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JASSOC: An Automated Vehicle Powered by Green Energy

M. Jahnavi[1] and L. Magthelin Therase[2]

[1]Master of Engineering, Embedded System, Sathyabama University, Chennai, India.
[2]Department of ECE, Sathyabama University, Chennai, India.

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Vehicles provided with green power are extensively used in East Asian countries like Japan and China. Although the vehicle design is well suited to the environment in our country the India which it operates, are not well preferred. It is a crude and inefficient design due to poor vehicle maintenance. This paper details an overall development of an advanced solar assisted automatic self driving vehicle JASSOC which is a three wheeled prototype. Research on conventional vehicles is presented as well as future conceptual infrastructure designs for the electric vehicles, the recent designs research simulations and experimental validation of the next automated vehicle JASSOC. The proposed automatic solar/battery electric three wheeler is meant to match and exceed the conventional vehicle performance and completely ignoring manual driving system. We introduce the next overall design of the proposed prototype as JASSOC 1.0 and the general conventional vehicular design and performance as VEHICLE 2.0 the combined form of mechanical and technical development aim for JASSOC 1.0 is to decrease the total electric power needed for propulsion with an optimized battery system and a more efficient motor and inverter. Several configurations are simulated and analyzed to make the complete automatic system. Many elements are used to locate the vehicle and run it automatically like Google voice search engine with GPS and RF grid system by sending vb signals.

Key words: Battery, JASSOC, Manual driving system, Conventional vehicle performance, Motor, Inverter, GPS, RF grid system, Vb signals.

For the past hundred years, innovation within the automotive sector has brought major technological advances, leading to safer, cleaner, and more affordable vehicles where the changes have been incremental and evolutionary. In this revolutionary change the industry appears to be on the cusp with potential to dramatically reshape not just the competitive landscape but also the way we interact with vehicles, the future design of our roads and cities and, indeed, mainly the advent of autonomous or "self-driving" vehicles. India's roads are becoming more congested each year with not only cars and buses but, particularly, two and three wheelers. India is home to more than 5 million three and four wheelers, and this number is growing each year by which the conventional resources are not sufficient. Research has shown that motorization is increasing even more rapidly than urbanization, and the increased traffic worsens India's already-prevalent pollution problem. With the factors of pollution and increased traffic in mind, the best way of revamp the transportation facilities is to develop a more efficient design that will be powered by a nonpolluting energy source, which can be achieved with an electric drive train since there are zero pollutants at the tailpipe.

First thing to be considered is a renewable source would make it a better solution compared to the current alternative fuel- powered vehicles. One way to do this is to use an energy system that can take advantage of several sources of renewable

* To whom all correspondence should be addressed.

energy - namely, an electric system. The electricity may be provided by solar, wind, hydro, or other renewable sources in addition to energy-storage systems such as batteries. Some renewable sources (i.e., solar cells) may be able to be located on the vehicle itself, or the batteries could separately be charged by the renewable sources via an off-site recharging station, or a combination of these two options could be considered. Second thing to be considered is the atomization of the vehicles which can be done with a most improvised way to make an advanced vehicle. Finally the compact system binding both things namely usage of renewable resources and atomization with a most featured mechanical frame design will gives us a wonderful advanced innovation in Indians history of transportation system.

Fig.1. Photo of an Auto Rickshaw

Table 1. Physical dimensions of rickshaw 1.0

Parameter	Value
Length	2675mm
Height	1700mm
Clearance	180mm
Frontal area	2.09m2
Coefficient of drag	0.5
Center of vehicle mass	0.4m
Wheel base	2000mm
Kerb weight	280kg
Daily distance driven	70-120km

Table 2. Physical specifications of the engine block of rickshaw 1.0

Parameter	Value
Type	4 stroke
Weight	45kg
Displacement	175cc
Maximum power	6KW @5000 rpm
Maximum torque	12.7Nm @ 4000rpm
Pay load	310kg(max) – 100kg (avg)

This paper will first give a brief history of India's conventional transportation system VEHICLE 2.0(considering an auto rickshaw) and with a focus on the efforts by the government to reduce pollution and promote less-polluting technologies (see Sections II and III). In Section IV, the research on a proto type of JASSOC 1.0 gathered with its features will be covered.

Conventional vehicle 2.0

Considering an auto rickshaw

Conventional VEHICLE 2.0 auto rickshaws (such as that shown in Fig.1) are suited to the Indian environment. They are small and narrow, allowing maneuverability on congested roads. They have a top speed of 55 km/h or 34 mi/h and generally carry one to four passengers and their cargo. Despite the apparent advantages in the vehicle design, auto rickshaws present a huge pollution problem in major Indian cities. This is due to poor vehicle maintenance and the use of an inefficient engine with very little pollution control.

India's transportation industry development

India has taken many steps to promote alternative sources of energy in the past few decades. In particular, in the transportation sector of energy use, much attention and effort have been focused on CNG and LPG technologies. According

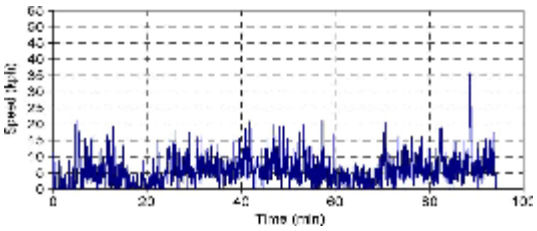

Fig. 2. Representative daytime driving cycle.

Table 3. load characteristics of the auto rickshaw 1.0

Variable	Value
Top speed	55kph
Grade ability	16% @ 10kph and 334kg payload
Acceleration	0 to 20kph 4.4sec
	0 to 30kph 6.6sec
	0 to 40kph 10sec
	0 to 55kph 19.6sec

to the Ministry of Non-Conventional Energy Sources (MNES), part of this is due to India's desire to depend less on energy imports. Sparked by a public-interest litigation filed in the Supreme Court in 1985 about the failure of the government to protect Delhi's environment, attention was given to pollution caused by vehicle emissions (an estimated 70% of total pollution). This led to many policies and initiatives eventually culminating in the replacement of the entire Delhi bus fleet with CNG buses in2001. To this day, some major Indian cities are stipulating that only zero-emission vehicles should be allowed to operate in the city, and some have even banned petrol-powered vehicles.

India also has one of the world's largest programs for renewable energy. The MNES has many initiatives and targets for increasing wind power, solar and solar thermal power, hydro power, and other sustainable projects. In fact, renewable account for 32.0% of India's total electricity-generation capacity; compare this with a mere 11.5% in the U.S. and approximately 21.0% and 20.0% for China and Japan. In particular, for solar power, a large increase in capacity is expected since India experiences 250 –300 clear sunny days a year in most parts of the country. India receives an estimated 5000 trillion kWh of solar radiation per year, and therefore, solar power offers great potential to meet a part of the country's fast-growing energy requirements. As far as incorporating renewable energies into transportation is concerned, according to the MNES website, new initiatives by MNES include the research and development of new and renewable systems for transportation, portable, and stationary applications for rural, urban, industrial, and commercial areas. Unlike India's major successes in the area of CNG, electric vehicles have seen limited applications, such as shuttling tourists from their parked vehicles to historical sites and monuments. In the consumer market, the REVA electric car company has seen increasing sales of its three-door hatchback model since it began production in 2001. In addition, the major Indian

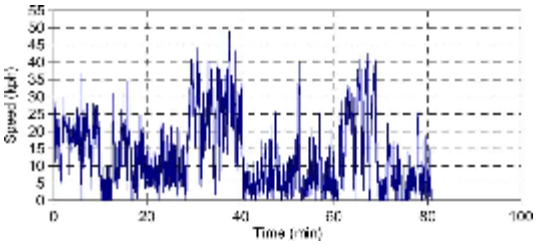

Fig.3. Representative evening driving cycle

Fig. 4. The complete version of vehicle jassoc.

Table 4. List of items

Item	Needed
Iron	8kgs
Wood	1 sheet
Wheels	Front/ 2 back
Battery	4(12v) connected SLA
Motor	(DC Motor)
Belt	For the wheel movement
Access wheel	1
Aluminum pipes	4(5' inch)
Miscellaneous	Bolts/nuts/stools

Fig. 5. Internal working system for the vehicle jassoc

automaker Tata has just introduced a concept electric car, which will be brought to market in 2011. The trend of electrification is now slowly beginning to catch on with two and three-wheelers by the company Indus-Electrans and other companies. Coming to the point of automation most of the Indian teams are fled to East Asian countries to excel themselves. Our Indian government has only one organization called Automation Systems Technology Centre (ASTeC) program having 11 ASTeC projects consisting minimal automation works. So, we can say that our country India is in need of more development in technical and manufacturing works to change the transport system into a complete compact one.

Prototype of jassoc 1.0

Jassoc is an automated vehicle which is designed as a replica of innovation in the felid of fast and furious technical development. There are many elements which are combined to form a compact version of jassoc. The total version will be divided in different forms like chassis designing, GPS installation, automation, solar panel installation which are explained in sec IV(a),IV(b),IV(c),IV(d).

Chassis designing

Chassis design is completely a mechanical work which comprises the designing of frame work. Frame work needs the exact design with modified features and drawings containing the ultimate infrastructure which will be the base of the complete vehicle construction. Many materials should be used for the construction of this frame. It is depended on the budget of the project or prototype to be constructed. In this paper we have discussed the material which we have used for the construction of the frame work and the chassis design. Here we are in the need of the welding work along with the perfect angular fixation near the handle of the vehicle. All these combined together to form a complete chassis which is the basical structure to be constructed.

Motor we used here is a DL DC motor with an capacity of 48v 250w which is generally used in e-bikes. The selection of motor is completely depended upon the power we need to supply. Depending on the capacity of the motor the running load capacity of the bike will be determined. Batteries are the wells of energy which are sources of running the load. The number of batteries will be depended upon the voltage. Here we have used four 12v which are connected in SLA system where lead – acid batteries are mostly used. Wheels should be selected depending on the parameters like load of the vehicle and torque.

GPS installation

The main theme of this vehicle after constructing the chassis design is the locating the vehicle. The ultimate feature in this vehicle is that the user can give a command using Google search voice search engine which is a part of this section. Using this command the GPS tracker will track the path. For tracking the whole system we need to get two signals, one is the present location which is given by sensor. The second one is the destination place which is given by the user. This is normally done in the Google maps also in all android phones and mobiles which are majorly used in cars and individuals.

Automation

Automation of the vehicle is the most innovative thing in the present history of vehicles which is implemented in the jassoc. We have used RF grid system to get an signal to the controller where it is located and which direction it has to be moved. The working of RF grid system is the most innovative implementation. The place where the automation has to be done is totally divided in to grids and the RF id's are assigned to each and every point. Now if the vehicle is present in grid

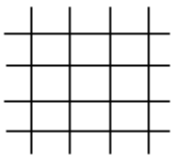

Fig. 6. Grid RF system

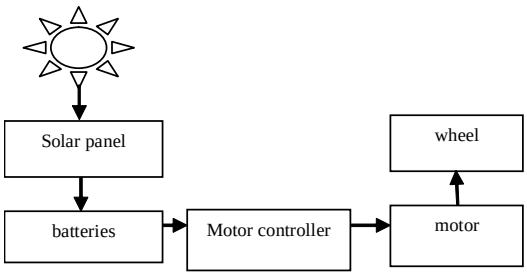

Fig. 7. Solar Panel working system for the vehicle jassoc

1(1) the respective signal will give and command to the controller to get an instruction to the small mechanical section which is connected to the front wheel for the steering and suspension. This process is repeated for each point of the RF grid system.

Solar PV panels are the most efficient power resources which we have selected even though we had so many power elements like wind energy and many. We have used eight 10v where the maximum power 17.6v so that the efficiency and tolerance are calculated and matched with the working of the motor capacity. Panels installation and wiring should be done properly. All the panels are connected in series and the final connection should be in parallel.

Summary

All the automated vehicles are the compact elemental systems like GPS systems RF grid control system along with the solar power installation which is the energy source for the vehicle to move. This is one of the innovative work done in the history of the transportation with technical and automation.

CONCLUSION

Simulations and testing show that an automated vehicle jassoc with solar assist can achieve a feasible range of operation during a single charge. One rickshaw design considered as a case study here can go about 90 km. With appropriate control and solar energy input, it is possible to achieve the average daily range of the vehicle, which makes the case for the technology of a plug-in electric rickshaw with solar assist. From this point, efforts should partly be focused on increasing the efficiency of the electrical system and all mechanical components. Future experimental verification should focus on the solar panels mounted on the prototype, for example, the effects of rapidly changing atmospheric conditions (such as driving through treelined streets) on the overall vehicle efficiency. Future research will also entail a detailed analysis of solar technologies, including dimensions and schemes. For example, an analysis of the advantages of adding a partial sun-tracking system and MPPT system, and the tradeoffs associated with such additions will be explored. In addition, further investigation of the motor and controller efficiency is necessary to optimize the overall vehicle efficiency.

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