Autonomous Software Agents
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1 Introduction - Smart Home Domain

Problem 1

Provide here your introduction to the smart house domain.

Solution. Smart home technology has long been the subject for futurists predicting robot butlers, starting from novels until movies and series, smart home automation system enables inhabitants to automate and control remotely the electronic, electrical and other technology-based systems in their home. It provides several advantages such as real-time monitoring, interconnectivity of devices functionalities as smart devices can communicate with one another and be remotely controlled by homeowners, safety due to alarm and security procedure in emergency situations revealed through Deep-Learning based sensors, real-time fault detection, consumption saving to reduce the waste of time, battery, storage, energy and moving to renewables by controlling lighting, HVAC systems, window coverings and irrigation, customization by means of data collection and mobile applications that enable homeowners can access the systems with the help of the internet from any corner of the world at any time by means of a user interface that uses either wall-mounted terminals, tablet or desktop computers, a mobile phone application, or a Web interface, smart controls and well-being. Many sources in literature point to Nikola Tesla's creation of a remote control for a toy by means of a small, radio-transmitting control box that reminds us nowadays drone, as one of the first easily accessible consumer-oriented automation, that motives the researchers community to call him "the father of robotics". Another interesting application in this domain was the first engine-powered vacuum cleaner in 1901, then thanks to the introduction of electric power distribution[Ger99] home automation focused on self-contained electric or gas powered home appliances and this led to the introduction of electricity.powered vacuumm[Spa07] in 1907, water heaters in 1889, refrigerators in 1913 , sewing machines, dishwashers, clothes dryers, irons, toasters, and so much more. In early 40s, the introduction of the first automatic washing machine[Joh37] and the invention of the electrical digital computer[Arb90], [Ata84]. The first true home automation device, ECHO IV, was released in 1966, it controlled the temperature, the appliances, and the shopping lists, but it did not reach any commercial success because of its unaccessible price, the same reason there was behing the fault of the Kitchen Computer[Atk10]. One of the first practical devices for smart home dates back to 1975: X10, it was a communication protocol that leverages a AC electric power transmission wiring in the home to enable communication between devices installed in the home and remote console and remote modules managed remotely by users, but it was expensive, slow, unencrypted, and prone to signal loss and interference, it mainly worked on controlled small appliances and lighting fixtures, that sends digital information through radio frequency bursts onto a home's existing electrical wiring. A home automation system typically connects controlled devices to a central smart home hub, gateway, then it is crucial to analyze the networking history to fully comprehend the evolution of smart home, In general, control networks are based on power line communication and wireless transmission are dominant in residential home automation due

to lower component prices and installation cost whereas wire line control networks, on the other hand, are found in the premium residential segment and in industrial building control applications. In those years, it was released ARPANet [Rus01], the grandfather of the Internet, and the invention of micro-controllers[MB92] translates in a relevant price reductions to electronics, in 1973, it was invented Ethernet[MB76], to connect multiple computers, and the successive year was created the communication standard IEEE 802.11, whose invention was followed by rhe releasment of low-cost wireless network protocols[NK19] such as Zigbee, a.k.a. 802.15 [SM06a][Erg04][RSP11][SM06b] and Z-Wave [Bab+20][YMK16] that are similar to WiFi but they are more stable, use less data, and can have a more extensive range, on the other hand Z-Wave can even support a wireless mesh network to allow devices to talk to each other also at 500 feet each other but it's a closed standard by contrast Zigbee is open source but Zigbee products need to be within 60 feet of each other. Despite their limitations, these protocols remove the need of cables to route through walls, lay the foundations towards security in the smart home as both of them have supported encrypted communication, and speeded up the production of smart devices, in which a particular effort came from Microsoft, such as motion-sensing lights, automatic garage door openers, programmable thermostats, and security systems,In the 1990s Microsoft proposed several security systems, environment controls, smart locks, and lighting controls, but these devices still retained many properties of X10 such as centralised control, wired devices, and simple automations, these novelties motivated the American Association of Home Builders to coin the term "smart house" [DS15]. In 90s the invention of Wi-Fi[TW10] for wireless, based on IEEE 802.11, the proliferation of more stable routers, and the successive commercialization of cloud-based computing power to access features has dramatically changed the communication system scenario and has converted this smart technology into commercial products in the mass market. This was the beginning of the remote access era in Smart Home, it was coined the term Internet of Things [AIM10] [MS14][REC15][WW10] to describe a system where the Internet is connected to the physical world via ubiquitous sensors [SBA01][Ash99] and the term Smart City too to describe a system that aims at To these years, it dates back also a proposal behind the term Smart City[Dal+14] [KM18] [Yin+15], it was Gerontechnology[Roc+19] that aims at helping senior citizens in their daily lives. Throughout the 2000s, smart devices began to increase in popularity, at the beginning of the 2000s, it was released the Z-wave platform[Bad+17] which is not affected by interference from Wi-Fi and other wireless technologies such as Bluetooth, it built a mesh network to enable remote communication from device to device, then homeowners can also add non-Z-Wave products to their network by plugging them into Z-Wave accessory modules. Another alternative that has get quite popular is Thread as it provides its own dedicated mesh network, and is not reliant on a home internet connection. So, instead of every device connecting with one access point, each Thread-enabled device acts as a mini-hub, moreover it offers a number of benefits including faster response times, improved reliability and better security and it leverages the IEEE 802.15.4 MAC/PHY protocol, which reduces the power consumption with respect to WiFi. The smart home hub is still an open question as some smart home systems run entirely on WiFi, which requires only a home's WiFi router but precludes battery powered devices because of the high electrical power needed, while Bluetooth reduces the amount

of required energy but has a shorter range, in alternative Z-Wave or Thread are low-power protocols with longer range than WiFi, but they require a dedicated hub that may also needs an internet connection to connect to any backend services associated with the smart home. In order to address this hub issue, they have been recently proposed novel wireless protocols such as LTE Cat-M and NB-IoT that connect IoT devices to cellular networks, while keeping power consumption low enough to allow for long battery life, additionally, the introduction of LoRa radios enable to cover many kilometres of range, but the cost of the components is significantly greater than the short-range radios aforementioned. If in the past smart home still requires the ubiquitous presence of a human-in-the-loop, recently the trend is moving toward ambient computing that trains deep learning models in such a way to progressively learn inhabitants' habits thanks to a more invasive data collection, thanks also to more advanced sensing techniques such as Ultra-Wide Band, some of the first examples thereof are the Nest Learning Thermostat[Kaf+19] produced by Apple in 2010 that pointed out the power of data collection to track activity of inhabitants and make the thermostat infer its action based on the people habits, then they were released multiple systems such as Nest Labs by Google and Amazon Echo by Amazon in 2014 Living Tomorrow Smart Home in 2015 that enables to control every daily aspect from groceries and shopping to entertainment, Mobility Vision by Hunday in 2017, then starting from Amazon Echo that was just a voice-controlled music solution, it was deployed Alexa that works as a smart home hub that has began the trend of smart voice personal assistant. At the beginning of 2010, there were already 1.5 million automated home systems in place. and according to the research of Forbes, more than 45 million smart home devices will be installed in U.S. homes by the end of the year 2018 and the market business will progressively enlarge from $64 billion in 2022 until $163 billion in 2028, according to the research of Statistica. Smart devices are beginning to affect also the real estate markets as it is increasing the offering of homes with integrated smart home features, an example thereof culminates in the design a smart home by ECSI in Minneapolis with complete automation of Savant systems smart host system. Nowadays smart home systems today are quite cheaply and flexible based on the end user interest, and the amount of released devices keep increasing, such as smart speakers,smart (door) locks, thermostats, small appliances, doorbell cameras, lights, sound system, televisions, floor cleaning, security cameras, heating and cooling systems, smart bulbs, smart plugs, smart wifi, voice assistants, remote mobile control, scheduling appliances, TVs, doors, mobile/email/text notifications, and remote video surveillance, and living greener to prevent unnecessary waste, security by locks, cameras, and many others. There are two main approaches to realize a smart home, the first one relies on a remote application for each device, the second one relies on a single remote application for all the devices, as proposed by Alexa, Google Home[FM20], Apple HomeKit or Ring, the latter is becoming more popular as it prevents the users from installing tons of applications, in general we can state that they are based on a smart hub that connects all the devices on your home automation system through a single piece of hardware, such as a single centralized computerized touchscreen panel, while software which can remotely control your home via some hardware to directly control the smart home. Smart home criticisms are mostly due to proprietary software and closed-source protocols, that result in the lack of universal standards, limited

inter-connectivity, unreliability, rare compatibility, and security of devices and hubs limited by their short durability, maintenance and support. The vulnerability of smart home devices is a critical aspect in this domain as it exposes the user to provide third parties access to their home networks, and even other devices on those networks. In addition, vast networks of smart devices are regularly used as part of botnets, which wreak havoc in cyber attacks. These security issues are not new, and they are pervasive, a key example it the discovery of out-of-date openSSL libraries on a multitude of smart devices. This leads governments to review legislation concerning the security of connected devices being drafted. However, since everyone stands to benefit from committing to a standard open protocol for smart home connectivity there is a lot of interest in establishing a common communications platform, as it has been argued that the real benefits of the smart home will not be realised until all the devices will be inter-operable, able to communicate with each other, in fact recently a possible solution has been proposed by Matter that is an open-source connectivity standard, that connects Thread, Wi-Fi, Bluetooth, and ethernet to allow all your devices to communicate with each other locally, without the need for a cloud[Ham+22]. Another argument of concerns is the aggressive data collection that has been conducted by the smart home devices[SCZ20], as in many other area of application of Data Analytics[Cus+19]. In general a smart home is composed of five building blocks: devices under control (DUC) as home appliances or consumer electronics, which are controlled by the home automation system, sensors that quantifies some property in the environment (e.g. temperature, humidity, light, liquid, gas, motion, noise), actuators that directly act on the environment to reach some desired state (e.g. mechanical actuators such as pumps and electrical motors or electronic actuators such as electric switches and dimmers), the control network that can a Powerline Communication, a Wireless Transmission, or a Wireline Transmission that connects devices under control, sensors, and actuators with the controllers, the controller that collects information through sensors, receives commands through remote control devices, and acts based on commands, a set of predefined rules. and the remote control devices that connect the home automation application to the home controller either by connecting to the controller through the control network itself, or through any other interface the controller provides, such as WLAN,the Internet, or the telephone network.

2 Introduction Multi-Agent in SmartHome

Problem 2

Present the multi-agent approach in the smart house domain and additional details of the implemented simulation.

Solution.

Smart home refers to the possibility of managing in an automated manner dwelling, enhancing the comfort, safety, convenience and interactivity of home life, and optimizing people's life style. It is a natural consequence of the widespread of the internet in our daily life, merged with the advances in networking and Artificial Intelligence (AI). Over the last

decades, Parallel and Distributed Systems have became increasingly common, while artificial intelligence has reached a novel peak, after the first AI winter due to the XOR problem, thanks to the back propagation breakthrough that enables to overcome the aforementioned limitations. These two domains have been naturally combined into Internet of Things (IoT) that leverages interconnected devices and their capability of acting in a smart way within the environment, some of their applications are smart car, smart city, industrial IoT and Smart Home. The project under analysis emulates a Smart Home as a Multi-Agents system, the key idea behind the integration of the Agent-Oriented Software Engineering techniques in the Smart Home domain is to provide additional flexibility to the design, since the Object-Oriented Software Engineering techniques were born to model the objects in the world and their action but they were not produced to deal with autonomous entities. In the Smart Home domain, it would be possible to apply several of the Agent-Oriented Software Engineering techniques, in this case the choice has been to rely on Belief-Desire-Intention (BDI) paradigm. Belief-Desire-Intention paradigm is based on the idea that an agent represents the world through a proper language in its belief that are based on the information received from the sensors with which it interacts, while its desires or goals represent what the agent would achieve, then according to the agent's current beliefs and its goal, the agent selects an intention that will produce a sequence of actions, also known as plan, that will be operated by the devices, or actuators, to achieve the goal. In the domain under analysis, it is clear the need for agents, sensors and actuators for helping and automatizing daily activities. A basic example of actions of the BDI paradigm is the application of Smart Lights, where the agent creates a belief about the presence of people in the room according to the information provided by some Computer Vision sensor, if this is the case if there is enough light outside, thus the agent tells some devices to apply the proper sequence of actions to turn on the roller shutter in the room, otherwise it turn on the lights in the room. The reason behind the separation of the sensors and the beliefs of the agent is due to the separation of these two physical entities that run on separate hardware that communicate by means of some protocols that may translate in a misleading knowledge of the agent. Based on the idea just described, it has been implemented the project, the environment has been modeled according to the Object-Oriented paradigm, while its interaction with the sensors and the devices, and the interaction of the latter has been realized according to the AOSE paradigm in Java Script because of its support to the event-driven programming, and finally the sequence of actions to be performed to achieve the Agent intention is the results of the conversion from Java Script to Planning Domain Definition Language (PDDL) to be fed as input to one of the most celebrated server for remote automated planning [C. Muise, Planning.domains, ICAPS system demonstration]. Once the *planning.domains* has produced the sequence of actions, they are concretely applied in JavaScript in such a way to update the environment by means of some method implemented in the device instance of interest for the specific case; this will then result in a sensing operation and the update of the agent beliefs.

More specifically, there are multiple methodologies that aim at formalizing the necessary steps in the deployment of an agent-oriented software system, more specifically they define: a modeling language and a conceptual framework, a development process, an analysis and a design technique and the supporting tools. The main methodologies in Agent-Oriented

Software Engineering are GAIA, Tropos, Mas-Commonkads, Prometheus, PASSI, Adelfe, Mese, RAP, Message and Ingenias. In the current project, it has been used the TROPOS methodology that accounts for BDI-like agents whose development is realized top-down, and covers early and late requirements, architectural and detailed designs. In TROPOS the intentional entities, actors, have hard-goals or soft-goals that can be satisfied by means of a sequence of actions, a.k.a. task, that are achieved by accounting for social dependencies with other actors, whereas the physical or informational entities, resources, have no intention, a key attempt of this methodology methodology is the design of relations that could be decomposition, means-ends, contribution, resource need or production. It defines three main types of models: the first one is actor modeling that covers goal modeling that recognizes hard-goal and soft-max that are later AND/OR-decomposed, task modeling that identifies tasks for each goal, later AND/OR-decompose the tasks and identifies the resources needs and production and, in the case of design, the capability model. The second type of model is the Dependency Model that organizes the social interactions by iteratively identifying the actors and then their social interaction, while the third type of model is the Mixed model

3 House description and blueprint

Problem 3

This section presents the house plan.

Provide a description of the house, including rooms disposition on the floors, doors,windows…,

You may put a blueprint, or a representation of the house plan, and limitation considered in the implemented simulation.

Solution.

The country house is 180 squared meters, it is surrounded of a wide garden equipped of a small pool, and it is located at few kilometers from Trento. It is inhabited by a family composed of Marco and Sabrina and their two small children Soleira and Lorenzo. Marco is a 36 years old professor that is currently teaching Deep Learning in Università degli Studi di Trento while it proceeds its research on Explainability in the Graph Neural Networks and their application in Bioinformatics especially for the healthy-care sector, Sabrina is a 35 years old Italian teacher in the elementary school in the center of Trento while it researches pedagogy and philosophy of education in association with Università degli Studi di Trento, writes stories for children and is planning to write children's tales, their children are Soleira who is a seven years old girl extremely interested in studying Maths and sciences who dreams to be a Novel price despite her early age and Lorenzo who is a five years old boy who loves playing football and read children's stories. Their home is often full of guests such as their hometown friends, their foreign friends, their families and often the friends of their children. Because of their social life and the size of the house, they need a smart environment able to automatize the simplest operation and, because of the presence of kids, a safe environment. The entering room is the kitchen that is connected to the living room where there is a door

that opens to the living room. From the living room it is accessible the corridor on which left and right side there are the first bathroom and the utility room, and at the end of the corridor by going down the stairs it is possible to reach the garage where there is the eletric car, otherwise by going up is possible to reach the second floor. The second floor contains the sleeping area, it is crossed by a long corridor that has on the left and right side three bedrooms, one for Sabrina and Marco, the remaining two bedrooms are devoted to the children respectively Soleira and Lorenzo, and another bathroom. The light system turn on the lights if and only if there is someone in the room and it is night, moreover it assumes that if someone is in the room while there is light but as the hour proceeds it gets dark, he/she is not interested in turning on the lights. The implementation of this aspect would just require the introduction of an additional await on the the hour member (hh) of the time component that is also already passed as input parameter to the goal related to LightAgent. It is also assumed that there is just one light per room and there is no auxiliary system to handle fault of the devices and sensors and their eventual substitution. All the aforementioned rooms are connected to the others by means of a door. In the case of the washing machine device, it is assumed that there will be a person that extracts the dress and will take care of them once the washing machine procedure ends and it is not implemented any synchronization mechanism that separates the moment in which someone empties the washing machine and the reloading of new dresses, moreover there are no limitations about the capacity of the washing machine as the device carries any dress it finds along the house. A complete representation of the environment, in the case of a room, should require to integrate the light and the sound too, and the presence of specific objects for future more advanced extensions. The temperature system even is simplified as it does not account for any kind of automatized window, then it is entirely based on the temperature perceived inside the room. The bedroom where Soleira sleeps, holds a wardrobe, and a clothesline. All the rooms are equipped with two cameras that aim at detecting the desire respectively of the inhabitants located in that room to drink or eat or to workout or to have party, another camera that aims at detecting the presence of burglars walking in that room, another camera that detects the presence of dirty dresses across the house and another camera that reveals if there are some missing resources such as food, detergent, or toilet paper. The sensors in the house are not just cameras, in fact there are also a sensor to reveal the leak of smoke in the air, and a thermometer to measure the temperature in the room. The living room contains also the garbage sensor and a garbage device. The rooms are not only equipped with these sensors, they are needed multiple devices to exert the will of the agents on the environment, in fact each room has a Security alarm that activates the emergency procedure in case of fire within the house, has a emergency call device that is used to shut down the fire, has a heating and a cooling system in order to, respectively, heat or cool down the temperature when it gets enough different from the desired one, The the kitchen contains the Garbage device and the Charging device The garage is assumed to contain the car of the family, while the other car is parked in the street. The Charging component to simplify the log reading has been simulated just on few devices, but it can be extended by means of the same methods to all the others since the devices to be charged are not an active part in this interaction, as they just wait for the charging device that crosses the house to charge

them directly.

In Planning, temporal planning and durative actions have not been realized because of the planner that does not support them. The introduction of fluents may be crucial for the management of advanced refill or simply more granular operation (e.g. meal device that takes the food from some specific location in the house, or also measure how much plenty is the garbage). A representation and planymetry of the levels of the house are reported on the following figures.

Figure 1: Representation of the house

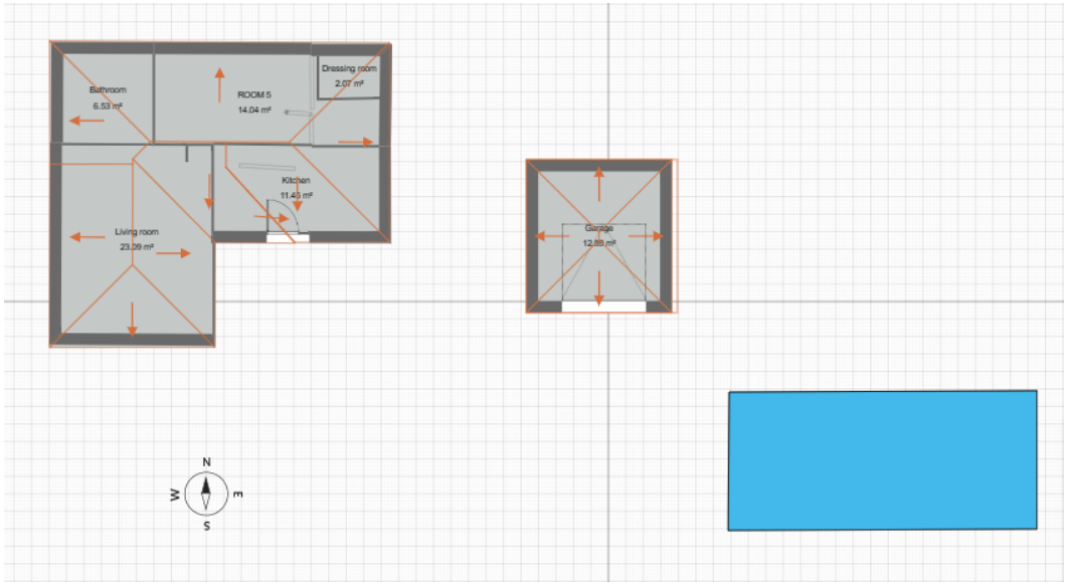


Figure 2: Planimetry at terrain level

Figure 3: Planimetry at ground level

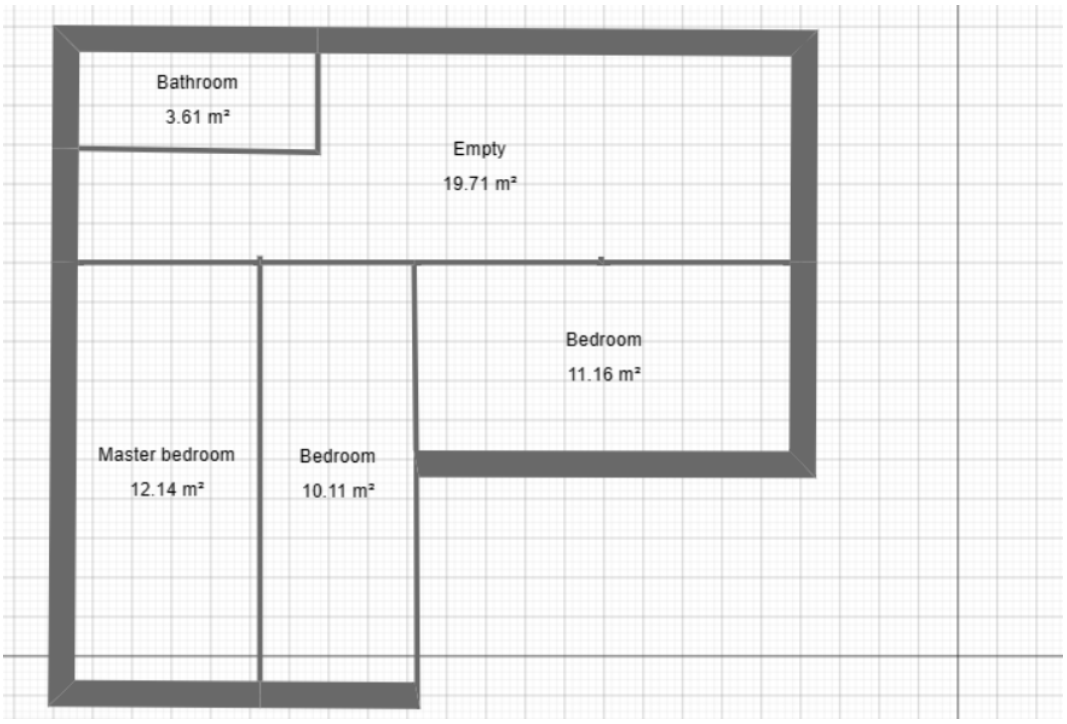


Figure 4: Planimetry at the second level

4 Rooms

Problem 4

This section provides more details for each room of the house...

You can discuss here general aspects valid for all the rooms, or devices available in every rooms.

Solution. For the sake of simplicity the outdoor space (**out**) has been implemented as a special room with its own properties, even if it does not maintain all the devices of the other rooms, even the stairs connecting hallway in the down stair and hallway at the up stair (**stairs**), the hallway (**hallway**) in the down stair, the hallway (**hallway**) at the up stair and the garage (**garage**) have been implemented as traditional room owning the same methods and attributes as the others.

The garden, the roof and the pool have not been specified in any class, class attribute, or class method, because of the lack of agents, sensors and devices working on them. But it is not excluded that further developments of the project to introduce additional components to manage gardering, a smart way of managing the pooling maintenance, and additional properties related to the roof.

The door connecting each pair of room have not been implemented but has been held a structure that specifies the possibility to reach each room from the other one, while the property of the adjacency between pair of rooms, in terms of both adjacent wall-to-wall rooms and floor-to-ceiling rooms, that are not connected by a door has been completely ignored. It is not excluded that this property could be integrated in such a way to realize a smarter cooling or heating mechanism.

The height, as the width and the length of each room have not been directly implemented at this step of prototyping, since they have not been withheld fundamental at this stage, but they could help in practical cases to enable the vacuum cleaner and mop to evaluate the time required, the same also for the moving agent which completely ignores the space in terms of meters while crossing the house as they just account for the room visited.

The other room that have been implemented, as stated before, are the kitchen (**kitchen**), the living room (**living_room**), the first bathroom at the down stair(**bathroom_0**) the second bathroom, the utility room (**utility_room)**), the first hallway at the down stair (**hallway**), the second hallway at the up stair (**hallway_upstairs**) and the three bedrooms, the one of Marco and Sabrina (**master_bedroom**) and the ones of their children (**bedroom_0**) and **bedroom_1**).

All the rooms, a part of the outside space (out), have been equipped of the smoke device (**camera_sensor**) to check the presence of smoke within a specific room, the burglar camera (**burglar_camera**) to check the presence of strangers that may be potentially burglars within a room, the workout sensor (**workout_sensor**) that monitors the people in a room to decide whether their are interested into train, the thermometer sensor (**thermometer**) that monitors the temperature within each room, the dress camera sensor that monitors the presence of dirty dresses, the refill sensor (**refill_sensor**) that checks the need of buying some resources (e.g. food, dresses, etc...), the meal sensor (**meal_sensor**) that establishes if someone is interested into having meal, and the garbage sensor (**garbage_sensor**) that check if the garbage container is full and then if the waste it contains has to be thrown out.

These components have been drawn at high level, for instance the workout sensor

(**workout_sensor**) just monitors the interest of someone of doing workout but does not provide specific information about which are the specific weights (e.g. 5, 10, 20 kg) or gym equipment of interest (e.g. barbell, dumbell, bench), also the refill sensor (**refill_sensor**) does not state which is the specific instance of interest (e.g. water, pasta, detergent), and the meal sensor (**meal_sensor**) does not account for the specific food or drink that the person in a room wants.

The devices that are present in each room are the emergency call device (**emergency_call_device**) to directly call the police in case of burglar in the house, the security alarm (**security_alarm**) to directly call the firemen in case of awkward presence of smoke in the house and open the water in the room where it is suspected the presence of smoke, the heating system and the cooling system to, respectively, cool down or warm up a room if the temperature is, respectively, too high or too low, the smoke device (**smoke_device**) to activate the needed procedure in case of fire within the house.

Then there are devices that are located just in few rooms as the one that is related to the smart weights that enables the carriage of the gym components if someone is interested into them (**smart_weight_device**) and it is initially located in the kitchen, also the recycle device (**recycle_device**) is initially located in the kitchen, while the garbage device (**garbage_device**) in the Soleira bedroom and the washing machine (**washing_machine**) in the bedroom. Another component that have been introduced is an Alarm that plays some music based on when a subject set it.

It is crucial to notice that the devices totally ignore some property such as velocity, moreover the design of the devices could be improved by introducing a hierarchy that accounts for non-moving objects then simple switch-off devices and on the other hand moving devices that are partitioned in grabbing and non-grabbing devices. The grabbing ones are capable of grab some object and carry it along the house, the non-grabbing ones are just able to move by itself.

5 Devices

Problem 5

This section discusses (smart) devices available in the house.

[General description of the device - Example: Lights provide illuminations to the rooms at night time, which we consider always from 8.00 to 19.00] [List possible statuses of the device - Example: Light status is either on, off, or disconnected] [List actions that can be executed with respect to device - Example: Actions that can be done on the lights are $\text{turn}_o n \text{and} \text{turn}_o ff$][$Listprerequisitestoturnonthelights$][$Eventually, itispossibletouseastatemachinetodescribethedevice$]
$Example : Eachlightconsumes 20 W of electricitywhenswitchedon$][$Methodsandstatusesofthedevicesconsideredintheimple$

Solution.

The devices implemented in the current project have been partitioned into two parts moving devices and static devices, all of them are characterized by unique name and a specific location that is specified by means of the name of the room where they are.

The static devices are the ones that have their own status but are not able to move autonomously across the house.

The moving devices are the ones that can move and are further partitioned into other two categories: grabbing and non-grabbing devices, the first one are able to grab some components and carry it across the house by means of an autonomous arm, the second one are able to move but are not able to carry other physical components a part of themselves.

In the current sections they have been completely ignored many crucial components in the design of a Multi-Agent System such as the weight of the objects that is crucial in a safe management of the object, the velocity of the moving object and detailed robotics and mechanical components such as the direction and orientation of the moving object or the application of the strength when carrying an object.

Light: The lights are the most static device in the house as they are nor able to autonomously move neither able to be carried by other devices. They admit just two status based on if they are turned on or turned off, in fact these are two unique actions they are able to. They are used by the agents to guarantee light in the rooms where there are subjects during the evening and the night, and to avoid useless waste of energy during the morning and the afternoon. They are located in every room in the house.

WashingMachine: The washing machine is assumed to be just one over the entire house. It is not autonomous in terms of movement and cannot be moved by anyone else. It admits just two status, working or not working, and it can start to wash an arbitrary amount of dresses if and only if a logistic device is in the room and put the dresses inside the device, and if and only if it is not already started a wash step for other dresses. In the current project it has not been explored the possibility of limiting the number of dresses or to separate the dresses carried by the logistic device in multiple steps.

EmergencyCall: The emergency call component is only able to call the policeman in case of burglar entering in the room and wait for them. But it can be further extended to store the recording of the burglar in the house in the room where it is, rather than having volatile video and activate some alarm to note the people in the house of the risk, and to notice also awkward behaviours by unfamiliar subjects outside of the house. Moreover the actual implementation accounts for a parallel action if there are separated group of burglars in the house. As a consequence of the action it does, it is a static object that realizes a direct communication with the police.

SecurityAlarm The Security Alarm is another static device which is activated in case of the presence of smoke within the house. In this project it is seen just from an high level perspective, then it is resumed in a single function that shut down the fire (e.g. by calling the fireman). This device that handles this dangerous case could be extended to some acoustic alarm in the other rooms, or notification to the inhabitants (e.g. phone message if they are not at home) and some specific behaviour aiming at reducing the fire, while waiting the fireman.

Cooling Device and Heating Device they are completely different physical components, but it is possible to analyze them together because both of them aim at, some extent, the same goal. The cooling device is activated if the temperature is too high in the house with respect to what the people in the house wants

SmartWeight: The Smart weights are devices able to carry the weights over the house when some people in the house is interested in doing workout. It is assumed there is just one unique atomic component for the gym that must be shared by the person in the house, then if someone is training, the other people in the house cannot. The level of granularity of the project, does not account for the specific components to be taken and does not consider that the smart weight can go back to the depot before doing other deliveries, moreover once a person ends to train the Smart Weight device does not take them again at the original position, but leaves the weights in the place where the person has just done workout until someone else will ask for the gym equipment. Since the SmartWeight carry the weights, to enable the person that, has done the request, to have workout, has to leave the weights and stopping carrying them, of course this device can leave them only in the room when there is the subject who request for them. In general, we can state that the SmartWeights are a sort of Grabbing device but they carry object not directly model and lacking of electronical components (neither sensors nor devices).

Music Device: The Music devices completely ignore the hour, then it could play music also at late night and completely ignores if while it is on, passes close to the camera where someone is studying, working or sleeping

More granularity in model Room aspects such as audio, (e.g. too much noise from the street, then close the window)

More granularity in Music choice, e.g. exploit Spotify API to choice some playlist based on the music taste of the majority of the people in the room

Logistic Device: The logistic device is able to move across the house and is able to grab the objects. It is used in the scenario in which there are dirty dresses in the house, then it moves to grab them and put them in the dishwasher if it is not working. Then the actions in which it is involved are MoveLogisticDevice in which it moves across the house while it is not carrying anything, then it contributes to update the knowledge base of the agent about its own position.

MoveGrabbingLogisticDevice in which contribute to update the knowledge base of the agent about its own position and the position of the objects it is grabbing (e.g. the dresses to wash).

A relevant assumption is that is arm has no limit and can carry any arbitrary quantity of objects, this assumption can be clearly overcomed by introducing the requirement ”fluents” in the Planning part.

Of course a necessary precondition in its action regard the position of the rooms within the house as it can move from a room to another only if two rooms are neighbouring.

MealDevice: The meal device has been assumed to be self-contained, in such a way that the resources are autonomously managed with no need of additional devices buying it, even if it is a natural consequence of the Refill device that has been implemented.

Meal management not that granular, really high level, missing Nutrizionista, missing healthy attention etc, to prevent the people from eating the entire day if they are at home, it has been set a SmartMealSensor able to recognize by means of Computer Vision sensor if someone is hungry.

Charging Device: Charging devices are multiple in the house, have a certain battery

and their duration depends on the power they use and the actions they do.

The charging device has the capacity to grab the other devices within the house to carry them to the charging station.

Their status account just for three main characteristics: if they are charging some other object or not, if they are on movement or not, and if they are grabbing some objects to take them to the charging station

Rather than let the objects, that has to be charged, move across the entire house, the charging device has been implemented as a device that crosses the house to go toward the devices having low charge and charging them, and since the charging device is a device too, when it has low battery it is charged in a fixed charging station.

This assumption is more than reasonable and even convenient, as an object that has low battery may not be able to move across the entire house to reach the charging device and this enables the devices to keep guaranteeing their services, even if they have low battery as they can work also during the charging step.

Garbage device: Garbage simplification (no specific hours and specific days to throw out the garbage)

Garbage implements a mechanism to check when it is full but no mechanism to do some recycle operation

RefillDevice:

The Refill management assumes that the device goes autonomously out of the house to buy the resources, but it does not directly managed the payment procedure neither where exactly it goes, online procedures are completely ignored and also the possibility that a resource needed in one room can be carried from another room.

Since the content of the refill is not explicitly modeled in the Planning domain, it is presented "content_in" to state if the device is carrying the refill content, but in the JavaScript replication there are not explicit modeling by means of specific states.

Moreover the resources that have been bought during Refill are not positioned in any specific location in the house.

In a more realistic scenario, the Refill would be a consequence not just of a sensor perception, but could be a result of a communication among agents.

Alarm:

The alarm contains specific properties related to the song to play, the specific hour in which the alarm has to start, and the decibel of the music to play. It is not executed as a consequence of some plan, but is simply called as a consequence of the desire of an agent of running the alarm.

Vacuum Cleaner and MopBot The vacuum cleaner is assumed to be just one in the house. It is able to realize two different actions: move across rooms and suck. The mop bot device is still assumed to be one, it is quite similar to vacuum cleaner but it is able to wash the floor too. The keypoint of the relation between vacuum cleaner and mop bot is that a room to be washed must be already sucked and not dirty. Moreover the action of sucking and cleaning requires the presence of, respectively, the vacuum cleaner and the mop bot in the room to be sucked or cleaned. A room can be sucked or cleaned only if there are no people within that specific room.

Implementation detail, some functions have been implemented in a safe mode (e.g. lookforsong in Alarm) to be easily extensible for future developments (e.g. introduce Spotify API and data analytics techniques)

Most of the automatic action, as programmed daily operations have typically been replaced by some smart sensors that analyzes people behaviour to capture their desire.

SmartWeights is assumed to carry the objects until it leaves them

ManageWeight too is a simplified version as it delivers the weights, but leaves them in the place where they have been requested and does not take them again in the original place when the subject ends to train

Furthermore another approximated point in the implementation is due to the implementation of duration of the Planning actions by means of a Timeout, rather than by accounting for the global Clock; even if the extension is intuitive, since the time step is fixed, it has been retained more appropriated to use a Timeout, but for real world extension of the project, it is required the introduction of a check on the global clock.

The source code has been designed in such a way to provide extensions but temporarily has been assumed that there is just one instance per each type of actuator for each agent, but since the data structure to handle them are lists and have been created all the supported subroutine, by focusing on parallel calculus it could be possible to exploit more than one of them.

Procedure related to fire in the house and procedure related to burglar in the house have been extremely simplified to the call of just one method, even if this could be realized just by means of an House Agent, for coherence with the principles expressed in Wooldridge, it has been preferred to call the planning procedure that calls these methods

6 Metrics

Problem 6
Report at least one metric with a short description and some quantitative value

Solution. During the implementation they have been accounted just three metrics, the first one is related to the electricity, the gas, the battery and the time to perform an action.

The electricity is involved in Cooling system and Heating system.

The gas is involved only in the preparation of Meal.

The battery is used by a device when it is turned on and when it is doing some action, while is kept unaltered when a device is off.

The time is computed as the sum of the actions that compose a plan to reach a goal.

7 People

Problem 7

This section presents people in the house.
List residents living in the house and describe their behavior
Implemented behavior of people and actions they can take in the simulation

Solution. The people in the house, are a married couple (Marco and Sabrina) and their children (Soleira and Lorenzo)

Every day at six o' clock Marco wakes up to do workout.

At seven o' clock, Sabrina wakes up in the master badroom and wake up also their children in their respective bedroom.

They have breakfast together, then Marco accompanies both children at the elementary school, while Sabrina directly goes to work to the elementary school.

Once finished to work at the school, Sabrina goes to the elementary school where the children are and take them back home.

When they arrive home, they directly have launch.

During the afternoon, Sabrina work from home in the living room, while the children study and play together in the garden outside.

Then at 16:30, she take both of them to do sport, then at 18:30 Marco take back home them again.

When at home, they have dinner, then spend some hours playing together in the living room.

At 22, children go to sleep while their parent stay awake until 23.

During saturday, the children go to school at morning and during the evening the entire family goes out and go back at saturday evening.

During sunday, they go out from morning to late afternoon.

The action a person can take are: have meal, move from a room to another one and workout.

During the simulation they have been provided two cases, one that follows this routine, the other one that completely randomize the sequence of actions.

8 House Agent

Problem 8

This section presents intelligent and autonomous entities in the house. Specific discussion of the autonomous behavior, including triggering events and procedures. Description of behavior in the simulated scenario

Solution. HouseServerAgent: The houseServerAgent is the agent that communicates with the agents that manages moving objects and then grabbing objects too- It is able to know the disposition of the room in the house, then it communicates, as a consequence of its experience (or more specifically, of some exploring device), the configuration of the house.

Once he acquire this information, it just has to communicate this to other agents in case of

some request, that is automatically accepted if the agent doing the request correctly passes its information, as written in the MessageDispatcher, Postman and PostmanAcceptAllRequests classes.

Then the only aspects of which it is responsible, are the knowledge of the house configuration to be passed to the client Agent and to do that it needs to be set up by means of an initial exploration that enables to set up its beliefs.

SecurityAgent: The SecurityAgent handles the aspect related to safe environment. This aspects refers to the presence of smoke in the house and the presence of burglar in the house. Both are consequence of specific and extreme event. The presence of smoke is noted by some smoke sensor that the SecurityAgent is looking at while the presence of burglars is noted by some camera within the house. In case of smoke, it open the water in the room where the fire has been detected, calls the firemen, run an alarm in each room to tell the inhabitant the presence of this risk and send a phone message to some reference number. In case of Burglar, it activates the recording procedure of the cameras in the house that runs until the burglars do not get out from the house, the idea behind the activation of all the cameras is that in the case that some burglar was not detected by the system, it will be at least recorded, then it runs an alarm in each room to make aware the inhabitants of the risk and send a phone message to some reference number.

ThermostatAgent:The thermostat agent based on the temperature perceived by the sensor in the rooms, activates the cooling system or the heating system or none of them in the room of interest, and this are kept turned on until is not reached again a desired temperature.

AlarmAgent: The Alarm agent setup the alarms within the house and runs some song in a specific room based on the hour in which it is set up.

MealsAgent: Based on some multimodal machine learning techniques, the sensors located within the house detect if someone in the room where they are, is interested into have meal, if this the case, the Meal Agent communicate to the Meal Device to prepare a meal for a specific person. Thus the MealDevice is charged of preparing the meal and delivering it.

9 Planning Agent

Problem 9
Introduction of the planning domain and problem.

Solution.

ChargingAgent: The Charging agent wants that all the devices within the house are enough charged to do their own actions, in order to guarantee this property, he observes a sensor that is located on each device. This sensor is called Battery, if it set up the ”low_battery” flag to true, it means that the object has to be charged, as it is written in the *ChargeDevice* goal, as defined in PDDL goal. When the agent notice that one of the devices he is observing has low battery, then it updates its knowledge base according to the

room where the device is and the name of the device. The action of Charging is carried by a ChargingDevice that is able to move in the house and is able to charge the devices when it is in the same room of a device.

The predicate that are involved in this planning procedure are:

- in ?r1: refers to the room where the device
- door ?r1 ?r2: refers to the adjacency of two rooms
- request_in ?r1: refers to the room where the agent that, has to be charged, is
- need_to_charge ?name: refers to the name of the device that has to be charged

The actions are the following ones:

- MoveCharging ?r1 ?r2: it needs that the two rooms are adjacent and the ChargingDevice is located in r1, once verified the precondition it calls the Move method of the ChargingDevice method and update the agent's knowledge base by telling that it is no more in room1 but it is room2. Of course the Move method in the Agent device has its own check to guarantee action consistency and the consistency of sensor and the knowledge base of the agent
- ChargeDevice ?r1 ?r2 ?name: whose precondition check if the charging device, the device to be charged are in the same room and the name of the device to be charged. Then once the ChargingDevice has called its own method to charge, it updates the agent knowledge base by telling that there are no more requests in that room and that the specific device has no more to be charged.

This is one of the defined planning procedure is more parallelizable and possible to handle in a more efficient way, for instance by leaving an agent handle just the procedure for a specific part of the house. Moreover there could be devices for which it is more important to be charged (e.g. devices related to safety rather than dishwasher)

GarbageAgent: The Garbage Agent wants that the Garbage container in the house is never full when it is in the house. In order to guarantee this property he observes a sensor (GarbageSensor) that is integrated in the Garbage, it enables to tell whether the container is full or not yet. When this sensor notice that the garbage is full, the Garbage looks for a plan to throw out the garbage, then he needs to reach the home garbage container, grab the home garbage container, go out of the house, find the outside garbage container, empty the home garbage container and put it back home. The device that works on this plan is the GarbageDevice.

A key assumption is that the out space is not modeled, thus everything that regards the space outside of the house has no description.

Note that it is assumed that there is a garbage container that holds a garbagesensor to state if it is full or not and once the agent grab this container, it carries the garbage container and then the sensor inside the garbage container too; of course once the garbage device is out, it empties the container and take exactly the same container with the same sensor again in the house.

The GarbageAgent goal is called ThrowGarbageOut and is realized by means of Garbage-Planning.

The GarbagePlanning defines the following predicates:

- in ?room1: refers to the room where the GarbageDevice is
- has-garbage ?room1: refers to the content of the GarbageContainer
- in-garbage ?room1
- door ?room1 ?room2
- grab
- full

Note that the Garbage Container that is a real world component is not directly modeled in the project, it is just modeled the GarbageSensor contained inside of it.

The actions that can be realized are the following ones:

- MoveGarbage ?room1 ?room2 move while carrying the garbage
- MoveNoGarbage ?room1 ?room2 move while not carrying the garbage
- PutOutGarbage ?room1 put the garbage out while it is full
- PutEmptyGarbage ?room1 put the empty garbage
- PickGarbage ?room1 pick the garbage
- LeaveEmptyGarbage ?room1 empty the garbage if it is full

As stated before, the final aim is that the garbage is again in the initial room, that it is not full, that the GarbageDevice is gone back in the original place and that it is not grabbing anything.

GymAgent

- MoveGarbage ?room1 ?room2
- MoveNoGarbage ?room1 ?room2
- PutOutGarbage ?room1
- PutEmptyGarbage
- PickGarbage
- LeaveEmptyGarbage

MusicAgent

- turn_on_music ?r1 turn on the music in r1 if most of people in r1 want to listen music, and the device is in r1 and the device is turned off

- turn_off_music ?r1 turn off the music if most of people in r1 do not want to listen music, and the device is in r1 and the device is turned on
- MoveMusicDevice ?r1 ?r2 move the device carrying the music device turned off from r1 to r2
- MoveTurnedOnMusicDevice move the device carrying the music device turned on from r1 to r2

RefillAgent is an agent that aims at refilling the house of some resources if it is missing as described in the intention in RefillAgent file.

- in ?r1
- door ?r1 ?r2
- content_in ?r1 checks if the content to be refill is in room r1
- content_bought states if the content to be bought has been bought or not
- need_to_refill ?r1 states if the refill has been done in a room or not

The supported actions are the following ones:

- Move ?r1 ?r2 moves the refill device while it is not carrying anything
- MoveRefill ?r1 ?r2 moves the refill device and the content it is carrying
- BuyRefill ?r1 checks if the subject is in the proper room
- DeliverRefill ?r1 checks if the refill has been delivered

VacuumCleanerAgent is an agent that aims at sucking all the dirty from a room in order to clean it as described in the intention defined in AgentIntentions file. It follows the list of predicates:

- in ?room
- door ?r1 ?r2
- dirty ?room
- clean ?r
- sucked ?r

The supported actions are two, the first one is **Move** that given two rooms (r1 and r2), if the device is in r1 and r2 is adjacent to r2, applies the move action of the device and update the agent knowledge as the device will be no more in r1, but it will be in r2. The second one is **Suck** that given a room, if the room is dirty and it is clean and the device is exactly, in that room, will tell that the room is not dirty and that it has been sucked

The location of the project components is not modeled in a granular manner, but from an high-level perspective as we specify just the room where the components are.

It could be an interesting improvement to introduce Robot Planning to deal with real-world cases.

10 Sensors and agent perception

Problem 10

Discuss how agents perceive the environment, their perspective, and the assumptions taken. How status of the world is encoded in the agent internal knowledge to represent a partial vision of the world.

Solution.

The agents describe the world by means of beliefs that are described in Propositional Logic. Further extensions related to BDI design may introduce Modal Logic to define not only the knowledge of the Agent but also what an agent knows about the knowledge of the other agents and to introduce a third status in the representation by means of the unknown in the modal formula, or it could be also possible to introduce Descriptive Logic to provide a more common logic in the context of Knowledge Representation and Intelligent Web too. The beliefs of the agent about the world are a consequence of what the sensors perceive, usually it is clear in the project; but there are also subcases in which the agent knowledge comes from the communication with other agents, a clear example thereof is the communication of the HouseServerAgent with the PlanningAgent(s) that manage some moving device or grabbing device, this is due to their need of knowing the entire configuration of the house in terms of room positions and adjacencies, and this approach enable to have just one exploration of the house that is realized by the HouseServerAgent and then a single communication between the just mentioned agent and some other agents to communicate the house configuration. The unique additional information an agent may access from its own class is related to the devices with which it can communicate to order them to do an action (as planning requires).

A brief list of the used predicates is the following ones, for the entire list of predicates and KB of Planning agent, look at the Planning Agent section, while for House Agent looks directly to the Agent folder under the file referring to the agent of interest:

- in: used by all the agents to know the room where the device they handle is. Notice that this is an high level representation, as it completely misses any latitude or longitude (GPS-level) information.
- door: used by all the moving agents to know how the device they handles can move within the house, as an agent can go from a room to another only if they are adjacent, at least from an atomic perspective.
- dress_to_was: used only by the DishwasherAgent to know in which room are the dresses to wash are located.
- in-washing-machine: used only by the WashingMachineAgent to know in which room is the washing machine
- dress_washed: used to tell if all the dresses in the house have been washed or not

- has_garbage: used only in the Knowledge Base of the GarbageAgent to state if there is garbage in a room
- in_garbage: used only in the Knowledge Base of the GarbageAgent to state in which room the Garbage is located
- grab: used only in the Knowledge Base of the GarbageAgent to state if the GarbageDevice has grabbed and then is carrying some garbage container (that contains the sensor too)
- full: used only in the Knowledge Base of the GarbageAgent to state if the garbage container is full or not
- leave-weights: used only in the Knowledge Base of the GymAgent to state if the SmartWeightDevice is grabbing or not the weights
- waiting ?name: used only in the Knowledge Base of the MealAgent to state if a specific person is waiting for food
- ready_meal ?name: used only in the Knowledge Base of the MealAgent to state if the meal that, a specific person is requested, is ready or has to be prepared yet.
- person_in_room ?room used only in the Knowledge Base of MopBotAgent and VacuumCleanerAgent to state if in a specific room there are some people
- sucked ?r
- dirty ?r

  An interesting improvement could be to introduce Modal Logic in place of Propositional Logic as proposed in Weiss and Wooldridge.

11 Agents acting in a shared environment

Problem 11

Discuss how agents interact with the world and with devices. Provide examples of actions taken by agents and how these affect the state of the world.

Solution.

The Agent perceives the world by means of the sensors, in fact each Util file for a specific content is equipped with one or more associated sensor, typically at least one per room, and one (if centralized) or more (if one per room) actuators/devices that enables the agent to act on the environment based on the method implemented on the devices.

The simplest agent just call a predefined sequence of methods, while the Planning Agent call a Planning procedure that found a sequence of actions, where each action corresponds to a method implemented on a device, to operate on the environment.

The environment modification executed by the agent, leads the environment to change and since, while this action operated by the devices occur, the Sensor by means of the *NotifyChange* method perceives the environment change, since at the same time the agent is looking at the sensor, the agent perceives a change on what the sensor has perceived, this change leads the agent to update its internal knowledge that is based on beliefs, in our case expressed in Propositional Logic.

12 Agent interaction and coordination

Problem 12

Discuss about agent interaction and/or coordination in the simulated scenario.

Solution. They are provided two possible kind of interactions: an interaction in which an agent asks and the HouseServerAgent accept to provide it information about the house configuration if the input parameters are rights (in this case it is a client-server architecture, in which the first agent that works as the client asks some information and the HouseServer-Agent that works as the server provides some information), the second type of interaction regards the communication among agents having the same goal or opposite goal that require, respectively, cooperation or negotiation, in this case the flow of information is double-ended then it is a Peer-To-Peer architecture. The communication is realized by means of a simple Stack, that has been slightly modified with respect to the provided implementation, in order to handle multiple requests and prevent some bugs.

The key case of the HouseServerAgent are defined in the Ask/Send functions written in which the HouseServerAgent communicates what it has perceived previously to some client agent.

The HouseServerAgent mostly looks at what the house configuration and communicate to agents that manage moving or grabbing agent, the disposition of the room within the house or communicates the status of the room as it occurs in the case of the VacuumCleaner.

The security of this communication is has not been implemented in detail, and this aspect is crucial in the management of sensible data like the ones taken during daily life in a smart home.

Communication protocols

13 Scenarios and Running the scenarios - Logs

Problem 13

Implemented scenario and general description of the events happening during the simulation. Description of the events happening in the simulation. Compact and/or extended version of logs from running the scenarios

Solution. In the scenario, they have been left enough freedom to the tester to debug, since they have been provided different files in such a way to separate the necessary part of the any scenario from the randomized one.

A possibility is to randomize the temperature variation, the presence of burglar, the presence of smoke, the mood variation, the training desire of a person, the presence of dirty dresses in the house, the moments when the garbage get full, the desire of having a meal of a person and this can be done for all the functionalities provided in the project, this possibility have been resumed in the file Utils. It is crucial to notice that these randomization have been completely realized on the environment and not on the sensors, as the entire project attempts to model the real-world case in three levels, at the top level the agent, at the second one the sensors and the devices and at the third one the environment. Since the sensor will measure some property in the environment, their measurements will find this variation on the environment. An interesting additional experiment, could be to perturb the sensor to check the robustness of the model in case of noise during measurements.

A part of this possibility, the scenario that have been implemented assumes a quite simple routine of the inhabitants and from some point of view unrealistic too, this has been motivated by the number of logs to be analyzed during the execution of a project.

Since this project attempts to model multiple aspects of a daily life and the planning agent are multiple, in the reported log, the scenario is straightforward and it is based on what is written in the SabrinaRoutine, MarcoRoutine, SoleiraRoutine and LorenzoRoutine under the Utils package, while all the other components in the house have been perturbed according to what it is written in the Utils file.

The scenarios have been splitted in three parts to make them a little bit more readable.

```
PS C:\Users\marco\Desktop\uni\info\Artificial Intelligence\1.0 Autonomous Agent Systems\unitn\auto-home.js-main> node ./src/smart-home/scenarios/complete_scenar
io.js
                house_server_agent                      Trying to use intention LearnHouseConfigurationIntention to achieve goal LearnHouseConfigurat
ionGoal#0
exploring_device_house_server_agent182 ExploringDevice  Exploring device: Move from kitchen to out requires 2 minutes
                washing_machine_agent                   Trying to use intention AskRoomLocationIntention to achieve goal AskRoomLocationGoal#1
                charging_agent                          Trying to use intention AskRoomLocationIntention to achieve goal AskRoomLocationGoal#3
                music_agent                             Trying to use intention AskRoomLocationIntention to achieve goal AskRoomLocationGoal#5
                garbage_agent                           Trying to use intention AskRoomLocationIntention to achieve goal AskRoomLocationGoal#7
                refill_agent                            Trying to use intention AskRoomLocationIntention to achieve goal AskRoomLocationGoal#9
                gym_agent                               Trying to use intention AskRoomLocationIntention to achieve goal AskRoomLocationGoal#11
                house_server_agent                      Trying to use intention PostmanAcceptAllRequest to achieve goal Postman#13
                charging_agent                          Trying to use intention DetectBatteryIntention to achieve goal DetectBatteryGoal#14
                charging_agent                          Trying to use intention ChargingIntention to achieve goal ChargingGoal#15
                meal_agent                              Trying to use intention PersonMealIntention to achieve goal PersonMealGoal#16
                meal_agent                              Trying to use intention PrepareMealIntention to achieve goal PrepareMealGoal#17
                light_agent                             Trying to use intention PersonRoomIntention to achieve goal PersonRoomGoal#18
                light_agent                             Trying to use intention LightIntention to achieve goal LightGoal#19
                music_agent                             Trying to use intention PersonPartyIntention to achieve goal PersonPartyGoal#20
                music_agent                             Trying to use intention MusicIntention to achieve goal MusicGoal#21
                garbage_agent                           Trying to use intention DetectFullGarbageIntention to achieve goal DetectFullGarbageGoal#22
                garbage_agent                           Trying to use intention ThrowGarbageIntention to achieve goal ThrowGarbageGoal#23
                refill_agent                            Trying to use intention DetectRefillIntention to achieve goal DetectRefillGoal#24
                refill_agent                            Trying to use intention refillIntention to achieve goal refillGoal#25
                security_agent                          Trying to use intention DetectSmokeIntention to achieve goal DetectSmokeGoal#26
                security_agent                          Trying to use intention DetectBurglarIntention to achieve goal DetectBurglarGoal#27
                security_agent                          Trying to use intention FireIntention to achieve goal FireGoal#28
                security_agent                          Trying to use intention BurglarIntention to achieve goal BurglarGoal#29
                gym_agent                               Trying to use intention DetectWorkoutIntention to achieve goal DetectWorkoutGoal#30
                gym_agent                               Trying to use intention HandleGymObjectsIntention to achieve goal HandleGymObjectsGoal#31
                temperature_agent                       Trying to use intention ThermostatIntention to achieve goal ThermostatGoal#32
                temperature_agent                       Trying to use intention DetectTemperatureIntention to achieve goal DetectTemperatureGoal#33
                washing_machine_agent                   Trying to use intention DetectDressCameraIntention to achieve goal DetectDressCameraGoal#34
                washing_machine_agent                   Trying to use intention WashingMachineIntention to achieve goal WashingMachineGoal#35
                vacuum_cleaner                          Trying to use intention PostmanAcceptAllRequest to achieve goal Postman#37
                vacuum_cleaner                          Trying to use intention LearnHouseIntention to achieve goal LearnHouseGoal#36
                house_agent                             Trying to use intention PostmanAcceptAllRequest to achieve goal Postman#38
                alarm_agent                             Trying to use intention AlarmIntention to achieve goal AlarmGoal#39
                alarm_agent                             Trying to use intention AlarmIntention to achieve goal AlarmGoal#40
                alarm_agent                             Trying to use intention AlarmIntention to achieve goal AlarmGoal#41
```

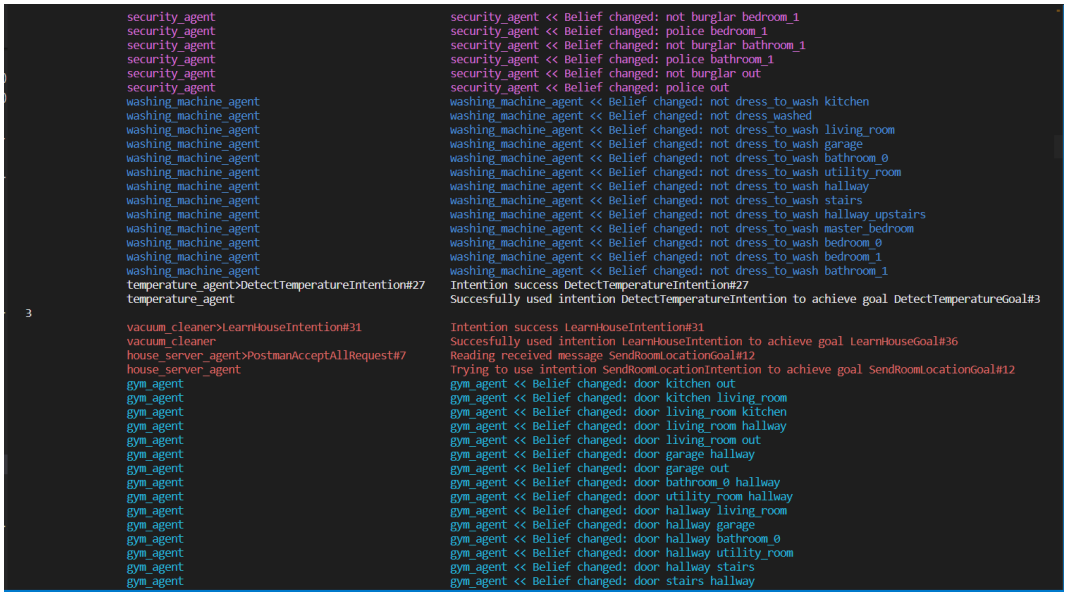
14 Source code organization

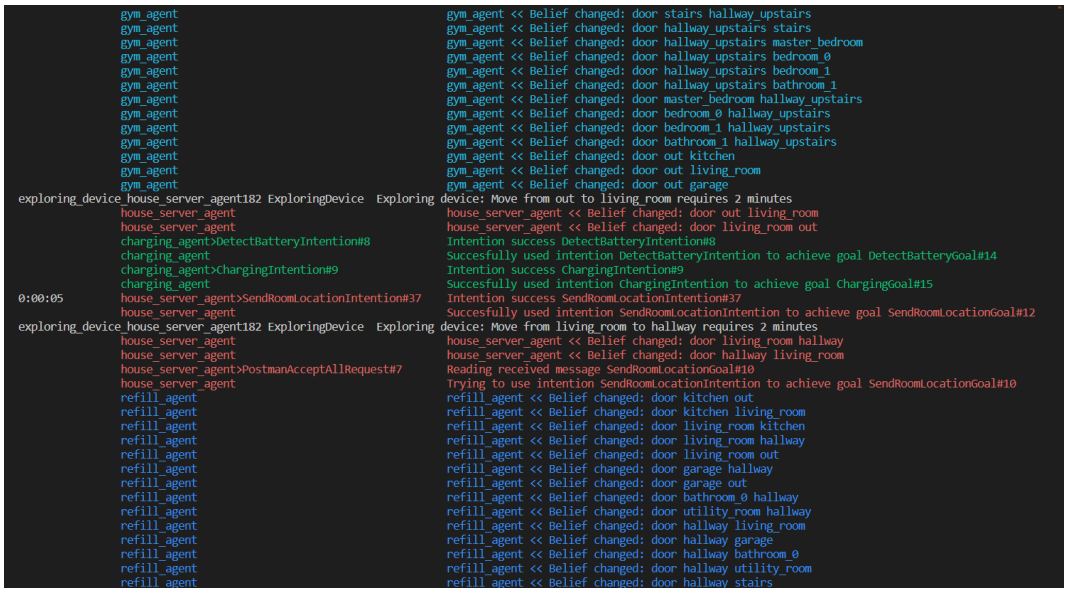
```
alarm_agent                Trying to use intention AlarmIntention to achieve goal AlarmGoal#42
house_server_agent         house_server_agent << Belief changed: door kitchen out
house_server_agent         house_server_agent << Belief changed: door out kitchen
washing_machine_agent      washing_machine_agent << Belief changed: in-dishwasher bathroom_0
washing_machine_agent      washing_machine_agent << Belief changed: in-logistic-device kitchen
charging_agent             charging_agent << Belief changed: in kitchen
light_agent                light_agent << Belief changed: switch_off kitchen
light_agent                light_agent << Belief changed: not switch_on kitchen
light_agent                light_agent << Belief changed: switch_off living_room
light_agent                light_agent << Belief changed: not switch_on living_room
light_agent                light_agent << Belief changed: switch_off garage
light_agent                light_agent << Belief changed: not switch_on garage
light_agent                light_agent << Belief changed: switch_off bathroom_0
light_agent                light_agent << Belief changed: not switch_on bathroom_0
light_agent                light_agent << Belief changed: switch_off utility_room
light_agent                light_agent << Belief changed: not switch_on utility_room
light_agent                light_agent << Belief changed: switch_off hallway
light_agent                light_agent << Belief changed: not switch_on hallway
light_agent                light_agent << Belief changed: switch_off stairs
light_agent                light_agent << Belief changed: not switch_on stairs
light_agent                light_agent << Belief changed: switch_off hallway_upstairs
light_agent                light_agent << Belief changed: not switch_on hallway_upstairs
light_agent                light_agent << Belief changed: switch_off master_bedroom
light_agent                light_agent << Belief changed: not switch_on master_bedroom
light_agent                light_agent << Belief changed: switch_off bedroom_0
light_agent                light_agent << Belief changed: not switch_on bedroom_0
light_agent                light_agent << Belief changed: switch_off bedroom_1
light_agent                light_agent << Belief changed: not switch_on bedroom_1
light_agent                light_agent << Belief changed: switch_off bathroom_1
light_agent                light_agent << Belief changed: not switch_on bathroom_1
garbage_agent              garbage_agent << Belief changed: in bedroom_0
refill_agent               refill_agent << Belief changed: in kitchen
gym_agent                  gym_agent << Belief changed: in kitchen
gym_agent                  gym_agent << Belief changed: not in living_room
gym_agent                  gym_agent << Belief changed: not in garage
gym_agent                  gym_agent << Belief changed: not in bathroom_0
gym_agent                  gym_agent << Belief changed: not in utility_room
gym_agent                  gym_agent << Belief changed: not in hallway
gym_agent                  gym_agent << Belief changed: not in stairs
gym_agent                  gym_agent << Belief changed: not in hallway_upstairs
gym_agent                  gym_agent << Belief changed: not in master_bedroom
```

```
gym_agent                  gym_agent << Belief changed: not in hallway_upstairs
gym_agent                  gym_agent << Belief changed: not in master_bedroom
gym_agent                  gym_agent << Belief changed: not in bedroom_0
gym_agent                  gym_agent << Belief changed: not in bedroom_1
gym_agent                  gym_agent << Belief changed: not in bathroom_1
gym_agent                  gym_agent << Belief changed: not in out
gym_agent                  gym_agent << Belief changed: not zero_battery
temperature_agent          temperature_agent << Belief changed: not turn_on_heating kitchen
temperature_agent          temperature_agent << Belief changed: not turn_on_cooling kitchen
temperature_agent          temperature_agent << Belief changed: not turn_on_heating living_room
temperature_agent          temperature_agent << Belief changed: not turn_on_cooling living_room
temperature_agent          temperature_agent << Belief changed: not turn_on_heating garage
temperature_agent          temperature_agent << Belief changed: not turn_on_cooling garage
temperature_agent          temperature_agent << Belief changed: not turn_on_heating bathroom_0
temperature_agent          temperature_agent << Belief changed: not turn_on_cooling bathroom_0
temperature_agent          temperature_agent << Belief changed: not turn_on_heating utility_room
temperature_agent          temperature_agent << Belief changed: not turn_on_cooling utility_room
temperature_agent          temperature_agent << Belief changed: not turn_on_heating hallway
temperature_agent          temperature_agent << Belief changed: not turn_on_cooling hallway
temperature_agent          temperature_agent << Belief changed: not turn_on_heating stairs
temperature_agent          temperature_agent << Belief changed: not turn_on_cooling stairs
temperature_agent          temperature_agent << Belief changed: not turn_on_heating hallway_upstairs
temperature_agent          temperature_agent << Belief changed: not turn_on_cooling hallway_upstairs
temperature_agent          temperature_agent << Belief changed: not turn_on_heating master_bedroom
temperature_agent          temperature_agent << Belief changed: not turn_on_cooling master_bedroom
temperature_agent          temperature_agent << Belief changed: not turn_on_heating bedroom_0
temperature_agent          temperature_agent << Belief changed: not turn_on_cooling bedroom_0
temperature_agent          temperature_agent << Belief changed: not turn_on_heating bedroom_1
temperature_agent          temperature_agent << Belief changed: not turn_on_cooling bedroom_1
temperature_agent          temperature_agent << Belief changed: not turn_on_heating bathroom_1
temperature_agent          temperature_agent << Belief changed: not turn_on_cooling bathroom_1
temperature_agent          temperature_agent << Belief changed: not turn_on_heating out
temperature_agent          temperature_agent << Belief changed: not turn_on_cooling out
garbage_agent              garbage_agent << Belief changed: in-garbage living_room
vacuum_cleaner             vacuum_cleaner << Belief changed: in living_room
vacuum_cleaner             vacuum_cleaner << Belief changed: not zero_battery
vacuum_cleaner             vacuum_cleaner << Belief changed: door kitchen out
vacuum_cleaner             vacuum_cleaner << Belief changed: door kitchen living_room
vacuum_cleaner             vacuum_cleaner << Belief changed: door living_room kitchen
vacuum_cleaner             vacuum_cleaner << Belief changed: door living_room hallway
vacuum_cleaner             vacuum_cleaner << Belief changed: door living_room out
```

```
vacuum_cleaner  vacuum_cleaner << Belief changed: door garage hallway
vacuum_cleaner  vacuum_cleaner << Belief changed: door garage out
vacuum_cleaner  vacuum_cleaner << Belief changed: door bathroom_0 hallway
vacuum_cleaner  vacuum_cleaner << Belief changed: door utility_room hallway
vacuum_cleaner  vacuum_cleaner << Belief changed: door hallway living_room
vacuum_cleaner  vacuum_cleaner << Belief changed: door hallway garage
vacuum_cleaner  vacuum_cleaner << Belief changed: door hallway bathroom_0
vacuum_cleaner  vacuum_cleaner << Belief changed: door hallway utility_room
vacuum_cleaner  vacuum_cleaner << Belief changed: door hallway stairs
vacuum_cleaner  vacuum_cleaner << Belief changed: door stairs hallway
vacuum_cleaner  vacuum_cleaner << Belief changed: door stairs hallway_upstairs
vacuum_cleaner  vacuum_cleaner << Belief changed: door hallway_upstairs stairs
vacuum_cleaner  vacuum_cleaner << Belief changed: door hallway_upstairs master_bedroom
vacuum_cleaner  vacuum_cleaner << Belief changed: door hallway_upstairs bedroom_0
vacuum_cleaner  vacuum_cleaner << Belief changed: door hallway_upstairs bedroom_1
vacuum_cleaner  vacuum_cleaner << Belief changed: door hallway_upstairs bathroom_1
vacuum_cleaner  vacuum_cleaner << Belief changed: door master_bedroom hallway_upstairs
vacuum_cleaner  vacuum_cleaner << Belief changed: door bedroom_0 hallway_upstairs
vacuum_cleaner  vacuum_cleaner << Belief changed: door bedroom_1 hallway_upstairs
vacuum_cleaner  vacuum_cleaner << Belief changed: door bathroom_1 hallway_upstairs
vacuum_cleaner  vacuum_cleaner << Belief changed: door out kitchen
vacuum_cleaner  vacuum_cleaner << Belief changed: door out living_room
vacuum_cleaner  vacuum_cleaner << Belief changed: door out garage
music_agent     music_agent << Belief changed: not people_want_party kitchen
music_agent     music_agent << Belief changed: not people_want_party living_room
music_agent     music_agent << Belief changed: not people_want_party garage
music_agent     music_agent << Belief changed: not people_want_party bathroom_0
music_agent     music_agent << Belief changed: not people_want_party utility_room
music_agent     music_agent << Belief changed: not people_want_party hallway
music_agent     music_agent << Belief changed: not people_want_party stairs
music_agent     music_agent << Belief changed: not people_want_party hallway_upstairs
music_agent     music_agent << Belief changed: not people_want_party master_bedroom
music_agent     music_agent << Belief changed: not people_want_party bedroom_0
music_agent     music_agent << Belief changed: not people_want_party bedroom_1
music_agent     music_agent << Belief changed: not people_want_party bathroom_1
refill_agent    refill_agent << Belief changed: not need_to_refill kitchen
refill_agent    refill_agent << Belief changed: not need_to_refill living_room
refill_agent    refill_agent << Belief changed: not need_to_refill garage
refill_agent    refill_agent << Belief changed: not need_to_refill bathroom_0
refill_agent    refill_agent << Belief changed: not need_to_refill utility_room
refill_agent    refill_agent << Belief changed: not need_to_refill hallway
```

```
refill_agent    refill_agent << Belief changed: not need_to_refill hallway_upstairs
refill_agent    refill_agent << Belief changed: not need_to_refill master_bedroom
refill_agent    refill_agent << Belief changed: not need_to_refill bedroom_0
refill_agent    refill_agent << Belief changed: not need_to_refill bedroom_1
refill_agent    refill_agent << Belief changed: not need_to_refill bathroom_1
security_agent  security_agent << Belief changed: not fire_now kitchen
security_agent  security_agent << Belief changed: shut_down kitchen
security_agent  security_agent << Belief changed: not fire_now living_room
security_agent  security_agent << Belief changed: shut_down living_room
security_agent  security_agent << Belief changed: not fire_now garage
security_agent  security_agent << Belief changed: shut_down garage
security_agent  security_agent << Belief changed: not fire_now bathroom_0
security_agent  security_agent << Belief changed: shut_down bathroom_0
security_agent  security_agent << Belief changed: not fire_now utility_room
security_agent  security_agent << Belief changed: shut_down utility_room
security_agent  security_agent << Belief changed: not fire_now hallway
security_agent  security_agent << Belief changed: shut_down hallway
security_agent  security_agent << Belief changed: not fire_now stairs
security_agent  security_agent << Belief changed: shut_down stairs
security_agent  security_agent << Belief changed: not fire_now hallway_upstairs
security_agent  security_agent << Belief changed: shut_down hallway_upstairs
security_agent  security_agent << Belief changed: not fire_now master_bedroom
security_agent  security_agent << Belief changed: shut_down master_bedroom
security_agent  security_agent << Belief changed: not fire_now bedroom_0
security_agent  security_agent << Belief changed: shut_down bedroom_0
security_agent  security_agent << Belief changed: not fire_now bedroom_1
security_agent  security_agent << Belief changed: shut_down bedroom_1
security_agent  security_agent << Belief changed: not fire_now bathroom_1
security_agent  security_agent << Belief changed: shut_down bathroom_1
security_agent  security_agent << Belief changed: not burglar kitchen
security_agent  security_agent << Belief changed: police kitchen
security_agent  security_agent << Belief changed: not burglar living_room
security_agent  security_agent << Belief changed: police living_room
security_agent  security_agent << Belief changed: not burglar garage
security_agent  security_agent << Belief changed: police garage
security_agent  security_agent << Belief changed: not burglar bathroom_0
security_agent  security_agent << Belief changed: police bathroom_0
security_agent  security_agent << Belief changed: not burglar utility_room
security_agent  security_agent << Belief changed: police utility_room
security_agent  security_agent << Belief changed: not burglar hallway
security_agent  security_agent << Belief changed: police hallway
```


security_agent security_agent << Belief changed: not burglar bedroom_1
security_agent security_agent << Belief changed: police bedroom_1
security_agent security_agent << Belief changed: not burglar bathroom_1
security_agent security_agent << Belief changed: police bathroom_1
security_agent security_agent << Belief changed: not burglar out
security_agent security_agent << Belief changed: police out
washing_machine_agent washing_machine_agent << Belief changed: not dress_to_wash kitchen
washing_machine_agent washing_machine_agent << Belief changed: not dress_washed
washing_machine_agent washing_machine_agent << Belief changed: not dress_to_wash living_room
washing_machine_agent washing_machine_agent << Belief changed: not dress_to_wash garage
washing_machine_agent washing_machine_agent << Belief changed: not dress_to_wash bathroom_0
washing_machine_agent washing_machine_agent << Belief changed: not dress_to_wash utility_room
washing_machine_agent washing_machine_agent << Belief changed: not dress_to_wash hallway
washing_machine_agent washing_machine_agent << Belief changed: not dress_to_wash stairs
washing_machine_agent washing_machine_agent << Belief changed: not dress_to_wash hallway_upstairs
washing_machine_agent washing_machine_agent << Belief changed: not dress_to_wash master_bedroom
washing_machine_agent washing_machine_agent << Belief changed: not dress_to_wash bedroom_0
washing_machine_agent washing_machine_agent << Belief changed: not dress_to_wash bedroom_1
washing_machine_agent washing_machine_agent << Belief changed: not dress_to_wash bathroom_1
temperature_agent>DetectTemperatureIntention#27 Intention success DetectTemperatureIntention#27
temperature_agent Succesfully used intention DetectTemperatureIntention to achieve goal DetectTemperatureGoal#3
3
vacuum_cleaner>LearnHouseIntention#31 Intention success LearnHouseIntention#31
vacuum_cleaner Succesfully used intention LearnHouseIntention to achieve goal LearnHouseGoal#36
house_server_agent>PostmanAcceptAllRequest#7 Reading received message SendRoomLocationGoal#12
house_server_agent Trying to use intention SendRoomLocationIntention to achieve goal SendRoomLocationGoal#12
gym_agent gym_agent << Belief changed: door kitchen out
gym_agent gym_agent << Belief changed: door kitchen living_room
gym_agent gym_agent << Belief changed: door living_room kitchen
gym_agent gym_agent << Belief changed: door living_room hallway
gym_agent gym_agent << Belief changed: door living_room out
gym_agent gym_agent << Belief changed: door garage hallway
gym_agent gym_agent << Belief changed: door garage out
gym_agent gym_agent << Belief changed: door bathroom_0 hallway
gym_agent gym_agent << Belief changed: door utility_room hallway
gym_agent gym_agent << Belief changed: door hallway living_room
gym_agent gym_agent << Belief changed: door hallway garage
gym_agent gym_agent << Belief changed: door hallway bathroom_0
gym_agent gym_agent << Belief changed: door hallway utility_room
gym_agent gym_agent << Belief changed: door hallway stairs
gym_agent gym_agent << Belief changed: door stairs hallway


gym_agent gym_agent << Belief changed: door stairs hallway_upstairs
gym_agent gym_agent << Belief changed: door hallway_upstairs stairs
gym_agent gym_agent << Belief changed: door hallway_upstairs master_bedroom
gym_agent gym_agent << Belief changed: door hallway_upstairs bedroom_0
gym_agent gym_agent << Belief changed: door hallway_upstairs bedroom_1
gym_agent gym_agent << Belief changed: door hallway_upstairs bathroom_1
gym_agent gym_agent << Belief changed: door master_bedroom hallway_upstairs
gym_agent gym_agent << Belief changed: door bedroom_0 hallway_upstairs
gym_agent gym_agent << Belief changed: door bedroom_1 hallway_upstairs
gym_agent gym_agent << Belief changed: door bathroom_1 hallway_upstairs
gym_agent gym_agent << Belief changed: door out kitchen
gym_agent gym_agent << Belief changed: door out living_room
gym_agent gym_agent << Belief changed: door out garage
exploring_device_house_server_agent182 ExploringDevice Exploring device: Move from out to living_room requires 2 minutes
house_server_agent house_server_agent << Belief changed: door out living_room
house_server_agent house_server_agent << Belief changed: door living_room out
charging_agent>DetectBatteryIntention#8 Intention success DetectBatteryIntention#8
charging_agent Succesfully used intention DetectBatteryIntention to achieve goal DetectBatteryGoal#14
charging_agent>ChargingIntention#9 Intention success ChargingIntention#9
charging_agent Succesfully used intention ChargingIntention to achieve goal ChargingGoal#15
0:00:05 house_server_agent>SendRoomLocationIntention#37 Intention success SendRoomLocationIntention#37
house_server_agent Succesfully used intention SendRoomLocationIntention to achieve goal SendRoomLocationGoal#12
exploring_device_house_server_agent182 ExploringDevice Exploring device: Move from living_room to hallway requires 2 minutes
house_server_agent house_server_agent << Belief changed: door living_room hallway
house_server_agent house_server_agent << Belief changed: door hallway living_room
house_server_agent>PostmanAcceptAllRequest#7 Reading received message SendRoomLocationGoal#10
house_server_agent Trying to use intention SendRoomLocationIntention to achieve goal SendRoomLocationGoal#10
refill_agent refill_agent << Belief changed: door kitchen out
refill_agent refill_agent << Belief changed: door kitchen living_room
refill_agent refill_agent << Belief changed: door living_room kitchen
refill_agent refill_agent << Belief changed: door living_room hallway
refill_agent refill_agent << Belief changed: door living_room out
refill_agent refill_agent << Belief changed: door garage hallway
refill_agent refill_agent << Belief changed: door garage out
refill_agent refill_agent << Belief changed: door bathroom_0 hallway
refill_agent refill_agent << Belief changed: door utility_room hallway
refill_agent refill_agent << Belief changed: door hallway living_room
refill_agent refill_agent << Belief changed: door hallway garage
refill_agent refill_agent << Belief changed: door hallway bathroom_0
refill_agent refill_agent << Belief changed: door hallway utility_room
refill_agent refill_agent << Belief changed: door hallway stairs

```
refill_agent                                refill_agent << Belief changed: door stairs hallway
refill_agent                                refill_agent << Belief changed: door stairs hallway_upstairs
refill_agent                                refill_agent << Belief changed: door hallway_upstairs stairs
refill_agent                                refill_agent << Belief changed: door hallway_upstairs master_bedroom
refill_agent                                refill_agent << Belief changed: door hallway_upstairs bedroom_0
refill_agent                                refill_agent << Belief changed: door hallway_upstairs bedroom_1
refill_agent                                refill_agent << Belief changed: door hallway_upstairs bathroom_1
refill_agent                                refill_agent << Belief changed: door master_bedroom hallway_upstairs
refill_agent                                refill_agent << Belief changed: door bedroom_0 hallway_upstairs
refill_agent                                refill_agent << Belief changed: door bedroom_1 hallway_upstairs
refill_agent                                refill_agent << Belief changed: door bathroom_1 hallway_upstairs
refill_agent                                refill_agent << Belief changed: door out kitchen
refill_agent                                refill_agent << Belief changed: door out living_room
refill_agent                                refill_agent << Belief changed: door out garage
gym_agent>AskRoomLocationIntention#6        Intention success AskRoomLocationIntention#6
gym_agent                                   Succesfully used intention AskRoomLocationIntention to achieve goal AskRoomLocationGoal#11
house_server_agent>SendRoomLocationIntention#38  Intention success SendRoomLocationIntention#38
house_server_agent                          Succesfully used intention SendRoomLocationIntention to achieve goal SendRoomLocationGoal#10
house_server_agent>PostmanAcceptAllRequest#7  Reading received message SendRoomLocationGoal#8
house_server_agent                          Trying to use intention SendRoomLocationIntention to achieve goal SendRoomLocationGoal#8
garbage_agent                               garbage_agent << Belief changed: door kitchen out
garbage_agent                               garbage_agent << Belief changed: door kitchen living_room
garbage_agent                               garbage_agent << Belief changed: door living_room kitchen
garbage_agent                               garbage_agent << Belief changed: door living_room hallway
garbage_agent                               garbage_agent << Belief changed: door living_room out
garbage_agent                               garbage_agent << Belief changed: door garage hallway
garbage_agent                               garbage_agent << Belief changed: door garage out
garbage_agent                               garbage_agent << Belief changed: door bathroom_0 hallway
garbage_agent                               garbage_agent << Belief changed: door utility_room hallway
garbage_agent                               garbage_agent << Belief changed: door hallway living_room
garbage_agent                               garbage_agent << Belief changed: door hallway garage
garbage_agent                               garbage_agent << Belief changed: door hallway bathroom_0
garbage_agent                               garbage_agent << Belief changed: door hallway utility_room
garbage_agent                               garbage_agent << Belief changed: door hallway stairs
garbage_agent                               garbage_agent << Belief changed: door stairs hallway
garbage_agent                               garbage_agent << Belief changed: door stairs hallway_upstairs
garbage_agent                               garbage_agent << Belief changed: door hallway_upstairs stairs
garbage_agent                               garbage_agent << Belief changed: door hallway_upstairs master_bedroom
garbage_agent                               garbage_agent << Belief changed: door hallway_upstairs bedroom_0
garbage_agent                               garbage_agent << Belief changed: door hallway_upstairs bedroom_1
garbage_agent                               garbage_agent << Belief changed: door hallway_upstairs bathroom_1
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garbage_agent                               garbage_agent << Belief changed: door bedroom_0 hallway_upstairs
garbage_agent                               garbage_agent << Belief changed: door bedroom_1 hallway_upstairs
garbage_agent                               garbage_agent << Belief changed: door bathroom_1 hallway_upstairs
garbage_agent                               garbage_agent << Belief changed: door out kitchen
garbage_agent                               garbage_agent << Belief changed: door out living_room
garbage_agent                               garbage_agent << Belief changed: door out garage
refill_agent>AskRoomLocationIntention#5     Intention success AskRoomLocationIntention#5
refill_agent                                Succesfully used intention AskRoomLocationIntention to achieve goal AskRoomLocationGoal#9
house_server_agent>SendRoomLocationIntention#39  Intention success SendRoomLocationIntention#39
house_server_agent                          Succesfully used intention SendRoomLocationIntention to achieve goal SendRoomLocationGoal#8
house_server_agent>PostmanAcceptAllRequest#7  Reading received message SendRoomLocationGoal#6
house_server_agent                          Trying to use intention SendRoomLocationIntention to achieve goal SendRoomLocationGoal#6
music_agent                                 music_agent << Belief changed: door kitchen out
music_agent                                 music_agent << Belief changed: door kitchen living_room
music_agent                                 music_agent << Belief changed: door living_room kitchen
music_agent                                 music_agent << Belief changed: door living_room hallway
music_agent                                 music_agent << Belief changed: door living_room out
music_agent                                 music_agent << Belief changed: door garage hallway
music_agent                                 music_agent << Belief changed: door garage out
music_agent                                 music_agent << Belief changed: door bathroom_0 hallway
music_agent                                 music_agent << Belief changed: door utility_room hallway
music_agent                                 music_agent << Belief changed: door hallway living_room
music_agent                                 music_agent << Belief changed: door hallway garage
music_agent                                 music_agent << Belief changed: door hallway bathroom_0
music_agent                                 music_agent << Belief changed: door hallway utility_room
music_agent                                 music_agent << Belief changed: door hallway stairs
music_agent                                 music_agent << Belief changed: door stairs hallway
music_agent                                 music_agent << Belief changed: door stairs hallway_upstairs
music_agent                                 music_agent << Belief changed: door hallway_upstairs stairs
music_agent                                 music_agent << Belief changed: door hallway_upstairs master_bedroom
music_agent                                 music_agent << Belief changed: door hallway_upstairs bedroom_0
music_agent                                 music_agent << Belief changed: door hallway_upstairs bedroom_1
music_agent                                 music_agent << Belief changed: door hallway_upstairs bathroom_1
music_agent                                 music_agent << Belief changed: door master_bedroom hallway_upstairs
music_agent                                 music_agent << Belief changed: door bedroom_0 hallway_upstairs
music_agent                                 music_agent << Belief changed: door bedroom_1 hallway_upstairs
music_agent                                 music_agent << Belief changed: door bathroom_1 hallway_upstairs
music_agent                                 music_agent << Belief changed: door out kitchen
music_agent                                 music_agent << Belief changed: door out living_room
music_agent                                 music_agent << Belief changed: door out garage
0:00:10  gym_agent                          Trying to use intention OnlinePlanning to achieve goal ManageWeights#43
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                garbage_agent>AskRoomLocationIntention#4          Intention success AskRoomLocationIntention#4
                garbage_agent                                     Succesfully used intention AskRoomLocationIntention to achieve goal AskRoomLocationGoal#7
exploring_device house_server_agent182 ExploringDevice  Exploring device: Move from hallway to garage requires 2 minutes
                house_server_agent                                house_server_agent << Belief changed: door hallway garage
                house_server_agent                                house_server_agent << Belief changed: door garage hallway
                house_server_agent>SendRoomLocationIntention#40   Intention success SendRoomLocationIntention#40
                house_server_agent                                Succesfully used intention SendRoomLocationIntention to achieve goal SendRoomLocationGoal#6
                house_server_agent>PostmanAcceptAllRequest#7      Reading received message SendRoomLocationGoal#4
                house_server_agent                                Trying to use intention SendRoomLocationIntention to achieve goal SendRoomLocationGoal#4
                charging_agent                                    charging_agent << Belief changed: door kitchen out
                charging_agent                                    charging_agent << Belief changed: door kitchen living_room
                charging_agent                                    charging_agent << Belief changed: door living_room kitchen
                charging_agent                                    charging_agent << Belief changed: door living_room hallway
                charging_agent                                    charging_agent << Belief changed: door living_room out
                charging_agent                                    charging_agent << Belief changed: door garage hallway
                charging_agent                                    charging_agent << Belief changed: door garage out
                charging_agent                                    charging_agent << Belief changed: door bathroom_0 hallway
                charging_agent                                    charging_agent << Belief changed: door utility_room hallway
                charging_agent                                    charging_agent << Belief changed: door hallway living_room
                charging_agent                                    charging_agent << Belief changed: door hallway garage
                charging_agent                                    charging_agent << Belief changed: door hallway bathroom_0
                charging_agent                                    charging_agent << Belief changed: door hallway utility_room
                charging_agent                                    charging_agent << Belief changed: door hallway stairs
                charging_agent                                    charging_agent << Belief changed: door stairs hallway
                charging_agent                                    charging_agent << Belief changed: door stairs hallway_upstairs
                charging_agent                                    charging_agent << Belief changed: door hallway_upstairs stairs
                charging_agent                                    charging_agent << Belief changed: door hallway_upstairs master_bedroom
                charging_agent                                    charging_agent << Belief changed: door hallway_upstairs bedroom_0
                charging_agent                                    charging_agent << Belief changed: door hallway_upstairs bedroom_1
                charging_agent                                    charging_agent << Belief changed: door hallway_upstairs bathroom_1
                charging_agent                                    charging_agent << Belief changed: door master_bedroom hallway_upstairs
                charging_agent                                    charging_agent << Belief changed: door bedroom_0 hallway_upstairs
                charging_agent                                    charging_agent << Belief changed: door bedroom_1 hallway_upstairs
                charging_agent                                    charging_agent << Belief changed: door bathroom_1 hallway_upstairs
                charging_agent                                    charging_agent << Belief changed: door out kitchen
                charging_agent                                    charging_agent << Belief changed: door out living_room
                charging_agent                                    charging_agent << Belief changed: door out garage
                music_agent>AskRoomLocationIntention#3            Intention success AskRoomLocationIntention#3
                music_agent                                       Succesfully used intention AskRoomLocationIntention to achieve goal AskRoomLocationGoal#5
                house_server_agent>SendRoomLocationIntention#42   Intention success SendRoomLocationIntention#42
                house_server_agent                                Succesfully used intention SendRoomLocationIntention to achieve goal SendRoomLocationGoal#4
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                house_server_agent>PostmanAcceptAllRequest#7      Reading received message SendRoomLocationGoal#2
                house_server_agent                                Trying to use intention SendRoomLocationIntention to achieve goal SendRoomLocationGoal#2
                washing_machine_agent                             washing_machine_agent << Belief changed: door kitchen out
                washing_machine_agent                             washing_machine_agent << Belief changed: door kitchen living_room
                washing_machine_agent                             washing_machine_agent << Belief changed: door living_room kitchen
                washing_machine_agent                             washing_machine_agent << Belief changed: door living_room hallway
                washing_machine_agent                             washing_machine_agent << Belief changed: door living_room out
                washing_machine_agent                             washing_machine_agent << Belief changed: door garage hallway
                washing_machine_agent                             washing_machine_agent << Belief changed: door garage out
                washing_machine_agent                             washing_machine_agent << Belief changed: door bathroom_0 hallway
                washing_machine_agent                             washing_machine_agent << Belief changed: door utility_room hallway
                washing_machine_agent                             washing_machine_agent << Belief changed: door hallway living_room
                washing_machine_agent                             washing_machine_agent << Belief changed: door hallway garage
                washing_machine_agent                             washing_machine_agent << Belief changed: door hallway bathroom_0
                washing_machine_agent                             washing_machine_agent << Belief changed: door hallway utility_room
                washing_machine_agent                             washing_machine_agent << Belief changed: door hallway stairs
                washing_machine_agent                             washing_machine_agent << Belief changed: door stairs hallway
                washing_machine_agent                             washing_machine_agent << Belief changed: door stairs hallway_upstairs
                washing_machine_agent                             washing_machine_agent << Belief changed: door hallway_upstairs stairs
                washing_machine_agent                             washing_machine_agent << Belief changed: door hallway_upstairs master_bedroom
                washing_machine_agent                             washing_machine_agent << Belief changed: door hallway_upstairs bedroom_0
                washing_machine_agent                             washing_machine_agent << Belief changed: door hallway_upstairs bedroom_1
                washing_machine_agent                             washing_machine_agent << Belief changed: door hallway_upstairs bathroom_1
                washing_machine_agent                             washing_machine_agent << Belief changed: door master_bedroom hallway_upstairs
                washing_machine_agent                             washing_machine_agent << Belief changed: door bedroom_0 hallway_upstairs
                washing_machine_agent                             washing_machine_agent << Belief changed: door bedroom_1 hallway_upstairs
                washing_machine_agent                             washing_machine_agent << Belief changed: door bathroom_1 hallway_upstairs
                washing_machine_agent                             washing_machine_agent << Belief changed: door out kitchen
                washing_machine_agent                             washing_machine_agent << Belief changed: door out living_room
                washing_machine_agent                             washing_machine_agent << Belief changed: door out garage
                charging_agent>AskRoomLocationIntention#2         Intention success AskRoomLocationIntention#2
                charging_agent                                    Succesfully used intention AskRoomLocationIntention to achieve goal AskRoomLocationGoal#3
                house_server_agent>SendRoomLocationIntention#43   Intention success SendRoomLocationIntention#43
                house_server_agent                                Succesfully used intention SendRoomLocationIntention to achieve goal SendRoomLocationGoal#2
0:00:15         washing_machine_agent>AskRoomLocationIntention#1  Intention success AskRoomLocationIntention#1
                washing_machine_agent                             Succesfully used intention AskRoomLocationIntention to achieve goal AskRoomLocationGoal#1
                house_server_agent                                house_server_agent << Belief changed: door hallway bathroom_0
                house_server_agent                                house_server_agent << Belief changed: door bathroom_0 hallway
                house_server_agent                                house_server_agent << Belief changed: door hallway utility_room
                house_server_agent                                house_server_agent << Belief changed: door utility_room hallway
                house_server_agent                                house_server_agent << Belief changed: door hallway stairs
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0:00:20         house_server_agent                          house_server_agent << Belief changed: door stairs hallway_upstairs
                house_server_agent                          house_server_agent << Belief changed: door hallway_upstairs stairs
                house_server_agent                          house_server_agent << Belief changed: door hallway_upstairs master_bedroom
                house_server_agent                          house_server_agent << Belief changed: door master_bedroom hallway_upstairs
                house_server_agent                          house_server_agent << Belief changed: door hallway_upstairs bedroom_0
                house_server_agent                          house_server_agent << Belief changed: door bedroom_0 hallway_upstairs
0:00:25         house_server_agent                          house_server_agent << Belief changed: door hallway_upstairs bedroom_1
                house_server_agent                          house_server_agent << Belief changed: door bedroom_1 hallway_upstairs
                house_server_agent                          house_server_agent << Belief changed: door hallway_upstairs bathroom_1
                house_server_agent                          house_server_agent << Belief changed: door bathroom_1 hallway_upstairs
0:00:30         gym_agent                                   Trying to use intention OnlinePlanning to achieve goal ManageWeights#44
                house_server_agent                          house_server_agent << Belief changed: door out garage
                house_server_agent                          house_server_agent << Belief changed: door garage out
exploring_device_house_server_agent182 ExploringDevice  Exploring device: Move from garage to hallway requires 2 minutes
exploring_device_house_server_agent182 ExploringDevice  Exploring device: Move from hallway to living_room requires 2 minutes
0:00:40         gym_agent                                   Trying to use intention OnlinePlanning to achieve goal ManageWeights#45
                gym_agent>OnlinePlanning#41                 Plan found:
                gym_agent>OnlinePlanning#41                 - (deliverweights kitchen)
                gym_agent>OnlinePlanning#41                 Starting sequential step (DeliverWeights kitchen) Effect: leave-weights kitchen
smart_weightkitchen162 SmartWeight  LeaveWeights action ends
                gym_agent                                   gym_agent << Belief changed: leave-weights kitchen
                gym_agent>DeliverWeights#46                 Intention success DeliverWeights#46
                gym_agent>OnlinePlanning#41                 Intention success OnlinePlanning#41
                gym_agent                                   Succesfully used intention OnlinePlanning to achieve goal ManageWeights#43
0:00:50         gym_agent                                   Trying to use intention OnlinePlanning to achieve goal ManageWeights#47
                house_server_agent                          house_server_agent << Belief changed: door kitchen living_room
                house_server_agent                          house_server_agent << Belief changed: door living_room kitchen
exploring_device_house_server_agent182 ExploringDevice  Exploring device: Move from living_room to hallway requires 2 minutes
exploring_device_house_server_agent182 ExploringDevice  Exploring device: Move from hallway to garage requires 2 minutes
                gym_agent>OnlinePlanning#44                 Plan found:
                gym_agent>OnlinePlanning#44                 - (moveweights kitchen living_room)
                gym_agent>OnlinePlanning#44                 - (moveweights living_room hallway)
                gym_agent>OnlinePlanning#44                 - (moveweights hallway stairs)
                gym_agent>OnlinePlanning#44                 - (moveweights stairs hallway_upstairs)
                gym_agent>OnlinePlanning#44                 - (moveweights hallway_upstairs master_bedroom)
                gym_agent>OnlinePlanning#44                 - (deliverweights master_bedroom)
                gym_agent>OnlinePlanning#44                 Starting sequential step (MoveWeights kitchen living_room) Effect: not leave-weights kitchen,
in living_room,not in kitchen
smart_weightkitchen162 SmartWeight  move action ends
exploring_device_house_server_agent182 ExploringDevice  Exploring device: Move from garage to out requires 2 minutes
                gym_agent                                   gym_agent << Belief changed: not leave-weights kitchen
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                gym_agent                                   gym_agent << Belief changed: not leave-weights kitchen
                gym_agent                                   gym_agent << Belief changed: in living_room
                gym_agent                                   gym_agent << Belief changed: not in kitchen
                gym_agent>MoveWeights#48                    Intention success MoveWeights#48
                gym_agent>OnlinePlanning#44                 Starting sequential step (MoveWeights living_room hallway) Effect: not leave-weights living_r
oom,in hallway,not in living_room
smart_weightkitchen162 SmartWeight  move action ends
                gym_agent                                   gym_agent << Belief changed: not leave-weights living_room
                gym_agent                                   gym_agent << Belief changed: in hallway
                gym_agent                                   gym_agent << Belief changed: not in living_room
                gym_agent>MoveWeights#49                    Intention success MoveWeights#49
                gym_agent>OnlinePlanning#44                 Starting sequential step (MoveWeights hallway stairs) Effect: not leave-weights hallway,in st
airs,not in hallway
                gym_agent>OnlinePlanning#45                 Plan found:
                gym_agent>OnlinePlanning#45                 - (moveweights kitchen living_room)
                gym_agent>OnlinePlanning#45                 - (moveweights living_room hallway)
                gym_agent>OnlinePlanning#45                 - (moveweights hallway stairs)
                gym_agent>OnlinePlanning#45                 - (moveweights stairs hallway_upstairs)
                gym_agent>OnlinePlanning#45                 - (moveweights hallway_upstairs bedroom_0)
                gym_agent>OnlinePlanning#45                 - (deliverweights bedroom_0)
                gym_agent>OnlinePlanning#45                 Starting sequential step (MoveWeights kitchen living_room) Effect: not leave-weights kitchen,
in living_room,not in kitchen
                gym_agent>OnlinePlanning#45                 Intention failed: pddl precondition not valid in MOVEWeights
                gym_agent                                   Failed to use intention OnlinePlanning to achieve goal ManageWeights#45: pddl precondition no
t valid in MOVEWeights
                gym_agent                                   No success in achieving goal ManageWeights#45
smart_weightkitchen162 SmartWeight  move action ends
                gym_agent                                   gym_agent << Belief changed: not leave-weights hallway
                gym_agent                                   gym_agent << Belief changed: in stairs
                gym_agent                                   gym_agent << Belief changed: not in hallway
                gym_agent>MoveWeights#50                    Intention success MoveWeights#50
                gym_agent>OnlinePlanning#44                 Starting sequential step (MoveWeights stairs hallway_upstairs) Effect: not leave-weights stai
rs,in hallway_upstairs,not in stairs
smart_weightkitchen162 SmartWeight  move action ends
                gym_agent                                   gym_agent << Belief changed: not leave-weights stairs
                gym_agent                                   gym_agent << Belief changed: in hallway_upstairs
                gym_agent                                   gym_agent << Belief changed: not in stairs
                gym_agent>OnlinePlanning#47                 Plan found:
                gym_agent>OnlinePlanning#47                 - (moveweights kitchen living_room)
                gym_agent>OnlinePlanning#47                 - (moveweights living_room hallway)
                gym_agent>OnlinePlanning#47                 - (moveweights hallway stairs)
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                gym_agent                                       gym_agent << Belief changed: not leave-weights hallway_upstairs
                gym_agent                                       gym_agent << Belief changed: in master_bedroom
                gym_agent                                       gym_agent << Belief changed: not in hallway_upstairs
                gym_agent>MoveWeights#52                        Intention success MoveWeights#52
exploring_device_house_server_agent182 ExploringDevice  Exploring device: Move from out to garage requires 2 minutes
                gym_agent>OnlinePlanning#44                     Starting sequential step (DeliverWeights master_bedroom) Effect: leave-weights master_bedroom
smart_weightkitchen162 SmartWeight  LeaveWeights action ends
exploring_device_house_server_agent182 ExploringDevice  Exploring device: Move from garage to hallway requires 2 minutes
                gym_agent                                       gym_agent << Belief changed: leave-weights master_bedroom
                gym_agent>DeliverWeights#53                     Intention success DeliverWeights#53
                gym_agent>OnlinePlanning#44                     Intention success OnlinePlanning#44
                gym_agent                                       Succesfully used intention OnlinePlanning to achieve goal ManageWeights#44
exploring_device_house_server_agent182 ExploringDevice  Exploring device: Move from hallway to bathroom_0 requires 2 minutes
0:01:55         house_server_agent>LearnHouseConfigurationIntention#0 Intention success LearnHouseConfigurationIntention#0
                house_server_agent                              Succesfully used intention LearnHouseConfigurationIntention to achieve goal LearnHouseConfigu
rationGoal#0
0:02:00         refill_agent                                    Trying to use intention OnlinePlanning to achieve goal RefillRoom#66
                refill_agent                                    Trying to use intention OnlinePlanning to achieve goal RefillRoom#67
                refill_agent                                    Trying to use intention OnlinePlanning to achieve goal RefillRoom#68
                refill_agent                                    refill_agent << Belief changed: need_to_refill living_room
                refill_agent                                    refill_agent << Belief changed: need_to_refill utility_room
                refill_agent                                    refill_agent << Belief changed: need_to_refill bedroom_0
0:02:25         refill_agent>OnlinePlanning#66                  Plan found:
                refill_agent>OnlinePlanning#66                  - (move kitchen out)
                refill_agent>OnlinePlanning#66                  - (buyrefill)
                refill_agent>OnlinePlanning#66                  - (moverefill out living_room)
                refill_agent>OnlinePlanning#66                  - (deliverrefill living_room)
                refill_agent>OnlinePlanning#66                  - (move living_room kitchen)
                refill_agent>OnlinePlanning#67                  Plan found:
                refill_agent>OnlinePlanning#67                  - (move kitchen out)
                refill_agent>OnlinePlanning#67                  - (buyrefill)
                refill_agent>OnlinePlanning#67                  - (moverefill out living_room)
                refill_agent>OnlinePlanning#67                  - (moverefill living_room hallway)
                refill_agent>OnlinePlanning#67                  - (moverefill hallway utility_room)
                refill_agent>OnlinePlanning#67                  - (deliverrefill utility_room)
                refill_agent>OnlinePlanning#67                  - (move utility_room hallway)
                refill_agent>OnlinePlanning#67                  - (move hallway living_room)
                refill_agent>OnlinePlanning#67                  - (move living_room kitchen)
                refill_agent>OnlinePlanning#66                  Starting sequential step (Move kitchen out) Effect: in out,not in kitchen
                refill_agent>OnlinePlanning#68                  Plan found:
                refill_agent>OnlinePlanning#68                  - (move kitchen out)
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                refill_agent>OnlinePlanning#68                  - (buyrefill)
                refill_agent>OnlinePlanning#68                  - (moverefill out living_room)
                refill_agent>OnlinePlanning#68                  - (moverefill living_room hallway)
                refill_agent>OnlinePlanning#68                  - (moverefill hallway stairs)
                refill_agent>OnlinePlanning#68                  - (moverefill stairs hallway_upstairs)
                refill_agent>OnlinePlanning#68                  - (moverefill hallway_upstairs bedroom_0)
                refill_agent>OnlinePlanning#68                  - (deliverrefill bedroom_0)
                refill_agent>OnlinePlanning#68                  - (move bedroom_0 hallway_upstairs)
                refill_agent>OnlinePlanning#68                  - (move hallway_upstairs stairs)
                refill_agent>OnlinePlanning#68                  - (move stairs hallway)
                refill_agent>OnlinePlanning#68                  - (move hallway living_room)
                refill_agent>OnlinePlanning#68                  - (move living_room kitchen)
                refill_agent>OnlinePlanning#67                  Starting sequential step (Move kitchen out) Effect: in out,not in kitchen
                refill_agent>OnlinePlanning#68                  Starting sequential step (Move kitchen out) Effect: in out,not in kitchen
refill_devicekitchen176 RefillDevice  move action ends
                refill_agent                                    refill_agent << Belief changed: in out
                refill_agent                                    refill_agent << Belief changed: not in kitchen
                refill_agent>Move#83                            Intention success Move#83
                refill_agent>OnlinePlanning#68                  Starting sequential step (BuyRefill ) Effect: content_bought,content_in out
refill_devicekitchen176 RefillDevice  buying action ends
                refill_agent                                    refill_agent << Belief changed: content_bought
                refill_agent                                    refill_agent << Belief changed: content_in out
                refill_agent>BuyRefill#84                       Intention success BuyRefill#84
                refill_agent>OnlinePlanning#68                  Starting sequential step (MoveRefill out living_room) Effect: not in out,not content_in out,i
n living_room,content_in living_room
refill_devicekitchen176 RefillDevice  move action ends
                refill_agent                                    refill_agent << Belief changed: not in out
                refill_agent                                    refill_agent << Belief changed: not content_in out
                refill_agent                                    refill_agent << Belief changed: in living_room
                refill_agent                                    refill_agent << Belief changed: content_in living_room
                refill_agent>MoveRefill#85                      Intention success MoveRefill#85
                refill_agent>OnlinePlanning#68                  Starting sequential step (MoveRefill living_room hallway) Effect: not in living_room,not cont
ent_in living_room,in hallway,content_in hallway
refill_devicekitchen176 RefillDevice  move action ends
                refill_agent                                    refill_agent << Belief changed: not in living_room
                refill_agent                                    refill_agent << Belief changed: not content_in living_room
                refill_agent                                    refill_agent << Belief changed: in hallway
                refill_agent                                    refill_agent << Belief changed: content_in hallway
                refill_agent>MoveRefill#86                      Intention success MoveRefill#86
                refill_agent>OnlinePlanning#68                  Starting sequential step (MoveRefill hallway stairs) Effect: not in hallway,not content_in ha
llway,in stairs,content_in stairs
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                refill_agent>OnlinePlanning#68                  Starting sequential step (MoveRefill stairs hallway_upstairs) Effect: not in stairs,not conte
nt_in stairs,in hallway_upstairs,content_in hallway_upstairs
refill_devicekitchen176 RefillDevice  move action ends
                refill_agent                                    refill_agent << Belief changed: not in stairs
                refill_agent                                    refill_agent << Belief changed: not content_in stairs
                refill_agent                                    refill_agent << Belief changed: in hallway_upstairs
                refill_agent                                    refill_agent << Belief changed: content_in hallway_upstairs
                refill_agent>MoveRefill#88                      Intention success MoveRefill#88
                refill_agent>OnlinePlanning#68                  Starting sequential step (MoveRefill hallway_upstairs bedroom_0) Effect: not in hallway_upsta
irs,not content_in hallway_upstairs,in bedroom_0,content_in bedroom_0
refill_devicekitchen176 RefillDevice  move action ends
                refill_agent                                    refill_agent << Belief changed: not in hallway_upstairs
                refill_agent                                    refill_agent << Belief changed: not content_in hallway_upstairs
                refill_agent                                    refill_agent << Belief changed: in bedroom_0
                refill_agent                                    refill_agent << Belief changed: content_in bedroom_0
                refill_agent>MoveRefill#89                      Intention success MoveRefill#89
                refill_agent>OnlinePlanning#68                  Starting sequential step (DeliverRefill bedroom_0) Effect: not need_to_refill bedroom_0
                refill_agent                                    refill_agent << Belief changed: not need_to_refill bedroom_0
                refill_agent>DeliverRefill#90                   Intention success DeliverRefill#90
0:03:25         refill_agent>OnlinePlanning#68                  Starting sequential step (Move bedroom_0 hallway_upstairs) Effect: in hallway_upstairs,not in
 bedroom_0
refill_devicekitchen176 RefillDevice  move action ends
                refill_agent                                    refill_agent << Belief changed: in hallway_upstairs
                refill_agent                                    refill_agent << Belief changed: not in bedroom_0
                refill_agent>Move#91                            Intention success Move#91
                refill_agent>OnlinePlanning#68                  Starting sequential step (Move hallway_upstairs stairs) Effect: in stairs,not in hallway_upst
airs
refill_devicekitchen176 RefillDevice  move action ends
                refill_agent                                    refill_agent << Belief changed: in stairs
                refill_agent                                    refill_agent << Belief changed: not in hallway_upstairs
                refill_agent>Move#92                            Intention success Move#92
                refill_agent>OnlinePlanning#68                  Starting sequential step (Move stairs hallway) Effect: in hallway,not in stairs
refill_devicekitchen176 RefillDevice  move action ends
                refill_agent                                    refill_agent << Belief changed: in hallway
                refill_agent                                    refill_agent << Belief changed: not in stairs
                refill_agent>Move#93                            Intention success Move#93
                refill_agent>OnlinePlanning#68                  Starting sequential step (Move hallway living_room) Effect: in living_room,not in hallway
refill_devicekitchen176 RefillDevice  move action ends
                refill_agent                                    refill_agent << Belief changed: in living_room
                refill_agent                                    refill_agent << Belief changed: not in hallway
                refill_agent>Move#94                            Intention success Move#94
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                refill_agent>OnlinePlanning#68                  Starting sequential step (Move living_room kitchen) Effect: in kitchen,not in living_room
refill_devicekitchen176 RefillDevice  move action ends
                refill_agent                                    refill_agent << Belief changed: in kitchen
                refill_agent                                    refill_agent << Belief changed: not in living_room
                refill_agent>Move#95                            Intention success Move#95
                refill_agent>OnlinePlanning#68                  Intention success OnlinePlanning#68
                refill_agent                                    Succesfully used intention OnlinePlanning to achieve goal RefillRoom#68
0:05:20         gym_agent                                       Trying to use intention OnlinePlanning to achieve goal ManageWeights#96
0:05:45         gym_agent>OnlinePlanning#96                     Plan found:
                gym_agent>OnlinePlanning#96                     Intention success OnlinePlanning#96
                gym_agent                                       Succesfully used intention OnlinePlanning to achieve goal ManageWeights#96
0:06:00         alarm_agent>AlarmIntention#34                    Plays: Can I call you tonight?, Decibel: 30' at: hh:6:mm0
0:06:15         alarm_agent>AlarmIntention#34                    Ends:'Can I call you tonight?' at: hh:6:mm15
0:07:00         alarm_agent>AlarmIntention#33                    Plays: I wish you were here, Decibel: 20' at: hh:7:mm0
0:07:10         alarm_agent>AlarmIntention#35                    Plays: Hey Joe, Decibel: 25' at: hh:7:mm10
0:07:15         alarm_agent>AlarmIntention#33                    Ends:'I wish you were here' at: hh:7:mm15
0:07:20         alarm_agent>AlarmIntention#36                    Plays: AO Joe, Decibel: 35' at: hh:7:mm20
0:07:25         alarm_agent>AlarmIntention#35                    Ends:'Hey Joe' at: hh:7:mm25
0:07:35         alarm_agent>AlarmIntention#36                    Ends:'AO Joe' at: hh:7:mm35
0:07:40         gym_agent                                       Trying to use intention OnlinePlanning to achieve goal ManageWeights#97
Sabrina Person moving from master_bedroom to hallway_upstairs
Sabrina Person moving from hallway_upstairs to stairs
Sabrina Person moving from stairs to hallway
Sabrina Person moving from hallway to living_room
Sabrina Person moving from living_room to kitchen
Soleira Person moving from bedroom_0 to hallway_upstairs
Soleira Person moving from hallway_upstairs to stairs
Soleira Person moving from stairs to hallway
Soleira Person moving from hallway to living_room
Soleira Person moving from living_room to kitchen
Lorenzo Person moving from bedroom_1 to hallway_upstairs
Lorenzo Person moving from hallway_upstairs to stairs
Lorenzo Person moving from stairs to hallway
Lorenzo Person moving from hallway to living_room
Lorenzo Person moving from living_room to kitchen
Marco 8: 5[Marco]: want to meal
meal_device_kitchen163 MealDevice  prepareMeal begins: in kitchen requires 20 minutes
                meal_agent                                      meal_agent << Belief changed: waiting marco
                gym_agent>OnlinePlanning#97                     Plan found:
                gym_agent>OnlinePlanning#97                     - (moveweights master_bedroom hallway_upstairs)
                gym_agent>OnlinePlanning#97                     - (moveweights hallway_upstairs stairs)
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                gym_agent>OnlinePlanning#97                     - (deliverweights kitchen)
                gym_agent>OnlinePlanning#97                     Starting sequential step (MoveWeights master_bedroom hallway_upstairs) Effect: not leave-weig
hts master_bedroom,in hallway_upstairs,not in master_bedroom
smart_weightkitchen162 SmartWeight  move action ends
                gym_agent                                       gym_agent << Belief changed: not leave-weights master_bedroom
                gym_agent                                       gym_agent << Belief changed: in hallway_upstairs
                gym_agent                                       gym_agent << Belief changed: not in master_bedroom
                gym_agent>MoveWeights#98                        Intention success MoveWeights#98
                gym_agent>OnlinePlanning#97                     Starting sequential step (MoveWeights hallway_upstairs stairs) Effect: not leave-weights hall
way_upstairs,in stairs,not in hallway_upstairs
smart_weightkitchen162 SmartWeight  move action ends
                gym_agent                                       gym_agent << Belief changed: in stairs
                gym_agent                                       gym_agent << Belief changed: not in hallway_upstairs
                gym_agent>MoveWeights#99                        Intention success MoveWeights#99
                gym_agent>OnlinePlanning#97                     Starting sequential step (MoveWeights stairs hallway) Effect: not leave-weights stairs,in hal
lway,not in stairs
smart_weightkitchen162 SmartWeight  move action ends
                gym_agent                                       gym_agent << Belief changed: in hallway
                gym_agent                                       gym_agent << Belief changed: not in stairs
                gym_agent>MoveWeights#100                       Intention success MoveWeights#100
                gym_agent>OnlinePlanning#97                     Starting sequential step (MoveWeights hallway living_room) Effect: not leave-weights hallway,
in living_room,not in hallway
smart_weightkitchen162 SmartWeight  move action ends
meal_device_kitchen163 MealDevice  prepareMeal ends
meal_device_kitchen163 MealDevice  deliverMeal  to marco requires 5 minutes
                meal_agent                                      meal_agent << Belief changed: ready_meal marco
                meal_agent                                      meal_agent << Belief changed: not waiting marco
                meal_agent                                      meal_agent << Belief changed: not ready_meal marco
                gym_agent                                       gym_agent << Belief changed: in living_room
                gym_agent                                       gym_agent << Belief changed: not in hallway
                gym_agent>MoveWeights#101                       Intention success MoveWeights#101
                gym_agent>OnlinePlanning#97                     Starting sequential step (MoveWeights living_room kitchen) Effect: not leave-weights living_r
oom,in kitchen,not in living_room
Soleira Person moving from kitchen to living_room
Soleira Person moving from living_room to out
Lorenzo Person moving from kitchen to living_room
Lorenzo Person moving from living_room to out
smart_weightkitchen162 SmartWeight  move action ends
meal_device_kitchen163 MealDevice  deliverMeal ends
audio_alarm_devicekitchen150 AudioAlarmDevice  Audio Burglar alarm stops
audio_alarm_deviceliving_room151 AudioAlarmDevice  Audio Burglar alarm stops
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audio_alarm_devicegarage152 AudioAlarmDevice  Audio Burglar alarm stops
audio_alarm_devicebathroom_0153 AudioAlarmDevice  Audio Burglar alarm stops
audio_alarm_deviceutility_room154 AudioAlarmDevice  Audio Burglar alarm stops
audio_alarm_devicehallway155 AudioAlarmDevice  Audio Burglar alarm stops
audio_alarm_devicestairs156 AudioAlarmDevice  Audio Burglar alarm stops
audio_alarm_devicehallway_upstairs157 AudioAlarmDevice  Audio Burglar alarm stops
audio_alarm_devicemaster_bedroom158 AudioAlarmDevice  Audio Burglar alarm stops
audio_alarm_devicebedroom_0159 AudioAlarmDevice  Audio Burglar alarm stops
audio_alarm_devicebedroom_1160 AudioAlarmDevice  Audio Burglar alarm stops
audio_alarm_devicebathroom_1161 AudioAlarmDevice  Audio Burglar alarm stops
emergency_call_kitchen54 EmergencyCall  CallPolice action in utility_room requires 10 minutes
                security_agent                                  security_agent << Belief changed: burglar utility_room
                security_agent                                  security_agent << Belief changed: not police utility_room
                security_agent                                  security_agent << Belief changed: not burglar utility_room
                security_agent                                  security_agent << Belief changed: police utility_room
                gym_agent                                       gym_agent << Belief changed: in kitchen
                gym_agent                                       gym_agent << Belief changed: not in living_room
                gym_agent>MoveWeights#102                       Intention success MoveWeights#102
                gym_agent>OnlinePlanning#97                     Starting sequential step (DeliverWeights kitchen) Effect: leave-weights kitchen
smart_weightkitchen162 SmartWeight  LeaveWeights action ends
                gym_agent                                       gym_agent << Belief changed: leave-weights kitchen
                gym_agent>DeliverWeights#103                    Intention success DeliverWeights#103
                gym_agent>OnlinePlanning#97                     Intention success OnlinePlanning#97
                gym_agent                                       Succesfully used intention OnlinePlanning to achieve goal ManageWeights#97
emergency_call_kitchen54 EmergencyCall  CallPolice action ends
                gym_agent                                       Trying to use intention OnlinePlanning to achieve goal ManageWeights#104
Sabrina Person moving from kitchen to living_room
Sabrina Person moving from living_room to out
0:09:05         gym_agent>OnlinePlanning#104                    Plan found:
                gym_agent>OnlinePlanning#104                    Intention success OnlinePlanning#104
                gym_agent                                       Succesfully used intention OnlinePlanning to achieve goal ManageWeights#104
audio_alarm_devicekitchen150 AudioAlarmDevice  Audio Smoke alarm stops
audio_alarm_deviceliving_room151 AudioAlarmDevice  Audio Smoke alarm stops
audio_alarm_devicegarage152 AudioAlarmDevice  Audio Smoke alarm stops
audio_alarm_devicebathroom_0153 AudioAlarmDevice  Audio Smoke alarm stops
audio_alarm_deviceutility_room154 AudioAlarmDevice  Audio Smoke alarm stops
audio_alarm_devicehallway155 AudioAlarmDevice  Audio Smoke alarm stops
audio_alarm_devicestairs156 AudioAlarmDevice  Audio Smoke alarm stops
audio_alarm_devicehallway_upstairs157 AudioAlarmDevice  Audio Smoke alarm stops
audio_alarm_devicemaster_bedroom158 AudioAlarmDevice  Audio Smoke alarm stops
audio_alarm_devicebedroom_0159 AudioAlarmDevice  Audio Smoke alarm stops
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audio_alarm_devicebathroom_1161 AudioAlarmDevice  Audio Smoke alarm stops
emergency_call_kitchen54 EmergencyCall  CallFiremen action in kitchen requires 15 minutes
                security_agent                                  security_agent << Belief changed: fire_now kitchen
                security_agent                                  security_agent << Belief changed: not shut_down kitchen
open_water_devicekitchen138 OpenWaterDevice  Open Water action ends
0:10:25         security_agent                                  security_agent << Belief changed: not fire_now kitchen
                security_agent                                  security_agent << Belief changed: shut_down kitchen
0:13:55heating_system_bathroom_081: switched on
heating_system_utility_room82: switched on
heating_system_hallway83: switched on
cooling_system_bathroom_1113: switched on
                temperature_agent                               temperature_agent << Belief changed: turn_on_heating thermometer_sensor_bathroom_093
                temperature_agent                               temperature_agent << Belief changed: turn_on_heating thermometer_sensor_utility_room94
                temperature_agent                               temperature_agent << Belief changed: turn_on_heating thermometer_sensor_hallway95
                temperature_agent                               temperature_agent << Belief changed: turn_on_cooling thermometer_sensor_bathroom_1101
Soleira Person moving from out to living_room
Soleira Person moving from living_room to hallway
Soleira Person moving from hallway to stairs
Soleira Person moving from stairs to hallway_upstairs
Soleira Person moving from hallway_upstairs to bedroom_0
Lorenzo Person moving from out to living_room
Lorenzo Person moving from living_room to hallway
Lorenzo Person moving from hallway to stairs
Lorenzo Person moving from stairs to hallway_upstairs
Lorenzo Person moving from hallway_upstairs to bedroom_0
heating_system_bathroom_081: switched off
heating_system_utility_room82: switched off
heating_system_hallway83: switched off
cooling_system_bathroom_1113: switched off
                temperature_agent                               temperature_agent << Belief changed: turn_off_heating thermometer_sensor_bathroom_093
                temperature_agent                               temperature_agent << Belief changed: turn_off_heating thermometer_sensor_utility_room94
                temperature_agent                               temperature_agent << Belief changed: turn_off_heating thermometer_sensor_hallway95
                temperature_agent                               temperature_agent << Belief changed: turn_off_cooling thermometer_sensor_bathroom_1101
0:17:00         garbage_agent                                   Trying to use intention OnlinePlanning to achieve goal ThrowGarbage#105
                garbage_agent                                   garbage_agent << Belief changed: has-garbage living_room
                garbage_agent                                   garbage_agent << Belief changed: full
0:17:30         garbage_agent>OnlinePlanning#105                Plan found:
                garbage_agent>OnlinePlanning#105                - (movenogarbage bedroom_0 hallway_upstairs)
                garbage_agent>OnlinePlanning#105                - (movenogarbage hallway_upstairs stairs)
                garbage_agent>OnlinePlanning#105                - (movenogarbage stairs hallway)
                garbage_agent>OnlinePlanning#105                - (movenogarbage hallway living_room)
```

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0:17:30         garbage_agent>OnlinePlanning#105                Plan found:
                garbage_agent>OnlinePlanning#105                - (movenogarbage bedroom_0 hallway_upstairs)
                garbage_agent>OnlinePlanning#105                - (movenogarbage hallway_upstairs stairs)
                garbage_agent>OnlinePlanning#105                - (movenogarbage stairs hallway)
                garbage_agent>OnlinePlanning#105                - (movenogarbage hallway living_room)
                garbage_agent>OnlinePlanning#105                - (pickgarbage living_room)
                garbage_agent>OnlinePlanning#105                - (movegarbage living_room kitchen)
                garbage_agent>OnlinePlanning#105                - (movegarbage kitchen out)
                garbage_agent>OnlinePlanning#105                - (putoutgarbage bathroom_1)
                garbage_agent>OnlinePlanning#105                - (moveemptygarbage out living_room)
                garbage_agent>OnlinePlanning#105                - (leaveemptygarbage living_room)
                garbage_agent>OnlinePlanning#105                - (movenogarbage living_room hallway)
                garbage_agent>OnlinePlanning#105                - (movenogarbage hallway stairs)
                garbage_agent>OnlinePlanning#105                - (movenogarbage stairs hallway_upstairs)
                garbage_agent>OnlinePlanning#105                - (movenogarbage hallway_upstairs bedroom_0)
                garbage_agent>OnlinePlanning#105                Starting sequential step (MoveNoGarbage bedroom_0 hallway_upstairs) Effect: in hallway_upstai
rs,not in bedroom_0
garbage_device_bedroom_0180 GarbageDevice  move garbage begins from  bedroom_0 to hallway_upstairs requires 3 minutes
audio_alarm_devicekitchen150 AudioAlarmDevice  Audio Smoke alarm stops
audio_alarm_deviceliving_room151 AudioAlarmDevice  Audio Smoke alarm stops
audio_alarm_devicegarage152 AudioAlarmDevice  Audio Smoke alarm stops
audio_alarm_devicebathroom_0153 AudioAlarmDevice  Audio Smoke alarm stops
audio_alarm_deviceutility_room154 AudioAlarmDevice  Audio Smoke alarm stops
audio_alarm_devicehallway155 AudioAlarmDevice  Audio Smoke alarm stops
audio_alarm_devicestairs156 AudioAlarmDevice  Audio Smoke alarm stops
audio_alarm_devicehallway_upstairs157 AudioAlarmDevice  Audio Smoke alarm stops
audio_alarm_devicemaster_bedroom158 AudioAlarmDevice  Audio Smoke alarm stops
audio_alarm_devicebedroom_0159 AudioAlarmDevice  Audio Smoke alarm stops
audio_alarm_devicebedroom_1160 AudioAlarmDevice  Audio Smoke alarm stops
audio_alarm_devicebathroom_1161 AudioAlarmDevice  Audio Smoke alarm stops
emergency_call_kitchen54 EmergencyCall  CallFiremen action in stairs requires 15 minutes
                security_agent                                  security_agent << Belief changed: fire_now stairs
                security_agent                                  security_agent << Belief changed: not shut_down stairs
open_water_devicestairs144 OpenWaterDevice  Open Water action ends
0:18:35         security_agent                                  security_agent << Belief changed: not fire_now stairs
                security_agent                                  security_agent << Belief changed: shut_down stairs
Sabrina Person moving from out to living_room
Sabrina Person moving from living_room to kitchen
Soleira Person moving from bedroom_0 to hallway_upstairs
Soleira Person moving from hallway_upstairs to stairs
Soleira Person moving from stairs to hallway
```

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Soleira Person moving from hallway to living_room
Soleira Person moving from living_room to kitchen
Lorenzo Person moving from bedroom_0 to hallway_upstairs
Lorenzo Person moving from hallway_upstairs to stairs
Lorenzo Person moving from stairs to hallway
Lorenzo Person moving from hallway to living_room
Lorenzo Person moving from living_room to kitchen
audio_alarm_devicekitchen150 AudioAlarmDevice  Audio Burglar alarm stops
audio_alarm_deviceliving_room151 AudioAlarmDevice  Audio Burglar alarm stops
audio_alarm_devicegarage152 AudioAlarmDevice  Audio Burglar alarm stops
audio_alarm_devicebathroom_0153 AudioAlarmDevice  Audio Burglar alarm stops
audio_alarm_deviceutility_room154 AudioAlarmDevice  Audio Burglar alarm stops
audio_alarm_devicehallway155 AudioAlarmDevice  Audio Burglar alarm stops
audio_alarm_devicestairs156 AudioAlarmDevice  Audio Burglar alarm stops
audio_alarm_devicehallway_upstairs157 AudioAlarmDevice  Audio Burglar alarm stops
audio_alarm_devicemaster_bedroom158 AudioAlarmDevice  Audio Burglar alarm stops
audio_alarm_devicebedroom_0159 AudioAlarmDevice  Audio Burglar alarm stops
audio_alarm_devicebedroom_1160 AudioAlarmDevice  Audio Burglar alarm stops
audio_alarm_devicebathroom_1161 AudioAlarmDevice  Audio Burglar alarm stops
emergency_call_kitchen54 EmergencyCall  CallPolice action in bathroom_1 requires 10 minutes
                security_agent                                  security_agent << Belief changed: burglar bathroom_1
                security_agent                                  security_agent << Belief changed: not police bathroom_1
                security_agent                                  security_agent << Belief changed: not burglar bathroom_1
                security_agent                                  security_agent << Belief changed: police bathroom_1
emergency_call_kitchen54 EmergencyCall  CallPolice action ends
Sabrina Person moving from kitchen to living_room
                music_agent                                     Trying to use intention OnlinePlanning to achieve goal LetTheMusicBegin#120
                music_agent                                     music_agent << Belief changed: people_want_party living_room
                music_agent                                     music_agent << Belief changed: in-music-device kitchen
0:21:25         music_agent>OnlinePlanning#120                  Plan found:
                music_agent>OnlinePlanning#120                  - (movemusicdevice kitchen living_room)
                music_agent>OnlinePlanning#120                  - (turnonmusic living_room)
                music_agent>OnlinePlanning#120                  Starting sequential step (MoveMusicDevice kitchen living_room) Effect: in-music-device living
_room,not in-music-device kitchen
music_device_kitchen15 MusicDevice  Move action ends
                music_agent                                     music_agent << Belief changed: in-music-device living_room
                music_agent                                     music_agent << Belief changed: not in-music-device kitchen
                music_agent>MoveMusicDevice#121                 Intention success MoveMusicDevice#121
                music_agent>OnlinePlanning#120                  Starting sequential step (TurnOnMusic living_room) Effect: turn_on_music living_room
music_device_kitchen15 MusicDevice  Switch on action ends
                music_agent                                     music_agent << Belief changed: turn_on_music living_room
```

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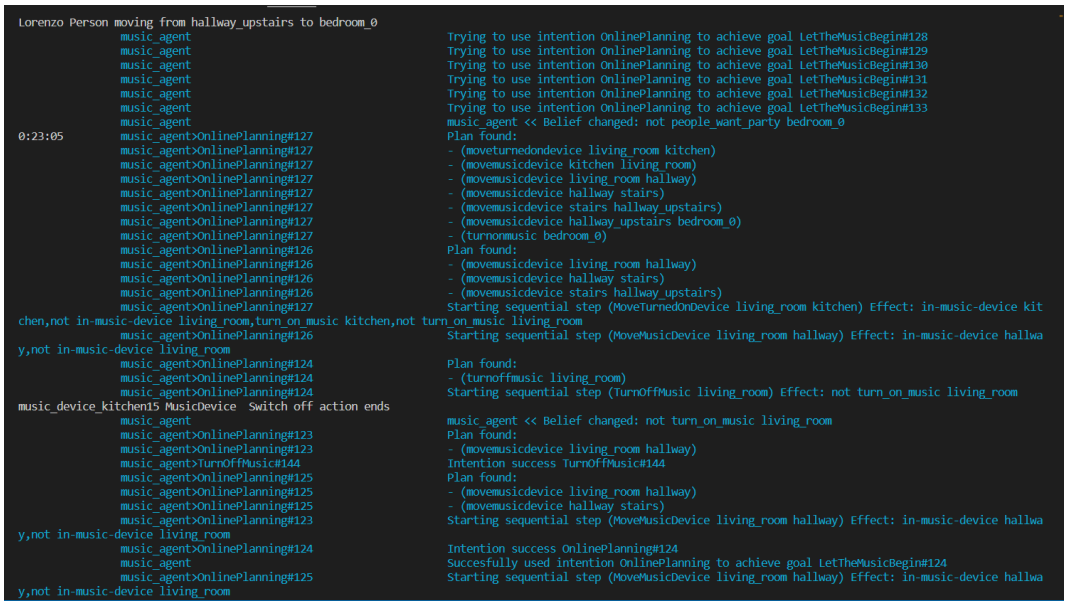
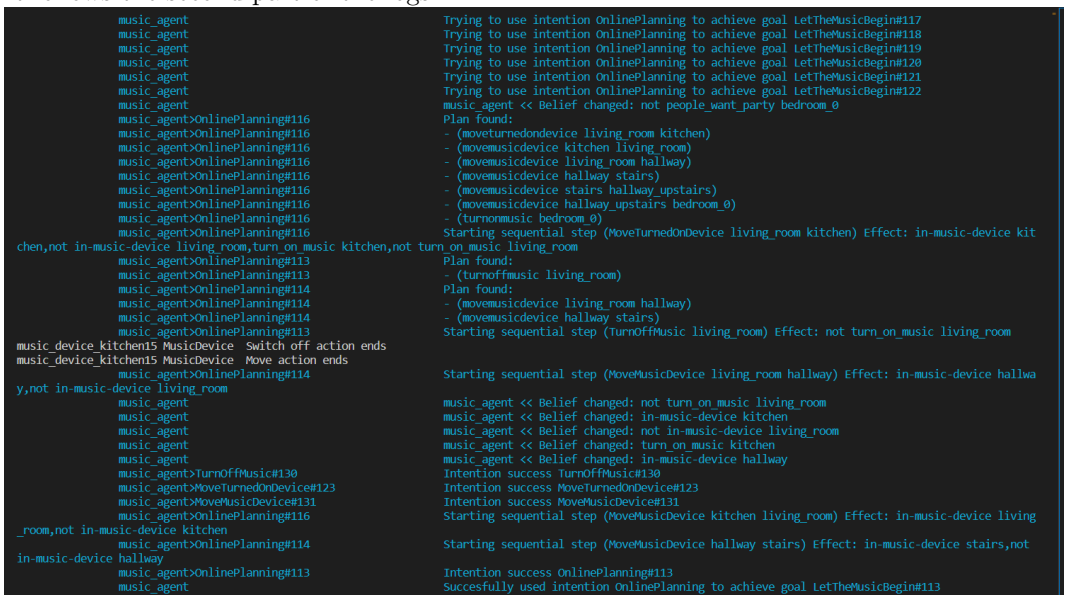
                music_agent>TurnOnMusic#122                     Intention success TurnOnMusic#122
0:21:35         music_agent>OnlinePlanning#120                  Intention success OnlinePlanning#120
                music_agent                                     Succesfully used intention OnlinePlanning to achieve goal LetTheMusicBegin#120
audio_alarm_devicekitchen150 AudioAlarmDevice  Audio Burglar alarm stops
audio_alarm_deviceliving_room151 AudioAlarmDevice  Audio Burglar alarm stops
audio_alarm_devicegarage152 AudioAlarmDevice  Audio Burglar alarm stops
audio_alarm_devicebathroom_0153 AudioAlarmDevice  Audio Burglar alarm stops
audio_alarm_deviceutility_room154 AudioAlarmDevice  Audio Burglar alarm stops
audio_alarm_devicehallway155 AudioAlarmDevice  Audio Burglar alarm stops
audio_alarm_devicestairs156 AudioAlarmDevice  Audio Burglar alarm stops
audio_alarm_devicehallway_upstairs157 AudioAlarmDevice  Audio Burglar alarm stops
audio_alarm_devicemaster_bedroom158 AudioAlarmDevice  Audio Burglar alarm stops
audio_alarm_devicebedroom_0159 AudioAlarmDevice  Audio Burglar alarm stops
audio_alarm_devicebedroom_1160 AudioAlarmDevice  Audio Burglar alarm stops
audio_alarm_devicebathroom_1161 AudioAlarmDevice  Audio Burglar alarm stops
emergency_call_kitchen54 EmergencyCall  CallPolice action in hallway_upstairs requires 10 minutes
                security_agent                                  security_agent << Belief changed: burglar hallway_upstairs
                security_agent                                  security_agent << Belief changed: not police hallway_upstairs
                security_agent                                  security_agent << Belief changed: not burglar hallway_upstairs
                security_agent                                  security_agent << Belief changed: police hallway_upstairs
emergency_call_kitchen54 EmergencyCall  CallPolice action ends
Sabrina Person moving from living_room to hallway
Sabrina Person moving from hallway to stairs
Sabrina Person moving from stairs to hallway_upstairs
Sabrina Person moving from hallway_upstairs to bedroom_0
                music_agent                                     Trying to use intention OnlinePlanning to achieve goal LetTheMusicBegin#123
                music_agent                                     Trying to use intention OnlinePlanning to achieve goal LetTheMusicBegin#124
                music_agent                                     Trying to use intention OnlinePlanning to achieve goal LetTheMusicBegin#125
                music_agent                                     Trying to use intention OnlinePlanning to achieve goal LetTheMusicBegin#126
                music_agent                                     Trying to use intention OnlinePlanning to achieve goal LetTheMusicBegin#127
                music_agent                                     music_agent << Belief changed: not people_want_party living_room
                music_agent                                     music_agent << Belief changed: people_want_party bedroom_0
Soleira Person moving from kitchen to living_room
Soleira Person moving from living_room to hallway
Soleira Person moving from hallway to stairs
Soleira Person moving from stairs to hallway_upstairs
Soleira Person moving from hallway_upstairs to bedroom_0
Lorenzo Person moving from kitchen to living_room
Lorenzo Person moving from living_room to hallway
Lorenzo Person moving from hallway to stairs
Lorenzo Person moving from stairs to hallway_upstairs
```



It follows the second part of the logs.



```
_room,not in-music-device kitchen
                music_agent>OnlinePlanning#114          Starting sequential step (MoveMusicDevice hallway stairs) Effect: in-music-device stairs,not
 in-music-device hallway
                music_agent>OnlinePlanning#113          Intention success OnlinePlanning#113
                music_agent                             Succesfully used intention OnlinePlanning to achieve goal LetTheMusicBegin#113
                music_agent>OnlinePlanning#112          Plan found:
                music_agent>OnlinePlanning#112          - (movemusicdevice living_room hallway)
                music_agent>OnlinePlanning#115          Plan found:
                music_agent>OnlinePlanning#115          - (movemusicdevice living_room hallway)
                music_agent>OnlinePlanning#115          - (movemusicdevice hallway stairs)
                music_agent>OnlinePlanning#115          - (movemusicdevice stairs hallway_upstairs)
                music_agent                             music_agent << Belief changed: in-music-device stairs
                music_agent                             music_agent << Belief changed: not in-music-device hallway
                music_agent>MoveMusicDevice#132         Intention success MoveMusicDevice#132
                music_agent>OnlinePlanning#112          Starting sequential step (MoveMusicDevice living_room hallway) Effect: in-music-device hallwa
y,not in-music-device living_room
                music_agent>OnlinePlanning#115          Starting sequential step (MoveMusicDevice living_room hallway) Effect: in-music-device hallwa
y,not in-music-device living_room
                music_agent                             music_agent << Belief changed: in-music-device hallway
                music_agent>OnlinePlanning#114          Intention success OnlinePlanning#114
                music_agent                             Succesfully used intention OnlinePlanning to achieve goal LetTheMusicBegin#114
                music_agent>MoveMusicDevice#133         Intention success MoveMusicDevice#133
music_device_kitchen15 MusicDevice  Move action ends
                music_agent>MoveMusicDevice#134         Intention success MoveMusicDevice#134
                music_agent                             music_agent << Belief changed: in-music-device living_room
                music_agent                             music_agent << Belief changed: not in-music-device kitchen
                music_agent>OnlinePlanning#115          Starting sequential step (MoveMusicDevice hallway stairs) Effect: in-music-device stairs,not
 in-music-device hallway
                music_agent>OnlinePlanning#112          Intention success OnlinePlanning#112
                music_agent                             Succesfully used intention OnlinePlanning to achieve goal LetTheMusicBegin#112
                music_agent>MoveMusicDevice#124         Intention success MoveMusicDevice#124
                music_agent                             music_agent << Belief changed: not in-music-device hallway
                music_agent>OnlinePlanning#116          Starting sequential step (MoveMusicDevice living_room hallway) Effect: in-music-device hallwa
y,not in-music-device living_room
                music_agent>MoveMusicDevice#135         Intention success MoveMusicDevice#135
                music_agent>OnlinePlanning#115          Starting sequential step (MoveMusicDevice stairs hallway_upstairs) Effect: in-music-device ha
llway_upstairs,not in-music-device stairs
                music_agent                             music_agent << Belief changed: in-music-device hallway_upstairs
                music_agent                             music_agent << Belief changed: not in-music-device stairs
                music_agent>MoveMusicDevice#136         Intention success MoveMusicDevice#136
music_device_kitchen15 MusicDevice  Move action ends
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                music_agent>OnlinePlanning#115          Intention success OnlinePlanning#115
                music_agent                             Succesfully used intention OnlinePlanning to achieve goal LetTheMusicBegin#115
                music_agent                             music_agent << Belief changed: in-music-device hallway
                music_agent                             music_agent << Belief changed: not in-music-device living_room
                music_agent>MoveMusicDevice#125         Intention success MoveMusicDevice#125
                music_agent>OnlinePlanning#116          Starting sequential step (MoveMusicDevice hallway stairs) Effect: in-music-device stairs,not
 in-music-device hallway
music_device_kitchen15 MusicDevice  Move action ends
                music_agent                             music_agent << Belief changed: in-music-device stairs
                music_agent                             music_agent << Belief changed: not in-music-device hallway
                music_agent>MoveMusicDevice#126         Intention success MoveMusicDevice#126
                music_agent>OnlinePlanning#116          Starting sequential step (MoveMusicDevice stairs hallway_upstairs) Effect: in-music-device ha
llway_upstairs,not in-music-device stairs
music_device_kitchen15 MusicDevice  Move action ends
                music_agent                             music_agent << Belief changed: not in-music-device stairs
                music_agent>MoveMusicDevice#127         Intention success MoveMusicDevice#127
                music_agent>OnlinePlanning#116          Starting sequential step (MoveMusicDevice hallway_upstairs bedroom_0) Effect: in-music-device
 bedroom_0,not in-music-device hallway_upstairs
music_device_kitchen15 MusicDevice  Move action ends
                music_agent                             music_agent << Belief changed: in-music-device bedroom_0
                music_agent                             music_agent << Belief changed: not in-music-device hallway_upstairs
                music_agent>OnlinePlanning#118          Plan found:
                music_agent>OnlinePlanning#118          - (movemusicdevice living_room kitchen)
                music_agent>OnlinePlanning#117          Plan found:
                music_agent>OnlinePlanning#117          - (turnoffmusic living_room)
                music_agent>OnlinePlanning#119          Plan found:
                music_agent>OnlinePlanning#119          - (movemusicdevice living_room hallway)
                music_agent>MoveMusicDevice#128         Intention success MoveMusicDevice#128
                music_agent>OnlinePlanning#116          Starting sequential step (TurnOnMusic bedroom_0) Effect: turn_on_music bedroom_0
music_device_kitchen15 MusicDevice  Switch on action ends
                music_agent>OnlinePlanning#118          Starting sequential step (MoveMusicDevice living_room kitchen) Effect: in-music-device kitche
n,not in-music-device living_room
                music_agent>OnlinePlanning#117          Starting sequential step (TurnOffMusic living_room) Effect: not turn_on_music living_room
                music_agent>OnlinePlanning#119          Starting sequential step (MoveMusicDevice living_room hallway) Effect: in-music-device hallwa
y,not in-music-device living_room
                music_agent                             music_agent << Belief changed: turn_on_music bedroom_0
                music_agent                             music_agent << Belief changed: in-music-device kitchen
                music_agent                             music_agent << Belief changed: in-music-device hallway
                music_agent>TurnOnMusic#129             Intention success TurnOnMusic#129
                music_agent>MoveMusicDevice#137         Intention success MoveMusicDevice#137
                music_agent>TurnOffMusic#138            Intention success TurnOffMusic#138
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                music_agent>TurnOffMusic#138                Intention success TurnOffMusic#138
                music_agent>MoveMusicDevice#139             Intention success MoveMusicDevice#139
                music_agent>OnlinePlanning#121              Plan found:
                music_agent>OnlinePlanning#121              - (movemusicdevice living_room hallway)
                music_agent>OnlinePlanning#121              - (movemusicdevice hallway stairs)
                music_agent>OnlinePlanning#121              - (movemusicdevice stairs hallway_upstairs)
                music_agent>OnlinePlanning#116              Intention success OnlinePlanning#116
                music_agent                                 Succesfully used intention OnlinePlanning to achieve goal LetTheMusicBegin#116
                music_agent>OnlinePlanning#118              Intention success OnlinePlanning#118
                music_agent                                 Succesfully used intention OnlinePlanning to achieve goal LetTheMusicBegin#118
                music_agent>OnlinePlanning#117              Intention success OnlinePlanning#117
                music_agent                                 Succesfully used intention OnlinePlanning to achieve goal LetTheMusicBegin#117
                music_agent>OnlinePlanning#119              Intention success OnlinePlanning#119
                music_agent                                 Succesfully used intention OnlinePlanning to achieve goal LetTheMusicBegin#119
                music_agent>OnlinePlanning#121              Starting sequential step (MoveMusicDevice living_room hallway) Effect: in-music-device hallwa
y,not in-music-device living_room
                music_agent>MoveMusicDevice#140             Intention success MoveMusicDevice#140
                music_agent>OnlinePlanning#120              Plan found:
                music_agent>OnlinePlanning#120              - (movemusicdevice living_room hallway)
                music_agent>OnlinePlanning#120              - (movemusicdevice hallway stairs)
                music_agent>OnlinePlanning#121              Starting sequential step (MoveMusicDevice hallway stairs) Effect: in-music-device stairs,not
in-music-device hallway
                music_agent                                 music_agent << Belief changed: in-music-device stairs
                music_agent                                 music_agent << Belief changed: not in-music-device hallway
                music_agent>OnlinePlanning#120              Starting sequential step (MoveMusicDevice living_room hallway) Effect: in-music-device hallwa
y,not in-music-device living_room
                music_agent>MoveMusicDevice#141             Intention success MoveMusicDevice#141
0:23:35         music_agent                                 music_agent << Belief changed: in-music-device hallway
                music_agent>OnlinePlanning#121              Starting sequential step (MoveMusicDevice stairs hallway_upstairs) Effect: in-music-device ha
llway_upstairs,not in-music-device stairs
                music_agent>MoveMusicDevice#143             Intention success MoveMusicDevice#143
                music_agent>OnlinePlanning#122              Plan found:
                music_agent>OnlinePlanning#122              - (movemusicdevice living_room hallway)
                music_agent>OnlinePlanning#122              - (movemusicdevice hallway stairs)
                music_agent>OnlinePlanning#122              - (movemusicdevice stairs hallway_upstairs)
                music_agent>OnlinePlanning#122              - (movemusicdevice hallway_upstairs bedroom_0)
                music_agent                                 music_agent << Belief changed: in-music-device hallway_upstairs
                music_agent                                 music_agent << Belief changed: not in-music-device stairs
                music_agent>OnlinePlanning#120              Starting sequential step (MoveMusicDevice hallway stairs) Effect: in-music-device stairs,not
in-music-device hallway
                music_agent>MoveMusicDevice#142             Intention success MoveMusicDevice#142
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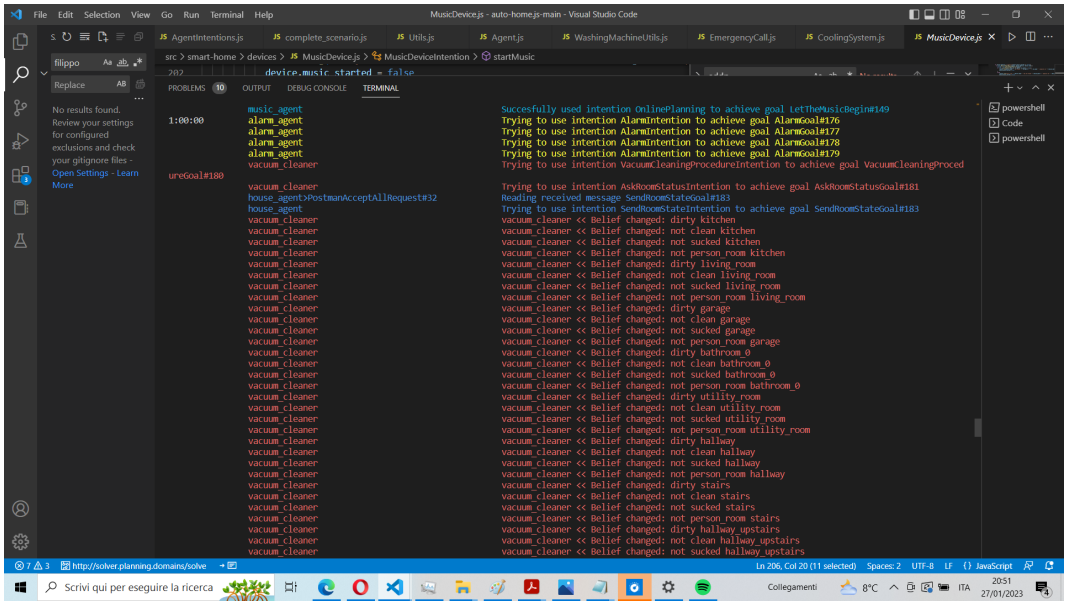
                music_agent                                 music_agent << Belief changed: in-music-device stairs
                music_agent                                 music_agent << Belief changed: not in-music-device hallway
                music_agent>OnlinePlanning#122              Starting sequential step (MoveMusicDevice living_room hallway) Effect: in-music-device hallwa
y,not in-music-device living_room
                music_agent>MoveMusicDevice#144             Intention success MoveMusicDevice#144
                music_agent                                 music_agent << Belief changed: in-music-device hallway
                music_agent>OnlinePlanning#121              Intention success OnlinePlanning#121
                music_agent                                 Succesfully used intention OnlinePlanning to achieve goal LetTheMusicBegin#121
                music_agent>MoveMusicDevice#145             Intention success MoveMusicDevice#145
0:23:40         music_agent>OnlinePlanning#120              Intention success OnlinePlanning#120
                music_agent                                 Succesfully used intention OnlinePlanning to achieve goal LetTheMusicBegin#120
                music_agent>OnlinePlanning#122              Starting sequential step (MoveMusicDevice hallway stairs) Effect: in-music-device stairs,not
in-music-device hallway
                music_agent                                 music_agent << Belief changed: not in-music-device hallway
                music_agent>MoveMusicDevice#146             Intention success MoveMusicDevice#146
                music_agent>OnlinePlanning#122              Starting sequential step (MoveMusicDevice stairs hallway_upstairs) Effect: in-music-device ha
llway_upstairs,not in-music-device stairs
0:23:45         music_agent                                 music_agent << Belief changed: not in-music-device stairs
                music_agent>MoveMusicDevice#147             Intention success MoveMusicDevice#147
                music_agent>OnlinePlanning#122              Starting sequential step (MoveMusicDevice hallway_upstairs bedroom_0) Effect: in-music-device
 bedroom_0,not in-music-device hallway_upstairs
                music_agent                                 music_agent << Belief changed: not in-music-device hallway_upstairs
                music_agent>MoveMusicDevice#148             Intention success MoveMusicDevice#148
0:23:50         music_agent>OnlinePlanning#122              Intention success OnlinePlanning#122
                music_agent                                 Succesfully used intention OnlinePlanning to achieve goal LetTheMusicBegin#122
1:00:00         alarm_agent                                 Trying to use intention AlarmIntention to achieve goal AlarmGoal#149
                alarm_agent                                 Trying to use intention AlarmIntention to achieve goal AlarmGoal#150
                alarm_agent                                 Trying to use intention AlarmIntention to achieve goal AlarmGoal#151
                alarm_agent                                 Trying to use intention AlarmIntention to achieve goal AlarmGoal#152
                vacuum_cleaner                              Trying to use intention VacuumCleaningProcedureIntention to achieve goal VacuumCleaningProced
ureGoal#153
                vacuum_cleaner                              Trying to use intention AskRoomStatusIntention to achieve goal AskRoomStatusGoal#154
                house_agent>PostmanAcceptAllRequest#32      Reading received message SendRoomStateGoal#156
                house_agent                                 Trying to use intention SendRoomStateIntention to achieve goal SendRoomStateGoal#156
                vacuum_cleaner                              vacuum_cleaner << Belief changed: dirty kitchen
                vacuum_cleaner                              vacuum_cleaner << Belief changed: not clean kitchen
                vacuum_cleaner                              vacuum_cleaner << Belief changed: not sucked kitchen
                vacuum_cleaner                              vacuum_cleaner << Belief changed: not person_room kitchen
                vacuum_cleaner                              vacuum_cleaner << Belief changed: dirty living_room
                vacuum_cleaner                              vacuum_cleaner << Belief changed: not clean living_room
                vacuum_cleaner                              vacuum_cleaner << Belief changed: not sucked living_room
```


File Edit Selection View Go Run Terminal Help
MusicDevice.js - auto-home.js-main - Visual Studio Code
AgentIntentions.js
complete_scenario.js
Utils.js
Agent.js
WashingMachineUtils.js
EmergencyCall.js
CoolingSystem.js
MusicDevice.js
src > smart-home > devices > MusicDevice.js > MusicDeviceIntention > startMusic
device.music_started = false
PROBLEMS 10
OUTPUT
DEBUG CONSOLE
TERMINAL
filippo
Replace
No results found. Review your settings for configured exclusions and check your gitignore files - Open Settings - Learn More
powershell
Code
powershell
1:00:00
music_agent Succesfully used intention OnlinePlanning to achieve goal LetTheMusicBegin#149
alarm_agent Trying to use intention AlarmIntention to achieve goal AlarmGoal#176
alarm_agent Trying to use intention AlarmIntention to achieve goal AlarmGoal#177
alarm_agent Trying to use intention AlarmIntention to achieve goal AlarmGoal#178
alarm_agent Trying to use intention AlarmIntention to achieve goal AlarmGoal#179
vacuum_cleaner Trying to use intention VacuumCleaningProcedureIntention to achieve goal VacuumCleaningProced
ureGoal#180
vacuum_cleaner Trying to use intention AskRoomStatusIntention to achieve goal AskRoomStatusGoal#181
house_agent>PostmanAcceptAllRequest#32 Reading received message SendRoomStateGoal#183
house_agent Trying to use intention SendRoomStateIntention to achieve goal SendRoomStateGoal#183
vacuum_cleaner vacuum_cleaner << Belief changed: dirty kitchen
vacuum_cleaner vacuum_cleaner << Belief changed: not clean kitchen
vacuum_cleaner vacuum_cleaner << Belief changed: not sucked kitchen
vacuum_cleaner vacuum_cleaner << Belief changed: not person_room kitchen
vacuum_cleaner vacuum_cleaner << Belief changed: dirty living_room
vacuum_cleaner vacuum_cleaner << Belief changed: not clean living_room
vacuum_cleaner vacuum_cleaner << Belief changed: not sucked living_room
vacuum_cleaner vacuum_cleaner << Belief changed: not person_room living_room
vacuum_cleaner vacuum_cleaner << Belief changed: dirty garage
vacuum_cleaner vacuum_cleaner << Belief changed: not clean garage
vacuum_cleaner vacuum_cleaner << Belief changed: not sucked garage
vacuum_cleaner vacuum_cleaner << Belief changed: not person_room garage
vacuum_cleaner vacuum_cleaner << Belief changed: dirty bathroom_0
vacuum_cleaner vacuum_cleaner << Belief changed: not clean bathroom_0
vacuum_cleaner vacuum_cleaner << Belief changed: not sucked bathroom_0
vacuum_cleaner vacuum_cleaner << Belief changed: not person_room bathroom_0
vacuum_cleaner vacuum_cleaner << Belief changed: dirty utility_room
vacuum_cleaner vacuum_cleaner << Belief changed: not clean utility_room
vacuum_cleaner vacuum_cleaner << Belief changed: not sucked utility_room
vacuum_cleaner vacuum_cleaner << Belief changed: not person_room utility_room
vacuum_cleaner vacuum_cleaner << Belief changed: dirty hallway
vacuum_cleaner vacuum_cleaner << Belief changed: not clean hallway
vacuum_cleaner vacuum_cleaner << Belief changed: not sucked hallway
vacuum_cleaner vacuum_cleaner << Belief changed: not person_room hallway
vacuum_cleaner vacuum_cleaner << Belief changed: dirty stairs
vacuum_cleaner vacuum_cleaner << Belief changed: not clean stairs
vacuum_cleaner vacuum_cleaner << Belief changed: not sucked stairs
vacuum_cleaner vacuum_cleaner << Belief changed: not person_room stairs
vacuum_cleaner vacuum_cleaner << Belief changed: dirty hallway_upstairs
vacuum_cleaner vacuum_cleaner << Belief changed: not clean hallway_upstairs
vacuum_cleaner vacuum_cleaner << Belief changed: not sucked hallway_upstairs
http://solver.planning.domains/solve
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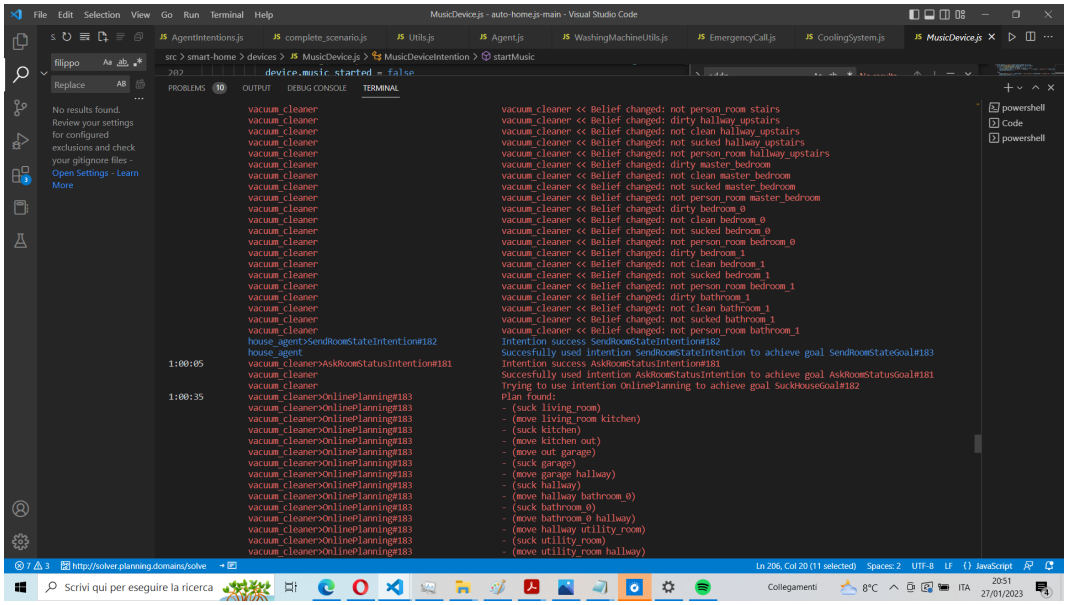
File Edit Selection View Go Run Terminal Help
MusicDevice.js - auto-home.js-main - Visual Studio Code
AgentIntentions.js
complete_scenario.js
Utils.js
Agent.js
WashingMachineUtils.js
EmergencyCall.js
CoolingSystem.js
MusicDevice.js
src > smart-home > devices > MusicDevice.js > MusicDeviceIntention > startMusic
device.music_started = false
PROBLEMS 10
OUTPUT
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Replace
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powershell
vacuum_cleaner vacuum_cleaner << Belief changed: not person_room stairs
vacuum_cleaner vacuum_cleaner << Belief changed: dirty hallway_upstairs
vacuum_cleaner vacuum_cleaner << Belief changed: not clean hallway_upstairs
vacuum_cleaner vacuum_cleaner << Belief changed: not sucked hallway_upstairs
vacuum_cleaner vacuum_cleaner << Belief changed: not person_room hallway_upstairs
vacuum_cleaner vacuum_cleaner << Belief changed: dirty master_bedroom
vacuum_cleaner vacuum_cleaner << Belief changed: not clean master_bedroom
vacuum_cleaner vacuum_cleaner << Belief changed: not sucked master_bedroom
vacuum_cleaner vacuum_cleaner << Belief changed: not person_room master_bedroom
vacuum_cleaner vacuum_cleaner << Belief changed: dirty bedroom_0
vacuum_cleaner vacuum_cleaner << Belief changed: not clean bedroom_0
vacuum_cleaner vacuum_cleaner << Belief changed: not sucked bedroom_0
vacuum_cleaner vacuum_cleaner << Belief changed: not person_room bedroom_0
vacuum_cleaner vacuum_cleaner << Belief changed: dirty bedroom_1
vacuum_cleaner vacuum_cleaner << Belief changed: not clean bedroom_1
vacuum_cleaner vacuum_cleaner << Belief changed: not sucked bedroom_1
vacuum_cleaner vacuum_cleaner << Belief changed: not person_room bedroom_1
vacuum_cleaner vacuum_cleaner << Belief changed: dirty bathroom_1
vacuum_cleaner vacuum_cleaner << Belief changed: not clean bathroom_1
vacuum_cleaner vacuum_cleaner << Belief changed: not sucked bathroom_1
vacuum_cleaner vacuum_cleaner << Belief changed: not person_room bathroom_1
house_agent>SendRoomStateIntention#182 Intention success SendRoomStateIntention#182
house_agent Succesfully used intention SendRoomStateIntention to achieve goal SendRoomStateGoal#183
1:00:05
vacuum_cleaner>AskRoomStatusIntention#181 Intention success AskRoomStatusIntention#181
vacuum_cleaner Succesfully used intention AskRoomStatusIntention to achieve goal AskRoomStatusGoal#181
vacuum_cleaner Trying to use intention OnlinePlanning to achieve goal SuckHouseGoal#182
1:00:35
vacuum_cleaner>OnlinePlanning#183 Plan found:
vacuum_cleaner>OnlinePlanning#183 - (suck living_room)
vacuum_cleaner>OnlinePlanning#183 - (move living_room kitchen)
vacuum_cleaner>OnlinePlanning#183 - (suck kitchen)
vacuum_cleaner>OnlinePlanning#183 - (move kitchen out)
vacuum_cleaner>OnlinePlanning#183 - (move out garage)
vacuum_cleaner>OnlinePlanning#183 - (suck garage)
vacuum_cleaner>OnlinePlanning#183 - (move garage hallway)
vacuum_cleaner>OnlinePlanning#183 - (suck hallway)
vacuum_cleaner>OnlinePlanning#183 - (move hallway bathroom_0)
vacuum_cleaner>OnlinePlanning#183 - (suck bathroom_0)
vacuum_cleaner>OnlinePlanning#183 - (move bathroom_0 hallway)
vacuum_cleaner>OnlinePlanning#183 - (move hallway utility_room)
vacuum_cleaner>OnlinePlanning#183 - (suck utility_room)
vacuum_cleaner>OnlinePlanning#183 - (move utility_room hallway)
http://solver.planning.domains/solve
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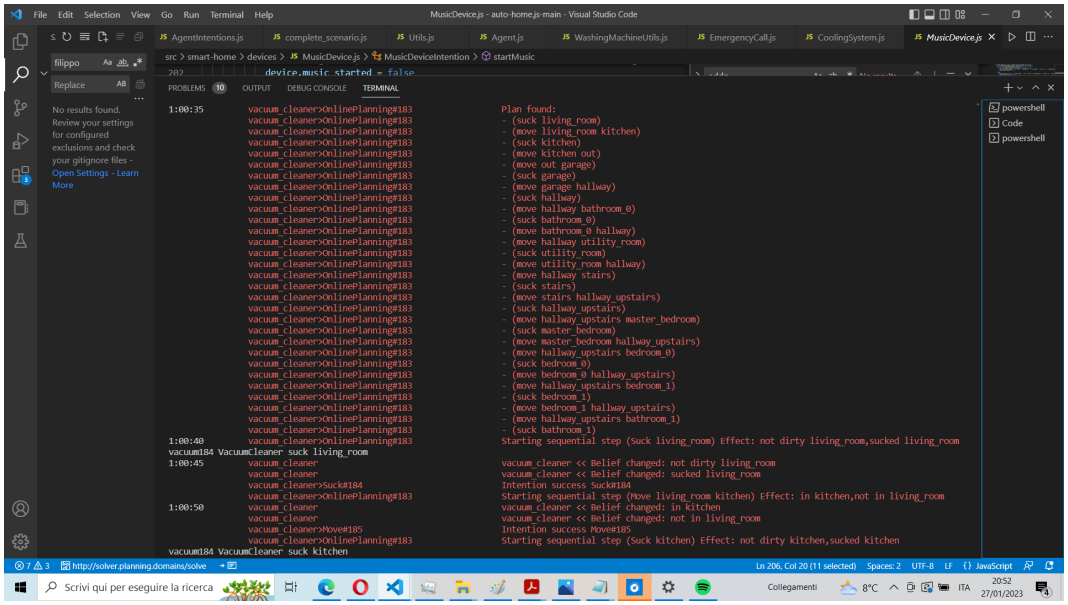
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CoolingSystem.js
MusicDevice.js
src > smart-home > devices > MusicDevice.js > MusicDeviceIntention > startMusic
device.music_started = false
PROBLEMS 10 OUTPUT DEBUG CONSOLE TERMINAL
1:00:35 vacuum_cleaner>OnlinePlanning#183 Plan found:
vacuum_cleaner>OnlinePlanning#183 - (suck living_room)
vacuum_cleaner>OnlinePlanning#183 - (move living_room kitchen)
vacuum_cleaner>OnlinePlanning#183 - (suck kitchen)
vacuum_cleaner>OnlinePlanning#183 - (move kitchen out)
vacuum_cleaner>OnlinePlanning#183 - (move out garage)
vacuum_cleaner>OnlinePlanning#183 - (suck garage)
vacuum_cleaner>OnlinePlanning#183 - (move garage hallway)
vacuum_cleaner>OnlinePlanning#183 - (suck hallway)
vacuum_cleaner>OnlinePlanning#183 - (move hallway bathroom_0)
vacuum_cleaner>OnlinePlanning#183 - (suck bathroom_0)
vacuum_cleaner>OnlinePlanning#183 - (move bathroom_0 hallway)
vacuum_cleaner>OnlinePlanning#183 - (move hallway utility_room)
vacuum_cleaner>OnlinePlanning#183 - (suck utility_room)
vacuum_cleaner>OnlinePlanning#183 - (move utility_room hallway)
vacuum_cleaner>OnlinePlanning#183 - (move hallway stairs)
vacuum_cleaner>OnlinePlanning#183 - (suck stairs)
vacuum_cleaner>OnlinePlanning#183 - (move stairs hallway_upstairs)
vacuum_cleaner>OnlinePlanning#183 - (suck hallway_upstairs)
vacuum_cleaner>OnlinePlanning#183 - (move hallway_upstairs master_bedroom)
vacuum_cleaner>OnlinePlanning#183 - (suck master_bedroom)
vacuum_cleaner>OnlinePlanning#183 - (move master_bedroom hallway_upstairs)
vacuum_cleaner>OnlinePlanning#183 - (move hallway_upstairs bedroom_0)
vacuum_cleaner>OnlinePlanning#183 - (suck bedroom_0)
vacuum_cleaner>OnlinePlanning#183 - (move bedroom_0 hallway_upstairs)
vacuum_cleaner>OnlinePlanning#183 - (move hallway_upstairs bedroom_1)
vacuum_cleaner>OnlinePlanning#183 - (suck bedroom_1)
vacuum_cleaner>OnlinePlanning#183 - (move bedroom_1 hallway_upstairs)
vacuum_cleaner>OnlinePlanning#183 - (move hallway_upstairs bathroom_1)
vacuum_cleaner>OnlinePlanning#183 - (suck bathroom_1)
1:00:40 vacuum_cleaner>OnlinePlanning#183 Starting sequential step (Suck living_room) Effect: not dirty living_room,sucked living_room
vacuum184 VacuumCleaner suck living_room
1:00:45 vacuum_cleaner vacuum_cleaner << Belief changed: not dirty living_room
vacuum_cleaner vacuum_cleaner << Belief changed: sucked living_room
vacuum_cleaner>Suck#184 Intention success Suck#184
vacuum_cleaner>OnlinePlanning#183 Starting sequential step (Move living_room kitchen) Effect: in kitchen,not in living_room
1:00:50 vacuum_cleaner vacuum_cleaner << Belief changed: in kitchen
vacuum_cleaner vacuum_cleaner << Belief changed: not in living_room
vacuum_cleaner>Move#185 Intention success Move#185
vacuum_cleaner>OnlinePlanning#183 Starting sequential step (Suck kitchen) Effect: not dirty kitchen,sucked kitchen
vacuum184 VacuumCleaner suck kitchen
powershell
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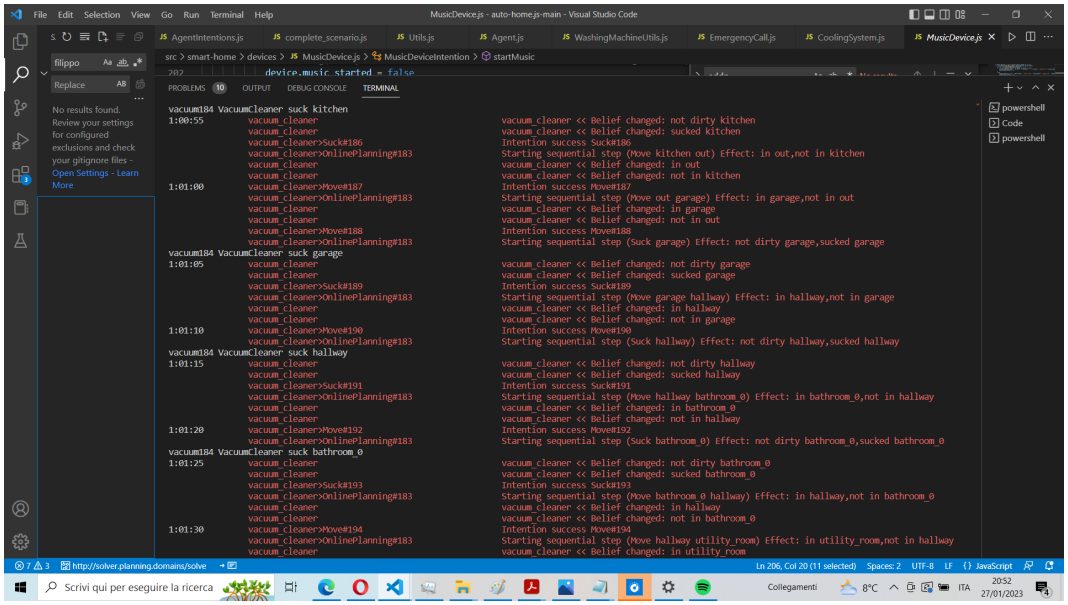
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MusicDevice.js
src > smart-home > devices > MusicDevice.js > MusicDeviceIntention > startMusic
device.music_started = false
PROBLEMS 10 OUTPUT DEBUG CONSOLE TERMINAL
vacuum184 VacuumCleaner suck kitchen
1:00:55 vacuum_cleaner vacuum_cleaner << Belief changed: not dirty kitchen
vacuum_cleaner vacuum_cleaner << Belief changed: sucked kitchen
vacuum_cleaner>Suck#186 Intention success Suck#186
vacuum_cleaner>OnlinePlanning#183 Starting sequential step (Move kitchen out) Effect: in out,not in kitchen
vacuum_cleaner vacuum_cleaner << Belief changed: in out
vacuum_cleaner vacuum_cleaner << Belief changed: not in kitchen
1:01:00 vacuum_cleaner>Move#187 Intention success Move#187
vacuum_cleaner>OnlinePlanning#183 Starting sequential step (Move out garage) Effect: in garage,not in out
vacuum_cleaner vacuum_cleaner << Belief changed: in garage
vacuum_cleaner vacuum_cleaner << Belief changed: not in out
vacuum_cleaner>Move#188 Intention success Move#188
vacuum_cleaner>OnlinePlanning#183 Starting sequential step (Suck garage) Effect: not dirty garage,sucked garage
vacuum184 VacuumCleaner suck garage
1:01:05 vacuum_cleaner vacuum_cleaner << Belief changed: not dirty garage
vacuum_cleaner vacuum_cleaner << Belief changed: sucked garage
vacuum_cleaner>Suck#189 Intention success Suck#189
vacuum_cleaner>OnlinePlanning#183 Starting sequential step (Move garage hallway) Effect: in hallway,not in garage
vacuum_cleaner vacuum_cleaner << Belief changed: in hallway
vacuum_cleaner vacuum_cleaner << Belief changed: not in garage
1:01:10 vacuum_cleaner>Move#190 Intention success Move#190
vacuum_cleaner>OnlinePlanning#183 Starting sequential step (Suck hallway) Effect: not dirty hallway,sucked hallway
vacuum184 VacuumCleaner suck hallway
1:01:15 vacuum_cleaner vacuum_cleaner << Belief changed: not dirty hallway
vacuum_cleaner vacuum_cleaner << Belief changed: sucked hallway
vacuum_cleaner>Suck#191 Intention success Suck#191
vacuum_cleaner>OnlinePlanning#183 Starting sequential step (Move hallway bathroom_0) Effect: in bathroom_0,not in hallway
vacuum_cleaner vacuum_cleaner << Belief changed: in bathroom_0
vacuum_cleaner vacuum_cleaner << Belief changed: not in hallway
1:01:20 vacuum_cleaner>Move#192 Intention success Move#192
vacuum_cleaner>OnlinePlanning#183 Starting sequential step (Suck bathroom_0) Effect: not dirty bathroom_0,sucked bathroom_0
vacuum184 VacuumCleaner suck bathroom_0
1:01:25 vacuum_cleaner vacuum_cleaner << Belief changed: not dirty bathroom_0
vacuum_cleaner vacuum_cleaner << Belief changed: sucked bathroom_0
vacuum_cleaner>Suck#193 Intention success Suck#193
vacuum_cleaner>OnlinePlanning#183 Starting sequential step (Move bathroom_0 hallway) Effect: in hallway,not in bathroom_0
vacuum_cleaner vacuum_cleaner << Belief changed: in hallway
vacuum_cleaner vacuum_cleaner << Belief changed: not in bathroom_0
1:01:30 vacuum_cleaner>Move#194 Intention success Move#194
vacuum_cleaner>OnlinePlanning#183 Starting sequential step (Move hallway utility_room) Effect: in utility_room,not in hallway
vacuum_cleaner vacuum_cleaner << Belief changed: in utility_room
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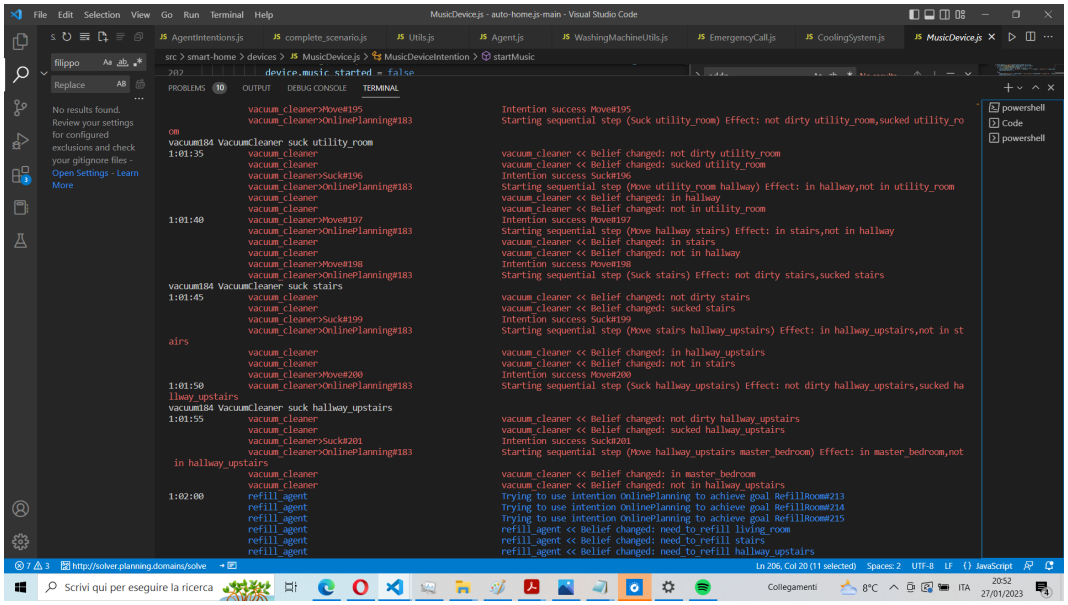
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EmergencyCall.js
CoolingSystem.js
MusicDevice.js
src > smart-home > devices > MusicDevice.js > MusicDeviceIntention > startMusic
device.music_started = false
PROBLEMS 10
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DEBUG CONSOLE
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vacuum_cleaner>Move#195 Intention success Move#195
vacuum_cleaner>OnlinePlanning#183 Starting sequential step (Suck utility_room) Effect: not dirty utility_room,sucked utility_room
vacuum184 VacuumCleaner suck utility_room
1:01:35 vacuum_cleaner vacuum_cleaner << Belief changed: not dirty utility_room
vacuum_cleaner vacuum_cleaner << Belief changed: sucked utility_room
vacuum_cleaner>Suck#196 Intention success Suck#196
vacuum_cleaner>OnlinePlanning#183 Starting sequential step (Move utility_room hallway) Effect: in hallway,not in utility_room
vacuum_cleaner vacuum_cleaner << Belief changed: in hallway
vacuum_cleaner vacuum_cleaner << Belief changed: not in utility_room
1:01:40 vacuum_cleaner>Move#197 Intention success Move#197
vacuum_cleaner>OnlinePlanning#183 Starting sequential step (Move hallway stairs) Effect: in stairs,not in hallway
vacuum_cleaner vacuum_cleaner << Belief changed: in stairs
vacuum_cleaner vacuum_cleaner << Belief changed: not in hallway
vacuum_cleaner>Move#198 Intention success Move#198
vacuum_cleaner>OnlinePlanning#183 Starting sequential step (Suck stairs) Effect: not dirty stairs,sucked stairs
vacuum184 VacuumCleaner suck stairs
1:01:45 vacuum_cleaner vacuum_cleaner << Belief changed: not dirty stairs
vacuum_cleaner vacuum_cleaner << Belief changed: sucked stairs
vacuum_cleaner>Suck#199 Intention success Suck#199
vacuum_cleaner>OnlinePlanning#183 Starting sequential step (Move stairs hallway_upstairs) Effect: in hallway_upstairs,not in stairs
vacuum_cleaner vacuum_cleaner << Belief changed: in hallway_upstairs
vacuum_cleaner vacuum_cleaner << Belief changed: not in stairs
vacuum_cleaner>Move#200 Intention success Move#200
1:01:50 vacuum_cleaner>OnlinePlanning#183 Starting sequential step (Suck hallway_upstairs) Effect: not dirty hallway_upstairs,sucked hallway_upstairs
vacuum184 VacuumCleaner suck hallway_upstairs
1:01:55 vacuum_cleaner vacuum_cleaner << Belief changed: not dirty hallway_upstairs
vacuum_cleaner vacuum_cleaner << Belief changed: sucked hallway_upstairs
vacuum_cleaner>Suck#201 Intention success Suck#201
vacuum_cleaner>OnlinePlanning#183 Starting sequential step (Move hallway_upstairs master_bedroom) Effect: in master_bedroom,not in hallway_upstairs
vacuum_cleaner vacuum_cleaner << Belief changed: in master_bedroom
vacuum_cleaner vacuum_cleaner << Belief changed: not in hallway_upstairs
1:02:00 refill_agent Trying to use intention OnlinePlanning to achieve goal RefillRoom#213
refill_agent Trying to use intention OnlinePlanning to achieve goal RefillRoom#214
refill_agent Trying to use intention OnlinePlanning to achieve goal RefillRoom#215
refill_agent refill_agent << Belief changed: need_to_refill living_room
refill_agent refill_agent << Belief changed: need_to_refill stairs
refill_agent refill_agent << Belief changed: need_to_refill hallway_upstairs
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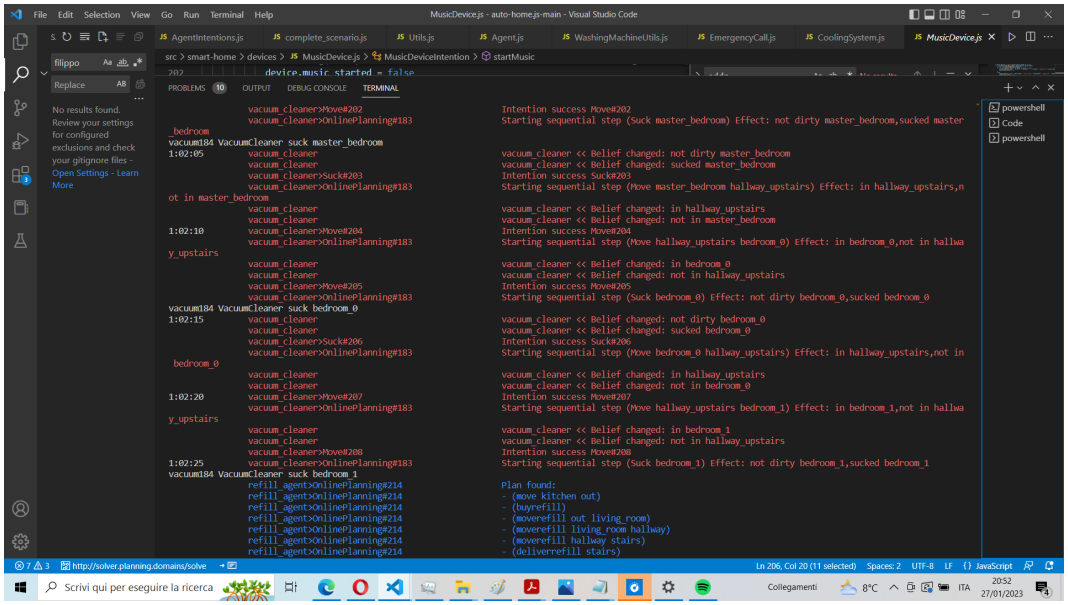
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CoolingSystem.js
MusicDevice.js
src > smart-home > devices > MusicDevice.js > MusicDeviceIntention > startMusic
device.music_started = false
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vacuum_cleaner>Move#202 Intention success Move#202
vacuum_cleaner>OnlinePlanning#183 Starting sequential step (Suck master_bedroom) Effect: not dirty master_bedroom,sucked master_bedroom
vacuum184 VacuumCleaner suck master_bedroom
1:02:05 vacuum_cleaner vacuum_cleaner << Belief changed: not dirty master_bedroom
vacuum_cleaner vacuum_cleaner << Belief changed: sucked master_bedroom
vacuum_cleaner>Suck#203 Intention success Suck#203
vacuum_cleaner>OnlinePlanning#183 Starting sequential step (Move master_bedroom hallway_upstairs) Effect: in hallway_upstairs,not in master_bedroom
vacuum_cleaner vacuum_cleaner << Belief changed: in hallway_upstairs
vacuum_cleaner vacuum_cleaner << Belief changed: not in master_bedroom
1:02:10 vacuum_cleaner>Move#204 Intention success Move#204
vacuum_cleaner>OnlinePlanning#183 Starting sequential step (Move hallway_upstairs bedroom_0) Effect: in bedroom_0,not in hallway_upstairs
vacuum_cleaner vacuum_cleaner << Belief changed: in bedroom_0
vacuum_cleaner vacuum_cleaner << Belief changed: not in hallway_upstairs
vacuum_cleaner>Move#205 Intention success Move#205
vacuum_cleaner>OnlinePlanning#183 Starting sequential step (Suck bedroom_0) Effect: not dirty bedroom_0,sucked bedroom_0
vacuum184 VacuumCleaner suck bedroom_0
1:02:15 vacuum_cleaner vacuum_cleaner << Belief changed: not dirty bedroom_0
vacuum_cleaner vacuum_cleaner << Belief changed: sucked bedroom_0
vacuum_cleaner>Suck#206 Intention success Suck#206
vacuum_cleaner>OnlinePlanning#183 Starting sequential step (Move bedroom_0 hallway_upstairs) Effect: in hallway_upstairs,not in bedroom_0
vacuum_cleaner vacuum_cleaner << Belief changed: in hallway_upstairs
vacuum_cleaner vacuum_cleaner << Belief changed: not in bedroom_0
vacuum_cleaner>Move#207 Intention success Move#207
1:02:20 vacuum_cleaner>OnlinePlanning#183 Starting sequential step (Move hallway_upstairs bedroom_1) Effect: in bedroom_1,not in hallway_upstairs
vacuum_cleaner vacuum_cleaner << Belief changed: in bedroom_1
vacuum_cleaner vacuum_cleaner << Belief changed: not in hallway_upstairs
vacuum_cleaner>Move#208 Intention success Move#208
1:02:25 vacuum_cleaner>OnlinePlanning#183 Starting sequential step (Suck bedroom_1) Effect: not dirty bedroom_1,sucked bedroom_1
vacuum184 VacuumCleaner suck bedroom_1
refill_agent>OnlinePlanning#214 Plan found:
refill_agent>OnlinePlanning#214 - (move kitchen out)
refill_agent>OnlinePlanning#214 - (buyrefill)
refill_agent>OnlinePlanning#214 - (moverefill out living_room)
refill_agent>OnlinePlanning#214 - (moverefill living_room hallway)
refill_agent>OnlinePlanning#214 - (moverefill hallway stairs)
refill_agent>OnlinePlanning#214 - (deliverrefill stairs)
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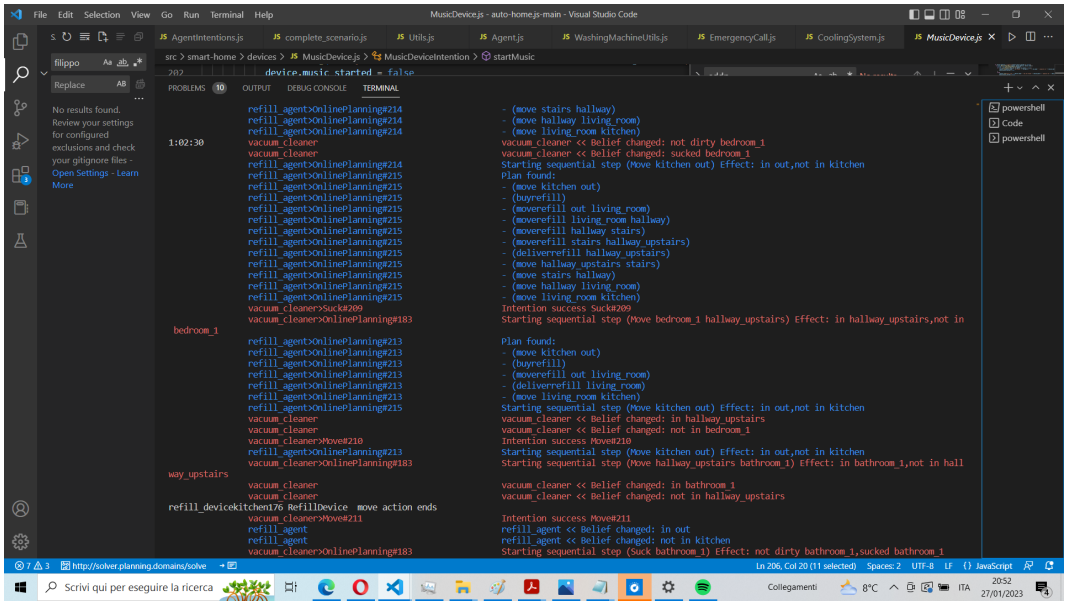
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src > smart-home > devices > MusicDevice.js > MusicDeviceIntention > startMusic
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PROBLEMS 10 OUTPUT DEBUG CONSOLE TERMINAL
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refill_agent>OnlinePlanning#214 - (move stairs hallway)
refill_agent>OnlinePlanning#214 - (move hallway living_room)
refill_agent>OnlinePlanning#214 - (move living_room kitchen)
1:02:30 vacuum_cleaner vacuum_cleaner << Belief changed: not dirty bedroom_1
vacuum_cleaner vacuum_cleaner << Belief changed: sucked bedroom_1
refill_agent>OnlinePlanning#214 Starting sequential step (Move kitchen out) Effect: in out,not in kitchen
refill_agent>OnlinePlanning#215 Plan found:
refill_agent>OnlinePlanning#215 - (move kitchen out)
refill_agent>OnlinePlanning#215 - (buyrefill)
refill_agent>OnlinePlanning#215 - (moverefill out living_room)
refill_agent>OnlinePlanning#215 - (moverefill living_room hallway)
refill_agent>OnlinePlanning#215 - (moverefill hallway stairs)
refill_agent>OnlinePlanning#215 - (moverefill stairs hallway_upstairs)
refill_agent>OnlinePlanning#215 - (deliverrefill hallway_upstairs)
refill_agent>OnlinePlanning#215 - (move hallway_upstairs stairs)
refill_agent>OnlinePlanning#215 - (move stairs hallway)
refill_agent>OnlinePlanning#215 - (move hallway living_room)
refill_agent>OnlinePlanning#215 - (move living_room kitchen)
vacuum_cleaner>Suck#209 Intention success Suck#209
vacuum_cleaner>OnlinePlanning#183 Starting sequential step (Move bedroom_1 hallway_upstairs) Effect: in hallway_upstairs,not in bedroom_1
refill_agent>OnlinePlanning#213 Plan found:
refill_agent>OnlinePlanning#213 - (move kitchen out)
refill_agent>OnlinePlanning#213 - (buyrefill)
refill_agent>OnlinePlanning#213 - (moverefill out living_room)
refill_agent>OnlinePlanning#213 - (deliverrefill living_room)
refill_agent>OnlinePlanning#213 - (move living_room kitchen)
refill_agent>OnlinePlanning#215 Starting sequential step (Move kitchen out) Effect: in out,not in kitchen
vacuum_cleaner vacuum_cleaner << Belief changed: in hallway_upstairs
vacuum_cleaner vacuum_cleaner << Belief changed: not in bedroom_1
vacuum_cleaner>Move#210 Intention success Move#210
refill_agent>OnlinePlanning#213 Starting sequential step (Move kitchen out) Effect: in out,not in kitchen
vacuum_cleaner>OnlinePlanning#183 Starting sequential step (Move hallway_upstairs bathroom_1) Effect: in bathroom_1,not in hallway_upstairs
vacuum_cleaner vacuum_cleaner << Belief changed: in bathroom_1
vacuum_cleaner vacuum_cleaner << Belief changed: not in hallway_upstairs
refill_devicekitchen176 RefillDevice move action ends
vacuum_cleaner>Move#211 Intention success Move#211
refill_agent refill_agent << Belief changed: in out
refill_agent refill_agent << Belief changed: not in kitchen
vacuum_cleaner>OnlinePlanning#183 Starting sequential step (Suck bathroom_1) Effect: not dirty bathroom_1,sucked bathroom_1
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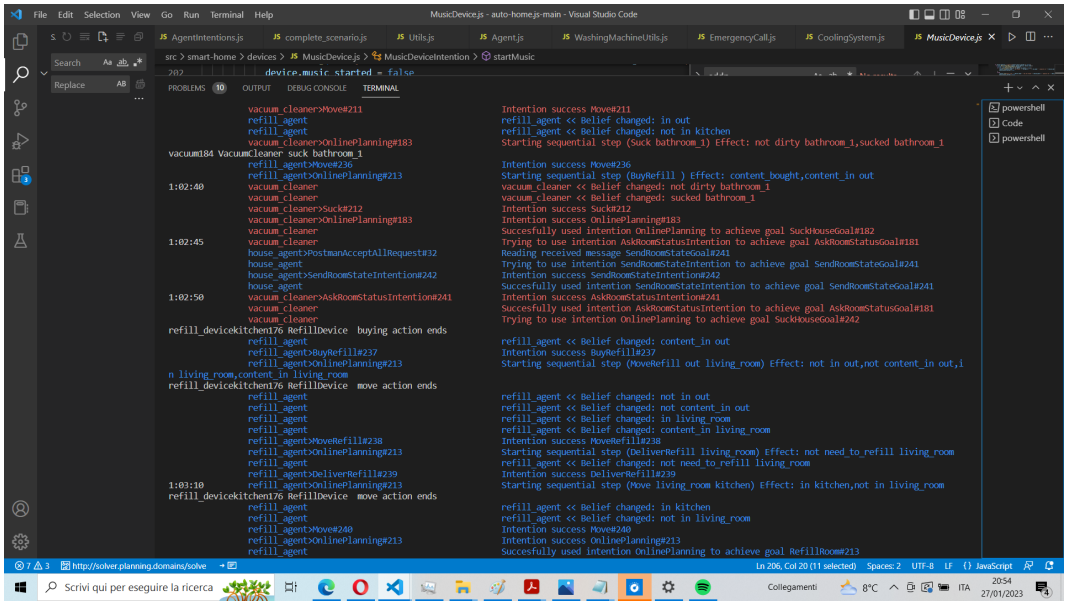
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src > smart-home > devices > MusicDevice.js > MusicDeviceIntention > startMusic
device.music_started = false
PROBLEMS 10 OUTPUT DEBUG CONSOLE TERMINAL
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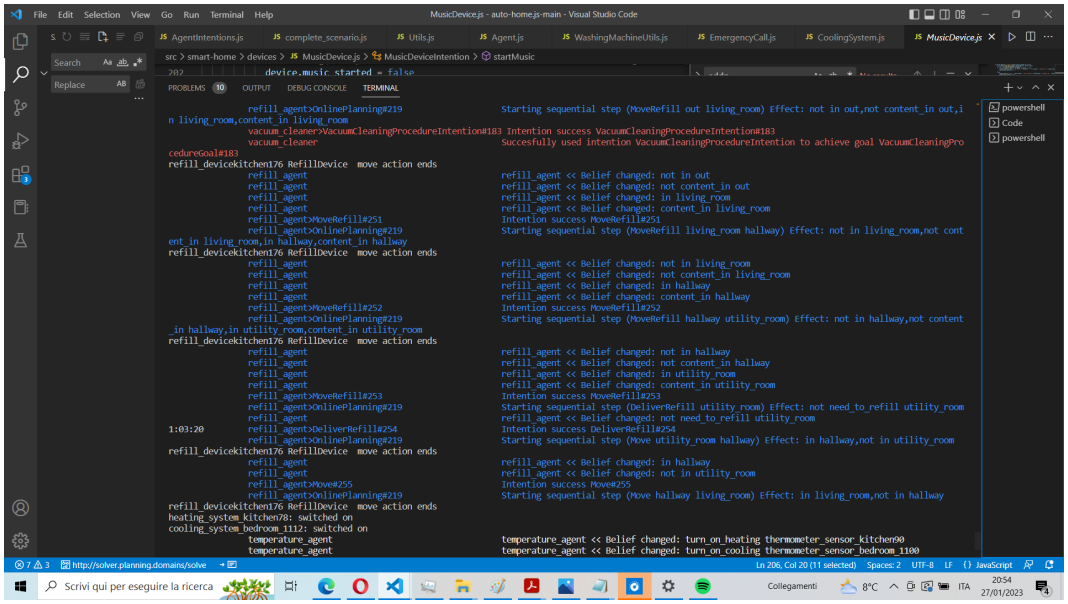
vacuum_cleaner>Move#211 Intention success Move#211
refill_agent refill_agent << Belief changed: in out
refill_agent refill_agent << Belief changed: not in kitchen
vacuum_cleaner>OnlinePlanning#183 Starting sequential step (Suck bathroom_1) Effect: not dirty bathroom_1,sucked bathroom_1
vacuum184 VacuumCleaner suck bathroom_1
refill_agent>Move#236 Intention success Move#236
refill_agent>OnlinePlanning#213 Starting sequential step (BuyRefill) Effect: content_bought,content_in out
1:02:40 vacuum_cleaner vacuum_cleaner << Belief changed: not dirty bathroom_1
vacuum_cleaner vacuum_cleaner << Belief changed: sucked bathroom_1
vacuum_cleaner>Suck#212 Intention success Suck#212
vacuum_cleaner>OnlinePlanning#183 Intention success OnlinePlanning#183
vacuum_cleaner Succesfully used intention OnlinePlanning to achieve goal SuckHouseGoal#182
1:02:45 vacuum_cleaner Trying to use intention AskRoomStatusIntention to achieve goal AskRoomStatusGoal#181
house_agent>PostmanAcceptAllRequest#32 Reading received message SendRoomStateGoal#241
house_agent Trying to use intention SendRoomStateIntention to achieve goal SendRoomStateGoal#241
house_agent>SendRoomStateIntention#242 Intention success SendRoomStateIntention#242
house_agent Succesfully used intention SendRoomStateIntention to achieve goal SendRoomStateGoal#241
1:02:50 vacuum_cleaner>AskRoomStatusIntention#241 Intention success AskRoomStatusIntention#241
vacuum_cleaner Succesfully used intention AskRoomStatusIntention to achieve goal AskRoomStatusGoal#181
vacuum_cleaner Trying to use intention OnlinePlanning to achieve goal SuckHouseGoal#242
refill_devicekitchen176 RefillDevice buying action ends
refill_agent refill_agent << Belief changed: content_in out
refill_agent>BuyRefill#237 Intention success BuyRefill#237
refill_agent>OnlinePlanning#213 Starting sequential step (MoveRefill out living_room) Effect: not in out,not content_in out,in living_room,content_in living_room
refill_devicekitchen176 RefillDevice move action ends
refill_agent refill_agent << Belief changed: not in out
refill_agent refill_agent << Belief changed: not content_in out
refill_agent refill_agent << Belief changed: in living_room
refill_agent refill_agent << Belief changed: content_in living_room
refill_agent>MoveRefill#238 Intention success MoveRefill#238
refill_agent>OnlinePlanning#213 Starting sequential step (DeliverRefill living_room) Effect: not need_to_refill living_room
refill_agent refill_agent << Belief changed: not need_to_refill living_room
refill_agent>DeliverRefill#239 Intention success DeliverRefill#239
1:03:10 refill_agent>OnlinePlanning#213 Starting sequential step (Move living_room kitchen) Effect: in kitchen,not in living_room
refill_devicekitchen176 RefillDevice move action ends
refill_agent refill_agent << Belief changed: in kitchen
refill_agent refill_agent << Belief changed: not in living_room
refill_agent>Move#240 Intention success Move#240
refill_agent>OnlinePlanning#213 Intention success OnlinePlanning#213
refill_agent Succesfully used intention OnlinePlanning to achieve goal RefillRoom#213
Ln 206, Col 20 (11 selected) Spaces: 2 UTF-8 LF JavaScript
Scrivi qui per eseguire la ricerca
Collegamenti
8°C
ITA
20:54
27/01/2023



Problem 14
Organization of source code files: agents, planning agents, beliefs, devices, house, scenarios. Present folder and sub-folder structure. [Please upload your code on github and include here a link to the repository.]

https://github.com/VMDL/ASA.

In *tmp* folder there are PDDL domains and problems. In *src*, the main folder is *smart-home*, where you can find under *agent* all the agents, their intention and desir, under *devices* all the devices that have been implemented, under *environment* all the components of the environment such as Room and House, , under *helpers* guidelines about communication, under *scenarios* the complete scenario implementation, under *sensors* all the used sensors, under *utils* all the files where each one groups a specific functionality as devices, planning, sensors and agents and also some schedule.

15 Conclusion

Problem 15
Personal considerations about the project and some potential future developments

Solution.

There are multiple components that separate this project from a real-world smart-home system. The first one regards the hardware components as the sensor have been emulated without accounting for any component specific implementation that could be required in

case of specific IoT components, moreover the Planning part is really high-level and since we deal with moving objects, it could be required the integration of Robot Planning techniques for the motion of the object, avoiding occlusions that requires the integration of Computer Vision analysis based on the acquired images.Another key improvement could be done by introducing ROS in the work environment, for instance by using roslibjs. Introducing more advanced planner, could enable to introduce Durative Actions (Temporal Planning), and also more advanced techniques such as Non-Deterministic planning by means of Conditional Planning and Probabilistic Planning (RDDL). Computer Vision should be required also from the sensors and to process the frames they acquire, in fact it is assumed to be integrated within the components that perceive the world and also Natural Language Processing application should be required to completely enable the system to be proactive to the inhabitants needs such as their interest into eating, the processing of the information listened by these sensor should require some Audio Signal processing as Speech-To-Text application, and it could be really interesting to connect this project through some interface to ChatGpt and/or Alexa. Other components that could be integrated regards Smart Metering, then automatic payment too, the usage of Recycle system and introduce the dishwasher, an automatic clothesline and wardrobe system. The design of these components may require two different approaches, either the application of Machine Learning on the Edge to prevent the need for strong hardware or the call to some Machine Learning model running on a remote server. Even if the second approach could be more convenient, especially in case of Active, Online or Reinforcement Learning, thanks to the acquisition of data from multiple houses, could introduce additional difficulties due to the need of the design of some Cloud data storage. The interaction between people in the house and the aforementioned components, could be helped by means of some Front-End applications that communicate with the Back-end running on the machine that processes information that has been captured from the users, this approach could make the environment more interesting from the marketing perspective and even more adequate to perceive direct need of the users within the house. Another completely missing perspective within this project is the application of some Security protocol to monitor the information that is crucial in smart home environment because of the sensitive data acquired about lifestyle of the subjects and also the application of Data Analytics techniques that are crucial in IoT domain in order to make the Agent more intuitive about the needs of the people. The system does not account for the prevention from a Single-point-of-failure, and the accounting for this point could make the system more consistent, as the management of a synchronized as the global clock is not completely realistic for a distributed system. Fireman and Police in emergency cases have been simplified really much as we do not handle directly their arrival in the house, and Switch On in heating and cooling system consider the time required to heat up/cool down the room, rather than account for the time required to click the button and create an additional functionality to guarantee the heating or cooling off the room. Furthermore the smart home does not apply directly Distributed System ideas even if the presence of a Multi-Agent environment neither Parallel Calculus algorithms that could be crucial to parallelize computations running on the components just designed. Furthermore the people have been modeled as environment, while it could be followed the advice of Weiss of modeling them as

Agent in order to describe their active behaviour, their desires and their intentions. Another interesting development is to combine this design project that mostly contain back-end components realized in JavaScript (that interfaces with PDDL) with a prototype house realized in Unity (and the combibation of Unity and JavaScript is feasible as proved in the official Unity documentation) and apply some front-end component and develop web application to let the people handle remotely the smart home devices and give the people the possibility to turn on/off the devices. We do not model any mechanism for the entrance door (e.g. when some device goes out, it does not handle the atomic level operation as open the door, the same for opening and closing the door between adjacent rooms), it is not implemented any mechanism for handling automatic opening of the entrance door (e.g. by means of some Biometry sensor that recognizes the people that wants to enter in the house and opens if they are inhabitant) and it is not implemented any mechanism to open and represent the doors between adjacent rooms, but it could be useful in specific cases such as the temperature management and it could be crucial to handle the opening and the closing of the door for the moving device; there are three possible alternatives: the first one is to realize the door as a sensor that opens automatically under certain circumstances (by means of some action called) that seems to be also the fastest idea, or put a device for each room that is responsible for opening the door (since a centralized device responsible for all the rooms may be too slow) but also this idea could not be appreciated by the inhabitants, or equip all the moving agents of the capacity of opening the door (this seems to be not really efficient as all the moving devices should have a specialized arm (and it could be really expensive as functionality considered the amount of moving devices within the house), moreover because of the presence of grabbing devices, they could be equipped of multiple intelligent arms, one or more for grabbing the components and the other one for opening the door and this seems really much expensive from mechanical perspective. Another keypoint to be realized is the intention priority, but also how to schedule the action to perform, for instance if a ChargingDevice has to charge some device it could apply some policy (e.g. first charge the devices that are more sensible as the ones related to security, then charge the devices which are doing some action, and then schedule the device ordering according to proximity and current level of charge criterion). Moreover the charging device currently employs the same time to charge any device and the same time regardless of the current battery level. Despite all of these points and of course many other that separate this project from a real-world implementation, I am satisfied on the content that have been explored during the course since, before doing this project and attending this course, I thought that there exist just few design paradigm for developing a system and I think it is crucial to work or research in Artificial Intelligence to know the Multi-Agent system methodologies, exactly as much as it is fundamental for a Computer scientist to know Object-oriented methodology.

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Solution.

PAPER1 PAPER2 PAPER3 PAPER4 PAPER5 PAPER6 PAPER7

References

[MB76] Robert M. Metcalfe and David R. Boggs. "Ethernet: Distributed Packet Switching for Local Computer Networks". In: *Commun. ACM* 19.7 (July 1976), pp. 395–404. ISSN: 0001-0782. DOI: 10.1145/360248.360253. URL: https://doi.org/10.1145/360248.360253.

[Ata84] John Vincent Atanasoff. "Advent of Electronic Digital Computing". In: *Annals of the History of Computing* 6 (1984), pp. 229–282.

[Arb90] Ann Arbor. "The First Electronic Computer: The Atanasoff Story, Alice R. Burks and Arthur W. Burks". In: *Bulletin of Science, Technology & Society* 10.1 (1990), pp. 50–50. DOI: 10.1177/027046769001000150. eprint: https://doi.org/10.1177/027046769001000150. URL: https://doi.org/10.1177/027046769001000150.

[MB92] Albert Paul Malvino and Jerald A. Brown. *Digital Computer Electronics*. 3rd. Glencoe/McGraw-Hill, 1992. ISBN: 0028005945.

[Ash99] Kevin Ashton. "That 'Internet of Things' Thing". In: 1999.

[Ger99] James Gerhart. "Home Automation Wiring, 1 ed." In: *New York: McGraw-Hill/TAB Electronics* (1999). ISSN: 978-0-07-024674-4.

[Rus01] Andrew L. Russell. "Ideological and Policy Origins of the Internet, 1957-1969". In: *CoRR* cs.CY/0109056 (2001). URL: https://arxiv.org/abs/cs/0109056.

[SBA01] Sanjay E. Sarma, David L. Brock, and Kevin Ashton. "The Networked Physical World Proposals for Engineering the Next Generation of Computing, Commerce & Automatic-Identification". In: 2001.

[Erg04] Sinem Coleri Ergen. "ZigBee/IEEE 802.15. 4 Summary". In: *UC Berkeley, September* 10.17 (2004), p. 11.

[SM06a] Stanislav Safaric and Kresimir Malaric. "ZigBee wireless standard". In: *Proceedings ELMAR 2006*. IEEE. 2006, pp. 259–262.

[SM06b] Stanislav Safaric and Kresimir Malaric. "ZigBee wireless standard". In: *Proceedings ELMAR 2006*. 2006, pp. 259–262. DOI: 10.1109/ELMAR.2006.329562.

[Atk10] Paul Atkinson. "The Curious Case of the Kitchen Computer: Products and Non-Products in Design History". In: *Journal of Design History* 23.2 (June 2010), pp. 163–179. ISSN: 0952-4649. DOI: 10.1093/jdh/epq010. eprint: https://academic.oup.com/jdh/article-pdf/23/2/163/993189/epq010.pdf. URL: https://doi.org/10.1093/jdh/epq010.

[AIM10] Luigi Atzori, Antonio Iera, and Giacomo Morabito. "The Internet of Things: A survey". In: *Computer Networks* 54.15 (2010), pp. 2787–2805. ISSN: 1389-1286. DOI: https://doi.org/10.1016/j.comnet.2010.05.010. URL: https://www.sciencedirect.com/science/article/pii/S1389128610001568.

[TW10] Andrew S. Tanenbaum and David J. Wetherall. *Computer Networks*. 5th. USA: Prentice Hall Press, 2010. ISBN: 0132126958.

[WW10] Rolf H Weber and Romana Weber. *Internet of things*. Vol. 12. Springer, 2010.

[RSP11] C. Muthu Ramya, M Shanmugaraj, and R Prabakaran. "Study on ZigBee technology". In: *2011 3rd International Conference on Electronics Computer Technology*. Vol. 6. 2011, pp. 297–301. DOI: 10.1109/ICECTECH.2011.5942102.

[Dal+14] Giuliano Dall'O et al. *Smart city*. Bologna: Società Editrice Il Mulino, 2014.

[MS14] Subhas Chandra Mukhopadhyay and Nagender K Suryadevara. *Internet of things: Challenges and opportunities*. Springer, 2014.

[DS15] Alexei Dingli and Dylan Seychell. "Smart Homes". In: *The New Digital Natives: Cutting the Chord*. Berlin, Heidelberg: Springer Berlin Heidelberg, 2015, pp. 85–101. ISBN: 978-3-662-46590-5. DOI: 10.1007/978-3-662-46590-5_7. URL: https://doi.org/10.1007/978-3-662-46590-5_7.

[REC15] Karen Rose, Scott Eldridge, and Lyman Chapin. "The internet of things: An overview". In: *The internet society (ISOC)* 80 (2015), pp. 1–50.

[Yin+15] ChuanTao Yin et al. "A literature survey on smart cities." In: *Sci. China Inf. Sci.* 58.10 (2015), pp. 1–18.

[YMK16] Muneer Bani Yassein, Wail Mardini, and Ashwaq Khalil. "Smart homes automation using Z-wave protocol". In: *2016 International Conference on Engineering MIS (ICEMIS)*. 2016, pp. 1–6. DOI: 10.1109/ICEMIS.2016.7745306.

[Bad+17] Christopher W Badenhop et al. "The Z-Wave routing protocol and its security implications". In: *Computers & Security* 68 (2017), pp. 112–129.

[KM18] Nicos Komninos and Luca Mora. "Exploring the big picture of smart city research". In: *Scienze Regionali* 17.1 (2018), pp. 15–38.

[Cus+19] Bart Custers et al. *EU personal data protection in policy and practice*. Springer, 2019.

[Kaf+19] Kaushal Kafle et al. "A Study of Data Store-Based Home Automation". In: *Proceedings of the Ninth ACM Conference on Data and Application Security and Privacy*. CODASPY '19. Richardson, Texas, USA: Association for Computing Machinery, 2019, pp. 73–84. ISBN: 9781450360999. DOI: 10.1145/3292006.3300031. URL: https://doi.org/10.1145/3292006.3300031.

[NK19] Gollu Appala Naidu and Jayendra Kumar. "Wireless Protocols: Wi-Fi SON, Bluetooth, ZigBee, Z-Wave, and Wi-Fi". In: *Innovations in Electronics and Communication Engineering*. Ed. by H. S. Saini et al. Singapore: Springer Singapore, 2019, pp. 229–239. ISBN: 978-981-13-3765-9.

[Roc+19] Nelson Rocha et al. "A Systematic Review of Smart Cities' Applications to Support Active Ageing". In: *Procedia Computer Science* 160 (2019). The 10th International Conference on Emerging Ubiquitous Systems and Pervasive Networks (EUSPN-2019) / The 9th International Conference on Current and Future Trends of Information and Communication Technologies in Healthcare (ICTH-2019) / Affiliated Workshops, pp. 306–313. ISSN: 1877-0509. DOI: https://doi.

org/10.1016/j.procs.2019.11.086. URL: https://www.sciencedirect.com/science/article/pii/S1877050919317879.

[Bab+20] Leonardo Babun et al. "Z-IoT: Passive Device-class Fingerprinting of ZigBee and Z-Wave IoT Devices". In: *ICC 2020 - 2020 IEEE International Conference on Communications (ICC)*. 2020, pp. 1–7. DOI: 10.1109/ICC40277.2020.9149285.

[FM20] Foteini Filippidou and Lefteris Moussiades. "*A* Benchmarking of IBM, Google and Wit Automatic Speech Recognition Systems". In: *Artificial Intelligence Applications and Innovations*. Ed. by Ilias Maglogiannis, Lazaros Iliadis, and Elias Pimenidis. Cham: Springer International Publishing, 2020, pp. 73–82. ISBN: 978-3-030-49161-1.

[SCZ20] Ke Sun, Chen Chen, and Xinyu Zhang. ""Alexa, Stop Spying on Me!": Speech Privacy Protection against Voice Assistants". In: *Proceedings of the 18th Conference on Embedded Networked Sensor Systems*. SenSys '20. Virtual Event, Japan: Association for Computing Machinery, 2020, pp. 298–311. ISBN: 9781450375900. DOI: 10.1145/3384419.3430727. URL: https://doi.org/10.1145/3384419.3430727.

[Ham+22] Badis Hammi et al. "Survey on smart homes: Vulnerabilities, risks, and countermeasures". In: *Computers Security* 117 (2022), p. 102677. ISSN: 0167-4048. DOI: https://doi.org/10.1016/j.cose.2022.102677. URL: https://www.sciencedirect.com/science/article/pii/S016740482200075X.

[Joh37] Jr Rex Earl Bassett John W Chamberlin. *Cleaning textile and similar materials*. U.S. Patent US2165884A Mar. 1937.

[Spa07] James M Spangler. *Carpet sweeper and cleaner*. U.S. Patent US889823A, Sep. 1907.