GUJARAT TECHNOLOGICAL   UNIVERSITY

CHANDKHEDA, AHMEDABAD

L.J.INSTITUTE OF ENGINEERING AND TECHNOLOGY

A REPORT ON

ELECTRICITY GENERATED BY SPEED BREAKER

UNDER THE SUBJECT OF

DESIGN ENGINEERING – 2B. (2160001)

B.E. 4, SEMESTER – 6

(MECHANICAL ENGINNERING)

Submitted By

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(Faculty Guide)

Mr. Kamlesh Kadiya

(Head of the Department)

Academic Year

2019-20

L.J. INSTITUTE OF ENGINEERING AND TECHNOLOGY

Department of Mechanical Engineering

2019-20

<u>CERTIFICATE</u>

Date:

This is the certify that Design Engineering – 2B. Work entitled

" <u>ELECTRICITY GENERATED BY SPEED BREAKER</u> ",Carried out by the group of students mentioned below under my guidance is approved for the Degree of Bachelor of Engineering in **Mechanical Engineering** (Semester – 6) of Gujarat Technological University , Ahmedabad during the academic year 2018-19.

List of Students :-

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Guide	**Head of Department**
Mr. Mehul V. Kodiya	Mr. Kamlesh P. Kadiya
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REPORT APPROVAL CERTIFICATE

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Name and Sign   **Name and Sign**

Internal Examiner   External Examiner

Chapter – 1   INTRODUCTION

1.1 Introduction About Team Members

- **SUTHAR DHRUV S. (160320119167)**
- **PRAJAPATI MITESH B. (160320119547)**
- **IMAM ZAKIRHUSEN J. (160320119040)**
- **DARUWALA MOINUDDIN I. (160320119509)**
- **PRAJAPAT NILESH J. (160320119127)**

1.2 Introduction to faculty guide

~ Mr. Mehul V. Kodiya

- Assistant Professor of L.J Institute Of Engineering And Technology

- Knowledge is really beneficial.He is good man with a kind heart.

- He has very wide knowledge in mechanical based subjects.

1.3 Understanding about Reverse Engineering

- Reverse engineering can be used when a system is required to interface to another system and how both system would negotiate is to be established. Such requirement typically exist for interoperability.
- However, the reverse engineering process in itself is not concerned with creating a copy of changing the artifact in some way. It is only an analysis in order to deduce design features from products with little or no additional about the procedures involved in their Original production.

1.4 Identification of component for reverse Engineering

- Rack and Pinion is connected
to the dynamo.Dynamo will convert
mechanical energy into the electrical energy.DC dynamo has
been connected to the DC light which shows generated energy.

Chapter – 2 APPLICATION OF REVERSE ENGINEERING

2.1 Details of component

Component:
1) DYNAMO

2) SPRING

3) RACK AND PINION

4) LED

5)WOODEN SHEET

2.2 Prior Art Search

In this model we show that how we can generate a voltage from the busy traffic. Conversion of the mechanical energy into electrical energy is widely used concept. It's a mechanical to generate power by converting the potential energy generated by a vehicle going up on a speed breaker into rotational energy. We have used that simple concept to the project. We connect one mechanical rod with the dynamo and fit this rod on the surface of the road. When any vehicle moves from this rack is press then due to friction, vehicle press the rack and pinion then rotated the dynamo. When dynamo move then it generates a voltage and this voltage now connects to the bulb. In actual practice with the help of this voltage we will charge the battery and then we use this voltage to light the small bulb.

If we install this unit to the any small fly over then with the help of this voltage we generate the small voltage, and with the help of this voltage we light the bulb.

2.3 Understanding the SCAMPER Tool

SCAMPER stands for:

- Substitute.
- Combine.
- Adapt.
- Modify
- Put to another use.
- Eliminate.
- Reverse

- Substitute:
  Rack and Pinion.

- Combine
  Rack and Pinion.

  Gear arrangement.

- Adapt
  In this machine we adapt rack and pinion mechanism.

- Modify

  The energy generated using speed breaker mechanism can be used to store in a batteries and can be used apart for various purpose.

- Put to other use

  Also used to store the energy.

- Eliminate

1)This machine eliminate the consumption of fossil fuel which is nonrenewable.

2)Eliminate the labor work.

- Reverse

  By the fluid mechanism we can also generate the electricity.

Chapter – 3 EMPATHY MAPPING

3.1 AEIOU Sheet And Its Summary

- **Environment**
- There was more noise in environment.
- There was evening time.
- Busy environment.
- There was summer season.

- **Activities**
- Students are going to school.
- Some of the passenger are waiting for the bus.
- There was also traffic of goods.
- Some the boys were listing the music.
- Traffic police were controlling the traffic.

- **Interactions**
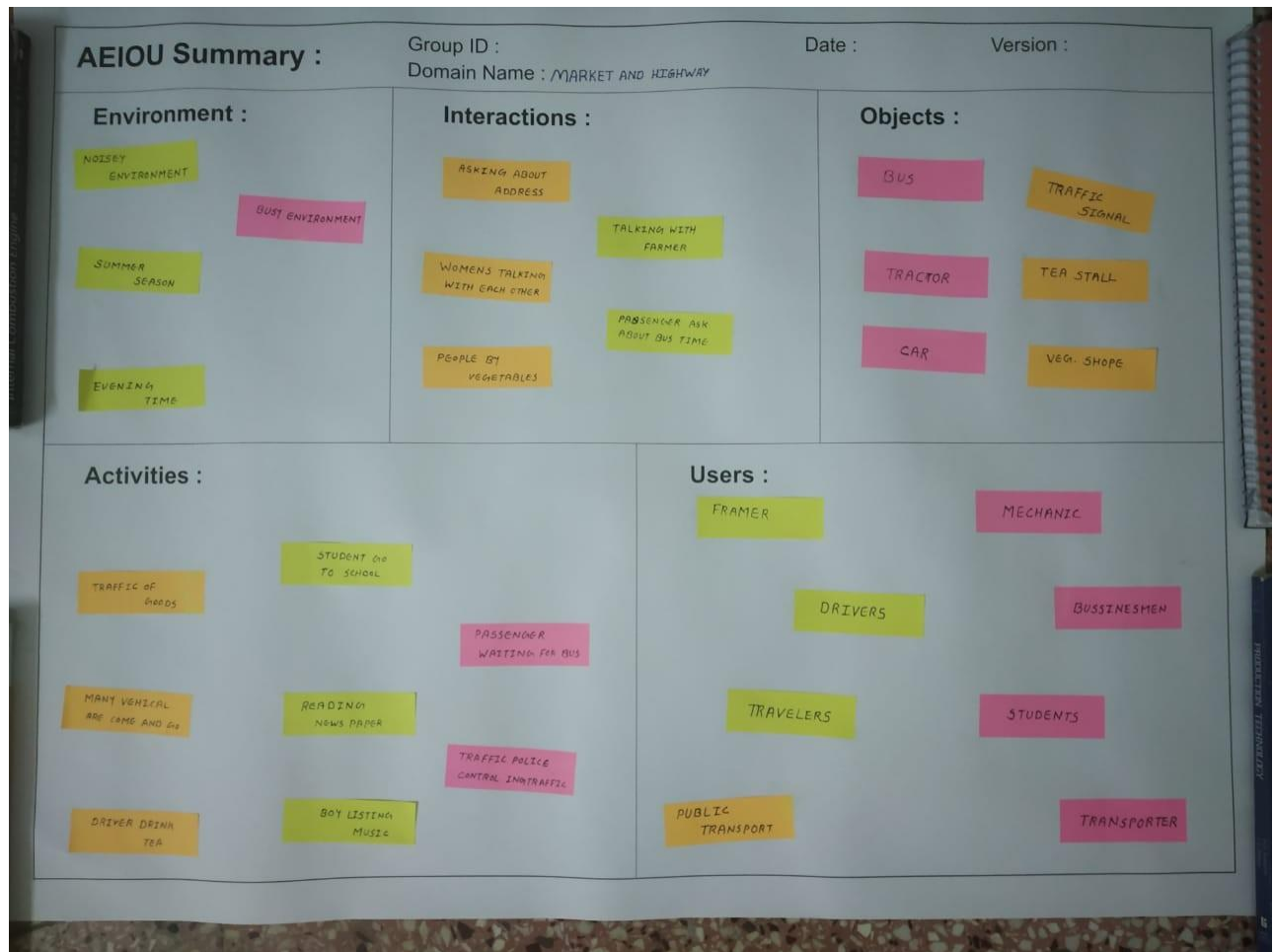- People were buying vegetables.
- Some of the people asking about the address.
- Interaction between the farmers.
- Womens were talking with each other.
- Passenger was asking about the bus time.

- **Objects**
  - Bus
  - Traffic signal
  - Tea stall
  - Vegetable shop
  - Car
  - Tractor

- **Users**
  - Transporter
  - Drivers
  - Public transport
  - Farmer
  - Mechanic
  - Business men
  - Student

AEIOU Summary: Group ID: Date: Version:
Domain Name: MARKET AND HIGHWAY

Environment:
- NOISEY ENVIRONMENT
- BUSY ENVIRONMENT
- SUMMER SEASON
- EVENING TIME

Interactions:
- ASKING ABOUT ADDRESS
- TALKING WITH FARMER
- WOMENS TALKING WITH EACH OTHER
- PASSENGER ASK ABOUT BUS TIME
- PEOPLE BY VEGETABLES

Objects:
- BUS
- TRAFFIC SIGNAL
- TRACTOR
- TEA STALL
- CAR
- VEG. SHOPE

Activities:
- STUDENT GO TO SCHOOL
- TRAFFIC OF GOODS
- PASSENGER WAITING FOR BUS
- MANY VEHICAL ARE COME AND GO
- READING NEWS PAPER
- TRAFFIC POLICE CONTROL IN TRAFFIC
- DRIVER DRINK TEA
- BOY LISTING MUSIC

Users:
- FRAMER
- MECHANIC
- DRIVERS
- BUSSINESMEN
- TRAVELERS
- STUDENTS
- PUBLIC TRANSPORT
- TRANSPORTER

AEIOU SUMMARY SHEET

3.2 Activities of Users and its Stockholders

- Many vehicles are coming and going.

- Passengers are waiting for the bus.
- Traffic police controlling traffic.
- Boys were listening the music.
- There were also traffic of goods.

3.3 Story Telling

- **HAPPY**:

1) It is used for power production.

2) It reduced the electricity supply.

-**SAD**:

1) In rainy season because of water it may damage.

2) Huge amount of power can not produce.

Design For

Design By

Date

Version

USER
- PUBLIC TRANSPORT
- DRIVER
- TRANSPORTER
- TRAVELERS

STAKEHOLDERS
- MECHANIC
- FARMER
- BUSSINESMEN
- STUDENTS

ACTIVITIES
- BOY LISTENING MUSIC
- READING NEWSPAPER
- PASSENAER WAITING FOR BOS
- MANY VEHICLES ARE COME AND GO
- DRIVER DRINK TEA
- TRAFFIC POLICE CONTROLLING TRAFIE
- STUDENTS GO TO SCHOOL
- TRAFFIC OF GOODS

STORY BOARDING

HAPPY
→ IT IS USED TO POWER PRODUCTION.
→ IT REDUCED THE ELECTRICITY SUPPLY.

HAPPY
→ BEST USE OF SPEED BREAKER.
→ IT STORE THE ENERGY AND SUPPLY IT WHENEVER REQUIRED.

SAD
→ IN RAINY SEASON BEACAUSE OF WATER IT MAY DAMAGE.

SAD
→ HUGE AMOUNT OF POWER CAN NOT PRODUCE.

SHEET OF EMPATHY MAPPING

Chapter -4   IDEATION CANVAS

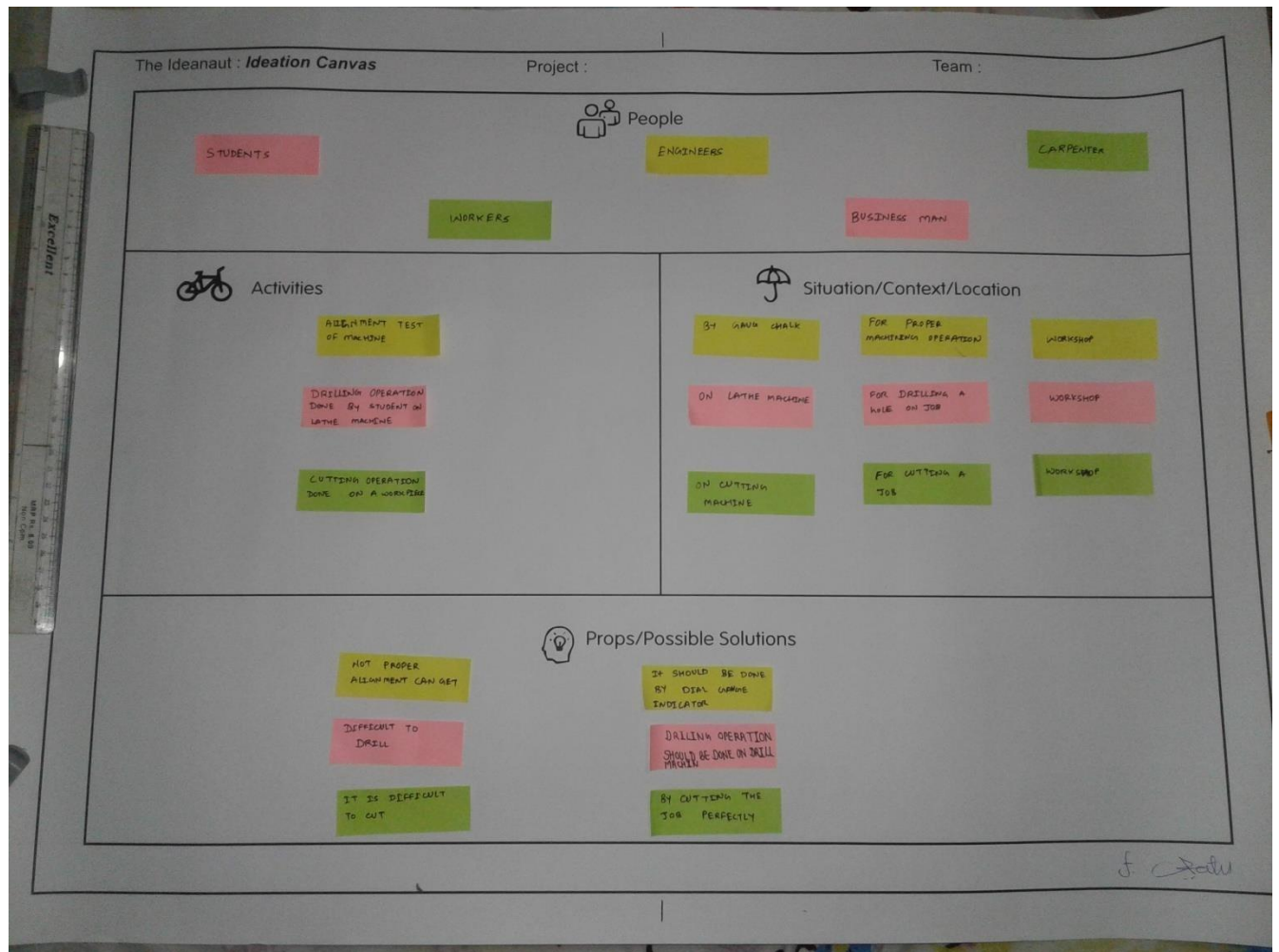## 4.1 Explanation of people and their activities

- People were jogging.

- Driving the vehicle.

- Transportation of goods.

4.2   Understanding about Situation

- Morning – For fitness - Highway

-Night – Travelling - Highway

- Night – Business – Highway

4.3 Relevant and Irrelevant Props

- Height of speed breaker.

- By providing night lamps and supplying electricity.

- Storing energy and supplied when it required.

- Reducing height of speed breaker.

- Accident.

The Ideanaut : *Ideation Canvas*   Project :   Team :

People

STUDENTS   ENGINEERS   CARPENTER

WORKERS   BUSINESS MAN

Activities

ALIGNMENT TEST OF MACHINE

DRILLING OPERATION DONE BY STUDENT ON LATHE MACHINE

CUTTING OPERATION DONE ON A WORKPIECE

Situation/Context/Location

BY GANG CHALK   FOR PROPER MACHINING OPERATION   WORKSHOP

ON LATHE MACHINE   FOR DRILLING A HOLE ON JOB   WORKSHOP

ON CUTTING MACHINE   FOR CUTTING A JOB   WORKSHOP

Props/Possible Solutions

NOT PROPER ALIGNMENT CAN GET   IT SHOULD BE DONE BY DIAL GAUGE INDICATOR

DIFFICULT TO DRILL   DRILLING OPERATION SHOULD BE DONE ON DRILL MACHINE

IT IS DIFFICULT TO CUT   BY CUTTING THE JOB PERFECTLY

SHEET OF IDEATION CANVAS

Chapter -5 PRODUCT DEVELOPMENT CANVAS

5.1 Purpose of Speed breaker

- To generate electricity.
- To supply electricity to street light.
- To store the electricity.

5.2 People

- Transporter

- Farmer

- Travelers

- Mechanics

5.3 Explanation of product components, Functions
And Features

- It convert reciprocating motion into rotary motion.
- Convert mechanical energy into electrical energy.
- Store the electricity.
- Electricity produced easily.
- Effective use of speed breaker.
- Generator
- Spring
- Rack and pinion
- Lamp

5.4 Discussion on product experience

- Excellent

- Very Useful

5.5 Customer Revalidation

- Damage in rainy season

- Best use of speed breaker

- Excellent

5.6 Discussion of Reject, Redesign and Retain Parameters

-Difficulty in maintenance.

- High amount of power is not produce.

Product Development Canvas

Team/Date/Version :   /   /

Purpose

What is the purpose of this concept you're developing ? Does it solve a problem, or it enhances a certain experience ?

Is it serving a need or is it trying to create a new need or fill an untapped need ?

- TO GENERATE ELECTRICITY
- TO SUPPLY ELECTRICITY TO STREET LIGHTS
- TO STORE THE ELECTRICITY

People

Who is the key customer segment who will use this product / service or the end product of the concept you're pursuing ?

Write here about them, describe them a little

- DRIVER
- TRANSPORTER
- TRAVELERS
- FARMERS
- MECHANIC

Product Experience

Define what your customer should feel like when he uses your product/service ? What emotions, feelings would define his experience ? Feeling of comfort, convenience, or feeling of buying more with less (cost conscious) or feeling of greater security, safety etc.

- EXCELLENT
- VERY USEFULL

Product Functions

Functions are a products answer to user problems/need. They do something that user wants. They are often verbs in nature. Every function is powered by many features. Multitasking is a function. Browser tabs is feature that powers the multitasking feature. A function can have one or more features powering it. Functions are very generic in nature, features are often more specific. Functions can be similar to product experience. Safety (product function) provides a feeling of safety (product experience)

- IT CONVERT RECIPROCATING MOTION INTO ROTARY MOTION
- CONVERT MECHANICAL ENERGY INTO ELECTRICAL ENERGY
- STORE THE ELECTRICITY

Product Features

Product features are specific. One or more features will power a function. Antilock Brakes, Airbags are features that power the safety function. Browser tabs, Apple's home button to multitask between apps are features powering the multitasking function. Each feature will have many components/sub components powering it. Sometimes a very popular components becomes a feature in itself. Like car stem is a major components and a feature at the sametime powering the in car entertainment function powering entertainments as a product experience.

- ELECTRICITY PRODUCED EASILY
- EFECTIVE USE OF SPEED BREAKER

Components

Components build up the features. For a airbag it will comprise a list of component like bags, triggers etc. that go into making it. For a tabbed browser it will comprise of various chunks of code that will make the tabs work. In cases where the feature is a major component, you could list here the auxiliary, components that are required to make the major component work. You can also list new adjustments and innovations you're planning here at the component level.

- GENERTOR
- SPRING
- RACK AND PINION
- LAMP

Customer Revalidation

Once you're finished with your feature set, test with the customer if the features, functions are useful. Speak to the customer i can

- EXCELENT
- DAMAGE IN RAINY SEASON
- BEST USE OF SPEED BREAKER

Reject, Redesign, Retain

Post customer validation, reject, those functions or features that the customers didnt find useful. Redesing those that were partially useful and retain those met the bar. Iterate with this until all functions/features are accepted

- DIFFICULTY IN MAINTANANCE
- MORE AMOUNT OF POWER IS NOT PRODUCED

PRODUCT DEVELOPMENT SHEET

Chapter 6. Learning need matrix

6.1 Introduction to learning need matrix

Matrix is a format that helps to clear out the all requirements and functions of device. It is necessary to obtain all the details of components and systems that are going to be used in the device to get maximum benefits from it . It makes the process easy to understand and quite more realistic to the researchers.

6.2 Description of Learning need matrix

Matrix makes understanding easier and effective to the reader or researcher. The 4 boxes in matrix are defined differently by skills/software required, tools/methods involved, design standards, component materials and strength criteria.

Tools/Methods/ Theories Involved:

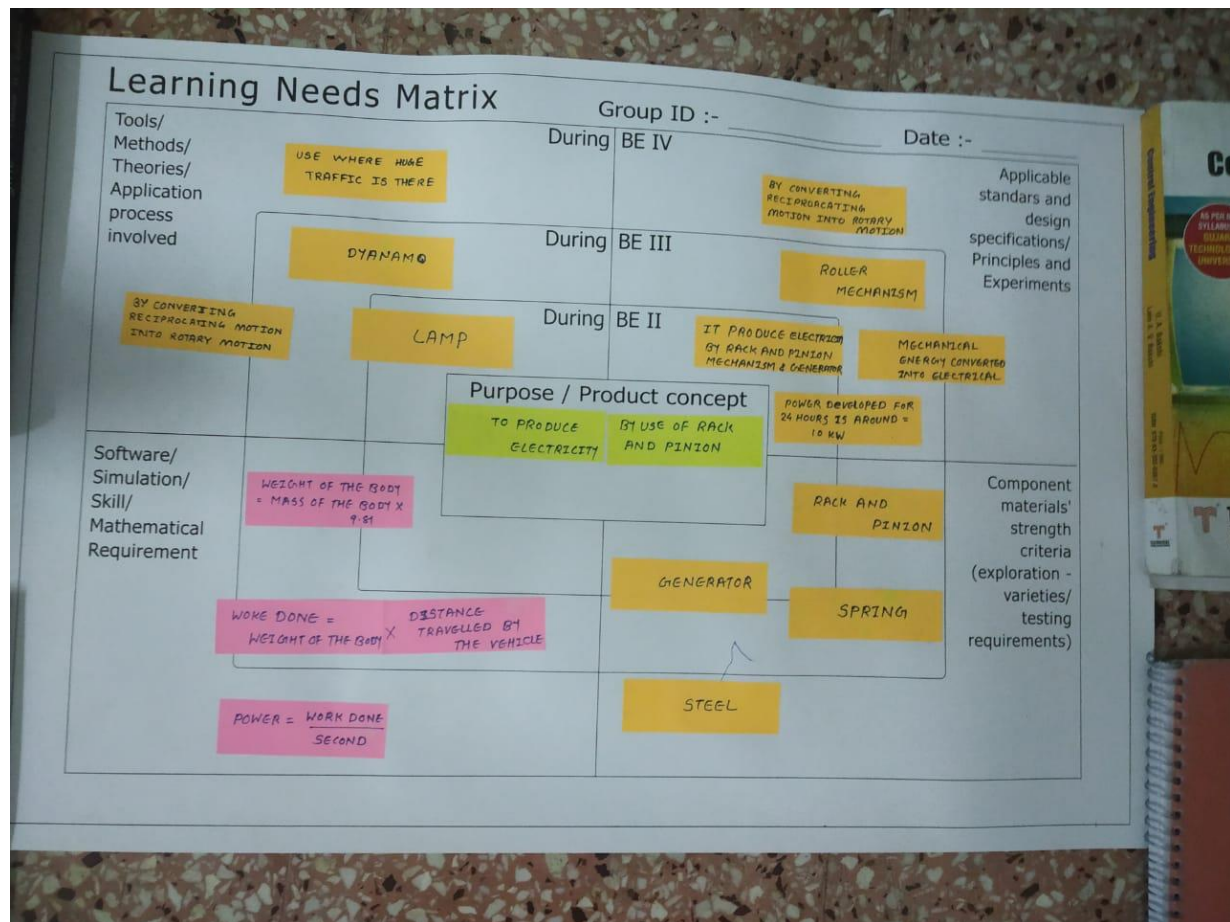- It can cut two metal at one time.
- Use in carpentary workshops.

Software/Skill Requirement:
- Use of speed ratio for calculating torque.
- N1/N2 = T2/T1.

Applicable Standards and Design:

- Work based on rack and pinion mechanism.
- It is applicable were speed breaker type element is used.

6.3 Snapshot of Learning need matrix

Chapter 7. PROTOTYPE DESIGN

1. MATERIALS USED :-
   - ☐ Rack   -   Mild Steel
   - ☐ Pinion   -   Mild Iron
   - ☐ Sprocket Wheels- Mild Steel
   - ☐ Chain   -   Mild Steel
   - ☐ Spur Gears -   Cast Iron
   - ☐ Springs   -   Mild Steel
   - ☐ Shaft   -   Mild Steel
   - ☐ Speed breaker-   Mild Steel

2. SPECIFICATIONS :-

   Generator - 12V DC generator
   Battery   -   Lead acid battery
   Inverter   -   250W AC inverter

3. CHAIN DRIVE DESIGN:-
   - ☐ Nearest chain lengths (in pitches) for a contemplated center distance C_c, are calculated by empirical formulae like (for a two sprocket system;

     $L = (N_1+N_2)/2 + (2C_c)/P + ((N_2-N_1)^2P)/4\pi^2C_c$

     Where N_1 and N_2 is the number of teeth on sprockets and P is the chain pitch.

4. FLYWHEEL:-

   Energy stored in a Flywheel
   Let m= mass of the flywheel in kg,
   K= Radius of gyration of the flywheel in meters,
   I = mass moment of inertia of the flywheel about the axis of rotation in kgm2
   N1 and N2= Maximum and minimum speeds during the cycle in r.p.m.
   W1and w2= Maximum and minimum angular speeds during the cycle in rad/s,
   N= Mean speed during the cycle in r.p.m.=$(N_1+N_2)/2$
   W= Mean angular speed during the cycle in rad/s= (w1+w2)/2
   C_s= Coefficient of fluctuation of speed = (N1-N2)/N
   As the speed of the flywheel from w1 to w2, the maximum fluctuation of energy,

   $\Delta E = 2EC_s$

5. OUTPUT POWER CALCULATIONS:-

Let us consider,

The mass of a vehicle moving over the speed breaker = 80Kg(Approximately)

Height of speed brake = 15cm

Work done = Force × Distance

Here,

Force = Weight of the Body

= 80 Kg × 9.81

= 784.8 N

Distance traveled by the body = Height of the speed brake

= 15cm

Output power = Work done/sec

= (784.8 × 0.15)/60

= 1.962 watts (For one pushing force)

Power developed for 1 vehicle passing over the speed breaker arrangement for one

minute = 117.72 watts

Power developed for 60 minutes(1 hr) = 7063.2watts

Power developed for 24 hours = 169516.8 watts

Velocity ratio of chain drives:

The velocity ratio of a chain drive is given by
$$V.R. = N1/N2 = T2/T1$$
$$=36/19= 1.894$$

Revolution

Revolution of shaft by one push;

Using tachometer, 300 rpm = 5rps

Torque:

Torque produced in one push;

$$T = (P \times 60)/2\pi N$$
$$= (1.962 \times 60)/2\pi \times 5 = 3.75 \text{ Nm}$$

6. DESIGN SPECIFICATIONS:-

- ☐ Shaft (Dia.) = 65 mm
- ☐ Diameter of flywheel = 540mm
- ☐ Thickness of flywheel = 20mm

7. SPROCKET WHEEL AND CHAIN :-

- ☐ No of teeth on large sprocket = 36
- ☐ No of teeth on small sprocket = 19
- ☐ Dia of large Sprocket = 460 mm
- ☐ Dia of small Sprocket = 230 mm
- ☐ Length of chain = 1620 mm
- ☐ Optimum center distance = 560 mm

8. SPRINGS:-

- ☐ Diameter of wire = 2 mm
- ☐ Mean dia. of coil = 12 mm
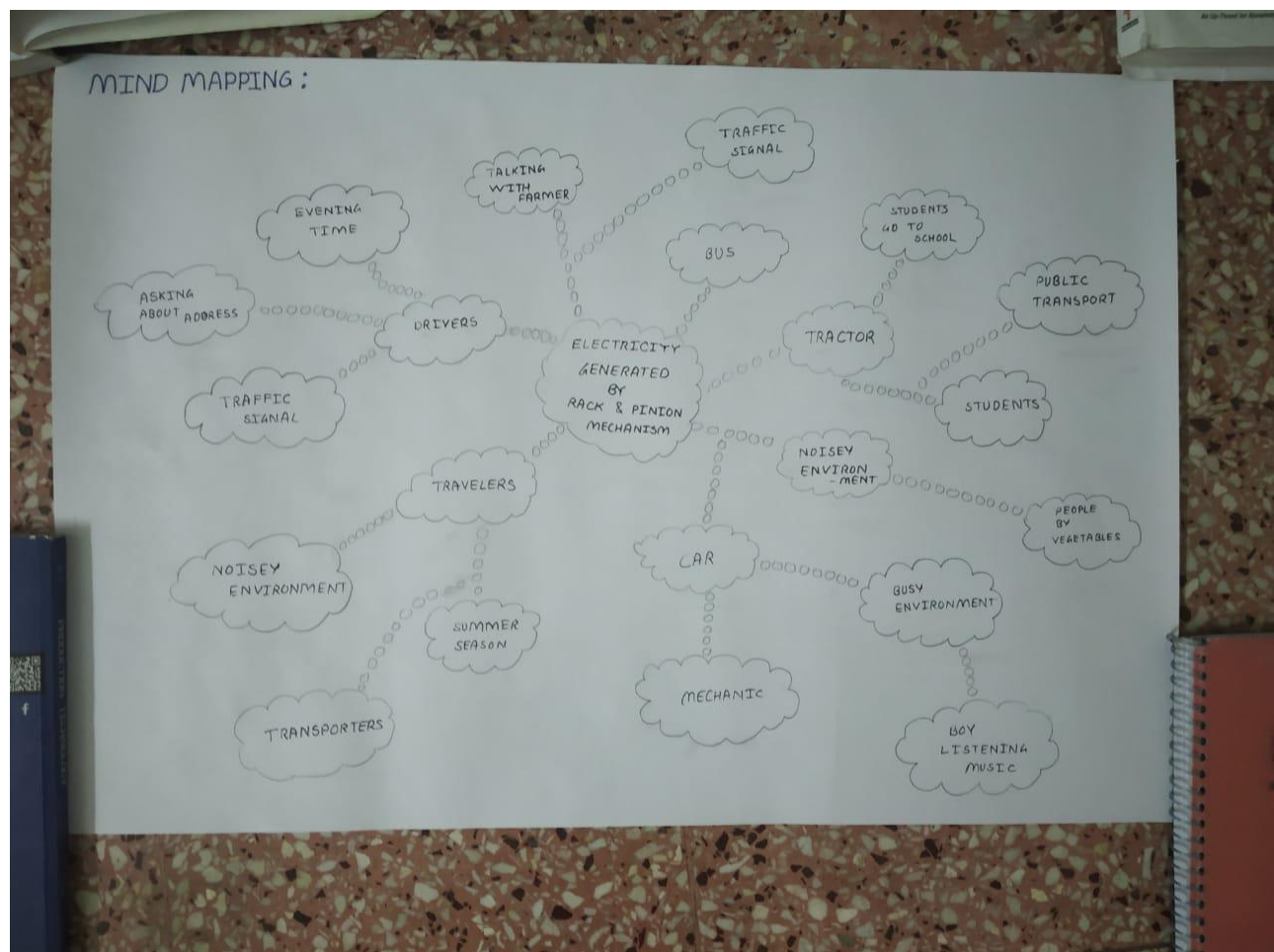- ☐ Free length of spring = 300 mm

9. SPUR GEARS:-

- ☐ No of teeth on Rack = 36
- ☐ Rack Length = 230 mm
- ☐ No of teeth on pinion = 36
- ☐ Diameter of pinion gear = 270mm
- ☐ Thickness of pinion gear = 20mm
- ☐ Length of speed breaker = 290mm
- ☐ Width of speed breaker = 220mm
- ☐ Height of speed breaker = 150mm

7.2 Snapshot of Prototype
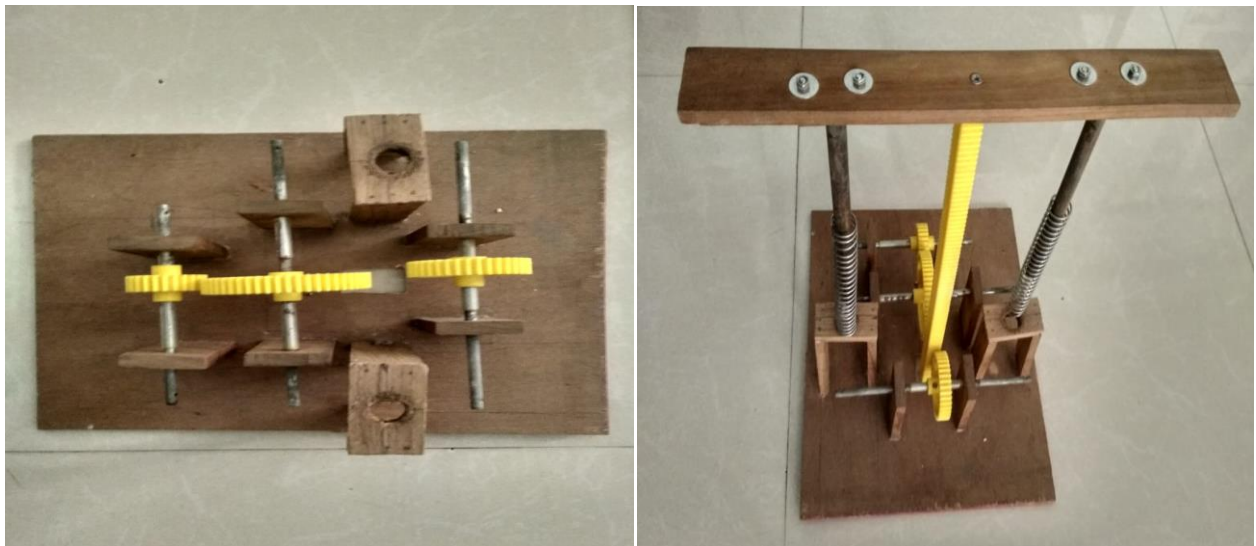
7.3 Snapshot of Mind Mapping canvas

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II. A Textbook of Machine Design by R.K.KHURMI AND J.K.GUPTA

III. Automobile Engineering, KirpalSingh.

IV. Automobile Engineering, S.M.Pandey & K.K. Shah