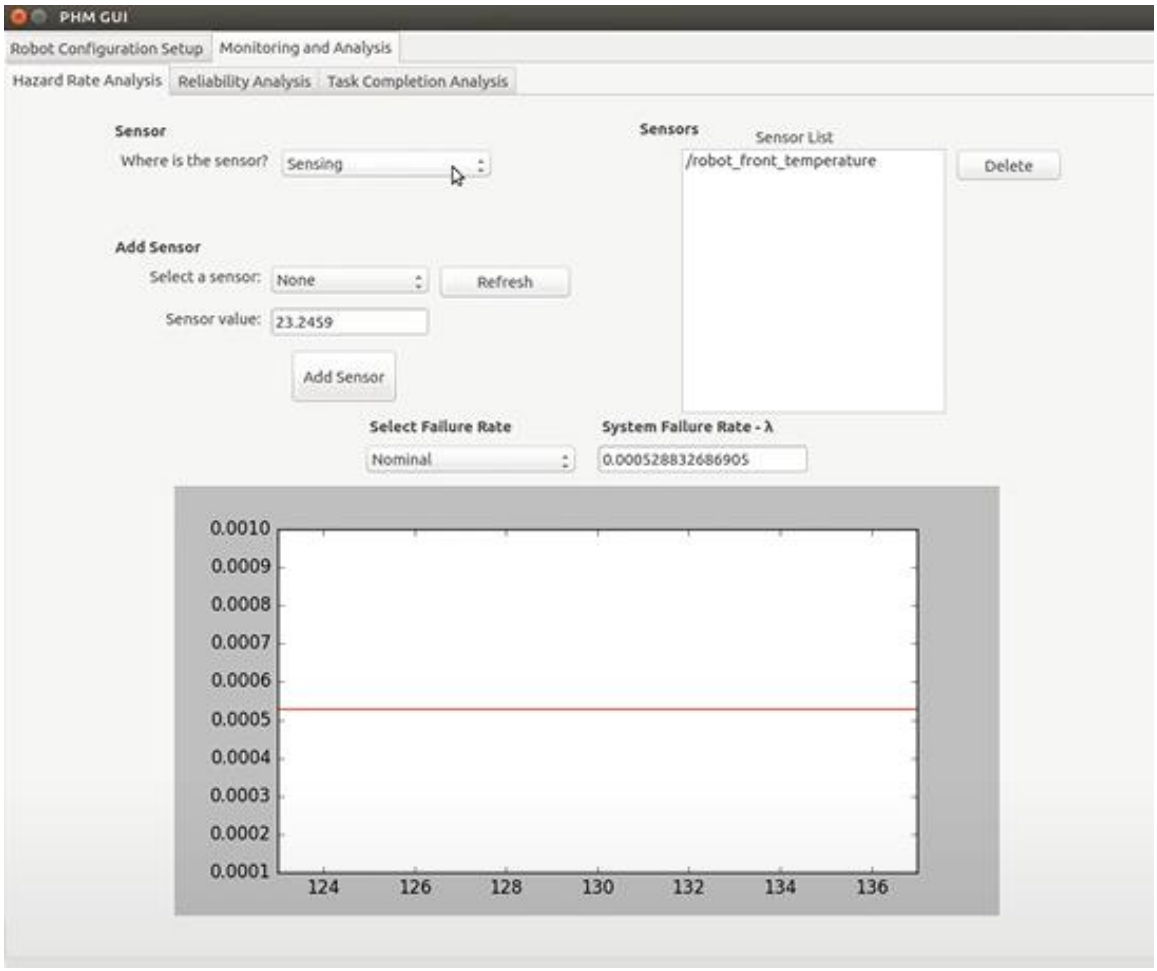

Figure 31 Adding sensors into the Sensing module

- The data from the sensor in the Computation module is obtained by subscribe to the "/robot_back_temperature" topic. The process of adding this sensor to the Computation module is shown in Figure 32.

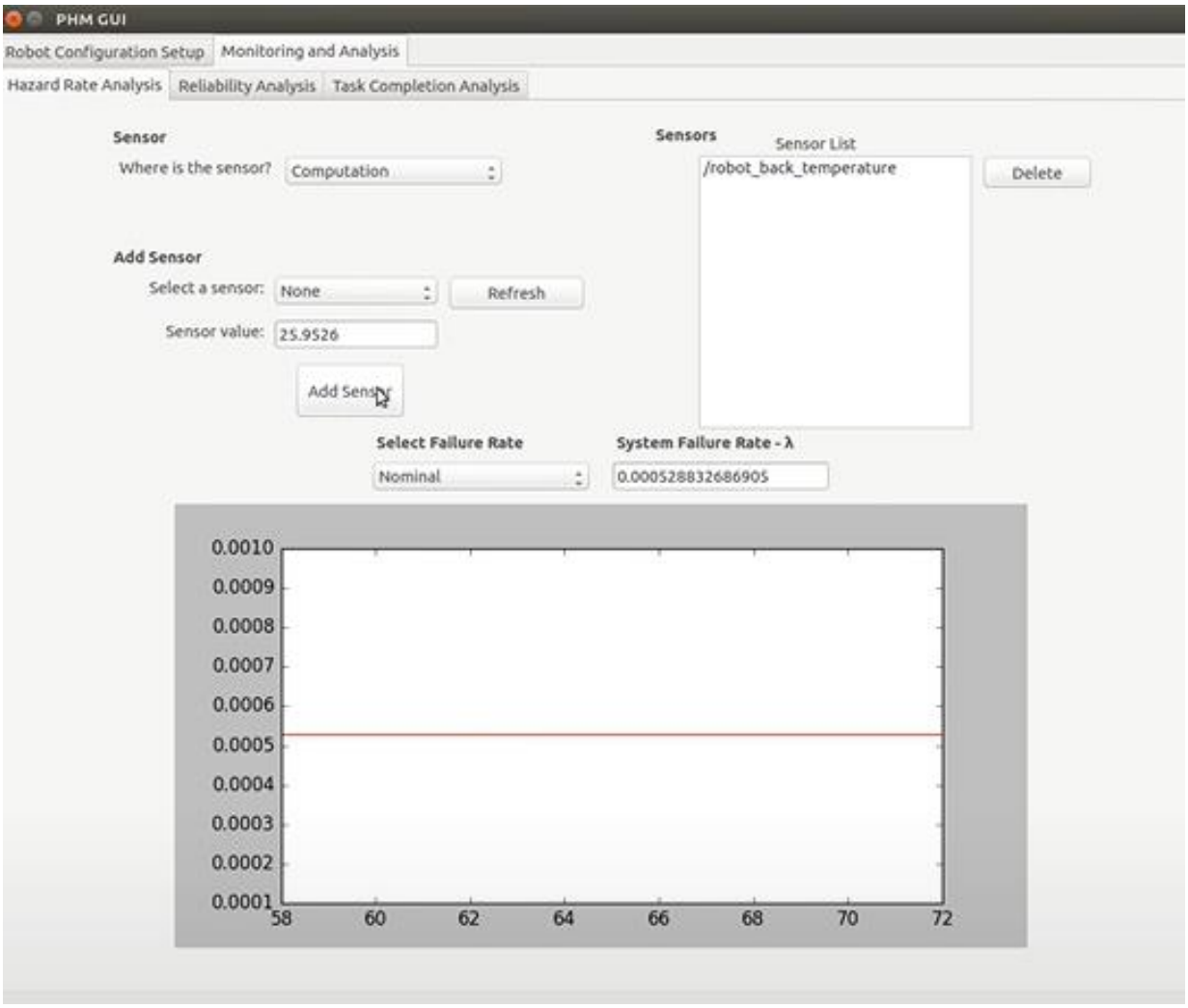

Figure 32 Adding sensors into the Computation module

- *In PHM Tool, calculation of sensor-based hazard rate and reliability values are done using temperature sensors only. These calculations' formulas are located in FailureRateCalculation class. In order to make these calculations by adding other sensor types (load, humidity, etc.), the sensor type must be specified as input by the user in the interface. Since PHM Tool is open source software, the user can make the necessary arrangements in the interface and create the necessary functions in the FailureRateCalculation class.*

3. Robot Design and Configuration

Since PHM Tool is a modular tool, each of the modules, submodules and components in OTA must be added in this tool. OTA design is done by adding modules, submodules and components in PHM Tool.

OTA should be configured by making physical arrangements of these added parts according to each other. As a result of the design and configuration of OTA in the PHM Tool, the hazard rate and failure rate values of the system are calculated. Detailed explanations of these processes are explained in detail in PHM Tool User Guide [1] document.

3.1. OTA Design

OTA on the modules, sub-modules, component, their amounts and PHM Tool, calculated for the failure by one of the rate values are shown in Table 2. OTA design is done in the "Robot Design" tab under the "Robot Configuration Setup" tab in the PHM Tool. All operations performed on the "Robot Design" tab are described in the PHM Tool User Guide [1] document under title 3.3.1.

At the same time, the design procedures in the PHM Tool use case scenario for OTA are described in the video on the PHM Tool - Robot Design link.

Modules	Sub-modules	Components	Quantity	Failure Rate (for 1 component)
Power	Battery	-	4	2,00E-08
	Battery Control Board	Capacitor	28	9,36E-06
		Thermistor	9	7,33E-06
		Diode	16	6,25E-07
		LED	9	5,00E-06
		Resistor	26	1,33E-07
		Trimpot	3	2,42E-06
		Step Down Switching Regulator	7	3,96E-07
		Terminal Blocks/Connector	9	2,21E-06
		Connector/Socket	1	1,18E-07
		Inductor	7	5,80E-08
		Current Sensor	2	2,50E-07
		Female Header	1	1,90E-06
	Low Level Control Unit: DSK-MD	XT60 Socket	4	7,53E-08
		Zener Diode	4	1,77E-07
		Ultrafast Diode	4	5,29E-07
		Aluminum Capacitor	4	1,40E-07
		Micro USB Connector	1	6,07E-07
		16MHz Cryst. Osc.	1	1,77E-06
		32.768Khz Cryst. Osc.	1	4,26E-07

		Resistors	65	4,99E-07
		STM32F407VGT6	1	1,00E-08
		Resettable Fuse	2	2,30E-06
Sensing	SICK Laser Sensor	-	1	8,00E-08
	IPS	Antenna	1	5,80E-07
		Micro USB Connector	1	6,07E-07
		DW1000 Chip	1	8,60E-08
		Resistor	5	4,46E-07
		Capacitor	5	9,36E-07
	Camera	-	1	5,88E-09
Communication	Communicaton Card: DSK-M	Resistor	9	4,53E-07
		Capacitor	9	1,66E-07
		25MHz Crystal Oscillator	1	6,54E-06
		16Mhz Crystal Oscillator	1	5,90E-07
		STM32F407VGT6	1	2,30E-07
		SN65HVD230DR	1	1,70E-07
		Fuse	4	8,00E-08
		LAN8720A-CP	1	5,90E-07
		Micro USB Connector	1	2,43E-06
	Antenna	-	1	7,50E-07
Mobility	Encoder	-	2	5,80E-06
	Driver wheel	-	2	1,80E-07
	Caster wheel	-	4	6,80E-06
	DC Motor	-	2	8,04E-06
	Bearing	-	4	3,61E-11

Computaion	YSK-M: High Level Control Unit	Inno-Box Industrial Box PC	1	6,50E-08
	YSK-G: Vision Control Unit	NVIDIA JETSON TX2	1	5,00E-08

Table 14: Modules, sub-modules and components list of OTA with component failure rates

3.2. OTA Configuration

PHM equipment located in each of the OTA Tool "After Robot Design" tab added, in order to calculate the total failure rate of the system must be configured and Reliability value of the system.

OTA is configured in the "Configuration Setup" tab under the "Robot Configuration Setup" tab in the PHM Tool. All operations performed on the "Configuration Setup" tab are described in the PHM Tool User Guide [1], in the title 3.3.2.

At the same time, the configuration procedures in the PHM Tool use case scenario for OTA are described in the video on the PHM Tool - Robot Configuration link.

In this document, section 3.2.1. describes the process of configuring the components in OTA. In section 3.2.2. the procedures for configuring the submodules in OTA are described. In section 3.2.3. lastly, the procedures for configuring the modules in OTA are explained.

3.2.1. Sub-Module Configuration of OTA

When configuring the system, the components must be configured first. As a result of configuring the components, the failure rate values of the sub-module containing the components are calculated. If there is no component under a sub-module, the failure rate of this sub-module is known and its configuration is not needed.

Module	**Sub-Module**	**Calculated Failure Rate After Configuration**
Power Module	Battery Control Board	0.0004193481212699
	Low Level Control Unit: DSK-MD	4.3225406177125e-05
	Battery	8.0e-08
Sensing	SICK Laser Sensor	8.0e-08
	IPS	8.1811842e-06
	Camera	5.88e-09
Communication	Communicaton Card: DSK-M	9.8745744208149e-06
	Antenna	7.5e-07
Mobility	Encoder	1.16e-05
	Driver wheel	3.6e-07
	Caster wheel	2.72e-05
	DC Motor	1.6082006e-05
	Bearing	1.44504e-10
Computation	YSK-M: High Level Control Unit	6.5e-08
	YSK-G: Vision Control Unit	5.0e-08

Table 15: Sub-modules in OTA and their failure rate values

Table 15 shows the values of the failure rate values of all sub-modules in OTA after the configuration process.

3.2.1.1. Battery Control Board Submodule Configuration

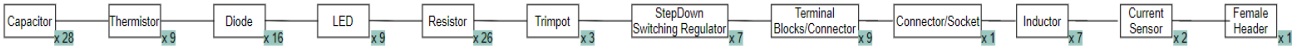

Figure 33 Battery Control Board Sub-module Configuration

To calculate for failure rate of the Battery Control Board submodule, the components in this submodule must be configured. In OTA, the components in this submodule are serially configured to each other as in Figure 33.

3.2.1.2. Low Level Control Unit: DSK-MD Submodule Configuration

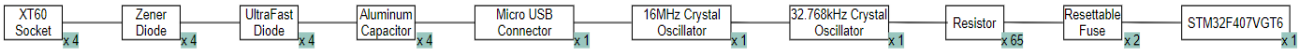

Figure 34 Low Level Control Unit: DSK-MD Sub-module Configuration

Low Level Control Unit: In order to calculate the failure rate of DSK-MD submodule, the components in this submodule must be configured. In OTA, the components in this submodule are serially configured to each other as in Figure 34. The reason it is configured in this way is to ensure that all components operate successfully.

3.2.1.3. IPS Submodule Configuration

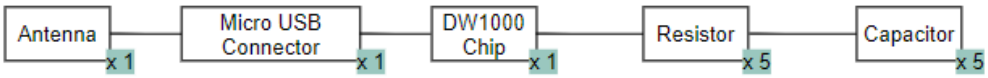

Figure 35 IPS Sub-module Configuration

IPS (Indoor Positioning System) to calculate the value of the failure rate of the component submodules must be configured in this submodules. In OTA, the components in this submodule are serially configured to each other as in Figure 35. The reason it is configured in this way is to ensure that all components operate successfully.

3.2.1.4. Communicaton Card: DSK-M Submodule Configuration

Figure 36 Communication Card: DSK-M Sub-module Configuration

Communicaton Card: In order to calculate the failure rate of DSK-M submodule, the components in this submodule must be configured. In OTA, the components in this submodule are serially configured to each other as in Figure 36. The reason it is configured in this way is to ensure that all components operate successfully.

3.2.1.5. YSK-M: High Level Control Unit Sub-module Configuration

YSK-M: High Level Control Unit sub-module contains only 1 component, Inno-Box Industrial Box PC. Therefore, this sub-module does not need to be configured. YSK-M: The failure rate of the High Level Control Unit sub-module is calculated the same as the failure rate of the Inno-Box Industrial Box PC component.

3.2.1.6. YSK-G: Vision Control Unit

YSK-G: Vision Control Unit sub-module contains only 1 component, NVIDIA JETSON TX2. Therefore, this sub-module does not need to be configured. YSK-G: The failure rate value of the Vision

Control Unit sub-module is calculated the same as the failure rate value of the NVIDIA JETSON TX2 component.

- *Battery, SICK laser sensor, Camera, Antenna, Encoder, Drive wheel Castor wheel, DC motors and for Bearing sub-module of failure rate values PHM Tool entered and below is not needed configuration since any component available.*

3.2.2. Module Configuration of OTA

Sub-modules should be configured after the components are configured. As a result of configuring the sub-modules, the failure rate values of the modules containing the sub-modules are calculated. If there is no sub-module under a module, its failure rate is known and its configuration is not needed.

Module	**Calculated Failure Rate Value After Configuration**	**Calculated Reliability Value After Configuration**
Power Module	0.000462653527447025	0.6296107375618971
Sensing	8.238437533333333e-06	0.9917954053917838
Communication	1.06245744208149e-05	0.989431667013337
Mobility	4.7201147504000006e-05	0.9538955045917938
Computation	1.15e-07	0.9998850066122466

Table 16: *Modules in OTA and their failure rate and reliability values*

Table 16 shows the failure rate and reliability values of all modules in OTA after the configuration process.

3.2.2.1. Power Module Configuration

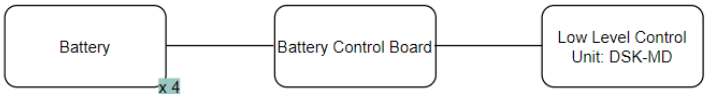

Figure 37 Power Module Configuration

To calculate the failure rate of the power module, the sub-modules in this module must be configured. In OTA, the sub-modules in this module are configured serially to each other as in Figure 37. The reason it is configured in this way is to ensure that all sub-modules work successfully.

3.2.2.2. Sensing Module Configuration

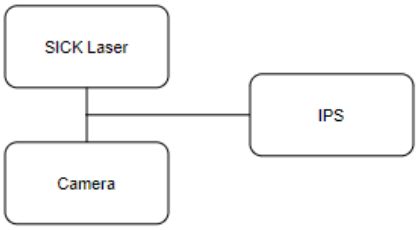

Figure 38 Sensing Module Configuration

To calculate the failure rate value of the Sensing module, the sub-modules in this module must be configured. SICK Laser and Camera in OTA are parallel to each other and IPS sensor is serially configured to them. The configuration of the sub-modules in the Sensing module is shown in Figure 38.The reason for configuring the SICK Laser and Camera in parallel is that when one of these two sub-

modules fails, the other can continue the operation of the system.However, a malfunction in the IPS sensor will affect the operation of the system.

3.2.2.3. Communication Module Configuration

Figure 39 Communication Module Configuration

To calculate the failure rate of the communication module, the sub-modules in this module must be configured. In OTA, the sub-modules in this module are serially configured to each other as in Figure 39. The reason it is configured in this way is to ensure that all sub-modules work successfully.

3.2.2.4. Mobility Module Configuration

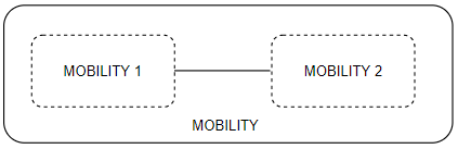

Figure 40 Mobility Module Configuration (a)

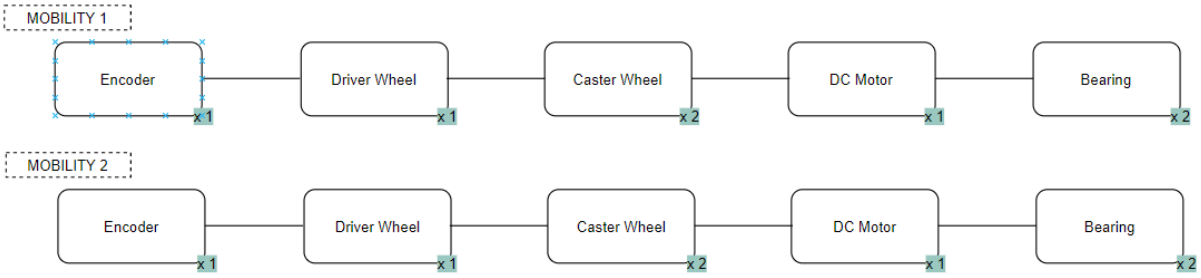

Figure 41 Mobility Module Configuration (b)

Mobility module has a different structure than other modules in OTA. Figure 40 and Figure 41 show the configuration for the left and right parts of OTA separately. The seriality of Mobility1 and Mobility 2 is equivalent to the seriality of the sub-modules within them. Since a malfunction in Mobility 1 or Mobility 2 will also cause a malfunction in the system, it is configured as series.

3.2.2.5. Computation Module Configuration

Figure 42 Computation Module Configuration

To calculate the failure rate of the Computation module, the sub-modules in this module must be configured. In OTA, the sub-modules in this module are configured serially to each other as in Figure 42. The reason it is configured in this way is to ensure that all sub-modules work successfully.

3.2.3. System Configuration of OTA

Modules must be configured after the sub-modules have been configured. As a result of configuring the modules, the overall failure rate of the system, that is, OTA, is calculated here.

Figure 43 System (OTA) Configuration

The modules in OTA are configured in series to each other as in Figure 43. The reason it is configured in this way is to ensure that the entire system operates successfully.

SYSTEM	Calculated Failure Rate Value After Configuration	Calculated Reliability Value After Configuration / 1000 hours
	0.0005288326869051733	0.589292457145637

Table 17: *Overall system failure rate and reliability value*

Table 17 shows the values of OTA's failure rate and reliability value after the configurations.

4. Monitoring and Analysis

In PHM Tool, after configuring the system and clicking the "Start Analysis" button, the hazard rate and reliability values are analyzed in real time. The results are displayed to the user as a graph in the interface in real time. PHM Tool sends the calculated values to the "phm_hazard_rate_calculation_node" and "phm_reliability_estimation_node" nodes.

In the "Task Completion Analysis" tab, the real-time task performance ratios of mobile robots are analyzed and predicted. In addition, further simulation of a certain task is made and the results are presented to the user in the form of graphs. Also, the analyzed values are sent to the "phm_robot_task_completion_node".

In the "Hazard Rate Analysis" tab, the failure rate values of the system and the modules in the system are calculated in real time. The user can analyze his system in more detail by adding sensors to the modules in the system. If sensors are added to the modules in the system, the results are presented to the user as "Sensor Based" by selecting the failure rate type from the interface. The process of calculating and displaying hazard rate values is shown in Figure 44. Sensors which are coming from rosbag to the modules in the system are shown in Figure 45. The calculated values are published with "std_msgs/String" message type from the "/gui_hazard_rate" topic. "phm_hazard_rate_calculation_node" subscribes to this topic and the hazard rate values are filtered. The filtered hazard rate values are published in real time with "phm_msgs/HazardRate" message type from the "/phm_hazard_rate" topic. This structure is shown in Figure 46 and published values are shown in Figure 47.

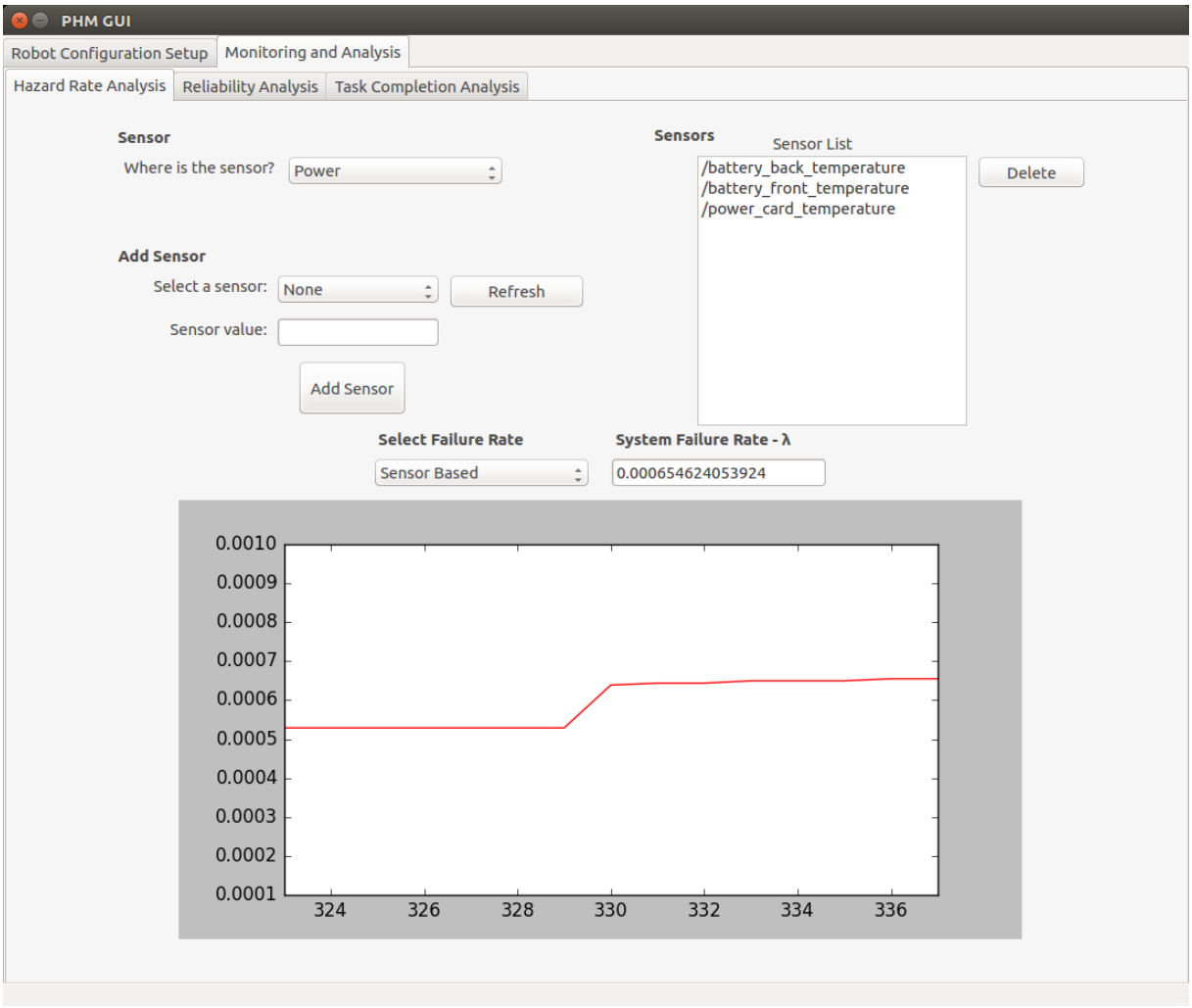

Figure 44 Hazard Rate Analysis Tab

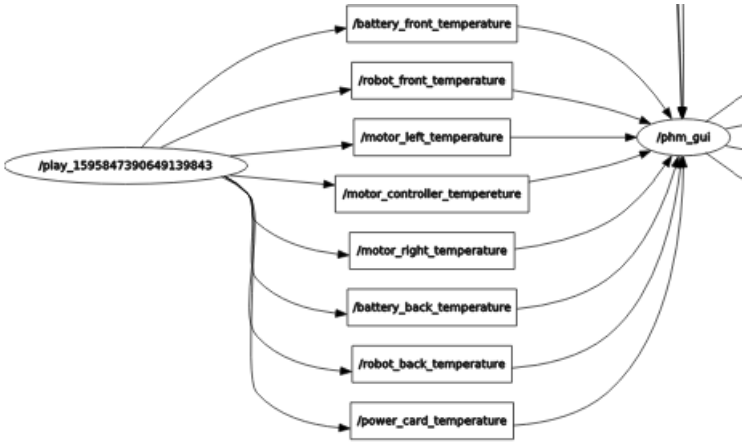

Figure 45 Sensors Added from Rosbag

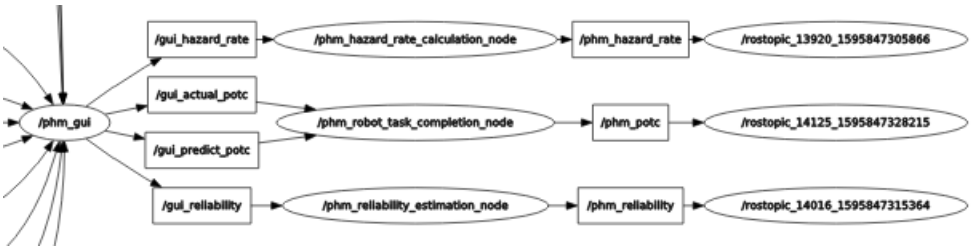

Figure 46 Architecture Between Phm Tools Nodes

```
---
stamp:
  secs: 1595847898
  nsecs: 882252931
system_value: 0.000528832664713
system_sensor_based_value: 0.000643686507829
module_names: [Communication, Sensing, Power, Mobility, Computation]
module_values: [1.062457431544317e-05, 8.238437658292241e-06, 0.000462653522
84535766, 4.7201148845488206e-05, 1.1499999885700163e-07]
module_sensor_based_values: [1.8180666302214377e-05, 7.968679710756987e-06,
0.0005704810027964413, 4.693265145760961e-05, 1.2352934675163851e-07]
---
stamp:
  secs: 1595847899
  nsecs: 882727384
system_value: 0.000528832664713
system_sensor_based_value: 0.000643686507829
module_names: [Communication, Sensing, Power, Mobility, Computation]
module_values: [1.062457431544317e-05, 8.238437658292241e-06, 0.000462653522
84535766, 4.7201148845488206e-05, 1.1499999885700163e-07]
module_sensor_based_values: [1.8180666302214377e-05, 7.968679710756987e-06,
0.0005704810027964413, 4.693265145760961e-05, 1.2352934675163851e-07]
---
```

Figure 47 Publishing the phm_hazard_rate Topic

In the “Reliability Analysis” tab, the real time reliability values are calculated using the calculated hazard rate values. In addition, the reliability model and unit are selected to calculate the reliability value. If the user has added sensors to the modules in the system, they can see the reliability values of the modules in the interface as sensor based or nominal type in real time. At the same time, if a sensor is added to any module in the system, the reliability value of the system can also be seen as sensor based or nominal graph in the interface. The process of calculating and displaying the reliability values is shown in Figure 48. The calculated values are published with "/gui_reliability" topic with the message type "std_msgs/String". phm_reliability_estimation_node subscribes to this topic and its reliability values are filtered. Filtered reliability values are published in real time via the message type "phm_msgs/Reliability" through the "/ phm_reliability" topic. This structure is shown in Figure 46 and published values are shown in Figure 49.

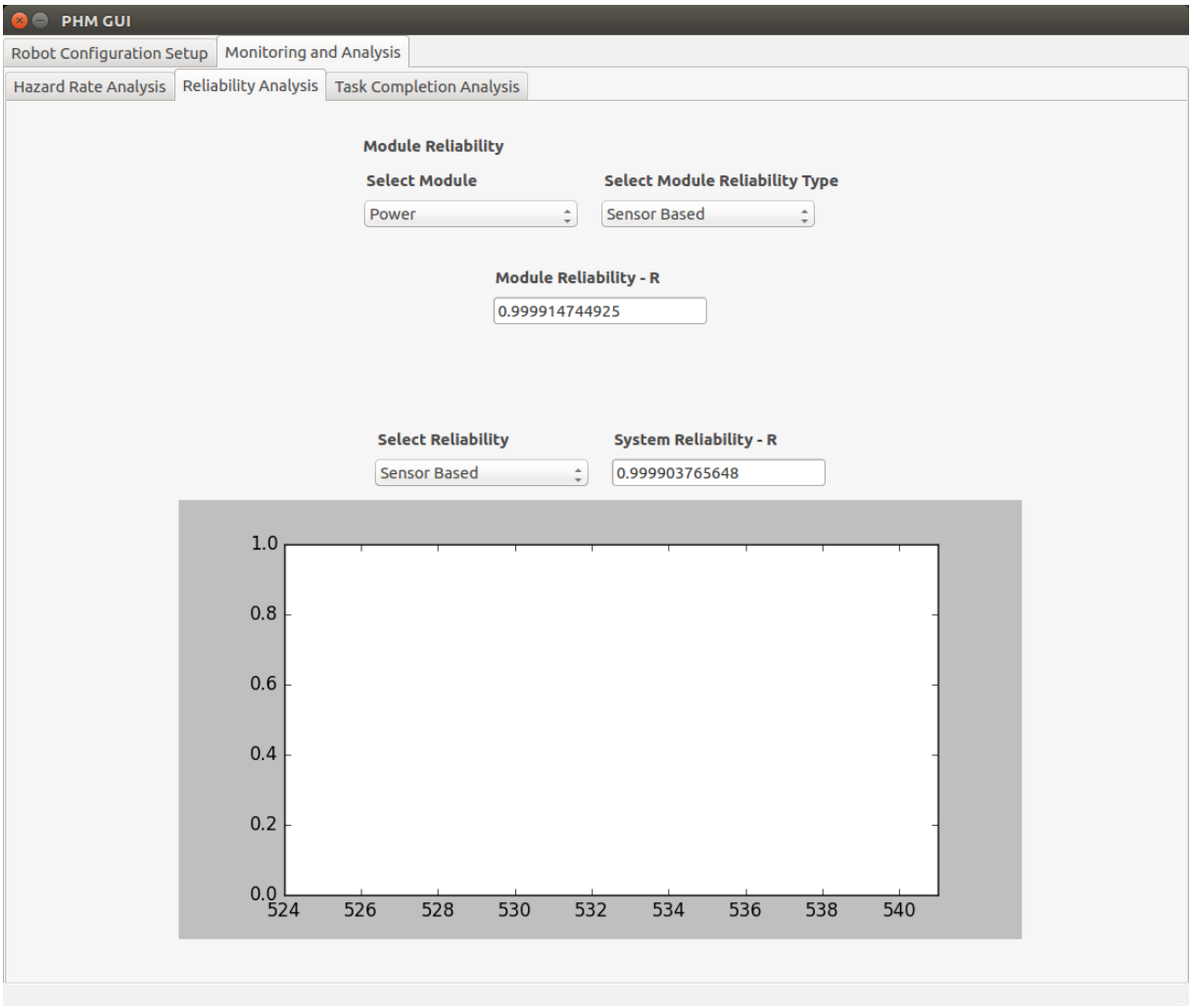

Figure 48 Reliability Analysis Tab

```
stamp:
  secs: 1595847898
  nsecs: 788770437
system_value: 0.999899208546
system_sensor_based_value: 0.999877333641
module_names: [Power, Computation, Communication, Mobility, Sensing]
module_values: [0.9999118447303772, 1.0, 0.9999979734420776, 0.9999909996986389,
 0.9999984502792358]
module_sensor_based_values: [0.9998912811279297, 1.0, 0.999996542930603, 0.99999
10593032837, 0.9999985098838806]
---
stamp:
  secs: 1595847899
  nsecs: 788094520
system_value: 0.999899208546
system_sensor_based_value: 0.999877333641
module_names: [Power, Computation, Communication, Mobility, Sensing]
module_values: [0.9999118447303772, 1.0, 0.9999979734420776, 0.9999909996986389,
 0.9999984502792358]
module_sensor_based_values: [0.9998912811279297, 1.0, 0.999996542930603, 0.99999
10593032837, 0.9999985098838806]
---
```

Figure 49 Publishing the phm_reliability Topic

In the "Task Completion Analysis" tab, the calculated reliability value is used. In order to calculate the POTC value, the task sent to the PHM Tool for the mobile robot must come. The task that comes to

the robot is published with "std_msgs / String" message type via the "/robot_task_list" topic in the format "[Position X, Position Y, Speed to Apply the Task]" (Ex. [[4.25, 2.18, 0.305032286643936], …]). POTC value, total time and distance values are estimated before the robot performs the task by applying "Predict Analysis" as soon as the task arrives. After the estimation process, POTC values are calculated on the interface by calculating nominal or sensor based as well as total time and distance values. POTC values are shown graphically. In addition, the incoming task can be used to calculate advanced simulation by adding it to the list of tasks in the "Prognostic Analysis" tab. After the robot has finished the current task, it transmits distance and time values to the PHM Tool. By applying "Actual Analysis", POTC value is calculated as nominal or sensor based. The calculated POTC values are displayed on the interface along with the total time and distance values, and POTC values are added to the graph. After the robot has finished the current task, the task information is published with "std_msgs/String" message type via the "/task_position" topic in the format "[Location X, Location Y]" (Ex. [[4.173425111935546, 0.6996212725439405], …]) and "std_msgs/ String" message type via the "/task_time" topic in the format "[Applied Time (in seconds)]" (eg. [7.070728063583374, …]). The process of calculating and displaying POTC values is shown in Figure 50. The calculation procedures in the "Prognostic Analysis" screen are shown in Figure 51. The calculated actual analysis values are published from the topics "/gui_actual_potc" with the message type "std_msgs/String" and the "/gui_predict_potc" with the message type "std_msgs/String". "phm_robot_task_completion_node" subscribes to these topics and POTC analysis values are filtered. Filtered POTC analysis values are published in real time through the message type "phm_msgs/Potc" through the "/phm_potc" topic. This structure is shown in Figure 46 and published values are shown in Figure 52. The tasks that come to PHM Tool are shown in Figure 53.

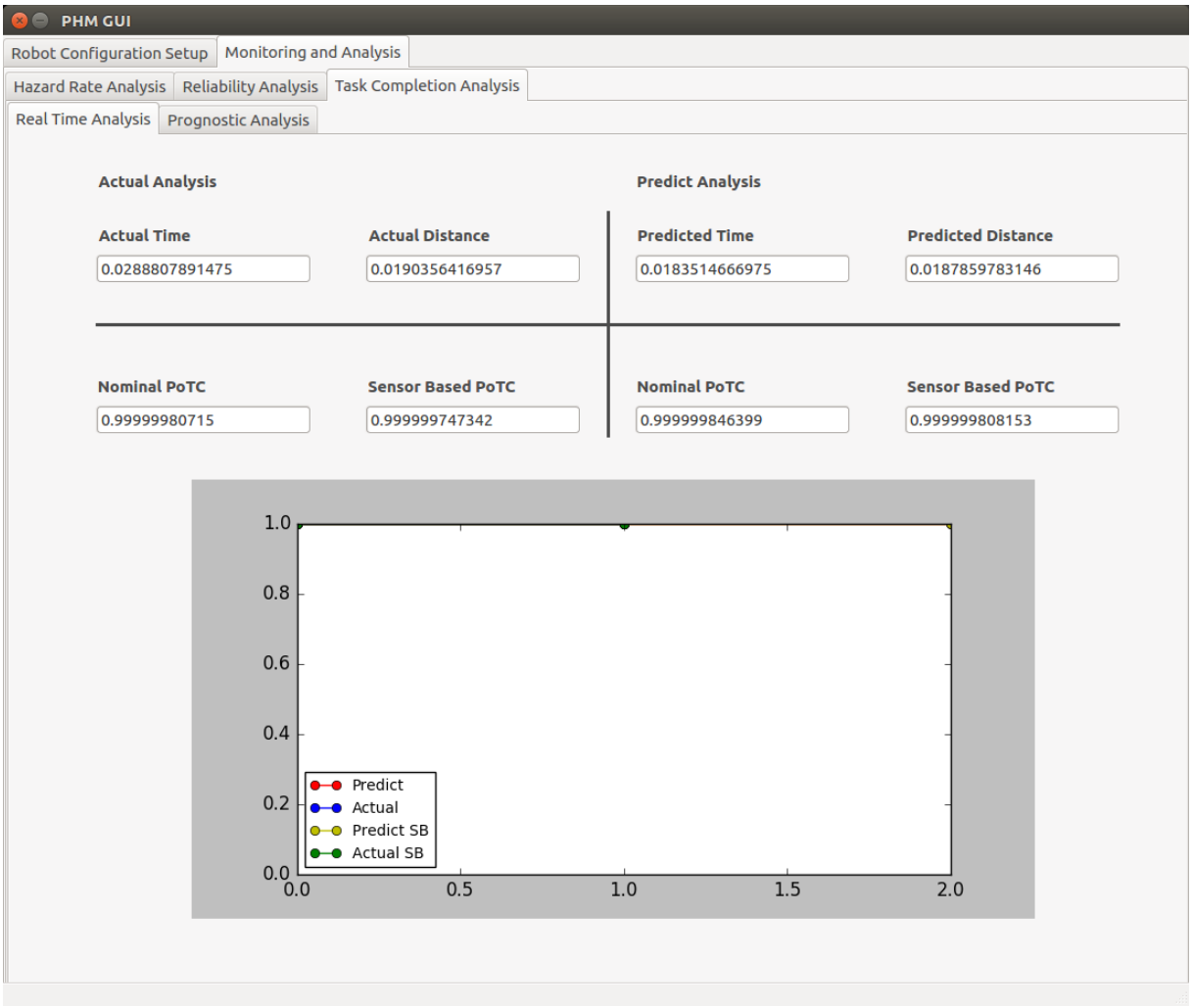

Figure 50 POTC Real Time Analysis Tab

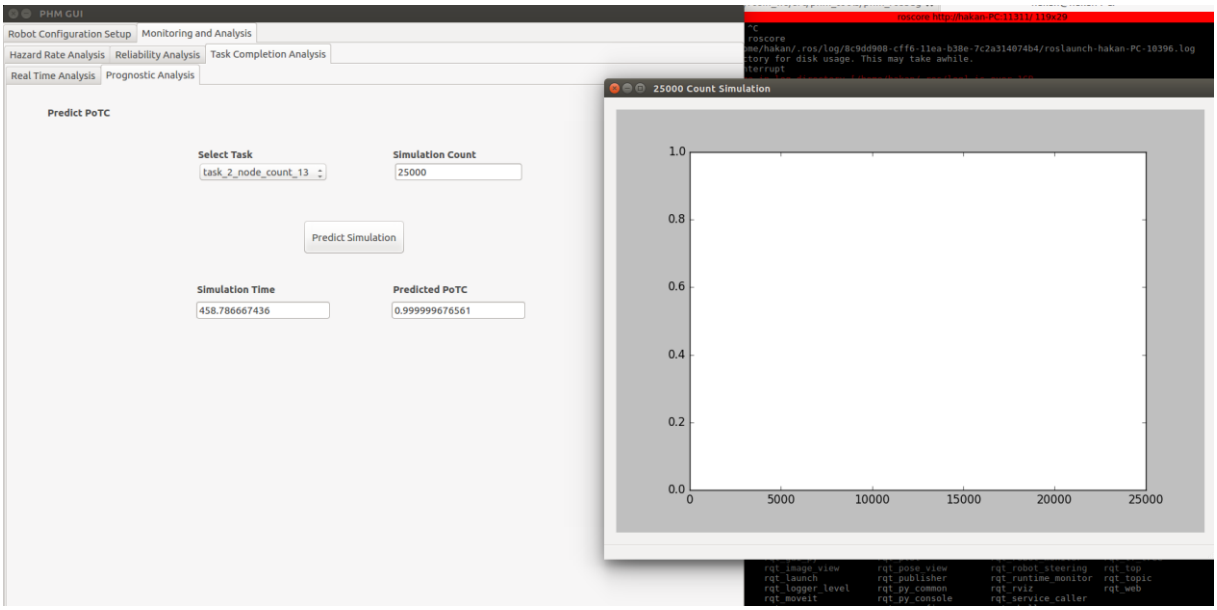

Figure 51 POTC Prognostic Analysis Tab

```
---
stamp:
  secs: 1595847899
  nsecs: 893797874
actual_potc:
  potc_nominal_value: 0.999999761581
  potc_sensor_based_value: 0.999999761581
  potc_time: 0.0263655483723
  potc_distance: 0.0191674716771
predict_potc:
  potc_nominal_value: 0.999999821186
  potc_sensor_based_value: 0.999999821186
  potc_time: 0.0183514673263
  potc_distance: 0.0187859777361
---
stamp:
  secs: 1595847900
  nsecs: 894494771
actual_potc:
  potc_nominal_value: 0.999999761581
  potc_sensor_based_value: 0.999999761581
  potc_time: 0.0263655483723
  potc_distance: 0.0191674716771
predict_potc:
  potc_nominal_value: 0.999999821186
  potc_sensor_based_value: 0.999999821186
  potc_time: 0.0183514673263
  potc_distance: 0.0187859777361
---
```

Figure 52 Publishing the phm_potc Topic

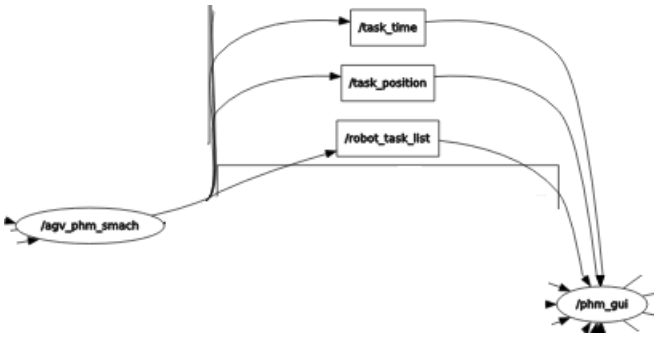

Figure 53 Publishing Tasks from Smach to PHM Tools

The POTC analysis applied in this use case was modeled in Gazebo. After configuring PHM Tool and clicking "Start Analysis" button, hazard rate and reliability values are calculated. In the "Task Completion Analysis" tab, the environment in Gazebo opens to calculate the POTC values. Smach application is running for Gazebo to be able to carry out the tasks. Due to Smach Viewer, it is possible to observe which state in the current task is in real time. Gazebo simulation is shown in Figure 54, Rviz image is shown in Figure 55, Smach application is shown in Figure 56. The operation of the Gazebo simulation with the Smach application is shown in Figure 57.

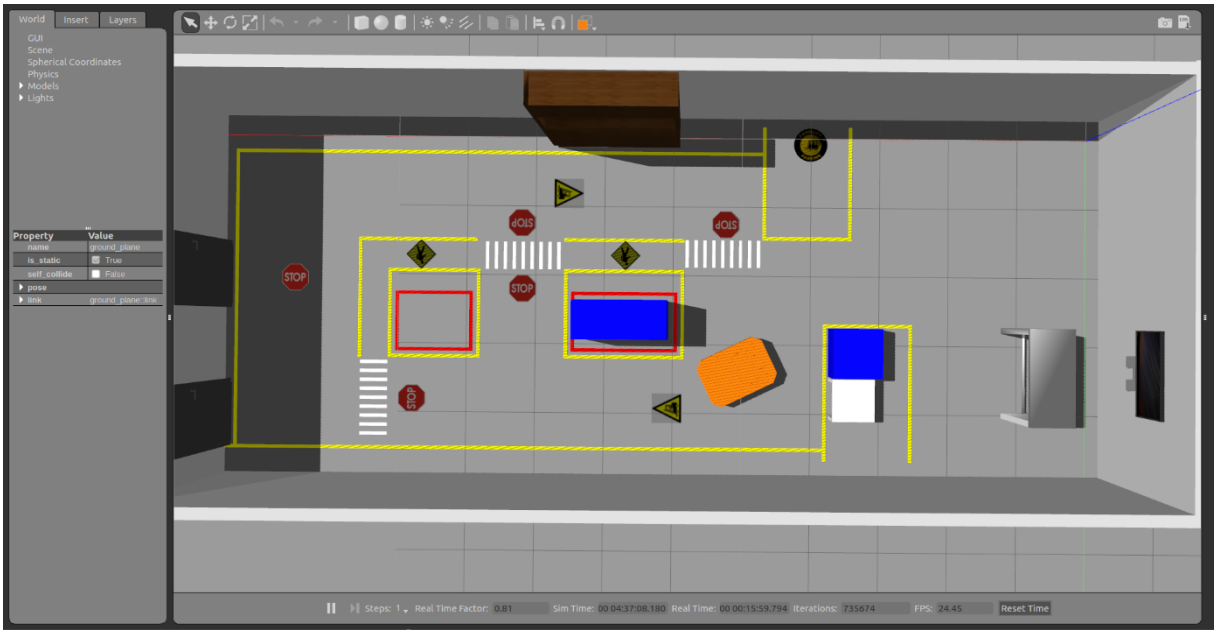

Figure 54 Gazebo

Figure 55 Rviz

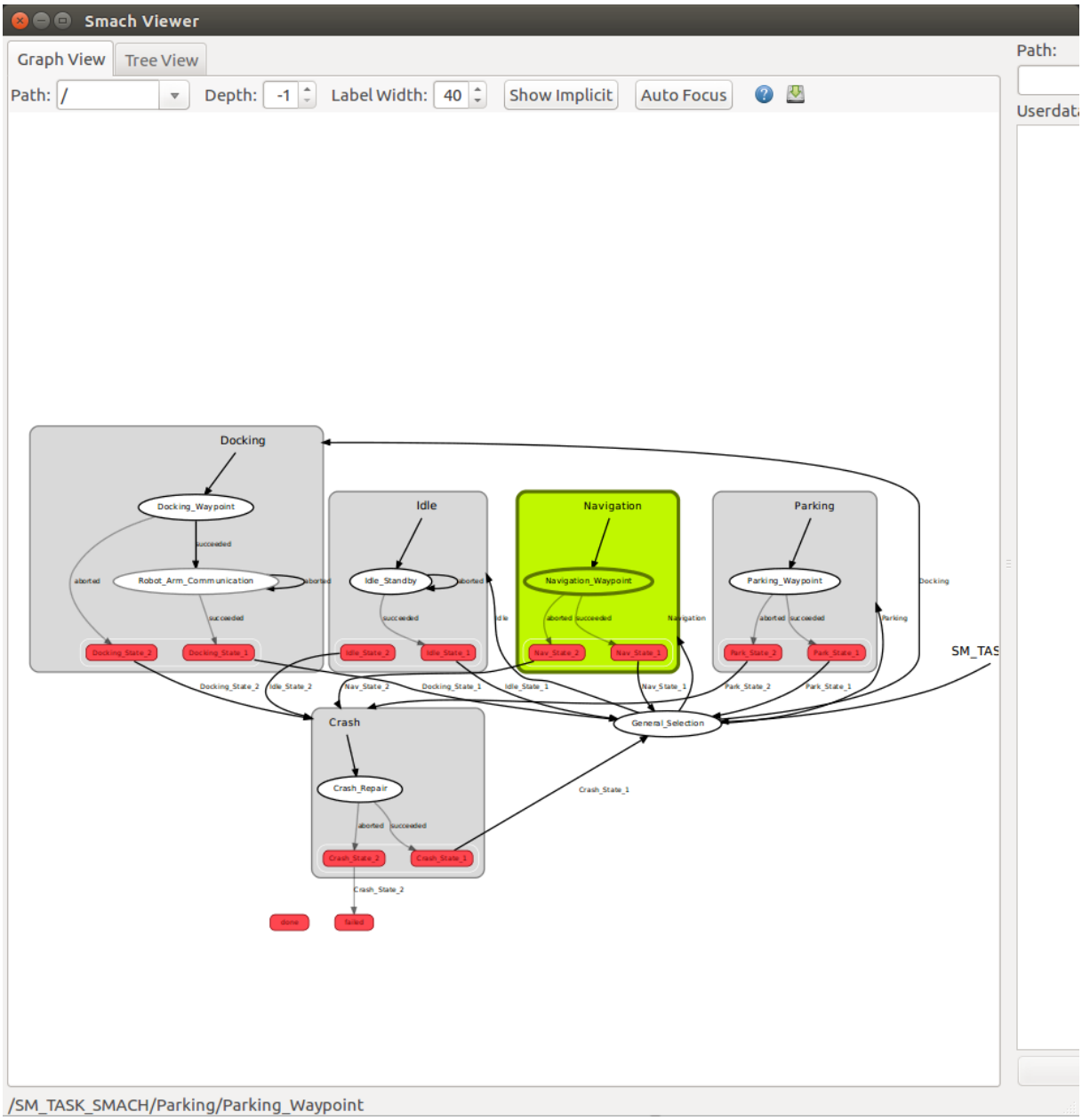

Figure 56 Smach Viewer

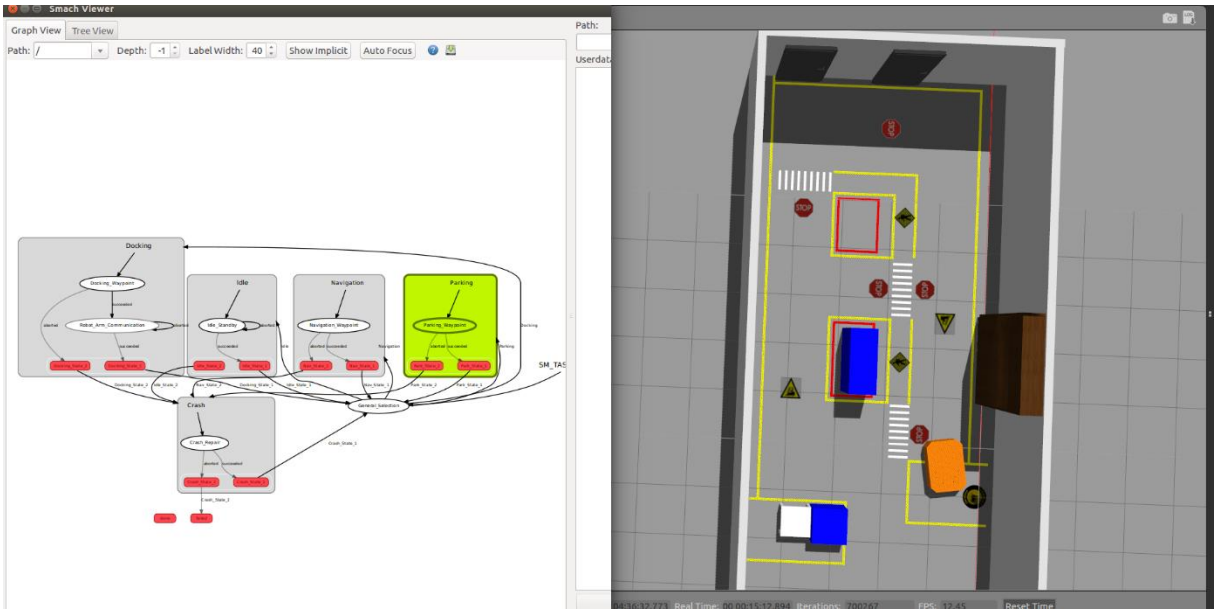

Figure 57 Smach Viewer and Gazebo

The values are updated in the interface as in Figure 50 after the tasks come and applied. The architecture of PHM Tool, which works with Gazebo, is shown in Figure 58 with topics and in Figure 59 in the form of nodes.

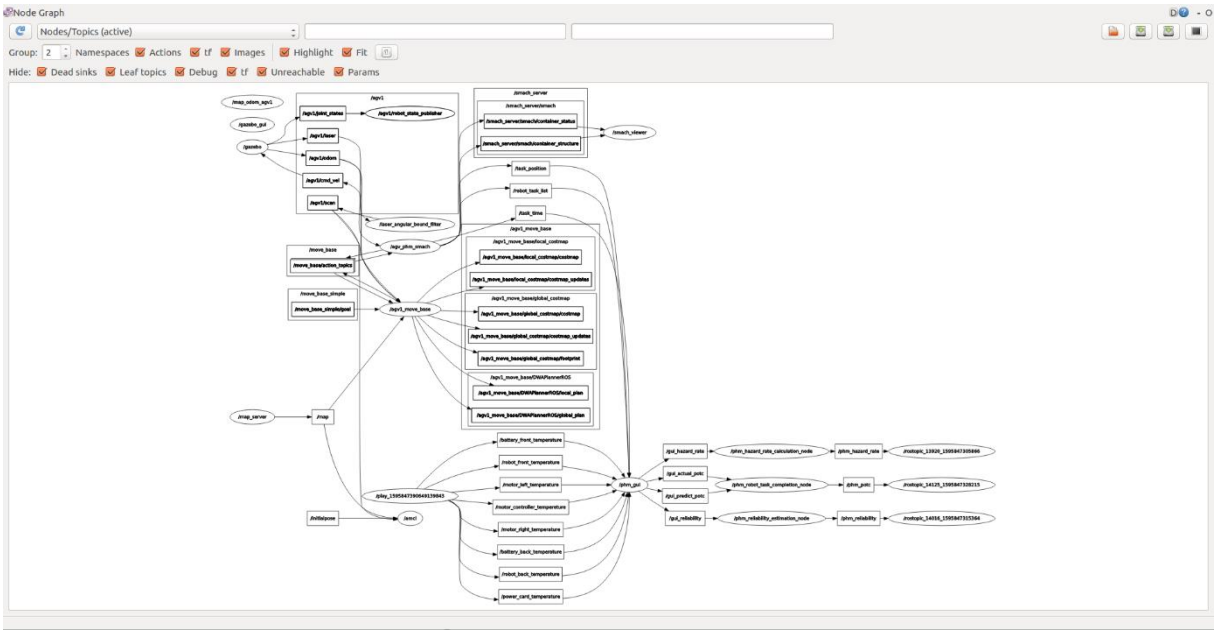

Figure 58 Architecture of PHM Tools Topics

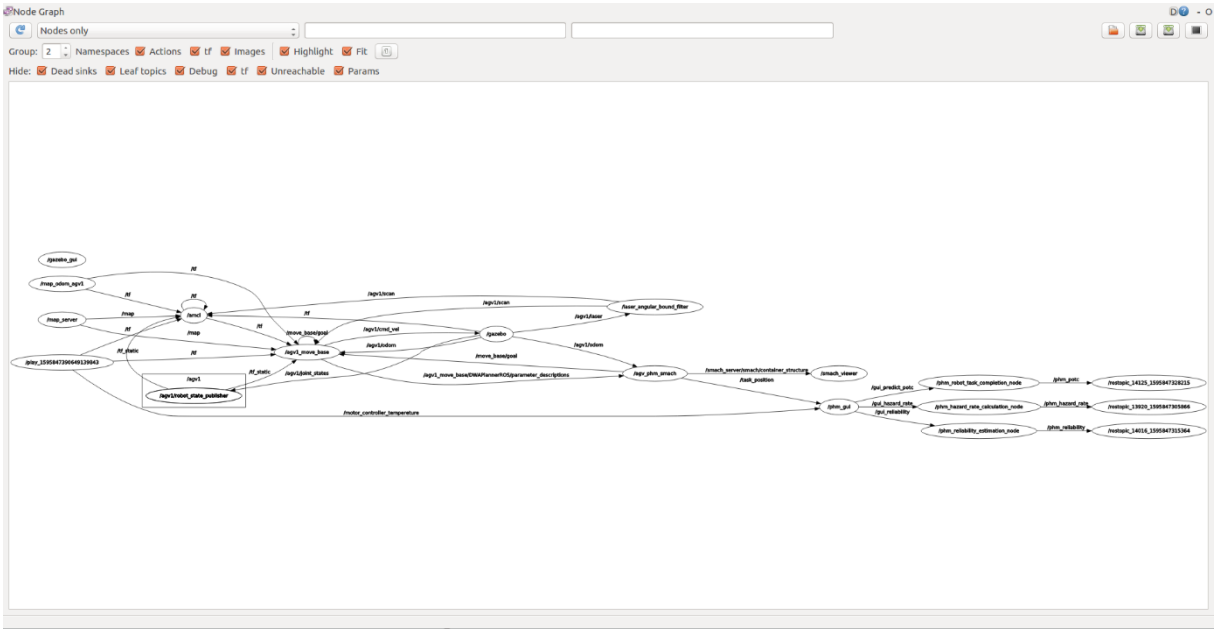

Figure 59 Architecture of PHM Tools Nodes

5. Tutorial

This section describes how to download the dependencies required for the installation of PHM Tool and run PHM Tool.

First, a workspace needs to be created. If there is no workspace, a workspace should be created by following the instructions in the Create a workspace link.

If the workspace has been created, you should go to the workspace directory in the terminal.

```
$ cd ~/catkin_ws/src
```

Then Phm Tool is downloaded.

```
$ git clone "https://github.com/inomuh/phm_tools.git"
```

The required PyQT5 and matplotlib dependencies must be downloaded for Phm Tool to work after it is downloaded.

```
$ sudo apt-get install python3-pyqt5
$ sudo apt-get install python3-matplotlib
```

Because it is high in size, go to the rosbag file (.zip) and extract.

```
$ cd ~/catkin_ws/src/phm_tools/phm_rosbag
$ unzip rosbag_sample.bag.zip
```

Then, the simulation package must be downloaded in order to apply Task Completion Analysis. To download the simulation package, go to the workspace directory in the terminal and download the package.

```
$ cd ~/catkin_ws/src
$ git clone "https://github.com/inomuh/agv2_pc.git"
```

The required dependencies must be downloaded in order to run the simulation package after it is downloaded.

```
$ sudo apt-get install ros-kinetic-navigation
$ sudo apt-get install ros-kinetic-gmapping
$ sudo apt-get install ros-kinetic-timed-roslaunch
$ sudo apt-get install ros-kinetic-dynamic-reconfigure
$ sudo apt-get install ros-kinetic-smach-viewer
```

Since it is high in size, it goes to the meshes file in the agv2_description package (.zip) and extracts.

```
$ cd ~/catkin_ws/src/agv2_pc/agv2_description/meshes
$ unzip OTA-v0.7.stl.zip
```

GAZEBO_MODEL_PATH must be updated for the simulation to work. For this, GAZEBO_MODEL_PATH must be specified in bashrc so that the terminal is not added every time it is opened.

```
$ gedit ~/.bashrc
```

The following command should be added to the bashrc file.

```
export
GAZEBO_MODEL_PATH=~/<WORKSPACE_NAME>/src/agv2_pc/building_editor_models:~/<W
ORKSPACE_NAME>/src/agv2_pc/model_editor_models:$GAZEBO_MODEL_PATH
```

After downloading the dependencies, go to the workspace and compile it.

```
$ cd ~/catkin_ws
$ catkin_make
$ catkin_make install
```

Programs start running after the workspace is compiled.

A new terminal is opened and roscore opens.

```
$ roscore
```

A new terminal opens after running roscore.

Phm Tool is run in this terminal.

```
$ roslaunch phm_start phm_start.launch
```

To configure the system, you can follow the document or watch the video in the Phm Tools link. Sensors from rosbag should be added to the system after configuring the system.

A new terminal opens, goes to the location where rosbag is and opens the rosbag. Sensors are added to the modules as in the video.

```
$ cd ~/catkin_ws/src/phm_tools/phm_rosbag
$ rosbag play rosbag_sample.bag
```

For Task Completion Analysis, task data must come from the smach included in the simulation package. For this, simulation is opened in a new terminal.

```
$ roslaunch agv2_start start_phm.launch
```

For "Predict Analysis" and "Prognostic Analysis" which are in Real Time Analysis, messages must be published from /robot_task_list topic. For Actual Analysis section, messages should be published from /task_time and /task_position topics. In order to be publish the messages from these topics, the task should be sent to the smach from the server. There is a parser node for Smach to perform tasks from the server in a meaningful way. The parser node is opened in a new terminal.

```
$ rosrun agv_smach phm_task_parse.py
```

There are 4 different tasks that send tasks in the same format as the server. To publish these tasks to the robot, a new terminal is opened and any task below is run.

```
$ rosrun agv_smach phm_task_pub_1.py
$ rosrun agv_smach phm_task_pub_2.py
$ rosrun agv_smach phm_task_pub_3.py
$ rosrun agv_smach phm_task_pub_4.py
```

6. Acknowledgements

Supported by ROSIN - ROS-Industrial Quality-Assured Robot Software Components.
More information: rosin-project.eu

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 732287.

7. References

[1] Prognostic & Health Management (PHM) Tool for Robot Operating System (ROS) User Guide Report, 2020.07.24.

Appendix 1

If we analyze the gathered data, C8 means which channel is gathered, second number means whic array index datas, the values between square brackets means the measured values.

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"0":[68,70,56,61,78,106,84,93,72,64,64,67,69,69,75,84,76,77,78,42,71,67,66,68,69,76,87,68,65,70]}}
{"C8":{"30":[60,68,77,84,74,82,78,88,64,64,65,74,78,86,75,78,70,81,51,60,48,75,78,82,85,66,65,68,57,66]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"60":[73,86,75,100,70,61,73,62,64,70,85,83,75,76,69,77,58,69,70,74,68,68,82,69,69,66,53,61,78,88]}}
{"C8":{"90":[76,83,73,64,93,65,65,69,82,81,73,79,61,53,52,88,68,100,80,82,78,65,69,68,60,66,79,83,74,85]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"120":[74,64,73,64,57,70,98,85,81,82,65,67,52,87,70,80,80,80,75,61,79,70,60,65,77,81,71,81,76,64]}}
{"C8":{"150":[59,62,59,70,84,87,81,78,68,72,28,82,66,79,86,82,77,64,71,66,58,66,80,87,76,80,72,64,65,62]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"180":[64,70,82,80,77,82,69,80,60,62,76,81,94,82,72,61,77,66,61,71,78,79,72,77,103,66,67,59,58,69]}}
{"C8":{"210":[88,86,80,78,66,77,55,67,73,84,91,82,72,65,68,59,55,69,80,84,75,81,75,72,70,64,61,67,82,82]}}
{"C8":{"240":[76,82,72,73,26,84,69,103,90,86,71,64,68,59,54,69,82,82,66,106,54,71,72,63,61,70,81,83,78,81]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"270":[66,72,52,80,89,75,84,83,72,70,76,55,52,69,83,88,76,87,88,66,69,61,61,72,84,87,77,78,68,70]}}
{"C8":{"300":[51,80,66,76,87,85,73,64,78,66,61,74,80,82,75,90,70,72,64,80,59,76,86,80,74,80,67,70,29,84]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"330":[67,80,87,84,70,68,80,64,56,76,84,90,78,83,74,66,64,62,64,73,83,78,78,77,70,77,56,59,64,80]}}
{"C8":{"360":[86,78,74,64,77,56,58,72,80,88,74,76,66,64,66,64,64,76,84,77,76,77,81,71,44,79,64,78,89,86]}}
{"C8":{"390":[71,64,71,60,55,80,81,90,72,98,65,66,62,64,66,76,87,75,75,73,81,69,32,88,65,77,86,86,73,67]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"420":[72,56,57,70,82,90,58,105,65,68,67,60,64,79,82,76,74,72,78,69,54,68,64,69,88,82,66,69,65,54]}}
{"C8":{"450":[56,72,79,89,84,80,66,76,66,60,61,77,89,81,75,68,72,67,60,91,72,82,89,80,68,71,67,58,56,70]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"480":[84,89,97,83,69,76,66,56,61,80,90,81,74,72,68,69,62,72,62,82,94,77,67,90,71,61,60,72,79,85]}}
{"C8":{"510":[82,80,67,75,64,56,57,77,90,85,76,70,66,69,58,68,68,80,80,88,69,75,70,61,55,69,78,91,62,104]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"540":[68,67,64,38,62,80,88,83,76,70,70,66,59,92,74,83,85,75,66,82,70,58,58,70,74,87,82,103,61,72]}}
{"C8":{"570":[65,54,60,80,85,81,72,71,76,67,34,85,66,84,93,78,66,78,68,62,59,71,74,88,80,93,59,64,65,56]}}
{"C8":{"600":[60,80,84,81,72,71,80,66,48,85,68,81,66,72,88,81,66,58,61,73,72,90,82,76,64,69,66,55,65,78]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"630":[88,80,75,71,76,65,61,65,69,81,88,76,65,73,66,60,64,76,74,82,75,86,67,72,62,57,60,76,87,79]}}
{"C8":{"660":[79,68,56,69,60,92,74,83,86,71,92,84,68,59,66,72,72,87,84,89,60,74,71,58,60,76,88,78,80,72]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"690":[73,65,61,58,67,87,93,76,65,85,59,56,64,75,80,87,80,102,72,72,66,59,59,72,84,80,80,73,46,56]}}
{"C8":{"720":[55,89,66,85,98,74,66,90,67,58,67,74,76,90,81,68,96,87,72,69,86,59,57,67,76,84,78,102,69,68]}}
{"C8":{"750":[69,67,61,64,78,79,80,76,71,74,60,82,60,86,79,85,74,69,84,64,59,66,65,83,82,110,68,67,71,64]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"780":[62,68,82,76,76,76,80,80,64,80,76,66,80,86,79,73,81,54,54,68,74,84,83,91,72,64,74,65,64,64]}}
{"C8":{"810":[76,77,77,76,77,78,64,92,52,70,82,82,77,74,75,56,57,66,72,83,82,100,88,76,68,60,64,71,78,80]}}

Connection has been established!
set([('192.168.3.2', 1552)])

{"C8":{"840":[82,77,76,76,58,91,49,65,85,83,73,73,80,59,60,69,70,82,81,70,68,76,66,68,66,73,82,76,75,73]}}
{"C8":{"870":[69,72,56,95,64,70,84,82,73,72,75,62,66,70,68,84,85,102,68,74,68,59,62,71,80,78,79,75,68,74]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"900":[61,84,59,70,84,79,75,81,75,60,60,70,74,83,82,101,65,70,70,53,61,70,78,78,77,76,76,74,59,96]}}
{"C8":{"930":[91,72,85,80,70,82,71,64,64,71,68,81,78,99,86,70,66,57,64,74,82,80,80,69,77,73,60,85,43,66]}}
{"C8":{"960":[84,81,73,76,76,63,61,66,61,76,80,102,68,68,76,58,65,72,77,78,80,76,77,72,60,96,61,70,87,80]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"990":[74,79,69,57,61,73,72,82,75,92,48,74,78,65,66,69,74,78,82,76,72,72,57,88,70,76,82,77,69,80]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"1020":[70,78,68,75,67,79,75,103,80,76,71,55,64,72,76,75,81,77,68,72,58,88,61,74,78,76,71,87,66,62]}}
{"C8":{"1050":[67,76,67,79,76,103,78,72,74,72,68,68,71,69,68,72,78,77,74,84,70,55,95,76,69,78,81,69,69,65]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"1080":[74,65,71,70,74,72,105,84,74,64,65,64,68,75,83,76,69,74,70,61,88,72,68,72,75,71,59,70,76,65]}}
{"C8":{"1110":[96,86,85,85,68,68,62,66,69,78,74,75,79,61,67,64,82,68,77,54,72,83,74,74,65,68,77,70,79,75]}}
{"C8":{"1140":[115,68,62,66,64,69,72,79,74,74,81,61,71,64,101,69,78,82,73,86,72,72,60,69,78,68,80,70,95,50]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"1170":[65,68,61,67,72,75,74,93,80,60,68,65,93,73,76,81,64,77,67,69,67,75,77,64,73,74,101,91,62,70]}}
{"C8":{"1200":[64,69,73,76,70,82,78,62,74,60,91,64,68,77,72,73,66,66,67,74,77,69,76,72,112,90,69,72,67,72]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"1230":[69,76,72,82,74,60,76,65,89,72,78,81,65,72,66,65,66,75,80,64,76,72,110,69,76,72,62,69,65,73]}}
{"C8":{"1260":[71,83,76,60,72,66,84,68,73,79,74,74,69,64,64,76,82,72,76,70,100,62,66,74,68,76,73,70,69,80]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"1290":[76,64,76,68,75,69,74,75,77,79,69,64,60,75,81,73,80,70,100,65,69,76,62,76,74,67,70,81,83,64]}}
{"C8":{"1320":[74,68,92,72,70,72,76,77,72,62,69,73,78,68,74,71,76,67,66,76,69,76,72,66,69,88,78,64,77,68]}}
{"C8":{"1350":[96,69,73,76,80,71,66,60,67,88,77,92,67,74,77,64,67,85,75,67,72,71,76,80,74,90,67,82,71,67]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"1380":[75,70,71,71,67,79,75,89,66,61,66,72,79,74,75,81,68,64,64,83,68,101,74,60,64,79,73,67,74,74]}}
{"C8":{"1410":[70,72,69,79,80,102,80,64,70,75,77,68,69,84,71,66,65,80,40,102,76,68,87,77,68,66,74,77,76,78]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"1440":[68,70,82,78,68,65,74,74,73,66,68,78,68,66,65,80,68,87,74,67,73,77,65,64,74,76,72,73,66,69]}}
{"C8":{"1470":[77,95,86,65,78,77,70,62,69,79,71,70,67,73,49,105,91,70,77,72,64,60,77,84,75,74,62,69,72,105]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"1500":[74,66,79,74,69,59,64,83,75,72,71,80,67,80,74,66,79,73,64,62,76,78,76,77,65,68,70,89,81,66]}}
{"C8":{"1530":[80,76,72,65,69,88,72,68,67,80,44,91,68,66,77,75,64,61,76,78,75,77,64,66,68,76,76,73,49,78]}}
{"C8":{"1560":[72,66,70,87,74,71,70,78,68,85,69,61,79,77,66,64,72,77,75,78,65,100,70,76,66,72,78,78,70,64]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"1590":[67,82,69,72,71,56,64,98,72,64,76,73,64,62,72,84,78,76,65,72,69,101,67,70,77,80,74,66,68,77]}}
{"C8":{"1620":[70,70,72,99,72,94,66,57,79,76,68,68,69,76,75,79,72,80,65,96,65,70,89,81,74,64,58,65,75,77]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"1650":[77,80,67,102,68,65,90,80,66,68,73,78,73,78,64,73,64,92,72,73,76,80,72,68,69,71,67,72,74,84]}}
{"C8":{"1680":[76,77,64,78,83,96,70,72,71,71,72,72,64,74,66,94,72,76,81,75,96,68,69,66,71,73,77,82,72,81]}}
{"C8":{"1710":[56,62,82,75,67,73,76,75,68,75,61,74,64,77,78,72,81,72,73,66,74,69,67,72,74,83,74,80,43,56]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"1740":[71,77,74,73,75,70,72,74,65,85,72,71,68,64,82,81,74,66,73,62,64,73,74,83,76,91,56,54,72,74]}}
{"C8":{"1770":[73,78,76,70,74,73,66,84,72,96,74,64,86,82,73,66,66,60,66,76,80,83,61,93,58,65,73,71,69,75]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"1800":[81,78,74,71,62,78,71,100,61,72,80,75,73,70,76,65,68,70,72,80,65,96,51,61,70,69,74,83,79,72]}}
{"C8":{"1830":[69,70,62,77,70,88,78,72,81,76,73,70,73,62,65,77,80,82,78,87,55,68,71,65,67,75,79,77,73,74]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"1860":[59,70,69,94,75,76,77,69,66,67,84,70,69,72,71,82,82,94,64,52,61,65,72,80,82,75,71,74,60,73]}}
{"C8":{"1890":[69,84,70,77,86,82,68,65,76,66,73,82,72,80,77,92,53,64,66,67,68,83,81,76,71,71,61,73,69,89]}}
{"C8":{"1920":[66,80,82,74,69,66,75,64,68,77,72,78,72,86,78,68,70,66,69,77,75,80,77,73,58,66,65,80,73,81]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"1950":[80,68,67,65,72,64,73,76,68,78,73,101,62,73,68,64,69,82,84,77,71,70,66,68,40,96,99,81,82,72]}}
{"C8":{"1980":[61,64,69,66,73,78,72,80,71,87,83,80,66,67,72,80,80,80,75,68,65,64,64,77,76,83,104,71,64,66]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"2010":[64,62,76,83,74,81,61,84,60,75,64,65,72,81,81,78,70,71,64,61,64,87,73,84,81,72,66,76,65,64]}}
{"C8":{"2040":[71,81,78,82,78,70,62,72,86,65,72,80,77,80,75,68,64,65,64,89,100,85,80,91,66,73,58,60,75,84]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"2070":[77,81,80,77,64,61,65,66,76,81,76,78,76,70,75,66,48,97,68,101,81,66,64,76,56,57,74,86,82,88]}}
{"C8":{"2100":[76,80,54,68,70,72,75,81,72,75,73,72,76,67,64,93,101,85,80,56,66,73,52,54,72,83,81,88,78,80]}}
{"C8":{"2130":[71,67,66,69,76,83,74,76,76,71,66,66,37,84,73,84,85,73,66,75,56,56,73,83,78,83,80,77,68,67]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"2160":[65,69,78,85,75,73,70,72,67,66,51,120,75,81,76,75,70,82,58,56,73,79,80,87,54,76,88,65,64,67]}}
{"C8":{"2190":[81,84,71,72,70,68,66,70,64,80,66,80,75,73,70,85,56,54,73,85,82,87,76,85,64,64,64,66,80,87]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"2220":[77,75,74,65,64,66,66,104,80,76,78,71,67,77,57,54,73,81,84,87,76,76,55,59,59,51,83,86,79,75]}}
{"C8":{"2250":[74,60,65,66,67,88,82,86,69,68,66,76,60,57,73,77,79,88,80,82,84,65,56,66,84,92,76,71,69,72]}}
{"C8":{"2280":[64,67,68,102,78,85,74,77,65,72,60,58,74,78,79,87,80,72,74,68,54,64,85,86,78,70,68,68,57,62]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"2310":[61,75,106,86,81,68,64,70,60,60,76,78,78,88,62,72,76,43,52,65,84,88,79,72,70,66,56,64,66,90]}}
{"C8":{"2340":[53,112,70,69,82,72,61,62,77,77,76,84,75,71,70,66,52,65,80,86,80,75,72,64,59,65,66,103,84,88]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"2370":[72,72,72,69,61,61,76,80,80,86,74,84,70,64,52,85,93,89,81,72,71,70,59,65,65,94,105,98,73,67]}}
{"C8":{"2400":[75,66,54,62,78,84,80,88,68,78,75,80,60,82,71,74,76,59,75,65,78,81,84,80,71,64,71,64,56,68]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"2430":[80,88,73,77,71,73,63,67,67,72,82,81,70,75,71,70,52,65,71,80,84,81,72,70,71,68,61,71,81,86]}}
{"C8":{"2460":[73,86,55,69,60,80,90,71,69,74,53,30,83,79,58,85,100,69,69,68,66,57,71,83,80,86,72,74,60,61]}}
{"C8":{"2490":[60,65,74,90,89,73,76,82,61,60,35,80,95,83,70,66,68,64,65,59,70,86,78,83,68,88,66,64,59,60]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"2520":[74,86,90,75,74,81,60,62,59,99,83,86,79,64,68,64,63,57,72,86,80,85,70,96,64,64,65,62,72,84]}}
{"C8":{"2550":[84,72,73,80,59,60,42,81,106,89,81,64,35,65,67,57,73,86,80,80,68,83,64,62,64,60,73,87,89,74]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"2580":[72,69,54,62,36,78,83,85,77,62,76,64,61,58,73,86,81,85,48,91,37,59,69,66,76,81,85,70,73,73]}}
{"C8":{"2610":[55,64,36,105,94,86,82,62,81,65,39,58,74,87,82,84,48,74,60,64,67,66,75,82,80,68,73,77,58,66]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"2640":[69,88,81,103,81,68,81,63,56,54,72,90,80,84,52,72,58,76,65,64,83,88,82,70,80,70,58,67,67,88]}}
{"C8":{"2670":[64,76,79,62,80,64,58,58,75,88,83,86,69,76,80,64,68,69,82,84,78,69,80,77,59,68,61,81,79,86]}}
{"C8":{"2700":[80,68,74,64,56,60,77,88,83,84,66,81,64,40,68,67,80,87,78,74,80,68,56,68,45,76,97,82,75,67]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"2730":[77,66,57,57,70,87,80,86,70,81,58,64,64,64,83,90,77,66,72,66,56,72,54,97,78,83,78,67,76,64]}}
{"C8":{"2760":[57,59,73,85,82,85,57,78,56,61,67,67,81,87,76,66,70,67,58,72,50,73,85,81,74,75,74,64,59,58]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"2790":[73,84,81,85,68,73,54,64,61,66,80,90,79,68,80,64,55,74,43,74,89,78,67,74,76,65,59,58,72,83]}}
{"C8":{"2820":[82,84,67,87,64,52,64,66,81,88,76,66,85,71,57,75,72,80,77,92,76,74,74,65,62,61,73,81,81,84]}}
{"C8":{"2850":[62,70,60,64,57,64,81,90,76,67,85,64,58,75,50,92,58,75,68,67,74,67,66,67,72,76,79,86,66,72]}}
{"C8":{"2880":[64,61,64,64,78,89,79,68,78,62,58,77,49,88,80,75,72,69,75,67,65,64,72,78,80,86,77,72,60,61]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"2910":[64,69,86,88,77,68,72,64,57,73,52,75,84,82,70,76,76,64,64,67,76,80,77,84,64,69,53,60,64,68]}}
{"C8":{"2940":[85,88,75,68,72,69,56,70,64,89,79,82,70,76,76,64,64,70,76,81,79,81,50,70,82,64,60,62,80,83]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"2970":[79,72,71,64,55,74,44,78,85,84,68,80,76,62,64,71,75,80,77,81,49,64,49,67,59,66,80,83,73,73]}}
{"C8":{"3000":[74,67,54,75,59,74,76,81,68,77,73,62,65,70,77,78,73,80,45,64,70,66,66,68,80,79,77,85,74,64]}}
{"C8":{"3030":[53,75,66,95,84,77,64,70,75,65,66,72,74,77,77,82,58,65,67,66,68,72,83,77,71,80,72,71,64,78]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"3060":[35,96,78,84,72,72,70,57,64,74,84,81,73,78,57,66,64,69,68,65,74,82,76,86,72,65,62,76,65,75]}}
{"C8":{"3090":[86,82,67,69,72,62,64,73,73,80,76,84,78,69,65,69,68,72,78,78,72,80,72,66,61,75,38,92,76,80]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"3120":[73,73,71,59,61,69,69,76,83,82,52,73,61,67,69,73,80,76,72,77,70,68,68,77,61,82,82,77,73,75]}}
{"C8":{"3150":[72,62,64,72,73,76,80,84,51,60,72,65,69,72,77,74,72,80,71,65,68,78,64,89,80,76,69,74,72,64]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"3180":[64,72,70,76,79,83,53,60,61,68,73,76,83,74,69,78,66,64,66,80,44,65,78,80,84,74,69,62,63,72]}}
{"C8":{"3210":[72,78,80,84,51,70,72,64,70,76,80,72,71,87,71,68,66,83,43,75,70,74,88,70,68,66,64,73,72,74]}}
{"C8":{"3240":[80,84,68,65,67,65,80,73,82,78,68,86,71,69,70,82,68,81,74,76,80,72,70,66,67,75,71,78,79,83]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"3270":[44,66,70,60,71,76,80,76,74,86,64,65,70,81,64,68,95,68,74,72,68,68,69,76,66,72,77,87,49,74]}}
{"C8":{"3300":[76,61,68,72,78,76,72,80,65,62,66,82,64,104,84,65,74,69,71,72,66,73,65,73,77,96,71,82,56,66]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"3330":[70,74,75,76,78,81,68,68,69,74,56,80,77,68,81,71,68,67,72,75,66,72,79,93,69,67,69,64,68,78]}}
{"C8":{"3360":[82,73,72,74,64,61,70,83,69,87,76,68,92,74,72,67,68,75,68,73,75,89,66,69,73,68,68,70,70,72]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"3390":[77,80,68,64,64,77,70,77,77,68,81,68,66,72,75,78,64,65,77,91,68,74,94,65,70,80,77,70,84,75]}}
{"C8":{"3420":[62,64,74,79,66,74,68,62,82,73,66,68,69,75,70,72,74,82,42,70,76,62,72,73,68,69,83,82,69,68]}}
{"C8":{"3450":[72,72,66,80,87,74,76,69,62,70,76,80,69,67,72,86,68,76,69,92,70,72,71,70,89,79,65,64,70,76]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"3480":[54,94,48,67,74,70,64,70,73,80,72,70,76,89,66,86,68,72,75,74,70,68,81,75,68,66,73,75,50,75]}}
{"C8":{"3510":[64,70,76,73,62,70,74,76,72,72,74,90,66,68,73,71,72,76,85,68,81,73,67,67,77,76,66,86,73,85]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"3540":[77,76,65,62,73,80,76,74,72,85,42,91,68,76,74,145,61,65,78,74,70,69,76,75,68,80,74,80,77,72]}}
{"C8":{"3570":[66,71,72,76,71,72,71,83,48,67,68,70,77,80,69,67,80,68,66,73,80,76,65,96,80,77,82,76,64,70]}}
{"C8":{"3600":[72,73,70,71,74,80,56,95,80,77,80,76,65,70,86,72,67,69,81,79,70,72,66,80,77,73,65,70,72,76]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"3630":[71,73,73,76,39,80,73,78,77,75,60,64,88,73,67,74,77,76,66,69,66,80,76,76,66,74,75,73,69,68]}}
{"C8":{"3660":[74,81,59,77,69,70,78,79,74,68,88,66,62,72,82,82,69,88,62,75,76,73,71,73,71,71,72,78,88,80]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"3690":[52,70,64,100,81,79,70,68,81,65,60,73,80,82,75,90,77,75,72,72,89,78,79,70,68,69,78,78,70,87]}}
{"C8":{"3720":[67,48,76,77,68,70,80,64,64,72,83,79,48,76,69,78,78,74,72,77,76,70,67,67,80,79,42,84,62,78]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"3750":[78,79,64,65,76,69,67,75,83,78,72,71,54,80,72,73,68,79,78,68,68,67,81,80,44,72,57,75,102,78]}}
{"C8":{"3780":[60,66,78,67,67,76,84,76,53,72,66,80,76,72,68,77,69,85,78,66,88,75,80,72,77,72,58,77,78,74]}}
{"C8":{"3810":[71,86,74,88,64,65,75,69,75,74,66,75,75,73,64,82,59,68,59,60,81,74,80,70,58,69,75,73,71,84]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"3840":[53,72,62,66,78,71,77,78,72,80,71,78,80,74,70,76,72,78,74,64,73,71,65,67,75,86,69,89,38,67]}}
{"C8":{"3870":[72,78,79,73,80,72,68,62,75,81,46,69,65,70,71,79,73,64,74,70,62,70,77,94,71,92,58,68,71,79]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"3900":[80,73,72,72,72,67,77,82,62,70,74,76,75,77,69,60,74,72,73,74,78,85,67,69,62,76,68,70,74,74]}}
{"C8":{"3930":[86,75,66,61,65,77,71,91,76,77,70,74,70,71,72,72,70,70,76,87,47,77,64,88,68,72,75,75,84,76]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"3960":[68,58,70,79,68,84,66,77,72,74,70,71,72,72,66,70,73,85,70,80,90,68,68,70,74,76,85,76,67,60]}}
{"C8":{"3990":[75,78,65,78,76,61,74,72,66,68,71,71,68,72,77,80,65,93,66,70,58,70,77,74,84,77,68,61,79,81]}}
{"C8":{"4020":[42,78,90,77,74,72,67,64,65,72,70,78,80,84,51,94,70,69,80,66,70,74,87,80,70,64,72,69,40,76]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"4050":[79,76,74,74,64,68,72,70,67,73,76,93,70,78,74,67,67,87,74,74,85,77,68,62,72,70,56,94,82,78]}}
{"C8":{"4080":[74,73,64,64,69,74,74,77,77,85,67,71,67,64,64,73,75,76,85,75,68,64,69,70,64,75,76,80,86,74]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"4110":[62,64,67,68,75,80,78,77,65,88,71,70,68,70,68,67,85,79,70,68,67,68,38,88,82,78,78,73,60,69]}}
{"C8":{"4140":[68,71,73,83,83,80,38,70,94,67,66,73,70,72,85,78,72,65,70,70,62,92,79,76,80,72,61,69,67,70]}}
{"C8":{"4170":[76,81,85,81,54,92,76,64,69,76,75,76,83,71,66,69,68,69,64,92,82,84,82,71,60,69,69,72,74,80]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"4200":[82,81,59,44,84,64,72,76,74,72,82,78,66,73,66,68,64,80,79,76,79,72,64,69,69,66,72,81,81,86]}}
{"C8":{"4230":[65,78,76,66,68,79,81,80,80,64,62,72,74,73,65,93,71,75,86,73,59,60,60,68,76,86,83,83,58,64]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"4260":[64,62,70,80,77,80,81,72,64,77,65,65,37,91,82,78,76,71,64,66,68,64,70,81,81,90,59,68,68,61]}}
{"C8":{"4290":[70,79,82,82,80,70,61,72,62,69,45,108,69,79,88,71,65,60,62,64,72,86,82,84,63,71,75,60,70,78]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"4320":[78,80,82,70,60,67,56,66,70,89,77,74,82,70,72,65,68,64,73,83,82,86,67,67,60,54,59,80,84,84]}}
{"C8":{"4350":[80,62,58,72,66,72,70,77,72,76,84,64,74,68,64,60,72,88,80,82,44,66,64,64,68,73,76,83,82,69]}}
{"C8":{"4380":[61,75,64,68,74,84,76,73,82,67,71,65,64,64,72,84,80,82,52,71,76,57,69,72,75,82,83,69,64,80]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"4410":[61,70,72,93,76,76,80,64,75,67,67,62,73,81,77,81,48,71,90,65,68,71,77,81,78,67,61,82,61,64]}}
{"C8":{"4440":[60,103,74,76,78,69,69,64,62,62,72,87,81,80,43,66,64,62,68,74,78,84,81,72,62,81,58,64,56,85]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"4470":[80,82,79,59,67,65,71,65,75,82,78,79,69,88,65,60,66,70,81,87,82,67,66,75,62,69,70,57,80,78]}}
{"C8":{"4500":[86,67,71,65,60,64,80,88,80,80,66,92,64,58,68,73,82,88,81,69,60,70,54,62,60,86,83,82,80,59]}}
{"C8":{"4530":[73,67,64,32,80,86,76,80,68,94,44,61,65,72,81,87,81,68,64,70,57,68,72,75,77,82,80,61,77,69]}}
{"C8":{"4560":[64,64,75,86,77,78,54,89,64,58,65,71,80,85,80,68,66,74,60,68,70,78,79,97,77,64,76,64,62,64]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"4590":[82,94,77,74,64,70,59,62,67,73,80,83,78,71,75,70,57,65,62,108,89,84,80,61,69,64,58,67,84,90]}}
{"C8":{"4620":[80,78,43,64,72,66,70,73,82,80,78,73,71,72,56,61,55,84,104,83,98,64,67,61,57,67,84,89,78,75]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"4650":[40,65,64,64,72,76,87,83,72,72,79,71,56,64,57,78,80,86,76,66,69,62,60,67,85,88,78,74,41,77]}}
{"C8":{"4680":[82,60,74,78,87,87,75,71,74,72,55,65,74,80,78,82,75,67,69,65,53,65,80,90,82,80,44,91,59,64]}}
{"C8":{"4710":[72,77,80,81,70,69,74,68,58,64,46,78,81,84,74,62,67,64,61,68,84,88,80,77,68,85,59,61,68,76]}}
{"C8":{"4740":[85,86,70,69,70,69,59,65,48,98,87,82,68,62,72,67,56,64,82,85,80,80,53,66,59,65,71,78,86,87]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"4770":[69,67,70,71,62,70,74,85,78,78,71,74,70,65,56,66,80,86,82,81,68,62,57,65,67,78,86,85,68,67]}}
{"C8":{"4800":[77,69,62,73,74,78,77,82,66,76,68,65,53,64,82,86,81,81,49,64,56,59,64,73,88,88,70,64,79,66]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"4830":[61,77,76,108,67,80,70,75,66,64,54,65,81,89,83,80,65,64,73,62,72,77,86,84,69,66,82,67,58,70]}}
{"C8":{"4860":[54,80,82,80,65,68,65,66,60,68,84,81,77,78,78,73,60,51,65,76,88,89,72,62,73,62,59,75,78,110]}}
{"C8":{"4890":[76,93,68,69,66,69,58,64,80,82,80,80,78,70,54,61,71,100,88,85,72,66,74,60,58,70,50,78,84,80]}}
{"C8":{"4920":[65,71,69,69,59,72,83,80,79,78,78,64,59,64,59,72,83,85,71,69,72,58,57,73,56,86,85,82,70,78]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"4950":[67,64,59,70,84,82,80,82,78,85,56,62,64,73,85,88,70,68,75,58,56,67,64,98,90,77,65,76,66,65]}}
{"C8":{"4980":[64,77,84,76,72,76,52,65,58,62,54,74,89,87,74,66,72,59,56,71,54,92,86,80,64,81,60,60,57,69]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"5010":[86,84,78,79,55,59,61,65,61,74,83,85,70,68,75,59,58,69,67,89,83,104,64,69,62,59,61,74,85,84]}}
{"C8":{"5040":[76,77,72,66,66,43,60,76,87,84,72,76,72,59,60,75,68,106,78,76,64,70,66,90,58,73,84,84,75,76]}}
{"C8":{"5070":[56,92,72,66,62,72,84,81,73,77,70,62,60,71,45,92,87,78,64,75,68,60,58,70,82,87,78,80,75,75]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"5100":[58,66,64,75,88,78,68,73,66,56,66,76,70,62,85,80,66,76,68,60,57,66,84,88,82,80,69,69,82,70]}}
{"C8":{"5130":[74,80,88,76,66,70,71,61,66,76,68,76,83,79,77,78,65,60,59,69,85,86,78,78,52,60,58,68,70,80]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"5160":[92,75,68,72,69,62,69,77,45,94,84,78,76,74,67,60,61,73,83,83,82,72,87,82,60,62,62,72,87,76]}}
{"C8":{"5190":[79,71,65,64,58,84,69,73,88,77,67,82,68,59,69,75,72,77,89,51,98,72,65,60,70,78,79,79,79,72]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"5220":[66,64,64,70,41,95,98,77,66,69,72,68,78,81,69,43,83,73,54,64,65,76,82,81,79,69,61,62,66,76]}}
{"C8":{"5250":[59,101,80,71,80,64,60,71,72,70,82,84,70,80,64,76,60,66,75,74,82,78,76,64,68,66,64,68,75,88]}}
{"C8":{"5280":[95,62,76,61,55,72,78,74,80,82,67,76,42,67,66,67,75,73,77,76,84,65,64,66,64,72,66,107,73,68]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"5310":[72,65,59,66,70,70,84,88,68,87,66,80,64,53,76,73,79,76,82,62,71,69,64,71,53,97,76,74,76,62]}}
{"C8":{"5340":[59,70,73,70,81,84,66,84,42,64,67,72,76,75,75,75,81,62,69,68,64,71,42,84,68,77,75,66,58,68]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"5370":[73,72,83,82,67,84,54,69,64,59,74,72,79,78,76,62,66,67,64,75,74,89,74,85,75,72,62,69,71,64]}}
{"C8":{"5400":[80,86,69,80,42,69,84,73,77,76,76,77,74,64,71,71,67,72,72,79,76,80,78,66,67,69,68,69,82,85]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"5430":[69,76,59,85,66,74,75,74,76,74,82,66,72,72,66,77,70,91,71,86,72,64,60,72,66,68,82,81,70,80]}}
{"C8":{"5460":[56,86,64,77,73,72,73,76,87,66,72,72,69,74,48,74,98,85,78,65,61,68,70,71,81,84,68,77,64,82]}}
{"C8":{"5490":[64,98,75,78,80,78,84,64,68,67,70,81,73,91,45,73,69,65,68,71,72,70,80,83,89,81,42,77,64,74]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"5520":[75,71,78,78,80,64,66,73,68,82,80,80,89,78,72,64,70,72,67,64,77,82,77,82,65,74,61,69,76,90]}}
{"C8":{"5550":[78,73,69,59,71,74,72,80,74,85,70,75,69,86,70,73,68,70,79,78,75,83,64,65,58,74,75,72,82,79]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"5580":[72,61,65,70,71,82,58,76,91,87,72,67,77,74,69,64,75,76,81,80,48,66,65,77,70,71,82,79,74,62]}}
{"C8":{"5610":[69,68,70,83,74,87,72,75,71,66,75,76,68,68,74,75,76,81,40,66,61,75,73,74,82,78,71,66,72,64]}}

{"C8":{"5640":[68,83,73,73,72,86,66,58,71,75,74,72,80,73,72,78,65,68,66,75,71,69,78,85,73,64,70,69,71,85]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"5670":[48,95,81,78,67,61,74,73,70,71,74,71,77,80,68,83,70,70,68,69,78,86,74,68,71,64,70,84,73,75]}}
{"C8":{"5700":[98,78,62,56,75,77,73,73,76,70,80,80,56,72,64,77,69,67,76,86,72,65,71,70,69,83,47,72,66,80]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"5730":[68,57,76,74,75,72,70,69,85,80,64,76,71,78,70,67,75,75,67,69,70,69,68,80,69,86,75,80,66,60]}}
{"C8":{"5760":[73,73,75,76,76,68,78,76,42,70,66,79,69,64,74,75,67,66,71,68,69,81,64,73,78,69,66,61,76,68]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"5790":[72,72,74,70,80,78,41,95,66,74,69,65,74,83,72,71,70,70,68,83,41,98,76,99,64,57,77,71,76,71]}}
{"C8":{"5820":[74,70,74,78,60,80,65,77,74,70,74,80,69,69,73,72,68,80,43,84,82,80,69,64,75,73,74,75,72,74]}}
{"C8":{"5850":[70,74,58,89,76,97,72,66,72,88,74,68,72,74,71,83,64,65,82,76,66,68,80,70,71,73,70,70,77,82]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"5880":[58,68,71,76,72,72,77,81,66,66,72,75,69,81,60,68,102,80,68,66,74,68,71,77,79,74,72,76,34,70]}}
{"C8":{"5910":[77,81,72,64,69,80,70,69,75,71,70,80,33,70,52,75,70,72,79,66,70,71,66,81,79,81,43,72,72,79]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"5940":[73,69,72,73,65,67,70,77,76,84,31,62,93,80,70,72,80,64,72,74,72,76,72,76,46,68,76,80,72,65]}}
{"C8":{"5970":[70,72,69,69,73,76,62,83,58,61,78,82,71,73,78,67,74,69,70,80,74,76,41,73,75,101,74,68,71,70]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"6000":[68,68,71,78,75,84,39,87,91,76,67,73,85,70,69,67,61,76,74,78,40,68,72,70,72,70,75,73,67,68]}}
{"C8":{"6030":[67,78,79,85,34,58,80,77,72,73,79,68,72,71,68,74,68,74,44,72,77,94,73,66,81,76,72,72,67,71]}}
{"C8":{"6060":[76,84,64,83,77,64,62,72,87,74,75,72,60,68,74,81,64,77,87,68,71,65,75,76,69,72,68,75,77,87]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"6090":[40,68,83,73,69,73,84,75,74,66,58,77,76,83,68,88,57,89,67,66,80,72,69,70,68,78,78,87,61,79]}}
{"C8":{"6120":[68,64,70,75,82,76,74,70,57,80,78,79,66,78,81,66,66,65,77,70,74,73,69,68,75,88,43,76,73,60]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"6150":[62,70,85,80,76,68,54,76,74,84,70,76,72,68,66,63,72,71,73,74,69,77,74,81,46,80,76,70,68,73]}}
{"C8":{"6180":[77,69,75,72,62,76,68,73,66,78,75,70,68,62,66,66,76,76,71,77,73,80,59,93,77,43,67,73,77,72]}}
{"C8":{"6210":[76,70,62,68,71,80,45,75,82,72,68,64,72,69,72,76,73,82,76,82,37,72,73,69,68,75,77,75,76,67]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"6240":[59,66,73,80,47,92,80,68,66,66,81,71,75,76,72,82,76,77,38,72,70,66,68,76,77,73,78,69,64,68]}}
{"C8":{"6270":[83,77,67,103,98,73,72,64,75,68,71,76,77,80,72,72,36,73,71,69,68,76,73,73,80,69,72,72,72,74]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"6300":[67,82,82,73,68,62,67,65,76,78,76,82,76,72,38,94,67,68,72,78,72,71,78,70,68,80,73,92,68,75]}}
{"C8":{"6330":[81,71,74,64,65,64,69,74,77,84,76,72,56,84,55,67,72,74,73,73,75,71,69,73,70,74,66,107,84,70]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"6360":[69,64,65,66,75,77,78,84,78,72,40,100,64,69,74,80,72,70,74,67,73,73,72,65,61,92,111,77,73,64]}}
{"C8":{"6390":[61,64,73,80,77,84,78,73,28,75,89,72,77,80,74,74,69,66,68,66,68,75,46,104,74,71,72,65,65,66]}}
{"C8":{"6420":[73,76,76,82,77,71,57,87,65,69,79,83,76,72,73,61,67,73,72,62,47,88,80,67,73,74,64,61,74,75]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"6450":[78,86,81,74,56,69,71,70,80,84,75,76,72,64,67,68,77,74,64,77,78,73,70,70,64,65,74,76,78,82]}}
{"C8":{"6480":[74,71,53,100,59,66,75,80,77,80,72,64,66,69,74,78,60,86,77,65,72,77,65,70,74,70,74,85,80,73]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"6510":[33,67,44,66,80,85,77,76,69,64,75,70,69,74,48,92,75,70,70,74,60,64,76,74,78,80,71,72,55,68]}}
{"C8":{"6540":[65,67,76,81,76,84,71,60,70,64,69,80,78,68,88,68,66,67,56,67,74,81,86,68,68,66,66,79,81,83]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"6570":[76,64,70,53,68,57,72,67,72,79,86,67,72,64,59,65,85,54,79,84,70,61,66,66,65,75,82,82,79,68]}}
{"C8":{"6600":[74,68,73,67,80,78,76,80,74,64,75,69,64,64,82,71,66,64,65,64,72,81,82,81,66,68,84,36,66,74]}}
{"C8":{"6630":[71,75,75,75,65,75,64,61,72,78,84,65,97,68,61,65,70,65,71,80,80,77,76,66,82,51,69,83,77,76]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"6660":[79,72,61,74,61,59,72,81,84,71,84,78,64,64,61,64,72,86,85,79,71,68,80,43,91,81,80,79,78,73]}}
{"C8":{"6690":[56,72,60,60,72,80,87,60,82,70,75,65,64,66,74,89,82,79,71,64,74,52,77,77,101,87,81,65,64,73]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"6720":[65,64,74,79,81,68,98,71,66,66,67,65,70,80,80,77,80,69,73,29,63,81,81,84,80,72,60,77,64,60]}}
{"C8":{"6750":[74,80,84,69,85,66,72,66,62,65,73,82,82,74,67,67,70,60,80,66,76,90,80,72,64,82,64,57,74,80]}}
{"C8":{"6780":[82,69,78,66,72,66,64,64,72,81,78,74,74,66,73,48,90,74,83,87,84,70,58,82,66,64,76,80,83,69]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"6810":[81,65,68,41,58,65,77,83,87,77,78,65,68,26,65,74,81,87,63,64,57,76,56,59,79,84,86,52,80,56]}}
{"C8":{"6840":[61,64,62,67,80,85,75,71,74,76,74,54,70,70,72,80,81,75,62,75,54,55,76,86,90,53,106,57,66,64]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"6870":[62,69,80,86,78,72,76,73,72,44,86,69,82,82,80,119,70,72,57,60,78,83,84,50,86,37,75,65,60,68]}}
{"C8":{"6900":[79,87,76,74,71,72,68,44,73,91,78,83,81,76,64,71,54,52,76,88,89,52,75,60,80,67,67,71,76,84]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"6930":[76,76,74,72,68,56,72,70,78,84,80,73,66,68,54,56,72,81,86,79,54,74,74,64,54,66,84,89,78,76]}}
{"C8":{"6960":[72,70,66,28,65,80,81,85,81,74,71,70,52,55,76,86,90,78,54,82,70,64,61,68,82,87,76,68,72,66]}}
{"C8":{"6990":[69,34,70,71,80,78,79,69,71,70,60,62,72,79,86,65,97,66,66,64,54,66,85,87,77,70,71,70,68,53]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"7020":[70,56,77,81,74,72,80,70,54,56,74,80,90,66,77,73,64,62,62,72,84,84,77,67,80,77,68,64,86,72]}}
{"C8":{"7050":[78,83,75,71,71,67,58,62,80,78,85,60,74,55,68,68,59,68,78,82,76,75,82,75,69,37,64,74,86,82]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"7080":[76,70,74,61,54,57,75,80,90,67,78,62,65,64,56,66,83,86,80,72,76,69,65,34,96,84,86,86,72,69]}}
{"C8":{"7110":[70,67,58,61,76,82,86,78,80,70,70,66,53,64,78,87,80,77,69,64,64,41,71,59,82,80,69,71,78,66]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"7140":[58,61,73,76,89,64,93,68,64,62,54,65,82,88,82,73,72,64,65,43,86,71,87,89,73,64,77,64,59,69]}}
{"C8":{"7170":[78,76,85,75,55,68,60,64,58,66,79,86,81,78,77,66,64,38,62,69,90,85,72,66,80,64,57,67,80,77]}}
{"C8":{"7200":[84,68,71,84,64,64,56,65,81,86,83,76,74,60,66,56,81,73,87,87,75,69,81,59,56,64,79,82,92,38]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"7230":[57,65,48,56,64,70,83,82,78,75,84,61,64,51,94,78,86,89,70,64,72,61,59,70,80,77,88,60,79,74]}}
{"C8":{"7260":[68,67,58,66,80,82,80,78,80,66,68,60,73,72,86,88,73,65,73,55,53,65,79,81,92,56,80,69,66,65]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"7290":[66,74,83,76,74,75,84,66,70,60,58,70,84,88,77,68,68,56,56,69,80,80,88,56,65,107,70,67,62,67]}}
{"C8":{"7320":[81,81,77,75,80,62,68,68,75,48,78,93,79,69,72,57,54,67,81,80,89,75,62,75,69,68,77,83,84,79]}}
{"C8":{"7350":[72,71,74,62,67,34,56,70,80,88,76,76,72,53,54,65,75,81,91,68,67,83,64,64,64,71,101,80,73,72]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"7380":[73,59,72,57,66,69,84,81,68,74,76,57,60,65,72,80,95,82,84,69,60,62,62,77,84,77,74,73,76,66]}}
{"C8":{"7410":[70,46,72,77,84,83,69,77,75,58,57,68,78,80,90,56,71,71,66,67,64,70,81,80,76,72,78,64,68,65]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"7440":[85,65,81,84,72,81,74,56,60,64,70,78,94,76,84,60,62,61,64,73,84,81,77,72,81,64,69,66,81,67]}}
{"C8":{"7470":[84,78,68,77,74,56,59,68,70,76,94,79,87,72,62,58,63,77,85,79,74,71,74,60,70,48,68,72,85,74]}}

Connection has been established!

set([('192.168.3.2', 1552)])
{"C8":{"7500":[67,75,71,61,64,70,74,77,89,48,77,72,66,59,62,74,83,81,77,73,68,58,69,38,79,107,87,76,64,79]}}
{"C8":{"7530":[72,59,66,72,72,74,87,73,90,78,64,60,62,75,82,81,74,72,69,65,69,66,75,76,84,76,66,82,70,58]}}
{"C8":{"7560":[68,72,75,74,87,71,86,70,79,60,64,68,80,84,80,76,68,64,67,22,78,72,86,75,66,83,72,58,66,70]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"7590":[72,75,86,48,101,64,65,60,62,77,81,82,75,79,69,62,70,66,72,101,84,74,66,76,71,61,70,73,76,74]}}
{"C8":{"7620":[85,69,86,70,67,61,65,70,75,81,77,78,72,66,69,44,68,75,85,74,69,76,66,56,69,74,76,74,83,47]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"7650":[72,71,72,64,67,72,76,80,79,83,70,66,69,64,86,81,86,77,69,76,68,58,67,73,69,75,83,45,84,98]}}
{"C8":{"7680":[64,59,68,80,81,76,73,79,69,68,72,37,94,74,73,77,72,74,67,57,68,72,72,82,89,58,85,68,60,64]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"7710":[70,72,73,78,77,82,67,62,68,50,71,77,84,72,68,74,65,59,67,78,73,78,86,43,79,64,66,65,69,74]}}
{"C8":{"7740":[76,74,76,80,66,68,72,34,77,57,91,82,92,78,64,59,66,77,75,78,88,66,75,69,42,62,76,76,74,73]}}
{"C8":{"7770":[75,78,71,70,72,42,68,72,96,81,84,76,64,57,66,72,71,77,89,64,64,81,58,58,75,78,77,76,72,76]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"7800":[66,70,74,65,84,68,80,107,89,75,60,57,66,76,78,83,85,60,72,85,69,65,77,74,72,75,77,87,68,69]}}
{"C8":{"7830":[75,39,69,82,74,75,87,80,62,59,69,75,72,80,85,70,69,64,61,64,75,79,79,76,73,83,67,69,76,48]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"7860":[76,72,75,74,78,69,64,62,69,69,70,81,85,70,82,49,60,60,73,75,76,78,76,78,65,71,77,44,97,64]}}
{"C8":{"7890":[73,76,82,72,62,64,72,68,67,77,86,54,69,65,61,64,77,79,76,73,74,72,62,68,75,64,102,84,72,74]}}
{"C8":{"7920":[80,76,64,70,68,66,68,77,88,64,73,65,60,64,75,79,76,75,74,69,64,71,78,72,80,81,85,68,64,69]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"7950":[72,64,72,68,77,74,64,69,69,70,72,80,71,67,89,66,61,70,100,73,67,75,76,76,67,65,67,64,80,57]}}
{"C8":{"7980":[87,78,81,75,65,68,66,69,77,78,69,68,89,40,70,68,75,64,62,84,69,61,60,81,88,81,90,81,68,60]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"8010":[69,74,73,74,72,69,69,90,52,60,67,90,76,67,64,65,77,76,71,72,66,81,66,68,74,85,73,64,68,64]}}
{"C8":{"8040":[70,81,77,72,67,84,58,60,55,74,74,68,72,70,86,79,70,70,68,84,65,80,74,88,73,68,70,68,67,76]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"8070":[74,71,69,84,53,65,73,74,76,73,75,57,77,73,69,72,67,80,60,69,73,84,70,67,70,68,69,82,77,72]}}
{"C8":{"8100":[76,82,58,66,100,76,80,70,70,65,81,75,70,71,66,84,58,92,94,85,72,70,69,64,68,81,77,72,77,80]}}
{"C8":{"8130":[37,68,104,78,76,72,68,67,85,75,72,72,69,82,64,81,64,89,72,68,69,70,70,74,70,70,87,85,39,73]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"8160":[90,72,68,73,72,68,74,70,69,72,76,82,42,65,69,98,75,69,69,64,69,76,80,73,80,75,33,80,77,78]}}
{"C8":{"8190":[75,71,69,65,28,58,64,74,74,83,66,67,69,85,73,69,73,70,71,72,73,71,79,77,59,65,69,77,81,74]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"8220":[69,78,73,70,66,73,75,84,45,82,61,82,74,71,72,73,72,73,66,69,81,86,60,76,77,64,73,77,75,82]}}
{"C8":{"8250":[73,75,64,74,79,87,69,64,91,73,51,70,74,76,67,75,66,64,84,89,40,88,68,69,75,73,72,76,73,70]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"8280":[64,70,75,84,66,76,65,73,67,71,72,76,76,80,64,64,89,84,44,66,68,67,73,71,71,77,72,68,64,69]}}
{"C8":{"8310":[77,85,62,88,60,72,68,70,74,74,76,77,66,66,84,84,64,84,76,66,72,73,67,70,70,67,70,72,76,88]}}
{"C8":{"8340":[69,68,81,68,67,70,71,80,74,76,61,61,80,83,40,72,80,68,71,71,70,72,74,68,64,72,74,81,51,72]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"8370":[71,71,69,69,70,77,75,75,62,60,76,83,51,76,103,72,71,72,74,81,73,67,64,68,80,85,71,86,96,69]}}
{"C8":{"8400":[68,72,70,78,78,76,61,61,74,78,46,78,80,61,72,72,66,84,78,70,68,70,80,81,66,68,74,56,70,74]}}

Connection has been established!
set([('192.168.3.2', 1552)])

{"C8":{"8430":[68,76,75,77,64,60,72,80,65,86,80,70,72,72,64,80,74,72,69,70,76,78,71,71,72,70,70,72,68,80]}}
{"C8":{"8460":[79,76,60,65,72,80,41,74,80,71,72,67,55,72,74,73,75,78,76,75,64,76,76,68,55,69,72,79,78,80]}}
{"C8":{"8490":[65,72,73,74,58,77,90,78,76,70,58,72,73,73,76,76,78,75,62,79,83,71,74,74,70,78,75,77,66,72]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"8520":[68,72,38,75,81,74,77,71,58,66,75,72,72,76,80,74,40,59,77,84,74,61,70,77,75,70,61,75,70,71]}}
{"C8":{"8550":[64,93,69,66,74,65,58,66,68,72,75,78,83,76,58,77,51,69,77,77,72,71,73,74,69,75,67,69,59,83]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"8580":[77,80,78,67,62,64,74,74,77,81,76,74,66,83,78,84,76,78,93,90,79,72,62,71,69,72,41,78,76,71]}}
{"C8":{"8610":[80,72,61,64,72,71,74,81,84,75,58,66,88,70,75,77,75,80,73,67,64,75,74,76,53,76,59,75,78,68]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"8640":[65,64,71,70,74,83,76,75,44,87,66,69,50,71,74,55,73,66,61,77,71,77,66,108,65,72,73,72,70,68]}}
{"C8":{"8670":[72,64,68,80,88,79,66,78,64,68,76,79,77,74,75,68,62,85,75,73,38,89,60,73,66,69,65,64,69,66]}}
{"C8":{"8700":[74,79,82,80,47,69,62,66,75,84,79,71,74,64,60,78,71,73,49,80,69,76,73,69,65,62,72,68,77,82]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"8730":[80,73,65,82,65,66,72,77,76,81,80,64,59,70,69,74,50,101,69,74,70,72,69,69,71,68,74,77,84,78]}}
{"C8":{"8760":[66,75,48,62,74,78,78,83,74,64,59,72,68,74,68,96,66,78,72,68,70,65,72,65,74,81,82,76,62,94]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"8790":[56,51,69,74,77,82,77,64,56,64,61,75,67,89,90,71,68,65,80,72,72,67,70,80,85,79,45,76,57,60]}}
{"C8":{"8820":[72,79,82,80,77,61,61,70,65,72,67,85,77,82,72,57,69,66,70,79,81,81,74,71,64,72,52,64,75,74]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"8850":[80,81,76,64,69,73,65,71,73,82,74,84,73,59,67,64,72,73,80,85,76,72,64,105,57,64,72,72,78,81]}}
{"C8":{"8880":[81,64,74,64,57,73,54,85,71,77,68,59,66,62,71,73,78,85,75,72,40,86,59,69,77,75,78,80,78,59]}}
{"C8":{"8910":[70,64,55,75,52,95,80,81,70,60,59,64,73,76,81,86,77,69,36,91,55,65,78,74,79,78,79,64,70,65]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"8940":[58,74,53,87,80,105,67,67,64,61,69,75,86,86,73,70,60,94,58,65,97,75,77,79,79,64,69,64,55,75]}}
{"C8":{"8970":[66,81,77,75,71,70,68,69,66,71,80,83,72,69,61,96,37,65,75,74,79,80,77,61,77,67,56,73,73,94]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"9000":[94,94,71,70,61,62,70,76,87,86,73,69,38,68,68,69,81,76,80,77,71,61,83,70,57,74,51,80,75,78]}}
{"C8":{"9030":[69,67,58,61,66,74,84,85,72,74,36,77,56,66,82,82,82,80,71,59,81,70,60,76,54,80,74,58,61,62]}}
{"C8":{"9060":[58,59,64,73,85,87,74,72,55,70,59,70,80,81,81,80,71,64,71,62,58,80,58,81,98,78,68,70,64,62]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"9090":[67,74,85,86,71,74,68,67,79,70,79,82,80,78,64,55,72,67,64,81,76,84,81,80,87,80,61,57,67,75]}}
{"C8":{"9120":[91,89,74,74,66,60,52,65,81,83,83,78,69,59,68,66,61,80,78,77,74,80,67,76,64,62,65,74,85,84]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"9150":[71,79,56,60,50,65,77,80,88,82,68,64,68,66,58,85,82,89,68,75,82,79,62,59,64,76,86,84,73,76]}}
{"C8":{"9180":[73,61,54,68,77,78,84,80,72,68,66,59,56,82,78,82,74,73,89,65,64,64,66,75,84,80,69,82,75,72]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"9210":[52,64,79,83,86,80,62,65,65,61,62,84,56,82,74,65,75,67,65,59,60,77,90,88,69,79,77,81,53,66]}}
{"C8":{"9240":[77,83,85,80,67,61,62,58,60,83,83,84,73,54,69,67,69,64,68,78,81,78,69,82,58,64,45,72,73,83]}}
{"C8":{"9270":[89,79,66,64,61,57,58,84,84,113,74,74,65,61,66,64,69,78,84,80,67,81,56,64,54,57,76,83,88,81]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"9300":[68,66,66,59,60,84,60,90,76,72,74,64,64,65,68,80,86,79,65,76,43,66,83,68,78,79,87,77,70,77]}}
{"C8":{"9330":[65,87,91,80,66,71,70,62,62,68,80,77,89,78,70,78,67,56,55,76,87,83,83,70,68,51,64,65,68,82]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"9360":[87,75,66,69,68,64,64,67,81,76,110,88,68,76,67,56,56,74,84,84,81,71,70,33,84,85,74,64,78,74]}}

{"C8":{"9390":[57,62,65,72,67,76,73,68,69,64,58,59,75,85,80,77,70,84,58,69,55,67,82,90,80,69,75,60,56,64]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"9420":[74,78,79,86,66,64,74,65,59,56,72,84,86,81,72,80,59,69,52,69,79,106,80,75,67,59,60,66,74,80]}}
{"C8":{"9450":[77,67,60,80,74,69,62,88,78,80,81,80,72,75,54,66,57,69,90,112,79,65,74,59,60,64,72,82,83,89]}}
{"C8":{"9480":[64,72,64,67,65,62,77,78,80,78,69,70,61,69,58,74,58,85,77,67,89,64,60,65,67,83,88,87,69,75]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"9510":[68,62,61,65,80,73,77,78,71,72,60,70,55,69,84,87,76,62,88,60,64,58,73,80,85,90,64,71,65,64]}}
{"C8":{"9540":[61,61,73,81,82,78,66,70,64,74,61,74,81,83,76,74,68,57,58,68,75,71,80,82,39,56,84,58,64,68]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"9570":[75,80,80,77,78,69,64,70,52,72,80,84,74,76,76,65,57,65,70,77,86,88,62,68,52,60,62,44,90,84]}}
{"C8":{"9600":[80,75,73,72,57,72,60,70,80,82,72,73,76,65,60,62,65,77,88,89,100,92,64,56,60,77,80,81,80,72]}}
{"C8":{"9630":[77,67,59,72,61,69,83,82,73,71,74,58,61,67,70,78,85,88,65,77,69,40,61,73,82,82,77,72,69,66]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"9660":[64,76,65,73,79,79,69,73,78,70,60,67,67,76,87,90,71,77,72,56,64,72,102,81,77,71,67,69,67,75]}}
{"C8":{"9690":[66,68,82,81,74,61,52,62,62,70,70,75,84,88,72,70,71,76,61,66,77,81,81,74,73,68,57,76,68,76]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"9720":[89,76,75,76,79,64,62,70,64,73,81,87,71,72,55,56,61,73,81,78,80,71,78,72,64,50,65,72,80,77]}}
{"C8":{"9750":[73,79,70,61,60,69,64,74,86,87,69,75,68,52,60,74,88,66,80,73,74,69,60,71,41,73,80,79,67,72]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"9780":[62,61,64,70,68,74,81,84,67,73,68,56,40,72,77,90,81,74,72,65,62,71,67,78,87,83,70,54,64,67]}}
{"C8":{"9810":[68,72,64,74,80,82,78,76,66,56,66,73,79,81,78,72,66,66,64,74,66,54,82,74,43,86,92,69,67,72]}}
{"C8":{"9840":[65,68,78,84,76,71,67,34,64,74,77,74,65,72,71,69,61,69,65,75,57,74,74,86,61,65,67,72,68,76]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"9870":[81,78,72,70,65,80,69,73,68,75,81,78,72,66,64,71,62,77,84,77,74,85,61,64,66,72,67,72,80,82]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"9900":[71,71,72,47,66,76,73,58,80,88,74,70,64,48,64,72,78,77,74,80,58,57,68,74,72,85,78,72,69,67]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"9930":[74,66,72,76,65,70,92,83,70,70,65,66,74,75,78,93,75,76,80,82,67,77,72,79,81,76,78,71,68,62]}}
{"C8":{"9960":[72,76,68,61,75,81,48,62,67,69,66,75,73,73,76,73,64,60,68,66,76,85,77,74,81,69,67,65,76,79]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"9990":[70,67,75,82,68,67,68,70,66,76,78,73,80,80,64,64,65,72,69,80,80,76,76,68,68,64,76,82,70,46]}}
{"C8":{"10020":[80,77,90,80,69,72,66,73,75,72,81,80,65,64,65,68,68,74,79,77,73,68,67,82,82,67,74,81,76,70]}}
{"C8":{"10050":[67,67,65,76,70,81,75,54,80,87,66,72,70,72,70,76,76,77,74,69,57,64,76,86,72,72,76,83,70,69]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"10080":[72,72,68,74,66,70,84,77,66,70,68,74,69,80,77,80,73,68,61,64,76,76,76,72,76,83,68,67,69,77]}}
{"C8":{"10110":[68,75,72,69,83,72,61,72,70,68,68,72,76,76,61,73,60,62,73,80,74,74,74,81,68,67,75,75,72,74]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"10140":[64,43,80,74,71,70,68,70,67,73,74,84,74,80,60,64,75,75,86,78,75,76,68,65,66,74,77,77,87,67]}}
{"C8":{"10170":[82,75,68,72,72,66,71,73,73,91,73,72,59,64,72,75,73,75,76,70,64,64,70,75,75,76,65,68,86,70]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"10200":[59,73,76,70,73,70,70,87,75,69,67,87,73,93,68,73,76,72,66,67,75,76,73,72,66,68,91,140,77,77]}}
{"C8":{"10230":[72,67,69,72,69,86,69,70,60,71,74,73,67,69,78,73,65,68,69,76,74,80,70,68,86,68,64,78,77,69]}}
{"C8":{"10260":[68,69,65,81,78,73,65,70,74,70,66,77,83,72,64,66,72,76,74,76,67,67,80,61,69,75,75,71,76,73]}}

Connection has been established!

set([('192.168.3.2', 1552)])
{"C8":{"10290":[68,80,68,70,66,77,74,69,68,71,80,75,74,73,67,71,75,74,66,67,80,67,62,73,77,72,72,73,62,85]}}
{"C8":{"10320":[72,70,66,77,78,71,68,69,85,73,70,70,69,73,75,81,66,73,101,74,60,76,73,73,77,73,61,89,73,72]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"10350":[88,78,76,72,69,70,79,70,70,72,67,74,70,66,81,69,68,68,69,83,71,69,68,73,72,75,79,57,95,91]}}
{"C8":{"10380":[72,59,67,77,71,77,70,67,83,72,75,62,99,75,69,62,65,74,71,76,73,72,70,77,75,62,82,80,62,67]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"10410":[74,73,72,75,65,64,78,75,76,62,104,69,74,67,69,74,66,71,67,74,74,77,80,55,98,71,68,46,66,71]}}
{"C8":{"10440":[72,78,70,71,74,72,70,61,107,71,73,48,65,84,76,73,71,74,72,77,74,58,106,81,64,72,70,73,68,76]}}
{"C8":{"10470":[66,61,74,75,76,67,104,78,75,68,71,84,67,69,70,77,83,80,72,52,95,77,64,68,77,73,69,73,66,61]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"10500":[75,75,73,64,98,69,49,66,65,80,69,71,73,75,80,77,72,52,86,69,66,73,73,72,74,76,66,76,81,76]}}
{"C8":{"10530":[70,64,106,75,73,62,67,75,70,72,73,73,77,78,72,56,102,73,67,69,74,79,73,72,59,62,78,76,74,62]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"10560":[96,88,70,64,65,71,70,69,75,71,76,76,70,56,104,71,67,70,72,75,72,74,64,74,77,70,68,64,107,76]}}
{"C8":{"10590":[69,70,65,68,72,73,69,74,81,78,74,57,104,47,67,74,76,75,72,72,64,66,75,70,71,64,100,77,96,67]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"10620":[69,70,70,72,73,74,80,79,70,54,100,71,71,53,89,78,71,72,59,67,77,77,78,65,93,69,74,69,68,75]}}
{"C8":{"10650":[72,70,65,70,82,79,72,57,98,60,69,79,78,73,76,74,64,76,74,72,73,69,110,78,79,73,89,59,72,74]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"10680":[71,71,79,80,81,79,47,54,66,69,89,80,74,82,71,66,64,64,59,71,77,74,72,87,71,73,71,70,67,69]}}
{"C8":{"10710":[77,79,77,78,71,59,74,69,76,42,104,72,76,67,65,64,68,69,73,72,73,45,70,73,68,75,79,76,73,73]}}
{"C8":{"10740":[58,69,70,70,80,76,86,74,71,61,69,82,77,83,75,71,83,69,70,66,92,66,69,80,74,77,74,68,56,64]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"10770":[72,68,80,75,101,74,68,66,89,70,73,75,72,75,80,67,71,68,50,82,72,78,74,80,77,72,60,64,70,69]}}
{"C8":{"10800":[78,77,87,95,72,60,71,68,70,77,76,76,81,65,69,66,84,64,68,79,73,84,80,70,64,65,68,70,79,75]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"10830":[93,74,70,68,66,66,68,75,74,76,85,70,71,66,66,78,73,80,78,76,74,68,70,69,69,62,73,76,84,104]}}
{"C8":{"10860":[70,70,60,83,72,82,76,77,85,66,68,50,68,66,74,82,75,76,76,68,67,62,70,68,78,54,91,78,66,65]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"10890":[58,60,72,78,79,82,85,64,67,76,80,67,78,80,70,74,72,70,66,64,68,68,75,74,89,58,70,78,61,59]}}
{"C8":{"10920":[69,80,81,81,80,60,66,70,78,67,70,78,73,79,77,69,66,59,67,66,80,78,81,71,87,74,59,58,70,76]}}
{"C8":{"10950":[77,82,87,65,68,40,65,65,72,80,72,77,73,68,75,65,71,69,78,51,77,62,69,76,58,60,69,75,64,61]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"10980":[77,77,80,82,84,64,69,64,64,67,78,91,75,87,73,48,70,93,71,72,75,79,75,76,70,74,60,39,75,78]}}
{"C8":{"11010":[80,84,84,66,68,64,52,66,82,86,85,49,70,57,60,61,64,72,82,82,73,70,67,78,67,32,74,76,70,83]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"11040":[86,68,71,62,54,65,81,86,86,58,88,58,64,64,70,73,81,82,74,72,65,81,68,44,77,77,80,80,82,67]}}
{"C8":{"11070":[56,56,49,71,85,83,86,58,69,58,65,66,67,73,80,80,68,78,73,79,58,57,76,100,80,82,79,64,69,61]}}
{"C8":{"11100":[53,64,80,83,85,73,79,64,58,58,66,75,84,86,72,73,61,71,64,54,92,74,78,79,77,64,74,69,58,87]}}
{"C8":{"11130":[87,82,83,76,58,72,66,61,57,71,87,85,73,71,61,70,66,41,88,79,80,81,72,65,83,68,54,64,84,79]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"11160":[84,64,73,70,61,60,64,73,86,85,72,71,69,66,60,42,76,78,82,82,73,65,81,70,52,45,66,72,83,56]}}
{"C8":{"11190":[66,64,58,61,66,72,81,82,75,77,75,66,62,58,79,84,80,80,71,61,78,66,57,69,84,79,81,72,76,66]}}

Connection has been established!
set([('192.168.3.2', 1552)])

{"C8":{"11220":[62,59,56,75,85,88,76,70,74,63,62,64,80,80,64,80,70,65,69,60,53,51,77,80,86,53,74,71,72,64]}}
{"C8":{"11250":[62,77,83,83,76,74,75,61,59,60,76,100,82,81,68,64,69,64,55,68,87,79,84,71,65,71,73,61,62,74]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"11280":[83,84,74,76,78,56,56,42,73,100,90,85,68,62,69,71,57,71,70,77,86,73,69,76,65,64,64,73,80,80]}}
{"C8":{"11310":[72,77,74,65,61,55,91,80,87,85,65,75,69,66,57,72,86,77,86,68,66,69,62,62,57,73,84,80,72,78]}}
{"C8":{"11340":[77,62,60,40,71,81,88,87,68,66,65,59,54,73,87,81,84,44,68,64,85,64,64,74,84,85,72,74,81,60]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"11370":[61,41,96,75,87,83,67,70,65,58,58,76,85,77,82,65,69,80,64,79,64,80,89,80,73,73,83,62,64,40]}}
{"C8":{"11400":[72,70,85,80,65,72,64,54,52,72,85,87,86,72,70,88,68,58,65,80,85,80,72,72,80,58,65,40,79,83]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"11430":[86,104,67,70,62,61,58,75,86,82,84,57,74,64,66,62,65,82,88,80,68,69,70,61,70,41,86,76,84,80]}}
{"C8":{"11460":[68,81,66,57,56,73,86,83,88,69,74,77,61,90,70,78,84,76,66,70,77,64,67,55,80,80,85,83,68,84]}}
{"C8":{"11490":[67,56,56,71,85,83,87,54,77,57,58,57,64,81,89,77,68,69,64,56,72,41,68,100,85,78,68,94,68,54]}}
{"C8":{"11520":[52,70,86,82,89,69,89,55,71,54,67,81,90,80,68,80,67,57,69,68,90,78,103,76,64,80,64,58,61,72]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"11550":[83,80,85,60,100,53,61,59,61,81,88,82,71,73,66,58,72,64,103,83,83,73,64,80,67,60,65,72,77,82]}}
{"C8":{"11580":[87,69,78,54,52,30,56,82,88,77,70,74,67,58,69,44,72,84,81,73,65,76,66,61,60,74,77,82,85,43]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"11610":[84,88,61,59,64,80,91,78,69,74,58,53,68,60,78,81,82,70,64,82,68,60,58,71,79,83,89,73,74,57]}}
{"C8":{"11640":[65,64,80,87,89,81,71,73,62,55,73,50,79,104,88,69,69,75,68,64,61,72,75,80,84,71,87,62,66,64]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"11670":[66,83,84,76,72,77,69,58,70,39,90,94,86,73,73,69,65,60,66,80,78,77,78,48,92,69,65,81,59,73]}}
{"C8":{"11700":[83,76,75,85,64,53,73,42,81,78,85,68,67,74,61,62,68,76,77,80,83,69,75,60,55,62,64,81,89,79]}}
{"C8":{"11730":[72,84,62,54,71,67,77,83,81,68,68,71,65,61,68,74,77,82,83,53,87,58,64,92,77,78,75,71,75,80]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"11760":[64,56,72,66,88,57,83,67,70,75,62,62,69,73,75,80,84,55,71,64,72,62,68,80,84,73,71,76,67,57]}}
{"C8":{"11790":[72,54,96,89,86,72,78,73,58,60,71,75,78,82,83,51,64,66,68,65,67,79,81,73,73,74,67,56,73,39]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"11820":[71,114,85,55,81,74,58,61,68,73,78,84,86,48,72,54,67,70,77,81,75,68,69,75,75,64,76,61,74,84]}}
{"C8":{"11850":[82,74,83,70,56,61,71,81,80,78,80,64,59,65,66,69,72,82,76,72,79,72,72,66,77,44,69,93,80,71]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"11880":[77,69,53,66,74,81,78,79,81,43,77,62,69,68,70,80,77,70,77,70,64,65,81,41,72,104,75,76,74,70]}}
{"C8":{"11910":[61,62,70,73,80,78,85,58,81,56,67,73,78,82,74,68,76,68,70,68,79,46,75,58,73,72,77,73,61,61]}}
{"C8":{"11940":[69,68,77,84,84,54,91,58,61,68,74,77,75,72,75,68,65,64,80,66,78,80,78,71,78,74,64,66,71,72]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"11970":[78,79,86,70,64,60,60,67,74,77,76,72,77,68,68,65,78,44,68,82,79,64,68,74,64,64,71,64,72,81]}}
{"C8":{"12000":[84,59,75,60,42,73,76,81,77,70,84,67,68,70,80,38,70,100,77,92,73,70,61,62,72,68,76,77,84,70]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"12030":[65,48,60,70,72,82,79,72,82,70,83,88,75,76,76,72,64,72,64,67,70,76,81,46,93,61,58,70,82,76]}}
{"C8":{"12060":[77,78,64,71,70,70,75,69,74,56,70,78,83,75,67,66,60,68,74,80,82,69,80,72,68,67,74,73,71,72]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"12090":[68,49,86,74,78,69,103,87,71,66,70,62,66,69,73,72,85,76,72,64,66,70,71,78,77,72,82,71,66,66]}}
{"C8":{"12120":[80,64,64,65,76,86,68,68,71,64,69,75,80,74,79,60,87,62,66,73,72,80,71,68,84,45,50,64,78,74]}}
{"C8":{"12150":[62,40,74,82,73,67,74,66,69,73,72,71,86,59,85,67,67,72,72,79,77,70,78,77,59,68,79,77,66,62]}}

Connection has been established!
set([('192.168.3.2', 1552)])

{"C8":{"12180":[84,82,71,70,73,67,72,76,74,71,91,74,65,64,72,73,69,71,74,77,78,57,64,68,83,78,74,68,72,83]}}
{"C8":{"12210":[68,67,76,72,74,76,69,68,88,50,65,65,69,72,74,78,76,69,70,70,61,69,82,52,68,60,77,86,68,68]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"12240":[76,66,74,74,68,67,88,71,64,64,74,69,73,73,75,87,72,68,61,69,80,75,72,64,74,84,71,68,75,68]}}
{"C8":{"12270":[74,76,68,68,85,73,68,86,74,70,72,72,74,81,79,70,66,67,78,74,91,76,52,72,64,66,77,70,79,75]}}
{"C8":{"12300":[60,61,92,50,65,70,76,70,71,71,67,78,80,73,67,62,79,73,90,72,72,68,64,66,80,74,82,76,65,62]}}
{"C8":{"12330":[96,69,44,88,74,72,71,73,72,78,71,67,59,68,80,72,70,68,76,68,67,69,71,67,78,81,69,68,90,62]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"12360":[61,70,82,76,74,66,66,74,78,74,66,68,79,66,74,67,102,76,64,67,76,74,75,74,61,62,88,50,70,69]}}
{"C8":{"12390":[74,72,75,70,68,80,75,70,67,80,84,52,66,68,80,73,72,71,66,68,80,81,68,67,83,39,76,72,81,68]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"12420":[73,70,64,82,80,75,69,80,81,69,66,60,61,75,69,74,69,69,78,78,68,82,91,66,65,70,79,74,76,68]}}
{"C8":{"12450":[64,82,76,74,67,75,76,65,71,67,78,69,70,70,68,72,79,80,64,67,84,48,86,71,78,72,76,71,61,76]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"12480":[72,69,66,80,83,68,66,66,72,70,72,72,69,69,73,80,69,59,81,52,66,66,87,76,77,68,61,73,71,71]}}
{"C8":{"12510":[71,79,79,47,64,82,76,70,76,72,68,72,73,74,67,77,85,59,70,70,80,76,83,67,57,71,73,71,72,76]}}
{"C8":{"12540":[84,67,65,71,81,73,77,76,70,72,83,70,64,80,82,66,80,70,80,75,76,66,60,70,73,70,73,76,84,68]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"12570":[70,93,84,73,70,73,72,78,74,71,62,74,80,44,70,70,93,73,81,70,64,69,72,67,70,82,85,58,62,60]}}
{"C8":{"12600":[82,74,76,77,72,76,80,64,59,70,78,56,72,72,76,70,78,70,72,68,72,72,70,78,84,69,72,87,78,66]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"12630":[69,75,73,77,75,68,60,72,81,66,72,56,80,74,80,68,64,68,72,66,72,77,80,72,73,68,69,65,70,75]}}
{"C8":{"12660":[72,80,78,67,102,79,85,69,93,77,96,67,74,69,72,73,69,68,70,78,86,74,68,75,68,65,72,73,73,80]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"12690":[75,68,61,79,82,41,74,74,77,71,76,65,70,71,72,69,71,76,81,70,72,75,66,69,74,72,75,86,80,69]}}
{"C8":{"12720":[58,77,80,49,76,76,76,70,70,61,64,70,75,74,72,76,80,65,69,66,77,69,74,73,73,82,77,71,57,72]}}
{"C8":{"12750":[76,64,105,80,77,69,70,64,66,71,72,73,72,75,78,42,74,92,71,66,70,71,74,88,75,68,57,66,76,65]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"12780":[87,81,71,72,72,67,74,72,70,65,69,78,85,51,80,68,66,66,74,76,74,85,76,66,60,67,75,67,92,78]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C0":0.293758,"C1":0.238032,"C2":0.226090,"C3":0.249973,"C4":0.232459,"C5":0.233255,"C6":0.266691,"C7":0.531790,"C12":0.81917
9,"C13":0.822364,"C14":0.822364,"C15":0.823160,"DMD_Temp":28.875000,"DMD_V_M1":24.392000,"DMD_I_M1":0.000000,"DMD_
P_M1":0.000000,"DMD_V_M2":24.389999,"DMD_I_M2":0.000000,"DMD_P_M2":0.000000}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"0":[73,78,70,73,66,91,81,68,76,67,76,81,79,74,64,64,62,69,83,72,61,77,88,66,64,67,75,69,69,77]}}
{"C8":{"30":[77,82,74,76,55,85,78,72,77,80,78,68,67,67,64,70,73,84,71,101,83,64,62,64,77,72,75,80,72,72]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"60":[67,77,58,89,79,72,73,77,108,72,64,74,64,71,70,84,73,100,84,63,59,64,76,74,80,77,69,73,67,69]}}
{"C8":{"90":[64,74,77,65,73,77,82,75,67,70,64,69,74,85,75,94,93,58,65,68,73,69,74,78,72,80,73,75,58,88]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"120":[86,73,73,76,81,70,65,73,66,71,70,78,72,109,74,65,60,62,75,74,77,62,72,82,68,72,64,87,78,73]}}
{"C8":{"150":[76,77,78,68,65,68,66,71,75,76,73,107,103,52,65,70,73,71,72,76,72,88,69,70,60,101,84,70,48,75]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"180":[105,69,66,69,67,77,74,78,66,93,77,70,64,72,68,46,75,77,75,88,69,65,61,74,78,74,74,77,76,66]}}
{"C8":{"210":[67,70,71,77,74,78,69,102,53,68,69,72,69,70,77,90,80,88,70,64,64,100,102,70,68,77,81,72,69,70]}}

{"C8":{"240":[70,82,73,75,41,103,81,66,69,49,63,70,74,78,74,81,69,65,64,93,80,96,75,74,81,68,66,74,69,81]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"270":[73,75,65,86,71,66,72,74,72,69,70,74,72,82,72,66,67,148,77,72,72,78,89,69,66,69,69,78,77,76]}}
{"C8":{"300":[65,93,51,65,66,77,76,72,68,72,73,80,73,66,65,99,71,71,64,76,85,70,64,72,67,81,78,74,65,94]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"330":[72,65,74,66,72,70,68,64,82,85,73,68,51,89,68,70,51,83,77,64,58,70,75,84,76,70,65,89,72,67]}}
{"C8":{"360":[74,76,72,69,72,72,75,77,72,68,67,89,79,72,71,78,95,68,68,72,71,79,77,76,68,100,82,66,70,77]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"390":[76,72,70,68,80,79,72,70,48,101,70,66,69,78,80,70,69,67,68,80,78,74,67,116,64,64,74,81,75,74]}}
{"C8":{"420":[68,62,74,75,73,71,49,101,72,68,68,76,75,69,68,73,72,77,80,74,64,101,68,57,67,78,72,75,67,64]}}
{"C8":{"450":[70,77,74,76,61,89,67,68,70,90,79,73,70,67,71,78,78,70,66,103,68,67,75,78,75,80,72,64,72,72]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"480":[68,75,76,102,70,68,70,82,77,74,70,68,69,77,75,73,67,86,66,60,65,76,75,80,70,60,76,77,71,75]}}
{"C8":{"510":[75,88,66,76,71,81,74,70,74,66,69,76,73,74,46,107,67,65,72,72,74,78,72,64,82,78,69,74,73,122]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"540":[100,68,67,87,80,73,73,66,64,76,77,77,70,83,64,64,70,80,70,80,68,57,83,79,72,75,74,101,72,69]}}
{"C8":{"570":[94,75,68,70,69,74,80,80,68,69,65,80,73,50,74,74,70,80,72,61,84,78,65,75,78,87,73,68,64,78]}}
{"C8":{"600":[84,50,72,65,73,78,71,72,70,99,70,68,74,76,72,58,70,62,78,80,64,72,69,96,73,69,71,70,72,74]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"630":[74,68,74,80,67,66,73,90,64,74,71,74,71,73,73,65,78,72,60,72,88,90,75,75,66,77,71,49,75,68]}}
{"C8":{"660":[73,73,67,66,48,86,66,67,72,74,73,77,67,62,76,76,67,70,77,89,72,72,60,77,71,71,76,72,102,78]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"690":[67,60,71,85,70,74,74,74,70,75,68,66,74,76,67,73,77,80,98,70,64,72,70,74,73,73,78,79,68,67]}}
{"C8":{"720":[75,72,50,74,75,80,66,74,65,64,76,80,68,74,76,94,75,70,72,75,69,68,70,70,84,80,68,61,66,86]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"750":[80,83,89,76,70,76,90,71,76,74,67,74,73,80,57,72,85,65,72,74,89,71,80,79,69,68,78,95,67,78]}}
{"C8":{"780":[79,80,77,76,61,66,74,75,65,76,53,102,70,76,65,69,74,77,72,68,76,77,70,75,83,84,74,70,78,86]}}
{"C8":{"810":[77,76,64,60,67,74,72,81,74,88,71,70,83,71,70,74,72,72,86,80,70,68,70,92,72,82,79,78,75,72]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"840":[60,67,71,77,69,80,75,89,96,75,75,65,67,54,69,70,87,80,70,65,64,80,67,71,85,75,73,75,62,75]}}
{"C8":{"870":[72,76,70,80,78,96,65,70,73,67,73,73,70,72,83,76,72,69,64,72,64,76,86,80,80,73,57,76,73,75]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"900":[74,82,75,105,67,69,66,59,73,77,72,71,82,77,67,71,66,88,66,76,102,79,76,88,60,71,69,70,79,82]}}
{"C8":{"930":[76,69,69,64,72,65,72,75,71,71,88,79,69,75,62,65,73,82,79,77,81,73,58,57,64,70,76,88,77,102]}}
{"C8":{"960":[64,91,74,67,75,77,73,74,82,72,65,81,66,89,67,74,77,74,80,74,59,58,65,73,75,86,78,106,75,66]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"990":[72,59,69,76,78,76,80,69,64,78,64,83,64,78,75,76,79,72,64,62,68,68,75,90,79,100,70,68,72,66]}}
{"C8":{"1020":[70,77,74,75,85,69,65,76,60,77,75,82,76,72,80,71,70,64,70,70,72,86,79,90,66,69,61,58,74,80]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"1050":[79,78,82,66,54,71,62,79,72,61,75,74,75,73,71,65,68,66,70,84,79,101,71,91,58,56,67,83,79,81]}}
{"C8":{"1080":[85,67,62,85,64,94,71,78,57,90,66,57,55,69,79,81,82,82,66,60,78,73,59,94,86,64,66,76,67,68]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"1110":[58,62,69,77,82,88,77,73,84,65,62,70,75,80,77,82,69,64,72,67,50,78,85,74,74,76,66,69,63,66]}}
{"C8":{"1140":[65,53,67,76,61,57,81,75,80,83,82,65,59,69,59,67,72,66,77,74,74,64,76,57,60,64,76,82,77,83]}}
{"C8":{"1170":[66,80,60,58,68,76,80,85,80,67,64,68,53,65,76,88,82,77,78,58,80,69,70,69,78,82,74,84,69,89]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"1200":[51,56,69,78,82,86,82,61,60,69,62,72,58,89,70,73,78,67,78,62,66,71,83,88,75,78,64,89,62,41]}}
{"C8":{"1230":[68,72,75,81,82,70,78,70,51,64,54,102,81,81,77,59,67,58,62,72,89,89,72,75,59,92,64,66,76,69]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"1260":[75,80,80,72,80,68,48,62,74,87,73,82,80,56,64,61,65,73,85,88,75,78,54,83,55,57,72,74,83,84]}}
{"C8":{"1290":[78,67,71,64,53,68,85,101,81,84,80,61,66,61,63,74,87,88,72,77,64,100,56,39,73,75,82,82,74,65]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"1320":[72,68,53,72,52,109,71,83,76,69,68,60,64,72,88,90,76,78,37,76,49,57,74,81,87,85,73,68,74,71]}}
{"C8":{"1350":[53,68,59,87,81,82,72,68,67,62,65,74,85,89,75,74,41,96,51,59,72,80,85,84,70,61,83,74,60,74]}}
{"C8":{"1380":[72,74,72,80,80,76,68,58,60,70,85,92,76,78,45,86,75,58,97,80,83,84,73,71,88,73,53,68,68,81]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"1410":[68,53,83,72,64,56,60,73,86,90,77,75,71,82,61,66,73,81,84,83,67,66,75,69,54,71,53,81,72,80]}}
{"C8":{"1440":[101,72,70,60,58,70,88,91,78,80,69,80,56,79,80,81,79,82,67,65,73,67,56,71,48,96,84,76,72,74]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"1470":[69,64,60,71,85,89,78,76,70,61,56,60,73,84,88,82,66,65,67,66,55,72,54,110,84,74,96,75,69,62]}}
{"C8":{"1500":[61,70,85,84,73,80,75,56,54,61,75,82,89,84,66,64,67,66,56,74,60,80,77,80,71,80,80,65,62,74]}}
{"C8":{"1530":[86,85,75,75,72,58,54,60,72,81,90,84,65,64,68,66,57,75,62,105,84,77,67,68,65,62,56,72,88,84]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"1560":[74,78,74,64,60,38,70,80,90,82,67,74,66,64,59,78,78,81,84,72,69,68,68,66,64,71,82,157,77,79]}}
{"C8":{"1590":[62,65,58,54,68,80,85,85,66,72,62,59,56,75,80,84,69,51,69,64,66,67,64,73,85,79,71,74,64,80]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"1620":[58,61,68,78,86,83,69,75,65,54,55,76,84,100,83,79,64,64,64,68,65,75,84,82,71,77,53,87,64,76]}}
{"C8":{"1650":[75,80,85,80,69,78,68,60,55,74,72,87,90,64,73,61,65,66,65,75,88,81,69,74,72,65,60,57,70,80]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"1680":[89,85,67,84,68,60,57,77,61,99,82,75,70,59,64,66,66,76,88,82,68,71,73,61,46,64,65,78,91,81]}}
{"C8":{"1710":[70,86,67,59,57,74,62,86,106,76,72,61,61,60,61,78,86,82,72,74,46,61,64,71,73,75,84,78,65,90]}}
{"C8":{"1740":[73,59,58,73,48,84,104,79,66,60,61,66,64,75,89,82,66,79,72,83,57,69,68,80,89,75,64,77,68,61]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"1770":[62,77,56,81,74,76,72,65,62,64,65,76,88,84,71,82,65,60,66,69,70,80,91,75,67,74,64,64,64,80]}}
{"C8":{"1800":[70,81,107,73,85,70,64,65,61,77,88,83,72,85,66,68,66,69,72,82,87,72,64,72,68,59,64,76,60,105]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"1830":[83,76,80,66,64,64,61,75,88,84,75,81,40,61,62,52,76,82,83,65,64,75,67,67,66,82,71,104,71,72]}}
{"C8":{"1860":[81,74,64,59,60,74,88,80,71,82,34,58,67,74,75,98,87,69,66,75,71,64,68,76,42,80,92,76,87,65]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"1890":[64,61,70,82,86,78,69,82,39,88,65,72,69,82,88,72,73,71,64,61,69,80,48,78,76,75,72,66,64,62]}}
{"C8":{"1920":[73,77,84,79,74,89,44,61,66,82,72,83,88,71,72,68,68,69,70,81,72,88,78,51,71,71,64,64,67,75]}}
{"C8":{"1950":[81,82,74,92,48,60,56,67,72,83,87,73,73,65,62,62,72,77,74,95,56,70,68,69,68,65,69,74,79,77]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"1980":[74,90,67,76,66,41,72,84,85,69,70,66,64,64,71,77,73,95,116,83,68,77,70,65,62,74,78,78,78,92]}}
{"C8":{"2010":[65,41,64,66,73,84,84,72,73,64,64,61,72,82,72,105,80,76,70,73,66,66,70,79,81,77,74,84,61,81]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"2040":[66,64,70,83,84,74,79,68,60,60,73,83,73,86,72,69,66,73,68,70,67,74,74,77,73,80,64,69,67,64]}}
{"C8":{"2070":[62,83,84,74,84,68,60,60,70,82,50,112,85,76,65,71,68,70,70,70,74,76,73,78,64,67,65,66,69,78]}}
{"C8":{"2100":[81,73,90,70,64,62,72,75,70,83,78,76,61,69,65,64,73,76,76,73,73,5,42,60,80,70,68,81,80,72]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"2130":[82,68,64,66,73,77,73,80,77,71,88,64,66,69,77,82,82,78,70,69,62,72,69,69,66,76,82,76,81,68]}}
{"C8":{"2160":[58,62,71,82,52,107,70,74,64,97,77,83,45,58,56,74,72,71,81,84,82,64,77,59,82,72,78,78,78,82]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"2190":[68,60,62,73,74,70,87,45,96,68,66,69,65,75,67,71,78,78,88,72,77,33,94,65,74,74,78,84,64,64]}}
{"C8":{"2220":[69,72,72,68,86,72,68,77,70,68,66,76,69,73,79,78,86,65,76,56,81,76,80,69,79,82,62,57,66,73]}}

Connection has been established!
set([('192.168.3.2', 1552)])
{"C8":{"2250":[76,74,86,47,80,74,71,70,65,76,69,71,78,76,82,71,77,56,74,74,77,78,78,83,64,60,70,73,75,70]}}
{"C8":{"2280":[85,46,77,82,70,70,70,79,68,66,75,74,77,79,75,55,68,75,82,81,74,86,64,58,72,74,76,70,84,65]}}
{"C8":{"2310":[84,73,69,68,70,81,72,72,76,70,74,77,78,62,80,72,93,72,74,93,68,61,70,69,72,74,80,64,94,72]}}