New LED Sequential Wave Imprinting Machine

***Abstract*—The Sequential Wave Imprinting Machine (SWIM), invented by Steve Mann in the 1970s, offers an augmediated reality experience which a group of people can all enagage in with the naked eye.**
The SWIM is swept in space like a broom, and produces a 2D holographic image of waves, similar to an oscilloscope display, but one which is registered not only in real-time but also in real-space, providing a seamless experience of augmediated reality, which embodies humanistic intelligence.
This paper outlines improvements in SWIM which are made possible by a novel circuit, and recent improvements in LED technology, which make the new SWIM simple, cheap, with greater resolution and thinner than ever, making it more wearable, and thus more accessible in general. Photos and scientific results (measurement of wavelength?) of the new SWIM are presented.

I. Introduction

Augmediated reality is an experience where by the means of a system of technology, people are able to seamlessly improve or otherwise alter their perception of reality, while situated in reality, which is real-time and real-space.
Augmediated reality systems may be organized into three types:

1) dB>0 - Those of augmentation, which involve amplification/enhancement/addition of information, such as the system presented here. These systems are augmented reality.
2) dB<0 - Those of diminishment which involve attenuation/subtraction of information, such as HDR for welding. [cite mann] These systems are diminished reality.
3) dB E R - Those which are dynamic and can do both, as needed.

Many augmediated reality systems are of the third type, designed as a generalized platform with the intention of supporting a variety of applications, which is in line with the way most personal computers (including smartphones) are thought of as being interacted with[cite?]. These systems consist of input and output devices, often cameras and aremacs respectively, with computer processing in between[cite mann gl45s]. Thanks to ongoing advancements in miniturization and wearable computer technology, there is large scale interest and commercial development ongoing in these areas [cite meta/visionertech]. The challenge with a system of this complexity is for it to embody the principles of humanistic intelligence[cite mann HI] which are key to a system which will provide a seamless and convincing experience which can advance technology for humanity.[more HI cite?]
The augmediated reality system in this paper is strictly additive (type 1). It is also purpose built for the specific application of the visualization of radio waves, in the same fashion as early augmediated reality experiments carried out by Steve Mann in the 1970s.[cite Mann SWIM] Recently, with the availability of high efficiency and small SMD LEDs, the SWIM no longer relies on incandescent bulbs and has thus become much more practical.
This paper presents a novel circuit which is used to make an LED based SWIM which is smaller than ever in volume, making these experiments in augmediated reality ever more practical as a wearable[show 2 pictures, side by side, LED swim and incandescant swim].
Television style, overlay (see-through) 2D displays worn over the eyes and mounted to the head like glasses, [cite, Sarang is there a word to describe this?] have been used extensively as the output device of choice for augmediated reality systems, [citations]. This is natural because they are usually already designed to work as computer displays. These types of devices are well suited to personal augmediated reality experiences, but do not work as easily for activities where multiple people or groups of people are involved and wish to partake in the same experience. For everyone to partake, everyone must wear their own pair of glasses, and high level software/networking systems are required to render the experience for everyone. This creates bottleneck points and opens up opportunities for delays and other issues which can strip the system of its humanistic intelligence, making the experience anything from less convincing to illness inducing to painful.[cite people getting sick from AR]
The SWIM system forfeits the complexity imposed by the need for a general purpose system, and instead focuses as a single-purpose-built augmediated reality system which makes visible the normally invisible radio waves. In order to achieve this effect, the SWIM is simply driven with the doppler return output of any low power X band microwave radar set.[cite doppler return?]
The SWIM works similarly to an oscilloscope with no time-base generator, (which is incidentally how Steve Mann was inspired) by painting out a sensed/measured wave in light so that it is made visible. Instead of the effect of the oscilloscope phosphor we have the phenomenon of persistance of exposure[cite mann]. An oscilloscope works in real-time but virtual-space on its own 2D display, like most AR systems, while the SWIM uses a 1D display to produce an image like a 2D holograph, which is registered in real-time as well as in real-space, as the user sweeps the SWIM device itself through the waves in space.
Last and perhaps most importantly, the augmediated reality experience SWIM creates is easily shared among a group of people, all of whom may bear witness with the naked eye.

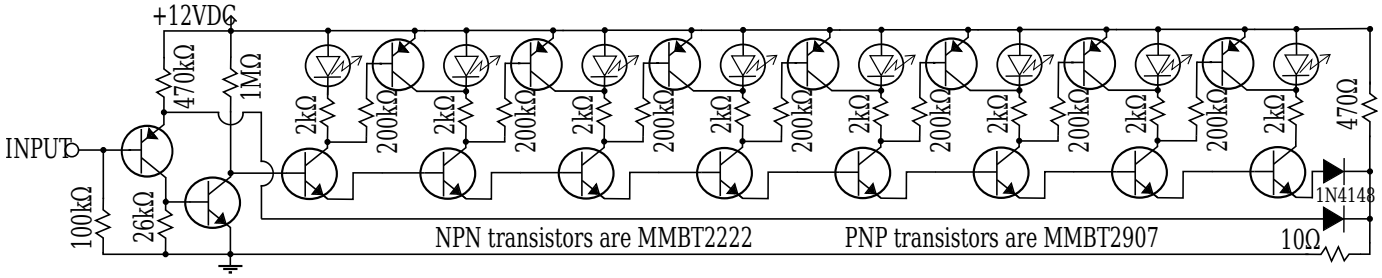

Figure 1. Schematic of novel discrete transistor LED SWIM device.

II. Recent Advances in SWIM

Recently new interest has been raised over SWIM, and several have been built. The first and simplest to implement were digital, with a microcontroller driving cascaded serially programmable WS2812 RGB ”neopixels”, which can conveniently be purchased in a strip, but pixels are large (greater than 0.5cm) and they suffer from a very poor refresh rate (?Hz).

Next SWIMs were built around the LM3914 cascadable 10 segment dot/bar graph display driver IC, which produces excellent results with a high degree of accuracy, tested up to at least 100(did we? 80?) cascaded ICs for HD pixel counts and large scale size. The LM3914 was measured to have a bandwidth around 2Mhz, which translates to a very high ”refresh rate” and the simple analog system controlling it approaches linear time invariancy, eliminating the possibility of any lag, so the system always responds instantly and the experience is seamless and convincing: humanistic integrity is maintained.

Finally a novel discrete transistor circuit has been devised which makes a low pixel count SWIM smaller and cheaper than is possible with the LM3914. See schematic Fig. 1. A 0.5”x0.75” SWIM small enough to wear on a ring has been built and is presented.

We need pictures.

III. Humanistic Intelligence