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Experimental Verification Using Database Model for Power Generation by Gravity Machine

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Abstract: ***The formulation of generalized field data based model for the power generation by gravity machine aims is field data based modeling for power generation by gravity is improve the power by correcting or modifying the inputs for improving output. Reduced human energy consumption will increase overall power, the no of variables involved were large so they are reduced using dimensional analysis into few dimensionless P_i terms. Buckingham P_i theorem is used to establish dimensional equations to exhibits relationships between dependent term and independent terms. Mathematical relationship exhibit that which input variables is to be maximized or minimized to optimized output variables. Model is optimized by using the optimization technique. The model will be useful for an entrepreneur of an industry to select optimized input so as to get targeted responses. The problem of generating power is recent quest so everyone should thick gravity be the option in non conventional energy sources, because gravity is available all over in abundant quantity. The concept of power generation by gravity is simple, when the body goes downward from higher attitude to lower attitude, one its potential energy get converted into kinetic energy, dynamometer generates electricity by this kinetic energy into rotary motion.***

Keywords: Electrical energy, Dimensional analysis, FDBM, Gravitational Machine, PMDC Generator

1. Introduction

Frame structure: frame structures are the structures having the combination of beam, column, and balanced load. Portal frame structure is a look like a door, very much use in construction of industrial and commercial buildings. Load path frame structure is used for transmitted the load from frame structure to the foundation, and this frame have economical design, this frame select for high rise building due to versatility. Braced frame structure is used in between beams and columns to increase their resistance against the lateral forces and sideways forces due to applied load.

Rotating wheel: Rim wheel is the outer edge of wheel, holding the tyre, in bicycle wheel rim is used large hoop attached to the outer ends of spokes of the wheel that holds the tyre and tube. Spokes wheel is one of some number of rods radiating from the centre of wheel, connecting the hub with the round traction surface. Spokes was more commonly applied to finished product of the wheel wrights work than the material used.

Bearing: bearing is a device used to enable rotational or linear movement, while reducing friction and handling stress. Ball bearing are the extremely common because the can handle both radial and thrust loads but can handle a small amount of weight. Roller bearing is designed for carry heavy loads, handle radial loads but can't handle thrust loads. Ball thrust bearing is used for the thrust loads at low speed low weight. Roller thrust bearing is much like as ball thrust bearing handle loads, it can support significantly larger amount of thrust loads. Tapered rolling bearing is designed for handle large radial and thrust loads and load versatility.

Battery: battery is a device consisting of one or more electrochemical cells that converted stored chemical energy into electrical energy there are the two types of the batteries one is the primary batteries which is disposable batteries. Secondary battery is rechargeable batteries, which are designed to be recharged and use multiple times. In this project we used 6V, 4AH rechargeable batteries.

LED Light: light emitting diode is a semiconductor light source, led is used as indicator lamps in many devices and are increasingly used for other lighting. Led's emitted low intensity red light, but modern version available across the visible, ultraviolet and infrared wavelengths with very high brightness.

2. Research Methodology

Working: first we take the M.S. material frame, after that two tapered roller bearing is mounted on the frame. There attached the flywheel through gravity weight at same dimensions. The clamp arrangement is made were a crank and pin is attached for the higher impact of load through a nut and bolt arrangement, total eight cranks and similar arrangement are attached to the flat plate. This plate is mounted around the rotating wheel. Eight crank pin arrangement the total eight variable loads in ascending order is attached now when motor run then arrangement run. The fluctuation in rotation is balanced by flywheel. When the force acting on the weight attached wheel at 75 degree of wheel then the wheel started to the revolution then due the gravity force the weight moves potential energy into kinetic energy, kinetic energy is converted into rotary motion and this rotary motion of axle shaft converted into rotary motion of the axle of dynamometer. By this rotary motion of dynamometer generate the electricity, after that this generating this electricity stored in the battery and transfer the power from battery to LED light. The velocity of falling object is allowed to accumulate over a period before its movement is transmitted into the electrical energy. When velocity of falling object has reached a predefined value, the falling object produce electricity in two ways, via by generating armature torque and by interacting with generating coils, in the process electrical energy is elicited by kinetic energy of the falling objects.

Problem identification: Basic problem is the optimization in the machine component the reduced the cost and it is beneficial to power generation industries. Weight of gravity is when Secondary weight should be adjust such that to fulfill requirements weight of the wheel arm is maintain the needs of rotary motions. Weight of the gravity machine reduced so that manufacturing cost is also reduced. For reducing cost, we will have to use either low grade material or to reduce its section or thickness up to certain limit but in accordance with specification. Failure in strength by reducing weight we may achieve low manufacturing cost and high productivity but its strength is to be considered because reducing weight may cause some extent failure to system.

Problem formulation: In the gravity machine concept, the bicycle mechanism for converting and transmitting human energy through force to rotational kinetic energy of gravity machine is hereby proposed. Due external force generate the power. Bicycle wheel converting kinetic motion into rotary motion with increasing speed. Problem facing gravity machine is mounted in such a way that the operator can work on any side. Due to difficult approach in operating the gravity machine, accuracy of the process is reduced. Power output is small the goal of project is to provide cheap and harmless energy alternative. The power output is enough to small led light. Welding In between the rotating wheel and connecting plate the arc welding is used in proper ways. Cutting In the machine cutting problem is very most important because in the cutting in proper manner and proper size.

Database model: Process variables

Table 1: Shows list of process variables which include dependent and independent variables of gravity m/c

Sr.No.	Variables	Symbol	Unit	$M^0L^0T^0$	Type of Variable	Variable/ Constant
1	Torque of shaft	T	N-m	$M^1L^2T^{-2}$	Dependent	Response Variable
2	Angular speed of shaft	N	Rpm	T^{-1}	Dependent	Response Variable
3	Revolution of wheel	A	Rpm	T^{-1}	Dependent	Response Variable
4	Radius of wheel	R	M	L	independent	Constant
5	Force	F	N	$M^1L^1T^{-2}$	independent	Variable
6	Acceleration due to gravity	G	m/sec^2	LT^{-2}	Independent	Constant
7	Power	P	Watt	$M^1L^2T^{-2}$	Dependent	Variable
8	Moment of inertia	I	Kg-m^2	$M^1 L^2$	Dependent	Constant
9	Weight	W	N	$M^1L^1T^{-2}$	Independent	Variable
10	Material property of wheel (modulus of elasticity)	E	N/mm^2	$M^1L^{-1}T^{-2}$	independent	Constant

Using Buckingham Π Theorem Method for Dimensional Analysis

F (T, N, A, R, F, G, P, I, W, E) = 0

Total no of variable (n) = 10

Total no of repeating variable (m) = 3

Consider repeating variables as 'E', 'N', and 'R'

Therefore No. of Π terms = n – m = 10 – 3 = 7

Equation T, and P can be written as

Response Variable $\pi_1 = (E)^{a1} (R)^{b1} (N)^{c1} T$

$(M)^0 (L)^0 (T)^0 = (M^1L^{-1}T^{-2})^{a1} (L)^{b1} (T^{-1})^{c1} (ML^2T^{-2})$

For 'M'	$M=0 = a_1+1$ $a_1= -1$
For 'L'	$L=0 = - a_1 + b_1 + 2$ $0 = 1+ b_1+2$ $0 = b_1 + 3$ $b_1 = -3$
For 'T'	$T= 0 = - 2a_1 – c_1 -2$ $0 = 2 – c_1 - 2$ $c_1 = 0$

By putting the values of a_1, b_1, & c_1 we get

$\pi_1 = (E)^{-1} (R)^{-3} (N)^0 T$

Hence

$\pi_1 = (T / E R^3)$ -------- Eq. (1)

Response Variable $\pi_2 = (E)^{a2} (R)^{b2} (N)^{c2} A$

$(M)^0(L)^0 (T)^0 = (M^1L^{-1}T^{-2})^{a2} (L)^{b2} (T^{-1})^{c2} (T^{-1})$

For 'M'	$M=0 =a_2$ $a_2= 0$
For 'L'	$L=0 = - a_2 +b_2$ $0 = 0 + b_2$ $0 = b_2$ $b_2 = 0$
For 'T'	For 'T' $T= 0 = - 2 a_2 – c_2 -1$ $0 = 0 – c_2 -1$ $c_2 = -1$

By putting the values of a_2, b_2, & c_2 we get

$\pi_2 = (E)^0 (R)^0 (N)^{-1} A$

Hence

$\pi_2= (A / N)$ ------------ Eq. (2)

Response Variable $\pi_3 = (E)^{a3} (R)^{b3} (N)^{c3} F$

$(M)^0(L)^0 (T)^0 = (M^1L^{-1}T^{-2})^{a3} (L)^{b3} (T^{-1})^{c3} (M^1L^1T^{-2})$

For 'M'	$M=0 = a_3 +1$ $a_3= -1$
For 'L'	$L=0 = - a_3 + b_3 +1$ $0 = 1 + b_3 +1$ $b_3 = -2$
For 'T'	For 'T' $T= 0 = - 2a_3 –c_3 - 2$ $0 = 2 – c_3 - 2$ $c_3 =0$

By putting the values of a_3, b_3, & c_3 we get

$\pi_3 = (E)^{-1} (R)^{-2} (N)^0$ F

Hence
$\pi_3 = (F / E R^2)$ ----------- Eq. (3)

Response Variable $\pi_4 = (E)^{a4} (R)^{b4} (N)^{c4}$ G
$(M)^0 (L)^0 (T)^0 = (M^1 L^{-1} T^{-2})^{a4} (L)^{b4} (T^{-1})^{c4} (LT^{-2})$

For 'M'	$M=0 = a_4 + 0$ $a_4 = 0$
For 'L'	$L=0 = - a_4 + b_4 + 1$ $0 = 0 + b_4 + 1$ $0 = 1 + b_4$ $b_4 = -1$
For 'T'	For 'T' $T= 0 = - 2a_4 - c_4 - 2$ $0 = 0 - c_4 - 2$ $c_4 = -2$

By putting the values of a_4, b_4, & c_4 we get
$\pi_4 = (E)^0 (R)^{-1} (N)^{-2}$ G

Hence $\pi_4 = (G / RN^2)$ **--------- Eq. (4)**

Response Variable $\pi_5 = (E)^{a5} (R)^{b5} (N)^{c5}$ P

$(M)^0 (L)^0 (T)^0 = (M^1 L^{-1} T^{-2})^{a5} (L)^{b5} (T^{-1})^{c5} (M^1 L^2 T^{-2})$

For 'M'	$M=0 = a_5 + 1$ $a_5 = -1$
For 'L'	$L=0 = - a_5 + b_5 + 2$ $0 = 1 + b_5 + 2$ $b_5 = -3$
For 'T'	For 'T' $T = 0 = - 2a_5 - c_5 - 2$ $0 = 2 - c_5 - 2$ $c_5 = 0$

By putting the values of a_5, b_5, & c_5 we get,
$\pi_5 = (E)^{-1} (R)^{-3} (N)^0$ P

Hence
$\pi_5 =$ **(P / ER^3)** --------- Eq. (5)

Response Variable $\pi_6 = (E)^{a6} (R)^{b6} (N)^{c6}$ I

$(M)^0 (L)^0 (T)^0 = (M^1 L^{-1} T^{-2})^{a6} (L)^{b6} (T^{-1})^{c6} (M^1 L^2)$

For 'M'	$M=0 = a_6 + 1$ $a_6 = -1$
For 'L'	$L=0 = - a_6 + b_6 + 2$ $0 = 1 + b_6 + 2$ $C_6 = -3$
For 'T'	For 'T' $T= 0 = - 2a_6 - c_6 + 0$ $0 = 2 - c_6$ $c_6 = 2$

By putting the values of a_6, b_6, & c_6 we get,
$\pi_6 = (E)^{-1} (R)^{-3} (N)^2$ I

Hence
$\pi_6 = (N^2 I / E^1 R^3)$ ------- Eq. (6)

Response Variable $\pi_7 = (E)^{a7} (R)^{b7} (N)^{c7}$ W

$(M)^0 (L)^0 (T)^0 = (M^1 L^{-1} T^{-2})^{a7} (L)^{b7} (T^{-1})^{c7} (M^1 L^1 T^{-2})$

For 'M'	$M=0 = a_7 + 1$ $a_7 = -1$
For 'L'	$L=0 = - a_7 + b_7 + 1$ $0 = 1 + b_7 + 1$ $b_7 = -2$
For 'T'	For 'T' $T= 0 = - 2a_7 - c_7 - 2$ $0 = 2 - c_7 - 2$ $c_7 = 0$

By putting the values of a_6, b_6, & c_6 we get,
$\Pi_7 = (E)^{-1} (R)^{-2} (N)^0$ W

Hence $\pi_7 = (W / E^1 R^2)$ -------- Eq. (7)
f $(\pi_1, \pi_2, \pi_3, \pi_4, \pi_5, \pi_6, \pi_7) = 0$
f [(T/ER^3) ,(A / N) , (F / E R^2), (G / RN^2), (P / ER^3),(N^2 I / E^1 R^3), (W / E^1 R^2)] = 0
Hence functional equation can be written as,

1) Torque of shaft :
= f [(A / N) , (F / E R^2), (G / RN^2), (P / ER^3),(N^2 I / E^1 R^3), (W / E^1 R^2)]
T = E R^3 x **f [** (A / N) , (F / E R^2), (G / RN^2), (P / ER^3),(N^2 I / E^1 R^3), (W / E^1 R^2)]

2) Power
= f **[** (T/ER^3) ,(A / N) , (F / E R^2), (G / RN^2), (N^2 I / E^1 R^3), (W / E^1 R^2)]
P = ER^3 *f **[** (T/ER^3),(A/N),(F / ER^2),(G /RN^2),(N^2I / ER^3), (W / ER^2)]

Table 6.4: Dimensional Matrix

	T	N	A	R	F	G	P	I	W	E
M	1	0	0	0	1	0	1	1	1	1
L	2	0	0	1	1	1	2	2	1	-1
T	-2	-1	-1	0	-2	-2	-2	0	-2	-2

$\pi_1 = (T / E R^3)$, $\pi_2 = (A / N)$, $\pi_3 = (F / E R^2)$, $\pi_4 = (G / RN^2)$,
$\pi_5 = (P / ER^3)$, $\pi_6 = (N^2 I / E^1 R^3)$, $\pi_7 = (W / E^1 R^2)$

Table 6.5: Reduction of independent variables of gravity machine

Sr. No.	Independent dimensionless ratio or π terms	Nature of basic physical quantities
1	π_{d1}	Roller Material Property
2	π_{d2}	Geometric Variables
3	π_{d3}	Instantaneous Process restive Torque

Table 5: Experimental data collection

Force (F)	Torque (T)	Weight (W)	No Of Load	Rev (N)	Time (t)	Power (P)
3	1.14	0.55	4	1	0.5	0.119
4	1.52	0.55	4	1	1	0.159
5	1.9	0.55	4	2	1.3	0.397
5.5	2.09	0.55	4	2	1.5	0.437
6.3	2.39	0.55	4	3	2	0.751
3	1.14	0.55	8	2	0.5	0.238
4	1.52	0.55	8	3	1	0.477
5	1.9	0.55	8	4	1.5	0.796
5.5	2.09	0.55	8	4	2	0.875

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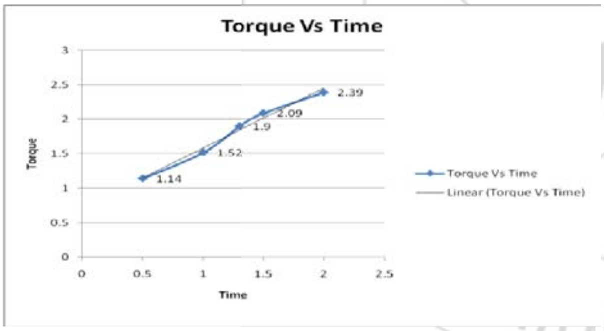
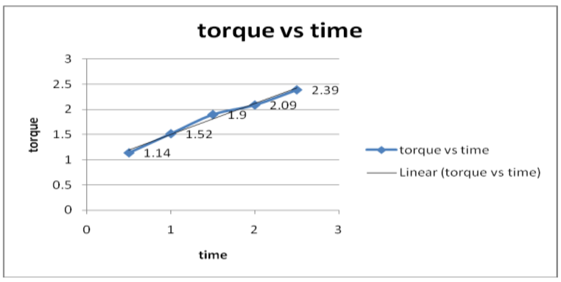
6.3	2.39	0.55	8	5	2.5	1.25
3	1.14	0.6	4	3	1	0.358
4	1.52	0.6	4	4	1.5	0.637
5	1.9	0.6	4	6	2.3	1.19
5.5	2.09	0.6	4	7	2.5	1.53
6.3	2.39	0.6	4	8	3	2
3	1.14	0.6	8	4	2	0.477
4	1.52	0.6	8	5	2.5	0.796
5	1.9	0.6	8	7	3	1.39
5.5	2.09	0.6	8	8	3.5	1.75
6.3	2.39	0.6	8	9	4	2.25
3	1.14	0.65	4	6	3	0.71
4	1.52	0.65	4	7	3.5	1.11
5	1.9	0.65	4	8	4	1.59
5.5	2.09	0.65	4	9	4.5	1.97
6.3	2.39	0.65	4	10	5	2.5
3	1.14	0.65	8	5	2.5	0.597
4	1.52	0.65	8	7	4	1.11
5	1.9	0.65	8	9	5	1.79
5.5	2.09	0.65	8	11	6	2.41
6.3	2.39	0.65	8	12	6.5	3

Torque	Time
1.14	0.5
1.52	1
1.9	1.3
2.09	1.5
2.39	2



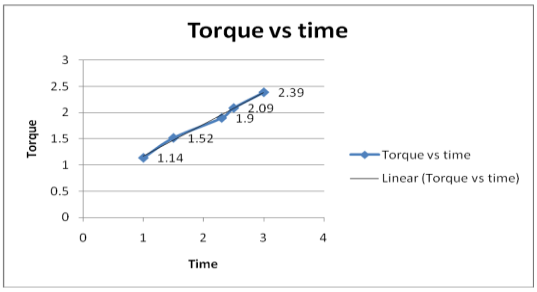
Graph 1: Torque vs time

Torque	Time
1.14	0.5
1.52	1
1.9	1.5
2.09	2
2.39	2.5



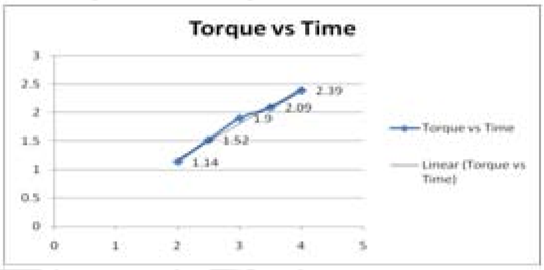
Graph 2: Torque vs Time

Torque	Time
1.14	1
1.52	1.5
1.9	2.3
2.09	2.5
2.39	3



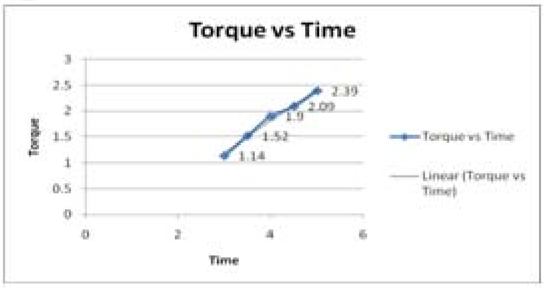
Graph 3: Torque vs Time

Torque	Time
1.14	2
1.52	2.5
1.9	3
2.09	3.5
2.39	4



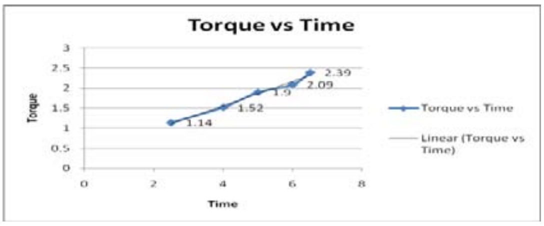
Graph 4: Torque vs time

Torque	Time
1.14	3
1.52	3.5
1.9	4
2.09	4.5
2.39	5



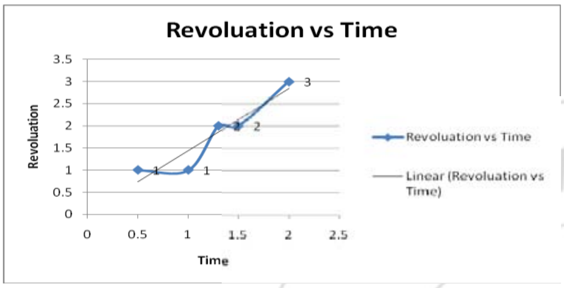
Graph 5: Torque vs Time

Torque	Time
1.14	2.5
1.52	4
1.9	5
2.09	6
2.39	6.5



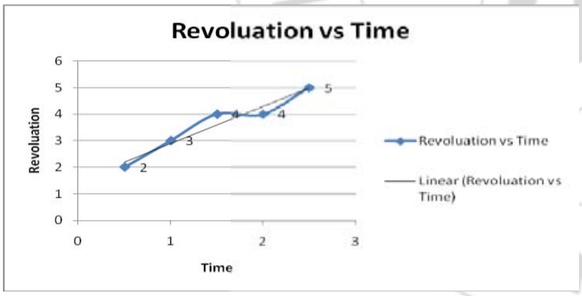
Graph 6: Torque vs Time

Rev	Time
1	0.5
1	1
2	1.3
2	1.5
3	2



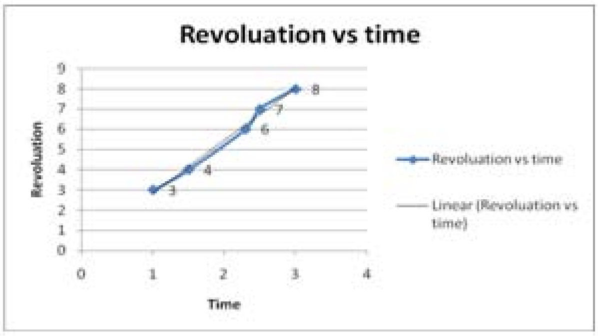
Graph 7: Revolution vs Time

Revaluation	Time
2	0.5
3	1
4	1.5
4	2
5	2.5



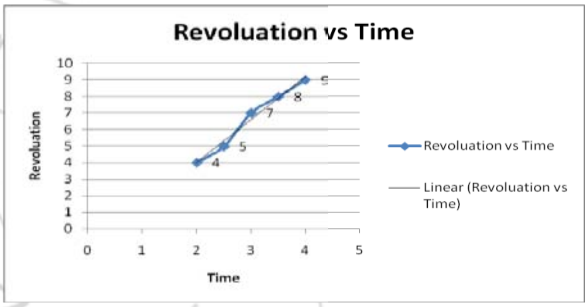
Graph 8: Revaluation vs time

Revaluation	Time
3	1
4	1.5
6	2.3
7	2.5
8	3



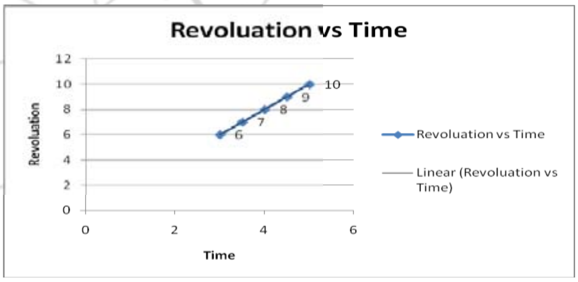
Graph 9: Revaluation vs time

Revolution	Time
4	2
5	2.5
7	3
8	3.5
9	4



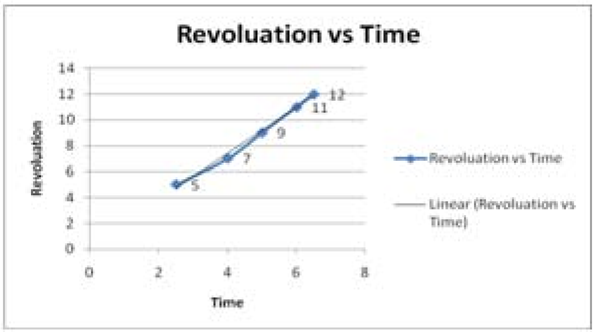
Graph 10: Revolution vs Time

Revolution	Time
6	3
7	3.5
8	4
9	4.5
10	5



Graph 11: Revolution vs Time

Revolution	Time
5	2.5
7	4
9	5
11	6
12	6.5



Graph 12: Revolution vs Time

3. Result

Thus the mathematical equations are established in reduced or compact mode in order to make the complete experimentation process less time taking having generation of optimum data. Database models to predict the performance of power generation by gravity machine were established and optimum values of various parameters were arrived at on the basis of experiments and a new theory is proposed. The outcome of these models can significantly contribute to improve all response variables. The model for the phenomenon represents the degree of interaction of various independent variables in this model we got when time increase simultaneously, increase the revolution of wheel also increase torque and power.

4. Future Scope

Whether a developing nation with ambitions of economic growth, or an industrialized region moving towards a low carbon economy, the challenges of future electricity production are shared. Therefore an attempt is made to generate electricity with an eco-friendly concept using gravity. Prototype is a simple one which generates little voltage. Researchers are being carried out to make improvements to this idea. The major cost involved in this project is with the pmdc generator. It can be made economical by minimizing the generator cost. Large scale production can be achieved using this knowledge.

5. Conclusion

Generation of gravity power can be increased by applying much heavier load at the end of bicycle wheel. Though heavy load increases the voltage and current of synchronous motor but it decreases the lighting time of LED. Applying heavy load, it may cause bending to the pipe stand. So a suitable mass must be used to fall it as much long time as possible. If we use 1-14 rpm synchronous motor, the lighting time will increase. Due to friction of the rotating shaft and motor shaft, there is a power loss. Gravity light needs no operating cost, so it can be operated as the demand of the light. In the remote areas, it may play a great important rule for the education as well as fulfilling the demand of the power. Moreover, the power can be stored in the battery so that it may give a great advantage to emergency situation by increasing the specifications of the components we can improve the power output. By such arrangements, the gravity power generation mechanism consider as: a simplified structure, higher conversion ratio and more environment-friendly but only needs a little starting energy to perform a long time energy conversion and stable energy output.

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