

Novel Flow Sensor and Electronic Platform for Smart Metered-Dose Inhalers

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The growing number of asthma cases is a source of concern due to the increasing burden on healthcare systems. Using metered-dose inhalers (MDIs) promises many patients a controlled disease course. However, the efficacy of MDIs is limited by the patients' mistakes and the poor adherence to the therapy. Measuring the inhalation flow and the MDI firing timing while following the inspiratory parameters evolution over time provides a data basis to support improved drug delivery and adherence. Our development consists of enabling such measurements without affecting the inhaler performance nor the user experience. Inhalation flow measurement was realized by a miniaturized flow sensor measuring a defined by-pass flow during inhalation. The system was enhanced by an accelerometer to detect the MDI fire timing and save power consumption. A Bluetooth module enables the data transfer to a mobile app. Tested with a spirometry syringe, the method showed an accurate flow measurement within 3% accuracy of the inhaled volume. Superimposing the drug firing with the flow measurement allows to quickly understand if the drug delivery and inhalation were timed correctly. Inhalation-related indicators, including peak-inspiratory flow, inspired volume and airway resistance were extracted and streamed them to a terminal that tracks the patient data and the disease course. In a nutshell, our inhaler clip-on enables a reliable indication on the efficiency of the MDI usage and an accurate tracking of the inhalation indicators which allow to understand the course of the disease, improve the disease management and possibly prevent the next exacerbation.