CSCI 491/591 - Embedded System - Project Proposal

Final project – CSCI491/591 Embedded System

Autonomous Robot Car

Subtitle: Real-time self-driving robot car implementing Extended Kalman Filter for noise reduction and efficient states for car's operations

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# Introduction

Autonomous robot cars have gained popularity in recent years due to advancements in robotics and artificial intelligence. These cars can sense their environment and navigating without human intervention. In this project, we propose to design and implement a low-cost, real-time autonomous robot car using a hardware PoC of Arduino Uno and different sensors (IMU ICM20948, ultrasonic HCSR04). In addition, we also apply a technique called Extended Kalman Filters on the sensors data for noise reduction and introduce a set of operation states to help the car work stably.

# Goal/Objective

The primary goal of this project is to design and implement a lightweight, low-cost, and real-time autonomous robot car using an Arduino Uno, Inertial Measurement Unit (IMU) sensor, and ultrasonic sensors for distance measurement. The car will be able to navigate and avoid obstacles using sensor fusion as an output from EKF algorithm.

The project will be divided into the following components:

* Hardware and sensor integration: Assemble the robot car and integrate the necessary sensors for navigation and obstacle detection.
* Software implementation: Develop the EKF algorithm and control logic for the car's movement.
* Testing and evaluation: Test the autonomous robot car in different environments and evaluate its performance.

# Controlling mechanism and Algorithm design

\*\* Draw a flow chart

\*\* Draw a state machines to completely describe each state of the system and how systems transition between states? Under what conditions ?

# Hardware

The hardware components of the autonomous robot car will include:

* Microcontroller Arduino Uno
* IMU sensor (ICM20948)
* Ultrasonic sensors for distance measurement (HC-SR04)
* Motors and motor drivers for car movement
* Battery for powering the system.

\*\* Estimate power consumption and lifetime: