

Transmissive Spherical Rotating LED POV Display with Wireless Power Supply for Board Games

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1 Introduction

Board games are one of the most fascinating games, with a strong emphasis on player interaction, and they play a major role in entertainment. Virtual gaming gadgets have advanced tremendously, while board game devices have remained essentially unchanged, with paper products working as their primary components. Therefore, the table game urgently needs a revolution for a whole new gaming experience.

The purpose of this study is to create a completely new board game user interface. This study addresses the design of a new LED POV (Persistence of vision) display that is compact, mobile, and highly transparent, allowing players to use multiple displays together while easily to move around. we consider using wireless power supply technology instead of installing batteries. In conclusion, we have designed a simple and enjoyable game by using the new user interface to evaluate the concept of this study.

2 Related works

2.1 wireless power supply system

The wireless power supply technology is especially suitable for multiple small electronic devices circumstances. A battery-free mouse is suggested for gaming [2]. As a board game, we consider using the 2D communication sheet [4] as a technology by using the microwave for wireless power transmission. Printed antennas are used instead of coils, which is thin, light and foldable to any form. The electronic devices need to set up an antenna receiver only, while the multiple devices are also able to move freely on the sheet surface.

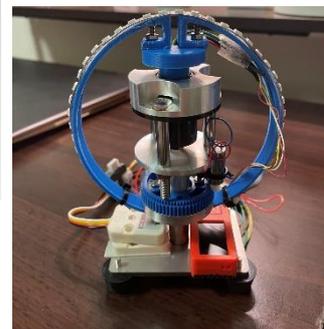
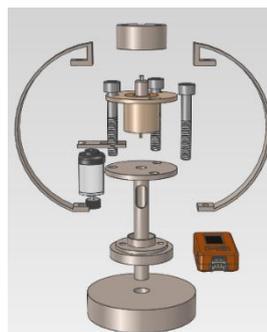
2.2 POV effect

Persistence of vision is a very common natural phenomenon. When the image appears in the human retina, the eye will keep it for 0.1~0.4 seconds [3]. If the next image appears in the retina before the previous one disappeared, the brain will consider it as one image. The image must obtain at least 10fps or 600 rpm [4].

3 POV display device design and manufacture

3.1 The prototype

In order to achieve this POV display that can be used as a gaming rig, it must be small enough to be easily installed and stored by the player, therefore it must be kept at a size and weight that a hand can grip. The power supply must be kept to a minimum. As a result, we decided that utilizing a wireless power supply instead of batteries to power the LEDs would reduce



the overall weight and also makes it free to move, while the power supply must be kept to a very low limit, and the display components must be as simple as possible so that players do not have to replace them frequently.

Fig. 1. IRONCAD Design and prototype

To overcome these difficulties, we consider designing and manufacturing a new circular POV device, which can meet the requirement that the screen can be seen from all directions. The POV device consisted of a M5stickC (ESP32) core, cycloid RGB LEDs bar (40 LEDs), DC motor, Slip ring, Hall effect sensor, and controller units. The DC motor and slip ring are fixed on a hollow cylinder supporter as the axis. The support is connected with the circular LED bar through a slip ring that surrounds the whole structure. The LED bar is the only part for rotation connected with the DC motor and rotation part in slip ring by gears and bearings. The bottom part comprises antenna receivers that gathers power wirelessly from 2D sheet as power supply for M5stickC core and DC motor though wires are hidden

inside the hollow supporter.

3.2 Produce the POV image

The length of each LED is 3mm, the resolution of pixel is divided $360/3=120$ parts, therefore the resolution is 40×120 .

We designed an algorithm to detect the rotation speed by using Hall effect sensors, the interrupt function of the ESP32, and the results showed that the desired speed of 12Hz could be achieved at 1.2V Power supply obtained a delay time of 0.75s for each column of LED blinking.

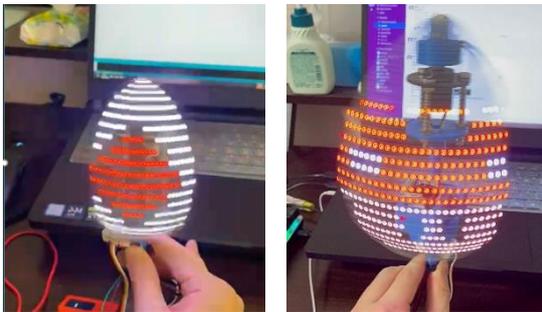


Fig. 2. Simple image display

4 Communication methods for multi POV devices

The ESP32 has built-in communication options including Bluetooth, Wi-Fi, and the unique ESPNow method. The ESPNow using the 2.4GHz Wi-Fi channel allows peer-to-peer or Broadcast communication between two ESP modules without going through the Wi-Fi router, which is a suitable method to implement communication between multiple POV devices in order to certain events during gaming.

5 Evaluation method

To evaluate this new user interface, we have developed a prototype of a simple mini-game that provided 4 students to play it and get feedback. The game contained concepts and features we demanded, such as two POV displays, wireless power supply, mobility and interaction of multiple POV devices. The two new POV displays that communicate with each other via ESPNow. The main content is that the player operating a character displayed on one POV display to invade a castle, while the castle has a defense tower displayed on another POV display. The game site uses a 2D sheet to power the player's device wirelessly. The player will need to steer the direction of the POV

display at any times to avoid the defense towers in order to enter the castle. The results showed that all 4 students agreed the new device to be innovative and appropriate for use in a board game. In addition, the new gadget may be employed in a variety of other applications. The game's interactive interface is interesting. Also appropriate for use in the creation of new board games. board games.

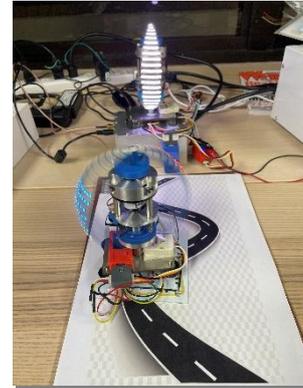


Fig. 3. Mini game interface

6 Summary

The POV display is low cost, portable, suitable for multiple users and wirelessly powered. It can be simply manufactured in different sizes and replacement of parts such as LED, controller as required to allow for the development of more board game applications. It can also be used for other demands such as advertising, Demonstration, etc. we believe the new POV display has a great variety of scope for further development

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