This work investigates the design of an Impulse Radio Ultra Wide Band (IR-UWB) transmitter used in a ranging transceiver based on the time-of-flight measurement. The presented transmitter employs a calibrated clock burst generator with immediate start-up and stop time, hence it has a constant processing time, which is a key function of the continuous-time time-of-flight measurement system. The proposed IR-UWB transmitter was fabricated in TSMC 90 nm CMOS technology and has been successfully demonstrated in ranging communication systems with resolution of about 1.4 cm. With good power efficiency and minimal standby power, the reported transmitter is suitable for battery-operated wireless localization systems.

Also, an IR-UWB Multi-Input Multi-Output radar-based imaging array is developed for close range beamforming. The radar transceiver is implemented TSMC 90 nm CMOS technology. The true-time-delay technique is explored to realize the UWB beamforming system, where the programmable digital gates are used as delay elements. The main challenge is compensating the mismatches between array elements. By using the proposed calibration circuit all the process variations and mismatches are compensated and the transmitting/receiving elements are aligned. By using a clutter map method the mutual coupling between array elements is reduced and the image quality is improved. The MIMO radar array is configured with different number of transmit and receive antenna elements and various inter element spacings to investigate the array focusing performance. The presented IR-UWB MIMO radar-based imaging array is suitable for low power, low cost and close range imaging application such as medical imaging or through wall imaging.