ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 3, Special Issue 15, March 2016

NAVIGATION AND GPS BASED PATH CONTROL OF AN AUTONOMOUS VEHICLE

VINOTHINI L
II- M.E. (EMBEDDED SYSTEM TECHNOLOGIES), DEPT OF ECE, VIVEKANANDHA INSTITUTE OF ENGINEERING AND TECHNOLOGY FOR WOMEN, TIRUCHENGODE, NAMAKKAL
itsmevinothini@gmail.com

Mrs.S.GEETHA M.E.,
ASSISTANT PROFESSOR, DEPT OF ECE, VIVEKANANDHA INSTITUTE OF ENGINEERING AND TECHNOLOGY FOR WOMEN, TIRUCHENGODE, NAMAKKAL

Abstract— In this paper the navigation and GPS based trajectory control of an unmanned autonomous vehicle is introduced. The caterpillar tread like mobile vehicle with duo cycle drive is equipped with a mobile GPS and micro controller. To get accurate position data, a DGPS (Differential GPS) with a local base station is used. In order to let the vehicle to follow a desired trajectory, a reference path is given by using Way Points as GPS data's to micro controller, which provide the position and orientation control of the vehicle. The instant position and orientation of the vehicle in accordance to an assigned plane coordinate frame are calculated by micro controller from detected latitude and longitude values (land coordinates) of mobile GPS, which receive corrected on line data's from base station. The duo cycle vehicle is driven with geared DC motors, which are equipped with chained caterpillar tread drives, so that it can have better motion, clambering and tracking performances. Successful navigation and path following results are obtained with several experiments by various control applications.

Index Terms—**Automatic control, LabVIEW, Remote control, Sensors.**

I.INTRODUCTION

An autonomous vehicle, also known as a driverless vehicle, self-driving vehicle is an vehicle capable of fulfilling the human transportation capabilities of a traditional vehicle. As an autonomous vehicle, it is capable of sensing its environment and navigating without human input. Autonomous vehicles sense their surroundings with such techniques as radar, lidar, GPS, and computer vision. Advanced control systems interpret sensory information to identify appropriate navigation paths, as well as obstacles and relevant signage. Some autonomous vehicles update their maps based on sensory input, allowing the vehicles to keep track of their position even when conditions change or when they enter uncharted environments.

Navigate in its environment is one of the most important capabilities. In general, the navigation task can be defined as the combination of three basic competences: localization, path planning and vehicle control. Localization denotes the robot's ability to determine its own position and orientation (pose) within a global reference frame. Path planning defines the computation of an adequate sequence of motion commands to reach the desired destination from the current robot position. Due to its planning component, path planning is typically done before motion. The planned path is followed by the robot using feedback control. This controller includes reactive obstacle avoidance as well as global path preplanning.

Jonathan Petit et al. investigated the potential cyber attacks specific to automated vehicles, with their special needs and vulnerabilities and analyze the threats on autonomous automated vehicles and cooperative automated vehicles. An attacker who is able to infiltrate virtually any electronic control unit (ECU) can leverage this ability to completely circumvent a broad array of safety-

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 3, Special Issue 15, March 2016

critical systems. They demonstrate the ability to impose hostile control over a wide range of automotive functions and completely ignore driver input, including disabling the brakes,selectively braking individual wheels on demand, and stopping the engine. However, their attack provides a limited degree of automation as it does not control steering or acceleration. remote exploitation is feasible via a broad range of attack surfaces (including mechanics tools, CD players, Bluetooth, and cellular radio),and furthermore, that wireless communications channels allow long distance vehicle control, location tracking, in-cabin audio exfiltration and theft[1].

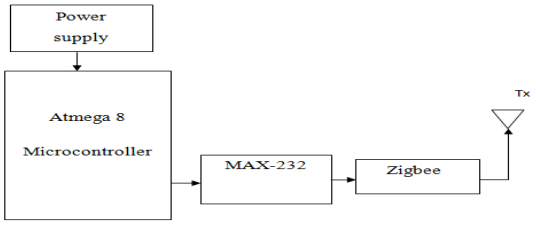
[2]Unsupervised algorithms automatically calibrates our 64-beam rotating LIDAR with accuracy superior to tedious hand measurements. Improved perception and recognition algorithms now enable Junior to track and classify obstacles as cyclists, pedestrians, and vehicles; traffic lights are detected as well. [3]Driver-assistance systems already help make vehicle navigation safer and more comfortable .An increasing amount of traffic on the streets causes congestion and environmental pollution.[4]demonstrated practical controller are network (CAN) bus attacks ,where an attacker can manipulate electric window lifts, warning lights, and the airbag control system.

In order to assess these threats we introduce a model of attacks on an inter-vehicle communication system and identified several difficult to detect attacks on the hard- and software, and on the sensor input[5]. Basic traffic data is largely based on road sensors embedded in the pavement. Such sensors mostly use inductive loop detectors (ILDs) and are able to measure temporal traffic characteristics[6].

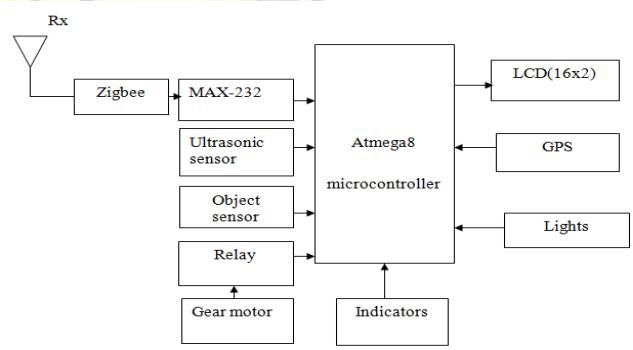
In [7] and [8], present multisensor data fusion and data clustering techniques that enable data categorization. Then, in function of the category of data considered, different protection strategies are developed.In this paper, a less hardware, low-cost, flexible, and vehicle to infrastructure communication with zigbee is presented. Section II provides detailed implementation of the developed system; Section III presents the working methodology of the system; Section IV & V presents the results and the Conclusion of the work.

II SYSTEM DESCRIPTION

The system has been designed for measurement of electrical parameters of household Road accidents account for for a severe threat to human lives from both an injury as well as financial perspective. Fig. 1 shows the functional description of the developed vehicle to infrastructure communication.



a) Transmitting Section(Infrastructure)



b) Receiving section(vehicle)

Fig 1. Functional block diagram of vehicle to infrastructure communication

Vehicle-to-Infrastructure(V2I) Communications for Safety is the wireless exchange of critical safety and operational data between vehicles and roadway infrastructure, intended primarily to avoid motor vehicle crashes. Ultrasonic sensor is also known as transducers they both send and receive the signal. It works on the principle similar to radar or Sonar which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively.
The zigbee module is interconnected with the eight bit microcontroller. The CMOS logic is used between the Microcontrollers and zigbee module, the information is transmitted and received using ZigBee.

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 3, Special Issue 15, March 2016

III WORKING METHODOLOGY

Vehicle communication systems permit the occupants of a moving vehicle to communicate with the rest of the world using the cellular telephone network. These systems enable voice and data communications for personal and business purposes as well as communications for traffic monitoring, navigation, diagnostics, entertainment and safety applications. Many new vehicles on the market today come with systems that are connected to communication services provided by the automobile manufacturer. With these systems, drivers can get in touch with a 24/7 customer service provider either at the touch of a button or automatically in the case of an accident.

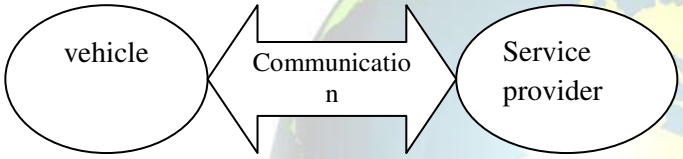


Fig 2 Basic description of V2I communication

Services like GM's On Star and Ford's Sync employ a GPS system to continuously monitor the position of the vehicle, while also keeping track of the vehicle's operational status. They also allow the occupants of the vehicle to initiate phone calls, enable the vehicle to send diagnostic information, and are capable of calling emergency services in the event of a severe accident. Christo Ananth et al. [10] discussed about Intelligent Sensor Network for Vehicle Maintenance System. Modern automobiles are no longer mere mechanical devices; they are pervasively monitored through various sensor networks & using integrated circuits and microprocessor based design and control techniques while this transformation has driven major advancements in efficiency and safety. In the existing system the stress was given on the safety of the vehicle, modification in the physical structure of the vehicle but the proposed system introduces essential concept in the field of automobile industry. It is an interfacing of the advanced technologies like Embedded Systems and the Automobile world. This "Intelligent Sensor Network for Vehicle Maintenance System" is best suitable for vehicle security as well as for vehicle's maintenance. Further it also supports advanced feature of GSM module interfacing.

A. Measurements of Electrical Parameters

1)Ultrasonic Measurement: Different techniques can be used to measure the distance by using ultrasonic sensors. Among them , continuous-wave and pulse-echo technique are widely known. In continuous-wave methods, the transmitter generates a continuous output, whose echo is detected by a separate receiver. In this case, accuracy depends on the measurement of the phase shift between the transmitted and the reflected wave.

2) Infrared Measurement: An infrared sensor is an electronic instrument which is used to sense certain characteristics of its surroundings by either emitting and/or detecting infrared radiation. Infrared sensors are also capable of measuring the heat being emitted by an object and detecting motion**..** Infrared tracking, or infrared homing, is a missile guidance system which operates using the infrared electromagnetic radiation emitted from a target in order to track it. These missile systems are often known as 'heat-seekers' as infrared is radiated strongly by hot bodies such as people, vehicles and aircraft.
Infrared detectors are used in order to detect the radiation which has been focused. The output from the detector is usually very small and hence pre-amplifiers coupled with circuitry are required to further process the received signals.

3) Global Positioning System: Used for localization and positioning on the integrated map. We assume that the vehicle includes multiple GPS2 (e.g., one GPS for navigation display and one for automation).
In typical GPS operation, four or more satellites must be visible to obtain an accurate result. The current GPS consists of three major segments. These are the space segment (SS), a control segment (CS), and a user segment (US). The navigational signals transmitted by GPS satellites encode a variety of information including satellite positions, the state of the internal clocks, and the health of the network. These signals are transmitted on two separate carrier frequencies that are common to all satellites in the network

4) *Zigbee*: ZigBee is the name of a specification for a suite of high level communication protocols using small, low-power digital radios based on the IEEE 802.15.4-2006 standard for wireless personal area networks (WPANs), such as wireless headphones

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 3, Special Issue 15, March 2016

connecting with cell phones via short range radio. The technology is intended to be simpler and less expensive than other WPAN's, such as Bluetooth

- Microcontroller combined with a miniature transceiver a small amount (ex. 32 KB) of flash memory and RAM.
- The XBee module is interconnected with the eight bit microcontroller.
- The CMOS logic is used between the Microcontrollers and XBEE module, the information is transmitted and received using ZigBee.

Types of zigbee:
ZigBee Coordinator (ZC): The most capable device, the coordinator forms the root of the network tree and might bridge to other networks. There is exactly one Zigbee coordinator in each network since it is the device that started the network originally. It is able to store information about the network, acting as the Trust Centre.

ZigBee Router (ZR) : It can act as an intermediate router, passing data from other devices.

B. Atmega8 microcontroller

ATmega8 is a low-power CMOS 8-bit microcontroller based on the AVR RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega8 achieves throughputs approaching 1 MIPS per MHz, allowing the system designer to optimize power consumption ver- sus processing speed.

Atmega 8 microcontroller has 23 programmable input/output (I/O) pins which can be used for interfacing with external world. It is possible to configure the input or output by setting a particular register value through programming. This IC comes in3 different packages but were using the popular 28 pin PDIP package(atmega 8-16 PU).An Arduino board consists of an Atmel 8-bit AVR microcontroller with complementary components to facilitate programming and incorporation into other circuits. An important aspect of the atmega8 is the four time faster than other microcontroller.

D. Autonomous lawn moving

Autonomous lawn mowing consists of us in the above-mentioned behaviors in a systematic way. To autonomously mow a lawn the following flow chart is followed

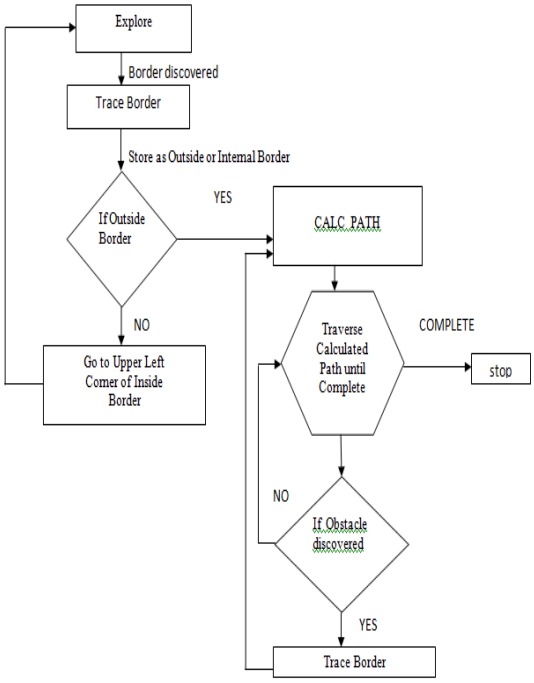


Fig 3. Flow chart for Autonomous Lawn Mowing

V2I applications can be designed to help improve critical safety situations. Potential V2I Safety Applications crash scenario mitigation opportunities.

- intersection safety
- roadway departure prevention
- speed management
- transit safety and operations
- commercial vehicle enforcement and operations
- at-grade rail crossing operations
- priority assignment for emergency vehicles

IV SIMULATION ENVIRONMENT RESULTS

The screen shots below provides simulation output of navigating and control of an autonomous vehicle using proteus(simulation tool).using navigational algorithm

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 3, Special Issue 15, March 2016

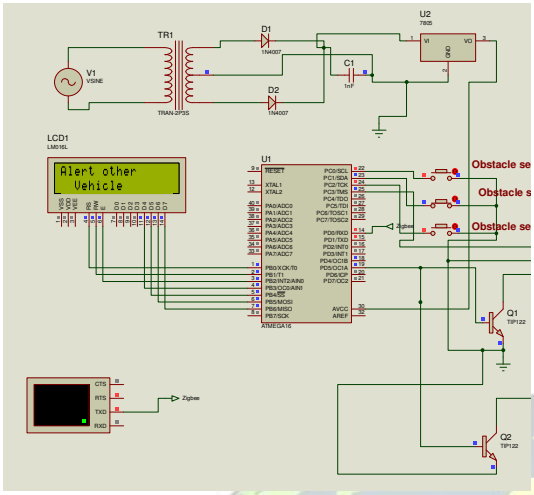


Fig 4 Shows the result of alert other vehicle

Navigation and control serves as the major limitation of the overall performance, accuracy and robustness of an autonomous vehicle. PROTEUS VSM- interactive circuit simulation into the design environment. For the first time ever it is possible to

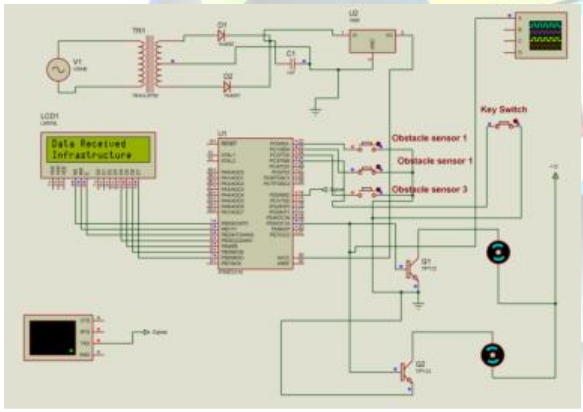


Fig 5 .shows data received from Infrastructure

draw a complete circuit for a microcontroller base d system and then test it interactively, all from within the same piece of software . Meanwhile ISIS retains a host of features aimed at the PCB designer ,so that the same design can be exported for production with PCB layout software.

V CONCLUSION

Object tracking can be widely used for vehicle navigation, such as path planning and obstacle avoidance capabilities. Whether it be through transport, industry or research applications, autonomous and unmanned vehicles have great potential to change the world we live in. In order to achieve a widespread take-up of this machinery, the hurdles to overcome are not so much technological but questions of safe and practical implementation.

REFERENCES

[1] Geiger A., Martin Lauer, Frank Moosmann, Benjamin Ranft, Holger Rapp, Christoph Stiller, and Julius Ziegler., 'Team AnnieWAY's Entry to the 2011 Grand Cooperative Driving Challenge', IEEE Trans. Intell. Transp. Syst., vol. 13, no. 3, pp. 1008–1017, Sep. 2012.

[2] pachinko A and Pimenidis A,'Towards practical attacker classification for risk analysis in anonymous communication', in Proc. 10th IFIP TC-6 TC-11 Int. Conf. CMS, 2006, pp. 240–251

.

[3] Aijaz A, Bernd Bochow, Florian Dotzer, Andreas Festag, Matthias Gerlach, Rainer Kroh and Tim Leinm¨uller., 'Attacks on inter vehicle communication systems—An analysis', in Proc. 3rd Int. WIT, 2006, pp. 189–194.

[4] Ernst D. Dickmanns (2002) 'Expectation-based, multi-focal, saccadic (EMS) vision for ground vehicle guidance' Control Engineering Practice 10 (2002) 907–915.

[5] Onishi H. 'Paradigm change of vehicle cyber security',in Proc. 4th Int.Conf. CYCON, 2012, pp. 1–11.

[6] Levinson J. 'Towards fully autonomous driving: Systems and algorithms', in Proc. IEEE IV Symp., 2011, pp. 163–168.

[7] Jonathan Petit and Steven E. Shladover 'Potential Cyberattacks on Automated Vehicles',IEEE

transactions on intelligent transportation systems, vol. 16, no. 2, april 2015.

[8] Faouzi N-E E. Leung H, and Kurian A, 'Data fusion in intelligent transportation systems: Progress and challenges—A survey', Inf. Fusion,vol. 12, no. 1, pp. 4–10,Special Issue on Intelligent Transportation Systems, 2011.

[9] Shladover S.E Charles A. Desoer. 'Automated vehicle control developments in the PATH program', IEEE Trans. Veh. Technol., vol. 40, no. 1, pp. 114–130,Feb. 1991

[10]Christo Ananth, C.Sudalai@UtchiMahali, N.Ebenesar Jebadurai, S.Sankari@Saranya, T.Archana, "Intelligent sensor Network for Vehicle Maintenance system", International Journal of Emerging Trends in Engineering and Development (IJETED), Vol.3, Issue 4, May 2014, pp-361-369

[11] Bibmeyer N, Petit J, and Bayarou C M, 'CoPRA: Conditional pseudonym resolution algorithm in VANETs', in Proc. 10th IFIP/IEEE Annu. Conf. WONS, 2013, pp. 9–16.

[12] Raya M and Hubaux J P. 'Securing vehicular Ad Hoc networks', J. Comput. Security, vol. 15, no. 1, pp. 39–68, Jan. 2007.

.