Parshvanath Charitable Trust's
A. P. SHAH INSTITUTE OF TECHNOLOGY
(Approved by AICTE New Delhi & Govt. of Maharashtra, Affiliated to University of Mumbai)
(Religious Jain Minority)

Self Driving Car

Group No. 15

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Abstract

The basic idea behind the project is to develop an automated car that is capable of sensing its environment and moving without any human input. The automation will be achieved by detecting lane marking, signals, obstacles, stop sign using image processing and neural network to react and take decisions such as changing the course of the car, stopping on stop signs and red signal, and moving on green signal.

Introduction

- **Why Automation?**

Objective

The objective behind developing this project is:

- To have a driverless car.
- To provide user convenience.
- To make service available 24*7.

Literature Review

Paper Title: Real-Time Self-Driving Car Navigation Using Deep Neural Network

Authors: Truong-Dong Do, Minh-Thien Duong

Publication details: International Conference on Green Technology and Sustainable Development (GTSD), 2018

Findings: In this paper, they have presented an autonomous car platform based on the softmax function squashes the outputs of each unit to be between 0 and 1, just like a sigmoid function.[1]

Advantages: The system uses only one single camera for all inputs and it drives at about 5-6 km/hr whether the lane markings are present or no.

Disadvantages:This model only detects lane markings and turn signs. It just hovers the car left or right and does not sense signals or stop sign.

Literature Review

Paper Title: Neural controller of autonomous driving mobile robot by an embedded camera

Authors: Hajer Omrane, Mohamed Slim Masmoudi and Mohamed Masmoudi

Publication details: International Conference on Advanced Technologies For Signal and Image Processing - ATSIP, 2018

Findings: They have build an autonomous RC Car that uses Artificial Neural Network (ANN) for control. It describes the theory behind the neural network and autonomous vehicles[2]

Advantages: Using an embedded pi camera for input and gray scale of images for training in neural network.[4]

Disadvantages:The system detects lane markings for each direction and does not offer any other functionality other than that.

Literature Review

Paper Title: Driverless Car: Autonomous Driving Using Deep Reinforcement Learning In Urban Environment

Authors: Abdur R. Fayjie, Sabir Hossain, Doukhi Oualid, and Deok-Jin Lee

Publication details:15th International Conference on Ubiquitous Robots (UR) Hawaii Convention Center, Hawai'i, USA, June 27-30, 2018

Findings: In this paper, they have presented a reinforcement-learning based approach with Deep Q Network implemented in autonomous driving.[3]

Advantages: Using fusion of camera and lidar helps in better knowing of the surroundings and all kinds of obstacles.

Disadvantages:They have implemented a model using lidar(laser sensor) which is a very costly sensor and it is applicable for large scale cars.

Problem Definition

Problem Detected	Solution
Existing cars needs effort to be driven and certain amount of time goes in reaching one destination which could be utilised in some other work.	The existing human driven cars to be replaced by effective self driven cars keeping in mind of various safety conditions. So developing a model scaled car which can be implemented using monocular vision method and technology in an actual car. Implementing machine learning and image processing to gain better knowledge of new technologies. We are creating a prototype to explain the concepts of machine learning which will be helpful to teach the students as it can be presented as the live example of machine learning.

Existing System

- Human driven cars use technologies to provide safety and detect obstacles and auto stop in various high end cars but none of them works completely driverless.
- The existing cars does not contain the feature of automation to the extent that car can drive autonomously.
- There is constant need of drivers without it the car becomes unavailable but with self driving car we can make the availability of car constant on roads.
- In traditional cars the driver constantly needs to keep check on the signals, road safety signs, obstacles and lane and needs to make decisions accordingly.

AUTOMATION LEVELS OF AUTONOMOUS CARS

LEVEL 0

There are no autonomous features.

LEVEL 1

These cars can handle one task at a time, like automatic braking.

LEVEL 2

These cars would have at least two automated functions.

LEVEL 3

These cars handle "dynamic driving tasks" but might still need intervention.

LEVEL 4

These cars are officially driverless in certain environments.

LEVEL 5

These cars can operate entirely on their own without any driver presence.

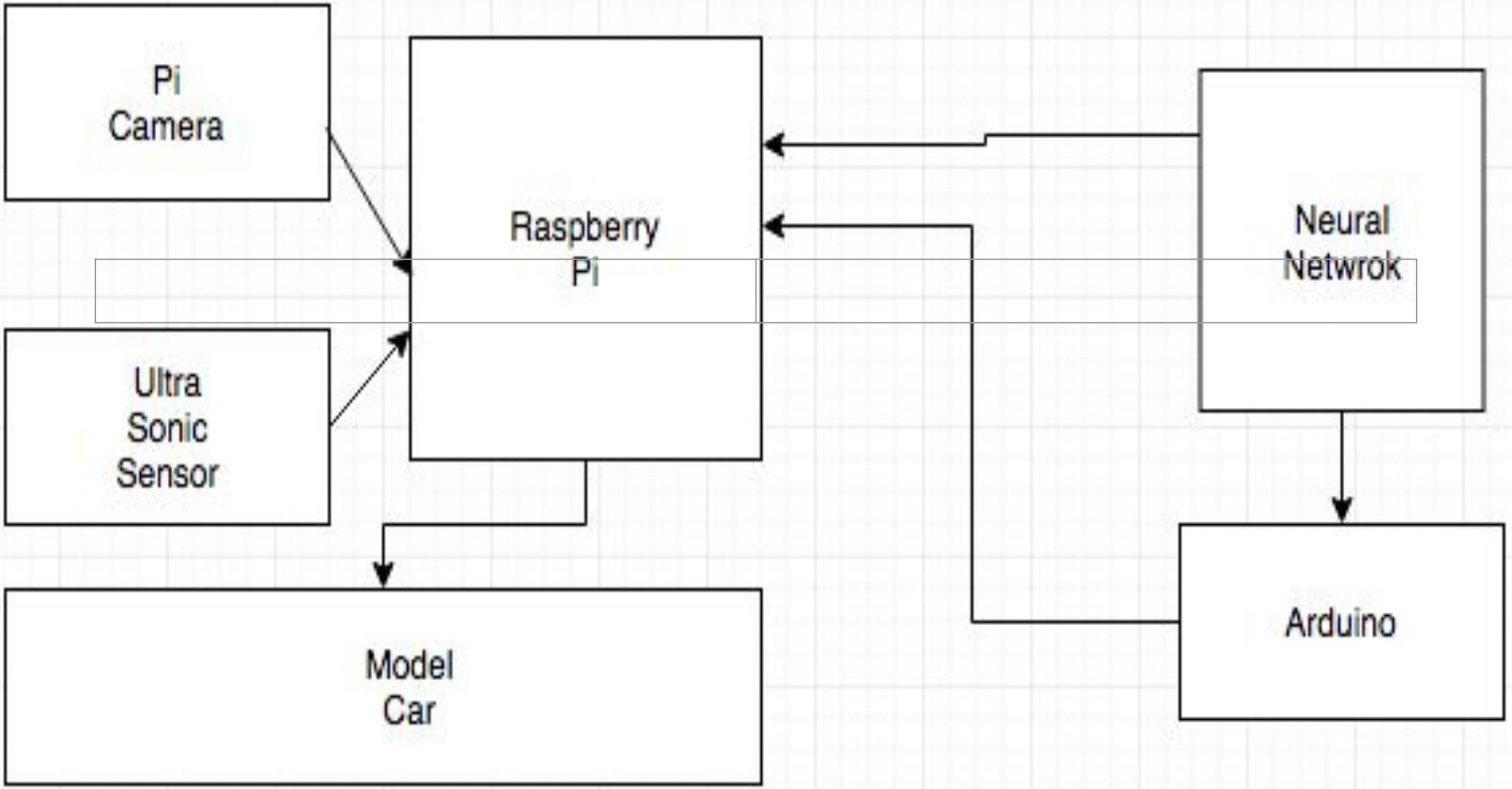
SOURCE: SAE International

BUSINESS INSIDER

Proposed System

- This project builds a self-driving RC car using Raspberry Pi, Arduino and open source software.
- Raspberry Pi collects inputs from a camera module and an ultrasonic sensor, and sends data to a computer wirelessly.
- The computer processes input images and sensor data for object detection (stop sign and traffic light) and collision avoidance respectively.
- A neural network model runs on computer and makes predictions for steering based on input images. Predictions are then sent to the Arduino for RC car control.
- The system uses sensor and
- camera constantly to check for obstacles and safety signs.

Flow Diagram



Technology Stack

- Raspberry Pi 3
- Arduino Nano
- OpenCV
- Ultrasonic sensor
- Pi camera

Scope

- Our car will be able to provide automation between level 4 and 5.
- Car will be able to detect lane markings, obstacles, traffic signals, stop signs and take decisions accordingly.
- To traverse on any road not visited before.
- To work in a model environment.

Limitation

- The car will not work automatically if there is no internet connection.
- When there are no lane markings on the road the pi camera will not be able to detect the boundary within which the car should move.
- Trusting a computer to perform adequately.
- Sensors fail during following conditions : Drastic weather conditions, Human traffic signals and Roadblocks and local traffic laws.

Conclusion

With this project we are proposing a system that will allow automation of car with the help of machine learning and allows complete driverless controls and decisions made autonomously.

References

[1]Truong-Dong Do, Minh-Thien Duong, Quoc-Vu Dang and My-Ha Le, “Real-Time Self-Driving Car Navigation Using Deep Neural Network” in *International Conference on Green Technology and Sustainable Development (GTSD),* 2018

[2]Hajer Omrane, Mohamed Slim Masmoudi and Mohamed Masmoudi, “Neural controller of autonomous driving mobile robot by an embedded camera” in *International Conference on Advanced Technologies For Signal and Image Processing - ATSIP,* 2018

[3]Abdur R. Fayjie, Sabir Hossain, Doukhi Oualid, and Deok-Jin Lee, “Driverless Car: Autonomous Driving Using Deep Reinforcement Learning In Urban Environment” in *15th International Conference on Ubiquitous Robots (UR) Hawaii Convention Center, Hawai'i, USA*, June 27-30, 2018

[4]F. Shumaila Mateenuddin, Mrs. V.S. Jahagirdar, "An Android Controlled Mini Rover for real time surveillance using Raspberry Pi 3", in *International Journal Of Advanced Research in Engineering & Management (IJAREM), 2017.*

Thank You