

HARDWARE PROPOSAL

FOR DELIVERY ROBOT



OVERVIEW

1. YANDEX DELIVERY ROBOT HISTORY
2. PROPOSAL FOR NEW VERSION



YANDEX DELIVERY ROBOT HISTORY

R1-June 2019

R1.5

R2

R3

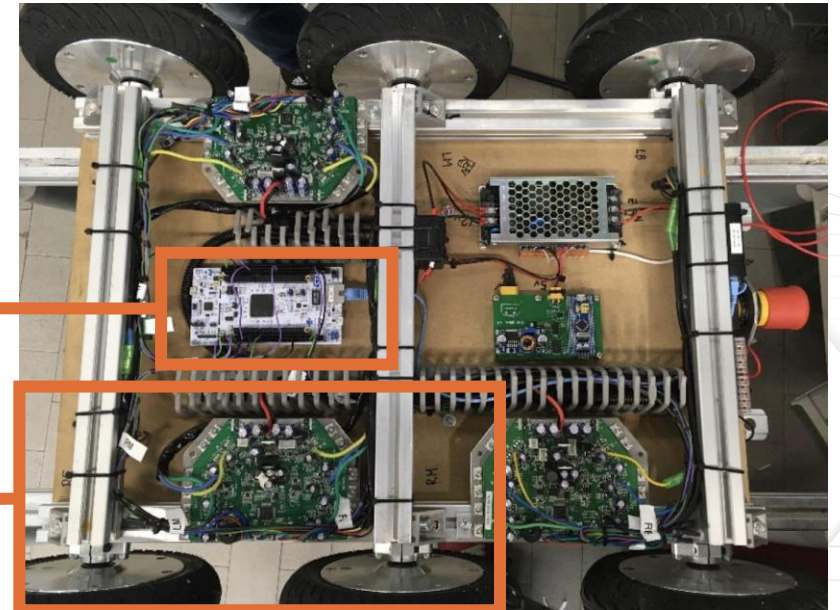


X / FIRST GENERATION



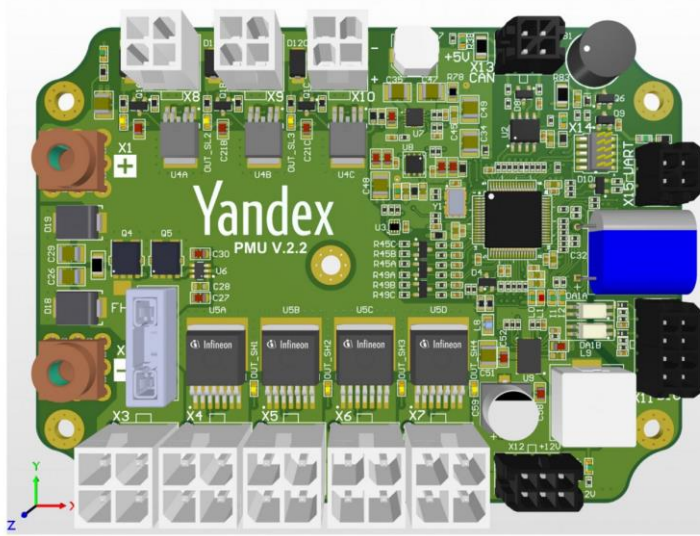
T0-June 2019: prototype using off-the-shelf components
4 months: Design and assemble a prototype from scratch







R1.5: Develop new chassis

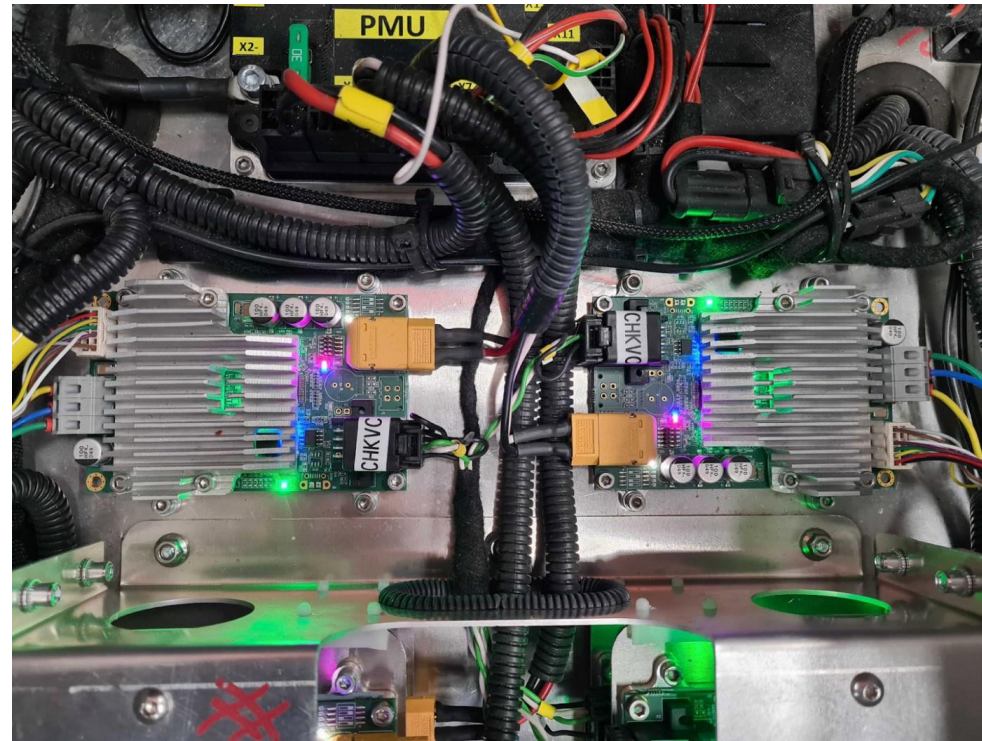


Power Management Unit:

- Monitor voltage & current
- Control reboot peripheral devices



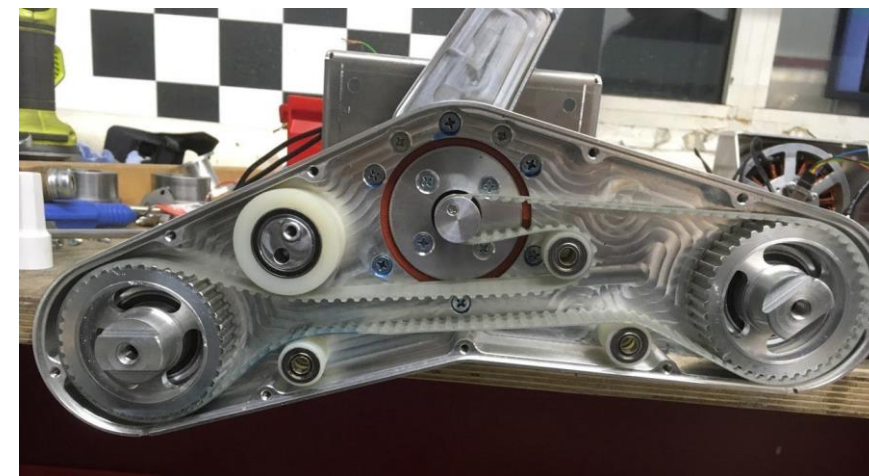
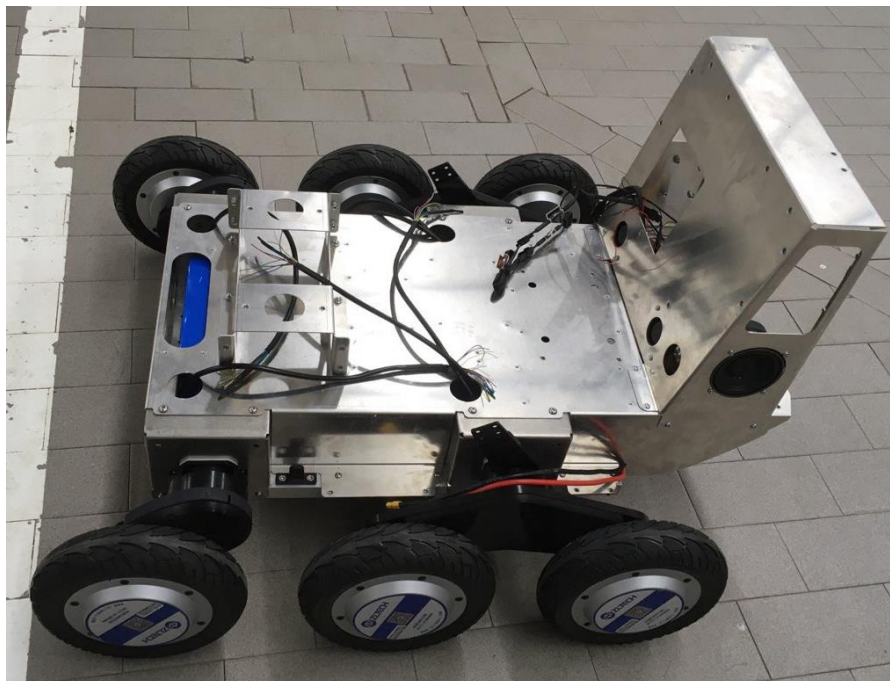
IP Camera to GMSL



BLDC Motor Controller: Change UART to CAN



R2: 100 commercial robots



Design:

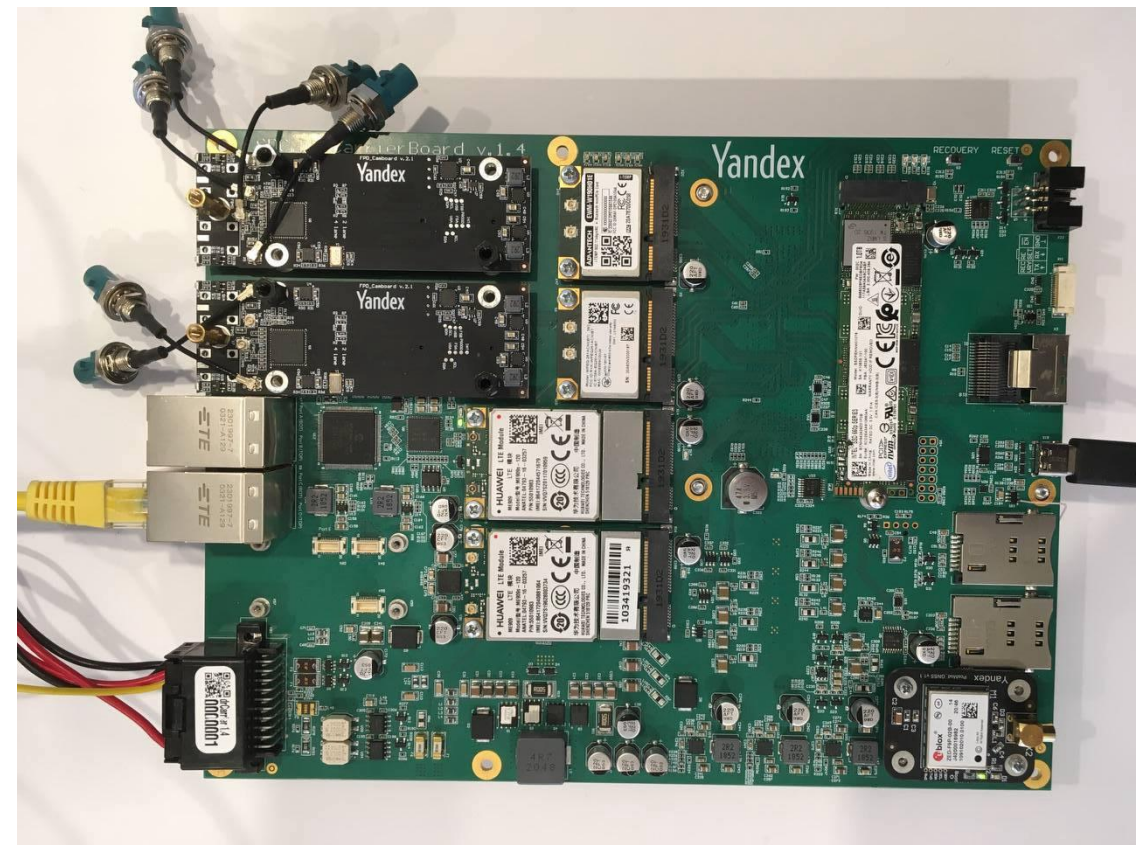
- Monocoque design (unibody)
- No joints
- Fiberglass

Frame:

- Welded aluminum
- Aluminum sheet housing
- Suspension, battery, electronics & monocoque attached to the frame
- Sensors placed on the monocoque

Transmission:

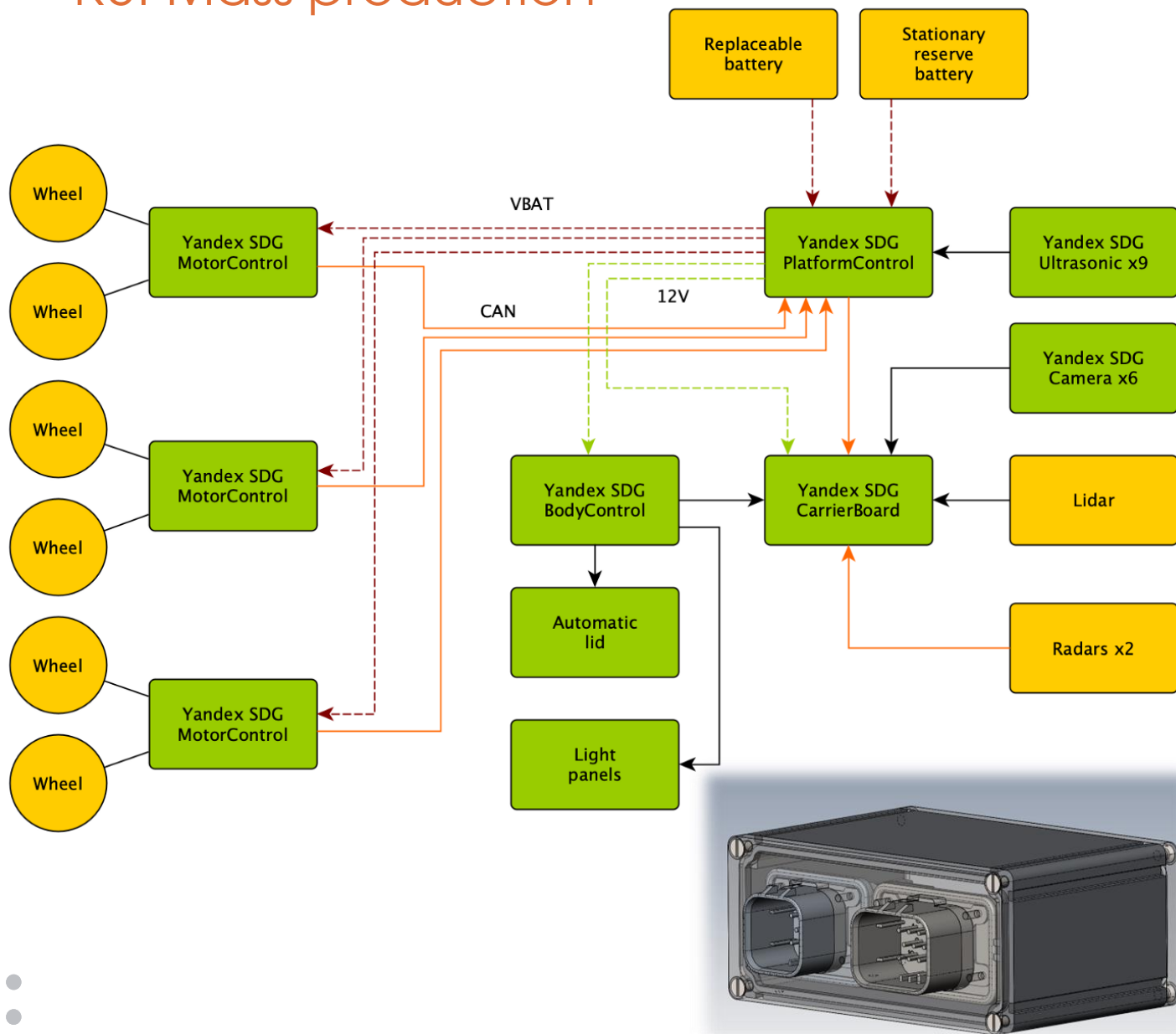
- Motorized wheel: different features each batch, not weatherproof.
- System of pulleys & belts.



Mother board:

- GMSL Cameras video inputs
- Ethernet, Wifi, LTE
- GNSS Module
- Reduce number of interconnections & reduce power consumption

X / R3: Mass production



● MCU	
● Lidar	× 1
● Radar	× 2
● Camera	× 5
● Ultrasonic	× 7



HESAI 64 beams



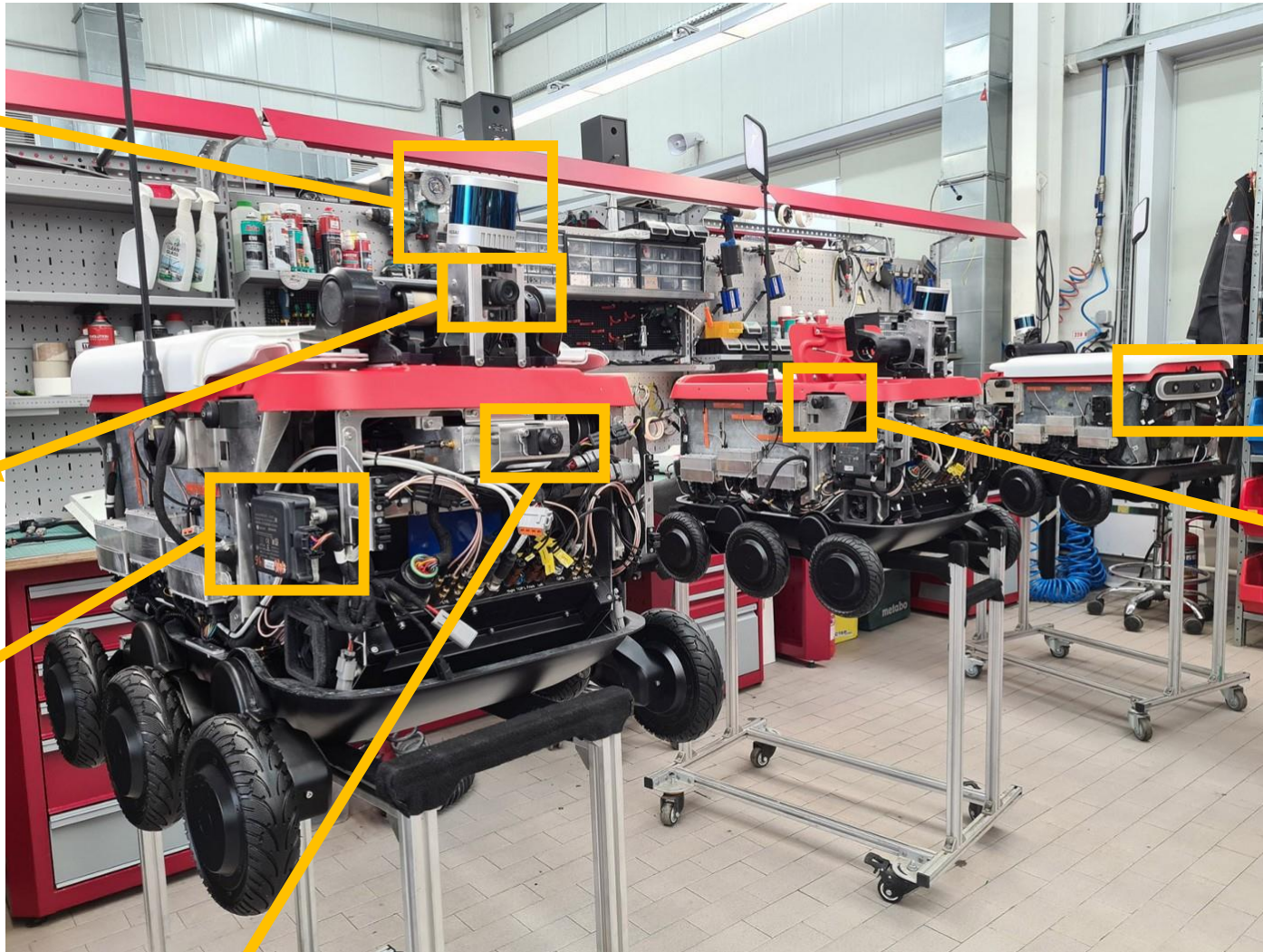
Front Camera (Wide)

Continental Radar

Front Camera (Far)

Back Camera

Side Camera



X / Suspension & Lid

Suspensions:

- Carbon leaf spring suspension on each axle
- Test on shaker



Lid:

- Integrating the hinge directly into the lid
- Sense a user's attempt to slam the lid shut
- Sense if a foreign object is interrupting its path





PHENIKAA-X DELIVERY ROBOT

ISSUES & PROPOSAL FOR NEW VERSION





Current hardware version

Finish R1: 11/2021 – 05/2022

- Prototype using off-the-shelf component

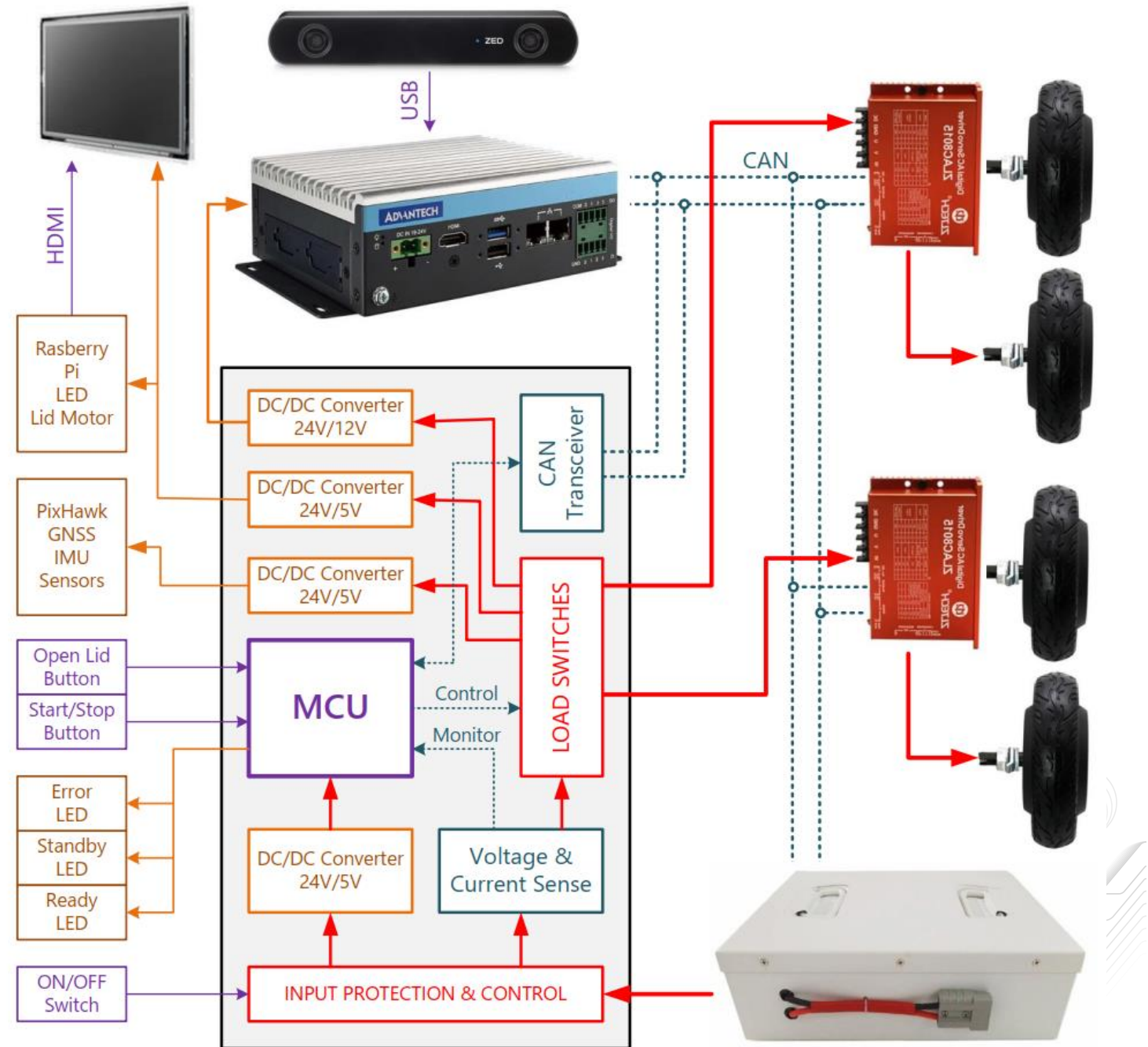
Issues:

- Heavy => Aluminum
- USB reliability => CAN/RS485
- Screen brightness => Outdoor LED screen
- Computer performance & throttle => Test Xavier AGX, RB5, KV260
- Magnetometer & GNSS interference issues
- No power sequence, power control for each peripherals
- Suitable battery
- Expensive sensors



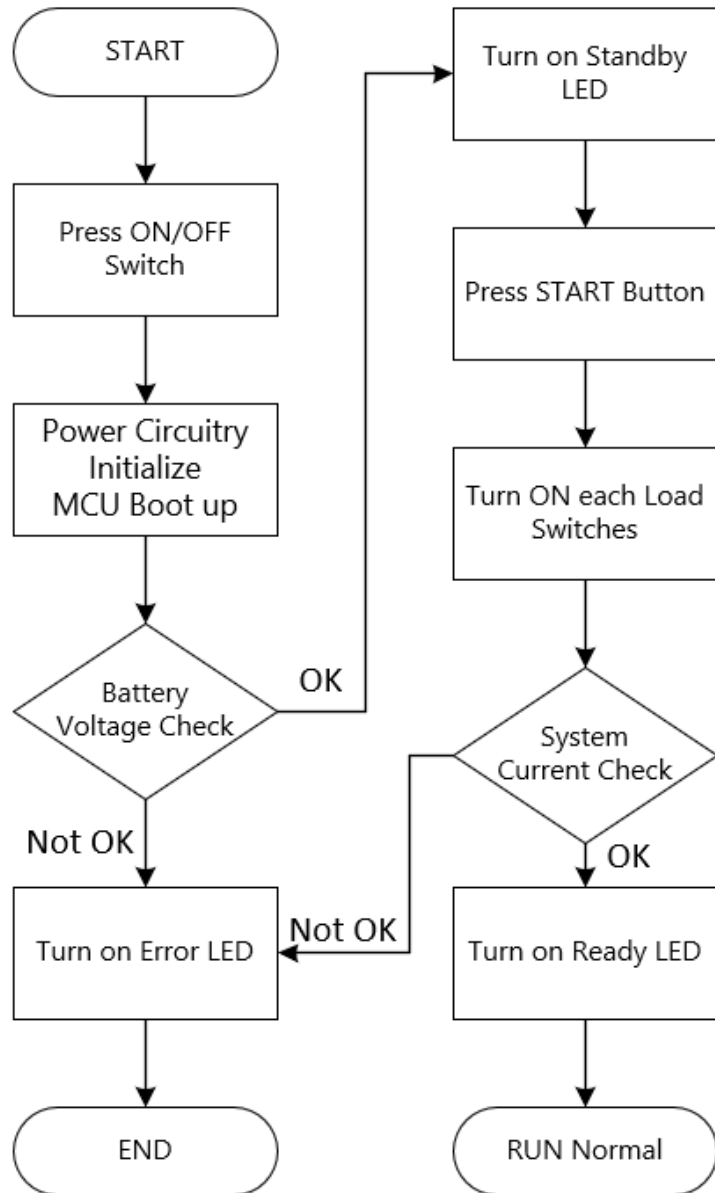
X / R1.5 Block Diagram

- High brightness display (1200nits)
- Communication Protocol: USB to CAN
- Power Management Unit:
 - Input Protection
 - Control Power Sequence
 - Monitor Voltage & Current
 - Control reboot Peripherals

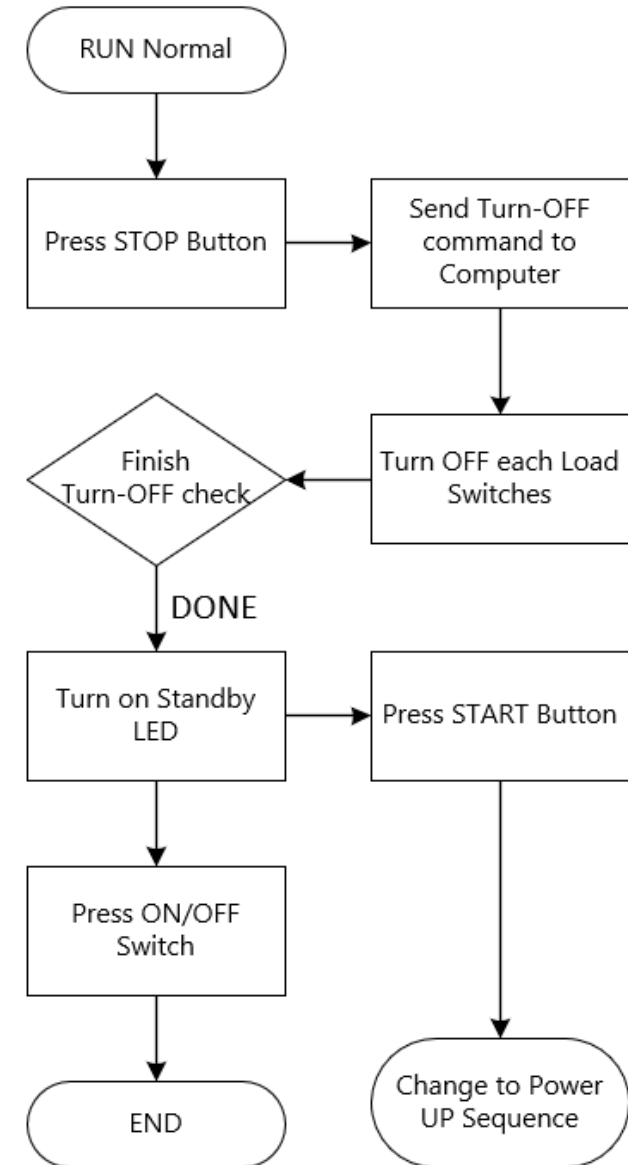




R1.5 Power UP Sequence



R1.5 Power DOWN Sequence

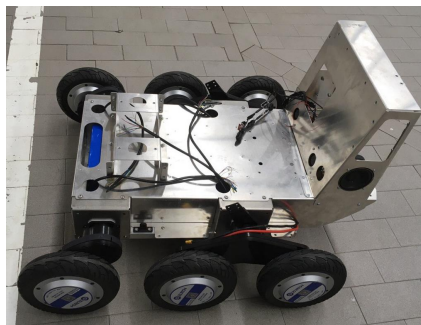




R1 Price

- Base: Scout Mini **117.300.000VND**
- Electronics (without IMU): **94.000.000VND**
 - Display: Waveshare 5.460.000VND
 - GNSS: 7.700.000VND
 - Xavier NX: 18.000.000VND
 - Zed: 12.650.000VND
 - LiDAR + Sonar: 5.000.000VND
 - DC Converter: 4.000.000VND
- Mechanical: **29.000.000VND**

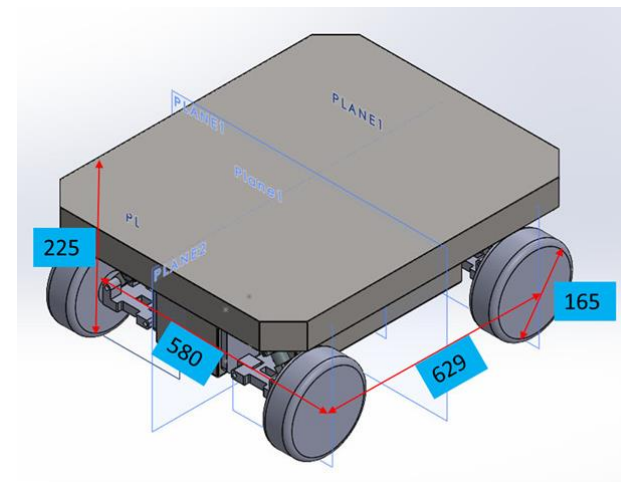
TOTAL: 227.000.000VND



R1.5 Base

- Motors & Drivers: $2 \times 5.620.000 + 4 \times 4.575.000 = 29.540.000\text{VND}$
 - Power Management Unit: sample ICs ready, estimate price $\sim 5.000.000\text{VND}$
 - Battery LiFePO4 - 2688Wh, 29.2V, BMS, 16kg, 445x135x151mm: 22.800.000VND
 - Mechanical: estimate price 22.000.000VND
- Base: **79.340.000VND**

Suggest: 02 Scout Mini + 02 inhouse bases





Timeline & Resource

- 01/06/2022: Kickoff base Robot
- 01/07/2022: Finish Requirements, Preliminary Design, Testing with COTS components
- 01/08/2022: Build prototypes & test.
- 01/09/2022: Finish first version of base Robot
- Human Resources (hardware team):
 - Linh: continue follow upper electrical system design
 - Giang: power management unit
 - Đại: robot main board base on Qualcomm RB5: GMSL camera inputs, 5G, Ethernet, GNSS, etc
 - Bình: cross-check
 - Need 1 more electrical engineer for cable & harness design (robot, EV, drone)





TRÂN TRỌNG CẢM ƠN!