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# The LivePaper system: augmenting paper on an enhanced tabletop

John A Robinson <sup>a</sup>   ... Charles Robertson <sup>b</sup> 

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## Abstract

The LivePaper system augments ordinary pieces of paper with projected information. Pages, cards and books are placed on an instrumented tabletop to activate their enhancement. To the user, it appears as if the paper gains new visual and auditory features. Projected annotations track the orientation and location of pages as the user moves them on the desktop. A piece of paper that is removed, but then returned to the desk, regains the same features that it previously exhibited. The LivePaper system accomplishes this by using features extracted from written material on the page, not from glyphs or other artificial marks.

The paper describes both the system as a whole, and a number of sample applications we have developed to illustrate the feasibility of the LivePaper system. These applications include an architectural visualization tool, which projects a 3D hidden-line rendering of walls onto a page. The user may rotate and move the page to view the rendering from different angles. Another application is an audio player, which begins

playing when a page (such as a business card) is laid on the desk. The user may control playback with his or her finger via projected buttons. Other applications include page-sharing, remote collaboration, and World Wide Web page viewing. From the user's perspective, all of these applications are attributes of the particular page, not features of the tabletop.

Particular attention is given to the design of interaction: LivePaper is object-oriented, because the individual sheets are treated as computational units, but it also provides functions that involve several objects. The design principles applied to handle the different kinds of functionality are explained and illustrated in the LivePaper system, but are also proposed for wider use in augmented reality.



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## Keywords

Video augmented environment; Enhanced tabletop; Human-computer interface

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