

臻善圈決賽隊伍提案摘要 Project Summaries of WIT Finalists

基於資產生命週期管理的 PIS播控設備延壽方案 Life Extension Solution for PIS Broadcast Equipment Based on Asset Life-Cycle Management



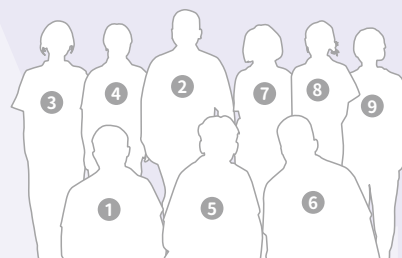
圈員資料 Team's Information

成立日期 Date of Team Formation 01/2022

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問題剖析 Problem Analysis

- 杭州地鐵一號線的通信系統已持續運營13年，PIS系統的播放控制器故障率正逐年增加。儘管已進行定期保養，仍無法解決因設備元器件老化帶來的根本問題，需要整體更換；
- 更甚的是，供應商的報價較上期合同有239.3%的漲幅，更換預算遠超預計，且供應商為行業壟斷，無論在成本上，還是在技術上，我們都處於被動狀態；
- 按照該設備的生命周期，在特許經營授權合約內需要分兩批次更換，每次須投入1千6百萬元人民幣成本。
- The communication system of Hangzhou Metro Line 1 has been continuously operating for 13 years, and the failure rate of the PIS system's playback controllers increasing annually. Despite dedicated maintenance efforts, the fundamental issue of aging components cannot be resolved, necessitating a complete system replacement.
- More critically, the supplier's current quotation has surged by 239.3% compared to the previous contract. Due to the supplier's monopolistic position in the industry, we are facing both technical and cost-related vulnerabilities, and the replacement budget now far exceeds initial projections.
- In accordance to the equipment's lifecycle, two batch replacements will be required during the operation period under the concession agreement, incurring a cost of 16 million CNY per replacement.



改善方法 Improvement Methods

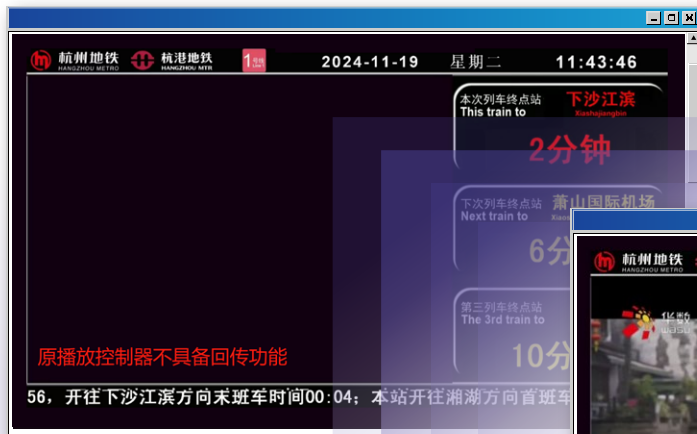
- 考慮到該設備不屬於安全設備，我們根據港鐵GOSI框架下的C1資產生命週期管理的理念，測算得出延長設備的生命週期可減少一次設備置換，從而顯著降低成本；
- 針對原播放控制器軟體只能在供應商的專用硬體設備上運行的痛點，我們採用了虛擬機器方案。此方案透過硬體虛擬化技術，為原設備的軟體運行提供硬體基礎，有效解決其環境適配與穩定性問題。既不用改變設備軟體，又可以確保設備運行穩定，同時只需少量成本即可突破原設備的技術壁壘。
- Considering the equipment is non-safety-critical, we conducted an analysis based on the C1 asset life-cycle management concept under the MTR's GOSI framework, which indicates that one batch replacement could be eliminated by extending the equipment's lifecycle, significantly reducing costs.
- To address the limitation of the original playback controller software being locked to the supplier's proprietary hardware, we implemented a virtual machine (VM) solution. This approach utilizes hardware virtualization. We recreate the hardware environment required for the legacy software, resolving compatibility and stability challenges. This approach avoids the need for software modifications while ensuring operational reliability, breaking the supplier's technical barriers at minimal cost.



杭港地鐵通信實訓基地
MTRHZ Communication Training Base



軟硬體適配可行性研究
Hardware-Software
Compatibility Study



直播視頻畫面回傳功能

Live video screen return function



總結成果 Summary of Achievements

有形得益

- 單次採購成本節省 (供應商採購價-自研成本) : $(95,000-7,049) \times 82 = 7,211,982$ 元人民幣 ;
- 設備穩定性 : 運行8個月錄得零故障 , 減少相應的維修工時 ;
- 節省一次更換成本 : 1千6百萬元人民幣。

Tangible Benefits

- Single Procurement Cost Saving (Supplier quote vs. in-house development): $(95,000-7,049) \times 82 = 7,211,982$ CNY.
- System Stability: Zero failure over 8 months of operation, significantly reducing maintenance labour hours.
- One-Time Replacement Cost Avoidance: 16 million CNY.

無形得益

- 科技創新 : 通過虛擬技術打破原廠技術的壁壘 ;
- 應用範圍廣泛 : 該解決方案可跨行業跨設備適用於大部分工業用控制系統 ;
- 通信設備的更新反覆運算迅速 , 為我們在設備延壽期間採購到低價高質的設備提供可能性 ;
- 將港鐵GOSI資產生命週期管理理念應用於實際工作中。

Intangible Benefits

- Technological innovation: The virtual technology breaks the technical barriers of the original manufacturer.
- Wide range of applications: The solution is applicable to most industrial control systems across various industries and devices.
- The rapid update and iteration of communication equipment provide us with the possibility to purchase low-cost and high-quality equipment during the life extension of the equipment.
- We successfully applied MTR GOSI Asset Life-cycle Management concept to practical work.