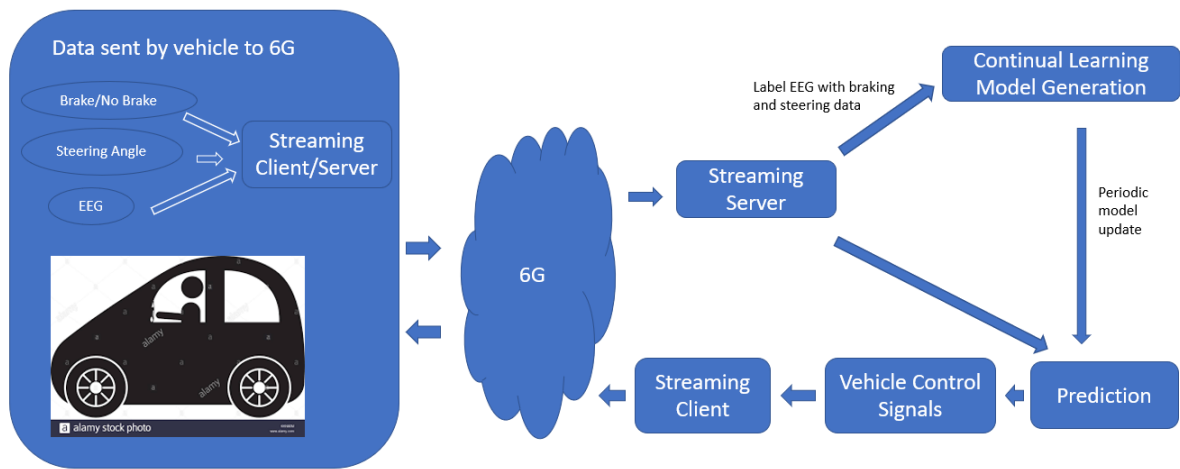


Vehicle Steering/Braking using BCI over 6G



Assumptions

1. The following signals are time synced:

- **EEG**
- **Steering Angle:** The steering angle tells whether the current direction is the same as previous direction (No direction change involved) or opposite of previous direction (There is direction change). Let us assume that 0 stands for *No Direction Change* and 1 stands for *Direction Change*.
- **Soft Brake/Hard Brake:** The soft brake is applied in the environment which is known to the driver. For Example: When driver comes across a traffic signal. Hard brake is applied in unusual/sudden/surprise scenarios. For Example: Sudden appearance of pedestrian during driving. Let us assume that 2 stands for *Soft Brake* and 3 stands for *Hard Brake*.

This way, the EEG labelling is done in 4 classes.

2. The payload in each packet transmitted over the network, will contain instantaneous value of each of the above signals. Thus, the payload consists of time synced values of:
- a. Instantaneous EEG potential
 - b. Instantaneous steering direction (0 or 1)
 - c. Instantaneous braking signal (2 or 3)

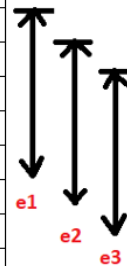
Labelling EEG for training

The payload in each packet over 6G will be processed. The following information is retrieved after processing.

| Instantaneous EEG (in microvolts) | Instantaneous Labels (Steering) | Instantaneous Labels (Braking) |
|--------------------------------------|------------------------------------|-----------------------------------|
| 1.2 | 0 | |
| 1.5 | 0 | |
| 0.9 | 0 | |
| 2.4 | 1 | |
| 2.9 | 1 | |
| 3.3 | 1 | 2 |
| 0.3 | 0 | |
| 1.1 | 0 | |
| 4.5 | 1 | 3 |

The above information is then grouped into an epoch of **configurable** number of instantaneous EEG samples.

| Instantaneous EEG (in microvolts) | Instantaneous Labels (Steering) | Instantaneous Labels (Braking) |
|--------------------------------------|------------------------------------|-----------------------------------|
| 1.2 | 0 | |
| 1.5 | 0 | |
| 0.9 | 0 | |
| 2.4 | 1 | |
| 2.9 | 1 | |
| 3.3 | 1 | 2 |
| 0.3 | 0 | |
| 1.1 | 0 | |
| 4.5 | 1 | 3 |



e1 = epoch 1, e2 = epoch 2 and so on

Each epoch is assigned a **label based on pre-defined criteria**. A simplistic criteria would be to consider maximum number of instantaneous labels in a group, to be considered as group label. Considering this simplistic labelling criteria, the above table will look like below (for the three epochs)

| Epochs | EEG samples per epoch (in microvolts) | Epoch labels |
|--------|--|--------------|
| e1 | 1.2, 1.5, 0.9, 2.4, 2.9 | 0 |
| e2 | 1.5, 0.9, 2.4, 2.9, 3.3 | 1 |
| e3 | 0.9, 2.4, 2.9, 3.3, 0.3 | 1 |

The epochs are then fed to the classifier along with labels. This classifier is a continual learning classifier. It will generate a model which will be updated in the predictor periodically.