**EVER 2024 Autonomous Track**

**Zagazig /IEEE Zagazig SB**

Institution /Team Identification………………………………………………………………….

**Overview­­**

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| In this milestone, we have successfully achieved the required objective by controlling the vehicle in a simulated environment with no feedback control. The process took some time from the team but nevertheless it was perfectly implemented. |

**Methodology Used**

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| First of all, we began studying vehicle controller types and what could be considered open-loop. Initially, we attempted using a Stanley controller with a predefined path. However, since Stanley requires feedback such as current position and acceleration, we handled the current position using bicycle model equations to calculate the vehicle's next position in X and Y. To obtain acceleration without IMU feedback, we explored two methods: deriving it from dynamics equations and measuring it by drawing graphs at constant pedal pressure. Unfortunately, both methods resulted in poor acceleration accuracy.  Consequently, we opted for a more challenging approach, simulating how anyone would drive a car in the real world with step-by-step instructions, like applying pressure on the pedal and adjusting steering angle. This method proved effective in achieving the desired shapes. To ensure accurate distances, we utilized multiple equations, such as R = L/tan(delta) and delta = 2Lsin(alpha)/ld. Drawing these shapes required introducing a mandatory thing which is the delay between instructions, which posed challenges in determining simulation time. To address this, we used a system delay and, through trial and error, successfully achieved accurate shapes.  It's essential to note that when running this on another PC, customization of delays is necessary, depending on the simulator's performance and real-time factor. Additionally, we utilized an odometry sensor to map the moving path, ultimately achieving our goal. |

**Built Tracks**

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**Results**

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| Straight Line |
| Switch Lane |

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| One Circle |

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| Two Circles |

**The Written Code**

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| Straight Line  Switch Lane  Two Circle  One Circle  Straight Line |

**Conclusion**

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| Regarding the challenges, we have faced multiple problems installing the simulator at the beginning. later, we needed to integrate and find equations for each trajectory which enforced all the team to look for resources to understand the dynamics of the vehicle to output the most optimum result (that was not implemented as we are still understanding these).  Some of us then needed to work on the data analysis part to better understand our simulations and its results and generate graphs to better analyze the data. |