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APPLICATION OF RFID FOR TRANSPORTATION

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***Abstract*—In this paper, we propose a systematic approach to designing and deploying a RFID Assisted Navigation System (RFIDANS)for VANETs. RFID-ANS consists of passive tags deployed on roads to provide navigation information while the RFID readers attached to the center of the vehicle bumper query the tag when passing by to obtain the data for navigation guidance. We analyze the design criteria of RFID-ANS and present the design of the RFID reader in detail to support vehicles at high speeds. We also jointly consider the scheduling of the read attempts and the deployment of RFID tags based on the navigation requirements to support seamless navigations. The estimation of the vehicle position and its accuracy are also investigated**.

***Index Terms*—RFID assisted navigation systems, vehicle networks, GPS, system design.**

I. INTRODUCTION

Autonomous robots are robots that can perform desired tasks in unstructured environments without continuous human guidance. Many kinds of robots have some degree of autonomy. Different robots can be autonomous in different ways. A high degree of autonomy is particularly desirable in fields such as space exploration, cleaning floors, mowing lawns and waste water treatment. To make a system autonomous we should consider two things without human guidance it can take decision in an unstructured environment. There are many different ways to make an autonomous robot. Some are being developed by human guidance also. This paper is the prototype of the Obstacles invariant navigation of An Autonomous Robot based on GPS. So here we have mentioned the different types of research methodology to combine in one platform to make easier and faster communication process in the autonomous field. Our main contribution is to introduce a prototype system that is autonomous, easier and cheap able in our surroundings. Various types of works like hospital management, Office management and any public place job which is like the human labor intensive and repetitive job can be implemented by autonomous vehicle robot easily. Robots are now widely used in many industries due to the high level of performance and reliability. Designing autonomous robot requires the integration of many sensors and actuators according to their task. Obstacle detection is primary requirement for any autonomous robot. The robot acquires information from its surroundings through sensors mounted on the robot. Various types of sensors can be used for obstacle avoiding. Methods of obstacle avoiding are distinct according to the use of different types of sensor. Some robots use single sensing device to detect the object. But some other robots use multiple sensing devices. The common used sensing devices for obstacle avoiding are infrared sensor, ultrasonic sensor, and laser range finder, charge - coupled device (CCD) can be used as the detection device. Among them infrared sensor (IR) is the most suitable for obstacle avoidance because of its low cost and ranging capability. The IR object detection system consists of the sender and receiver to measure the distance from the obstacle. The unit is highly resistant to ambient light and nearly impervious to variations in the surface reflectivity of the detected object. The paper is mentioned a type of IR sensors based wheeled mobile robot and mainly function as an obstacle avoidance vehicle. Intuitively, RFID-ANS complements to the current GPS navigation system when GPS signals are not available (such as in tunnels) or if the GPS position is ambiguous to a vehicle (such as at cloverleaf intersections). But in practice, GPS does not provide sufficient information for navigation due to its low positioning accuracy (5 to 7 meters).Moreover, even combined with map-matching technologies, GPS still cannot achieve lane level positioning and cannot provide information regarding the traffic direction in the current lane. Nevertheless, these information are necessary to prevent vehicles from entering a wrong way when roads are under construction or lanes are temporarily borrowed by the traffic along a different direction. Our RFID-ANS is designed to address such problems. Its convenience and benefits give incentives for users to install RFID readers on their vehicles. Additionally, RFID-ANS can be configured to provide electrical traffic signs. It might be essential to future autonomous vehicle systems as this system can provide more precise real time road information for traffic scheduling.

II. PROPOSED SYSTEM ARCHITECTURE

In this section we present the different components of the system and their functional description. A RFID system is composed of RFID tags and RFID readers. A RFID tag stores data, and a RFID reader accesses the tag to collect the data through wireless communications. There exist two types of RFID tags: active tags, which contain power modules to support wireless communications, and passive tags, which power their transmissions through the energy absorbed from the radio waves of the RFID readers. Compared to active RFID tags, passive RFID tags are easier to maintain as they do not need power, and their cost can be as low as several cents. Therefore, passive RFID tags are more appropriate for applications that require a large number of tags. These are IR obstacle detection and avoidance module: This is mainly working when an obstacle came in front of the vehicle.

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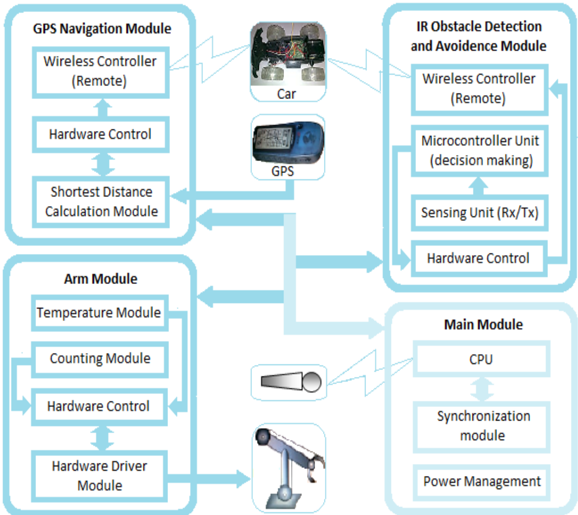

Fig 2.1 GPS navigation model

The working process of different modules are as follows:

- Sensing Unit (Rx/Tx): This unit mainly takes the information from the environment and sense whether any obstacle exists or not.
- Micro-controller Unit (decision Unit): Take the necessary decision according the result of the sensing unit.
- Hardware control: To perform the task from the command of the decision making unit.
- Wireless Controller: Perform the work according the input from hardware control.
- GPS navigation module: Navigate our vehicle according the result of the GPS. It is the combination of software and hardware module.
- GPS device (hardware): Here a GPS navigator is always navigates the current position of our vehicle and update the location time to time.
- Software module (calculate shortest distance): This gets the update information from the GPS device.
- Natural Language processing Unit: Here in this module CPU unit gets the command to start the autonomous robot instantly. This command is like “GO”, “STOP”, “LEFT”, and “RIGHT”.

III. IMPLEMENTATIONS OF RFID ASSISTED NAVIGATION SYSTEM MODEL

In our RFID-ANS model, passive RFID tags are deployed at the centers of the lanes and a RFID reader’s antenna is installed at the center of a vehicle’s front bumper, since this position exhibits the minimum error rate. We assume that a RFID tag can provide its physical position, the lane’s current traffic direction, and the road’s name, which can help the vehicle localize itself at a cloverleaf intersection or in a tunnel. A moving vehicle can obtain its current position through reading the tags when passing by. According to, a typical RFID reader’s read area is a function of its antenna’s height, read angle, and pitch angle. The design criteria of our RFID-ANS are explained as follows:

1. Each RFID tag should be covered by no more than one RFID reader’s read area at any instant of time.
2. Each RFID reader’s read area should cover no more than one tag at any instant of time.
3. If a vehicle is in a lane, the vehicle should be able to read tags that are deployed in the lane.
4. If a vehicle can read a tag, at least half of its body should be in the lane where the tag is deployed.
5. If less than half of a vehicle is in a lane, the vehicle should not be able to read any tag in the lane.
6. RFID tags should be deployed according to the road navigation requirements. In our study, navigation requirements are described by where and when a vehicle should successfully read tags.
7. A vehicle should schedule its read attempts such that the road navigation requirements can be satisfied and energy can be conserved.

Default Direction Algorithm-When the vehicle changes its current location then the controller calculates the default direction continuously, on every moment. Default direction helps to make a map for the shortest path on its goal. In this study, we use one kind of blind search that is described below. To find out the default direction it needs a subtraction of two types of angle, both ranges are 0 to 359 degrees, first is the angle (Goal) of the goal with XY axis, and second is the angle (Car) of the moving vehicle direction with XY axis which it gets from a built-in sensor. After getting two angles, the “Default Direction” can be found using this algorithm. It turns on default direction (left or right) when the angle difference is more than 15 degrees with the goal. The vehicle works with this process continuously.

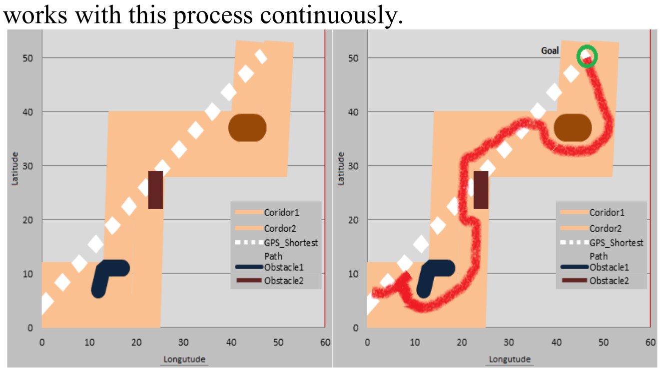

Fig 3.1 A sample corridor and its start state and goal state

Obstacle detection and avoidance algorithm-In this part, it uses four IR sensors to detect obstacles Those sensors are placed on the vehicles front side, front left side, front right side and back side. When it tries to move forward, if any obstacle prevents its movement it tries to turn its default direction on (if there is no obstacle prevention on that default direction). If there are obstacle prevention on that default direction, it tries to turn the opposite direction on of the default direction and this turning on is a continuous process before frequently moving forward to the goal. If turning or moving is not possible then it tries to move backward, otherwise it stops. It moves backward until it can turn toward left or right (if it moves forward, it goes back to the previous location unnecessarily). Every moment, the vehicle controller calculates the default direction continuously.

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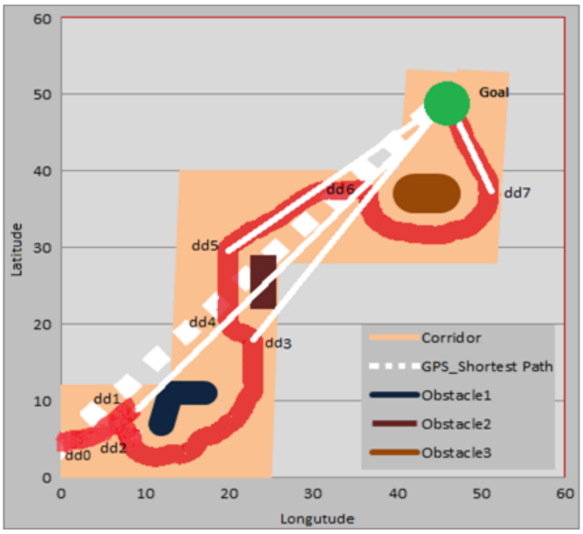

Fig 3.2 The graphical part of the start and goal state.

Adaptive Scheduling of the RFID Reader's Read Attempts-In this section, we propose approaches to adaptively scheduling a RFID reader's read attempts such that the vehicle can read the RFID tags with a high success rate. Assume that tags have been deployed based on the road navigation requirements. A straightforward and effective scheduling method is to keep sending read attempts. However, when tags are sparsely deployed, the drawbacks of this approach are obvious because of its low success rate and high energy waste resulted from unnecessary read attempts. Although the energy consumption of making read attempts is not comparable to that of the vehicle alternator, the accumulative power waste from failed readings of all vehicles could be a large value that should not be ignored. Moreover, in the scenario where multi vehicles are heading for the same lane or on a curved road, the probability of a read collision is large if all vehicles employ this straightforward method. Therefore, an ideal read scheduling method should be able to estimate the distance between two consecutive tags and be adaptable to different road segments where the distances between two tags might vary. Generally speaking, read scheduling seeks to determine when RFID readers should send read attempts. According to Section 4.3, vehicles should not attempt to read tags when they are completely stopped. Moreover, they should reschedule their readings after they change lanes or enter new road segments. We assume that a lane change can be detected through monitoring wheel revolutions; and the system can be aware of the event via digital maps that a vehicle is entering a new road. Therefore, we focus on scheduling the read attempts when a vehicle stays in its lane. We start from a time at which a read attempt reaches a tag and results in a successful data read operation. A vehicle is aware of its RFID reader's setting, therefore it can calculate the length of a tag's successful read area, as illustrated by the shadowed area shown in Fig. 1a. The vehicle can successfully obtain the data from a tag if it schedules its read attempt in the successful read area. The length of the successful read area, Lsuccess, is calculated by (5), where L0min is the minimum read length determined by the current vehicle speed. Note that L0min increases with the vehicle's speed, as a result Lsuccess becomes smaller if the vehicle is speeding up given Lread. Thus, it is believable that a speeding vehicle would slow down to get a larger chance of successfully utilizing the RFID-ANS service. The computation of L0min is detailed in the supplementary file,
available online.
Lsuccess = Lread _ L0min: ð5Þ

Vehicle position estimating-We assume that a vehicle can estimate its position as soon as it successfully reads a tag. As mentioned above, the vehicle does not know the exact time at which its front bumper passes a tag even if it can obtain the tag's position Ptag.Therefore, as shown in Fig. 4b, the vehicle should not simply use Ptag as its current position Pvehicle. We use to estimate a vehicle's position. The position error is bounded by Lsuccess2 , which is less than half of the lane width. Therefore, RFID-ANS can achieve lane level navigation. For a detailed discussion about the vehicle position estimation, please see the supplementary file, available online.
Pvehicle = Ptag--Lsuccess/2

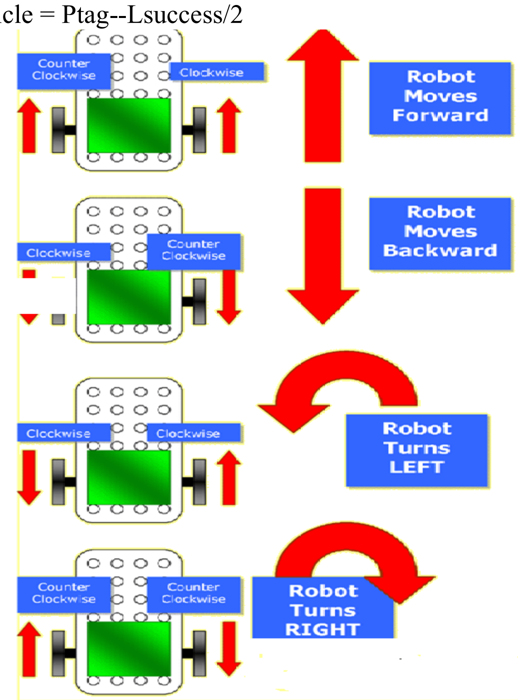

Fig 3.2 Conventional GPS sensor model

Conventional GPS sensor model-The Global Positioning System (GPS) became a synonym for satellite-aided global localization systems. GPS currently consists of 31 satellites orbiting at about 20, 000 km providing global coverage with free access for civilian usage. Anywhere in the world at least six satellites are visible at all times. The signals of four satellites are necessary for a GPS receiver to estimate its position. There are two major factors acting the accuracy of GPS. a) The geometric constellation of the satellites represented by a numeric value termed Dilution of Precision (DOP). b) The errors in the pseudo range estimation, referred to as user-equivalent range error. Map Generation After getting the required at least six satellites signal response from the GPS as drawing a map of the current location of our autonomous robot. The Unscented Kalman Filter (UKF) Let Xt be the state, Ut the control input, and Zt the observation at time t. Furthermore, assume that state transitions are given by a function g and observations by a function h, both corrupted by Gaussian noise. That is, Xt = g(Xt 1, Ut 1) + t , (1)Zt = h(Xt) + t , (2) Where t and t are zero-mean Gaussian

IV. SIMULATION

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In this section, we report our simulation results obtained from the example RFID-ANS mentioned in Section 7. We use two settings for Dtag. One thousand tags are placed in a straight line, where Dtag is changed alternatively once every 50 tags. We add a tag deployment error to each tag, which represents the shift from the tag's real position to its expected position. A virtual vehicle is employed in our simulation study to test the performances of the proposed RFIF-ANS. In this study, we setD0 ¼ 0:9 _ L success. The results indicate that more than 97 percent of the deployed tags can be successfully read by the vehicle, that almost 80 percent of the scheduled read attempts can yield successful reads, and that the position error is always upper bounded by 2 feet. The details on our simulation results are reported in the supplementary file, available online.

V. RESULT

In this section we discuss about our experiential result. At first controller calculate the default direction. Every obstacle positions the GPS and the IR working independently. According the priority of the calculation our autonomous vehicle has to take decision what is the right choice of the right time.Every circle position is the decision making approach where the vehicle turn the current position to take the right decision to pass shortest path as the time pass. We have taken here eight sample position where the vehicle have to take the decision in which directions is the right at the different position of the vehicle.Such that transportation of goods from one place to another place can be done and used in international park for transportation.

VI. CONCLUSION

In this paper we presented a prototype for an autonomous robot which is based on GPS navigation. We design a new approach of autonomous robot and implement it on the real life implementation. We have developed such a system easier to control, easier to maintenance and friendly for environment. Our mainly focused of the general people adapted with the robotic environment to transport the goods from one place to another and as autonomous car in parks using RFID as the guidance.

VII. REFERRENCE

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