ECO AUTONOMOUS PASSO – 4 (EAP-4) using Senors and LiDARs

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ABSTRACT

A passenger vehicle which is to be used inside the college campus for local transportation purpose. Such as: Medical aid for students and staff, Campus tour Etc. This vehicle will also be designed as an UMV, which is programmed to perform all the tasks that a driver can do and it is also fully automated from the start to parking. Further enhancements can be made to this project by adding some features, by which the UMV can be controlled fully by an android application from a mobile handset. Objective of the project, Vehicle which is capable of sensing its environment and navigating without human input, Fully automatic: the vehicle is intelligently designed to monitor roadway conditions and act solo, with safety-critical driving functions for a trip, Electric vehicle powered both by direct solar energy and battery powered, Creates pollution free campus, Sensor systems will be incorporated for automation that potentially perceive the environment better than human senses, The trips map will be fed in the console and based on that selections of route the UMV can transport automatically.

Keywords— ECO, LiDAR, Sensors, UMV, Autonomous.

I. INTRODUCTION

An autonomous vehicle, comprising plurality of sensors configured to detect environmental information associated with the autonomous vehicle. The overview of this project is to implement a driverless car that can drive itself from one point to destination without assistance of a driver. An autonomous vehicle is fundamentally defined as a passenger vehicle.

A completely autonomous vehicle is one in which a computer performs all the tasks that the human driver normally would. Ultimately, this would mean getting into the car, entering the destination into a computer and enabling the system. From there, the car would take over and drive to the destination with no human input.

Vehicle uses auto charging mechanism by electricity or solar energy. Due to use of solar energy the power consumption is reduced. The vehicle has the feature of auto parking that is it parks itself without assistance of human. It provides medical support for the disable and sick people. The vehicle is used for campus tour. The vehicle is automatically navigated towards the charging terminal in the parking shed. The vehicle uses GPS and LiDARs for navigating and to know the width of the road respectively.

Sensor technology could potentially perceive the environment better than human senses, seeing farther ahead, better visibility, detecting smaller and more suitable obstacles, more reasons for less traffic accidents. This vehicle will also be designed as an UMV, which is programmed to perform all the tasks that a driver can do and it is also fully automated from the start to parking.

The vehicle body is made up of lightweight aluminum, the frame structure is of MS(mild steel) materials. Front and rear end are covered with white fiber glass and the top is arranged by solar panels. There are two display placed in front and rear for both controlling and navigation.

The display is of 15 ″ LED.

There are five different modules involved in developing this project and they are Module 1: Where we design the structure of body building, Module 2: The power system with Li-ion Battery operated, Module 3: Which describes the drivers used, Module 4: It involves the GPS and navigation technology and Module 5: Circuit designing and programming for the sensor devices.

II. RELATED WORK

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Even as India goes green, lack of uniform standards for setting up charging stations is holding back companies. Alnoor Peermohamed reports.

India's bullish plans to switch over completely to electric mobility by 2030 might have caught the eye of Tesla Motors CEO Elon Musk, but there are several issues that require the government's intervention if this pipe dream needs to turn into reality. Retail sales of electric vehicles in India is almost negligible today, despite both the Centre and some state governments subsidizing the cost of these vehicles. Delhi, for instance, offers ₹1.5 lakh additional subsidy over the Union government's FAME benefit, yet adoption in the city by consumers remains low. The high cost of electric vehicles isn't the only thing hindering their sales. The infrastructure needed for charging these vehicles is inadequate, none of the large original equipment makers are currently present in the space save for Mahindra & Mahindra. In the two-wheeler market, customers do have a few options, but the products are mostly substandard.

"A flat subsidy incentivizes low-spec vehicle manufacturing disproportionately, since it makes the end-customer price for low-spec products very attractive. In a category that doesn't have high awareness and understanding amongst consumers, it creates the impression that electric vehicles are low end and compromise products," says Tarun Mehta, co-founder and CEO of Ather Energy.

While the government has been offering subsidies on electric vehicles from April 2015, it still has not introduced a standard for charging infrastructure. Work to define these standards, or Bharat Charging Standards as they have come to be known, is still on, with the government actively asking for the participation of the industry in defining them. The reason it is important for charging standards to be set in stone is that all players -- original equipment makers, charging station providers -- will then be able to build on it and crystallise their plans. Right now, the lack of any standards is holding back companies from making large investments in the space. They fear the infrastructure they set up right now might become redundant once the standards are introduced.

"A standardized charging unit allows the country to develop a robust, extensive and reliable infrastructure. At the same time, it allows people more variety of electric vehicles to choose from since all vehicles have a standard charging feature. Electric vehicle owners don't have to worry about charging infrastructure for each individual brand," says Mahesh Babu, CEO, Mahindra Electric.

Industry players expect the new standards to be decided on quickly, going by the vigour they claim to see in the way the Union government is pushing for electric mobility. Chetan Maini, the founder of India's first electric car company, Reva, believes that some of the government's bullishness comes from the fact that India has been able to crack the renewable power game. Deals by states to buy energy produced through renewable sources have dropped to under ₹3 per unit. This low-cost, localised energy source if used to power vehicles could save the government billions that it today spends in import of oil for feeding the country's growing demand for petrol and diesel.

"India's plans to go fully electric by 2030 and its investments in solar energy are linked. Renewable energy will be brought into mobility and displace oil. Industries can be changed in ten years. Even if we achieve 90 or 80 per cent of this goal, it will have a huge impact. It's all about getting the country to move in the right direction," says Maini.

Even if India manages to put in place all the infrastructure and policies to support fully electric mobility by 2030, the feasibility of the plan hinges a lot on the cost of lithium ion batteries. Today, batteries powering electric cars are the single most expensive part. The trend of falling costs of lithium-ion batteries over the past few years, however, is lending optimism to the future of electric vehicles. A McKinsey study estimated that the cost of lithium ion batteries had fallen from over $1,000 per kWh to $227 per kWh in 2016. By the end of this decade, the cost of batteries could drop below $190 per kWh, and by 2030 could fall below $100 per kWh.

"The cost of batteries has come down by nearly 15 per cent year-on-year for the past three years and if you extrapolate that curve, it's quite amazing what's possible in the next few years. But don't just look at that. The cost of renewable energy in some of the recent deals has been fixed at ₹2.44 per unit, and that cost is locked for the next 10 years," adds Maini.

III. BODYBUILDING

Materials Used: The materials used are aluminum, mild steel, fiber glass and solar panels.

Design: (Approx Beta Version)

BATTERY

The lithium-ion batteries **Li-Ion** usually have a nominal voltage of 3.6V or 3.7V., The **LiFePO4** have a nominal voltage of about 3.2V or 3.3V and the lithium-polymer. **Li-Po** batteries have a nominal voltage of 3.6V per cell.

With **Li-ion and LiPo** batteries the recommended per-cell safety zone is usually between 3V (fully discharged) and 4.2V (fully charged), although they can normally discharge down to about 2.8V without any problems. Discharging below that level may cause irreversible/irreparable damage. Therefore, these batteries often feature a built-in safety mechanism, preventing over-discharging. Conversely, overcharging can also be dangerous. The **Li-Po** batteries have lower number of recharging cycles than LiFePo4 **(1000@0.2C rate, IEC Standard**). The projected/estimated life of a Lithium-Ion battery is approximately 3 years from production.

LiFePO4:

The **LiFePO4** batteries exhibit slightly different properties: They have a bit lower operating voltage of about 3.2V – 3.3V, the minimum discharge voltage is 2.8V and the maximum charged voltage is 3.6V. The **LiFePO4** is a kind of Li-Ion rechargeable battery intended for high power applications, such as EV cars, electric bike, Power Tools and RC hobby. The **LiFePO4** batteries have more constant discharge voltage and are considered to **offer better safety** than other Lithium-based batteries. Other advantages of the Lithium-based rechargeable batteries include the ability of a much faster recharge and higher discharge rates than other chemistries mentioned and usually higher number of recharge cycles **(>2000@0.2C rate, IEC Standard)**, meaning longer life when not fully discharged, but its energy density is lower than normal Li-Ion cell (Li-Co).

LiFePO4 life expectancy is approximately 5-7 years.

Comparison:

	LiPo / Li-Ion			**LiFePO4**		
Nominal Voltage	**No. of cell S**	**Voltage S x 3,6V**	**Charging Voltage S x 4,2V**	**No. of cell S**	**Voltage S x 3,3V**	**Charging Voltage S x 3,6V**
12 V	**4**	14,4	16,8	**4**	13,2	14,4
24V	**7**	25,2	29,4	**8**	26,4	28,8
36V	**10**	36,0	42,0	**12**	39,6	43,2
48V	**13**	46,8	54,6	**16**	52,8	57,6
60V	**16**	57,6	67,2	**20**	66	72,0
72V	**19**	68,4	79,8	**24**	79,2	86,4

Why choose LiFeP04?

- High power: Higher charge and discharge rate for better performance and efficiency.
- High energy density.
- Excellent safety: Superior abuse tolerance.
- Extended cycle life: Long battery life in both deep and shallow cycling.
- No memory effects.
- Low self-discharge rate: less than 5% per month.
- Wide working temperature range: -20°C--60°C.
- Light weight: lighter 1/3 than the lead-acid batteries.
- Environmental friendly.

SOLAR PANEL

Monocrystalline:

The technology that started monocrystalline panels originated in the 1950s. The cells are cut from silicon in a cylindrical fashion, and each cell looks like a wafer. Combined tens of wafers make up a monocrystalline panel.

Advantages

Monocrystalline panels are generally constructed from high-quality silicon, giving them the highest performance rates in the industry, usually up to 21 percent. By comparison, monocrystalline panels outperform thin film by four to one. They also make wise use of space, so they offer a high-power yield per square foot. Warranties often last for 25 years and these panels perform better in low-light conditions than their poly-counterparts.

Disadvantages

The disadvantages of this panel type are significant: Because they are high-quality, these panels are also costly. Circuit break down is common when the panel is obstructed or shaded. The manufacturing process produces significant waste. The panels perform best in warm weather, with performance decreasing as temperatures increase.

Polycrystalline:

While monocrystalline and polycrystalline panels are both manufactured from silicon, instead of cutting out wafer shapes, manufacturers pour silicon into a mold to form polycrystalline panels.

Advantages

High temperature ratings are slightly lower than those for monocrystalline panels; however, the difference is minor, making these types of panels a good option for many homeowners.The manufacturing process produces little waste, and the technology allows for a cost-effective panel.

Disadvantages

Efficiency is lower, typically between 13 and 16 percent, which is not nearly as high as the ratings for monocrystalline panels. The panels require more space when installed to produce the same electrical output as a panel constructed from monocrystalline.

Thin-Film Solar Panel:

Manufacturers construct thin-film solar panels by putting down layer upon layer of a photovoltaic element, such as amorphous silicon or organic photovoltaic cells.

Advantages

The advantages of thin-film panels are many but generally don't outweigh the disadvantages. These panels are lightweight, they are generally immune to problems from shading or obstructions and low-light conditions generally don't hinder their performance. These panels are easy to mass produce, so they are an affordable option.

Disadvantages

On the other hand, thin-film solar panels come with a number of weighty downsides, including these:

Efficiency: Most thin-film panels score very low in terms of performance, hovering between 7 and 13 percent, with an average operating efficiency of about 9 percent.

Space: These panels generally require a lot of space. For commercial applications, they often make sense. For most residential installations, where space is tight, they don't work.

Cost: Due to the number of panels required for this type of system, associated costs are also higher because you'll need to purchase more support elements, cables and so forth to accommodate the system.

Life span: In most cases, thin-film panels don't last long and quickly succumb to the effects of weatherization. You typically won't find a manufacturer offering a long warranty to go along with a thin-film panel.

Comparison table:

	Monocrystalline	Polycrystalline	Amorphous	CdTe	CIS/CIGS
Typical module efficiency	15-20%	13-16%	6-8%	9-11%	10-12%
Best research cell efficiency	25.0%	20.4%	13.4%	18.7%	20.4%
Area required for 1 kWp	6-9 m2	8-9 m2	13-20 m2	11-13 m2	9-11 m2
Typical length of warranty	25 years	25 years	10-25 years		
Lowest price	50 ₹/W	40 ₹/W	45 ₹/W		
Temperature resistance	Performance drops 10-15% at high temperatures	Less temperature resistant than monocrystalline	Tolerates extreme heat	Relatively low impact on performance	
Additional details	Oldest cell technology and most widely used	Less silicon waste in the production process	Tend to degrade faster than crystalline-based solar panels Low availability on the market		

Electric Charging

Level 1 or 120-volt:

The "charging cord" that comes with every electric vehicle has a conventional three-prong plug that goes into any properly grounded wall socket, with a connector for the vehicle's charging port on the other end and a box of electronic circuitry between them. This is the slowest type of charging, although for plug-in hybrids with smaller battery packs (say 4 to 18 kilowatt-hours), it may be enough to recharge in a few hours to overnight.

The charging cord will test the circuit when you plug it in, to ensure that it's properly grounded and the current is strong enough to power the charger. Most have a series of colored lights that will indicate when or whether the car starts charging once you've plugged it into the wall, then into the car's charging port.

Level 2 or 240-volt:

Most dedicated home and public charging stations operate at 240 Volts, with their cables again connecting to the standard charging port on vehicle.

If you have a charging station installed at home, it will require the same type of wiring as an electric stove or clothes dryer. This will be at least twice as fast as Level 1 charging, often quicker, due to the higher amperage of the circuit. At minimum, the charging station should be installed on a dedicated 40-amp circuit, but if you want to future-proof your wiring, 50 or 60 amps is better.

DC fast charging:

Sometimes incorrectly called "Level 3" charging, DC fast charging uses direct current (DC) rather than household alternating current (AC) and is very high-powered. This means that only public sites dedicated to DC charging, often along highways, are practical—given the higher cost of the utility having to install dedicated high-power lines.

Brushless DC Motor

To make the operation more reliable, more efficient, and less noisy the recent trend has been to use brushless D.C (BLDC) motors. They are also lighter compared to brushed motors with the same power output.

Motor type:

There are 3 different types of brushless DC motors, identified by B for the slotted series (high torque, high speed, autoclavable option), BH for the slot less series (high speed, high efficiency), and EC (for Electronically Commutated). This product line is offered with various options: S (high-speed optimization), T (high-torque optimization,) and H (medium torque and speed), directly linked to the needs of your applications.

Motor size:

Typically, the best place to start when sizing a brushless DC motor is matching motor size (diameter, length). Diameter ranges from 13 mm to 30 mm. Brushless DC slotted motor diameter and length are specified in inches. Brushless DC slot less motor diameter is specified in millimeters, and length as a coding (S, M, L). Ultra EC Series motor diameter and length are specified in millimeters.

Winding:

Various winding options are proposed to best match with the application requirements – voltage, resistance and torque constant are the basic parameters for selection.

Electronics:

Generally, with three winding phases, brushless DC motors are electronically commutated. A simple way to drive these motors is to power two phases at a time, using hall sensors to know the rotor position, with a simple logic to allow optimal energizing of the phases as a function of rotor position. Another way is to use sensor less electronics, working with the zero-crossing criteria to determine rotor position and commutation cycle. This electronics format is well suited for constant speed applications as they are highly insensitive to hostile environments.

Why BLDC motors?

The brushes in conventional D.C motors wear out over the time and may cause sparking. As a result, the conventional D.C motors require occasional maintenance. Controlling the brush sparking in them is also a difficult affair.

Thus, the brushed D.C motor should never be used for operations that demand long life and reliability. Fort this reason and the other reasons listed in the introduction, BLDC motors are used in most of the modern devices. Efficiency of a BLDC motor is typically around 85-90%, whereas the conventional brushed motors are only 75-80% efficient. BLDC motors are also suitable for high speed applications (10000 rpm or above). The BLDC motors are also well known for their better speed control.

Application:

Brushless motors are found in electric vehicles, hybrid vehicles and personal transporters, which are in essence AC synchronous motors with permanent magnet rotors. Some electric bicycles use brushless motors that are sometimes built into the wheel hub itself, with the stator fixed solidly to the axle and the magnets attached to and rotating with the wheel. Most electrically powered RC models use brushless motors because of their high efficiency.

Rear Wheel Drive

The biggest benefit to rear wheel drive is that it spreads the loads of the vehicle across all four tires of the vehicle. In a rear wheel drive vehicle, the rear wheels do the pushing while the front wheels are reserved for the steering duties. In front wheel drive vehicles, the front tires must perform both functions. Each front tire in a front wheel drive vehicle must do two tasks. Both the cornering forces and the engine acceleration/deceleration forces in a front wheel drive vehicle act on the same tires. So, in a front drive the tire's capacity can be easily exceeded. In a rear drive vehicle, the rear tires handle the engine acceleration/deceleration while the front only need to handle the steering forces. Not only does this balance the load on the tires but it reserves the front tires exclusively for the all-important steering work.

Better weight balance:

Most rear wheel drive vehicles have the engine in the front and the drive components in the rear. Front drive cars have everything up front. By properly balancing the front and rear of the vehicle you can improve the handling, acceleration, braking, and thus safety of a vehicle.

Better acceleration:

Rear wheel drive vehicle accelerates faster than a front drive vehicle from a stop. This is because when you accelerate quickly from a stop the weight of the vehicle transfers to the rear of the vehicle. In a rear drive vehicle, this place extra weight on the rear of the vehicle, essentially jamming the tyres into the road greatly increasing traction. In a front drive vehicle, when the weight goes to the rear, weight is taken off the front wheels. This allows the front wheels lose traction and spin easier. If the wheels are spinning not only does this slow you down but it also makes it difficult to steer the vehicle. In the rear drive vehicle, the front tyres are available for steering even if the rears have lost traction.

Better Road Holding:

The better weight balance of rear wheel drive allows the vehicle to handle better. The more even weight allows the vehicle to drive neutrally through a corner. This means both the front and rear of the vehicle have near equal loads acting upon them.

Better Stopping:

Due to the better balance rear drive vehicles brake better.

No Torque Steer:

Front wheel Drive vehicles have a problem known as Torque Steer. This occurs when the acceleration of the engine effects the cars steering. Since the driveline is connected to the steering wheels the torque of the engine applies force to the front wheels causing the vehicle to pull to the right during acceleration. Rear Drive vehicles do not have this problem since the engine is not connected to the steering gear.

Better Ride and Feel:

The light front end of the vehicle allows it to "turn in" to a corner easier. The vehicle feels more nimble and controllable. Since the front is not so heavy it is not burdened by needing strong springs to keep it under control. This allows the suspension to be set up softer while maintaining good control ability.

Better Serviceability:

Rear wheel drive vehicles are more rugged, cheaper and easier to fix.

GPS

The GPS system does not require the user to transmit any data, and it operates independently of any telephonic or internet reception, though these technologies can enhance the usefulness of the GPS positioning information. GPS/GNSS satellites circle the earth in well-defined orbits and transmit satellite and signal information to the ground. GPS receivers take this data and use a "trilateration" process to calculate the user’s location. Essentially, the GPS receiver compares the time a signal was transmitted with the time it was received.

The most accurate type of GPS system, a differential survey-grade location system, requires a base station and a UMV, each of which must receive signals from at least four satellites, he explained. Survey-grade GPS units, which are typically dual-frequency, have accuracies within 1 cm (.39 in)

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. For any mobile robot, the ability to 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

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. The potential application areas of the autonomous navigation of mobile robots include automatic driving, guidance for the blind and disabled, exploration of Dangerous regions, transporting objects in factory or office environments, collecting geographical information in unknown terrains like unmanned exploration of a new planetary surface, etc.

This system takes the current position as source and gets the destination point from user. User has to specify the destination in the map. System finds the shortest path to the destination and extracts the lat, long coordinates from the graph & sends to the vehicle. Vehicle follows the coordinate using GPS and compass. If GPS signal not received, inertial navigation system is used to obtain current coordinate. Obstacles around the vehicle are sensed by laser range finder. Current location of the vehicle is uploaded to the server through GPRS. At the server, coordinates are obtained and displayed in the Google map for monitoring purpose. So the vehicle can be monitored from anywhere in the world.

The autonomous vehicle needs to be equipped to take the GPS and sensor information and turn it into actions, like steering, accelerating, or hitting the brakes. This in-vehicle electronic network has been in cars for decade

For the autonomous vehicle, the navigation and guidance subsystem must always be active and checking how the vehicle is doing versus the goal. For example, if the originally "optimum" route has any unexpected diversions, the path must be re-computed in real time to avoid going in a wrong direction. Since the vehicle is obviously constrained to the roadways, this takes much more computational effort than simply drawing a straight line between A and B.

The primary subsystem used for navigation and guidance is based on a GPS (Global Positioning System) receiver, which computes present position based on complex analysis of signals received from at least four of the constellation of over 60 low-orbit satellites. GPS system can provide location accuracy on the order of one meter (the actual number depends on many subtle issues), which is a good start for the vehicle. Note that for a driver, who hopes to hop in the car and get going, a GPS receiver takes between 30 and 60 seconds to establish initial position, so the autonomous vehicle must delay its departure until this first fix is computed.

The autonomous car must be able to see and interpret what's in front when going forward (and behind when in reverse, of course). It is also necessary to see what is on either side; in other words, it needs a 360^0 view. An array of video cameras is the obvious choice, with a camera to determine where the lane is and sense objects or markers on the road.

LiDARs

LiDAR is relatively young in the automotive sector, but is gaining rapid traction as the industry realizes that the technologies initially deployed (i.e. camera and radar) can't single-handedly provide the high level of reliability required to implement advanced ADAS functions and make autonomous driving a reality. Compared with camera vision systems, LiDARs provide more range and accuracy.

It's highly effective at creating a three dimensional map of an environment, whether man-made, natural or in-between, and updating that 3D picture several times a second. Human vision performs the same function, but achieves it in a different way - your brain calculating the difference between your left eye and right eye to understand the distance and relationship between you and those objects in 3D space.

LiDARs offer robust operation in all lighting conditions, while cameras react poorly to sudden luminosity changes, can be blinded by direct light, and are limited in night conditions. Cameras can also lose effectiveness when faced with rain, snow, dust or dirt. LiDAR delivers higher resolution, better object discrimination capabilities and easier beam forming than radar. Moreover, LiDARs based on Leddar technology are immune to interference from other sensors, including other Leddar-based devices, thanks to the technology's signal-processing algorithms that filter out unwanted noise.

Can LiDAR sensors be used alongside these conventional sensors?

Absolutely as we move towards the higher levels of autonomous driving, more sophisticated systems will rely on a sensor fusion approach .This approach will provide a holistic perceptual mapping of a vehicle's surroundings, and ensure system redundancy, reducing the occurrence of erroneous readings. Depending on the requirements, various combinations of LiDARs and cameras may be implemented .LiDARs can also be used as stand-alone sensors, as observed today on some mass-market vehicles

In the short term, fixed-beam LiDARs are well-positioned to make many ADAS functions more reliable. Moving forward, LiDARs may become the cornerstone for the successful development and commercialization of higher-level autonomous driving functions. LiDAR will likely be required to reach virtually fail-proof operation levels.

LiDAR technology is still evolving rapidly, and while existing prototypes of autonomous cars rely heavily on scanning LiDARs, future implementations targeting the mainstream car market will most likely be based on solid-state LiDARs in order to meet the cost, size, robustness, and performance requirements of high-volume automotive deployments .A few solid-state LiDARs placed around the vehicle will be able to generate 3D point-cloud measurements of up to 360-degree and with hundreds of thousands of data points per second to support autonomous driving functions. For these reasons, a vast majority of manufacturers already have development programs in place to integrate LiDAR technology in their portfolio.Lidar comprises a series of rotating, stacked lasers that shoot out at different angles. Each layer is called a channel, and is made up of two laser beams. The signal from each individual channel creates one contour line, and together, those lines generate a 3-D image of the surrounding environment. That means that, the more lasers in each stack, the higher the resolution.

As no man-made system can yet match a pair of human eyes and the image-processing power of a brain, compromises have to be made. This is why engineers use a belt-and-braces approach in equipping vehicles with sensors that can scan the road ahead. That way, just as your trousers will stay up if one or other of belt and braces fails, if one system misses a potential hazard, such as an oncoming car or a pedestrian, the others might spot it and direct the car to take evasive action. Lidar employs laser scanning and ranging to build up a detailed three-dimensional image of a vehicle's surroundings.

Advantages of LiDAR technology

The other methods of topographic data collection are land surveying, GPS, inteferrometry, and photogrammetry.

LiDAR technology has some advantages in comparison to these methods, which are being listed below:

- **Higher accuracy**: Vertical accuracy 5-15 cm (1s) Horizontal accuracy 30-50 cm.
- **Fast acquisition and processing:** Acquisition of 1000 km2 in 12 hours. DEM generation of 1000 km2 in 24 hours.
- **Weather/Light independence**: Data collection independent of sun inclination and at night and slightly bad weather.
- **Canopy penetration**: LiDAR pulses can reach beneath the canopy thus generating measurements of points there unlike photogrammetry.
- **Higher data density:** Up to 167,000 pulses per second. More than 24 points per m2 can be measured. Multiple returns to collect data in 3D.
- **GCP independence**: Only a few GCPs are needed to keep reference receiver for the purpose of DGPS. There is no need of GCPs otherwise. This makes LiDAR ideal for mapping inaccessible and featureless areas.
- **Additional data**: LiDAR also observes the amplitude of back scatter energy thus recording a reflectance value for each data point. This data, though poor spectrally, can be used for classification, as at the wavelength used some features may be discriminated accurately.
- **Cost**: Is has been found by comparative studies that LiDAR data is cheaper in many applications. This is particularly considering the speed, accuracy and density of data.

Resolution

Just like cameras, LiDAR units need good resolution - that is enough data mapped in 3D, in enough detail, in order for software to interpret what objects are.This is easy for us humans, but drop that resolution to a fly's eye and is gets very difficult. Because the infrared laser beams are emitted in a widening beam from the source, the resolution close-by is great (enough to see facial contours and fingers), but far away, it's dreadful (is that a lamp-post or a pedestrian?).

That, among the other issues cited above, is why LiDAR is one of several other types of sensor deployed in driverless cars. The beams sent out from the unit bounce back when hitting objects and after mapping into 3D space, generate a 'point cloud'. This is a complex group of points (depending on resolution, sometimes several million points created every second) which must be interpreted, usually into polygons. A polygon is a simpler shape to process, because - like the difference between a chocolate box and a wardrobe, the size, shape and distance make it easy for a computer to interpret and categorize.

SENSORS

Voice Recognition

In this project, we introduced a new concept of voice recognition in car which uses the concept of speech recognition algorithm. The digital image processing is also used. Voice recognition is associated to car navigation system. The user will command through microphone installed in the car. The signal is commanded in analogue form which needs to be converted into digital form. The car is installed with the large database which consist of vocabulary, that compose of all keywords used for commanding the car. The system is installed with fully computer system, the size of a voice-recognition program's effective vocabulary is directly related to the random-access memory capacity of the computer in which it is installed. The car is installed with special hardware that is display, which display all the available commands and the instructions to the users to make the system user friendly. If users will input the incorrect commands the display will generate error message and provide the most related commands to the user available in the system vocabulary and keywords on display to the users. Automatic Speech Recognition (ASR) is a model of voice recognition designed for dictation. This model is installed in the car for dictation. our concept is totally based on the concept on artificial intelligence and robotics.

How Speech Recognition Works

Speech recognition fundamentally functions as a pipeline that converts PCM (Pulse Code Modulation) digital audio from a sound card into recognized speech.

The elements of the pipeline are:

1. Transform the PCM digital audio into a better acoustic representation

2. Apply a "grammar" so the speech recognizer knows what phonemes to expect. A grammar could be anything from a context-free grammar to full-blown English.

3. Figure out which phonemes are spoken.

4. Convert the phonemes into words

Automated Braking System

What is an Automatic Braking System?

Automatic braking technologies combine sensors and brake controls to help prevent high-speed collisions. Some automatic braking systems can prevent collisions altogether, but most of them are designed to simply reduce the speed of a vehicle before it hits something. Since high-speed crashes are more likely to be fatal than low-speed collisions, automatic braking systems can save lives and reduce the amount of property damage that occurs during an accident.

How Do Automatic Braking Systems Work?

The braking system technology rely on some type of sensor input. Some of these systems use lasers, others use radar, and some even use video data. This sensor input is then used to determine if there are any objects present in the path of the vehicle. If an object is detected, the system can then determine if the speed of the vehicle is greater than the speed of the object in front of it. A significant speed differential may indicate that a collision is likely to occur, in which case the system is capable of automatically activating the brakes.

In addition to the direct measurement of sensor data, some automatic braking systems can also make use of GPS data.

If a vehicle has an accurate GPS system and access to a database of stop signs and other information, it can activate its auto brakes to stop in time.

What Systems Make Use of Automatic Brakes?

The primary use of automatic brakes is in pre-crash and collision avoidance systems. These systems are typically capable of warning the passenger of an impending collision, tightening seat belts, and taking other actions that can help prevent an accident or reduce the damage that occurs during a collision.

In addition to pre-crash and collision avoidance systems, many adaptive cruise control systems also make use of automatic brakes. These systems are capable of measuring the speed of a leading vehicle and matching it. They can also reduce speed by cutting the throttle, downshifting, and finally activating the brakes.

SEAT SENSORS

A system for sensing the presence, position and type classification of an occupant in a passenger seat of a vehicle, as well as for sensing the presence of human. This invention relates to automotive occupancy sensor (AOS) systems and methods of operation by sensor fusion to determine the presence and position of an object in a seat, and to classify it by type or nature, to provide an occupancy state or condition signal for use with other automotive control systems. To reliably detect change of state from an empty to an occupied seat and determine the nature (classify), position (location) and/or orientation of an object or passenger in the vehicle.

Seat sensors detection solutions use pressure sensor mounted on a seat, which provides information on whether someone is seated on the seat. The seat may also be occupied by passengers of different size, such as a small child or a larger person. An occupant may be reclined in the passenger seat or sleeping in the passenger seat without giving off much movement.

- The seat sensor recognize person over 10kg (min).
- No calibration necessary during lifetime.
- Simple and precise system.
- No failures because of seat adjustments or repositioning.
- Can be installed in the passenger and rear bench seats.
- Easily placed and fixed under the seat cover.
- The round sensor areas allow comprehensive occupant detection.
- If the weight of passenger exceeds 500kg then the caution is given.

Charging Sensors

Electrical charge sensors measure the electric charge contained in subatomic particles in order to determine the charge's electromagnetic interactions. The electrons have a -1 charge. The protons have an opposite charge of +1. In electrical circuits, these charges are detected by electrical charge sensors. For example, an electrical relay consists of two circuits: an energizing circuit and a contact circuit. These circuits are common to different electrical relays such as a latching relay, electromechanical relay, contact relay, and timing relay. Charged coupled device sensors (CCD sensors) are electrical components or electronic devices that can transform a light pattern into an electric charge pattern that can be detected by an electric charge sensor.

IV. CONCLUSION

CLOUD is widely evolving field where security is much more needed. Wireless sensor networks are different from traditional network in number of aspects, thereby, necessitating protocols and tools that address unique challenges and limitations. As a consequence, wireless sensor networks require innovative solutions for energy aware and real- time routing, security, scheduling, localization, node clustering, data aggregation, fault detection and data integrity. Through our proposed theory we are giving a new dimension for cluster security. Security of the cluster can be improved by trusted computing. CLARIN is like Chlorine, which cleans water by removing bacteria, similarly CLARIN which cleans cloud by removing viruses. CLARIN with DCS increases the performance of the cluster, faster access of data and increases the life time of the sensor nodes.

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