Engaging breathing exercises: developing an interactive XNA-based air flow sensing and control system
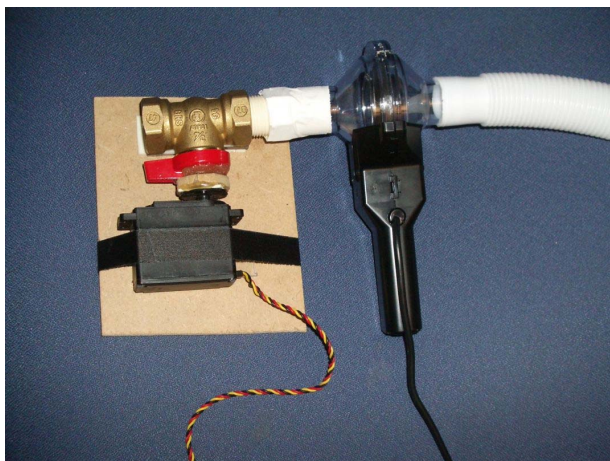
M.   as, B. Lange, I. Dallas, A. Huerta and A.A Rizzo

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CYSTIC Fibrosis is a chronic genetic condition caused by a protein deficiency in epithelial cells lining the lungs, digestive system, sweat glands and genitourinary system [1], [2]. The protein deficiency disrupts the passage of chloride through the cell membrane and disrupts fluid balance, resulting in the production of abnormally thick mucus. Cystic Fibrosis primarily affects the respiratory and digestive systems. The most common symptom of Cystic Fibrosis is chronic pulmonary infections due to the inability to clear the thick mucus from the lungs [1], [2]. Children and adults with this condition must clear mucus from the lungs regularly [2], [3]. This is commonly achieved by performing an Active Cycle of Breathing Technique (ACBT). The ACBT involves gentle diaphragmatic breathing control, thoracic expansion and forced expiratory techniques performed in cycles [3].

The aim of this poster is to describe the development of an input device that uses airflow measured from a spirometer and LabPro system (Vernier Software and Technlogy) to interact with an XNA- framework based game environment. The XNA framework is a free gaming platform available from Microsoft that can be used to develop games for Xbox or PC (Windows Vista). The game developed in this project will be played on PC.

When attached to the Spirometer, the LabPro device (Vernier Software and Technology) measures airflow from the Spirometer and presents the data on a computer screen in graph format. For this system, the LabPro device was programmed as an input device for interaction with a game developed using the XNA framework. This framework can also control an air-flow valve to restrict the flow. The poster
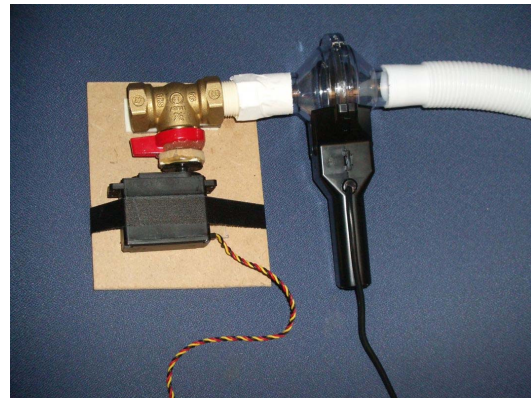
Fig. 1. Spirometer device with airflow attachment and servo controlled valve. The Spirometer is attached to the LabPro device that transmits flow data to the XNA framework.

Fig. 2. Prototype breathing mask. This mask attaches to the Spirometer and airflow controller.

will present the details of development of the airflow measurement system and include pictures of the game play. The game will be designed to encourage children to breath in order to interact with the game (e.g. to move a character the child will be required to breath deeply).

Future directions for this research will focus on usability and feasibility testing of the game with healthy children, followed by children with Cystic Fibrosis.

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[3] J.S. Wagener, and A.A. Headley, "Cystic Fibrosis: Current Trends in Respiratory Care." *Respiratory Care*, 2003, 48 (3) 234–245.