s6_t0

July 27, 2022

[ ]:
```
import matplotlib.pyplot as plt
import pandas as pd
import numpy as np
import msgpack as mp
import msgpack_numpy as mpn
import os
import sys
import cv2
import glob
# directory reach
directory = os.path.abspath('')
append_path = os.path.dirname(directory) # go two folders up
from pykinect2 import PyKinectRuntime
from pykinect2 import PyKinectV2

kinectColor = PyKinectRuntime.PyKinectRuntime(PyKinectV2.FrameSourceTypes_Color)
import pickle
# setting path
sys.path.append(append_path)
from cv2 import aruco
from datetime import timedelta

from support.pd_support import *
from support.calculations_support import *
from support.generate_ar_data import get_ar_pose_data, detect_ar_markers,␣
 ↪add_time_col
from support.camera_calibration import *
from support.ar_calculations import *
from support.mecanum_calculations import *
```

[ ]:
```
_pth_calibration = r"C:
 ↪\Users\CMC\Dropbox\mira\mira_vellore\splitVideos\ARUCXXXXMARKU010120000000XXXXXXXXX\Session
 ↪20-07-22_10-53-15_690"
```

[ ]:
```
""" importing calibration file """

calib_pth = os.path.join(_pth_calibration, "AR_CALIBRATION.msgpack")
```

```
_calib_file = open(calib_pth, "rb")
unpacker = mp.Unpacker(_calib_file, object_hook=mpn.decode)
_calib = []
for unpacked in unpacker:
    _calib.append(unpacked)

cameraMatrix = _calib[0][0]
distCoeffs = _calib[0][1]


yPos = 112
xPos = 274

yRes = 736
xRes = 864
scalling = 2
yRes
```

[ ]:

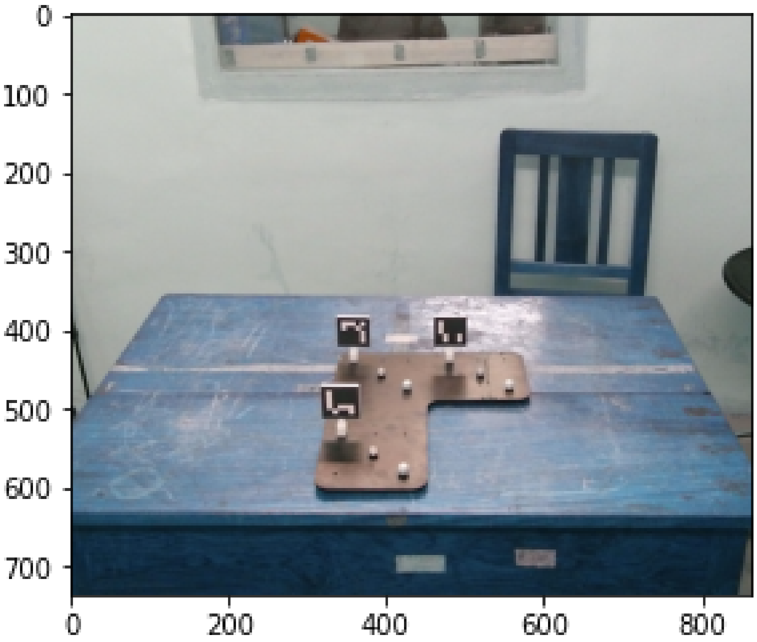
```
736
```

[ ]:

```
""" importing l frame data """
calib_file = open("new_l_frame2.pickle", "rb")
calib_img = pickle.load(calib_file)
calib_file.close()
plt.imshow(calib_img)
```

[ ]:

```
<matplotlib.image.AxesImage at 0x17bb4828b88>
```



[ ]:

```
"""detect the aruco markers"""
aruco_dict = aruco.getPredefinedDictionary(aruco.DICT_ARUCO_ORIGINAL)
arudo_parameters = aruco.DetectorParameters_create()

corners, ids, rejectedImgPoints = detect_ar_markers(calib_img,␣
 ↪arudo_parameters, aruco_dict)

rotation_vector, translation_vector, _ = cv2.aruco.
 ↪estimatePoseSingleMarkers(corners, 0.05, cameraMatrix, distCoeffs)
rotation_vector

"""

Idx: 6 - zvector
Idx: 9 - orgin
Idx: 10 - xvector
"""

print(ids)
zvec = translation_vector[0][0]
zvec = np.reshape(zvec, (3, 1))
org = translation_vector[2][0]
org = np.reshape(org, (3, 1))
xvec = translation_vector[1][0]
xvec = np.reshape(xvec, (3, 1))


translation_vector
zvec
rotMat = calculate_rotmat(xvec, zvec, org)
rotMat

t_xvec = xvec - org

translation_correction = np.array([0.045, -0.05, 0.045]).reshape(3, 1) # adding␣
 ↪the corrections in the new L frame

rotMat.T@t_xvec + translation_correction
```

```
[[ 6]
 [10]
 [ 9]]
```

[ ]:
```
array([[ 0.19988459],
       [-0.05      ],
       [ 0.045     ]])
```

[ ]:
```
# _data_pth = r"C:
↪\Users\CMC\Dropbox\mira\mira_vellore\splitVideos\ARUCXXXXMARKU010120000000XXXXXXXXX\Session
↪22-07-22_12-42-02_505" # session 5 test 1
_data_pth = r"C:
↪\Users\CMC\Dropbox\mira\mira_vellore\splitVideos\ARUCXXXXMARKU010120000000XXXXXXXXX\Session
↪26-07-22_10-27-13_120" # session 6 test 0

df = get_ar_pose_data(_data_pth, cameraMatrix, distCoeffs, process_raw=True)
df
```

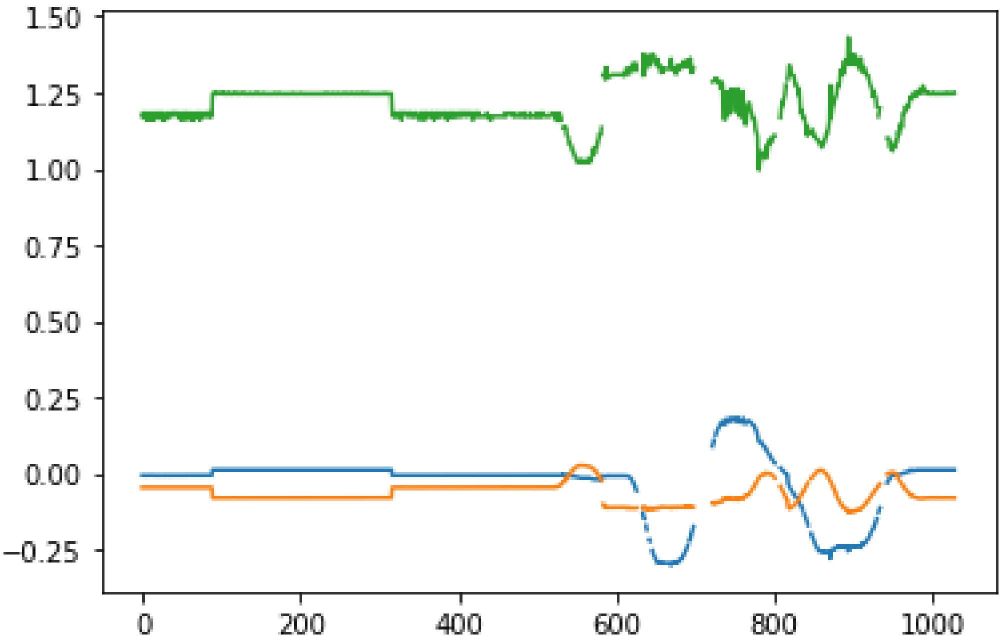
```
returning dataframe
```

[ ]:
```
      frame_id         x         y         z       yaw     pitch      roll
0          5.0 -0.005015 -0.045195  1.172664 -0.053384  3.029512  0.795643
1          5.0 -0.005337 -0.045384  1.184101  0.071220 -3.062403 -0.731841
2          5.0 -0.005015 -0.045195  1.172664 -0.053384  3.029512  0.795643
3          5.0 -0.005015 -0.045195  1.172664 -0.053384  3.029512  0.795643
4          5.0 -0.005337 -0.045384  1.184101  0.071220 -3.062403 -0.731841
…          …         …         …         …         …         …         …
1023       5.0  0.013014 -0.078591  1.246457 -0.055127  2.969929  0.735210
1024       5.0  0.013026 -0.079034  1.249041 -0.066245  2.992277  0.776526
1025       5.0  0.013026 -0.079034  1.249041 -0.066245  2.992277  0.776526
1026       5.0  0.013014 -0.078591  1.246457 -0.055127  2.969929  0.735210
1027       5.0  0.013026 -0.079034  1.249041 -0.066245  2.992277  0.776526

[1028 rows x 7 columns]
```

[ ]:
```
df = add_time_col(df,  _data_pth)
```

[ ]:
```
plt.plot(df["x"])
plt.plot(df["y"])
plt.plot(df["z"])
```

[ ]:
```
[<matplotlib.lines.Line2D at 0x17bb535f708>]
```

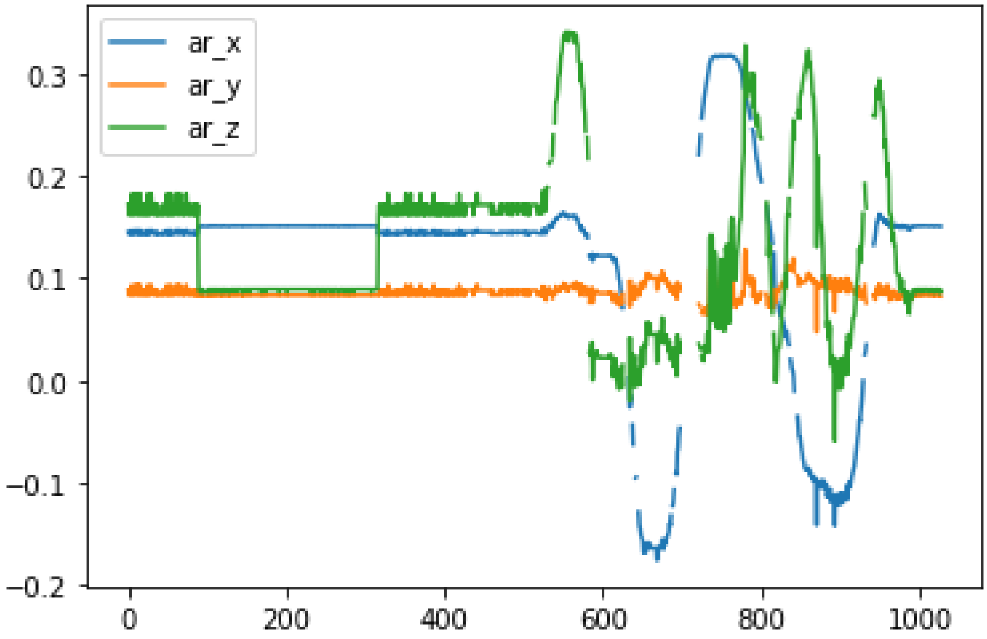


```
[ ]: ar_df = pd.DataFrame(columns=["x", "y", "z"])

     for i in range(len(df)):
         _val = df[["x", "y", "z"]].iloc[i]
         _val = np.reshape(_val.values, (3, 1))
         _val_t = _val - org
         _xyz = rotMat.T@_val_t + translation_correction
         _xyz = _xyz.reshape(3)
         ar_df.loc[i] = _xyz
     ar_df["time"]= df["time"]
```

```
[ ]: ar_df["time"] = pd.to_datetime(ar_df["time"])
```

```
[ ]: plt.plot(ar_df["x"], label="ar_x")
     plt.plot(ar_df["y"], label="ar_y")
     plt.plot(ar_df["z"], label="ar_z")
     plt.legend()
```

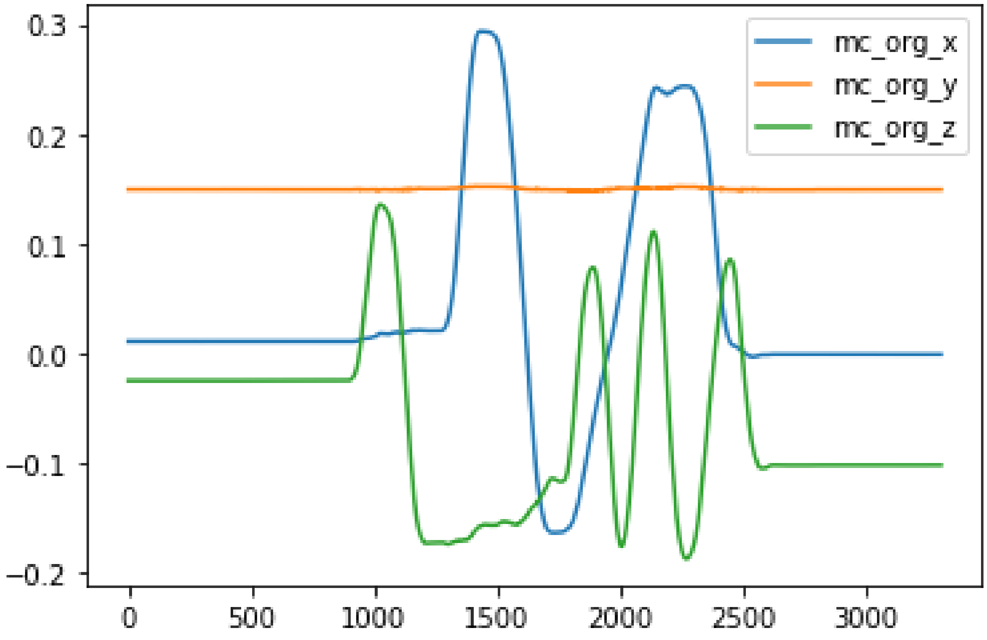
```
[ ]: <matplotlib.legend.Legend at 0x17bb5906548>
```



```
[ ]: """ getting mc df"""
     mc_df, mt_t = read_df_csv("ar_s6_t0.csv")

     mc_df = add_datetime_col(mc_df, mt_t, "seconds")
     plt.plot(mc_df["org_x"], label="mc_org_x")
     plt.plot(mc_df["org_y"], label="mc_org_y")
     plt.plot(mc_df["org_z"], label="mc_org_z")
     plt.legend()

     mc_df
```

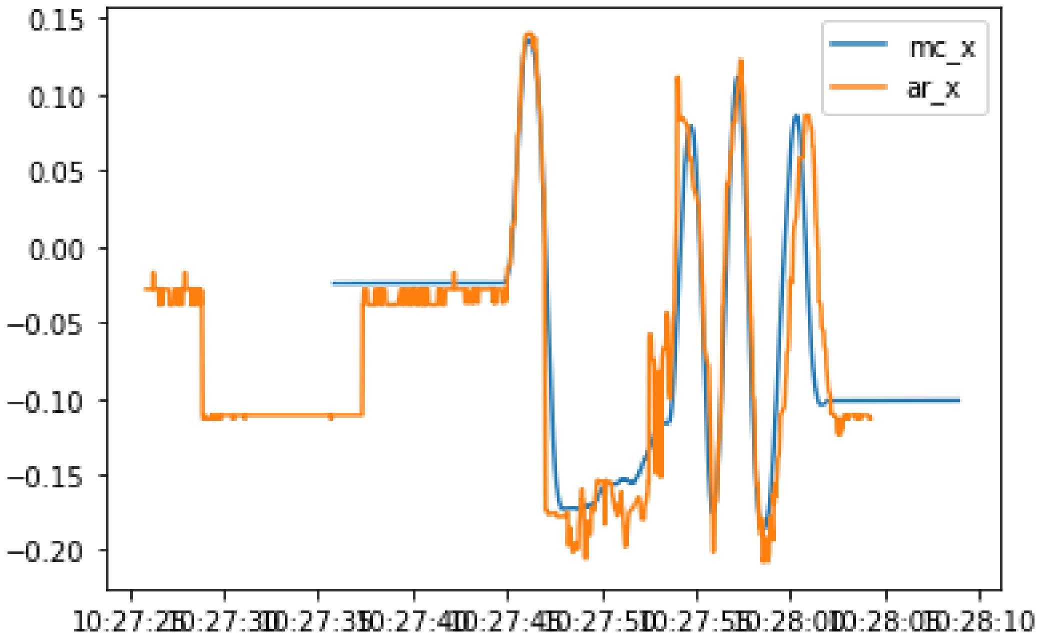
```
[ ]:       frame  seconds     org_x     org_y     org_z    xvec_x    xvec_y  \
     0         0     0.00  0.011143  0.149485 -0.024517  0.143142  0.149919
     1         1     0.01  0.011144  0.149493 -0.024511  0.143157  0.149925
     2         2     0.02  0.011150  0.149491 -0.024513  0.143153  0.149866
     3         3     0.03  0.011144  0.149497 -0.024518  0.143150  0.149924
     4         4     0.04  0.011151  0.149489 -0.024520  0.143177  0.149888
     …       …      …         …         …         …         …
     3304   3304    33.04 -0.000707  0.149333 -0.101714  0.131616  0.150364
     3305   3305    33.05 -0.000742  0.149333 -0.101692  0.131609  0.150609
     3306   3306    33.06 -0.000714  0.149316 -0.101726  0.131606  0.150610
     3307   3307    33.07 -0.000716  0.149316 -0.101725  0.131616  0.150367
     3308   3308    33.08 -0.000731  0.149350 -0.101699  0.131627  0.150367

             xvec_z    zvec_x    zvec_y    zvec_z                    time
     0    -0.035744  0.033077  0.150649  0.054005 2022-07-26 10:27:35.849
```

```
1    -0.035728  0.033075  0.150652  0.054001 2022-07-26 10:27:35.859
2    -0.035750  0.033079  0.150656  0.054007 2022-07-26 10:27:35.869
3    -0.035729  0.033093  0.150635  0.053989 2022-07-26 10:27:35.879
4    -0.035746  0.033082  0.150630  0.053976 2022-07-26 10:27:35.889
…         …         …        …        …                       …
3304 -0.106933  0.017551  0.150260 -0.022183 2022-07-26 10:28:08.889
3305 -0.106972  0.017345  0.150243 -0.022308 2022-07-26 10:28:08.899
3306 -0.106979  0.017545  0.150280 -0.022169 2022-07-26 10:28:08.909
3307 -0.106934  0.017557  0.150264 -0.022183 2022-07-26 10:28:08.919
3308 -0.106927  0.017361  0.150256 -0.022305 2022-07-26 10:28:08.929

[3309 rows x 12 columns]
```



```
[ ]: plt.plot(mc_df["time"], mc_df["org_z"], label="mc_x")
     plt.plot(ar_df["time"] - timedelta(seconds=8.4), ar_df["z"].interpolate().
      ↪rolling(3).median()-0.2, label="ar_x")
     plt.legend()
```

```
[ ]: <matplotlib.legend.Legend at 0x17bb81b6688>
```



[ ]:

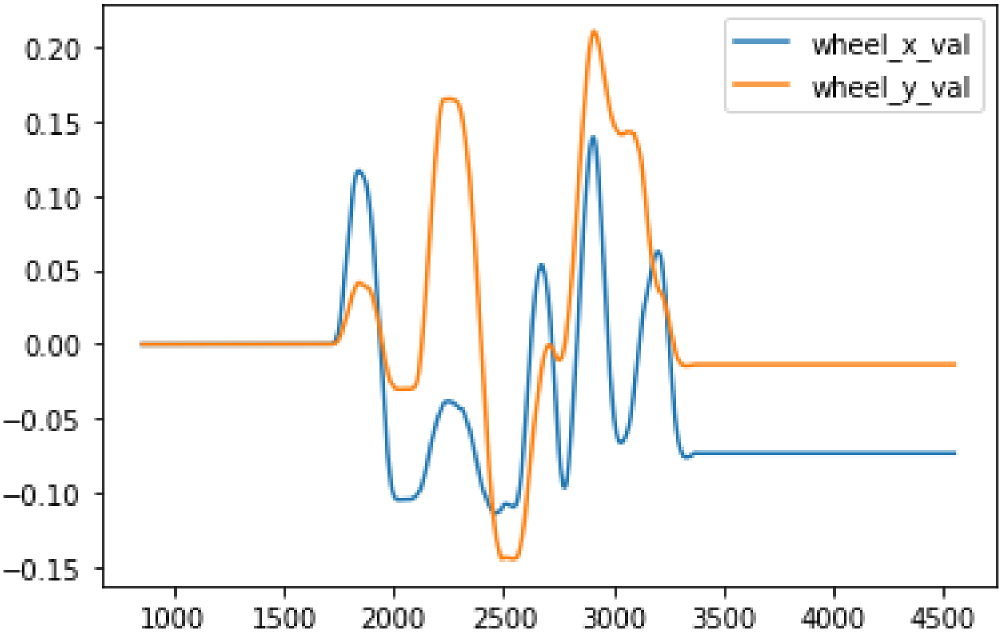
```
"""reading wheels data"""
_csv_pth = os.path.join(_data_pth, "imu01.csv")
cart_df = pd.read_csv(_csv_pth)

cart_df = add_datetime_diff(cart_df, mt_t, "sync", "mils", False)
cart_df

imu_df = cart_df[["sync", "mils", "ax", "ay", "az", "gx", "gy", "gz", "time"]]
```

[ ]:

```
""" this calculates the robots position using mecanum wheels"""

radius = 47.5/1000
lx = 79 #half of the distance between the wheels
ly = 122.5/2

lx = lx/1000
ly = ly/1000



cart_df = set_zero(cart_df, column_name=["e_fr", "e_fl", "e_rr", "e_rl"])
cart_df, c_names = get_angular_velocity(cart_df, column_name=["e_fr", "e_fl",␣
 ↪"e_rr", "e_rl"])
cart_df, c_names = get_directional_velocity(cart_df, c_names, radius, lx, ly)
cart_df, c_names = get_position(cart_df)
```

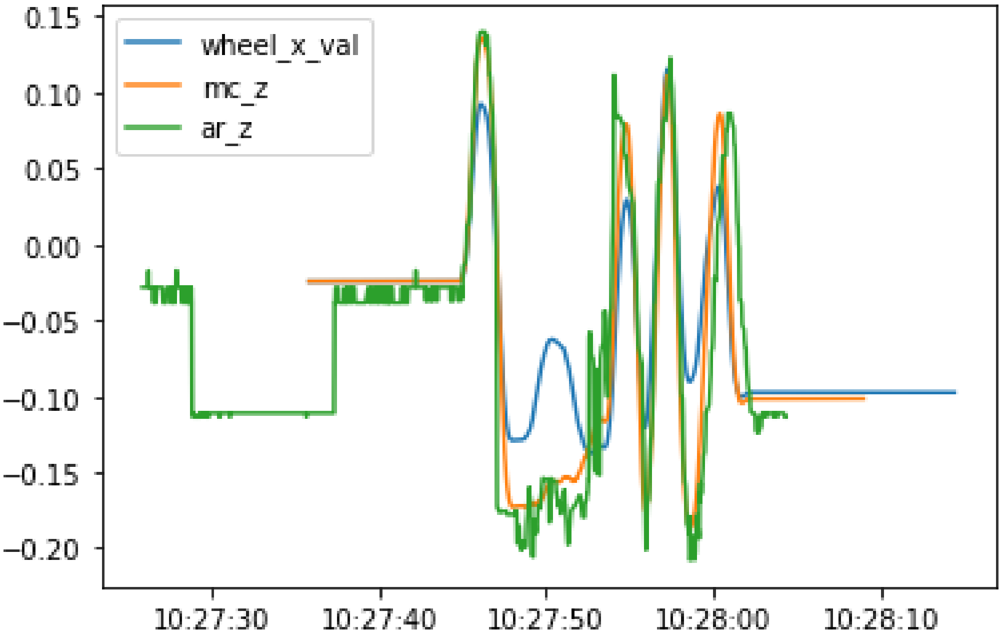
```
plt.plot(cart_df["x_val"], label="wheel_x_val")
plt.plot(cart_df["y_val"], label="wheel_y_val")
plt.legend()
```

```
[ ]: <matplotlib.legend.Legend at 0x17bb5991788>
```



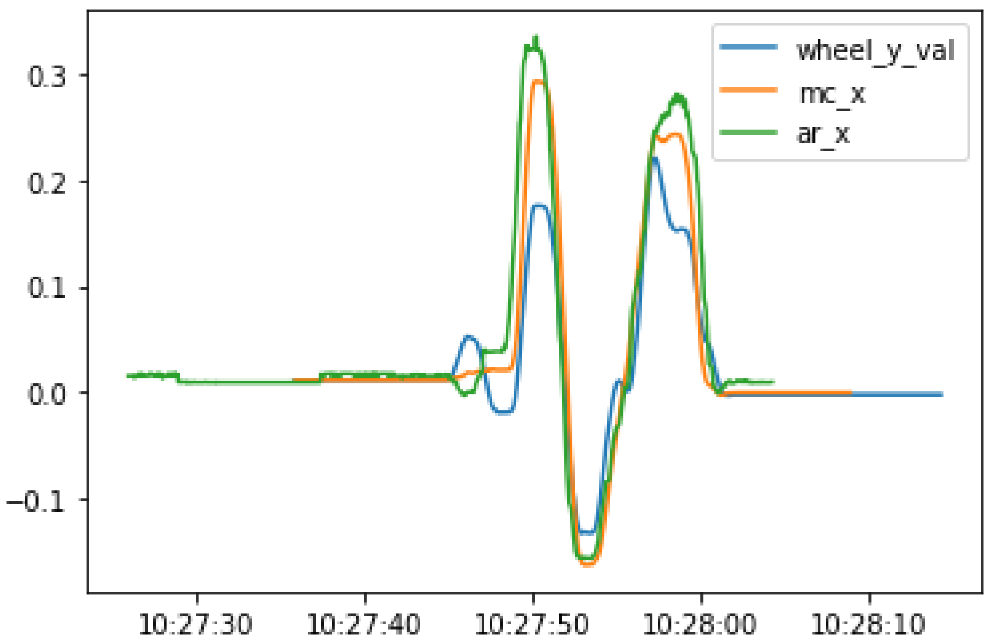
```
[ ]: plt.plot(cart_df["time"], cart_df["x_val"]-(cart_df["x_val"].iloc[0] -␣
      ↪mc_df["org_z"].iloc[0]), label="wheel_x_val")
     plt.plot(mc_df["time"], mc_df["org_z"], label="mc_z")
     plt.plot(ar_df["time"] - timedelta(seconds=8.4), ar_df["z"].interpolate().
      ↪rolling(3).median()-0.2, label="ar_z") #filtered data
     plt.legend()
```

```
[ ]: <matplotlib.legend.Legend at 0x17bbabcf488>
```



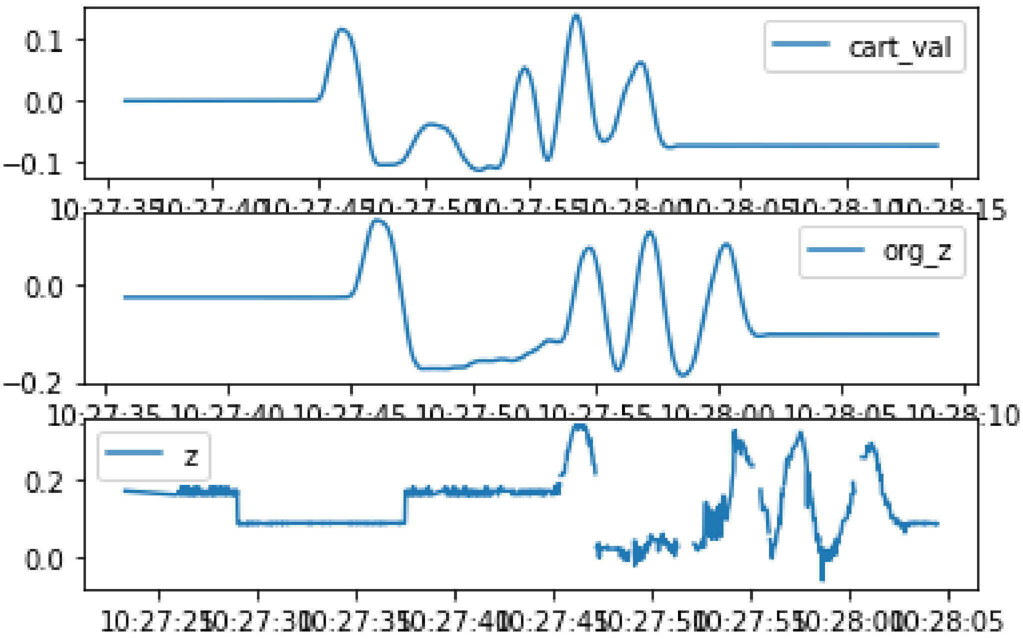
```
[ ]: plt.plot(cart_df["time"], cart_df["y_val"]-(cart_df["y_val"].iloc[0] -␣
      ↪mc_df["org_x"].iloc[0]), label="wheel_y_val")
     plt.plot(mc_df["time"], mc_df["org_x"], label="mc_x")
     plt.plot(ar_df["time"] - timedelta(seconds=8.4), (ar_df["x"].interpolate().
      ↪rolling(3).median()-0.16)*-1, label="ar_x") #filtered data
     plt.legend()
```

```
[ ]: <matplotlib.legend.Legend at 0x17bbc307108>
```



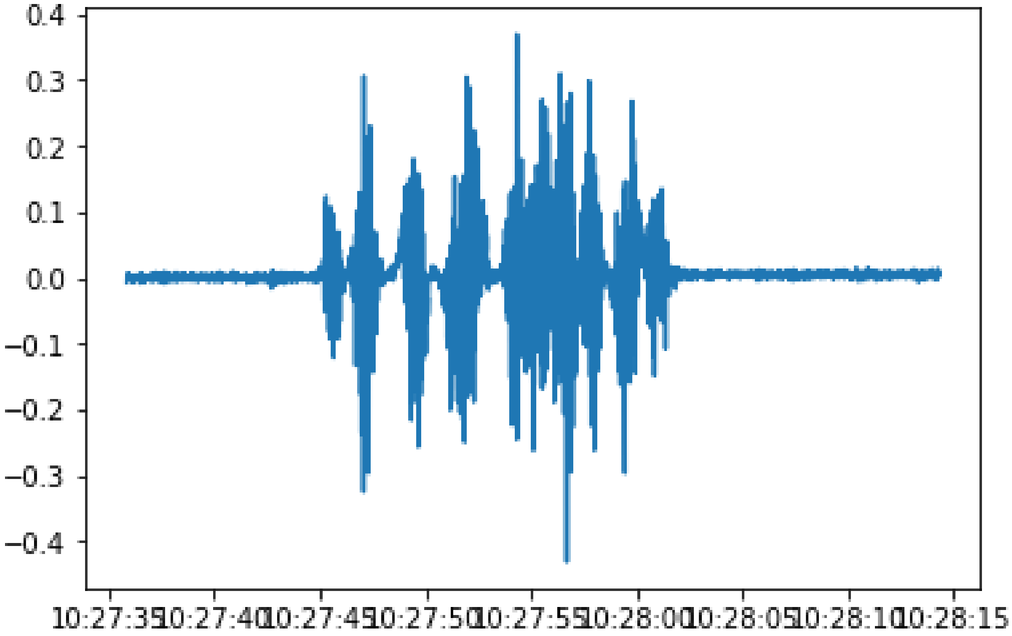
```
[ ]: plt.subplot(3, 1, 1)
     plt.plot(cart_df["time"],  cart_df["x_val"], label="cart_val")
     plt.legend()
     plt.subplot(3, 1, 2)
     plt.plot(mc_df["time"],  mc_df["org_z"], label="org_z")
     plt.legend()
     plt.subplot(3, 1, 3)
     plt.plot(ar_df["time"]- timedelta(seconds=8.2),  ar_df["z"], label="z")
     plt.legend()
```

```
[ ]: <matplotlib.legend.Legend at 0x17bb7bdfec8>
```



```
[ ]: plt.plot(imu_df["time"], imu_df["ax"], label="ax")
```

```
[ ]: [<matplotlib.lines.Line2D at 0x17bbc1f9bc8>]
```



```
[ ]:
```