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Design and implementation of persistence of vision displayusing ARDUINO and GSM shield

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Abstract

Persistence of Vision (POV) is a unique concept that we experience in our day-to-day life whenever an afterimage of something seems to persist for 1/30th of a second on the retina of our eye. POV display creates a perception of an image; occupying a spatial portion in rapid succession. This paper proposes the concept of persistence of vision using ARDUINO, Microprocessor ATmega328, Arduino GSM shield and a series of LEDs used for display wherein the Arduino GSM shield is used to interface ARDUINO with the SIMCOM modules. The theory behind this lies in the fact that, as long as the entire path between an image and human eye is complete during the visual persistence time, 'the whole image is perceived'. To overcome the drawbacks of old processor, we emphasize this paper on interfacing our POV display with GSM shield with an inserted SIM. Microcontroller board- Arduino uno based on ATmega 328, GSM shield integrated with SIMCOM module and IDE software are being used for achieving the desired results.

Keywords: Persistence of Vision, Microprocessor, ATMega 328, Microcontroller, GSM, ARDUINO, SMS, SIMCOM

Allen studied the effect of color of light on persistence of vision for an image and concluded that when no fluttering of color was able to be perceived at the center of retina, then even a slight motion of our eye would ruin the apparent continuity of light as the color of light would then be refracted at peripheral portions of retina and not its center [1]. It was back then in 1894, William Stern came up with a theory (of kind of retinal fusion), explaining the movement due to our perception. One of the three principles of motion perception by Stern can be stated as, "the essential condition of the perception of movement when the eyes are held stationary": with a two-flash display, after-image of the first flash persists even when the second flash occurs. Due to existence of this positive after-image of first flash, we perceive continuity in motion of light [2]. In 1900s, concept of persistence of vision through a human eye was brought to everyone's notice by Anderson [2], who stated its use in films and how historians introduced

this concept. In 1912 Max Wertheimer published his "Experimental Studies on the Seeing of Motion," wherein he performed various experiments on variations in two-element display and came up with three basic stages that are followed in an apparent motion: (a) beta movement (the object at A seen as moving across the intervening space to position B), (b) partial movement (each object seen moving a short distance), and (c) phi movement (objectless or pure motion) [3]. Persistence means continuance of an effect even after its cause has been stopped. We can relate this practically as we know and have felt that the world never gets completely black within a fraction of second, and if we suddenly close our eyes; there's a visual impression for 1/30th of a second. We can also take the example of CRT TVs that "draw" the image on the back of the screen using an electron beam that hits the phosphor dots which glow when electrically excited [4].

We have achieved the completion of our paper with the help of Arduino and GSM module, to overcome the problems of existing processor (persistence of vision wand). The hardware board can be designed around either an 8-bit Atmel AVR microcontroller, or a 32-bit Atmel ARM while the software consists of a standard programming language compiler and a boot-loader that executes on the microcontroller. We have built our hardware around AVR Microcontroller and this microcontroller board based on ATmega328 comes with preburned boot-loader thus, a user can upload a new code without any help from external hardware programmer. Arduino uno is programmed as a USB to serial converter. It simply has to be connected to a USB cable to get started. The device consists of an on-chip flash memory unlike microprocessors that helps the pre-programming of microcontroller with the use of boot loader to simplify the process of uploading of programs via softwares such as IDE. Its compatibility increases with various shields such as GSM module as they can be synchronized with Arduino uno and plugged into its pin headers [5].

Arduino uno physical characteristics, specifications and datasheet are given in [6]. Software that is used, the Arduino integrated development environment (IDE) is a cross-platform application written in Java, and is derived from the IDE for the Processing- programming language and the wiring projects [4]. Arduino is linked to the software and this link helps the software to compile and upload the programs on Arduino which further performs various tasks accordingly. To support our program in the device, program has to be compatible with the Arduino environment; hence the program is written in embedded C.

This paper is organized as follows: Section II describes our proposed architecture in detail. Section III shows results of our work whereas section IV concludes the paper.

Proposed Architecture

'Arduino GSM Shield SMS Detector and Display is our proposed design'.

GSM module is a wireless module that achieves its synchronization through an antenna which is connected externally to the hardware. A powerful shield like that of GSM can enable devices from the Arduino family (Uno and Mega) to interface with the SIMCOM modules SIM900 and SIM908. Thus, the SIMCOM GSM Shield will provide an efficient way to use the GSM network in cell phones, which will further find its application in receiving data from a remote location [4].

The Arduino GSM Shield is basically a physical add-on to Arduino that not only comes with a library to send/receive SMS.

And voice calls, but also to establish TCP (Transmission Control Protocol/Internet Protocol) communication over the broadly spread GSM network [5].

Step by Step Procedure for installation of hardware

Assembling the hardware, creating PC board and then soldering 20 LED'S and Resistors; one LED in series with the other and in parallel with the other pair as shown in figure1.

Arduino and GSM module are also wired with the PCB to ensure less hardware utilization in the circuitry.To deduce the probability of human error, we directed the POV's execution with a copper and brass stand (figure 2).

NOTE: GSM shield and Arduino gateway must not be connected while uploading the code.

The code is first uploaded on the Arduino Board. The USB cable is then plugged to the computer, followed by opening a serial port terminal which facilitates the communication via the USB port.

Fig. 1: Hardware Assembly

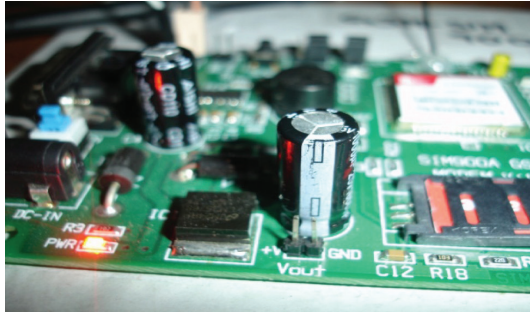**Fig. 2: POV on copper and brass stand**

Fig. 3: Working of Arduino Uno

We Reset the Arduino to clear the flash memory (PROM) and once the light blinks (fig3) we connect the GSM module with Arduino gateway; pin 0 Rx of Arduino with Rx of GSM shield and Tx of Arduino with Tx of GSM, keeping their grounds common [7].

Insert an unlocked SIM card to SIM Card Holder - 6 Pin Holder for SIM Cards. Both 1.8 volts and 3.0 volts SIM Cards are supported by SIM900 - the SIM card voltage type is automatically detected [6].
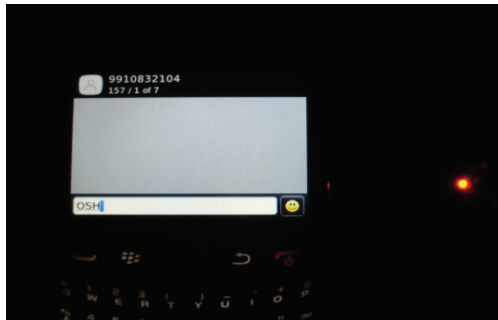

Fig. 4: Message sent

Results

Send a SMS on the number that SIM900 holds (fig4) and the blinking of LED ensures that the message is received and Synchronization is completed.

Fig. 5: POV Display of the sent message

Creating a POV display font is governed by the way the LEDs are connected to the microcontroller. We may use BINARY values to turn on / off each of the LEDs for 20 LEDs of the POV display in succession with help of Proteus software (fig6) [8].
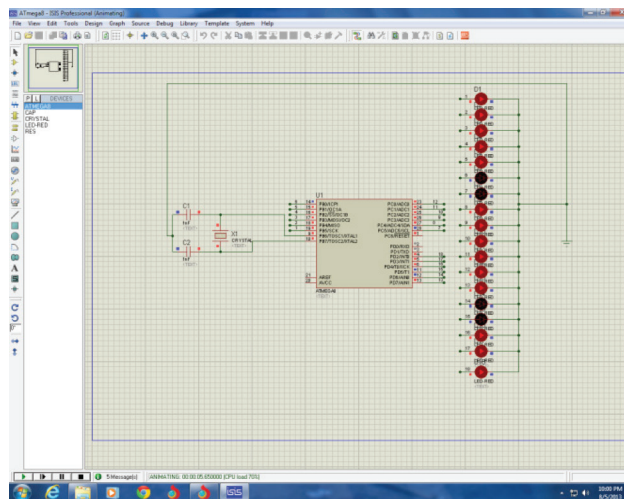

Fig. 6: Arduino simulation using Proteus (isis)

Conclusion

The GSM shield has been created as a collaboration between Arduino and Telefonica I+D (TID) [9]. A GSM (Global System for Mobile telecommunications |or GroupeSpécial Mobile) is a wireless modem which works in association with GSM wireless network. It transfers data through radio waves. It uses a SIM card for its operation. It is used for performing various functions like Sending and receiving SMS, Monitoring the strength of a signal. Supervising the charging level of the battery, accessing phonebook entries etc. We have worked upon a GSM shield which works in collaboration with Arduino. Its advantage is that it allows the Arduino to connect to the internet and access calls and messages too. This application has a lot of usage in the field of persistence of vision. The Arduino device is used to program the circuitry of POV. When a GSM shield is assembled with Arduino, the programming becomes more flexible [10].

The number of messages processed per minute is restricted but it makes the whole device as a real-time working model. This application holds various future aspects. We witness this phenomenon in metro, on televisions, and in our day to day life. Hence, this holds a bright future in our technological world. What makes this device attention grabbing is that even with the use of limited electronics and programming, it can convert ideas and projects to real-time working models.

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