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February 6, 2014

EGR302

Research Summary Assignment

Project: Design a rotating LED wand that can be used to signal for emergencies or advertise for a company.

Existing Product:

After researching I have found several existing projects that provide information about LED POV, or Persistence of Vision. Persistence of Vision is the term used to describe the lingering of light afterimages upon the human retina. These POVs attempt to utilize this phenomenon by rotating the LEDs fast enough that a single image is seen.

One similar LED display is a “Propeller Clock on a Mirror” (Henk, 2003) that uses a single strip of LEDs to form a small clock. The designer of this clock utilized a DC fan’s motor to act as the base of the clock. He took the fan apart and added four threaded holes to fit the arm of the clock, LEDs, and other electronics within the fan. He also fixed a sleeve and copper wiring to the stator frame which turned it into a motor with a transformer to distribute power to the rotating components of the clock. For the base, he used an IR sensor along with a MIC2941A (to decode the pulses from the sensor) to switch from standby to active mode. Originally he used a PC16F628 to decode the pulses but noticed a problem when the current load of the transformer changed then the motor changed as well. While in active mode the MIC generates a PWM signal for the motor which is about 40Hz. The result of the PWM signal along with the duty cycle adjustment means that the clock’s period of revolution is 1920 rpm with a display refresh rate of 32Hz. For the propeller the voltage from the coil is rectified using a diode bridge which is then turned into a stable 5V, using a 78L05, for the CPU. At the center of the propeller is a PIC16F628 running at 20MHz with an oscillator circuit to provide accurate clock readings. Two inputs go to the CPU; first an IR transistor to find the position of the rotor while in motion and, second, an IR sensor/demodulator which de-modulates the IR information. To run the LEDs he used a transistor constructed as a current-source. He used Nichia NSPB636AST (Blue) and NSPG636AST (Green) because the luminous intensity for them is extremely high. The mcd (millicandela) for them are 550 and 2000, respectively, compared to 2-7 for most standard LEDs.

A team at Utah State University designed a mounted LED POV and used YouTube to provide videos of their project (Melangeaddict, 16 December 2011). They explained that they used 48 RGB LEDs to create the afterimage and two printed circuit boards to hold the LEDs and the LED Driver. They had a black box placed in the center of the cantilever which housed the microcontroller (type unknown) and their Bluetooth module receiver. On the other end of the rotating arm, acting as a counter weight to the LEDs, they had a DC-DC converter, which converts 12V to 5V (controller uses 12V; everything else uses 5V), and a communicator for the microcontroller. Under the cantilever is an infrared receiver coupled with an infrared LED on the base which together triggers an interrupt in the firmware to start the next rotation sequence. In the base is a 300 Watt power supply, a pulley-belt drive system connected to the motor which turns the cantilever. Under the shaft of the motor is a rotating electrical connecter which is needed to provide power over a rotating shaft (theirs is rated a 3000 rpm). Off to the side is a control box and switch used to turn the motor on/off from a distance. They use a Bluetooth transmitter to transmit the code (created in MATLAB) to the POV.

Another project is the POV display created by Cornell University (Bjanes & Ma, 2005). They provide detailed diagrams and meticulous explanations for their project. Looking at the diagram within their Introduction (Figure 1), they use a mounting bracket to hold their motor and supply power to their POV. The motor then spins the Plexiglas cantilever which has a radio receiver, 9V battery, on-board ATmega644 (an RISC microcontroller), 5 Max 6966 (LED driver), and the LED strip (with 14 RGB LEDs) on it. Off to the side they have a radio transmitter and another ATmega644. Additionally, for the electrical components, they use a pair of IR transmitter and receiver, a LP2951 Linear Regulator, a LM340-15 Linear Regulator, and various resistors, capacitors, wires, and header pins. For the hardware they use a Bodine Electric Company AC motor, base support plate, vertical support plate, several 3M dual locks, and various screws.

Overall, these projects provide a great basis for our project. Being able to test, adapt, and advance our project using previous experiments gives our project a higher advantage.

References

Henk. (9 October 2003). Propeller Clock on a Mirror. *Soubry.* Retrieved from http://propellerclock.soubry.net/

Bjanes, D. & Ma, J. (2005). Persistent of Vision Display. *Cornell University*. Retrieved from http://people.ece.cornell.edu/land/courses/ece4760/FinalProjects/s2012/jm787\_dab355/jm787\_dab355/

Melangeaddict (16 December 2011). *YouTube*. Retrieved from https://www.youtube.com/user/crazysabrist?feature=watch