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Motorized coil wireless charger with computer vision assisted alignment

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ABSTRACT

This disclosure describes techniques for a wireless charger to identify a device e.g., smartphone, wireless headset, smartwatch etc. that is placed on a charging surface and to automatically align the transmitter coil to the exact location of the receiver coil. When a device is placed on charging surfaces, cameras on the wireless charger captures images of the device. The image is processed to construct a three-dimensional model and identify the exact model of the device to determine the location of the receiver coil within the device relative to the charging surface. When the location of the receiver coil is determined, the transmitter coil is aligned by use of motorized arms and coils to achieve optimal charging performance and efficiency.

KEYWORDS

- electromagnetic induction
- wireless charger
- inductive charging
- motorized coil
- charging efficiency
- charging mat

BACKGROUND

Devices that include wireless charging features utilize electromagnetic induction between two planar coils. The charging surface that is connected to a power supply includes a transmitter coil that generates an oscillating magnetic field. The magnetic field generated by the transmitter coil couples with the receiver coil within devices such as smartphones, smartwatches, tablets, or

other devices to induce current in the receiver coil. Close spacing and alignment between the transmitter and receiver coils ensures efficient power transfer. For example, wireless charging requires alignment of the transmitter coil and the receiver coil within 10mm or less. The requirement that the transmitter coil and receiver coil be aligned places limits on where the user can place devices on the charging surface.

Current motorized coil wireless chargers locate the receiver coil by using a matrix of small sensing coils in the wireless charger. Although sensing coils are capable of locating the receiver coils in larger devices such as smartphones, tablets, etc., it is often difficult to sense receiver coils in smaller devices such as wireless headsets, smartwatches, etc. Additionally, sensing accuracy is diminished due to the spacing between neighboring sensing coils approximating of the location of the receiver coil.

DESCRIPTION

This disclosure describes techniques to identify a device e.g., smartphone, wireless headset, smartwatch etc. that is placed on a wireless charging surface and to align the transmitter coil to the exact location of the receiver coil housed within the device. The wireless charger is not limited to a single charging surface, e.g., bottom charging surface, top charging surface etc. When a device is placed on a charging surface, cameras on the wireless charger captures images of the devices that are placed on the wireless charger. Analysis of the captured images is performed by a processor, e.g., within the wireless charger, to reconstruct a three-dimensional image of the devices. Machine vision technology can be used for identification of the devices. Based on the device identification, the location of the receiver coil housed within the device placed on the charging surface is determined. When the locations of the receiver coils in the

devices are determined, the transmitter coils are aligned by motorized arms and/or coils to achieve optimal charging performance and efficiency.

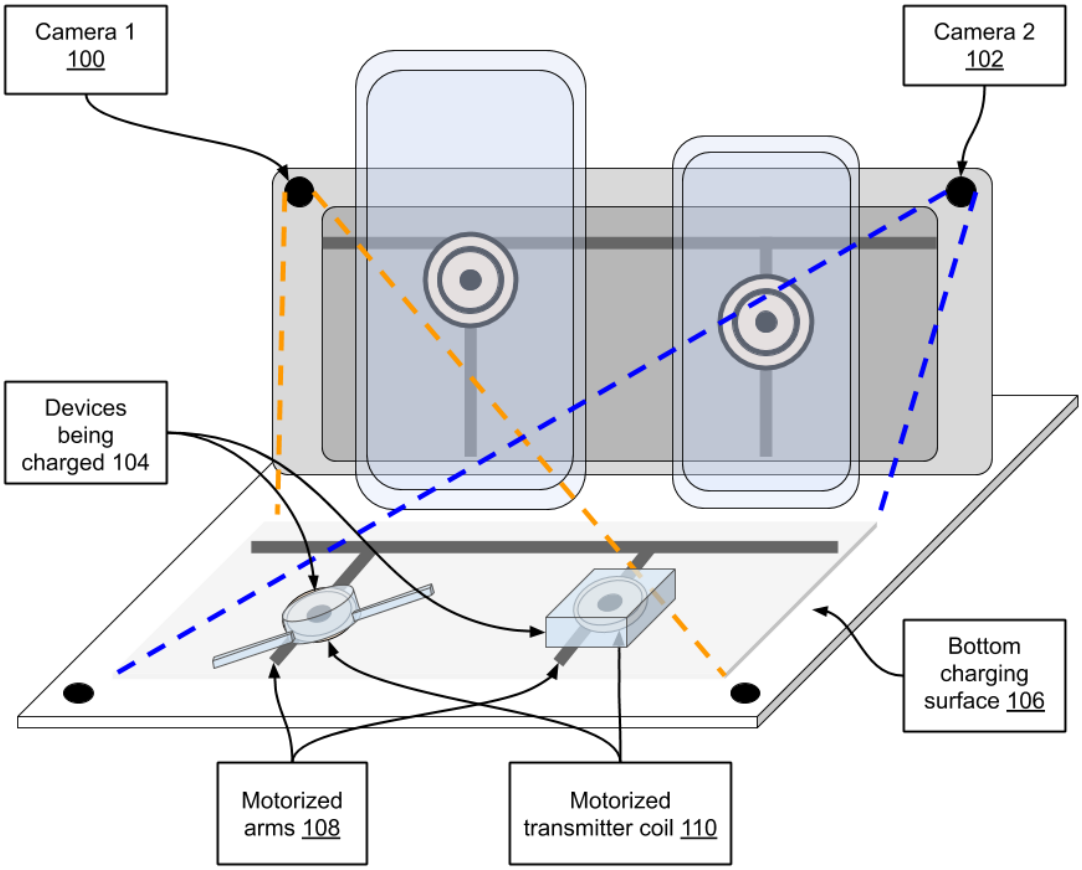

Fig. 1: Motorized coil wireless charger with computer vision assisted alignment for bottom charging surface

Fig. 1 illustrates an example wireless charger with devices placed on the bottom charging surface. Camera 1 (100) and Camera 2 (102) are utilized to detect devices (104) placed on the bottom charging surface (106). Camera 1 and Camera 2 each take a photo of the bottom charging surface. The make and model of devices placed on the charging surface are determined by analysis of the captured image. The position of the receiver coils within devices placed on the charging surface are calculated based on a three dimensional image created using machine vision techniques. For example, in Fig. 1, the smartwatch is identified as the model A and a headset is identified as the model B. The processor determines that the receiver coil of the smartwatch of

model W is located at the position (X_W, Y_W, Z_W) and of the headset of model H is located at the position (X_H, Y_H, Z_H). The motorized arm (108) and motorized transmitter coil (110) align the transmitter coil where maximum power transfer is ensured for devices placed on the bottom charging surface. For example, the motorized arm and coil aligns the transmitter coil to locations that align with the receiver coils in the smartwatch and the headset.

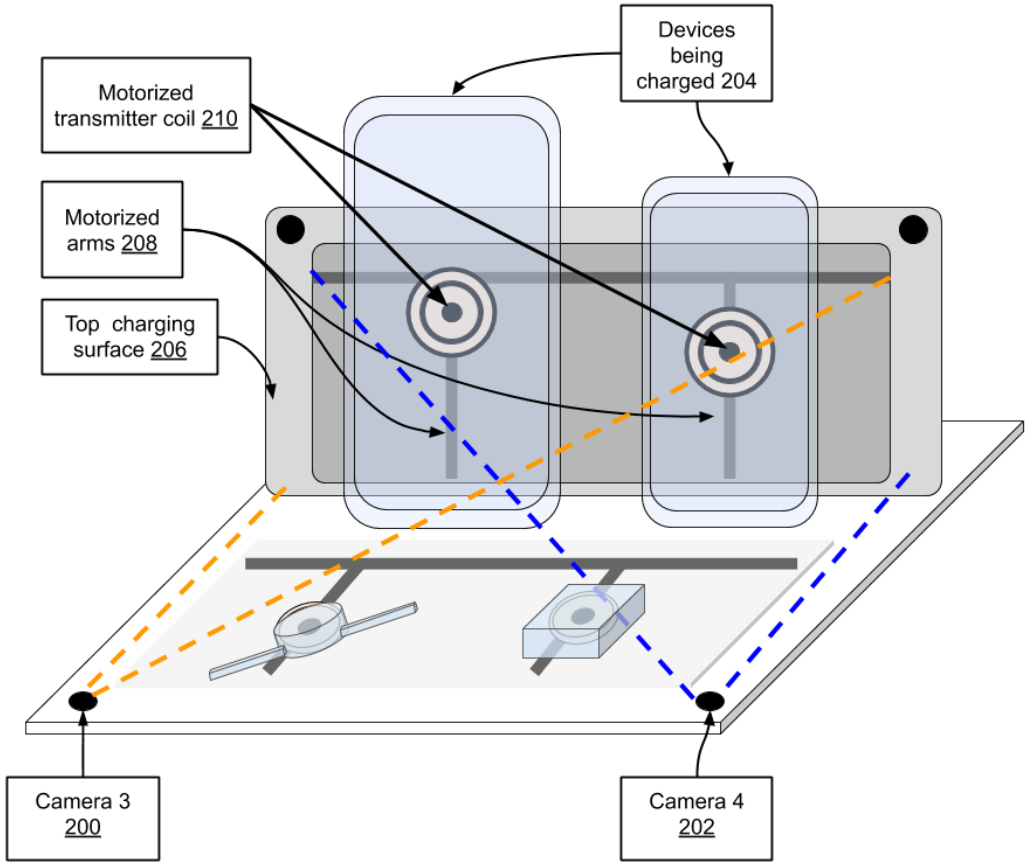

Fig. 2: Motorized coil wireless charger with computer vision assisted alignment for top charging surface

Fig. 2 illustrates an example in which devices are placed on a top charging surface of a wireless charger. Camera 3 (200) and Camera 4 (202) are used to capture images of devices (204) placed on the top charging surface (206). Analysis of the images is performed to identify the devices model S and model L smartphones. The motorized arm (208) and motorized

transmitter coil (210) are utilized to align the transmitter coil, e.g., to the receiver coils for the device of model S smartphone (X_S, Y_S, Z_S) and model L smartphone (X_L, Y_L, Z_L).

While Fig. 1 and Fig. 2 each illustrate a wireless charger with two charging surfaces, the techniques can be utilized with any number of charging surfaces. A suitable number of cameras that cover the surface area of the charging surfaces is provided in the wireless charger. The wireless charger can be utilized to charge any number of devices and supports devices with wireless charging capabilities.

CONCLUSION

This disclosure describes techniques for a wireless charger to identify a device e.g., smartphone, wireless headset, smartwatch etc. that is placed on a charging surface and to automatically align the transmitter coil to the exact location of the receiver coil. When a device is placed on charging surfaces, cameras on the wireless charger captures images of the device. The image is processed to construct a three-dimensional model and identify the exact model of the device to determine the location of the receiver coil within the device relative to the charging surface. When the location of the receiver coil is determined, the transmitter coil is aligned by use of motorized arms and coils to achieve optimal charging performance and efficiency.

REFERENCES

1. https://www.youtube.com/watch?v=LZwR19n6EGM