

# FABRICATION OF MOBILITY TRIKE WITH HYDROGEN AS BI-FUEL

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## Abstract :

This report covers the fabricating process based on the design considerations provided. The mobility trike comes forward from the basic idea on auto rickshaws. The tricycle rickshaw or what we call 'Auto Rikshaws' is a very common sight in India. The frame is in the tadpole style in which there is one front wheel and two rear wheels. Components of the trike include parts that were purchase, hand-manufactured and searched from existing bicycle. Tricycles are used primarily for recreation, shopping, and exercise. Tricycles are favored by children and senior adults for their apparent stability versus a bicycle. However, a conventional trike has poor dynamic lateral stability, and the rider must take care when coming to avoid tipping the trike over. Unconventional designs such as recumbent have a lower centre of gravity so require less care. The motive to use hydrogen as bi fuel is because hydrogen has a wide flammability range in comparison with all other fuels. As a result, hydrogen can be combusted in an internal combustion engine over a wide range of fuel-air mixtures. A significant advantage of this is that hydrogen can run on a lean mixture. A lean mixture is one in which the amount of fuel is less than the theoretical, stoichiometric or chemically ideal amount needed for combustion with a given amount of air. Hydrogen gas generators are a safe, convenient and typically the more cost-effective alternative to using high pressure cylinders of hydrogen. A hydrogen generator will provide hydrogen of a consistent purity, eliminating the risk of variation in gas quality.

**IndexTerms** – Frame, Hydrogen , Mobility trike, stoichiometric, pollutants, Pressure cylinders.

## I. INTRODUCTION

Our project is about the fabrication of an economical, compact and eco-friendly mobility trike. A trike is simply a bicycle that has three wheels instead of two. This additional wheel changes the look, feel and ride of the trike. An upright trike rides and steers like a two-wheeled bike, but it is heavier and less maneuverable. To increase Comfort Delta trikes utilize a seat that distributes your weight across a large area. Greater weight distribution decreases the pressure you might otherwise feel in your bottom when you sit on the smaller seat found on upright bikes. To increase Stability The trike's third wheel provides greater stability than a bicycle, making it easier for you to keep your balance. Compared to a bicycle, a trike could be better for you, particularly if you have poor balance or a condition that prohibits you from riding an upright bike safely and comfortably. Purpose of using hydrogen as fuel it is a clean fuel due to absence of sulphur and other toxic chemicals it less harmful when compared to petrol and diesel and it is also environmental friendly. To increases the performance due to its high flammability range compared to petrol. To increase the mileage of the vehicle Hydrogen has high flame speed at stoichiometric ratios. Under these conditions, the hydrogen flame speed is more the petrol. It is less expensive fuel and readily available compared to other fuels. Fuel cells have a higher efficiency than diesel or gas engines. To eliminate pollution caused by burning fossil fuels; for hydrogen fuelled fuel cells, the only by-product at point of use is water. Hydrogen comes from the electrolysis of water driven by renewable energy, then using fuel cells reduce greenhouse gases over the whole cycle.

## II. METHODOLOGY

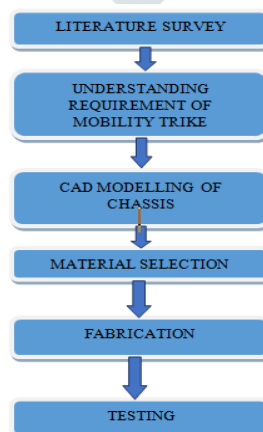


Fig.2.1 Methodology

**III. PROBLEM DEFINITION**

A hydrogen vehicle is an alternative fuel vehicle that uses hydrogen as its on-board fuel for motive power. Although hydrogen is a component of gasoline, hydrogen alone has unique characteristics compared to gasoline. The difference between a hydrogen ICE from a traditional gasoline engine could include hardened valves and valve seats, stronger connecting rods, non-platinum tipped spark plugs, higher voltage ignition coil, fuel injectors designed for a gas instead of a liquid, larger crankshaft damper, stronger head gasket material, modified intake manifold, and a high temperature engine oil. Hydrogen engines burn fuel in the same manner that gasoline engines do. The power output of a direct injected hydrogen engine vehicle is 20% more than in a gasoline engine vehicle and 42% more than a hydrogen engine vehicle using a carburettor. Based on current information, traffic accidents with liquid hydrogen fuel involve notably lower risks for drivers, passengers, and pedestrians due to hydrogen's very short evaporation and burning times in comparison to conventional fuels such as gasoline and diesel fuel, when released in equivalent amounts, because of the extremely fast distribution and dilution of evaporating hydrogen in the open.

**IV. CAD MODELLING**

Design process was carried out using Solidworks software and the model was developed and it is presented. The design of components started from scrap defining dimensions for each and every component. A number of models were developed before actually confirming the final design. Due to several reasons such as material wastage, cost effectiveness, time involved in fabrication, difficulties in manufacturing a number of design changes were made and obtained as final model as shown in the figure 1 and 2.

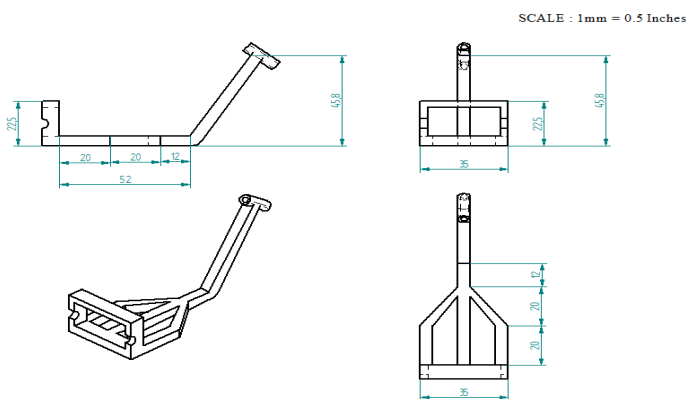
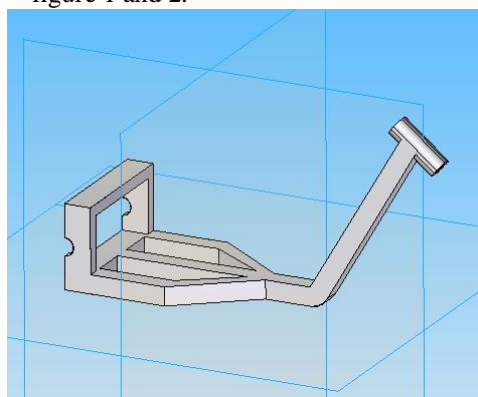


Fig.3.1 CAD Model

Fig.3.2 Orthographic Drawing

**V. WORK CARRIED OUT**

Then we started doing the research on materials of the components that we will be using. We also decided which part is supposed to be bought from the market and which part is to be fabricated as it will become an economical.

**5.1 DESIGN**

After reviewing and studying we finally came to know that what would be design. The aim is to make a light weight and ergonomic design.

**5.1.1 Frame connected to bicycle**

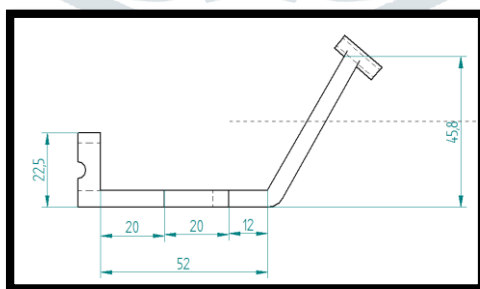


Fig.5.1 Frame

Materials used in bicycles have followed a similar pattern as in aircraft, the goal being high strength and low weight. Since the late 1930s alloy steels have been used for frame and fork tubes in higher quality machines. By the 1980s aluminum welding techniques had improved to the point that aluminum tube could safely be used in place of steel. Since then aluminum alloy frames and other components have become popular due to their light weight, and most mid-range bikes are now principally aluminum alloy of some kind. The great majority of modern bicycles have a frame with upright seating that looks much like the first chain-driven bike.

### 5.1.2 Engine



**Fig.5.2 Engine**

The engine to be used in this project is a 150cc Bajaj Pulsar engine. It is powered by a 149cc air-cooled, single-cylinder, twin spark engine with a maximum power output of 14bhp at 8,000rpm and a peak torque output of 13.4Nm at 6,000rpm. The engine is mated to a 5-speed gearbox. The engine features Bajaj's DTS-i technology which delivers improved performance. The acceleration is brisk and linear. The motorcycle can sprint from 0-60km/h in just 5.6 seconds and can reach a top-speed of 111km/h. The bore and stroke length of the engine is 57x56.4. The compression ratio is at 9.5:1. This engine uses a constant mesh gear box for transmission and a multiplate clutch system. Its ignition system is based on CDI (capacitor discharge ignition) and the fuel supply is through a carburettor.

### 5.1.3 Hydrogen generator kit



**Fig.5.3 Hydrogen Kit**

Hydrogen gas generators are a safe, convenient and typically the more cost-effective alternative to using high pressure cylinders of H<sub>2</sub>. A hydrogen generator will provide hydrogen of a consistent purity, eliminating the risk of variation in gas quality, which can impact on analytical results. A generator also produces gas on-demand around the clock, meaning that you don't need to worry about running out of gas at an inopportune moment. A hydrogen generator will free up more of your time since you will not need to spend time ordering and changing out replacement cylinders. A generator is an environmentally friendly alternative to cylinders. Electrolysis of water is the best method of producing high purity hydrogen gas on demand. The most important element of the generator is the electrolyser cell where the electrolysis reaction takes place. The cell consists of two electrodes which are separated by the ion exchange membrane.

### 5.1.4 Axle Bearing



**Fig.5.4 Axial Bearing**

A bearing is a machine element that constrains relative motion to only the desired motion, and reduces friction between moving parts. The design of the bearing provide free linear movement of the moving part or for free rotation around a fixed axis; or, it may prevent a motion by controlling the vectors of normal forces that bear on the moving parts. Rotary bearings hold rotating components such as shafts or axles within mechanical systems, and transfer axial and radial loads from the source of the load to the structure supporting it. In the ball bearing and roller bearing, to reduce sliding friction, rolling elements such as rollers or balls with a circular cross-section are located between the races or journals of the bearing assembly. The stiffness of a bearing is how the distance between the parts which are separated by the bearing varies with applied load. With rolling element bearings this is due to the strain of the ball and race.

### 5.1.5 Wheels



**Fig.5.5 Wheels**

The front tyre used is from the bicycle which is attached to the front end of the bicycle frame. . Bicycle tires provide an important source of suspension, generate the lateral forces necessary for balancing and turning, and generate the longitudinal forces necessary for propulsion and braking. Although the use of a pneumatic tire greatly reduces rolling resistance compared to the use of a rigid wheel or solid tire, the tires are still typically the second largest source, after air drag, of power consumption on a level road. The modern detachable pneumatic bicycle tire contributed to the popularity and eventual dominance of the safety bicycle.

The rear end uses two Honda Activa(2004 model) tires at each side. '90/100-1053J' is the standard tyre used in the case of this project where 90/100 are the respective measurements in mm of varying heights and diameter. The tyre type used in this case at the rear are tubed tyres. '10' represents the rear wheel size and '53J' represents the diameter of the wheel rim in inches. The shape of the tyre is maintained by mounting the rim onto the tire as it maintains the tyre rigidity so that it can maintain its shape even under load.

### 5.1.6 Sprocket



**Fig.5.6 Sprocket**

A sprocket or sprocket-wheel is a profiled wheel with teeth, or cogs, that mesh with a chain, track or other perforated or indented material. The name 'sprocket' applies generally to any wheel upon which radial projections engage a chain passing over it. It is distinguished from a gear in that sprockets are never meshed together directly, and differs from a pulley in that sprockets have teeth and pulleys are smooth. Sprockets are used in bicycles, motorcycles, cars, tracked vehicles, and other machinery either to transmit rotary motion between two shafts where gears are unsuitable or to impart linear motion to a track, tape etc. Perhaps the most common form of sprocket may be found in the bicycle, in which the pedal shaft carries a large sprocket-wheel, which drives a chain, which, in turn, drives a small sprocket on the axle of the rear wheel.

### 5.1.7 Chain



**Fig.5.7 Chain**

Chain drive is a way of transmitting mechanical power from one place to another. It is often used to convey power to the wheels of a vehicle, particularly bicycles and motorcycles. It is also used in a wide variety of machines besides vehicles. Most often, the power is conveyed by a roller chain, known as the drive chain or transmission chain, passing over a sprocket gear, with the teeth of the gear meshing with the holes in the links of the chain. The gear is turned, and this pulls the chain putting mechanical force into the system.

### 5.1.8 Rear Axle

Most often, the power is conveyed by a roller chain, known as the drive chain or transmission chain, passing over a sprocket gear, with the teeth of the gear meshing with the holes in the links of the chain. The gear is turned, and this pulls the chain putting mechanical force into the system. A straight axle is a single rigid shaft connecting a wheel on the left side of the vehicle to a wheel on the right side. The axis of rotation fixed by the axle is common to both wheels. Such a design can keep the wheel positions steady under heavy stress, and can therefore support heavy loads. In rear-wheel drive cars and trucks, the engine turns a driveshaft which transmits rotational force to a drive axle at the rear of the vehicle. A chain-drive system uses one or more roller

chains to transmit power from a differential to the rear axle. This system allowed for a great deal of vertical axle movement, and was simpler to design and build than a rigid driveshaft in a workable suspension.

### 5.1.9 Battery



**Fig.5.9 Battery**

A battery is a device consisting of one or more electrochemical cells with external connections provided to power electrical devices such as flashlights, smartphones, and electric cars. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that will flow through an external electric circuit to the positive terminal. When a battery is connected to an external electric load, a redox reaction converts high-energy reactants to lower-energy products, and the free-energy difference is delivered to the external circuit as electrical energy.

### 5.1.10 Final Model



**Fig.5.10 Final Model**

### 5.1.11 Advantages

1. As the battery charges simultaneously, the deep discharge of battery gets avoided. Hence it increases the battery life cycle.
2. This method can be adopted in current electric vehicle to increase its efficiency.
3. This vehicle consumes no fuel and so it is more Eco friendly.
4. Zero Emission.
5. Reduction in time and electric power for recharging the battery.

### 5.1.12 Applications

1. This project suits well applicable in golf cart vehicle.
2. Mainly it can be used in small scale industry for transportation.
3. It can also be used as an On-road vehicle. I

## VI. RESULTS AND DISCUSSION

By fabrication of mobility trike with hydrogen as bifuel as following operations completed finally model created.

- Bicycle frame cutting : The frame of the cycle is cut at the front at two rods using a cutting machine. This front end of the bicycle frame is used along with its front wheel as the front end of the mobility trike.
- Frame building : The front end of the bicycle frame is elongated by fabricating a base frame as a chassis to mount the engine, to accommodate the rear axle and provide seating space for the driver.
- Engine mounting : The engine is mounted on the rear end of the chassis, behind the seating space. The engine is held in place with the help of brackets.
- Rear axle: Firstly, the bearings are welded to the rear end of the frame. The rear axle rod is then inserted into both the bearings. The axle is then welded to the bearings. The sprockets are then inserted to the axle and welded. The brake disc is fixed by welding to either side of the rear axle.
- Fixing of wheels : The wheels are fitted to the customized wheel hub.
- Installing of hydrogen kit : The outlet pipe of the hydrogen kit bubbler is fixed into the air intake pipe of the carburettor. The hydrogen kit is connected to the battery. This means the kit runs only when the engine is running. The kit is held in place with the help of basic U clamp.

## VII. CONCLUSION AND FUTURE SCOPE OF THE PROJECT

Hydrogen fuel cells are a promising alternative to current automotive fields. They essentially combine the energy density and the convenience of liquid fuels with clean and efficient operation of electric vehicles. Although current aspects of technology such as efficient onboard storage still requires some improvement, there are no reasons why hydrogen could not become equally convenient

and attractive transportation fuel as diesel and gasolie are today. Individually, each application ( power and transport) has its own advantages. Using hydrogen storage to balance the grid discourages fossil fuel energy generation and encourages renewable generation. This has many benefits, such as lower emmissions and cleaner air. Encouraging hydrogen transport is advantageous and promoting cleaner transport technologies, further reducing emmissions in accordance with policies. This also provides cleaner air, and therefore enhances air quality in cities as pollution levels will decrease. (petrol cars are replaced by hydrogen cars). Combining these two applications , power and transport ,is unique as its serves two sectors with one infrastructure system . this dramatically reduces the initial invetment required and makes the business financially more feasible.

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