深圳臻善圈

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

Tian Circle 技安圈

地鐵閘機大客流模式控制板開發

Development of high-capacity mode control board for metro fare gates

圈員資料 Team's Information

成立日期 Date of Team Formation 05/2018

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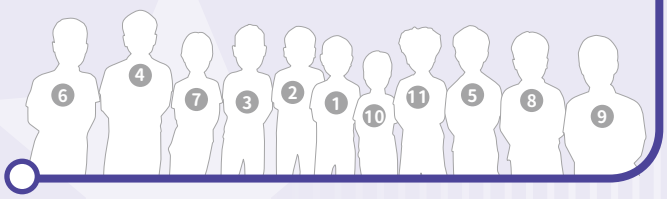


問題剖析 Problem Analysis

- 城市舉辦活動期間，深圳地鐵4號線的現有閘機無法有效應對極大客流，導致車站出現乘客滯留，影響乘車體驗。
- 改造前，站務部只能通過斷電讓閘機扇門常開，確保乘客安全有序過閘，雖提升通行效率，卻影響公司票務的收益，亟需兼顧安全效率與收益的解決方案。
- 閘機原廠設計未包含大客流應對邏輯，行業內無成熟解決方案。據了解，現有技術無法兼顧「安全高效通行」與「票務管控」，需通過創新技術實現扇門常開時正常刷卡驗證，既可保障乘客通行的效率，也能避免異常票卡後續處理。

- During city events, the existing fare gates at Shenzhen Metro Line 4 cannot handle extreme passenger flow efficiently, resulting in passenger backlogging at stations and negatively impacting travel experience.
- Before upgrading, stations staff had to disconnect the power and leave the flaps open to ensure orderly passenger flow. While this improved throughput, it compromised the fare revenue. We urgently need a solution that balances safety, efficiency, and revenue.
- The original gate design lacked logic for crowd control, and there is no mature solution within the industry. We cannot ensure "safe, efficient passage" and "fare control" simultaneously using existing technology, therefore we need to rely on technological innovation to enable normal card verification while keeping the flaps open to ensure smooth passenger flow and prevent handling invalid tickets.

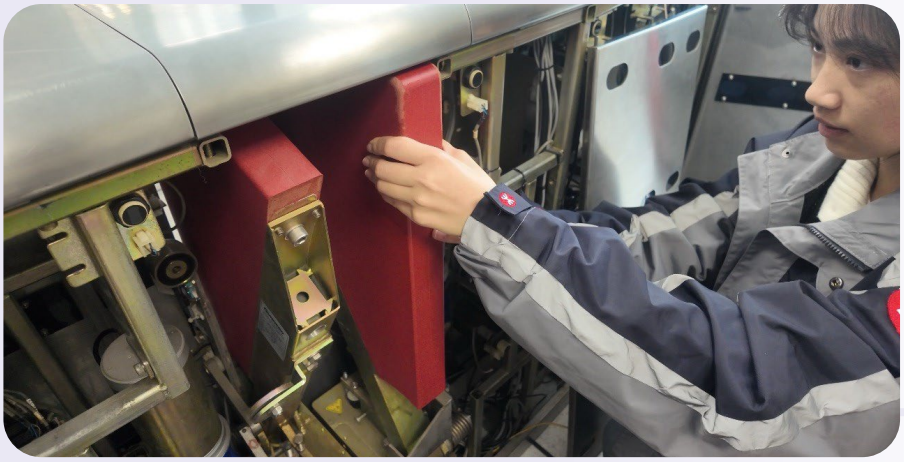
改善方法 Improvement Methods

車站維修技術團隊討論控制板設計思路及確定設計目標。
The station maintenance technical team discussed the design concept of the control panel and finalized the design objectives.

- 團隊成員多次實地調研及數據分析，結合車站大客流時段的通行需求和設備運行狀況，對多個技術方案進行反覆論證和版本迭代。
- 期間，通過模擬不同客流場景的線上測試，並邀請站務人員、乘客代表參與體驗評估，不斷優化控制邏輯和通行體驗。
- 經歷數月的技術攻關，最終確定以開發地鐵閘機大客流模式控制板作爲改造方案。
- 該控制板於2024年7月順利完成研發工作，並同步完成現場安裝調試，正式投入車站運營使用。

- After multiple on-site investigations and data analyses, and considering the station's demands and equipment performance during peak hours, the team rigorously evaluated and iterated various technical solutions.
- The team simulated several different passenger flow scenarios online, and incorporated feedback from station staff and passenger representatives to continuously optimize the control logic and passage experience.
- Following months of technical development, the team finalized the solution – to develop a dedicated high-capacity mode control board for metro fare gates.
- The board was successfully developed in July 2024, followed by on-site installation and commissioning, and was officially deployed for station operations.

車站維修部與電子廠按照設計目標製作控制板
The station maintenance team worked with the electronics factory to produce the control board according to the design specifications



大客流控制板現場安裝與調試
On-site installation and commissioning of the high-passenger-flow control panel

總結成果 Summary of Achievements

有形得益

- 憑藉自主研發技術優勢，地鐵閘機大客流模式控制板開發總成本僅8,501元。
- 改造前，極端大客流場況下爲保障乘客安全，站務將閘機斷電並保持扇門常開放行，導致大量票卡交易異常，每小時約損失扣款金額3,600元，每次模式啟用約5小時、每年啟用約30次，年度累計損失扣款金額約360,000元 。
- 改造後，透過大客流控制板，車站啟用大客流模式，有效避免上述票務收益流失。由此可見，該項目以極低開發成本，保障了交易數據的完整性，充分展現技術創新的優勢 。

Tangible Benefits

- Leveraging in-house R&D capabilities, the total development cost of the high-capacity mode control board for metro fare gates amounted to only 8,501 RMB.
- Prior to the upgrade, stations were forced to disconnect gate power and leave flap doors open during extreme passenger flow to ensure safety. This resulted in widespread fare transaction abnormalities, causing a loss of approximately 3,600 RMB per hour. With each occurrence lasting around 5 hours and happening around 30 times a year, the total revenue loss amounted to approximately 360,000 RMB annually.
- After the upgrade, the high-capacity control board enables stations to activate a dedicated mode, effectively preventing such revenue leakage. This project demonstrates how minimal R&D investment safeguarded transaction integrity while highlighting the value of technological innovation.

無形得益

- 團隊效益：展現高效創新、多向溝通、靈活應變同團隊合作精神。
- 有效提升乘客滿意度同服務質素。
- 地鐵閘機大客流模式控制板已經申請專利，充分顯示港鐵員工嘅專業技術實力。

Intangible Benefits

- Team Benefits: Demonstrated high-efficiency innovation, multi-directional communication, flexible adaptability and collaborative spirit.
- This has effectively elevated passenger satisfaction and service quality.
- The high-capacity mode control panel for metro fare gates has been patented, fully showcasing MTR staff's professional technical capabilities.