Intelligent Power Generation and Conversion for Estimation of the Location

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Abstract—The paper focuses on the practicality and application of mechanical structure being used for the purpose of generating a small voltage to act as an alternative source of power and send information in case of mobile electronics and wearable electronics. The present scenario of mobile phones does not allow the mechanical structure to suit the needs and design of mobile phones. To compensate this problem mechanical design and structure can be used to generate a small amount of voltage and power microelectronics inside a mobile phone. Working with the design and weight shifting property of mechanical shafts we can provide a setup to generate a small voltage of electricity and send the required information of the mobile phone, even when the device is offline. The information maybe, location or sim card details so that a device can be tracked down even when it is switched off.

Index Terms—tracking system, wearable electronics, power management

I. INTRODUCTION

The currently used mobile phones and devices are basically completely dependent on batteries, for the purpose of their functioning. Whenever a device is lost, the major problem is to figure out the device's location because the power is either turned off or there is no power in the device. To solve this problem, we are using a mechanical semi-circular shaft to generate power for the core electronic components and generate a voltage for the purpose of transmission of information. The generated voltage is also stored in a small battery to maintain the flow of current while the operation is taking place. The structure design of the prototype allows us to fit the circuit internally or externally in the circuit and allow the mechanism to work when the device is being displaced or moved. The fact that mechanical kinetic energy is being used to generate electricity for the device allows some open source possibilities for the setup, to work under different situations and conditions.

II. PROBLEM

The source of energy for the current devices being just a single battery is a problem for lots of devices. Though we are using rechargeable batteries for the purpose of device operation, we are short of opportunities to access the device once the device is being turned off. The device information such as location and sim card access are majorly important when it comes to the fact that we want to find the device or access the device data. Thus the device location and connection requires some other source of energy for the purpose of functioning and operation. If we can store or generate energy remotely then we will be able to fix this problem and have a new domain of power conversion and data transmission over the device.

III. SOLUTION

The generation of power remotely on the device itself is achieved by the use of semicircular shafts and electronics mounted on the device itself to allow the generation and storage of power and electricity on the device. A small mechanical disc is constructed using the vibration motor and inverting the power coils of the coil to generate the power instead of using it for the purpose of mechanical rotation.

IV. RELATED WORK

Ayushi Jain [1] on PFC based BLDC controlled explained how a BLDC Motor can be used to solve the problem of power halting and power balancing. With the use of simple electronic components, we can stabilize the bldc to run accordingly.

Anitha [2] Varghese explained the low strength Wi-fi connection being used in industrial application, this system will allow the connection to have no interruptions when the network is single channel.

F. Vázquez Gallego [3] explained the delay analysis and breakdown of the internal delays that can be added to the control system to enable for the internal power reduction and control of the Wi-fi module internally.

Minh-Son [4] on this paper explained how we can enable Wi-fi module for the effectiveness over the low power mode and also how ESP8266 can be used to connect over the Wi-fi networks.

Allan Gregori [5] used a finite control method to control method to control the BLDC, this system when reverse engineered can help us in forming a stable system which can take out power from the BLDC.

B. V. Ravi [6] made a fault tolerant system that can be used to detect and control the output of BLDC Motor, this will also help in controlling the backflow of the current when modified with a linear diode.
Ranjan K. [7] Stabilized the weight of the system and allowed to balance the counter weight in BLDC. This method allowed to have a stability control over the output of the system and the Weight of BLDC.

Jiaxing Shen [8] showed his grouping concept in his paper that allows multiple Wi-fi to create a group. In our case we can use this concept to connect to nearest Wi-fi and use it as a medium to send the data or information over a longer distance without any interruptions or breaks. Hence the data from Wi-fi can have a jumping property.

V. DESIGN OF THE POWER GENERATION SYSTEM
A. Outer Casing and Mount
The case for BLDC is designed in SolidWorks keeping all the electronics intact. The semicircular shaft is also kept on the inner side of the casing making the system completely sealed. (Fig. 1)

B. BLDC Placeholder
We used BLDC motor to generate electricity on the first go. The power generated on the three-phase motor is then sent to the rectifier. The dual rectifier allows the conversion of simultaneous power and helps in recharging the rechargeable battery. (Fig. 2) The balance of the weight along with the housing is made so as to keep the motor and weight stable. [5]

C. Circuit Placement
The circuit is aligned with the center of the whole setup. The circuit consists of mainly a dual rectification system which allows for the 3 phase motor to produce a linear output for the battery [6] and the circuit (Fig. 3).

D. Battery Placeholders and Fixtures
We place a regular 1S lithium polymer battery at the right end of the circuit for powering the system. The battery is fixed to the base plate using adhesives and is aligned parallel to the Wi-Fi module. It is connected to the charge controller of the circuit.

E. Wi-Fi Module Placeholder
We connected the Wi-Fi module to receive the maximum signal strength. The Wi-Fi module is placed on the extreme end of the setup and is capable of receiving and transmitting the Wi-fi signals. (Fig. 4)

VI. ELECTRONICS AND CONTROL SYSTEM
The core electronic components include a BLDC motor, Rectifiers, Charge Controller, Wi-fi Module and a 200MaH battery.
A. BLDC Motor
We used a standard BLDC motor 1200kv in the prototype as it allows the implementation of free motion when compared to other motors. A brushless motor can operate at speeds above 10,000 rpm in both loaded and unloaded conditions. Another advantage is that BLDC motors have life expectancies of over 10,000 hours. We placed the motor at the lower fixture of the case allowing us to get the maximum weight shift.

B. Rectifiers
To convert the reciprocating waveforms generated by the BLDC we are using dual rectification system which consists of diode arrangement, since it “straightens” the direction of the current. After rectification, we use this regulated voltage to charge the battery and run the circuit.

C. Charge Controller
The charge controller is being used to charge the circuit. The charge controller is connected directly to the supply input which allows the charging of the circuit when the circuit is in standby and also to use it in real-time when required.
D. Wi-Fi Module (802.11 Dual Band)

We have used ESP8266 Wi-Fi microchip. This small module allows to connect to a Wi-Fi network and allows for the connection and sending of data to the known wifi network.

E. Battery

The system requires 3.7V to run, so we have used a lithium polymer rechargeable battery to optimize and run the entire system, the battery that we have used is a 1S battery with the capacity of 200mah. The battery is capable of running the system for a total of 7-8 hours [7].

VII. CODING THE CHARGE CONTROLLER AND WI_FI MODULE

The charge controller is an Arduino Nano in our prototype which helps us to customize the charging cycle. The charging is optimized in such a way so as to understand the external scenario and make the stored charge getting consumed in an efficient way. The charge controller is also connected to the Wi-fi module to get an acknowledgment of the data signals from Wi-fi. If the signals are not available then the system will automatically go into sleep mode and will result in saving of power in the system.

A. Wi-fi Module (NodeMCU)

The Wi-fi module is designed in such a way that it can receive data from nearest open Wi-fi and send the active location of the device. The setup can be internal or external. The Wi-fi module is linked to ThingSpeak which can account for active notification system and alert the person for the location mapping and other details. The person may also set up an auto clear off function to clear the data remotely. (Fig. 5)

![Figure 5. ESP8266 based NodeMCU](image)

B. Power Management and Coding

The power required to supply the Wi-fi module is originally 5V-300mah. After removing all the extra electronics and all the LED indicator we were able to reduce the required voltage to 50mah. This small voltage required by the ESP module enables it to connect it to the Wi-fi and send and receive communication protocols without interruptions.

C. Coding the Wi-fi Module

The Wi-fi module is coded in such a way to connect to the nearest open Wi-fi and send the location coordinates. In this scenario, we have also introduced an additional battery which is connected to the BLDC which checks for the motion. During the motion of the device, the weight shifting takes place resulting in the generation of voltage which is monitored by the charge controller.

VIII. THE OUTPUT OF THE LOCATION COORDINATES

The output of the location coordinates is obtained on the main panel of the ThingSpeak online server. The server allows us to gather real-time data and get the values from the GPS module of the device tactics.

A. Android Device Manager

The preinstalled android device manager service allows the android devices to be located when they are lost. In our case, we can also use the android device manager skill set to obtain the location over the Google Maps.

B. Mapping on Matlab

The Data obtained is then analyzed on Matlab for the purpose of plotting (we plotted a contour map in Matlab). This map then can further be converted into a coordinate system, meaning we can use the given data to plot on X, Y coordinates. The following image shows the plot of a contour map generated with the position of the receiver exactly at the center and the data being analyzed with the transmitter Wi-Fi at the corners of the area making a rectangular region. (Fig. 6)

![Figure 6. Contour map 1 plotted in MATLAB](image)

C. Two Point Location Estimation on the Basis of Intersection Point Estimation

The above image shows a region map of the area being distributed to form high precision regions. The areas distributed can be used to form and decide the position of the device. This also concludes that even with two routers being kept at a particular distance, the estimation of location is possible, hence the location for the given device is estimated. (Fig. 7)
IX. APPLICATION

The output of the location coordinates is obtained on the main panel of the ThingSpeak online server. The server allows us to gather real-time data and get the values from the GPS module of the device tactics.

A. Mobile Phone Tracking

The detection system can be used in smartphones to detect the location when it is stolen or left behind at any place. Hence this will reduce the number of phones being lost and stolen.

The back mount can be made using any Cad software and then can be 3D printed to fit the required phone and hence allow for the system to be portable and handy along with being trendy.

B. Laptop Tracking

Bigger devices such as laptops can also be integrated with such setup to allow tracking of devices possible. Additional mounts can also be designed for the purpose of attaching the module externally.

X. CONCLUSION

This concept helps us in adding an additional feature to the smartphones in the current market. The location tagging and mapping allow us to navigate through unknown locations. For devices which are costly, this additional feature will allow the market industry to fix the problem of lost phones. The location maps can thus be plotted over the Google Maps. And the coordinates are stored over the Thingspeak server services also. With the additional battery, the device can be located in a very short span of time.

REFERENCES


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