SINGAPORE AIRLINES

Let's endow engineers' iPad a brain!

—— Intelligent Aircraft Maintenance Assistant

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Content

SINGAPORE AIRLINES

TongJi Optimization

A group proficient at software and algorithm with reliable airlines background

Yang Shan, Tongji's student, law double major in Fudan University, webpage / iOS full-stack engineer, computer vision engineer, also a part-time graphic designer. Yang Shan has created his own company in the direction of AI and served as CEO, whose software obtained thousands of users. Shan also worked for Innospace Shanghai as an Investment Assistant and other startups.

Ma Chang, Tongji's student, Web/Android full-stack engineer, well mastery of large-scale database query and natural language processing technology. Ma Chang has experience in system optimization development. Chang also do well in large database design and maintenance and has experience in speech processing and keyword statistical analysis.

Wang Zilu, Tongji's student, web full-stack engineer, proficient in cross-platform development and good at servers development technology. Wang Zilu has high I/O server, GIS, PDF processing development experience. ZiLu also has achieved large-scale data network crawlers and is admired as a geek in our school.
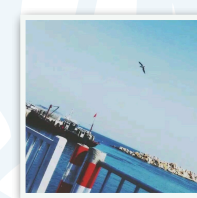
Sun Yan, Tongji's student, web engineer, big data processing engineer, won the first prize of Mathematical Modeling Contest in Tongji University. With Vue.js-based web development experience, Sun Yan also has much experience in statistics and analysis based on large-scale data sets and complex database design.

Liang Zhe, Professor of MSE in Tongji University, winner of the China National Natural Science Outstanding Youth Fund, director of the Xiamen Aviation Joint Laboratory of Tongji University. Professor Liang's main research areas are large-scale combinatorial optimization etc, which applied to many aviation fields such as abnormal flight recovery, aircraft maintenance system planning. Mr. Liang also established cooperative relationships with many domestic airlines such as Xiamen Airlines.

Problem Analysis

Why intelligent maintenance is the trend and how to achieve it
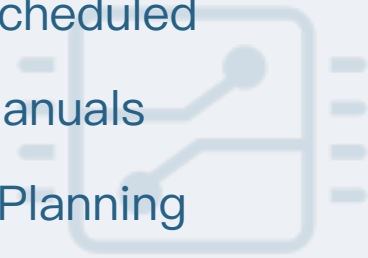
1 E-system now is most airlines' choice

Job Card Auto Constructed

Digital Maintenance Record

Auto Maintenance Scheduled

Digital AMM/IPC manuals

Enterprise Resource Planning
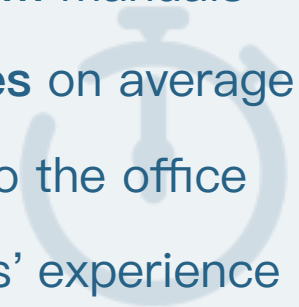
2 Complicated but useless work wastes time

An aircraft has more than **100k parts**

An aircraft has over **80 AMM** manuals

A manual has over **1000 pages** on average

Consulting ERP needs go to the office

Prediction requires engineers' experience

Intelligent technologies
should be applied to aircraft maintenance

One/few shot learning
enables the computer to recognize components by just one photo

PDF technology
can help us process PDF and precisely extract information

Data mining
makes it possible to predict what will happen using flight data

Search algorithm
could compute and sort results according to matching rate

Comparison and Solution

From Informatization to Intelligentization!

100k	**80k**	**1000**	**None**
components on an aircraft.	pages in B737 Manuals	pages in a PDF on average	easy way to get record

Existing solution

Electric System

E-system has ERP and can schedule aircraft maintenance automaticly……

Real-Time System

For example Fly Always Punctual (飞常准) in China which can show the status of airplanes.

Both of these solutions do not help much of the above.

Mainly rely on the time spent by engineers.

Our solution

Take a photo
to know all about the component

Input keywords
to retrieve the best matching manual pages

Simply click
to easily browse PDF
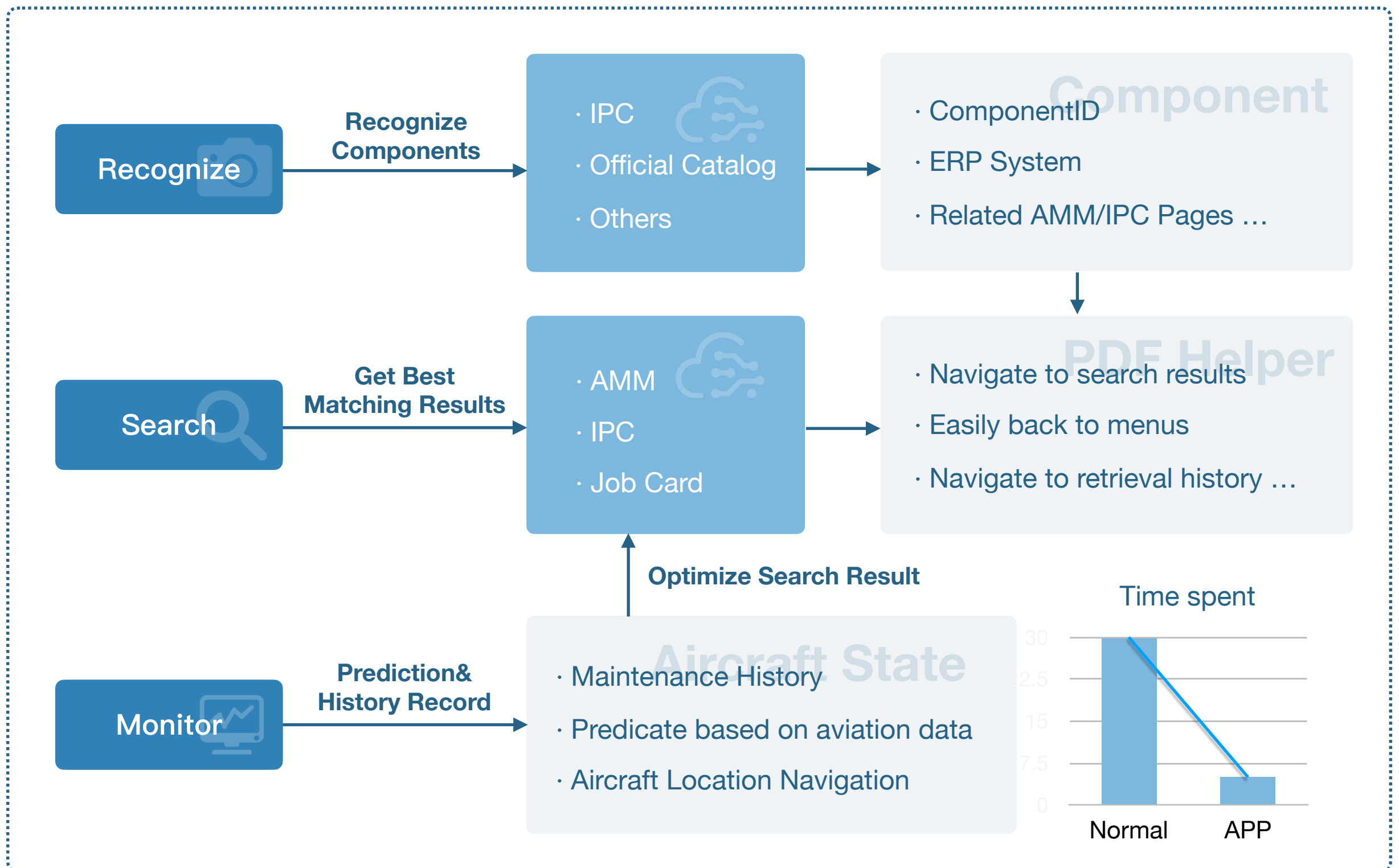
Just use an app
to monitor history and predict "future"

Mainly rely on the intelligent technology.

Intelligent Aircraft Maintenance Assistant's Structure

Endow engineers' iPad a brain, everything just on iPad

Recognize —Recognize Components→ · IPC · Official Catalog · Others → · ComponentID · ERP System · Related AMM/IPC Pages …

Component

Search —Get Best Matching Results→ · AMM · IPC · Job Card → · Navigate to search results · Easily back to menus · Navigate to retrieval history …

PDF Helper

Optimize Search Result

Monitor —Prediction& History Record→ · Maintenance History · Predicate based on aviation data · Aircraft Location Navigation

Aircraft State

Time spent

- 30
- 22.5
- 15
- 7.5
- 0

Normal   APP

This system can also connect to other exists databases and display their data

Technology Barrier

Our technology is at the forefront and has a technical threshold

Component Recognize

We have almost implemented a computational model that can recognize images with only a small number of samples.

PDF Process

AMM/IPC has a lot of content and updates frequently. We can now precisely process these pdfs and let engineers use easily.

Search & Match Algorithm

Find the best matching results in the manuals with high degree of title overlap and large scale data by keywords and historical search.

Data Mining & Prediction

We will predict the probability of specific repairs based on the state of the aircraft, historical maintenance etc.

Some of these technologies are being adapted to aircraft maintenance, others are being optimized and tested. We provides source code and introduction in GitHub and prototype. <u><Github link></u>
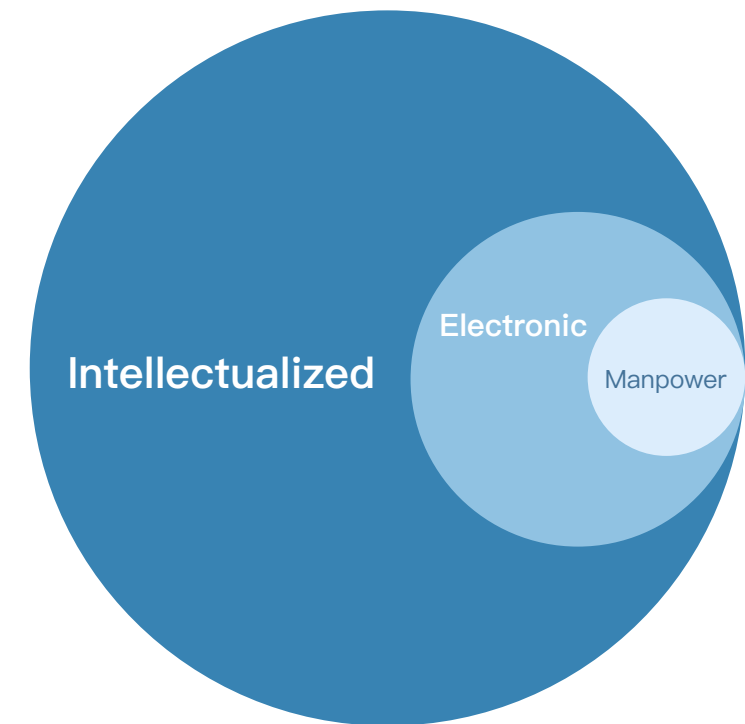
Business Value

How big is the market for intelligent aircraft maintenance?

Maintenance & Engineer Market

According to Commercial Market Outlook 2019 -2038 produced by Boeing, money spends on Maintenance & Engineer will further increase. For example, **China's aircraft maintenance market will be as high as 300 billion.**
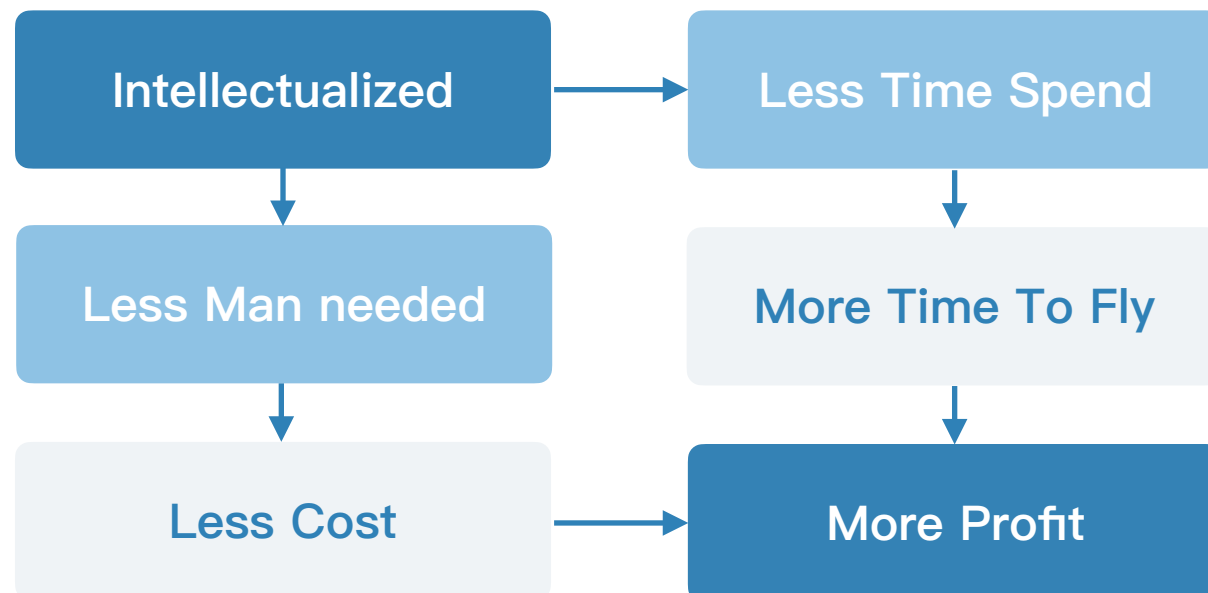
It's our stage.

Intellectualized	→	Less Time Spend
Less Man needed		More Time To Fly
Less Cost	→	More Profit

Market size at each stage

Intellectualized
Electronic
Manpower

From electronic system to intellectualized technology is just like from manpower to electronic system.

Electronic system is now nearly every airlines' choice.

Grasp it or give up?

Project Plan

Become the technology provider for intelligent aircraft maintenance
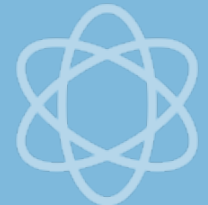
Achieved

PDF Process/Read

AMM/IPC Search

Location Navigation

History Display ...

Optimizing

We are adapting the recognition algorithm to aircraft component recognizing

Prediction algorithm will work well using fly data with maintenance status

Apply it to Cooperative Airlines

We can apply this system to cooperative airlines(Xiamen airline etc). Airlines could spend less time and manpower for maintenance without any cost and we can optimize our algorithm and database.
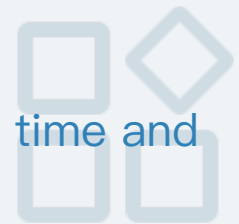
Apply it to Other Airlines

Take advantage of our technology and provide services to other airlines at low prices. Further optimize the algorithm and accumulate data.
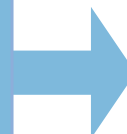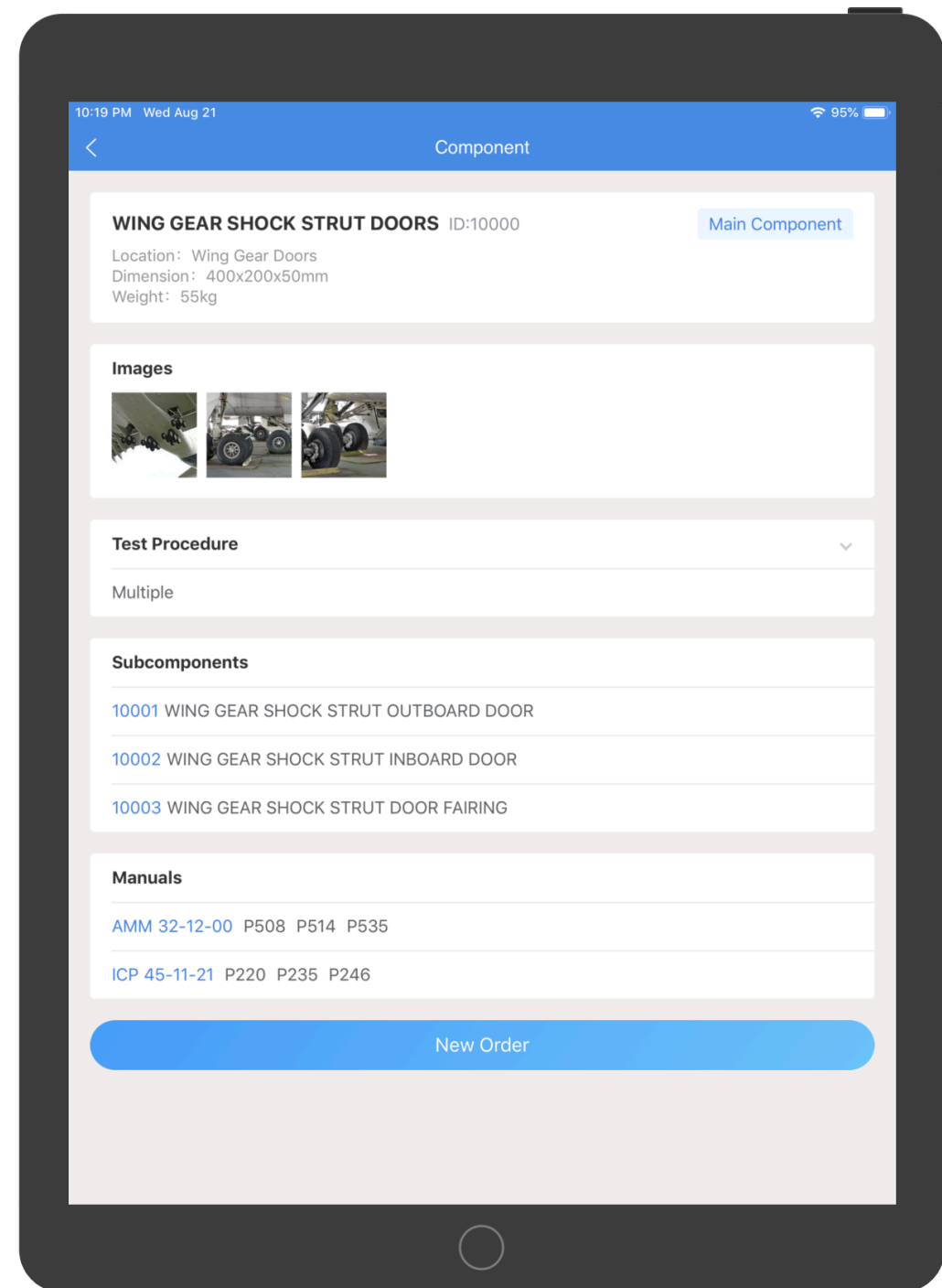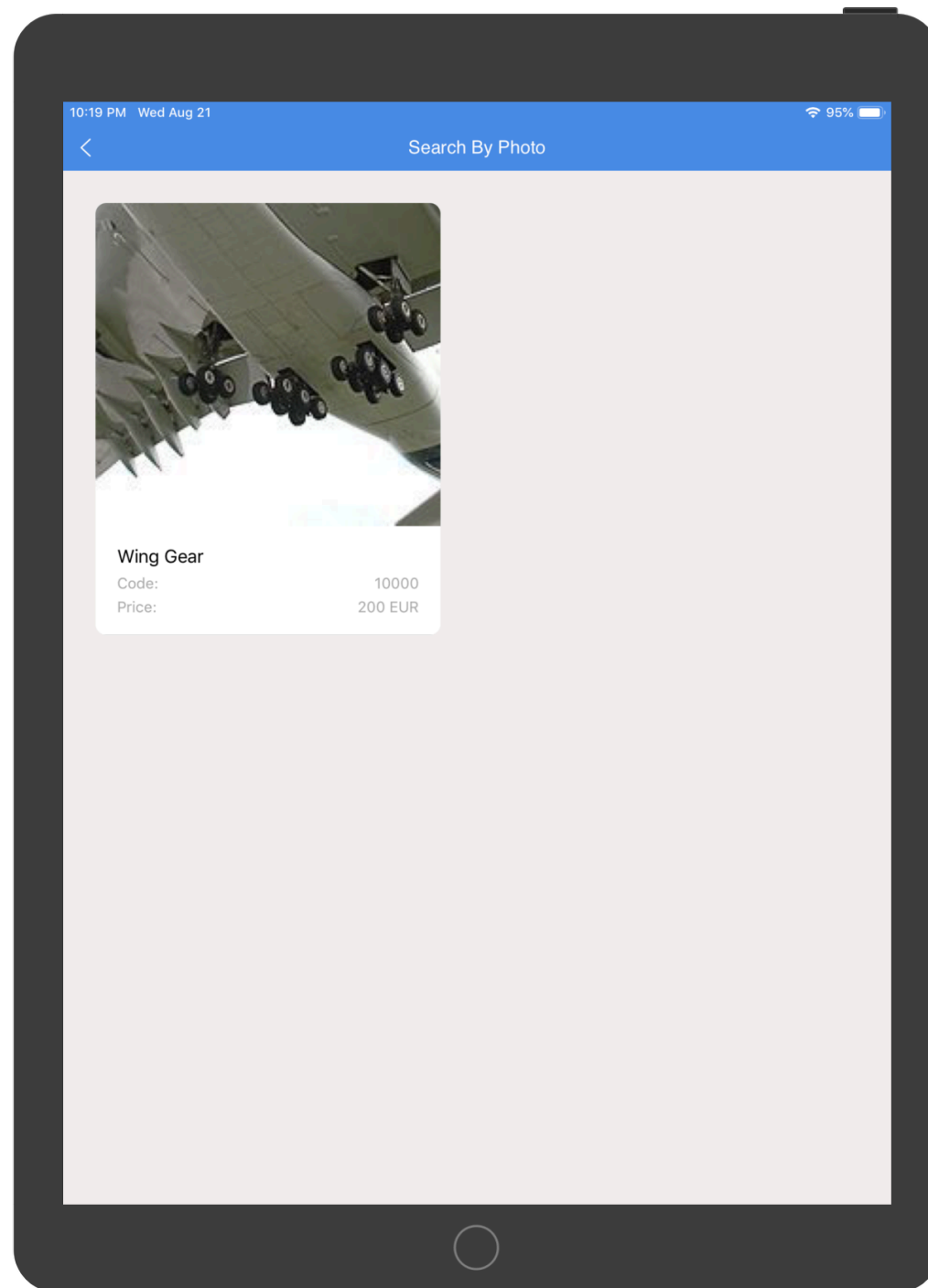
Intelligent Technology Provider

Stay profitable and become a technology provider of intelligent aircraft maintenance with the advantages of data and algorithms.
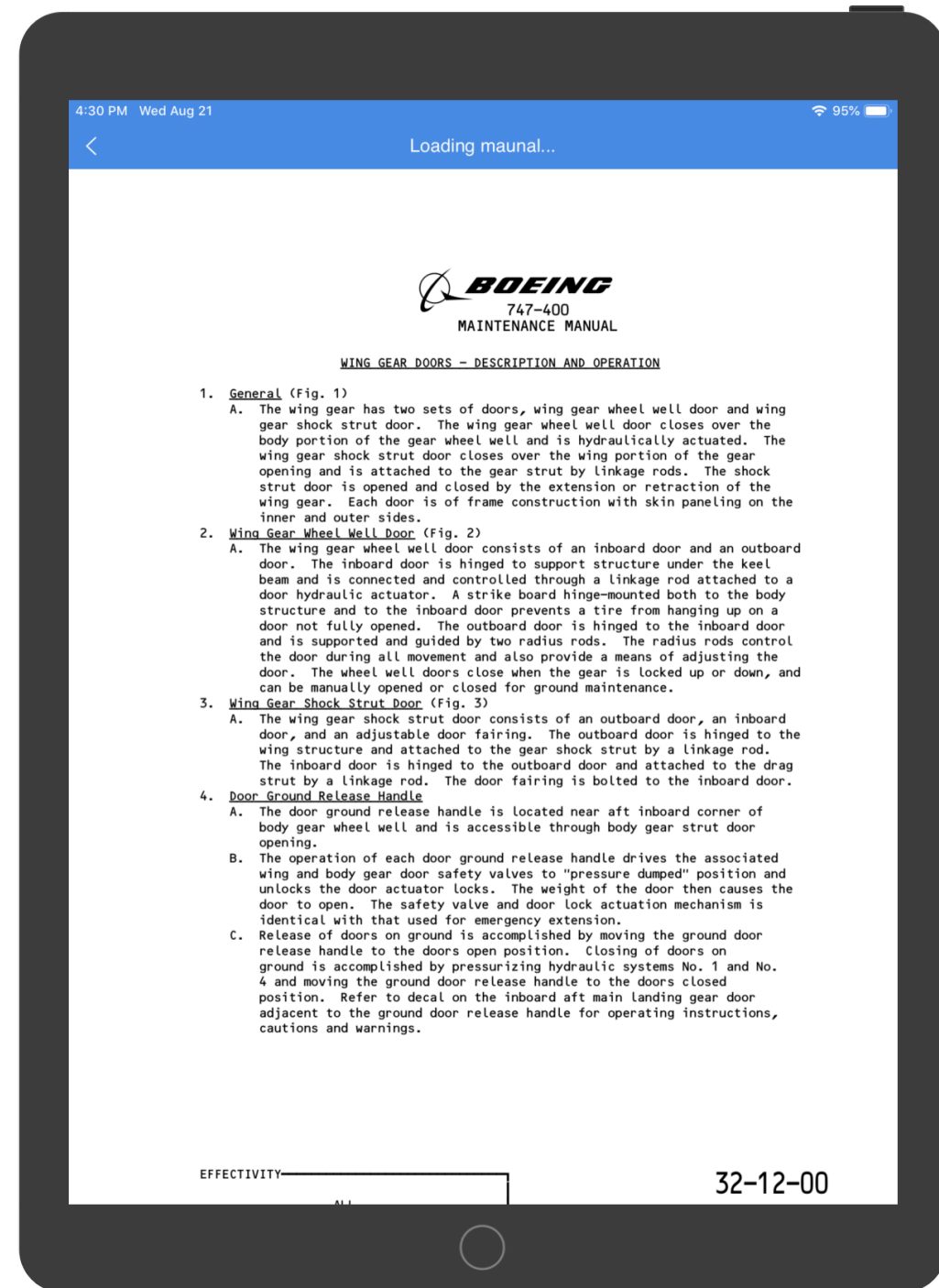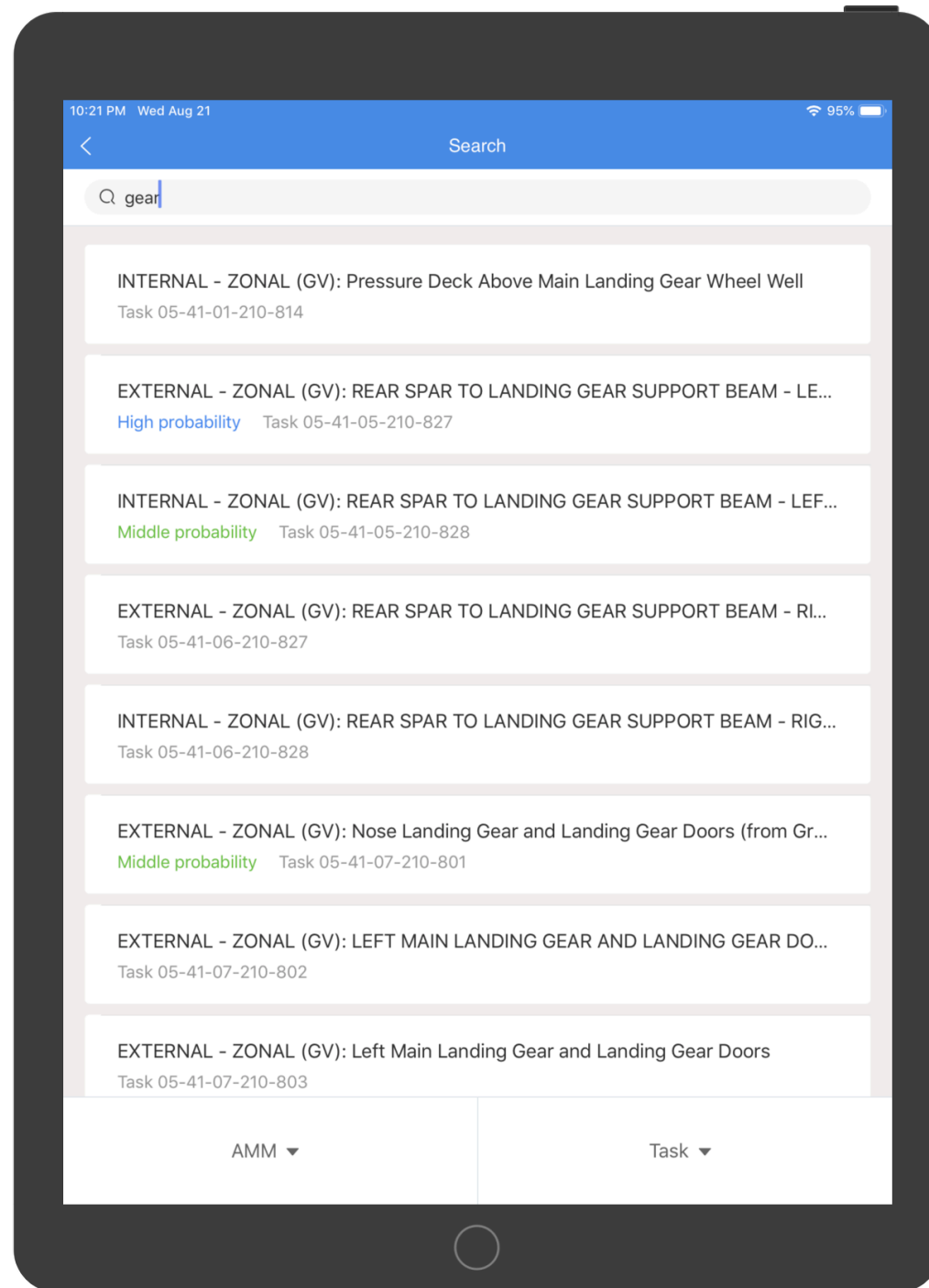
Demo(1/2)

More detail please consult our prototype file

Take a photo and the engineers can get the code and information for the components in the photo. If necessary, they can also submit an order to the planner.

Demo(2/2)

More detail please consult our prototype file

By entering keywords, engineers can get the most relevant results in the manual based on search records, actual content etc. At the same time, click on the search results to access PDF files directly and conveniently. Probability predicted by data will also show here(initial version).

• References •

Documents

Prototype file: The prototype file we submitted contains our source code and product model.

Github Link: All of our files are also uploaded to our Github private warehouse. We have given access to the account SIAppChallenge. https://github.com/Prinway/Tongji-Optimization

Prototype

The prototype folder contains screenshots of our features and introduction. Some of the features not shown in this PPT are displayed in the prototype.

Source Code

Our source code folder contains source code for the software and algorithms, as well as specific implementation progress and technology introduction.

Practical application

At this stage, our software is being optimized and not actually used. However, some of the functions in the software, in addition to the requirement of Singapore Airlines, are also developed according to the actual needs of Chinese Eastern Airlines' engineer.

Thank You!

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