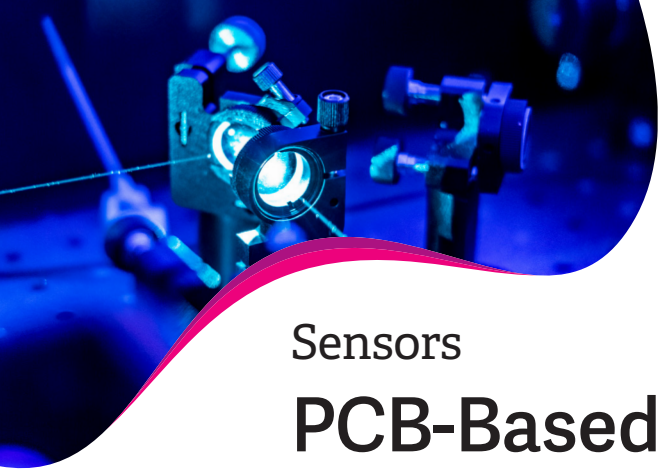

OST
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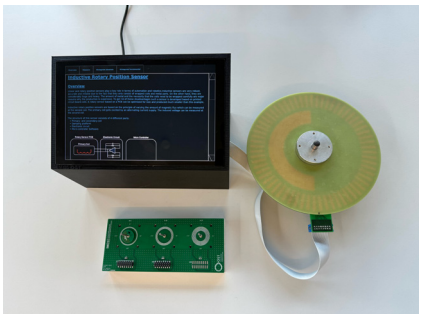
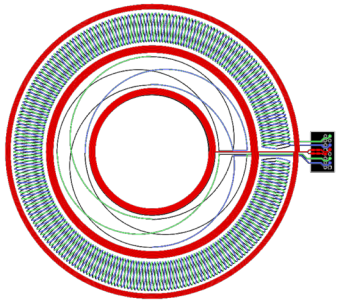
Sensors

PCB-Based Rotary Encoder

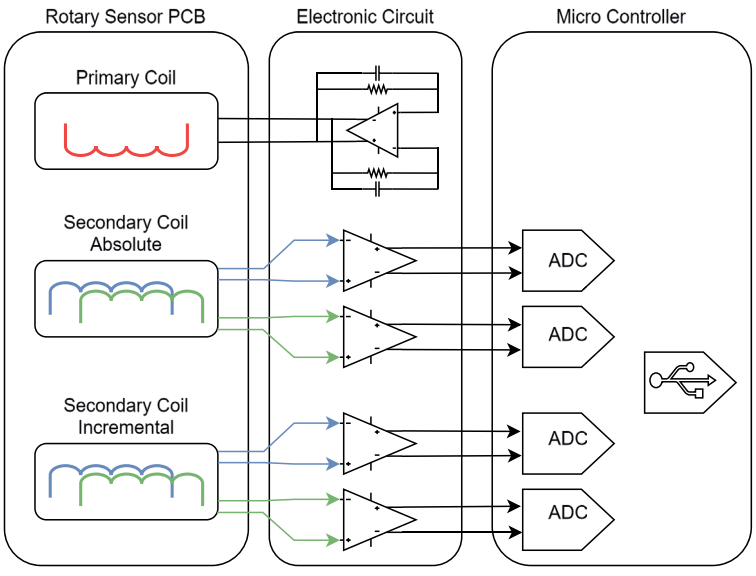
Position sensors play a crucial role in automation and robotics. While inductive sensors, composed of coils and metal parts, are known for their robustness and reliability, they can present a challenge in terms of size, cost and weight. To overcome these disadvantages, a very cost effective sensor based on PCB coils has been developed. The electronic circuit of the sensor contains a driver circuit and an amplifier circuit. The sensor data is analyzed by a STM32 MCU and sent to a Raspberry Pi via UART.



Demonstrator with 4 connectable sensors Primary and secondary coils on PCB



Primary and secondary coils on the PCB



Block diagram of the system

Background

Linear and rotary position sensors play an important role in automation and robotics. Inductive sensors are very robust, accurate and reliable because they consist only of wound coils and metal parts. On the other hand, they are also very large, expensive, and heavy. The amount of metal and the need to carefully wind the coils are the main reasons why they are expensive to manufacture. To overcome these disadvantages, such a sensor was developed based on printed circuit board (PCB) coils. A PCB-based rotary sensor can be optimized in terms of size and manufactured very cost-effectively.

Electronic circuit

The electronic circuit consists of two parts. The driver circuit and the amplifier circuit. The driver circuit uses an LC resonator to generate an alternating current. The weak signals from the secondary coils are amplified by a differential amplifier circuit. The amplified signal is then sent to the MCU's integrated analog-to-digital converters (ADC).

Software

A STM32 F303ZE MCU is used to evaluate the sensor data. The sine and cosine signals of the absolute and incremental positions are sampled by 4 ADCs. These signals are interpreted as real and imaginary parts in a complex plane and used to calculate the angle of the sensor.
The resulting angle and the imaginary and real parts for the absolute and incremental position are sent to a Raspberry Pi via UART. A GUI written in Python displays the measurements on the Raspberry Pi.

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