

THIS IS

FIND A METHOD TO DEFINE VELOCITY
VECTOR → MAGNITUDE + DIRECTION

APPLICATION → RACING CARS → WHAT'S THE PROBLEM?

- TRADITIONAL METHODS NOT SO ACCURATE
- HIGH SPEED
- HIGH VIBRATIONS
- DIFFERENT WEATHER/EXTERNAL CONDITIONS
- SLIP DEPENDENCY

TRADITIONAL
METHODS →

- IMU → FIND ACCELERATION AND INTEGRATE ON TIME → DRIFT AND INTEGRATION PROBLEMS
- ENCODER → ABSOLUTE } GETTING 2 POSITIONS AND THE DERIVE ON TIME → VIBRATION PROBLEMS AND IT IS POSSIBLE TO CALCULATE JUST THE MAGNITUDE (YOU NEED ANOTHER ENCODER ON STEERING WHEEL)
→ RELATIVE
- GPS → BASED ON POSITION UNLESS USING RTK (NOT EASY DUE TO DISTANCE CONSTRAINTS) BUT IT IS ALSO NOT SO ACCURATE AND IT IS SLOW

FIND VECTOR VELOCITY WITH THESE INFO THEN IT WILL
WITH TRADITIONAL METHODS → BE POSSIBLE TO VALIDATE
THE NEW METHODS

1ST NEW METHOD → TAKE 2 CONSECUTIVE FRAMES
CV BASED ON MULTIPLE FRAMES OF THE ASPHALT AND FIND THE DIFFERENCE BETWEEN THEM. THE RESULT IS A SET OF VECTORS FOR EACH FEATURE DESCRIBING DIRECTION AND AMPLITUDE (THIS MUST BE CALIBRATED).

2ST NEW METHOD

FFT BASED ON
SINGLE LONG
EXPOSURE FRAME

→ TAKE 1 FRAME BUT WITH "LONG" EXPOSURE. THE RESULT IS A STRETCHED FEATURES IMAGE. THEN STUDY THE SHAPE AND DIRECTION OF STRETCHES. USE BOTH A SPACE DOMAIN AND FOURIER DOMAIN APPROACH. FFT SHOULD BE FASTER.

USE CV FILTERS
TECHNIQUES

→ EQUALIZATION, EDGES, FEATURES EXTRACTION, BLOBS DETECTION

SAMPLING TIME
AND EXPOSURE TIME

→ IN BOTH 2 NEW METHODS SPEED IS VARYING → SO SAMPLING TIME AND EXPOSURE TIME SHOULD CHANGE ACCORDINGLY → HIGH SPEED NEEDS SHORT TIME EXPOSURE, LOW SPEED NEEDS LONG TIME EXPOSURE (OTHERWISE YOU HAVE MAGNITUDE OUTSIDE DETECTION RANGE AND YOU CAN JUST FIND DIRECTION). TO DO THIS → YOU DON'T HAVE THE ACTUAL VELOCITY SO USE A KALMAN FILTER TO PREDICT NEXT SPEED AND SET THE SAMPLING TIME ACCORDINGLY (NEEDS CALIBRATION).

CAMERA PARAMETERS
MUST BE SET

→ CALCULUS AND EXPERIMENTS TO FIND THEM

ACQUISITION
SYSTEM

→ HOW ACQUISITIONS AND TESTS WERE DONE

CONCLUSION → COMPARISON BETWEEN TRADITIONAL AND IMPROVEMENTS AND NEW METHODS