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RFID car using arduino mega 2560 by dijkstra's algorithm

K. Sujay[1], M.V.S.Visweswar[1], B. Sai Teja Reddy[1], Md. Ali Hussain[2], Sridevi Sakhamuri[3], and Laith Abualigah[4,5,6,*]

[1]Department of Electronics and Computer Engineering, Koneru Lakshmaiah Education Foundation, Vaddeswaram, Guntur, AP, 522502, India
[2]Department of Electronics and Computer Engineering, Koneru Lakshmaiah Education Foundation, Vaddeswaram, Guntur, AP, 522502, India
[3]Department of Electronics and Computer Engineering, Koneru Lakshmaiah Education Foundation, Vaddeswaram, Guntur, AP, 522502, India
[4]Computer Science Department, Prince Hussein Bin Abdullah Faculty for Information Technology, Al al-Bayt University, Mafraq 25113, Jordan.
[5]MEU Research Unit, Middle East University, Amman, Jordan.
[6]Hourani Center for Applied Scientific Research, Al-Ahliyya Amman University, Amman 19328, Jordan.

aligah.2020@gmail.com

Abstract. This paper introduces a module which is used to transport goods or people from one place to another without any driver assistant. It is mainly used in big industries to save the time and energy. This module is built around an RFID sensor. RFID technology uses fields of electromagnetic waves to track and monitor tags attached to objects. When triggered with a field of electromagnetic waves investigate pulse from an adjacent RFID reader device, this tag delivers digital information back to the reader, which is often an inventory number. This number can be used to keep track of inventories. The sensors collect the data and sends to the main algorithm and then it takes the decision which way to go, we implemented our car to be completely automated and does not required any instructions from human. To achieve this we have chosen the shortest path algorithm know as Dijkstra's algorithm.

Keywords: Self-driving car, RFID sensor, Self-parking, Dijkstra algorithm.

1. Introduction

An autonomous vehicle is one that can perceive its circumstances and function with no need for human involvement. At no time is a human traveler expected to take control of the car, nor is a human traveler required to be present in the vehicle at all. A self-driving automobile can go anywhere a conventional car can go and achieve everything a skilled and experienced driver can do. The Society of Automotive Engineers (SAE) has identified six levels of driving automation, ranging from entirely manual to completely automated (fully autonomous).

Self-driving car

A self-driving car is a vehicle that travel s amongst destinations without any aid of a physical being utilising Artificial Intelligence (AI), sensors, radar, cameras. To consider as completely autonomous, a

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vehicle must be able to traverse without human oversight (or) control to a predefined location on the roads that have not been modified for its use. Companies developing and testing autonomous cars include Tesla, Audi, Google, BMW, Volkswagen, Ford, General Motors, and Volvo. Google tested a collection of self-driving automobiles, including a Toyota Prii and an Audi TT, that travelled around 140,000 miles along streets and highways of california.

Autonomous VS Self-driving

The term "automated" is used by the SAE instead of "autonomous." One reason is that the term autonomy has meanings that go beyond the electromechanical. A completely self-driving automobile would be self-aware and capable of making its own decisions [1]. For example, you may request that the car "drive me to work," but the automobile may decide to take you to the beach instead. A completely autonomous automobile, on the other hand, would take commands and then drive itself. 10 The terms self-driving and autonomous are frequently used interchangeably [2]. However, it's a little different. Although a self-driving automobile can drive itself in some, if not all, scenarios, a human passenger must always be there and ready to take charge.

Features of Self-driving car

An exemplar of a self-driving car is Google Waymo Project where the car is almost entirely autonomous. It still needs human presence but to only to retract when required. It isn't truly self-driving, but it can drive itself in perfect conditions. It has a great degree of independence [3]. Many of the automobiles on the market has a low level of autonomy but have some self-driving technologies. The self-driving features that are available:

Auto-pilot mode gives you hands - free steering makes your car to take control of the acceleration and brakes.

Adaptive cruise control (ACC) [4] maintains a certain distance between the cars near you.

Lane-centering steering stays in lane and when the car is parking the car stays in between the lanes.

It analyzes the RFID tag and proceeds according to the algorithm established in the control board, making important decisions in order to cover the distance in the shortest period of time. The sensors collect data and then send it to the main algorithm, which chooses the path to take. In this project, our car is completely self-sufficient and does not require any human intervention. We utilized the shortest-route algorithm, often known as Dijkstra's algorithm.

2. Related work

Vehicle route planning is a critical topic for automotive navigation systems. When constructing a path, it is more appropriate to consider the time was spent at intersections; hence, it is reasonable to study the path planning inherent problem with confluence features in mind. In this research study, we explore the issue in some kind of a predetermined network with the goal of reducing transit times from origin to destination. The shortest - path (SP) is a classical graph theoretical algorithm challenge in which the goal is to discover the shortest paths in an existing network .

Many real-world problems can be converted into shortest-path problems [5]. In 1959, the Dijkstra algorithm was introduced to resolve the shortest route issue. The Dijkstra algorithm is a well-known solution to single-source shortest path route issues. It stores the relationship between vertices and vertices in an adjacency matrix storage structure and traverses all vertices one by one. We propose a platform for self-driving cars that researchers and practitioners may use. Learners can also use the service also to study about self-driving self - driving technology and issues, while research teams can use it to test and iterate possibilities to self-driving car concerns [6]. Since this setup is minimal and simple, it is suitable for both teaching and research. This platform implements key technologies required for self-driving automobiles, such like computer vision and motion tracking. We'll start with a high-level review of how self-driving systems work. Designed to imitate self-driving commercial vehicles on a simpler, more realistic, and inexpensive scale has become a possibility as self-driving car platform becomes more widely available. This allows a greater range of individuals to collaborate on, evaluate, and enhance the technology utilized in today's [7] autonomous cars. When compared to self-driving automobiles at the industry level, this platform gives users access to the key technology used in autonomous vehicles. More enhancements may be done to better the model's similarity to manufacturing autonomous cars. Deep Reinforcement Learning has opened new avenues for tackling complicated control and navigation problems. The study shows how Deep Reinforcement Learning trajectory tracking and obstacle avoidance of self- driving automobiles may be applied to a simulated car in an urban area that used a Deep Q Network. As input, the methodology uses two forms of sensor data: a camera sensor and a laser sensor in front of the vehicle. It also provides a low high-speed automobile prototype that really can execute the same algorithm in real time. In the vehicle's front, a camera and a [8] Hokuyo Lidar sensor are used. It runs deep-learning algorithms based on sensor inputs on an integrated GPU (Nvidia-TX2). The autonomous car has been getting attention for over decade and continues to do so .Researchers, robotics groups, and the automotive sector have mostly been drawn to the autonomous car. Human driving is prone to mishaps. We're buzzed, drowsy, and fatigued. Road accidents, property loss, and casualties are produced by our inability to produce better on-road selections [9, 10]. The autonomous automobile gives us the ability to substitute human who are prone to accidents by offering comfort and safety.

3. Proposed work

This section gives the details about the modes for this prototype.

3.1. Self-driving mode

In this mode, Car don't require the any manual assistance. Car can take about the control. It is requiring the nine modules. Here we used ultrasonic sensor to avoid the obstacles by using ultrasonic waves, a RFID sensor which uses radio waves to activate the tag, Dijkstra's algorithm to calculate the shortest distance for car to travel, DC motors are used to rotate motors.

The Self-driving mode is achieved by the combination of 3 modules named as

- Object detection Module
- Tracking according to the map
- Following the instructions given by theAlgorithm

3.2. Self-parking mode

In this mode, it is used to parkthe car automatically by using nine modules. But we used Object Detection module and Motor module for the self-parking mode.

Input Signature:

- Inputs are given using RFID tags which is used within the organization
- This tag will deicide the destination of the car in the created map

Output Signature:

- Achieved by using the algorithm.

The fundamental purpose of this article is to effectively use new relevant techniques to solve the preceding problems and give real-time information about shipments to those other clients and packaging businesses. The proposed package tracking system is largely dependent upon radio frequency identification (RFID) advancements for shipping trains and is made up of two primary interconnected subsystems. The first subsystem is a wireless tracking system. Each product in this sub - system is barcoded and stored inside a box with an RFID tag identifier (ID), also the secondary segment is an internet communication system that receives and stores data from the very first subsystem and makes it available to all authorised parties. The simulation findings show that both users and support staff can log on visit the web through existing credentials to monitor their goods in real-time.

4. Workflow

It scans the RFID tag and moves according to the algorithm written in the control board and take decision in a way to reach the distance in a minimal time as shown in Fig.1. The sensors collect data and transmit it to the main algorithm, which then determines which path to go. In this project, our automobile is totally autonomous and does not require any human input. To do this, we used the shortest - path algorithm, commonly known as Dijkstra's algorithm.

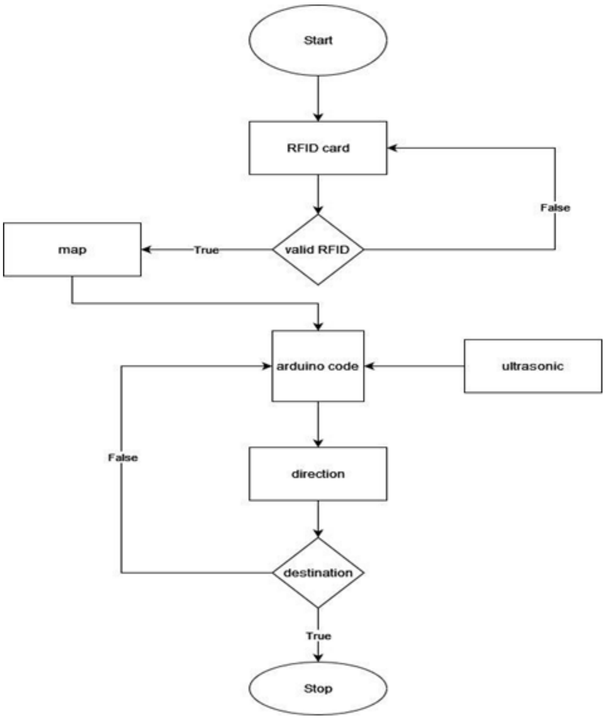

Figure 1. Block diagram of the proposed model.

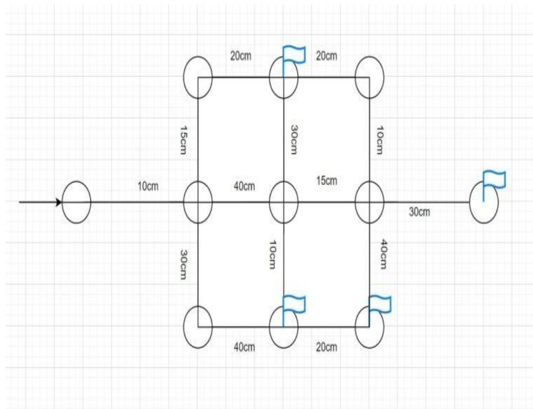

Figure 2. 2-dimensional eight-neighbor grid map.

5. Results & Analysis

This section shows the results and the analysis of the module.

As we can see in Fig. 2. from the starting point that's the arrow our algorithm that chooses the right and shortest way to the destination that is flag. Discovering the shortest distance from an independently determined starting point to a single target position is particularly useful in a variety of domains, such as partly or entirely settings or directing several robots from different starting points to proceed to the goal position. This study investigates a property on an eight-neighbor grid map it suggests an enhanced Dijkstra's algorithm (IDA) to address the problem. Especially tried to compare to the Dijkstra's technique, the characteristic we explored ensures that each site only needs to calculate once to discover the shortest paths to the objective point in IDA. The property we investigated assures that each location only needs to compute once to find the shortest distance to the goal point in Improved Dijkstra's Algorithm.

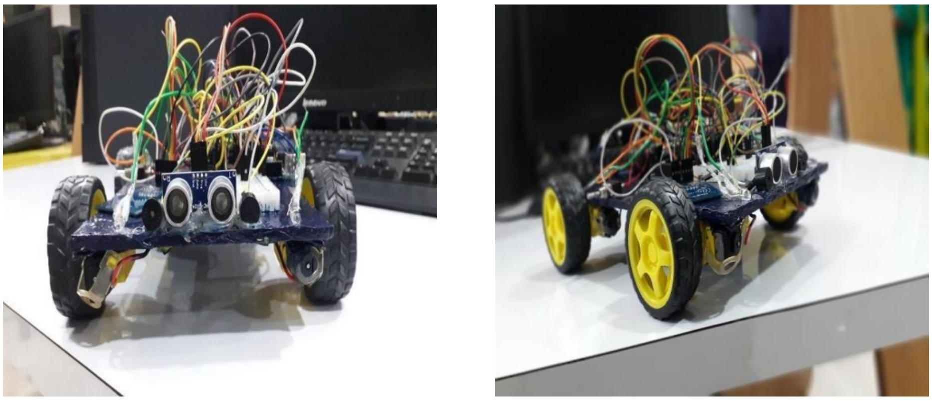

Figure 3. Prototype of Car module.

As we can see in the Fig. 3 which consists of RFID sensor, Ultrasonic sensor, DC motor, Arduino Mega 2560, Buzzer, L293D. We connected all the four DC motors to L293D driver module, and these L293D pins are connected to Arduino Mega 2560. This is done in an organization level in such a way that used in a enclosed environment. This can be achieved without any human instructions by using its algorithm reaches the destination in the shortest path.

6. Conclusion

We implemented a self-driving car prototype which takes input from humans, it travels and decides the destination subsequently in the best optimal path. We used a eight point grid map and observed that the car managed to avoid the obstacles placed in varies places by us. It achieved to reach the destination in shortest route inspite of the placed obstacles. This is cost-effective model to implement the tracking and delivering of the goods from one place to another place. In Future, we can implement an app to track these goods.

References

[1] Wang, J., Zhang, L., Huang, Y., Zhao, J., & Bella, F. (2020). Safety of Autonomous Vehicles. Journal of Advanced Transportation, 2020, 1–13. doi:10.1155/2020/8867757
[2] Kröger F. (2016) Automated Driving in Its Social, Historical and Cultural Contexts. In: Maurer M., Gerdes J., Lenz B., Winner H. (eds) Autonomous Driving. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-662-48847-8_3
[3] Bagloee, S.A., Tavana, M., Asadi, M. et al. Autonomous vehicles: challenges, opportunities, and future implications for transportation policies. J. Mod. Transport. 24, 284–303 (2016). https://doi.org/10.1007/s40534-016-0117-3
[4] PETERS, B. (2001). ADAPTATION EVALUATION. IATSS Research, 25(1), 51–60. doi:10.1016/s0386-1112(14)60006-6
[5] D. -D. Zhu and J. -Q. Sun, A New Algorithm Based on Dijkstra for Vehicle Path Planning Considering Intersection Attribute, in IEEE Access, vol. 9, pp. 19761-19775, 2021, doi: 10.1109/ACCESS.2021.3053169.
[6] J. Newman, Z. Sun and D. -J. Lee, Self-Driving Cars: A Platform for Learning and Research, 2020 Intermountain Engineering, Technology and Computing (IETC), 2020, pp. 1-5, doi: 10.1109/IETC47856.2020.9249142.
[7] T. A. O. Hassan, A. A. osman, S. D. Awadalkareem, I. G. A. Zurgani, R. S. M. Saadaldeen and R. M. Hassan, A Design of Packages Tracking System Based on Radio Frequency Identification, 2018 International Conference on Computer, Control, Electrical, and Electronics Engineering (ICCCEEE), 2018, pp. 1-6, doi: 10.1109/ICCCEEE.2018.8515832.
[8] L. Wenzheng, L. Junjun and Y. Shunli, An Improved Dijkstra's Algorithm for Shortest Path Planning on 2D Grid Maps, 2019 IEEE 9th International Conference on Electronics Information and Emergency Communication (ICEIEC), 2019, pp. 438-441, doi:

10.1109/ICEIEC.2019.8784487.
[9] K. -H. Chen and Y. -T. Lu, A Distance-Aware Technique for Object Detection Used in Self-Driving Vehicles, 2020 International SoC Design Conference (ISOCC), 2020, pp. 197-198, doi: 10.1109/ISOCC50952.2020.9333071.
[10] J. Lee, K. Park, S. Hong and W. Cho, Object Tracking Based on RFID Coverage Visual Compensation in Wireless Sensor Network, 2007 IEEE International Symposium on Circuits and Systems, 2007, pp. 1597-1600, doi: 10.1109/ISCAS.2007.378823.