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Mechanical Foot Steps Power Generator

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ABSTRACT:-
Kinetic energy is considered as one of therenewable energies. Substantial amounts ofresearches were conducted to investigate thefeasibility of converting the kinetic energyinto electricity. Never the less, most of theseprevious works emphasized on the selectionof suitable materials and the design of powergenerator which tends to be complicated. Inthispaper,asimpleandyetlow-costmechanismhasbeenproposedtoenhancetheperformanceandefficiencyofenergyconversion from kinetic energy to electricityenergybyplacingamechanicalfootsteppowergenerator onthe hind footregion. Atotalof45individualswereinvitedtoparticipateintheexperimentsandtheexperiment results are then compared withthetheoreticalresults

I. INTRODUCTION

1.1 MOTIVATION:

This project was motivated by the need for adevice that would generate electricity fromhumanmotion,especiallyfootsteps.Electricityisaveryimportantresourceinpeopledailylife.Therearenumeroussourcesfromwhich areabletogenerateelectricalenergy. The major sources of energy includebutarenotlimitedtocoal,naturalgas,petroleum,andnuclearenergy.Mostofthesesourceshaveadverseeffectsontheenvironmentalinclusionsuchasairpollution;forexample,fromcoalenergygenerationplantswhichthencumulativelyleadstoeffectssuchasincreaseinratesofglobalwarming.

This project seeks to establish anenvironmentally friendly way of generatingelectricpowerfromhumanmotion.Suchasystem could be highly effective forinstallationinplacesthatexpectfrequentmobilityofalargepopulationsuchasineducationalinstitutionslikeuniversitiesandsubwaystation entrancesand platforms.

1.2 FUNCTIONSTATEMENT:

Thefunctionofthisstatementistogenerateelectricalpower from humanmotion.

1.3 REQUIREMENTS:

1. Thisdeviceisrequiredtohavetheabilityandcapacitytostoretheenergygenerated6kw/h.
2. The device should be able to supportthe weight of an average human beingwhichis approximately137 pounds.
3. Onceactivatedthetopplateofthedevicemustreturntotheinitialposition with displacement not lastingmore than 5seconds.
4. Thedisplacementmustbecompensated appropriately to preventovershoot in the device. It must be 1inch.
5. Thedeviceshouldmeasure50centimetres in length, 35 centimetreswideandathicknessof25centimetres.

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1.4 SUCCESSCRITERIA:

1. The project must meet all the requisitesafetycriteria.
2. The device developed should also berelativelysmallandlightweightwithout compromising itsfunctionality.
3. The device should be manufacturablewithease.
4. Its construction materials need to beeasily accessible and inexpensive so asto minimize the cost of production perunit.
5. Tobeabletogenerateoptimumfunctionalityofth edevicemustbeinstalled in areas where there is a largepopulationdensity.

1.5 SCOPEOF EFFORT:

Theprojectwillonlyseektoharnesstheenergy generated by the impact of the footonthe floorduringthe gaitcycle

II. DESIGN &ANALYSIS

2.1 PROPOSEDSOLUTION:

The solid works design and dimensions arerepresented in **Appendix B**, and analyses arepresentedin**AppendixA.**Theanalysiscontains only the structure, and the designwill be performed efficiently whenall thedimensions, loads and requirements are metcompletely.

2.2 DESIGNDESCRIPTION:

The design for whole device comes with topplate, base plate, 3 gears, 1 rack with pinion,rodsupports,left/rightsidesupportandgenerato r

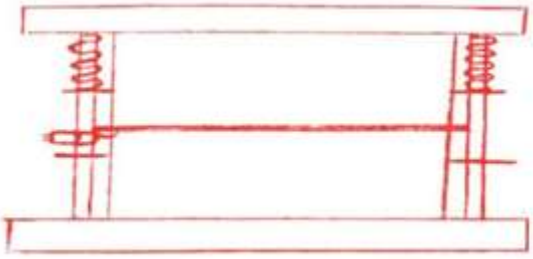

Fig2.1 sideview

Fig2.2actual project

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Fig2.3 frontside of actual project

2.3 BENCHMARK:

Windturbinesareoneofthesourcesofgreenenergyasdependonwindcurrentstoturntheturbinesandgenerateelectricityandalsoinexpensive to maintain since propulsion isnatural.Similarly,thedeviceissoughttodevelop would have zero negative impact ontheenvironmentandwouldbeinexpensivetomaintain since it depends on human momenttoproduceelectricity,also;notbeaffectedbyshiftsinweatherpatterns;unlikewindturbines whose productivity solely dependsonthenaturalwinddirection.Thisnewdevice would be fully dependent on humanmotionwhichisentirelyunderpeoplecontroltooperate.

2.4 PERFORMANCE PREDICTION:

Theperformanceoftheprojectwillbeasdescribed below:

1) Thefootsteppowergeneratorelectricityprovided byhumanmotion.
2) Thedisplacementmustbecompensatedappropriatelytopreventovershoot in the device. It must be 1inch.
3) Once activated the top plate of thedevicemustreturntotheinitialpositionwithdisplacementnotlastingmore than 5 seconds.

2.5 DESCRIPTION OF ANALYSES:

A1:Findingthemaximumpermissibletorqueforashaftofknowndimensions,tryingtocalculatethemax.Permissiblefortheshaftandknowingthewholedimensionscanusefor shaft.

A2: Measuring one force on the beam to tryhow the average human weight 137 lb. willbeon the device.

A3:Measuringthetwoforcesonthebeamforhuman motion, just example if two humans'motionbeonthesteelbeamhowwillbegoodforsteelandnothingwillhappenforthesteelsuchas broken.

A4: trying to get exact measure for top platethatwillworkindevice,andiftryingtomake it bigger can change the volume to higher tobe good.

A5:tryingtogetexactmeasureforbaseplatethatwillworkindevice,andiftryingtomakeit bigger can change the volume to higher tobegood.Butinthebaseplatethelengthshouldbe bigger than thetop plate.

A6: L-bracket measure it and want to knowhowcanbendingthebracketby90degreestoget the exact measure and be work in devicetohold theRod Supportwith base plate.

A7: Measuring the Left/right side support toknow how can support the load for one forceon thetop side support.

A8: Measuring the punch hole for top plateand base plate, Shear stress and strain forpunch hole to Top plate and Base plate andavoid theextra space.

A9: calculating the shear stress for top platethat help the device to know how and will begoodforhuman.

A10:Calculatingtheshearforceandbendingmoment Diagram to know if the steel of topplate will be bending for 137 lb. for humanmotionor not.

A11: Calculating the spring's constant andhowfarthestretchedorcompressedandusing the Hooke's Law to measure constantandcompressed. F = -kx.

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A12: Box measuring, trying to measure howcanmakingaboxforthedevicetobeingoodconditi on and how canuse sizefor thebox.

2.6 SCOPE OF TESTING ANDEVALUATION

Mechanical testing includes testing each partof the machine/robot individually followedbythecompletetestingafterwhichtheproject isready to beused.

III. CONSTRUCTION

3.1 METHOD:

Thecompletediagramofthepowergeneratio n using footsteps. L-shapes windowis inclined in certain small angle which isusedtogeneratethepower.Thepushingpower is converted into electrical energy byproperdriving arrangement.

12The rack & pinion, spring arrangement isfixedatthefootstepswhicharemoundedbellow the L-shapes window. The spring isused to return the inclined L-shapes windowin same position by releasing the load. Thepinion shaft is connected to the supporter byendbearings.Thelargersprocketalsocoupled with the pinion shaft, so that it isrunning the same speed of pinion. The largersprocketiscoupledtothesmallcyclesprocketwit h thehelp ofchain cycle.

This larger sprocket is used to transfer therotation force to the smaller sprocket. Thesmallersprocketisrunningsamedirectionforthefor wardandreversedirectionofrotationalmovement of the larger sprocket. This actionlockslikea cyclepedalling action.

- **Methodofconstruction:**

One of the major factors that determined thenatureofthegenerationsystemwasenvironmental issues. constructing a devicethat generated power while conserving theenvironment was the most critical factor thatmotivated the idea of coming up with thisgeneration system. The system is designed inawaythatthepeoplemovementwillbeutilized to generate electricity. The footsteppowergeneratorbasicallytranslatestheoscilla torymotiontocircularandlatertoelectricity.Theconstr uctionofthesystemincludesmeasurement,manualcutt ing,drillingand welding.

Manufacturingissues:

Mostofthematerialpurchaseddidnotconfor m to the measurement of the parts ofthe generator. Getting materials with similarmeasurements was impossible. In addition,some materials are not locally available. Thelast problem is the cost of the material. Forinstance,the priceof steelis relatively high.

Methodsusedin tosolve theproblem:

Inordertogetthecorrectmeasurement,measu rementandmanualcuttingofthematerials were done. Where the screws wereneeded,drillingwasdonetoensurethatthe boltswerefittedcorrectly.Othermethodsusedinconne ctingdifferentpartsincludewelding.Weldingwasdone wherepermanentattachmentwasneeded.Toensuretha tenoughtimetomakethecuttingandmeasurement was available; all the materialswere orderedin time.

3.2 FOOTSTEPARRANGEMENT:

Thisism adeupofmildsteel.Thecompletesetupisfixedinthismo delfootstep.Thetwo L-shapesframeisfixedintheabovetwoendsof the track. Bellow this L-shapes window,the actual power generation arrangement isconstructed.

IV. TESTING METHOD

3.3 INTRODUCTION:

Footstep power generator is a project withthreemajorparts;structural,gearing,andgeneratin g power. In this proposal the focusmajorwillbeonstructural.Testingthefunctionali ty of the generator is important. Inorder to ensure that the generator setup isfully functional, various tests are done on thematerials.Also,afterthesystemisassembled, various tests will be carried tofind the efficiency of the generation systemandthepossibilitiesofthesystembreakdown.T hetestsdonebeforeassemblinginclude;verificationoft hematerialspurchased,themeasurementverification,a ndverification that the materials ordered weresupplied as instructed. After assembling thefollowing will be tested: the power of thegenerator,theefficiency,reliabilityofthesystem and probability of breakdown afterinstallation.

3.4 METHOD/APPROACH:

- **Performancetesting:**

Thistestinvolvesaprocessoffindingoutthere sponsiveness and stability of the footsteppowergenerationsystem.Thetestwillprovide informationregardingtheproductioncapacity of the generator. This approach willtest the average power the power generationsystemcanproduceatdifferentenvironmen talaspects.

- **Usabilitytesting:**

Thismethodoftestdeterminestheeasinessofusing generation system. The system shouldbeeasytouse.Differentuserswillberequested

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to use the generator while beingobserves. Qualitative data will be collectedforthe analysis

- **Securitytesting:**

Security test will be carried to determine ifthere are any risk involved when operationthefootstepspowergeneration system.

3.5 TEST PROCEDUREDESCRIPTION:

To verify if the materials are supplied are asordered a procedural check is done. Tickingofeverymaterialthatissuppliedwillbedone.The missing materials will be marked withcross(X)forreordering.Also,themeasurementsverificationwillbedone.Everycomponentofthesystemswillbemeasuredtoverifyifthemeasurementconformstothecalculatedmeasurement.After assembling, the system average powerwillbemeasured,theefficiency,andthecontinuityof power generation.

V. BUDGET

5.1 PART SUPPLIERS,SUBSTANTIVECOSTS,SEQUENCEOR BUYINGISSUES:

Thematerialforthemainsectionsofthedesign such as Top Plate, Base plate, RodSupportcomesfromOnlinemetals.com.Sincebuyingmassquantitiesofnutsandboltsisnotsuitedforconstructingjustasinglepair.So,beforepurchasingthematerialsfromOnlinemetals.com,makingsureof thesize in good condition.

5.4 ESTIMATETOTALPROJECTCOSTS:

Theestimatetotalfortheprojectwillbearound $300 dollars. Also, each part shouldbe separate and each one has different price.Otherwise,someofpartsarecomingtogethersuchasleft-sidesupportandright-sidesupport.

5.5 FUNDINGSOURCES:

Expectedprojectcost:(Therearenofunding Sources)

Theinitialcostoftheprojectwas.6,000Rs.Thepurchaseofsomepartswaspurchasedseparately as gears, rack and pinion.However,purchasingasteelplateof0.24”thickness for the left and right-side support.**Costchange due to change in design:**

No cost was incurred due to change in thedesign.Thetotalmanufacturingcastsummedto 6,500Rs.

Costdue to errors:

Some of the items that were bought were notconforming to measurements. The item thatneededrepurchasewas8inchesspringwhichcosts 500 Rs. The only option was to buyanother item. There was no additional labourcostasfixedit.Noexternallabourwasneeded.

VI. ACKNOLEDGEMENTS

This project could not be completed withoutthe support of the faculty and other adviserstothisproject.Alargethanksgoestoprofessor FesateA.V,H.O.DBidveA.V,andprincipal Dharashive P.S for rendering someassistancewiththeprojectandtakinghistimetohelpwithallthequestionsthatwerehadupto this point. While this is a mostly groupprojectthecollaborationbetweenotherpartnersisanimportantpartofthedevelopmentprocess.

VII. CONCLUSION

Mechanical Footsteps Power Generator is arisk-free electricity generation system. Muchof the energy that is wasted when people aremoving is well utilized and transformed toelectricalenergywhichcanbeusedinschoolsandotherinstitutions.Thismethodofpower generation is cost effective when usedcontinually. Basically, the cost efficiency isrealized inthe longterm. This methodofpower generation can be installed in areassuchasmalls,schools,colleges,attherailwaystationsoranyotherareaswherepeople movementis intensive.

Theproductionofelectricityusingthismethodisenvironmentalconservativebecausepowerisproduceswithoutpollutingtheenvironment.Also,thepowerthatiswastedbyhumanwhileworkingisutilizedbythis system to produce electricity. Therefore,the system ensures maximum utilization ofavailableenergy.Theenergysourceisrenewableandisavailablecontinuously.Therefore,themethodisvery convenientthan other methods of power generation. Thepower generated by this system can be usedin the rural areas. The method is also veryeco-friendly; the production does not requirefuelling,thatproducesmokeandotherpollutants. The tests that have been done sofar have confirmed that the system is bestbecausebeingprovidesaffordableenergysolutiont o people.

Although the method seems advantageous inmostaspects,theamountofpowerthatcanbegenerated by this system may not be used inplaces where mass electricity is needed. Thesystemisconstructedtogenerate6kw/h.Therefore, thesystemcanonlygeneratepowerforlightingandpoweringsimpleelectricitygadgets.However,moreimprovementcanbedonetoincreaseitsproduction such as coming up with a methodof stepping up thegenerated power.

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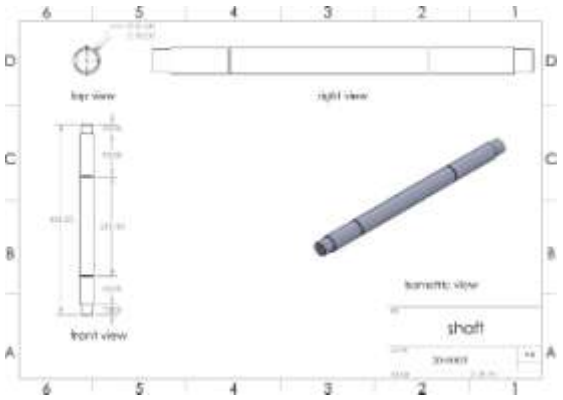
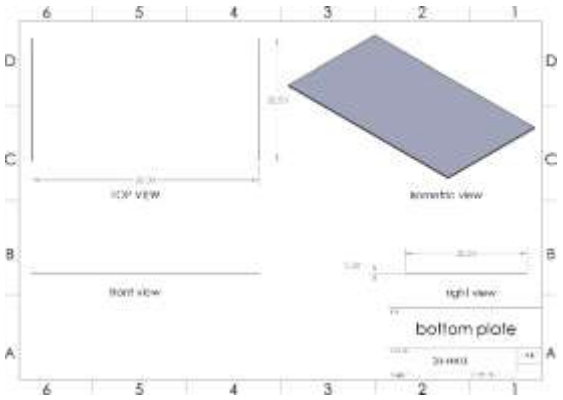
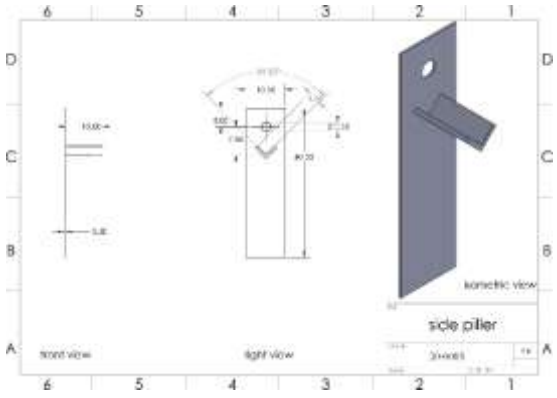


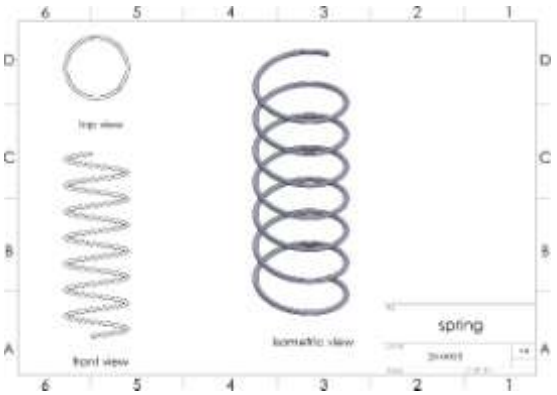
shaft



bottom plate



spring



sidepillar

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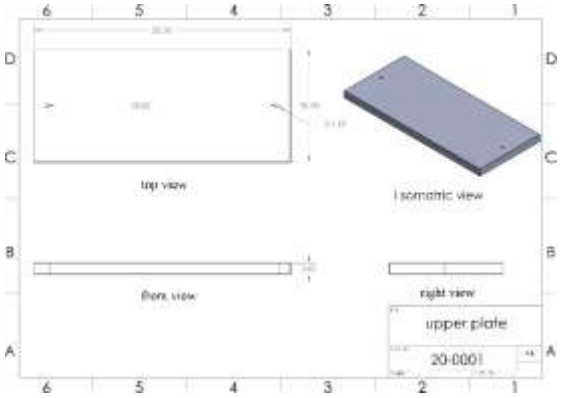

upperplate

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