Low-Cost and High Performance Antenna Setup for Updating ePaper Displays on Curved RFID SmartTags Used in Pharmaceutical Studies

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STATUS QUO

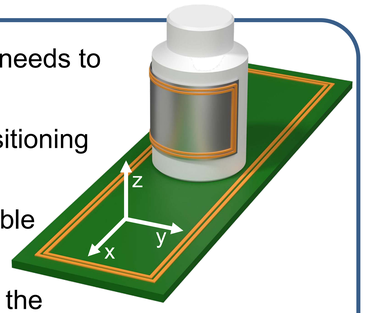
- New findings in pharmaceutical studies often result in changed expiration dates
- Presently this necessitates manual relabeling of drug containers by authorized personnel
- This is time-consuming, wasteful of resources, and introduces the risk of human error

NEW INSIGHTS

- Replace traditional labels with digital SmartTags
- RFID infrastructure enables wireless updates and energy transfer
- ePaper displays make batteries redundant and result in a passive system
- Audit trails ensure traceability

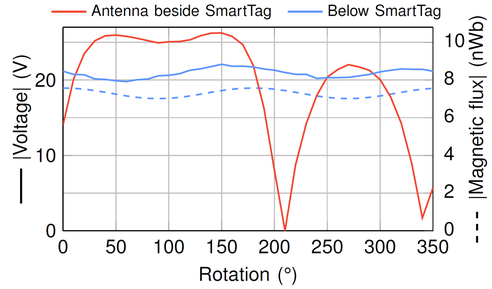
DESCRIPTION

- A box of 4x4 SmartTags needs to be updated
- Rotation and precise positioning is unknown
- An update shall be possible under all conditions



- Previous concepts place the reader antenna beside the SmartTags leading to large overall systems while the induced voltage is dependent on rotation (—)
- Placing the reader antenna beneath the SmartTags leads to a more uniform induced voltage (—)

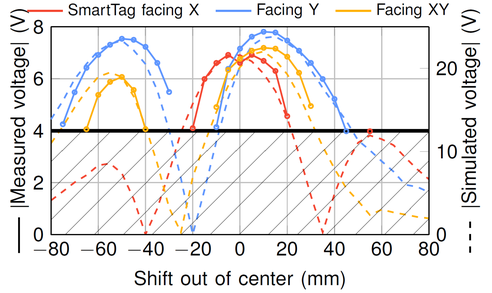
$$\Phi_B = \frac{\mu_0 \rho I}{2\pi} \iint \frac{z \sin\phi}{\left(\frac{d}{2} - \rho \sin\phi\right)^2 + z^2} - \frac{z \sin\phi}{\left(\frac{d}{2} + \rho \sin\phi\right)^2 + z^2} \, d\phi dz$$



- The tags' curvature is exploited in this concept while it is a hindrance in other concepts
- Multiple antennas are used to cover a larger area

QUANTITATIVE IMPACT

- Measurements of single SmartTag show good agreement with simulation



- All 16 SmartTags can repeatedly be updated

PROPOSED CONCEPT GOALS

- Fully digital relabeling process
- No human interaction beyond placing the box on a table equipped with antennas
- Tracking of drug containers

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