Vertical Wind Turbine Powered Highway Blind Turn Early Warning and Blind Turn Illumination System for Remote and Accident Prone Highways

Miss Preeti[1], Mr. Abhishek Upadhyay[2]
M.Tech Scholar[1], Asst. Professor[2]
Electronics and Communication Department.
CBS Group Of Institutions Jhajjar,
Haryana.

Abstract **- Blind turns, one of the most common phenomenon's and often the most common reasons of vehicle born fatal accidents because of the absence of any early warning and detection system. There are plethora of evidences which are enough to prove the contribution of highway blind turns in causing road accidents in world in general and in India in particular.**

In this paper we are concentrating over technical know-how to develop a state of the art technique for providing early warning of blind turns and also to illuminate that particular stretch of highway which have maximum possibility of accident and miss-happening by applying embedded technology and sensors and also harnessing highway wind energy stock produced by heave vehicular traffic as non conventional energy resource by installing vertical wind turbine system which produces sufficient electricity to run the system independently.

Key Words **- Blind turn, illumination, early warning, wind energy stock**.

1. INTRODUCTION

As per the recent survey published by NHAI, the intensity of accidents happens in remote areas and hilly areas are 67% affected by blind turns which is again not good news to highway users.

That is why this is inevitable to develop a system which can trickle down the intensity of accidents.

The major roadblock in these highways to develop the system which can warn vehicles, are depend upon the availability of constant current supply because in India only fraction of highways are electrified and in case of hilly areas majority of highways remain in dark during night time.

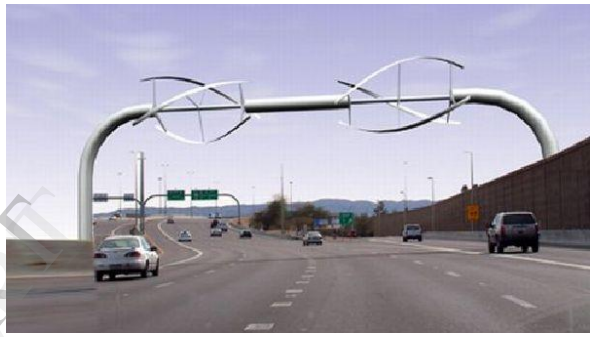

Fig: 1.1 spiral wind turbine installed in Brazil.

Fig: 1.2 vertical wind turbine 3D design.

That particular problem can be rectify by using vertical wind turbine system which can convert mechanical energy of wind into electrical energy. Vertical wind turbines are capable to convert wind energy into electrical energy and provide a best possible option to harness non conventional energy resource present in the highway via traffic intensity[3][1].

1.1 Wind turbine design

In remote areas there are very limited stock of wind energy and require huge amount of resources to establish a wind farm but as we all know the vehicular activity itself can generate a non conventional resource to harness electricity for general purpose.

To make the system independent and cost effective vertical wind turbines or terrestrial wind turbine are installed alongside of the highway in such a way so that the wind thrust generated by the highway heavy vehicular traffic could be harnessed and transformed into electric current.

The outer diameter of vertical wind turbine is drum shaped and size is depending upon the geographical situation of highway and installation surface.

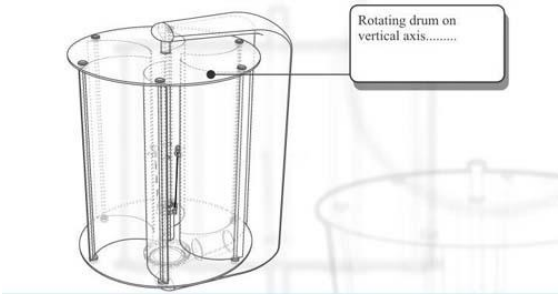

Fig: 1.3 prototype design of vertical wind turbine.

The vertical wind turbine has following features-

- The mechanical rotation speed regulator which prevents burn-out in high winds, common in traditional designs.
- Cylinder design and configuration of the turbine blades make the turbine silent running, making it suitable for installation in highways.
- As the blades do not cut across the airflow, there is less stress on the blades.
- Affordable Economic design than traditional designs as there are no electronic systems to control blade pitch or revolution speed.
- No gearbox and no brake pads means easy maintenance and no expensive parts to replace.
  .
- Can be scaled up and down making it suitable for industrial or domestic embedded generation scenarios.
- Presents a new medium for outdoor advertising.
- Independent: as there is no electronic steering system, no power supply is needed, making it suitable for installation in remote areas. (Other turbine systems need up to 80% of their power to operate their electronics.)

As a result of the design advantage, developmental works are under process to develop a sophisticated design which can convert maximum input of vehicular wind thrust into electricity[4][2].

1.2 Working of vertical wind turbine generation plant

In the system vertical cylinder of hollow type containing six vertical blades curved in 27 degree angle attached on two rotating disks in which there is a shaft intersecting both of the plates in the middle to provide equal momentum.

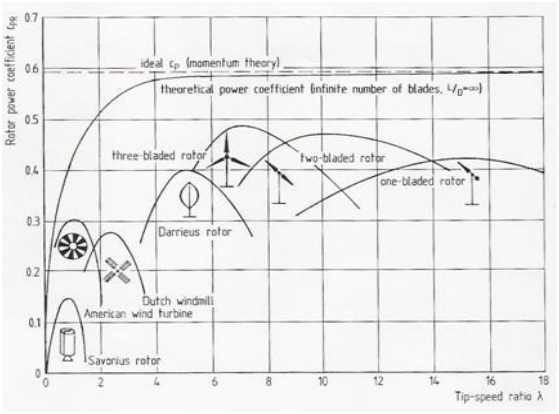

Fig: 1.4 The graph above is from the 2006 book by E. Hau., Wind Turbines: Fundamentals, Technologies, Application, and Economics. Springer. Germany. 2006.

In the bottom of the drum a bevel gear is attached with bevel pinion which convert low rotation of wind turbine into 90 degree angular high speed rotation through pinion and through the pinion the ultimate enhanced rotation interns into the dynamo to provide motion to the armature. [2]

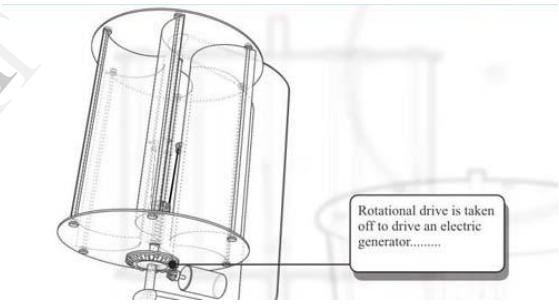

Fig: 1.5 instalment of Dynamo with vertical wind turbine

1.3 DYNAMO DESIGN

As we have wind energy as input with the limitation of vehicular input dependency, it is crucial to design an electric generator which have efficiency enough to convert even a low wind thrust generated momentum into wind turbine into electric. [9]

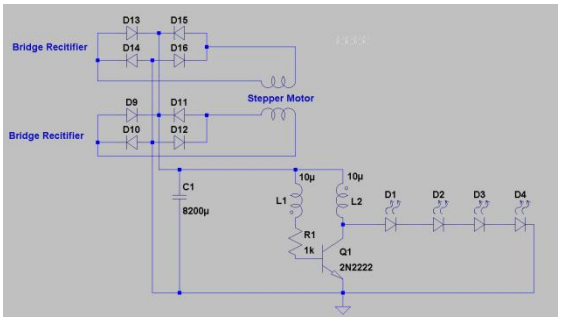

Fig: 1.6 circuit design for stabilizing current generated form wind electric generator.

That is why we are using multi segmented rotor and almost six different coils having 120 folds in each of the coil to produce maximum EMF through flux generation. The generator is brushed type because of its low cost and low maintenance.

NORMAL CALCULATIONS
Power provided by wind:
P=0.5×ρ×A×V3

P= 0.5× (1.225kg/m3) × (3×0.5×0.1016 m×0.0762 m) × (8.9408m/s)3

P=5.084 Watts

Power produced by generator:
P= (voltage) (amperes)

P= (2 V)(.5 A)

P=1 Watt

Efficiency: % eff = (Power produced by device/Power of wind) ×100

% eff = (1 Watt / 5.084 Watts) ×100

% eff = 19.7%

Another major problem was to select sensors which can efficiently sense vehicles and respond as fast as possible to start the system. For this I select infrared sensors due to its point to point range, low cost, high efficiency and low power consumption. These sensors can be installed in both of the sides of the road and can actively participate in the system. [7][9][5]

2. PRINCIPLE

The amplitude response of infrared (IR) sensors based on reflected amplitude of the surrounding objects is non-linear and depends on the reflectance characteristics of the object surface. As a result, the main use of IR sensors in obstacle sensing and object sensing seems quite feasible. Nevertheless, their inherently fast response is very attractive for enhancing the real-time operation of any obstacle sensing and early warning system and that is the sole reason why we have chosen Infrared sensors for early detection of vehicles in highways.in the system, IR sensors act as vehicular traffic sensing probe which provide early warning to the system and activated the system for pre coded programmatic response. As per the proposed layout the infrared sensors are installed approximately 20 to 50 meter before the blind turn to provide early response to the driver by which driver can manage and maintain the speed and can be escaped from any accident.

For early warning we have implanted a loud piezo-electric buzzer for sound response and LED based 'U turn' sign board along with LED strip for entire blind turn edge attached with LDR sensor which enable the blind turn illumination automated and enhances system efficiency.

3. METHODOLOGY

In the system IR SENSORS provide initial input through vehicle sensing and generate a low voltage signal for programmer (AVR- ATMEGA16) which process the signal and as per the programming it activated the red light, high intensity alarm and illumination of whole blind turn till the time vehicle could not cross the next infrared sensor present in the next edge of the blind turn.

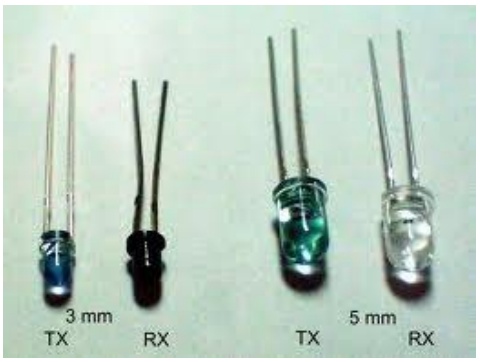

Fig: 1.7 IR transmitter and receivers.

4. EMBEDDED APPROACH

For efficient system it is essential to program the system and for which we have used Embedded C as a programming language and tried to develop simple, short and compact program which can run easily and can enhances system efficiency.
For controlling the circuit we will use inbuilt memory based microcontroller as the functions of system are quite simple and for that programming will also be less complicated so even a controller having 4 bit of programmable memory can produce good results.

5. CONCLUSION

Highway blind turn early warning itself capable to trickle down the higher graph of vehicular acc: 1.7idents happens in highways and the proposed independent system can be implanted anywhere in the world irrespective of presence & absence of constant current supply. The system can be installed, maintained, operate and afforded easily which provide it advantage to represent itself as a universal solution of highway blind turn early warning.
Energy generation from vertical wind turbine is capable to run the system efficiently because we have installed the most energy efficient infrared sensor along with LEDs for illumination and Piezoelectric buzzer for sound warning.
There are a lot of scope in our project which can really help the mankind and also emerges as smart system for highway illumination and accident avoiding. [1][3][7][8]

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