HOSPIBOT

MECHANICAL DEVELOPEMENT

Tamas Gabor, SDU Robotics – 09.05.2024, Kiel

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MECHANICAL DEVELOPEMENT

Mobile base fixings

System architecture

Humanoid Version 2

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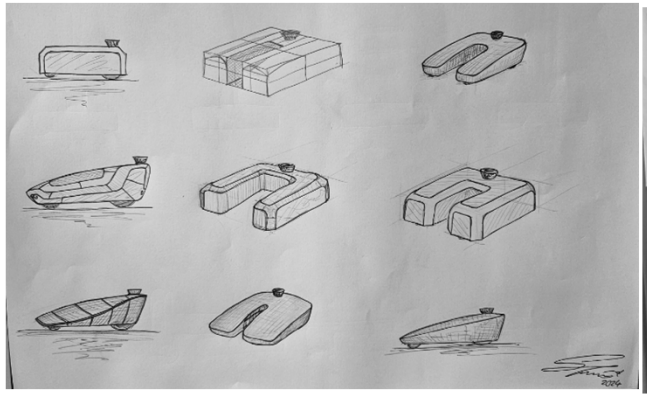
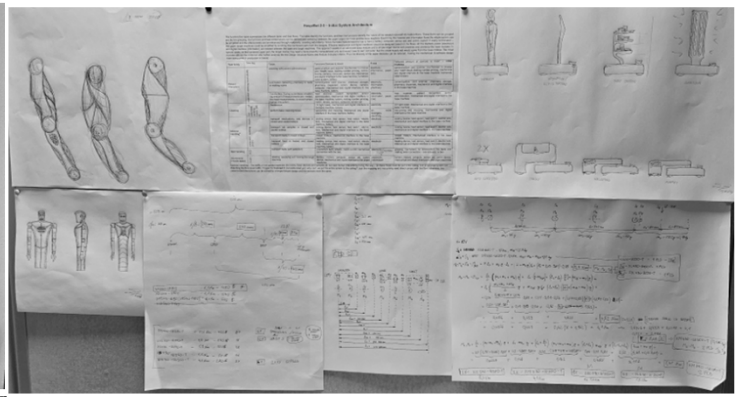
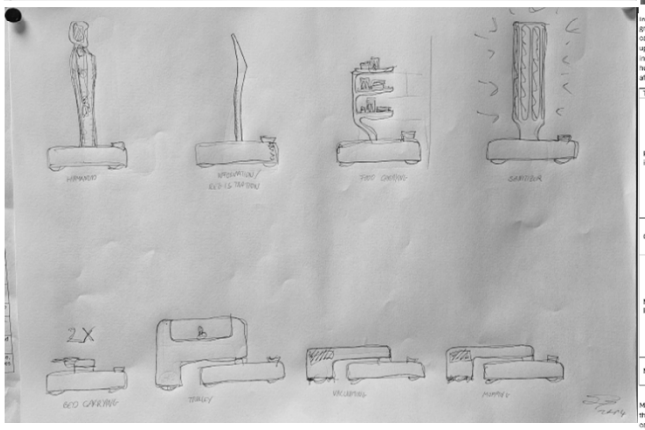
MECHANICAL DEVELOPEMENT
System architecture







In the following, the function-flow table summarizes the different tasks and their flows. The tasks identify the functions, and then the functions identify the nature of the needed material/information flows. These flows can be grouped and by this grouping, the functions and task combinations can be defined and sorted out between the upper target machines and the base machine. Examining the material and information flows the whole system can be simplified and the effectiveness can be enhanced through modularity, avoiding redundancy. Since the base module/machine has to have a battery, computer, sensor set, and comm. system in every combination – the upper, target machines could be simplified by avoiding the mentioned parts from the designs. Effective mechanical and digital interfaces should be designed based on the flows. At this moment power (electricity) and digital interface (information) are needed between the base and target machines. This approach results in an advanced base module and a simple target device set (powered and driven by the base module). In special cases, as the humanoid upper part, the target device may need a more powerful computational unit, so it would have its own computer, but the power supply still would come from the base module. The initial modules still can be combined after further analysis like the Design Structure Matrix and Module Indication Matrix. Thus the diversity of the upper modules can be reduced, making the mechanical- & software design more transparent (+ production in theory).

Task family	Time tag	Tasks	Functions/Devices to insert	Flows	Reduced amount of devices to insert - **initial modules**
Patient interaction	extended working hours (6-20)	assisting with patient administration	camera/yellow card scanner, touchscreen to choose your health issue, waiting number printing, comm. device, camera, computer, sensor set, mechanical and digital interface to the base machine, humanoid robot system, battery	electricity, information, paper, (ink)	camera/yellow card scanner, touchscreen to choose your health issue, waiting number printing, mechanical and digital interface to the base machine, humanoid robot system
		automation delivering pharmacy to beds or waiting rooms	camera/yellow card scanner, pharmacy storage, pharmacy dispenser, comm. device, camera, computer, mechanical and digital interface to the base machine, battery	electricity, information, pharmacy	camera/yellow card scanner, pharmacy storage, pharmacy dispenser, mechanical and digital interface to the base machine
		Disinfection: During a pandemic situation big amount of measurements are needed, like heat measurements, to avoid human-human interaction	heat scannor, patient recognition and/or administration, mechanical and digital interface to the base machine, battery, waiting number printing, comm. device, camera, computer, sensor set	electricity, information, paper, (ink)	heat scannor, patient recognition and/or administration, mechanical and digital interface to the base machine
Cleaning	out of extended working hours (20-6)	Sterilization	UV light tower, mechanical and digital interface to the base machine, battery	electricity	UV light tower, mechanical and digital interface to the base machine
		perform basic cleaning duties	vacuuming and mopping, mechanical and digital interface to the base machine, battery	air, water, detergent, electricity	vacuuming and mopping, mechanical and digital interface to the base machine
Material Handling*	extended working hours (6-20)	transport medications, and devices in closed and cooled trolleys	cooling device, heat sensor, heat switch, electric lock, mechanical and digital interface to the base machine, battery	electricity	cooling device, heat sensor, heat switch, electric lock, mechanical and digital interface to the base machine
		transport lab samples in closed and cooled trolleys	cooling device, heat sensor, heat switch, electric lock, mechanical and digital interface to the base machine, battery	electricity	cooling device, heat sensor, heat switch, electric lock, mechanical and digital interface to the base machine
		transport linens in closed trolleys	closed trolleys, mechanical interface to the base machine		closed trolleys, mechanical interface to the base machine
		transport food in heated and closed trolleys	heating device, heat sensor, heat switch, electric lock, mechanical and digital interface to the base machine, battery	electricity	heating device, heat sensor, heat switch, electric lock, mechanical and digital interface to the base machine
Movements	6-24	Holding, supplying and moving the target machine	Battery, motors, computer, sensor set, comm device, mechanical and digital interface to the target machines	electricity, information	battery, motors, computer, sensor set, comm device, mechanical and digital interface to the target machines

Material Handling*: The traffic of the carried materials like linens, food, devices and samples do not need human interactions during this way - so these flows could be put to the ceiling onto a monorail system not disturbing the floor-level traffic. Trigger for **Concept II** (not elaborated yet): why can't we put the entire system to the ceiling? Just the mopping and vacuuming need direct contact with the floor, otherwise, the patient-robot interactions can be solved by a longer/deeper design and the sensors work the same.

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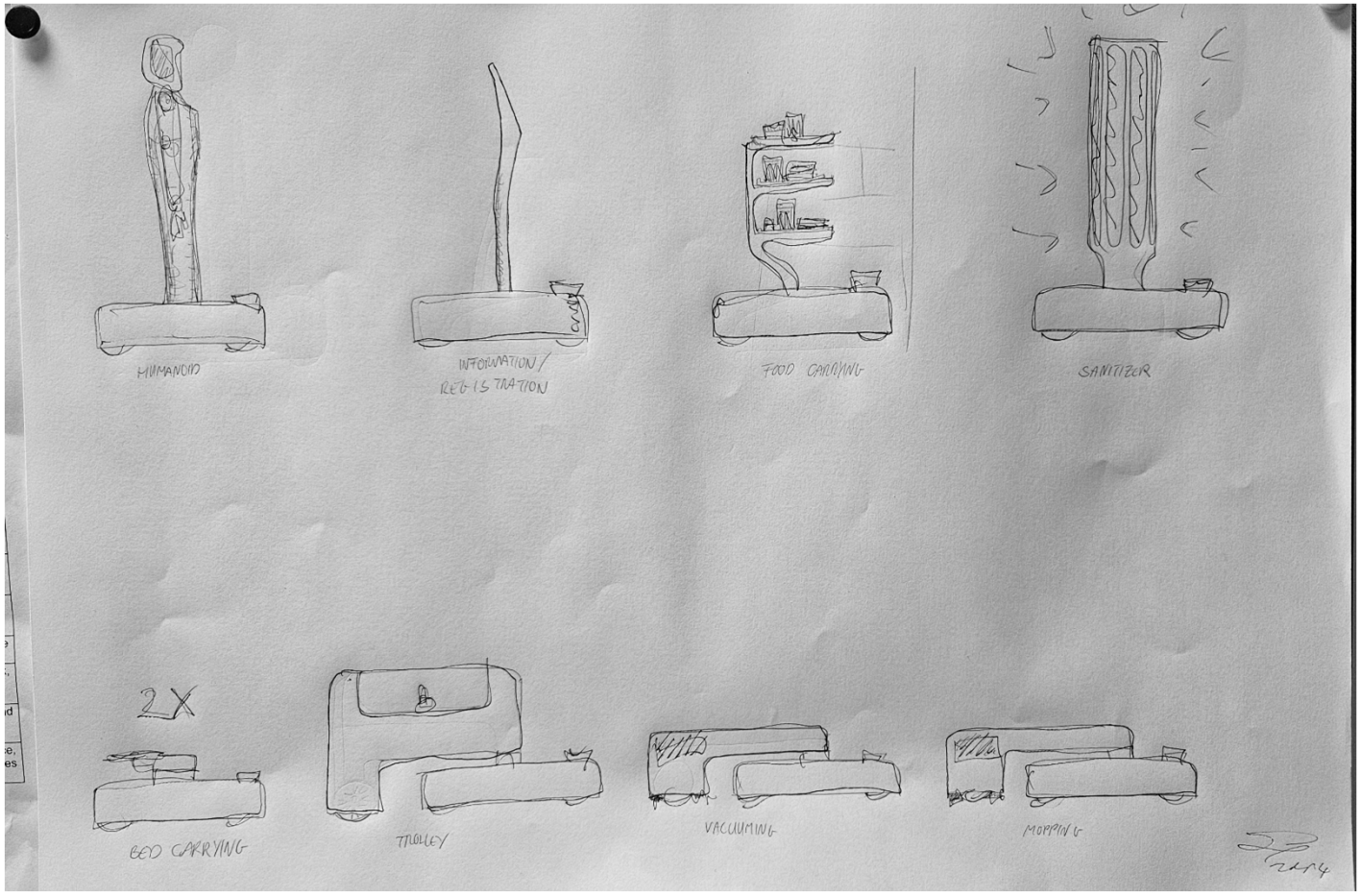
HOSPIBOT

MECHANICAL DEVELOPEMENT

System architecture



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In the following, the function-flow table summarizes the different tasks and their flows. The tasks identify the functions, and then the functions identify the nature of the needed material/information flows. These flows can be grouped and by this grouping, the functions and task combinations can be defined and sorted out between the upper target machines and the base machine. Examining the material and information flows the whole system can be simplified and the effectiveness can be enhanced through modularity, avoiding redundancy. Since the base module/machine has to have a battery, computer, sensor set, and comm. system in every combination – the upper, target machines could be simplified by avoiding the mentioned parts from the designs. Effective mechanical and digital interfaces should be designed based on the flows. At this moment power (electricity) and digital interface (information) are needed between the base and target machines. This approach results in an advanced base module and a simple target device set (powered and driven by the base module). In special cases, as the humanoid upper part, the target device may need a more powerful computational unit, so it would have its own computer, but the power supply still would come from the base module. The initial modules still can be combined after further analysis like the Design Structure Matrix and Module Indication Matrix. Thus the diversity of the upper modules can be reduced, making the mechanical- & software design more transparent (+ production in theory).

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		automation delivering pharmacy to beds or waiting rooms	camera/yellow card scanner, pharmacy storage, pharmacy dispenser, comm. device, camera, computer, mechanical and digital interface to the base machine, battery	electricity, information, pharmacy	camera/yellow card scanner, pharmacy storage, pharmacy dispenser, mechanical and digital interface to the base machine
		Disinfection: During a pandemic situation big amount of measurements are needed, like heat measurements, to avoid human-human interaction	heat scanner, patient recognition and/or administration, mechanical and digital interface to the base machine, battery, waiting number printing, comm. device, camera, computer, sensor set	electricity, information, paper, (ink)	heat scanner, patient recognition and/or administration, mechanical and digital interface to the base machine
Cleaning	out of extended working hours (20-6)	Sterilization	UV light tower, mechanical and digital interface to the base machine, battery	electricity	UV light tower, mechanical and digital interface to the base machine
		perform basic cleaning duties	vacuuming and mopping, mechanical and digital interface to the base machine, battery	air, water, detergent, electricity	vacuuming and mopping, mechanical and digital interface to the base machine
Material Handling*	extended working hours (6-20)	transport medications, and devices in closed and cooled trolleys	cooling device, heat sensor, heat switch, electric lock, mechanical and digital interface to the base machine, battery	electricity	cooling device, heat sensor, heat switch, electric lock, mechanical and digital interface to the base machine
		transport lab samples in closed and cooled trolleys	cooling device, heat sensor, heat switch, electric lock, mechanical and digital interface to the base machine, battery	electricity	cooling device, heat sensor, heat switch, electric lock, mechanical and digital interface to the base machine
		transport linens in closed trolleys	closed trolleys, mechanical interface to the base machine	-	closed trolleys, mechanical interface to the base machine
		transport food in heated and closed trolleys	heating device, heat sensor, heat switch, electric lock, mechanical and digital interface to the base machine, battery	electricity	heating device, heat sensor, heat switch, electric lock, mechanical and digital interface to the base machine
Movements	0-24	Holding, supplying and moving the target machine	Battery, motors, computer, sensor set, comm device, mechanical and digital interface to the target machines	electricity, information	battery, motors, computer, sensor set, comm device, mechanical and digital interface to the target machines

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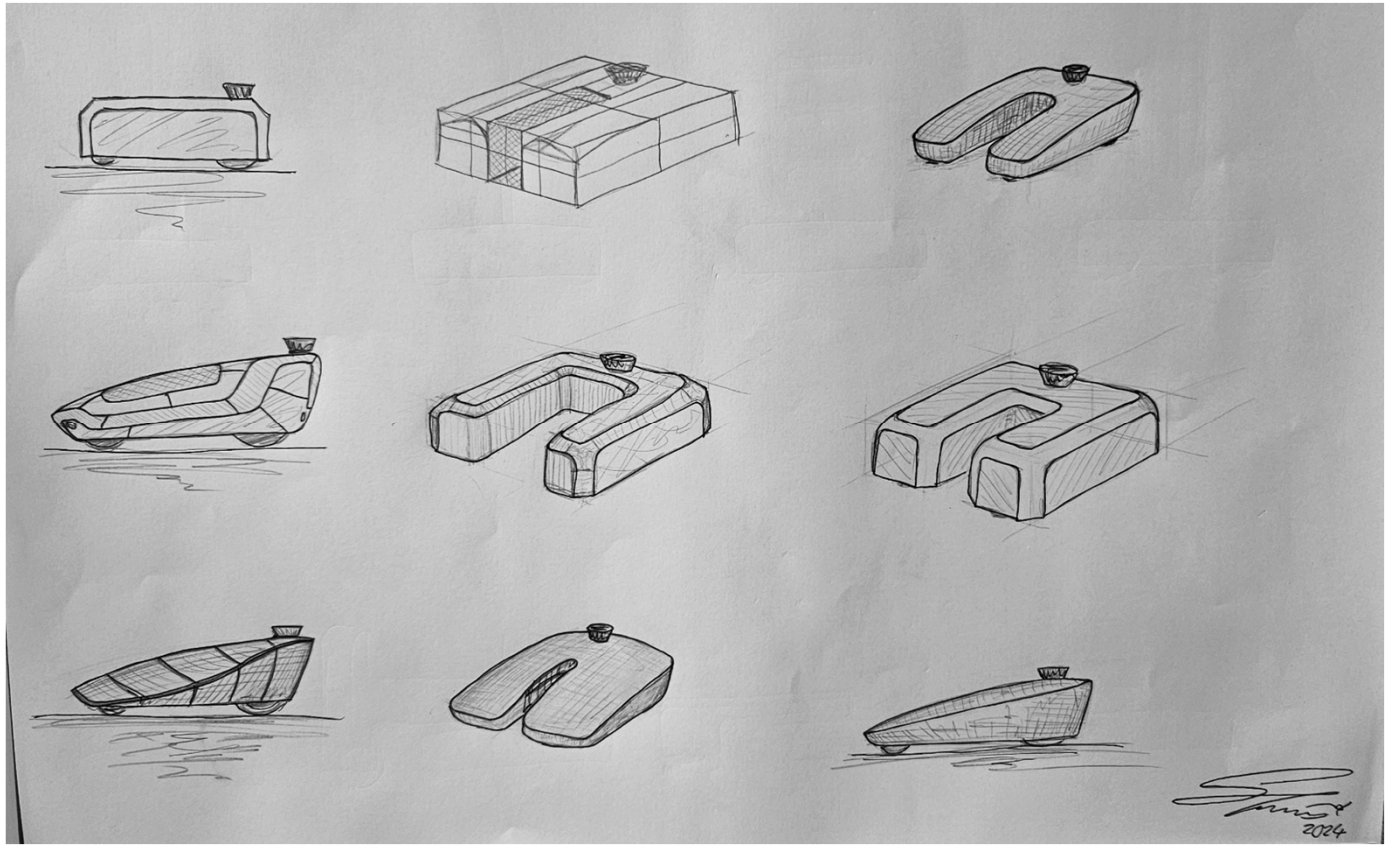

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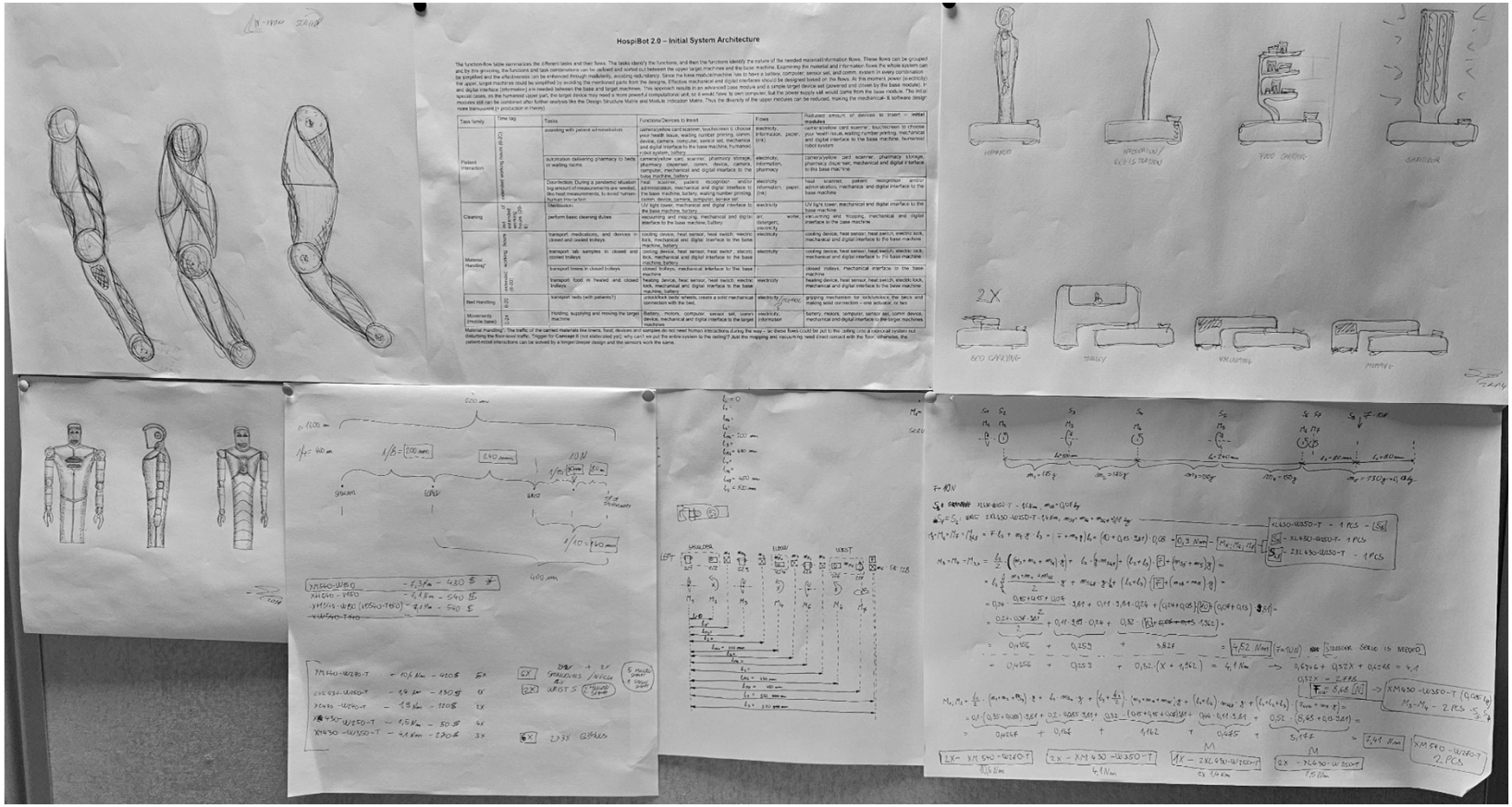

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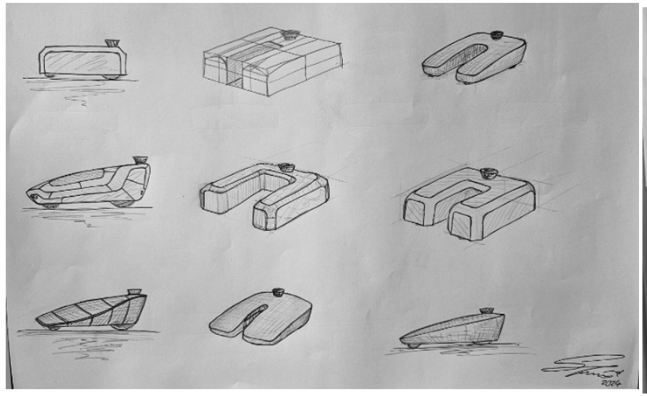

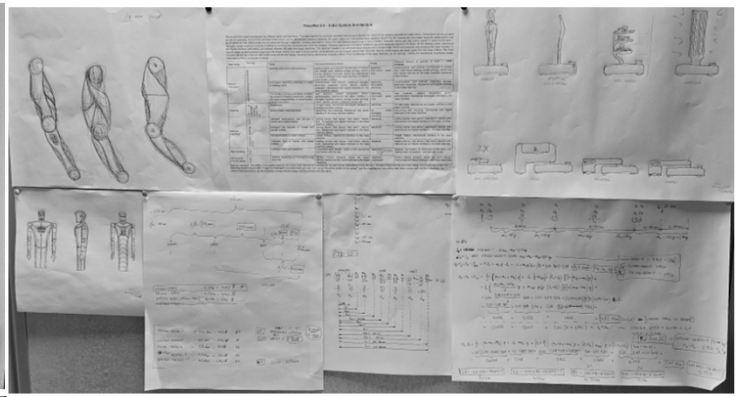

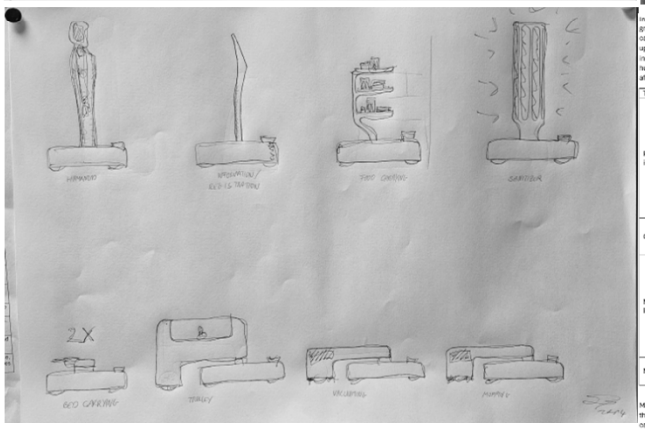

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Mobile base fixings

System architecture

Humanoid Version 2

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MECHANICAL DEVELOPEMENT
Humanoid Version 2

Main goal

Creating a highly customizable humanoid robot

Why?

Different hospitals, different departments can have demand for diverse appearances.

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Humanoid Version 2

Functional skeleton
+
Interchangeable cover segments

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HOSPIBOT
MECHANICAL DEVELOPEMENT
Humanoid Version 2

Functional skeleton

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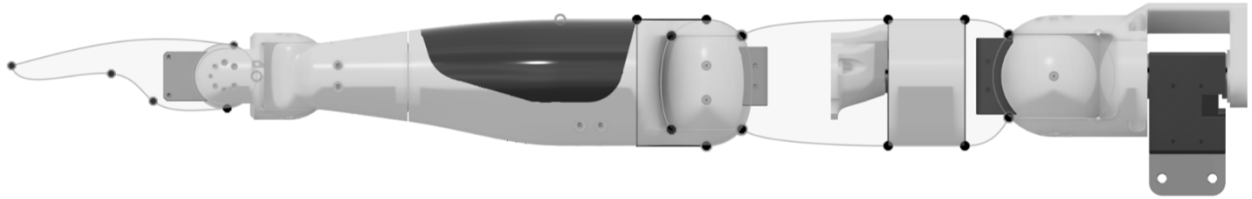
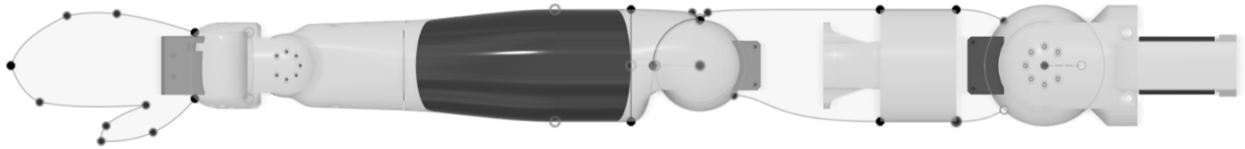
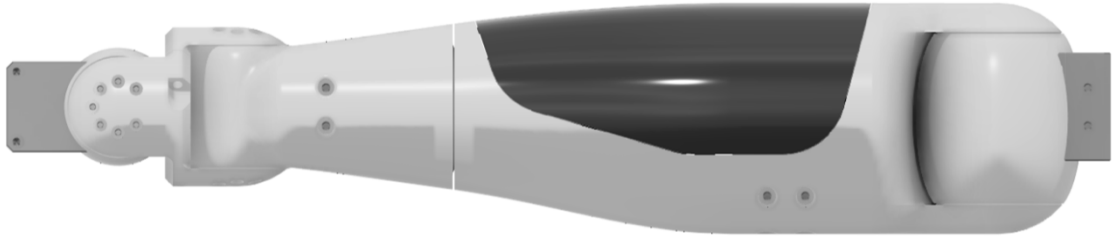
Interchangeable cover segments







Different shapes and color combinations can be tested without building a new robot. (Live demo)

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FIN

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