# Pi<> iCreate3 NETWORK CONFIG NOTES

## ICreate wifi and robot config

**To set wifi network on iCreate:**

Press buttons 1 and 3 on bot til it turns blue
Connect to robot hotspot then go to http://192.168.10.1
Then on main wifi network find local IP - eg
nmap -sn 192.168.1.0/24

Set ROS2 namespace - pibot1, pibot2, pibot 3 etc

**Create 3 ROBOT SETUP**

https://iroboteducation.github.io/create3_docs/setup/provision/

Update robot firmware by logging in via web interface
https://edu.irobot.com/create3-setup
**Install latest humble firmware:**
https://iroboteducation.github.io/create3_docs/releases/h_2_5/

Set up for local wifi and multi-robot setup ROS namespace

## Pi Network Setup

**SET PI LOGIN DETAILS**

Namespace: Set a unique ROS namespace for each Pi
Hostname: Your Pi Hostname

Username: YourPiUser
Password: YourPiPassword
VNC:

**Suggest setting wifi at card config, but if not to edit wifi networks access**

**the pi by connecting over its USB Ethernet address** 192.168.186.3/24:

ssh into YourPiUser@192.168.186.3

then edit  /etc/netplan/50-cloud-init.yaml on the pi,

then hit sudo netplan apply

then reboot twice

See ubuntu 22 instructions on SSH config

# UBUNTU / ROS SETUP NOTES

## Pi Ubunto 22.04 64 bit setup notes

PRE-REQUISITE ASSUMES YOU HAVE INSTALLED

1) Ubuntu 22.04 .03 64 bit LTS using raspberry imager.

**2) You may wish to install desktop to allow for VNC access.**

3) You can install raspi-config to set wifi, user name / password and IP address or edit

approriate files

Install raspi-config
sudo apt-get install raspi-config

If repository not found add

```
echo "deb http://archive.raspberrypi.org/debian/ buster main" >> /etc/apt/sources.list
hkp://keyserver.ubuntu.com:80 --recv-keys 7FA3303E
```

Install desktop manager to allow for VNC usage if not installing desktop
Used XFCE desktop
    sudo apt install tasksel
    sudo apt install xfce4 xfce4-goodies

    Create /etc/lightdm/lightdm.conf

**To install VNC on ubuntu 22.04 pi 4.(use latest file in archive.pi)**
https://forums.raspberrypi.com/viewtopic.php?t=335487

tightVNC description https://www.penguintutor.com/linux/tightvnc
https://bytexd.com/how-to-install-configure-vnc-server-on-ubuntu/

Prevent Wayland from use
    sudo nano /etc/gdm3/custom.conf
    Uncomment "WaylandEnable=false"

    THEN - to use headless
    sudo nano /boot/firmware/config.txt
    add
        hdmi_force_hotplug=1
        hdmi_force_mode=1
        hdmi_group=2
        hdmi_mode=82
        #dtoverlay=vc4-kms-v3d

Install xfce then sudo startxfce4 if desktop not installed

## Ros2 Humble Setup on Pi

To install ROS2 Humble (not required for Bluetooth Library)

**Install Ros2 Humble**
**Follow ROS2 instructions here**
https://docs.ros.org/en/humble/Installation/Ubuntu-Install-Debians.html

With adaptations for Icreate3 here
https://iroboteducation.github.io/create3_docs/setup/pi4humble/

- Install NTP: sudo apt install chrony

Must always first run and setup in bash script.
source /opt/ros/humble/setup.bash

# PIBOT: A Dream Bot for the Dream Club Lab

Architecture Outline  Rev Date 03.07.24

DEFINITIONS
ROS = ROS2 Humble
OSC = Open Sound Control
BOT = iCreate 3.0 Robot running firmware xxx
PIBOT = Pi 4B w/ 4gb ram, running Ubuntu 22.04
PiHUB - Pi 4 or 5  running Ubuntu 22 or 23 Desktop
VIDEO MAC = Primary control machine running OSX
ROS CONTROL =  Ubuntu 22.04 (either physical or virtual machine on video mac)

Pi <> Icreate setup

14.8 v unregulated charge
for LED/MOTOR/CAMERA power bank

bot1, bot2, bot3

GPIO PIN to switch relay
14.8v power / charge relay
isolate battery bank when solo,
allow charge when on dock

5V USB-C power connection
Video connection TBD

power 14.8 v

NDI-HX Over WIFI
Available to all macines

NDI Camera,
Mounted on bot
IP = DHCP Man

POWER FOR LED AND CAMERA
5V/12V battery bank.
CHARGES WHEN ON DOCK, OTHERWISE DISCONNECTED

Text: Charge Voltage
14.8 voltage in from i Create3

Relay

5v/12v power bank.
Ugreen

relay switch 3.3v GPIO pin

Text:USB charge to camera

12V battery bank power to LED

12 v USB Battery power to high side of DAC

TBD- stepper motor
for camera rotation

M

iCreate audio out
via ROS

ICREATE LEDS

iCreate3

USB-C Ethernet

5V / 3 A regulated

5A USB

PI

PiBot - rPI 4B

I2C Connection
0x40

PWM Control

DAC
16-Channel 12-bit
PWM/Servo Driver -
I2C interface
(PCA9685)

PWM to LED MOSFETS

RGBW Yuji
12V LED Strip, 2.5M,
18w/m 45w tota
10w/ channell
on standalone board

12v

TO-220 N Mosfet

LED 12V RED

LED 12V GREEN

LED 12V BLUE

LED 12V WHITE

I CREATE3 NETWORK DETAILS

- IP Addresses
- USB ETH = 192.168.186.2/24 - connects to iCreate3
- WLAN0 = DHCP - to LAN
- IP in access point mode = http://192.168.10.1

ROS2 node for PCA9685
over I2c

ROS2 TOPICS
16 Channel I2C Address
1-4 use as R, G,B, W
5-8 potential Stepper motor
control for camera

robotpi NETWORK DETAILS

- IP Addresses
- USB ETH = 192.168.186.3/24 - connects to iCreate3
- WLAN0 = DHCP - to LAN
- ETH0 = Configure backup wired connection
- Hostname = robotpi1 or (x)
- ROS Namespace = yournamespace(x)
- Runs Ros2 Humble
- SSH to yurusername@yourhostname.local

iCreate 3 ROS2
ACTION LIST

```
$ ros2 action list -t
/audio_note_sequence [irobot_create_msgs/action/AudioNoteSequence]
/dock [irobot_create_msgs/action/DockServo]
/drive_arc [irobot_create_msgs/action/DriveArc]
/drive_distance [irobot_create_msgs/action/DriveDistance]
/led_animation [irobot_create_msgs/action/LedAnimation]
/navigate_to_position [irobot_create_msgs/action/NavigateToPosition]
/rotate_angle [irobot_create_msgs/action/RotateAngle]
/undock [irobot_create_msgs/action/Undock]
/wall_follow [irobot_create_msgs/action/WallFollow]
```

iCreate 3 ROS2
TOPIC LIST
https://iroboteducation.github.io/create3_docs/api/ros2/

```
$ ros2 topic list -t
/battery_state [sensor_msgs/msg/BatteryState]
/cliff_intensity [irobot_create_msgs/msg/IrIntensityVector]
/cmd_audio [irobot_create_msgs/msg/AudioNoteVector]
/cmd_lightring [irobot_create_msgs/msg/LightringLeds]
/cmd_vel [geometry_msgs/msg/Twist]
/dock [irobot_create_msgs/msg/Dock]
/hazard_detection [irobot_create_msgs/msg/HazardDetectionVector]
/imu [sensor_msgs/msg/Imu]
/interface_buttons [irobot_create_msgs/msg/InterfaceButtons]
/ir_intensity [irobot_create_msgs/msg/IrIntensityVector]
/ir_opcode [irobot_create_msgs/msg/IrOpcode]
/kidnap_status [irobot_create_msgs/msg/KidnapStatus]
/mouse [irobot_create_msgs/msg/Mouse]
/odom [nav_msgs/msg/Odometry]
/parameter_events [rcl_interfaces/msg/ParameterEvent]
/rosout [rcl_interfaces/msg/Log]
/slip_status [irobot_create_msgs/msg/SlipStatus]
/stop_status [irobot_create_msgs/msg/StopStatus]
/tf [tf2_msgs/msg/TFMessage]
/tf_static [tf2_msgs/msg/TFMessage]
/wheel_status [irobot_create_msgs/msg/WheelStatus]
/wheel_ticks [irobot_create_msgs/msg/WheelTicks]
/wheel_vels [irobot_create_msgs/msg/WheelVels]
```

iCreate 3 ROS2
SERVICE LIST

```
$ ros2 service list -t
/e_stop [irobot_create_msgs/srv/EStop]
/motion_control/describe_parameters [rcl_interfaces/srv/DescribeParameters]
/motion_control/get_parameter_types [rcl_interfaces/srv/GetParameterTypes]
/motion_control/get_parameters [rcl_interfaces/srv/GetParameters]
/motion_control/list_parameters [rcl_interfaces/srv/ListParameters]
/motion_control/set_parameters [rcl_interfaces/srv/SetParameters]
/motion_control/set_parameters_atomically [rcl_interfaces/srv/SetParametersAtomically]
/robot_power [irobot_create_msgs/srv/RobotPower]
/robot_state/change_state [lifecycle_msgs/srv/ChangeState]
/robot_state/get_available_states [lifecycle_msgs/srv/GetAvailableStates]
/robot_state/get_available_transitions [lifecycle_msgs/srv/GetAvailableTransitions]
/robot_state/get_state [lifecycle_msgs/srv/GetState]
/robot_state/get_transition_graph [lifecycle_msgs/srv/GetAvailableTransitions]
/static_transform/change_state [lifecycle_msgs/srv/ChangeState]
/static_transform/describe_parameters [rcl_interfaces/srv/DescribeParameters]
/static_transform/get_available_states [lifecycle_msgs/srv/GetAvailableStates]
/static_transform/get_available_transitions [lifecycle_msgs/srv/GetAvailableTransitions]
/static_transform/get_parameter_types [rcl_interfaces/srv/GetParameterTypes]
/static_transform/get_parameters [rcl_interfaces/srv/GetParameters]
/static_transform/get_state [lifecycle_msgs/srv/GetState]
/static_transform/get_transition_graph [lifecycle_msgs/srv/GetAvailableTransitions]
/static_transform/list_parameters [rcl_interfaces/srv/ListParameters]
/static_transform/set_parameters [rcl_interfaces/srv/SetParameters]
/static_transform/set_parameters_atomically [rcl_interfaces/srv/SetParametersAtomically
```

PiBOT ROS2 NODES (NOTE ROS2 Latency issues prevented using, functionality was built using bluetooth SDK)

Master OSC INPUT / OUTPUT

LED RGBW CONTROL

MOTOR CONTROL (second tier)

Power control - charge LED/Camera battery bank - switches a relay also get battery voltage

Note Player - audio to ICREATE Audio Interface
(aka number stream from super collider over OSC to bot speaker in ns)

Joystick navigation

TBD -mapping to accomadate drafted ROS2 map via dead reckoning

## Dream Club Lab: Network setup

Wireless

**icreate1**
ROS Namespace = /pibot1
Wifi IP = DHCP
USB = 192.168.186.2

USB ETH

**PiBot1**
ROS Namespace = /pibot1
USB Eth = 192.168.186.3
Wifi IP = DHCP - Man
Eth IP =

**NDI Cam 1**
ROS Namespace = TBD
Wifi IP =
NDI Stream name

**NDI Cam 2**
ROS Namespace = TBD
Wifi IP =
NDI Stream name

**icreate2**
ROS Namespace = /pibot2
Wifi IP = DHCP
USB = 192.168.186.2

USB ETH

**PiBot2**
ROS Namespace = /pibot2
USB Eth = 192.168.186.3
Wifi IP = DHCP - Man
ETH IP =

**icreate3**
ROS Namespace = /pibot3
Wifi IP = DHCP
USB = 192.168.186.2

USB ETH

**PiBot3**
ROS Namespace = /pibot3
USB Eth = 192.168.186.3
Wifi IP = DHCP - Man
ETH IP =

**DMX Gateway**
IP =

**BOT CONTROL**
Physical machine with ROS2 Master Control
Connected via Ethernet to switch
IP =

**Video Control**
Video and DMX Control
Connected via Ethernet to switch
IP =

Cat 6 cable

Cat 6 cable

2.5G uplink

**Wifi 6 Router**
IP =

2.5G uplink

**SWTICH**
Switch IP =
8 port switch

**Internet WAN Connection / Gateway**
IP =