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Expanding the Pinball Market

There are two main markets for pinball machines, commercial (or location) and the home market. How to grow these markets is a topic of frequent discussion within the pinball crowd. The location market problem is easy; it all comes down to return on investment, or ROI. The home market is trickier; there the problem is a combination of purchase price, maintenance cost, and the most frequently noted one, space. This paper proposes a solution to these problems.

The proposed solution is actually quite simple, but it requires a fair amount of explaining as to how it solves the highlighted problems. It also requires a bit of history to understand the reasons pinball machines evolved as they did. The proposed solution is a distributed pinball CPU and driver board. The costly and bulky wire harness is replaced with a robust and reliable high-speed serial bus called CAN that allows the distributed controllers to communicate. Among the benefits of this structure is the enablement of an easily swappable playfield, something an early reviewer of this work dubbed the "Playfield Cartridge."

The Concept Machine

Picture an UltraPin[1] virtual pinball machine with a real playfield. The three main parts of the machine are connected with only two connections, a Molex plug for power and a Cat-5 cable for control. This makes it very easy to disassemble for moving. Furthermore, make the playfield easily swappable. You keep a set of playfields on hand that can be swapped in when you want a different game. If you're willing to spend time to keep the cost down, some parts could be transferred between playfields (e.g. drop target banks, controller boards, etc.) when you're swapping.

Background

Playfield upgrades are not a new concept; they were attempted with minimal success in the 1970s and 80s in the form of "Conversion Kits." Pinball 2000 provided an upgrade kit to convert "Revenge from Mars" into "Star Wars Episode 1." Whether this would have proven popular is unknown due to the closing of Williams Pinball. The question is whether the market has transformed to the point where this is now attractive. I claim it has, but there are other reasons for converting to a distributed control system: cost, reliability, and serviceability.

History

On older (i.e. EM) pinball machines it was very easy to disconnect the backbox and the playfield. Control for many playfield elements like pop bumpers and sling shots was located right near the devices, minimizing the harness wiring. With the introduction of

[1] http://www.globalvr.com/products_up.html

solid state logic the control functions moved to the Central Processing Unit (CPU), which was typically located in the backbox. At that time, processors were expensive, so consolidating control into one spot and expanding the wiring harness to get all inputs (switches) and outputs (lamps and coils) to the CPU was the most cost effective solution. Processors are now cheap, but tradition and momentum keep the configuration in place. The cost-optimal solution now is to replace the expensive copper and labor-intensive wire harness with a distributed network of controllers. The automobile industry started doing this in the late 80s. In fact, this proposal uses the same communication bus, the Controller Area Network, or CAN.

Advantage - Cost

Initial purchase cost is important to the commercial market, but less so for the home market.

One problem with cost is that the declining volume of new machines is forcing the per-machine cost upward. One way to improve this is to use more common parts. If you divide the centralized pinball controller into a number of identical parts, say 10, you now have increased the volume of parts purchased by a factor of ten. This also allows the amount of controller function (switches, lamps, coils) to be tuned to exactly what a given machine requires. The cost of maintaining an inventory of repair parts is also minimized. Another cost advantage is the removal of the main wire harness; with this proposal, only power is distributed globally, all wired connections to the playfield elements only go to the local controller. Finally, selling playfield upgrades means purchasers don't need to buy another cabinet and backbox to change machines, which lowers both the product and shipping costs.

Advantage - Reliability and Serviceability

Reliability is important to everyone. A reliable machine reduces the user cost as well as the manufacturer warranty expense. Solid state machines greatly improved pinball machine reliability, but over time that reliability was used up in the form of more complex machines.

The flip-side of reliability is repair and maintenance, also called serviceability. A distributed system of controller boards allows a person to keep a spare board on hand at a reasonable cost. The small board also lowers the cost of replacement or shipment of the board for repair. Returning the ability to easily separate the backbox and playfield allows home machine owners to more easily move their machines. The Pinball 2000 team recognized this as an advantage for operators as they could swap out the playfield and clean & repair it back at the shop.

Market Expansion

Space problems are a recurring theme in the pinball community. A common discussion thread revolves around trying to fit in "one more pin." Like telephones and television, eventually expanding the market comes down to selling more units to each home. While many people lack room for additional machines, many playfields will fit into the same space. Several populated playfields could easily fit into a closet.

Similar to the way you buy a new game for a video game console, you can buy a new playfield for your pinball machine. The backbox display would be an LCD monitor, so the image can be updated for the new playfield.

Prototypes

Two machines have been built as a proof-of-concept for this distributed system. The first was the lower playfield from a Gottlieb Black Hole built into a small demo machine. This was on display at Pinball Expo 2010 in Chicago. The second was a complete Gottlieb Solar City rebuilt into a fully electronic machine using the distributed controllers. This machine was on display at the Midwest Gaming Classic in March 2011. The latest prototype used five small controller boards for the playfield and three for the backbox. The hardware for all the controller boards is identical.

Summary

Distributing the control function of the pinball machine CPU and driver boards has many advantages that have been outlined above. The initial motivation was to enable swappable playfields, but advantages beyond this became apparent during the development. Implementing this system can reduce cost, improve serviceability, and expand the pinball market.