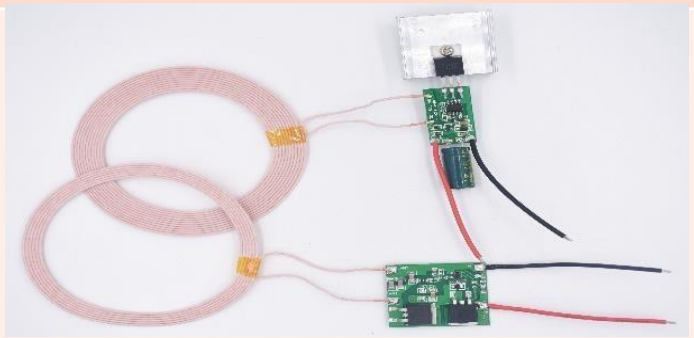
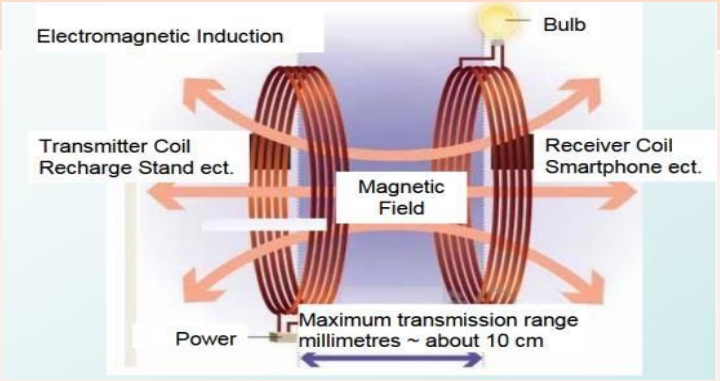
Effective Techniques for Wireless Charging for Unmanned Aerial Vehicles(UAV)

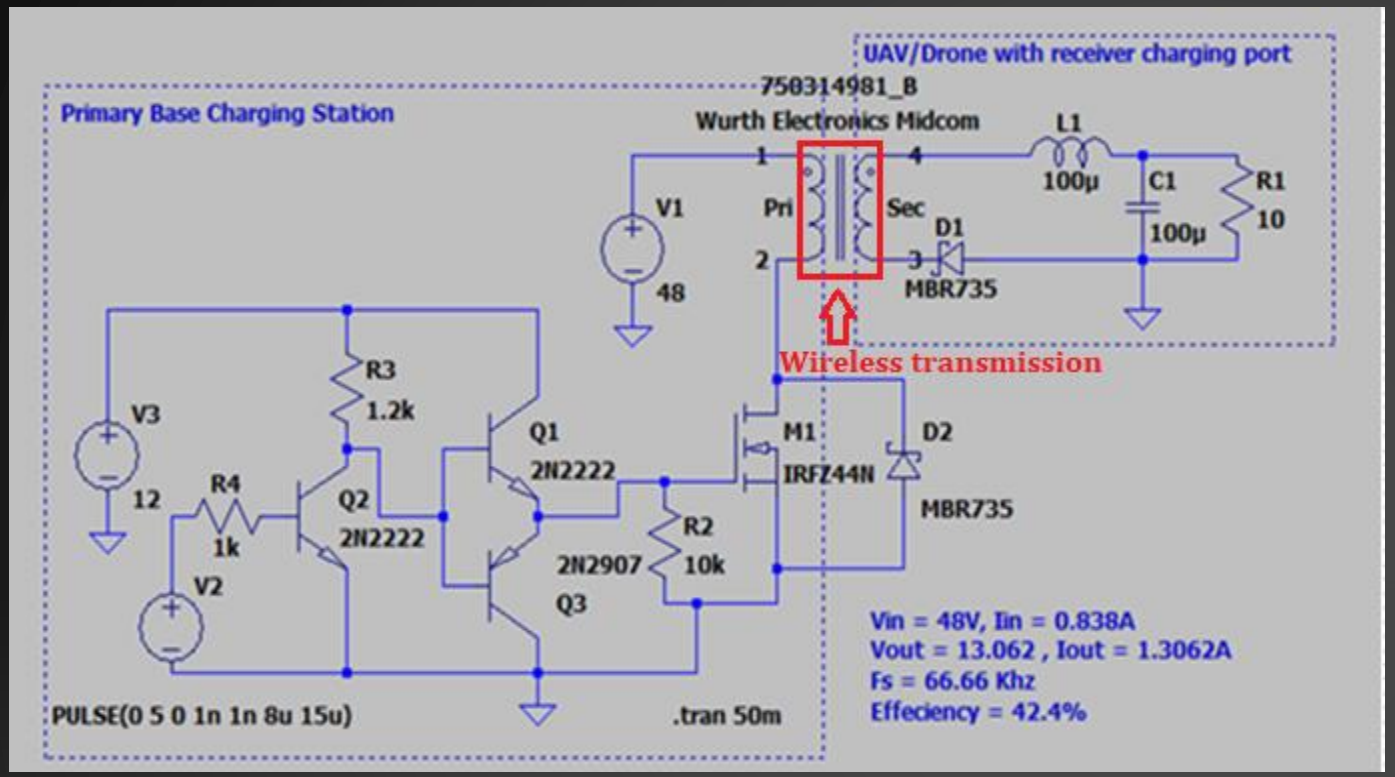
- Unmanned aerial vehicles are devices that can operate in air without any external human interference, thus making them completely autonomous. These devices are crucial for security surveillance and various payload services.
- The main aim in this paper will be to discuss the scope of wireless charging for such unmanned aerial vehicles (UAV) or simply speaking drones/quadcopters and to come up with the ways to efficiently implement the above aim using readily available Wireless Power Transfer (WPT) modules and components. Three methods with their advantages, drawbacks and overall efficiency is considered.

Drones(UAV) for surveillance

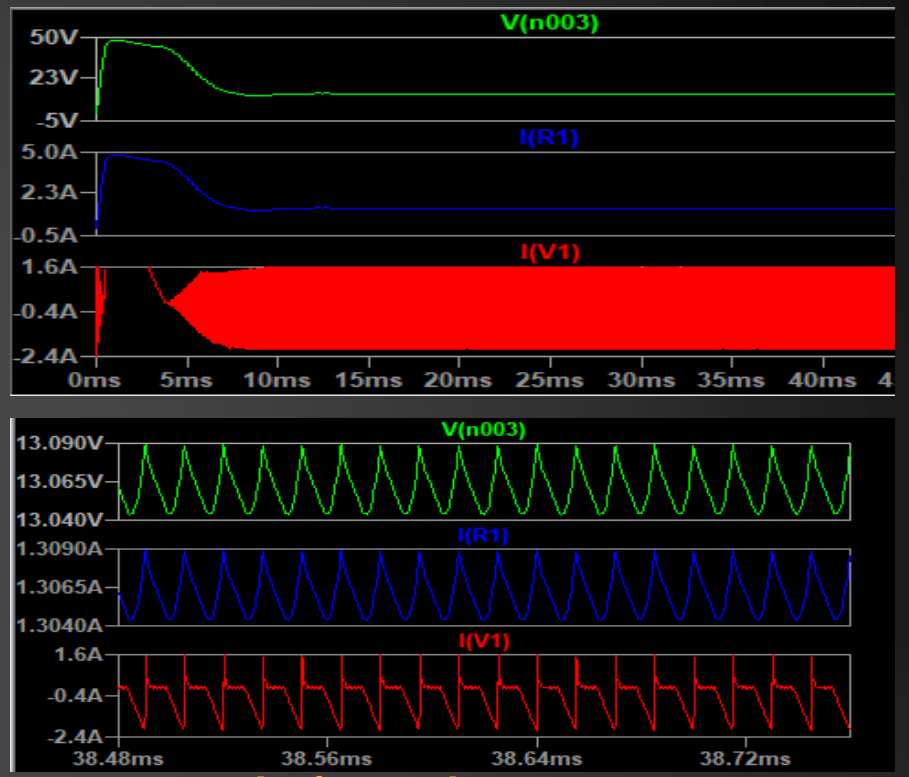
Wireless system

S.No	METHOD-1	METHOD-2	METHOD-3
1.	XKT-801 WPT module is used	Custom made flyback dc-dc wireless transmission method	Full- Bridge topology for wireless transmission
2.	Module can be connected to the charging base station	These windings will be used as a primary in the base charging station and as a secondary in the drone	Module can be connected to the charging base station
3.	The method provides a easy way for WPT although such modules are expensive and the scope for customizing (i.e. improving efficiency, Output power, switching frequency etc.) is limited	The efficiency in this case will be highly based on the various losses along the distance between both the windings.	The efficiency is improved greatly by utilizing a full flux swing for the magnetics.
4.	 XKT-801 WPT module	 **Wireless charging process**	A full bridge method also avoids core saturation as compared to that of a flyback thus greatly influencing the overall efficiency.

SIMULATION CIRCUIT & RESULT OF METHOD 2



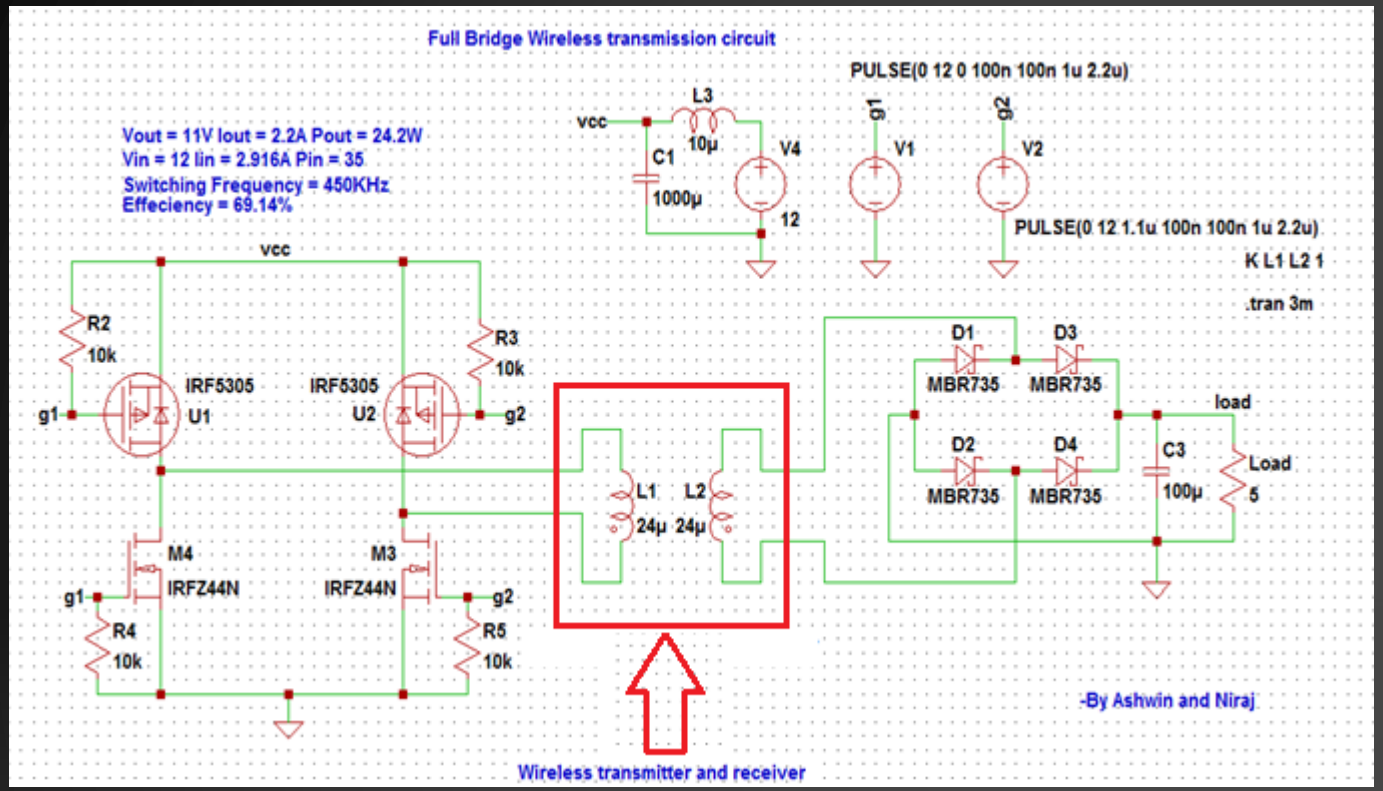
Circuit of Flyback mode for wireless power transmission



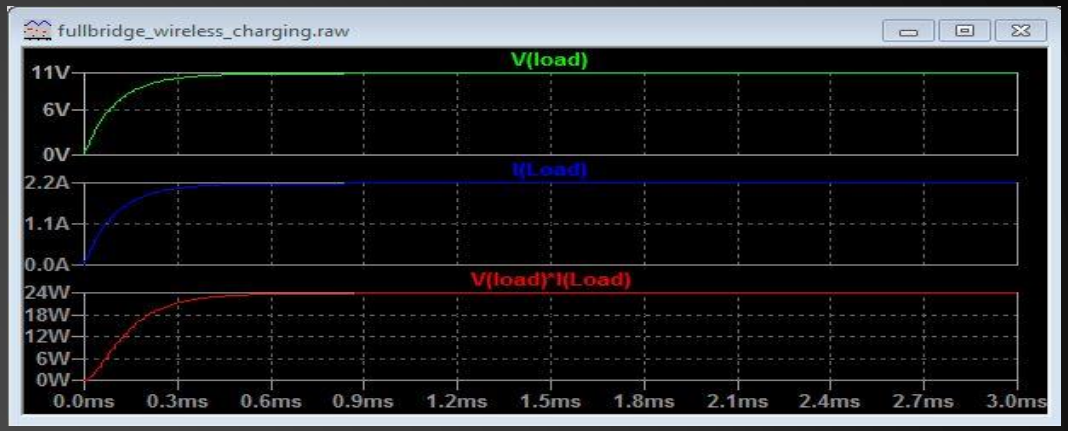
Result of UAV Charging process

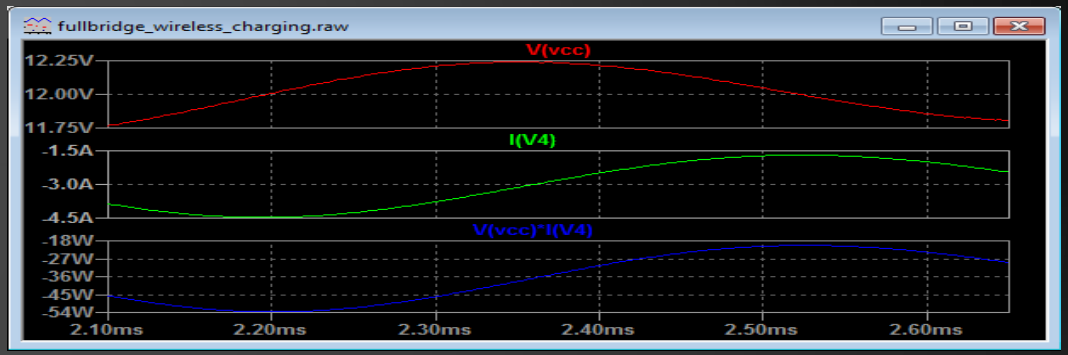
- The steady state output voltage and current of the above-mentioned method is about 13V and 1.3A respectively. A total dc output of almost 17 watts is obtained by this method with an **efficiency of 42.4%.**
- The ripple content of voltage and current waveforms are about 50mV and 50mA respectively which is 0.386% and 3.86% of the main dc waveforms, which is very low and thus can power up sensitive electric circuits that don't have much tolerances with respect to unregulated input power.

SIMULATION CIRCUIT & RESULT OF METHOD 3



Full Bridge Wireless transmission circuit





Full Bridge Wireless charging

- The Full bridge method provides us with an output of 12V and 2.9A almost leading up to a power output of 36 watts with an efficiency of 70%.
- The ripple content in this particular technique is less than 0.3% which can be considered to be almost nonexistent. Thus, this method proves to be much superior to method 2.

CONCLUSION

- In this paper, the scope of wireless charging for Unmanned aerial vehicles (UAV) such as Drones is discussed using 3 methods. One using WPT module & another ones without using it.
- In method 1, basic theories of WPT and analysis based on distance between transmitter and receiver is discussed for various voltage values. In method 2, the module replicated but by using a flyback transformer, discrete electronic components and a generic microcontroller. The microcontroller used makes this entire method completely open source and highly customizable. The edge, method 2 gives over method 1 is that the dependence on a commercial wireless charging module is completely removed. However, method 2 prevents us from completely utilizing the ferrite plate core. Hence method 3 can be executed to overcame this issue.
- Hence, charging stations can be used by drones for recharging and also routines tasks of drones can be finished accordingly. After a short time of charging, drones can repeat the mission again.