
MultiThreading and Mediator patter

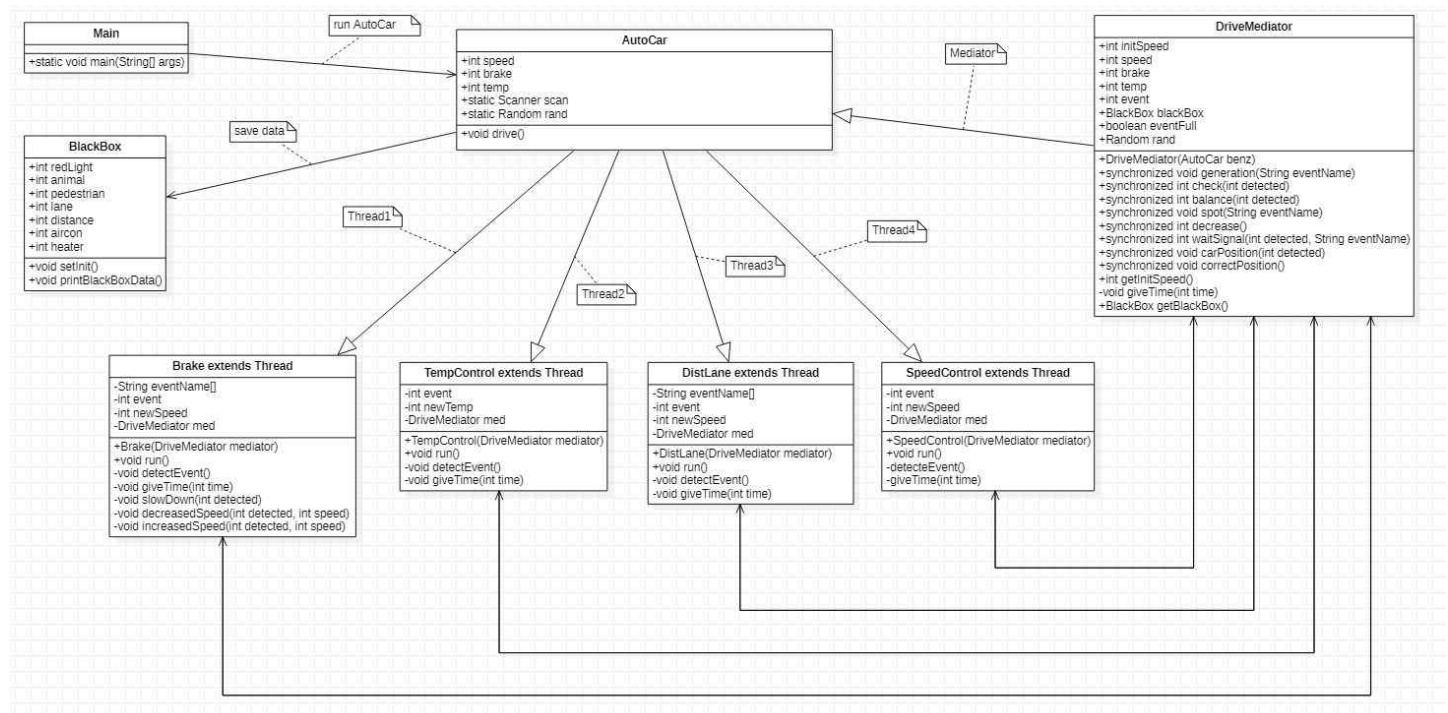
User's Document / Design Document

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Introduction

This program uses Multi-Threading and Mediator Pattern to create a Automatic Car driving through obstacles given randomly. Each thread work on its own time causing events sending it to the mediator. The mediator causes actions best fitting to the detected events. This automatic car have the mechanics to control speed on its own, stop when detected various obstacles, stabilize the temperature in the car, and drive safely in lane and in distance with the cars in front. When the automatic car is done, the black box of the car have saved all the datas retrieved during the drive.

UML Diagram



User's Manual

1. User can simply test the program through compile the .java file and running Main.
2. In the **AutoCar** class, The black box, mediator and the threads for automatic driving are created. Then the threads are given the mediator default setting and specific priority before starting.
3. The **DriveMediator** class is the default setting for each thread which mediates and handle MultiThread.
4. **Speed Controller** maintain the speed to plus and minus 3km to its user chosen initial speed.
※ Caution : There will be NO OUTPUT of action towards speed controlling thread, if and only if, the thread process of changing speed is being done by other threads.
“The process of increasing or decreasing doesn't need to be done twice during process”
5. **Temperature Controller** maintains the temperature between 23 and 26. Through thread signal of events telling the temperature that has gone under or over these number, there will heater or air conditioner will be turned on the stabilize the temperature back between 23 and 26.
6. **Brake** class allows the car to brake in front of random generated obstacles.
7. **Lane/Distance** controller maintains the right position of car, in lane center and distant from car in front.

Compile Result (MultiThread)

```
Self Driving Car Control
Car speed between 60 and 100 : 80
Speed set to : 80 KM
Temp set to : 26 degrees
Speed Controller at Work. - Thread 1
Brake Control at Work. - Thread 2
Thread for Speed Control, current Speed : 76 KM
Event Generated -- Red Traffic Light
Push accel to pick up Speed, current Speed : 82 KM
Red Traffic Light Sensed, Slow Down : SLOW DOWN!!!
Slow Down to Stop at Red Traffic Light...
Distance/Lane controller at Work. - Thread 3
Air Conditioner at Work. - Thread 4
Currently Decreased Speed infront of Red Traffic Light : 13 KM
Now the car made a complete stop infront of Red Traffic Light : 0 KM
.....Green Light Sensed... Start Driving.
Currently Increased Speed infront of Red Traffic Light : 56 KM
Event Generated -- Distance Getting Closer from the Front Car
Thread for Air Conditioner, current Temperature : 26 degrees
Thread for Speed Control, current Speed : 69 KM
Push accel to pick up Speed, current Speed : 77 KM
The Speed of Front Car Dropping Fast : Slow to Keep Distance
Event Generated -- Pedestrian
Current Decreased Speed for Distance from the Car Ahead : 8 KM
Pedestrian Sensed, Slow Down : SLOW DOWN!!!
Slow Down to Stop at Pedestrian...
Current Increased Speed Following the Front Car Increasing Speed : 61 KM
Currently Decreased Speed infront of Pedestrian : 11 KM
Now the car made a complete stop infront of Pedestrian : 0 KM
.....Pedestrian crossed the road... Start Driving.
Currently Increased Speed infront of Pedestrian : 56 KM
Thread for Speed Control, current Speed : 61 KM
Push accel to pick up Speed, current Speed : 83 KM
Thread for Air Conditioner, current Temperature : 30 degrees
Event Generated -- Not In Lane Center
Event Generated -- Pedestrian
Sensed Car not in Lane Center
Turn on AirCon to Lower Temperature, current Temperature : 25 degrees
Pedestrian Sensed, Slow Down : SLOW DOWN!!!
Slow Down to Stop at Pedestrian...
Currently Decreased Speed infront of Pedestrian : 9 KM
Thread for Speed Control, current Speed : 16 KM
Correcting car position to Lane Center
Now the car made a complete stop infront of Pedestrian : 0 KM
..Car successfully back in Lane Center
.....Pedestrian crossed the road... Start Driving.
Currently Increased Speed infront of Pedestrian : 51 KM
Thread for Air Conditioner, current Temperature : 21 degrees
Thread for Speed Control, current Speed : 48 KM
Event Generated -- Distance Getting Closer from the Front Car
Turn on Heater to Higher Temperature, current Temperature : 24 degrees
Event Generated -- Animal
The Speed of Front Car Dropping Fast : Slow to Keep Distance
Thread for Speed Control, current Speed : 46 KM
Animal Sensed, Slow Down : SLOW DOWN!!!
Slow Down to Stop at Animal...
Current Decreased Speed for Distance from the Car Ahead : 12 KM
Currently Decreased Speed infront of Animal : 8 KM
Current Increased Speed Following the Front Car Increasing Speed : 59 KM
```

```
Now the car made a complete stop infront of Animal : 0 KM
.....Animal cleared out the way... Start Driving.
Currently Increased Speed infront of Animal : 58 KM
Thread for Air Conditioner, current Temperature : 22 degrees
Turn on Heater to Higher Temperature, current Temperature : 26 degrees
Event Generated -- Distance Getting Closer from the Front Car
The Speed of Front Car Dropping Fast : Slow to Keep Distance
Current Decreased Speed for Distance from the Car Ahead : 13 KM
Thread for Air Conditioner, current Temperature : 30 degrees
Current Increased Speed Following the Front Car Increasing Speed : 71 KM
Turn on AirCon to Lower Temperature, current Temperature : 23 degrees
Event Generated -- Pedestrian
Thread for Air Conditioner, current Temperature : 21 degrees
Pedestrian Sensed, Slow Down : SLOW DOWN!!!
Slow Down to Stop at Pedestrian...
Currently Decreased Speed infront of Pedestrian : 8 KM
Turn on Heater to Higher Temperature, current Temperature : 26 degrees
Now the car made a complete stop infront of Pedestrian : 0 KM
.....Pedestrian crossed the road... Start Driving.
Currently Increased Speed infront of Pedestrian : 55 KM
Thread for Air Conditioner, current Temperature : 28 degrees
Event Generated -- Not In Lane Center
Sensed Car not in Lane Center
Turn on AirCon to Lower Temperature, current Temperature : 26 degrees
Event Generated -- Animal
Animal Sensed, Slow Down : SLOW DOWN!!!
Slow Down to Stop at Animal...
Correcting car position to Lane Center
Thread for Air Conditioner, current Temperature : 25 degrees
Currently Decreased Speed infront of Animal : 10 KM
Car successfully back in Lane Center
Now the car made a complete stop infront of Animal : 0 KM
.....Animal cleared out the way... Start Driving.
Currently Increased Speed infront of Animal : 56 KM
Event Generated -- Not In Lane Center
Sensed Car not in Lane Center
Correcting car position to Lane Center
Car successfully back in Lane Center
Event Generated -- Pedestrian
Pedestrian Sensed, Slow Down : SLOW DOWN!!!
Slow Down to Stop at Pedestrian...
Event Generated -- Distance Getting Closer from the Front Car
Currently Decreased Speed infront of Pedestrian : 9 KM
The Speed of Front Car Dropping Fast : Slow to Keep Distance
Now the car made a complete stop infront of Pedestrian : 0 KM
.....Pedestrian crossed the road... Start Driving.
Currently Increased Speed infront of Pedestrian : 56 KM
Current Decreased Speed for Distance from the Car Ahead : 13 KM
Current Increased Speed Following the Front Car Increasing Speed : 71 KM
=== Black Box Data ===
Speed Control Terminating.
Number of Animals Sensed : 2
Number of Pedestrian Sensed : 4
Number of Red Traffic Light Sensed : 1
Number of Distance Control : 4
Number of Heater Turned On : 3
=== Black Box in Sleep Mode ===
```

Multi Threading Logic

Four threads loop 15 times to generate random event. All the threads are logically given 50/50 chance to not give any event at all. When the random generator generates an event from a thread. The thread recognizes the signal and sends it to the mediator. Then the mediator sends information of the car (speed, temp etc) allowing thread to send next signal for acting towards the events. Threads all work at the same time but the operations are done in orderly structure through wait() and notifyAll(), with given default priority for each thread.

● Priority for the threads are given as it is :

- ▶ Speed Controlling Thread : 6
- ▶ Brake Giving Thread : 10
- ▶ Temperature Controlling Thread : 3
- ▶ Lane/Distance Controlling Thread : 8