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Self Charging EV Cycle by using BLDC Motor

Is the biggest step towards healthy Earth

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ABSTRACT: This paper presents solutions to the problems related with the E-cycles or E-bikes. As E-cycles are great to move around the town with less pedal power, but they comes with some problems like they are very expensive, their battery life span is also short and at some point they runs out of the charge. But this self charging EV cycle solved this problem as its initial cost is low, better battery life span and a ride can ride unlimited mileage with this self charging cycle.

I. INTRODUCTION

From the very beginning of the civilization, human adopted new technologies to make simple their life, it leads them to the urbanization & industrialization. Transportation is one of the major inventions of the mankind. As years passed further more advance technologies of transportation came which made a 0huge impact on human life, made life a lot easier but on the other hand after twentieth century transportation sector became the major contributor of the air pollution. Almost 70% of total pollution occurred due to the vehicle or transportation sector in INDIA. These gases are responsible for different type of health hazards in human being. Vehicle emission is largest contributor of total green house gas generation. It leads to the change of climate of that particular country causing sea level rise, flooding, drought, acid rain, rise in temperature etc. This emission is cause of death of a 361,000 people in 2010 & 385,000 people in 2015. In today's era everyone is engaged to free earth from the claws of carbon emissions, or CO_2 just by switching to electrical vehicles is a major step toward it. The use of electric vehicles for short distance travelling will help to reduce the pollution to some extent. E- cycles are convenient and reliable to use and cost effective than the other options on a short run. More over anyone can convert their own cycle into E-cycle because of which it became very popular nowadays. But there E-cycles also runs out of charge at some point and has to recharged, which is again indirectly leads to air pollution as most of the electricity in India is obtained from the firing of coal, high levels of city pollution are medically damaging to the residents of the city. However, it is bad for the planet, as a whole. In search of better option idea of our project came where it consists of two dynamos which is enough to generate power for the cycle and packed two batteries which can be switch to other when one is running low which give the battery a longer life span saves money and it have a longer running range. Longer the cycle runs more energy it will be generated, giving unlimited mileage to the rider.

II. PROPOSED METHODOLOGY

The environmental pollution has the long & severe effect in INDIA as well as in the whole world. Among the all types of environmental pollution Air pollution has the major effect in the environment as well as in the human being. Many cities of our country are enlisted in top polluted cities of the world. The metro cities Delhi, Kolkata, Mumbai are the most polluted cities of the country. The main contributor of air pollution in urban areas of the country is Transportation sector, nearly 27% of total air pollution. The number of vehicle increased rapidly in road of this country & it is expected to increase in the same rate as increased in past 10 years. This will affect directly or indirectly the economy, public health, global warming, and environment. The pollution due to automobiles is increasing with every passing day and the use of electric vehicles for short distance travelling will help to reduce the pollution to some extent.

E- Cycles are reliable on short run. More over anyone can convert their own cycle into E-cycle because of which it became very popular nowadays. These electric vehicle need to be recharged at a power point which is again very time

consuming not only this but it also needs money to get charged. An attempt is made to eliminate or reduce dependency on recharging from main supply by introducing a Self-Recharging Mechanism and to attract more people to switch to green vehicles.
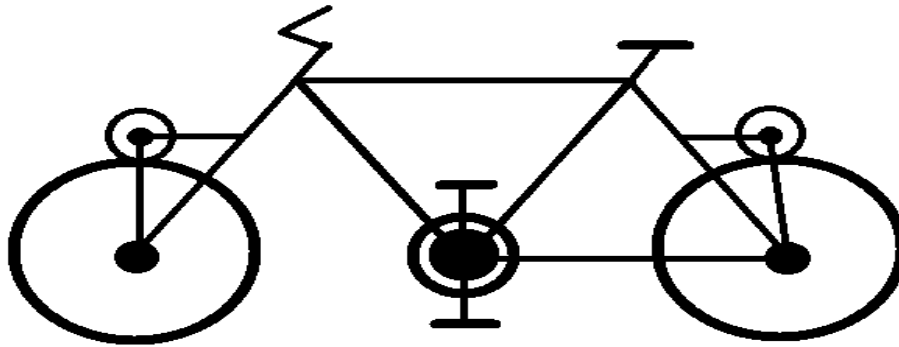
Basic diagram

Fig 1: - Basic diagram

Working

Firstly we have added two small wheels on top of both the main wheels. So that the main wheel and secondary wheel make a gear like structure together, when the main wheel will rotate the secondary wheel will also starts to rotate but in the opposite direction. Both the small wheels will acts as a turbine for two different dynamos on both side, which will generate dc power and further fed to the battery through a controller. Here we have used two batteries, when a battery is charging secondary battery will give the supply and vice versa. Batteries can manually switch to other when one is running low. Then the charge from the battery fed to dc starter motor through the help of another controller. Then this dc starter motor will drive the cycle.
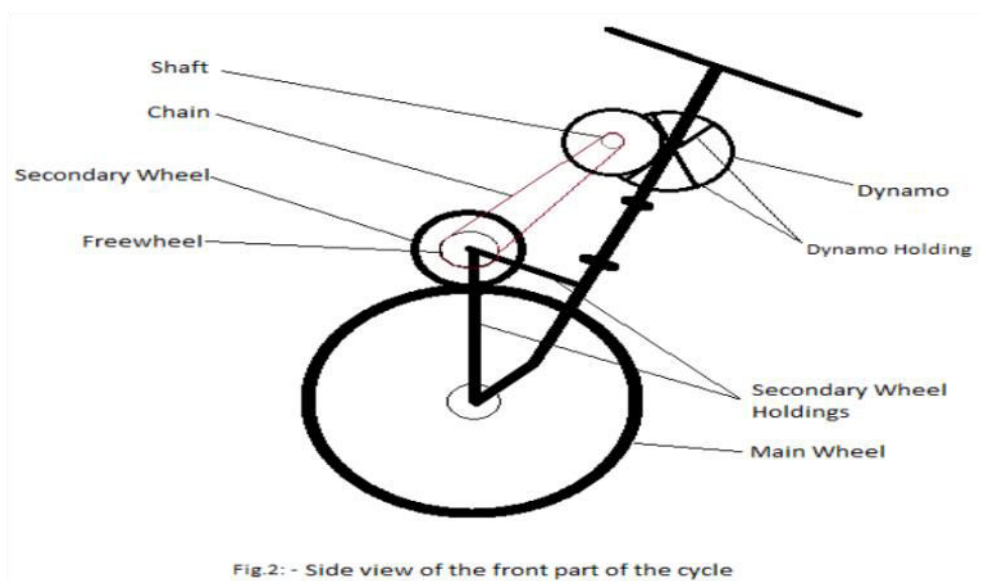
Drawings: -

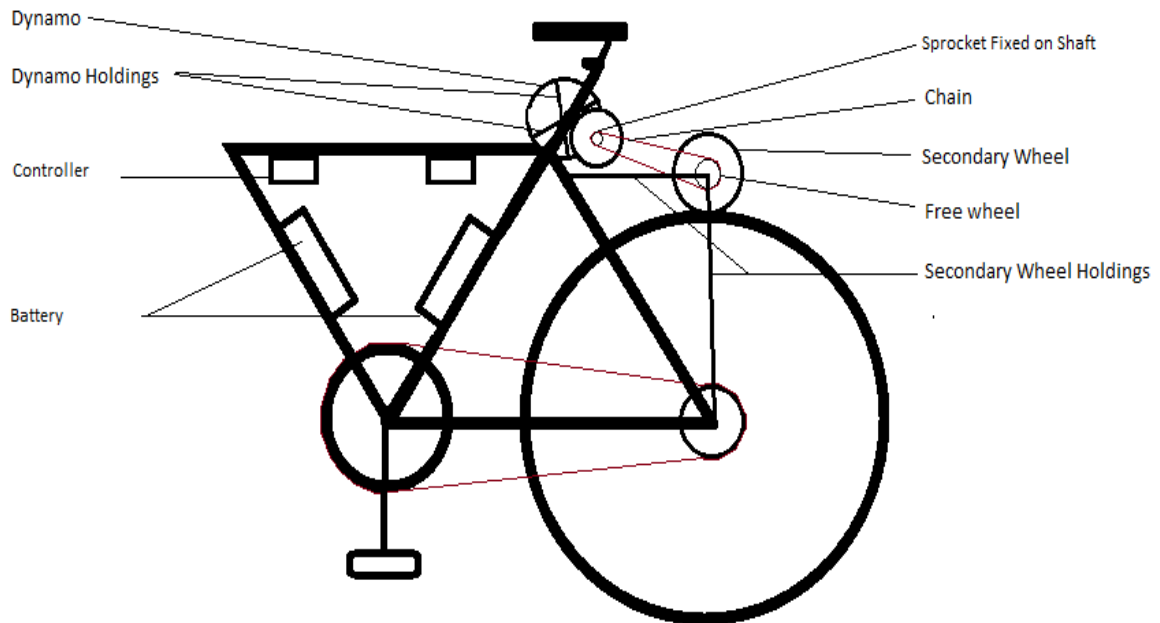

Fig.2: - Side view of the front part of the cycle
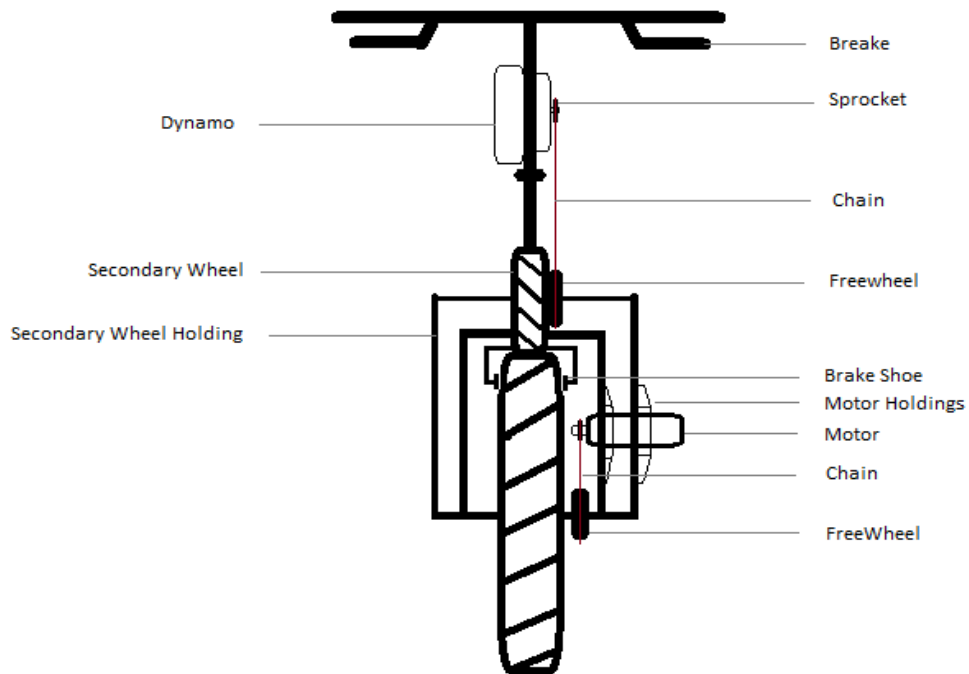
Fig.3: - Back side view of the cycle

Fig.4: - Front view of the cycle

Detailed analysis and component

1. *Dynamos*

For dynamos we have used 250w DC geared motor as show in the figure. And it was assembled along the Steering stem or head tube as shown in the fig.2 for the front side. For the back side it was assembled along the seat stay as shown in fig.3. These dynamos are connected with two different secondary wheels.

2. *Secondary wheel*

Here front and back wheel acts as main wheel and smaller wheels acts as secondary wheel. This secondary wheel was assembled on top of the main wheel , so that there should be enough contact between the secondary and the main wheel, when the main wheel start to rotate secondary wheel should also rotate .Main wheel rotates in one direction then secondary rotate in opposite direction resembles as a gear mechanism. With both secondary wheels a dynamo is connected with the help of a chain. With both secondary wheel sprocket was attached in order to transmit rotary motion to dynamo. By this way this secondary wheel was acting as turbines for dynamos, the charge from the dynamos was then fed to the battery through a controller.

3. *Controller*

We haveused two controllers; one for the optimized power to the battery and for the switching purpose, connected before the battery and another one connected after battery, used for the controlling purpose of the cycle including braking, indicator, power locking and a charging port for normally charging through supply mains if necessary.

4. *Battery*

Here we have used two batteries for better battery management. When a battery is charging the other one could be used for driving when running low then can be switched manually to the charged one. Here we have used valve regulate lead acid batteries which are used for motor cycle it would better if lithium ion batteries were used efficiency is much better than VRLA batteries. The charge from the battery was then fed to DC starter motor through a controller which was mentioned above.
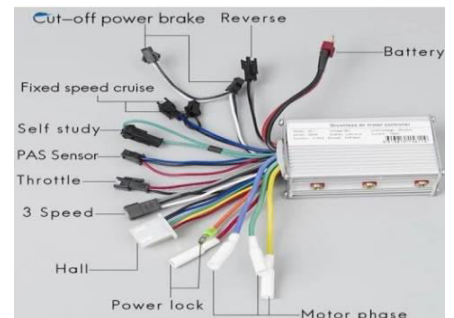

Fig.5: - DC gear motor 24V, 250W (Dynamo)

Fig.6: - Secondary wheel

Fig.7: - Controller

Fig.8: - Battery

5. *DC Starter Motor*

It was a type of motor which was usually used in motor cycle for the self starting part. We have used this motor as a driving motor and here we have done front wheel drive instead of rear normal rear wheel in order to make it simple as shown in Fig.4. The charge from the battery fed to the motor through the controller which was mentioned above and with the help of chain motor was connected to freewheel which was attached to the front wheel which then drives the cycle. If hub motors could be used instead of DC starter motor then it would give better efficiency as dc starter motor would get heated on a long run deteriorating the efficiency.

Undergoing project picture

PROBLEM FORMULATION

Known parts:-

Assuming bikers weight = 70kg.

Bike weight = 50kg.

Appling basic physics to cycling

Equation,

$F = m*a$ Where, F = force, m = mass, a = acceleration.

$Fp – Fr = ma.$ Fp = propulsive force, Fr = resistive force.

First of all we have to find the resistance,

There are three types of resistance

Rolling resistance (Rr), Gradient resistance (Rg), Aerodynamic resistance (Ra),

Total resistance = Rr + Rg + Ra.

- *Rolling resistance (Rr) = Cr*m*a.*
                        Where,

Cr= coefficient of rolling resistance,

Bicycle tire on asphalt road (Cr) = 0.004.

m= mass of the vehicle in kg,

Rider's weight + vehicle's weight = 50+70=120 kg.

a= acceleration due to gravity m/s^2,

Taken,

Cr = 0.004

m = 120 kg

a = 9.81 m/s^2

Rr = Cr*m*a.

= 0.004*120*9.81

=4.7088 N.

- *Gradient resistance (Rg) = m*a*sinØ*

Taken =   m = 120 kg   m= mass of the vehicle in kg

g = 9.81 m/s^2   a= acceleration due to gravity

Ø = 0° (for flat surface)   Ø= slope or gradient angle.

Ø = 15° to 22° (for slope)

Considering a flat surface,

Rg = 0 N

But for slope surface = m*a*sinØ

= 120*9.81*0.37

= 435.564N

We are considering it for the Flat surface.

- *Aerodynamics resistance (Ra) = 0.5(Cp*V^2*Ca*At)*

  p = Density of air medium (kg/m^3)
  V = velocity of vehicle (m/s)
  Ca = Coefficient of air resistance/Drag coefficient
  At = Frontal area of vehicle (m^2)

Taken,

  p = 1.23 kg/m^3(air at sea level)
  V = (25*1000)/3600 = 6.94 m/s.
  Ca =0.88 (for bikes).
  At = Frontal area of the vehicle

Calculation for the frontal area of the vehicle:-

  Two steps needed to be followed-

  1. Draw the front view of the vehicle.
  2. Measure the height and width of the front view.

(Note- for cycle width =up to length of the hand bar & height= up to person's helmet.)

At = (height*width)*adjusting value
  = (1.63*0.78)*0.70=0.83m^2
Ra = 0.5(1.23*6.94^2*0.88*0.89)
  = 24 N.

Therefore,

  Total resistance force,
      Rt = 4.71 + 0 + 24
         = 28.71 N

The motor cycle has to overcome 28.71 ≈ 29 N to get propelled.

Propelling power required to overcome this resistance force:-

  Power = Total resistance force * velocity of the vehicle (m/s)
       = 29 * 6.94

  Power = 200.1 watts.

III. RESULTS AND DISCUSSION

Day by day increasing pollution and decreasing in fossil fuels giving a worst impact on earth that's why everyone is trying to switch to an alternative method for traveling like electric vehicles, the use of electric vehicles for short distance travelling will help to reduce the pollution to some extent. E-cycle is a good option for that as it is cheap easy to get and low running cost. These electric vehicle need to be recharged at a point which is again very time consuming not only this but it also needs money to get charged. An attempt is made to eliminate or reduce dependency on recharging from main supply by introducing a Self-Recharging Mechanism is came. This self charging mechanism allows people to ride without worrying about the recharge and the running range, it allows them to ride more efficiently but with added advantages. Self charging EV cycle provides more running range with significant amount of charge for the batteries, with better battery life span and low cost and running cost which is not really possible before.

IV. FUTURE PROSPECT

Further advancement of the project can be done by the following ways: -

a) First of all instead of using chain system to connect the secondary wheel and the dynamos, just by upgrading this secondary wheel which is being used to a spoke wheel in which hub motor can be installed so the additional losses due to the chain can be avoided. Then this hub motors will work as a dynamo, more efficient than BLDC or geared motor.
b) Upgrading the batteries to lithium ion batteries for output and faster charging time long life.

V. CONCLUSION

Electric vehicles are vital part of our future as it makes transportation affordable, quick, easy, convenient and eco-friendly. One of the key reasons for the increase in electric bike is that batteries and motors have become high efficient, durable and light weight. No need to charge the battery externally as there is dynamo inbuilt through which battery is charged. If you want to charge battery externally you can charge using an adopter or eliminator and you can also add solar panel if you are able to bare the expenses. With an electric bike you don't need to worry about paying for any sort of special license or registration. Electric bike is one of the cheapest way of traveling. Electric bike riders can tailor the difficulty level of their rides to meet their unique health and fitness needs. You can go peddling incase the battery is totally discharged. The discharged battery gets recharged as you keep peddling or riding the bike.

REFERENCES

1. "Design and Analysis of Self-Recharging Electric Vehicle" Nagaraj Sindagi, Nandan K, Sunil N, Sumanth H R, Dr. Dhanalakshmi R. International Journal of Research in Engineering, IT and Social Sciences, ISSN 2250-0588, Impact Factor: 6.565, Volume 10 Issue 06, June 2020
2. "Self charging electric bicycle" Girish B Kallihal, Zein Ul Abedin K, Saifulla Lohar, Irshad Ali Kh, Muzaffar Ahamed G. IJCRT Volume 6, Issue 2 April 2018 ISSN: 2320-2882
3. "Continuous Onboard Vehicle Emission Monitoring through IOT" Soumyadeep Das Adhikary, Suman Dutta, Sohini Mondal, Sarbojit Ghosh, Souvik Dhar, Sourav Mallick, Partha Das. International Journal for Research in Applied Science & Engineering Technology (IJRASET) ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429 Volume 8 Issue V May 2020
4. Yogesh jadhav ,Gaurav Kale , Shekhar Manghare , Sager Patil "Self Charging Electric Bicycle" International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169 Volume: 4 2017
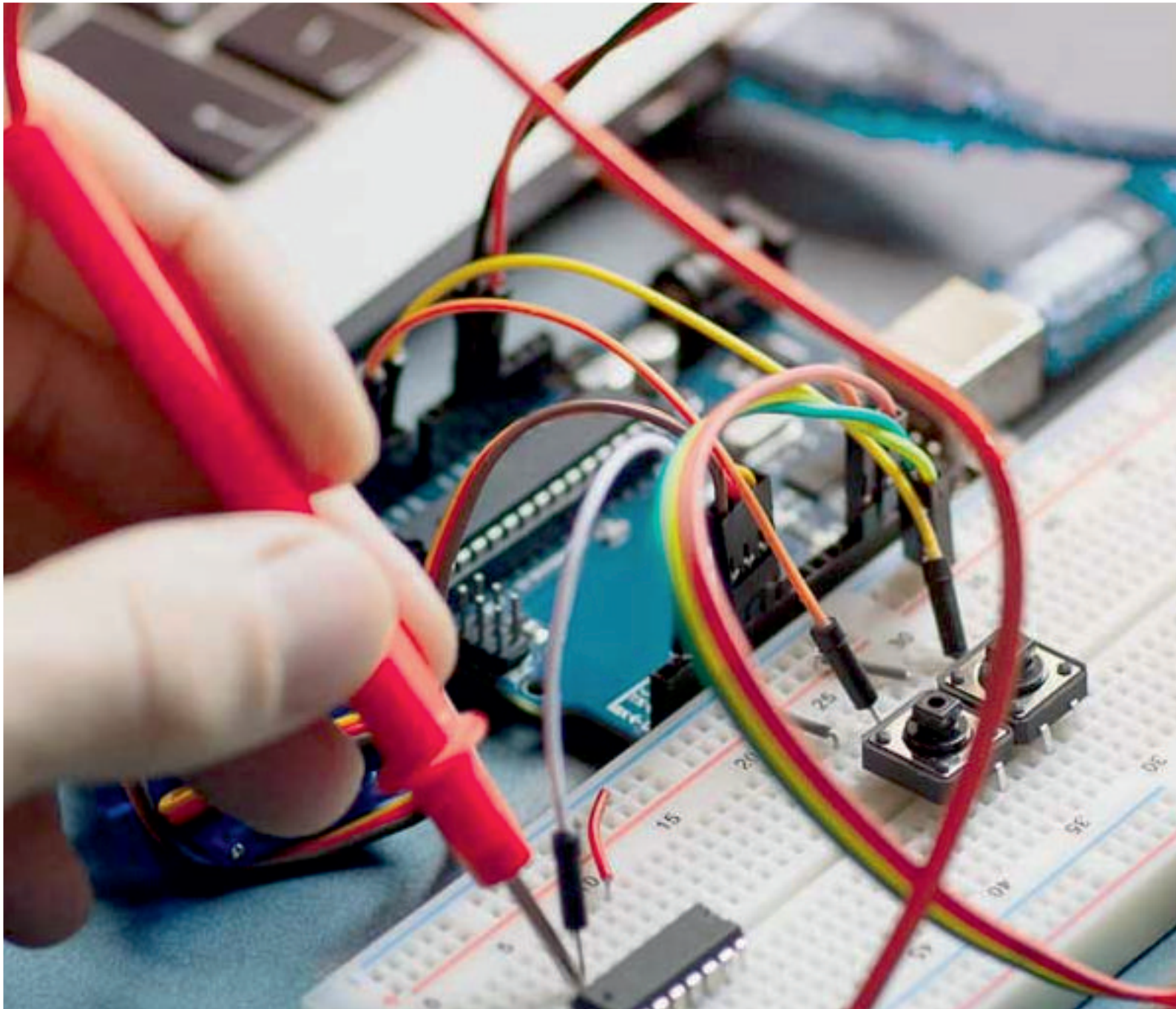
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