Design and Implementation of IoT based Golf Cart Autonomous Vehicles

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Abstract—Rapid improvements in technology are making autonomous vehicles feasible. Researchers and industry are looking for different methods to implement the concept of smart cities. Autonomous Vehicles provide a unifying framework for several research topics (e.g., navigation, localization and Global Positioning System (GPS) positioning, security, and privacy). Despite significant progress, I believe that fully autonomous vehicles will be deployed initially in constrained environments (e.g., closed loop areas, gated retirement communities). In this paper, I describe the development of a prototype autonomous golf-cart that can be used as a test-bed for a range of research projects. I explain the details of the conversion from a traditional golf-cart to an autonomously driven one. My target application is a system of autonomously driven golf-carts for use within a retirement community. I show my testing results, and how Internet of Things (IoT) devices can be used to extend the Wi-Fi coverage for log reporting and to request the golf-cart. Finally, I discuss the challenges and highlight improvements that can be performed that can be performed on the system.

Key Words—Autonomous Vehicles (AV), Navigation, Localization, Test-bed Prototype, Internet of Things (IoT)

1. Introduction

Independent vehicles are turning into a reality because of fast mechanical headway. Specialists and business visionaries are investigating a few different ways to incorporate the brilliant city thought. Self-sufficient vehicles fill in as a binding together structure for an assortment of study regions, including route, limitation, GPS area, security, and protection. Notwithstanding critical advancement, I accept that completely self-governing vehicles will first be utilized in quite a while (e.g. shut circle regions, shut retirement networks). This undertaking canter

Around making a model of a self-driving golf truck that can be utilized as a testing point for an assortment of exploration drives. The method involved with changing over a traditional golf truck into a self-governing working truck is depicted at the Depth. One self driving golf truck framework for use in the retirement local area is the objective application. I clarify our test results, just as how to utilize Internet of Things (IoT) gadgets to stretch out Wi-Fi inclusion to log reports and golf truck orders. At last, troubles and upgrades that may be made to the framework are talked about.

In the course of recent years, self-governing vehicle research has taken colossal steps. A few significant organizations have said they need to execute completely self-driving vehicle frame works by 2020. Thus, governments are feeling the squeeze to make proper authoritative and administrative structures. The improvement of self-governing vehicles keeps on supporting examination in regions like direction, situating, object revelation, security and protection, detachments, and so forth In spite of huge advancement, there are as yet critical difficulties to be confronted. The advancement of completely or to some degree independent frameworks to suit the versatility necessities of individuals who as of now drive regular vehicles has been a significant focal point of self-sufficient vehicle research.

1.1 Objectives

The purpose of this article is to illustrate the structure of a fully autonomous golf cart that can be tested without a person in the cart in a predetermined course in a controlled environment. The vehicle can detect obstacles in its path and stop completely until the road is clear.

2. Literature Survey

“Autonomous Vehicles: Building a Test-bed Prototype at a Controlled Environment”. This article depicts the production of a model independent golf truck that can be utilized as a proving ground for an assortment of exploration projects. We will go through the subtleties of changing over a conventional golf truck into a self-driving truck. Our planned application is an independent golf truck framework for use in the retirement local area. We show you the aftereffects of our tests, just as how we utilize the Internet of Things (IoT) gadgets to expand Wi-Fi inclusion for log reports and golf truck orders [1].

“Autonomous vehicles: The future of automobiles” Oneself driving vehicles introduced in this article are the keen vehicles of things to come, the ideal driverless, proficient

and impact confirmation metropolitan vehicles. To accomplish this objective, automakers started working in this field to understand the possibility to accomplish the ideal outcome and to beat existing impediments. This article examines how changing over customary vehicles into self-driving vehicles by embracing and executing many arising advances. This investigation likewise talks about the current prerequisites for independent vehicles and looks at the extension of self-driving vehicles in India with different business sectors. Therefore, the methodology of endorsement of self-sufficient vehicles under Indian economic situations was settled.[2]

In this investigation we present another way to deal with taking care of the nearby movement arranging issue in the self-ruling auto area. We get the situation with many time-step Horizon Composite T and fit into the nearby way by tackling the powerful programming issue as opposed to making many collectibles and picking the best one. The subsequent direction is sufficiently smooth to fulfill the constraints of the vehicle elements and traffic rules of the inner self. In the event that you rehash this interaction, oneself driving vehicle can anticipate its future course progressively. In reenactments with Matt Lab and Rescon, this methodology functions admirably. Contrasted with past advances, this technique has a quicker determined speed to drive a self-ruling vehicle continuously out and about.[3]

2.1 Implementation of the System

- All hardware components are connected to the top of the raspberry, which acts as the project central processing unit to control and process the data.
- Destination created with the help of smart phone app.
- The application also allows you to track the status of all sensors and its location while the vehicle is moving.
- The outputs of the GPS and ultrasonic sensors are sent up the raspberry.
- Processes data on raspberry and uses path algorithm to run engine; As a result, the car starts moving according to the trajectory algorithm.
- To send and receive data to the cloud, a Wi-Fi module is required.

3. Block Diagram

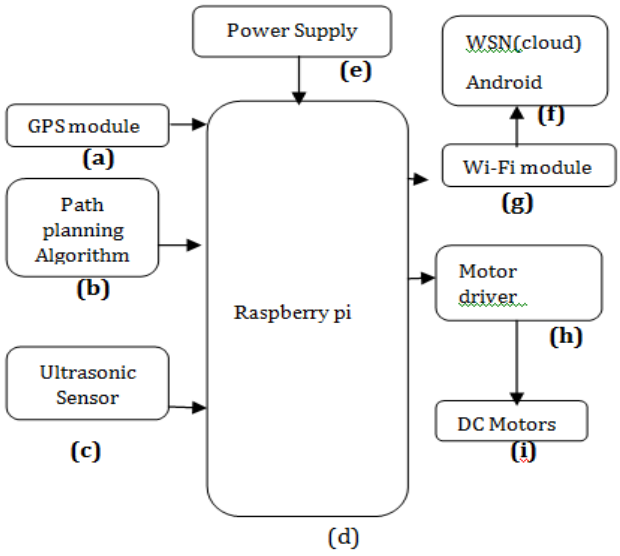

Figure 1: Block diagram of Autonomous golf cart. (a) NEO-6MV2global positioning system module, (b) path planning algorithm, (c) HC SR04 ultrasonic sensor, (d) raspberry pi 3, (e) power supply, (f) android app, (g) ESP8266 Wi-Fi module, (h) motor driver L293d, (i) DC motors.

METHODOLOGY

- Arranging and Navigation Analyzes information from different sensors to discover how a vehicle is moving to remain on a given street.
- Motor control is answerable for moving the vehicle in light of signs from the arranging and route framework.
- Natural sensor gathers information for transmission to the detecting and handling arranging and route framework.
- We have made a cell phone interface that permits us to demand a particular area while continually following the sensor status in the vehicle.

3.1 Planning and Navigation

The vehicle should design and explore a foreordained course. Arranging and Navigation Analyzes information from different sensors to discover how a vehicle is moving to remain on a given street. The GPS module is utilized to get the vehicle's GPS area for route. Motor control is answerable for moving the vehicle in light of signs from the arranging and route framework. What's more, the ultrasonic sensor distinguishes any hindrances before the vehicle. On the off chance that a snag shows up before the vehicle, it will naturally push left or right and afterward

ahead. The vehicle recognizes snags in its way and stops until the street is clear.

The sensor gathers information from the climate and sends it to the arranging and route framework through detecting and preparing. We have made a cell phone interface to demand whether the vehicle ought to go consequently or physically, contingent upon the worker or human run application.

3.2 Route and Arranging

The vehicle doesn't plan the course ready in its present arrangement. On the other hand, it can utilize an Internet map administration, for example, Google Maps to demand a scope of GPS waypoints.
While exploring, the Pure Pursuit calculation is utilized to compute the guiding signs and the PID-based speed regulator is utilized to control the choke. The scope of directions and the area of the vehicle is shipped off the Pure Pursuit calculation. It then, at that point chooses the predetermined distance before the current situation of the vehicle and goes towards it.

3.3 Motor Control

The connection between the ROS-based programming and the buggy gadget is kept up with by the motor control framework. Directing and speed guidance conveyance to the IoT gadget is taken care of by a solitary ROS hub (for this situation on Raspberry). The sequential convention is utilized to impart between the ROS hub and the Raspberry Pi board, which decides the necessary rotational span and speed.

On the fly, the ndt coordinating with technique is utilized to adjust continuous point cloud information got from Velodin LiDaR with a pre-processed 3D climate map. Indeed, even despite critical changes in a given climate, restriction was sufficiently quick to permit route
and precision inside a couple of centimetres (for example changing trees because of various periods).

The Garmin 18 LVC Global Positioning System (GPS) apparatus is additionally remembered for the truck. GPS is utilized as a helpful wellspring of low precision area data for show through the cell phone interface, as the cell phone interface doesn't need high situating exactness.

4. Flow Chart

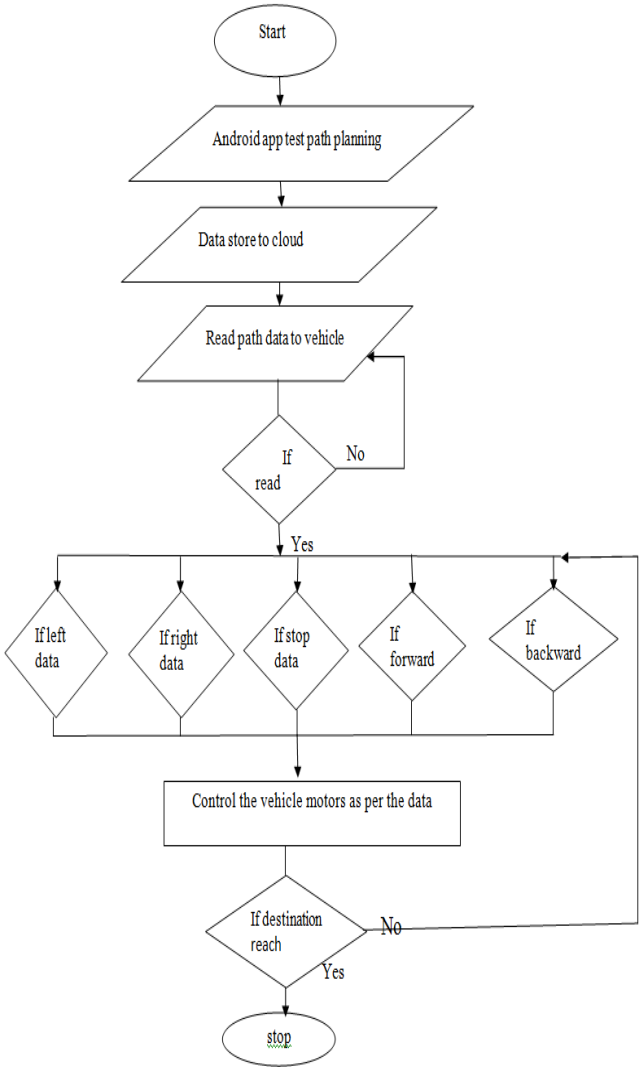

Figure 2: control of vehicle motor

5. Result and Conclusion

5.1 VNC VIEWER (VIRTUAL NETWORK COMPUTING)

Step 1- first connect the hardware as shown in the below and give power supply through USB cable.
Step 2- switch Wi-Fi hotspot on in the mobile where app is installed and connect to the laptop. Make sure that the mobile and laptop have the same local host.
Step 3- enable the VNC viewer

Figure 3: snapshot of VNC viewer window

Step 4- select the IP address.

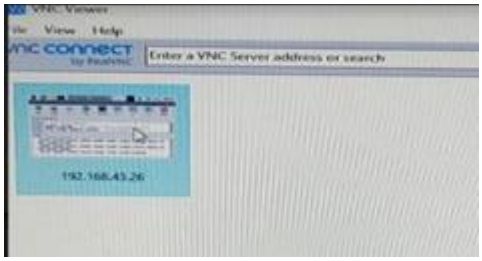

Figure 4: snapshot for selection of respective IP address

Step 5- enter the username and password.

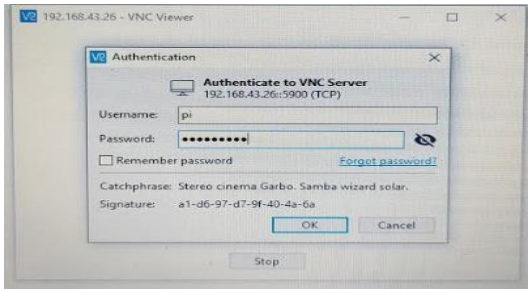

Figure 5: snapshot of VNC viewer authentication window

Step 6- now run the VNC viewer and see the output in the shell which displays vehicle condition,

5.2 Simulation Software

Let start with simulation part, or this simulation I'm going to use mat lab.Mat lab is a software package for high performance numerical computation and visualization.

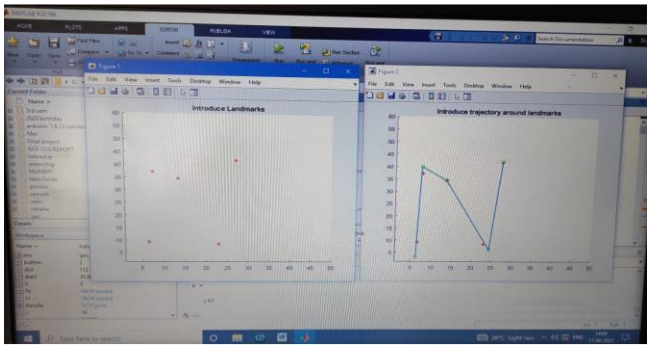

Figure 6: Introduce Landmark And Introduce Trajectory Around Landmark

Let see how this mat lab work in my project :

- Firstly I need to introduce landmark graphically, which is also called obstacles or object in the given graph.
- After introduce this land mark I will introduce trajectory around land mark, which is predefined path.

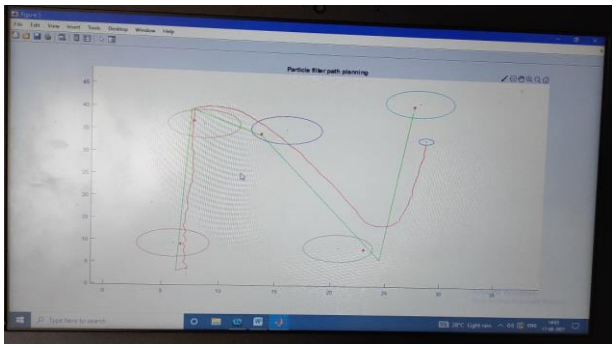

Figure 7: Particle Path Planning Algorithm

- After introduce trajectory around land mark I need to right click,
- After this steps the vehicle move accordingly in the graph show in above figure.
- The vehicle does not touch the object or landmark but it will move in given trajectory path.
- (trajectory: the path followed the object).
- The red line indicates the vehicle movement, which moves according to algorithm based path.
- The green line indicates the actual path.

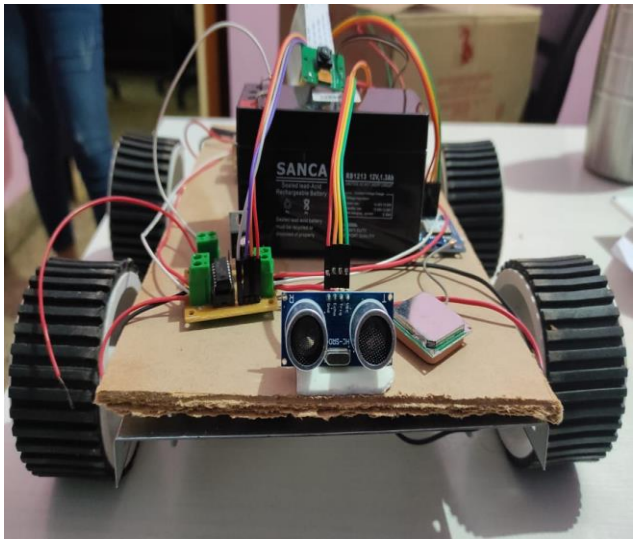

Figure 8: A Hardware Model Of Autonomous Vehicle

So let us move to the hardware model of autonomous vehicle and how its work, Here,

- vehicle travel in a pre determined path which is based on the planning and navigation. The planning and navigation system uses an ultrasonic sensor input signal to calculate how the vehicle is moving or standing on a particular road.
- The GPS module is used to get the GPS location of the vehicle for this navigation.
- DC motors control the driving focus in response to signals from the planning and navigation system. Navigation: Procedures for controlling and directing the movement of a vehicle from one place to another.
- The input signals from the ultrasonic sonic sensor detects if there is any obstacle in front of the vehicle.
- If an obstacle comes in front of vehicle, vehicle move left or right and then move forward.
- The vehicle can spot objects in its path and stops when the road is clear.

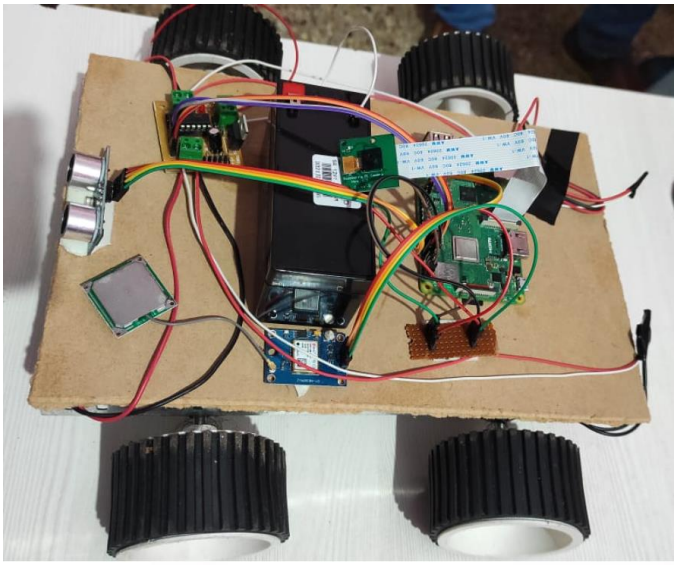

Figure 9: Autonomous Vehicle

- The main goal of the smartphone application is to provide a user interface that allows the vehicle to start its independent workflow after selecting a specific location from the user list.
- The application also allows you to track the status of all sensors as well as its location while the vehicle is in motion.
- The current method requires continuous Wi-Fi coverage.

5.3 Conclusions

Over the previous decade, critical advancement has been made on a wide scope of issues in PC vision, voice handling and voice acknowledgment. This achievement was generally powered by profound advances in the neural organization. In an assortment of testing tangible handling undertakings, these top to bottom learning models can arrive at human or close execution levels. The traveler observing abilities we need to investigate in this examination are generally founded on these top to bottom learning techniques.

At long last, in reality setting, more than one fairway works autonomously on a restricted grounds (for instance, the Seniors Community). Since there are so many self-driving golf trucks available, there are many exploration gives that should be replied with respect to which golf truck should take the traveler. Information is gathered to screen the protection and wellbeing of travelers, just as where and how it is put away and utilized.

6. Discussion

This examination makes a model of a self-driving golf truck that can be utilized as an exploration proving ground. There is still work to be done in numerous spaces. Making an IoT network organization to cover a vehicle course with Wi-Fi inclusion or association is helpful. Traveler checking and correspondence will be the primary concentration in future turns of events. An autonomous golf truck requires a UI that is open to the older. The truck's anxiety for rider condition is particularly significant for senior riders. Traveller perspectives, activities and mind-sets are checked by sensors outwardly and within the vehicle. For instance, the cart should just move subsequent to ensuring the traveller is protected and prepared.

7. Applications

The vehicle can be used to test algorithms that range from lane keeping, to obstacle detection and avoidance, to autonomous parking. Deep learning techniques can also be investigated in the context of pedestrian, traffic sign and vehicle detection.

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