WISSEN RESEARCH
EMPOWERING INNOVATION

SMART ELEVATOR SYSTEM - THE TIME CLOCK CASE!

Why did we name it "The Time Clock Case"? Because the client gave us a ticking clock—just 4 days to deliver results. Tick-tock, tick-tock! The pressure was on, but what we discovered was nothing short of fascinating.

This case revolved around a groundbreaking innovation: The smart allocation of elevator cars. But what makes it so smart? Let me take you on a quick ride.

Imagine elevators that think ahead, calculating parameters like destination floors, changes in distance, the number of passengers, and the shifting load as people get on and off at each floor. This dynamic, real-time optimization ensures efficiency and speed, transforming the way people move within buildings. Intrigued? Let's dive deeper!

Introduction to the Smart Elevator System

The smart elevator system aimed to find the best lift with the lowest per-floor arrival time when a destination call was made or passenger numbers were measured. It considered two key factors:

1. How would the moving distance change (from the current floor to the passenger's floor, then to the destination floor)?
2. How would the load change with passengers boarding and off-boarding?

After evaluating these factors, the system selected the best lift with the lowest arrival time for each floor.

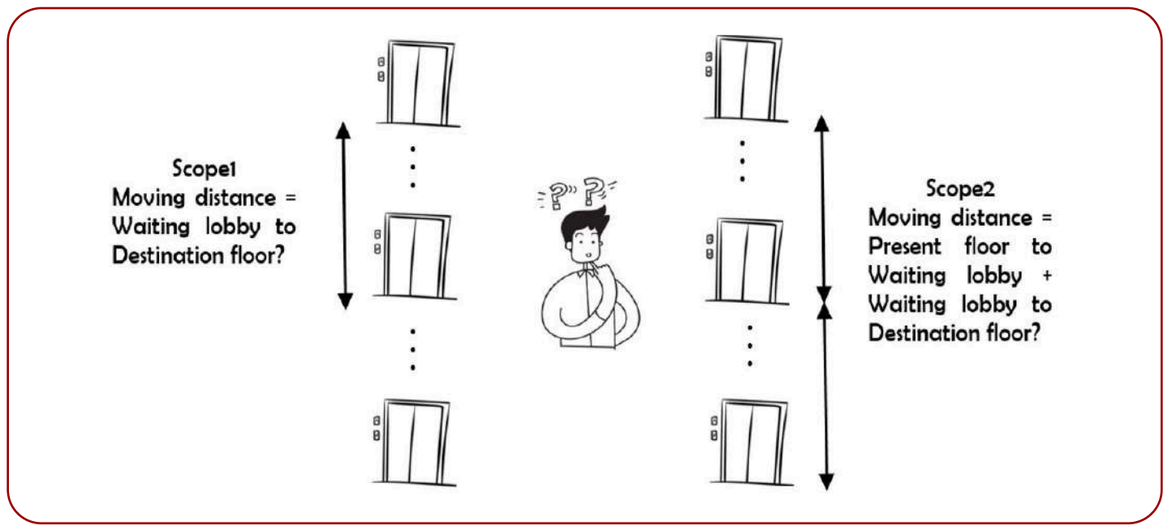
Phase 1:

The scope determining step

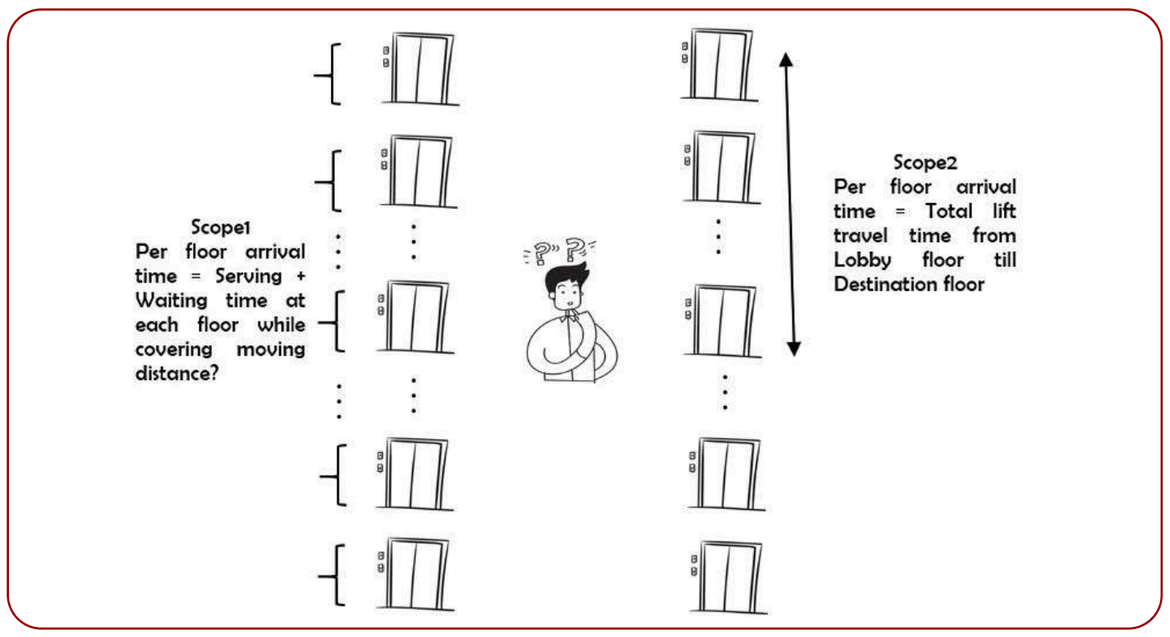
Upon initial review, the task appeared simple, but it soon revealed its complexity. The challenge lay in defining key terms like "moving distance for each lift," "predicted arrival time for each floor per lift," and "total time for each lift." The invention was not very clear on these points.

We had several questions regarding the scope of few claim terms:

1. What exactly is "moving distance"? Is it the distance from the hall call to the destination floor, or from the current floor to the hall call and then to the destination floor?



2. How is "predicted arrival time for each floor" calculated? Is it the total time to travel to the destination floor from hall call lobby, considering changes in speed and acceleration? Or is it the time taken at each floor based on the moving distance from the present floor to the lobby hall and then to the destination floor, using changing speed/acceleration concept?



These uncertainties made the problem more complicated than it initially appeared.

Phase 2:

The search begins, but no output!

All we knew was that we had to find the closest prior art within the given time. We geared up and started searching with a set of initial ideas in mind:

- Smart elevator systems
- Travel time for elevators
- Counting passengers before travel
- Measuring travel distance

Another challenge was the cut-off date: July 12, 2007 (i.e., 2007-07-12).

The invention was new to us, and we had rarely seen an elevator system with features like multiple hall calls, counting passengers, and assigning the fastest lift. We thought there might be something similar in movies or TV series, so we turned to non-patent literature—articles, blogs, studies, research papers, and YouTube videos.

We found a few documents like "Elevator Group Control with Artificial Intelligence," "Dynamic Scheduling Approach to Group Control of Elevator Systems with Learning Ability," and "An Intelligent Real-time Lift Scheduling System," but they weren't quite right. Nothing eye-catching yet!

Phase 3:

The turning point – Leads, Logics, Classes

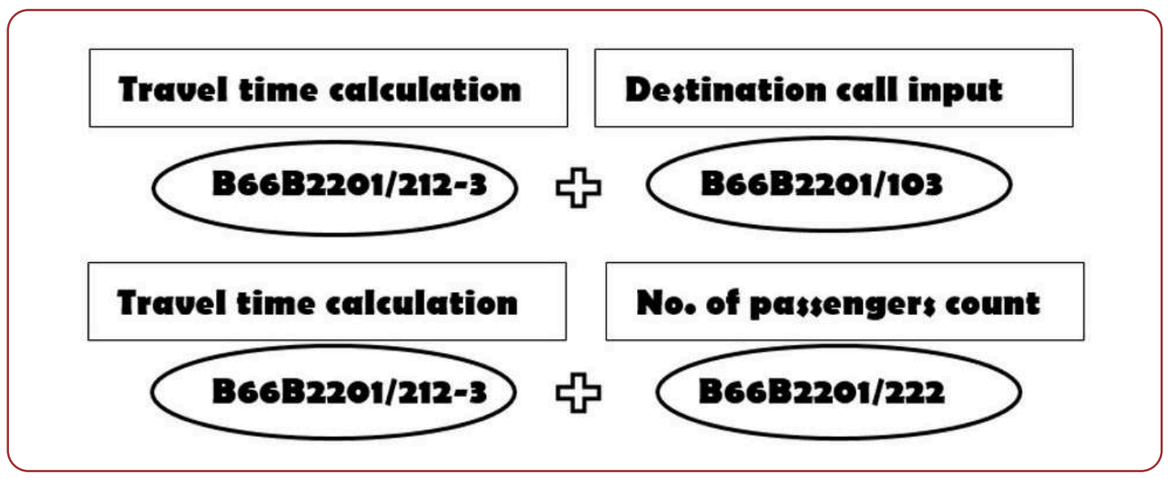
Our next step was to check the same assignee for any relevant publications from the year before the cut-off date. This search led us to 2-3 patents from Mitsubishi Electric Corp., such as USXXX146, USXXX050, and USXXX874. These were promising as initial findings, but we were still searching for something more definitive.

We then gathered our team and compiled all the leads we had found in the first two days. Since time was tight, we needed to accelerate our efforts.

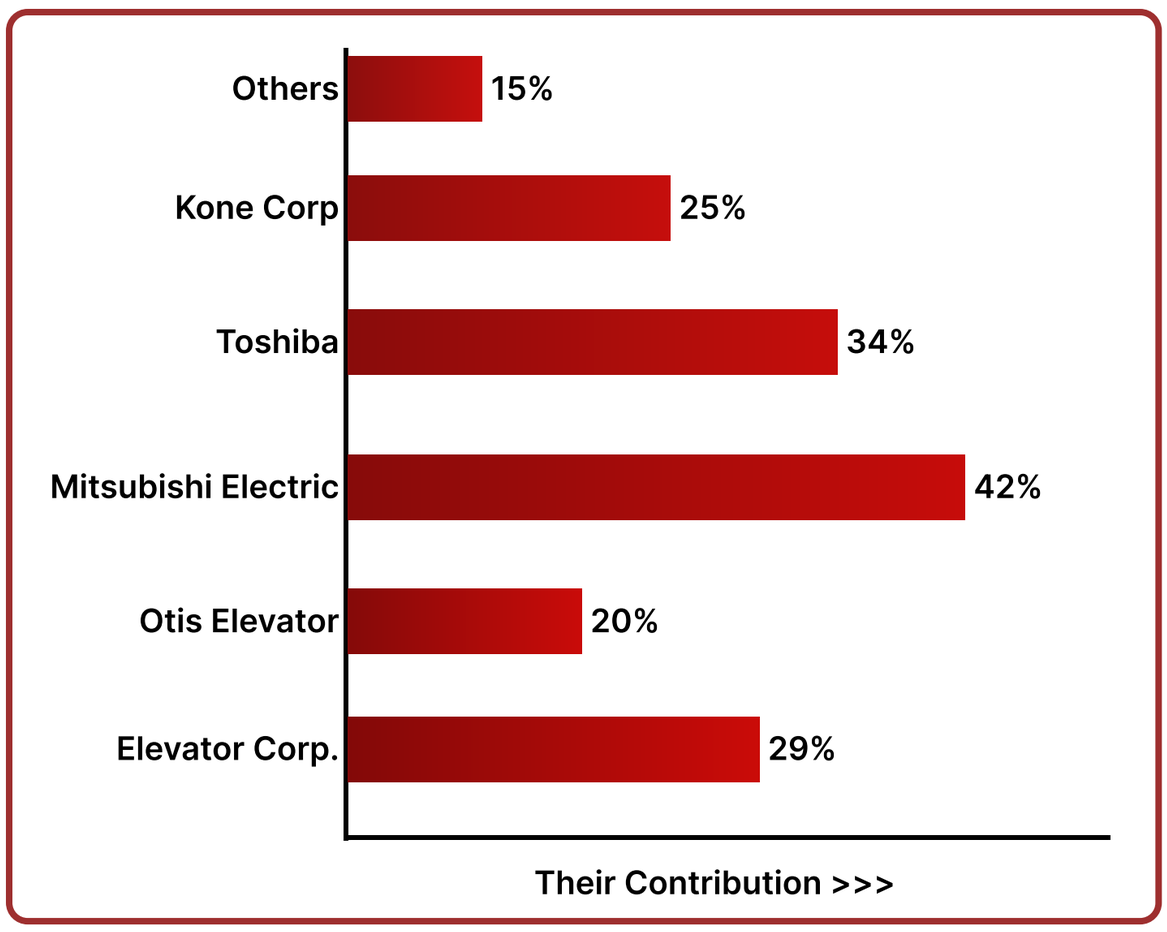
Lead 1:
After an in-depth analysis of open databases, some team members identified relevant point classes:

- B66B2201/213 and B66B2201/212: Travel time calculation
- B66B2201/222: Counting the number of passengers in the elevator car
- B66B2201/103: Inputting destination call before entering the elevator

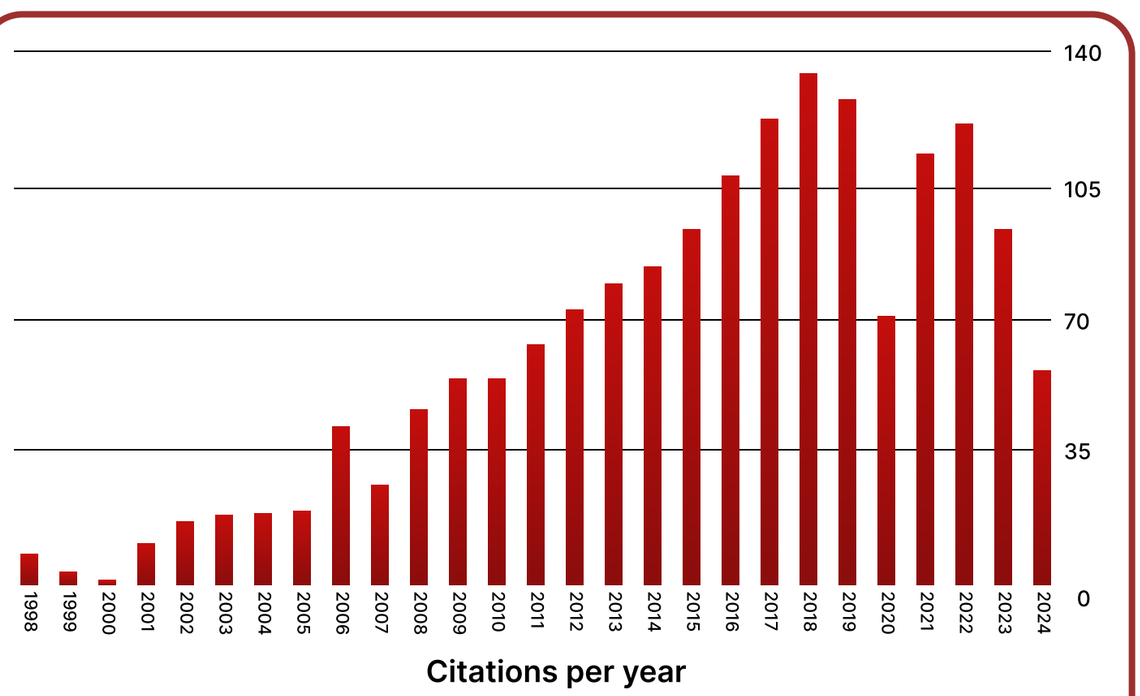
We already had information on travel time calculations based on passenger count and destination calls. What more did we need?



Lead 2:
We noted that several major players were active in optimizing elevator car travel time during this period, such as Kone Corp., Mitsubishi Electric, OTIS Elevator, Toshiba, Elevator Corp., Hitachi, Reliance Electric, Fujitec, and Westinghouse Electric.



Lead 3:
An interesting insight from our youngest team member was the frequent appearance of the inventor Marja-Liisa Siikonen. With over 588 publications cited, her work seemed significant. The titles of her publications were particularly eye-catching.



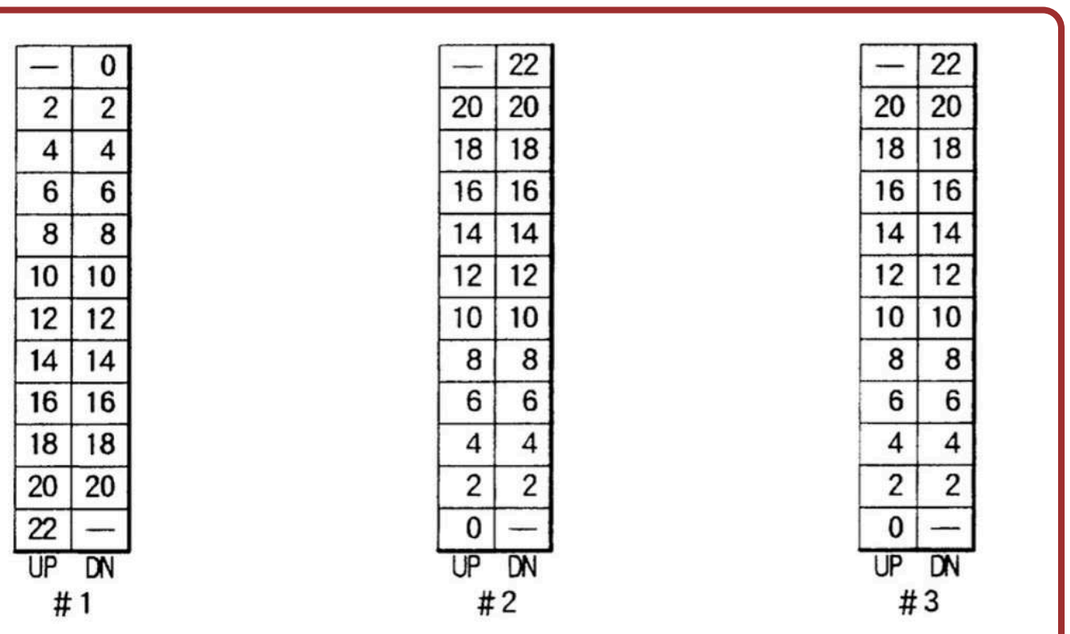
(Credits: Source)

Lead 4:
Another team member suggested analyzing IEEE documents. They found terms like "Modern Elevator Group Control Systems," "EGCS," "round trip time" (RTT), "waiting time forecast" (WTF) in their initial search. We agreed this could be a promising direction to narrow down our focus.

Phase 4:
The results

We had gathered all our resources, and now we had one goal: find the best prior art. With time running out, we quickly dove into our leads and started our search with a clear path ahead.

After some deep analysis, we felt confident we were on the right track The first promising result was a patent from Mitsubishi Electric Corp., USXXX050. It described a "per floor arrival time" calculation for three elevators, considering speed, acceleration, and per-floor heights.



3 lifts with per floor service/waiting time

Note: The above snapshot shows 3 lifts with "per floor arrival time" when they move up or down, Credit: Source]

Soon after, we found another relevant patent, USXXX232, which discussed the concept of RTT (round trip time). This patent detailed travel time calculations for each floor using load changes based on the number of passengers, and factors like floor height, stop and travel time, speed, and acceleration. It was a solid find!

On the non-patent literature side, we also hit gold. We found two documents: “Design and Implementation of Modern.....” and “Design of Modern Elevator....Systems." These provided proof of concept for calculating load changes based on passengers boarding and off-boarding at each floor.

We still had one last lead: Marja-Liisa Siikonen. Our team discovered she worked at Kone Corp. during 2005–2008. This was a good reason to check both patent and non-patent literature from her or Kone Corp.

And guess what?

We struck gold with USXXX874, a patent from Marja-Liisa Siikonen. It was a perfect fit for all our claim requirements. It mentioned the WTF (waiting time forecast) factor, representing a cumulative sum of both changing load (based on the number of passengers) and changing distance per floor height. The result was a calculation of waiting time per floor, based on both distance traveled and the number of passengers waiting in the lobby. Bullseye!

Tip

- Look for key areas (major classes, key terms, publishers, assignees) to enhance your analysis.
- Brainstorming the scope can lead to different interpretations of concepts (per floor time, RTT, WTF). It's okay to get stuck!
- The sooner you identify all key avenues, the faster you can plan your search.

Expert

He is a leading tech analyst with a curiosity for groundbreaking inventions. With an engineering degree in Electronics and Communications from UIET, Chandigarh, Ankush holds over 6 years of hands-on experience in the field. Leading a skilled team, he excels in conducting accurate prior art searches, comprehensive portfolio analyses, and crafting strategies tailored to client’s unique needs. His expertise spans a wide spectrum of cutting-edge technologies including 3G/4G/5G, Wifi, IoT, AI/ML, smart and power electronics, and beyond.