Welcome Address

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Program Manager FIT.Fest

FIT.Fest '25: Hackathon

Prelude

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Hackathon Element Captain

FIT.Fest '25: Hackathon
Hackathon

- The era of large teams handling product development lifecycle over durations is slowly being replaced by digital assistants and assets
- There are infinite resources available, that allow development of complex applications with minimum effort and knowledge
- The Challenge: Develop a product in 48 hrs that meets the RFP with documentation.
  - The product must be developed using tools and assistants available openly - No BGSW assets must be used for the development.
- The product must be fully demonstrable virtually - no physical prototype yet.

BGSW
FIT.Fest'25
Future. Innovation. Technology.
December 3-4
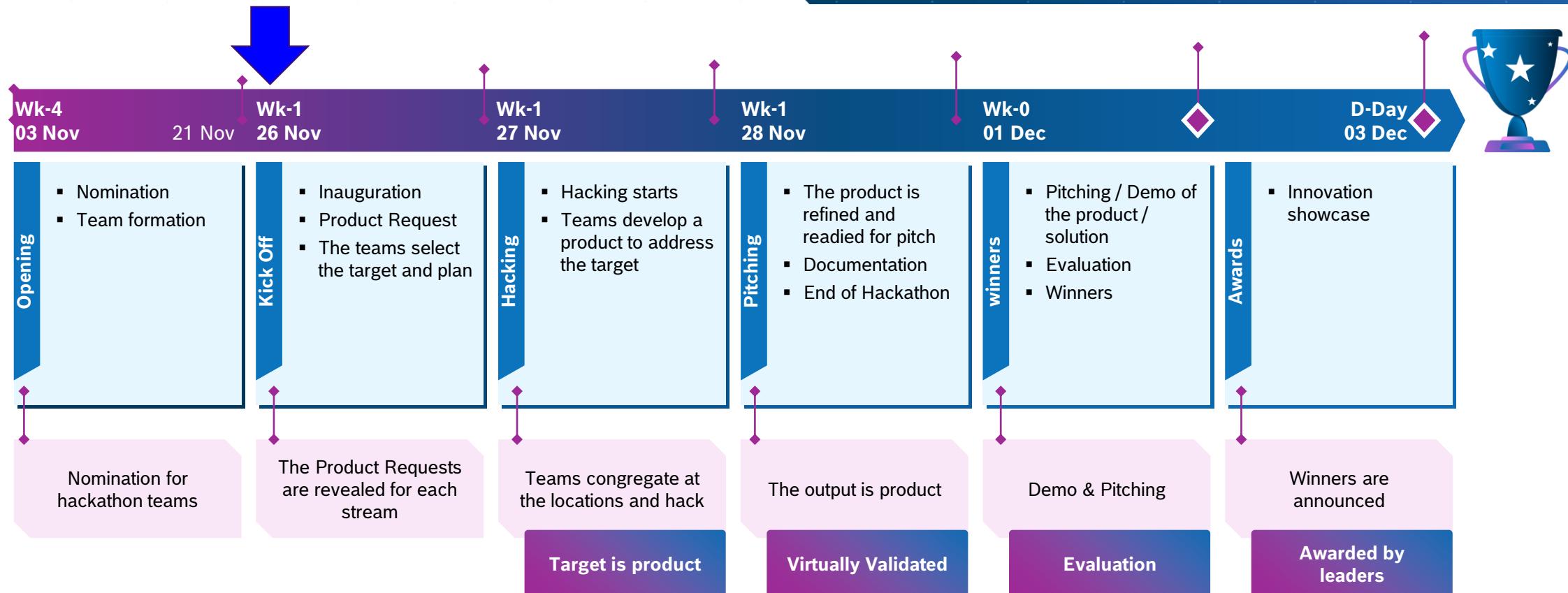
Request for Proposal

[ri-ˈkwest fər prə-ˈpō-zəl]

A business document that announces a project, describes it, and solicits bids from qualified contractors to complete it.

Consider yourself as a business leader with the capabilities to build a new product and the urge to make headways into new markets

FIT.Fest'25 Hackathon
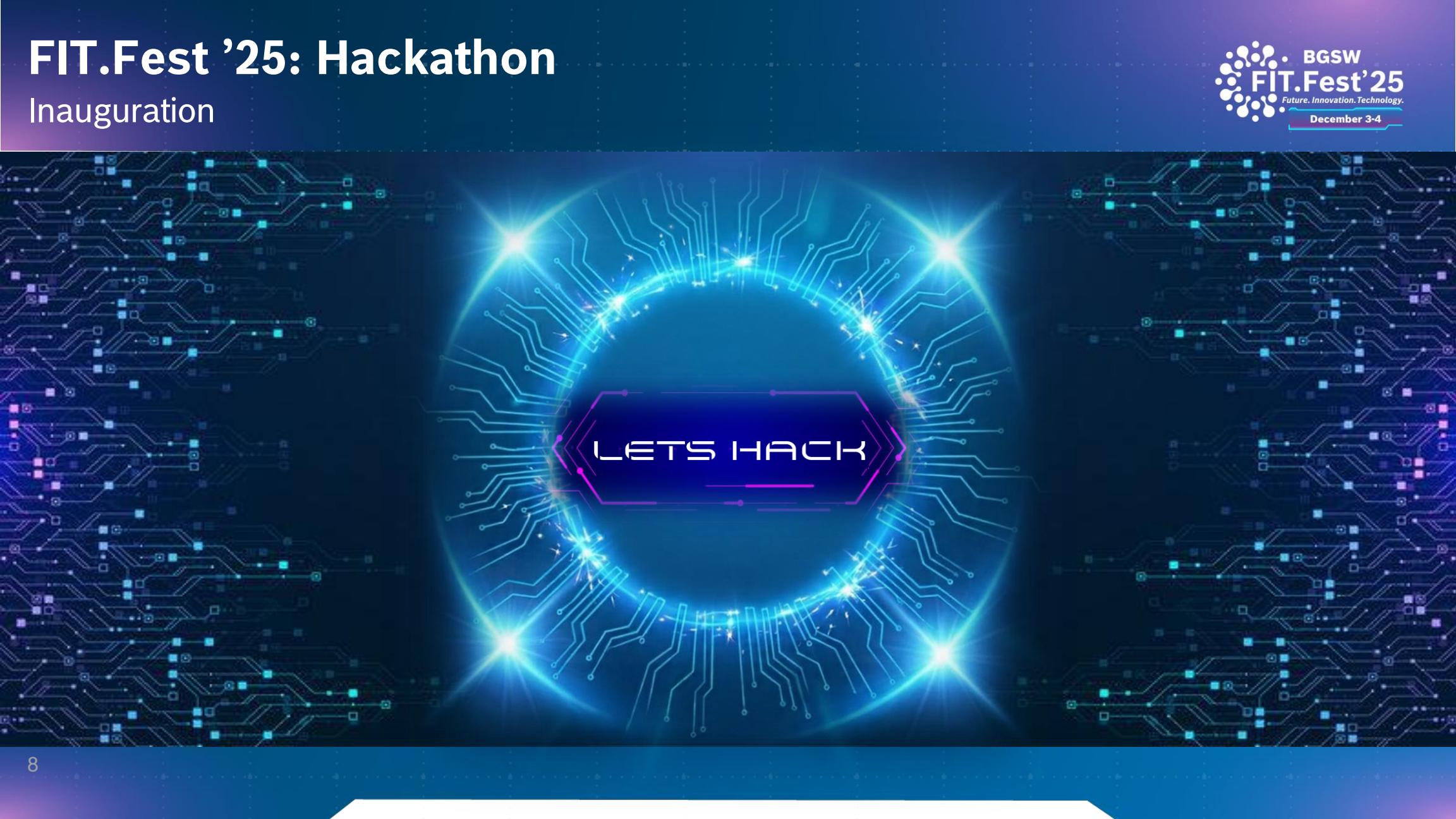
BGSW FIT.Fest'25
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December 3-4

Wk-4 03 Nov	21 Nov	Wk-1 26 Nov	Wk-1 27 Nov	Wk-1 28 Nov	Wk-0 01 Dec	D-Day 03 Dec

Opening
- Nomination
- Team formation

Kick Off
- Inauguration
- Product Request
- The teams select the target and plan

Hacking
- Hacking starts
- Teams develop a product to address the target

Pitching
- The product is refined and readied for pitch
- Documentation
- End of Hackathon

winners
- Pitching / Demo of the product / solution
- Evaluation
- Winners

Awards
- Innovation showcase

Nomination for hackathon teams

The Product Requests are revealed for each stream

Teams congregate at the locations and hack

The output is product

Demo & Pitching

Winners are announced

Target is product

Virtually Validated

Evaluation

Awarded by leaders

FitFest '25

Hackathon – Request for Proposals

Nov 2025

Hackathon – Electronics
Request for Design

Key Objective
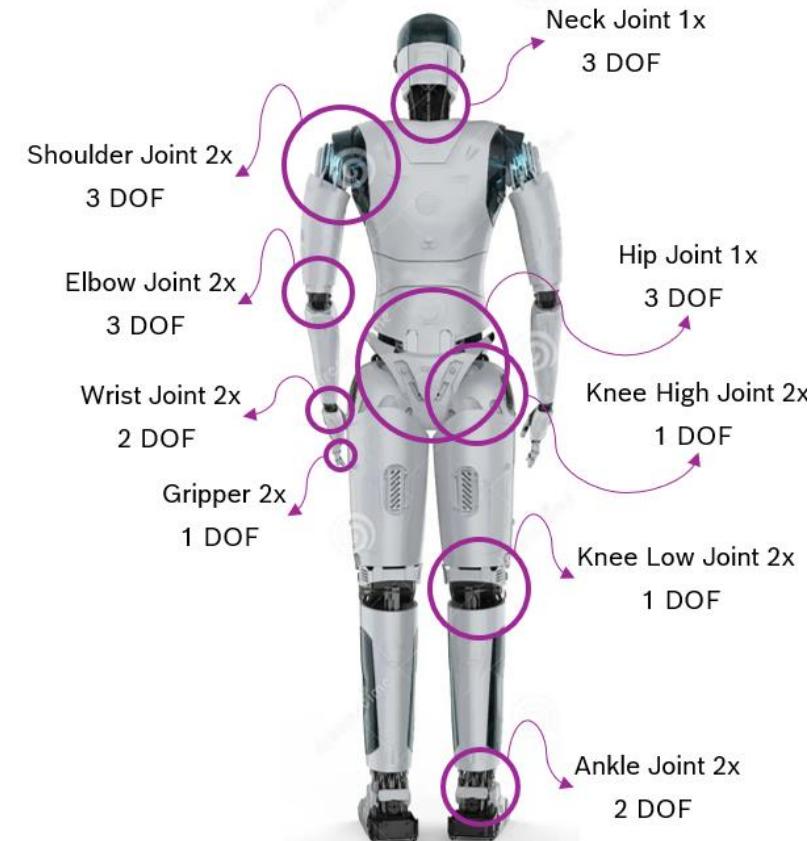
- Develop a 32 DOF Humanoid per attached specifications

Scope of Electronics

- Project 1: Main Robotics Processing and Communications Unit

- Project 2: Robotics Sensory and Perception Management System

- Project 3: Robotics Mobility and Manipulation Controller

- Project 4: Robotics Power Management Unit

Expected Deliverables for each

- Product Requirements Document

- Hw/Sw/Mech Requirements Spec

- High Level Design Document / Architecture,

- Schematics, CAD, Sw Code

- Design Analysis (WCA, Tolerance Stack-up, Signal Integrity, Reliability MTTF, MTBF, FMEA)

- Component and Module Test Plan

- Bill of Materials and Product Pricing for 10k pcs volume

- Simulation

Neck Joint 1x
3 DOF

Shoulder Joint 2x
3 DOF

Elbow Joint 2x
3 DOF

Wrist Joint 2x
2 DOF

Gripper 2x
1 DOF

Hip Joint 1x
3 DOF

Knee High Joint 2x
1 DOF

Knee Low Joint 2x
1 DOF

Ankle Joint 2x
2 DOF

FIT.Fest '25: Hackathon
Request for Proposal of Electronics product

H1: Main Robotics Processing and Communications Unit

- Orchestrates the entire robotics operation and acts as the brain
- Holds the main processing power for running all major algorithms
- High compute CPU and GPU architecture with >200 TOPS
- 32GB Memory
- Interfaces to Sensory and Mobility Controllers via high bandwidth bus systems – CANOPen, Ethernet, LVDS or similar
- Networked via WiFi-6 and 5G Cellular Modem with ability to connect Bluetooth 5 devices
- Operates on a 24V Power architecture

H2: Robotics Sensory and Perception Management System

- Manages the complete sensory system of the humanoid
- Intel Realsense camera for the headunit and running a 2D safety lidar. Secondary high resolution monocular camera for near view tasks
- All motors are DC with 360deg encoders running 3600 pulses per rotation
- High resolution two zone IMU for stability and direction
- Monitoring of temperature internal and external critical to product health
- Sensors at critical joints to detect load and strain during loading

H3: Robotics Mobility and Manipulation Controller

- Motor control and management for all DC servo motors
- Motor load at maximum of 5kgs and appropriate torque.
- Motion of humanoid to be at around 1m/s
- All motors are bidirectional with 180deg limits
- Arm speeds to be 0.3m/s
- Failsafe circuitry to avoid high speeds, safety and limp home functions

H4: Robotics Power Management Unit

- 24V Li-Ion battery management
- 500W Power output
- Multiple power topologies based on the overall architecture
- Failsafe and cutoff to ensure local failure doesn't impact full system
- Thermal management and active fuses
- Short-circuit, overload, high voltage and low voltage monitoring and cutoffs
- Wireless charging option plus charging via socket

FIT.Fest '25: Hackathon
Request for Proposal of SW product

S1: Main Robotics Processing and Communications Unit

- Operating System of Linux. Rest to be by choice
- Communications stack for defined network modules
- Interfaces to P2, P3 and P4 via CANOpen / Ethernet / LVDS / Optical
- High Focus on Safety
- SLM on board / Networked as required
- Health and diagnostics checks for all units
- Heartbeat and logs management
- Continuous feed to remote Cloud system for monitoring and logging

S2: Robotics Sensory and Perception Management System

- ROS2 Operating system
- Visual SLAM leveraging the Intel Realsense unit
- Depth and perception stacks
- Obstacle identification and management using VLMs
- Pose, Visual odometry and vector controls to be passed on to the main processing mobility controller

S3: Robotics Mobility and Manipulation Controller

- Control system and Motor control and management based on received information from S2 and S1
- Load management and controls
- Kinematics algorithms for motion and path planning, arm movements and gripping
- Failsafe software design to avoid high speeds, safety and limp home functions
- Remote operations handover / standby

S4: Remote Robot Management Cloud System

- Mobile Friendly Website with full monitoring of the Robot functions
- Remote Robot operations using Tele-operated Driving
- Remote updates
- Kinematics assessment and path logging
- Health parameters logging with cycle counter, battery status
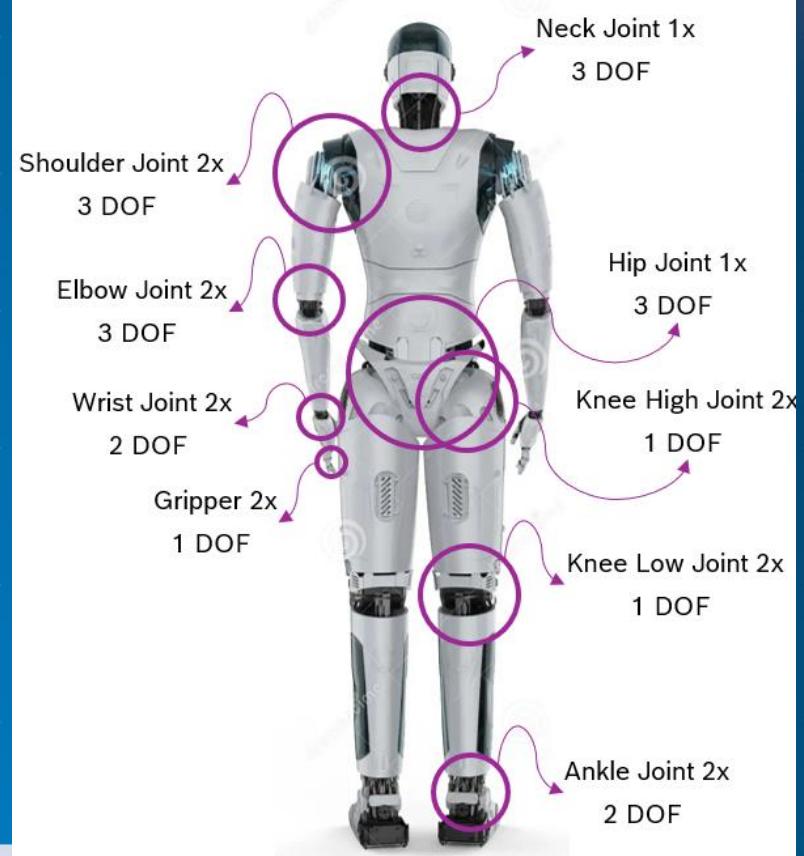
FIT.Fest '25: Hackathon
Request for Proposal of Mechanical product

P1: Humanoid Single Arm Design

- 9DOF single arm
- Shoulder joint with 3 axis of rotation and load of 5kgs pickup
- Rotation to be 180, 180, 90
- Alternatively in a ball and socket joint design and cabled rotation
- Elbow joint with 3 axis of rotation and supporting shoulder joint for 5kg pickup
- Rotation to be180, 90
- Wrist join with 2 axis of rotation
- Rotation to be 90, 90
- Gripper hand with 1 axis
- Arms to be limited to fixed rotation angles

P2: Robot Hand Design

- 5 finger arm
- 14 joints controlled by cabled mechanisms operated by micromotors
- Pitch and yaw movements for 5 joints
- Only pitch for remainder joints
- Has to simulate functioning of the hand
- Feedback with pressure and force sensors at finger tips and palm
- Capacitive sensing across hand as a skin layer

Neck Joint 1x — 3 DOF
Shoulder Joint 2x — 3 DOF
Elbow Joint 2x — 3 DOF
Wrist Joint 2x — 2 DOF
Gripper 2x — 1 DOF
Hip Joint 1x — 3 DOF
Knee High Joint 2x — 1 DOF
Knee Low Joint 2x — 1 DOF
Ankle Joint 2x — 2 DOF

FIT.Fest '25: Hackathon

Points to Note

1. Apart from the inputs, there will be no further information. You need to build based on your understanding of the RFP.

2. The evaluation will be based on the demo meeting the requirements and documentation.

3. There will be winners stream wise at every location*.

4. All members appearing for the evaluation will be provided participation certificate.

5. The teams are encouraged to be present at the designated venue during the 2 days.

6. The schedule of online evaluation of the demo will be shared by the location coordinators

7. Top 3 teams will be invited to present their products at the innovations showcase or other platforms

8. Bosch assets - tools are not permitted (Except Laptops). Use openly available tools to build the product.

Please refer the FAQ