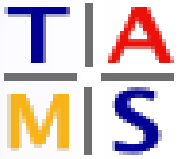
MIN-Fakultät
Fachbereich Informatik
TAMS

# Previous Work

Shuang Li



Tel: +49 1634014785
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2.May 2017

# Research Experience

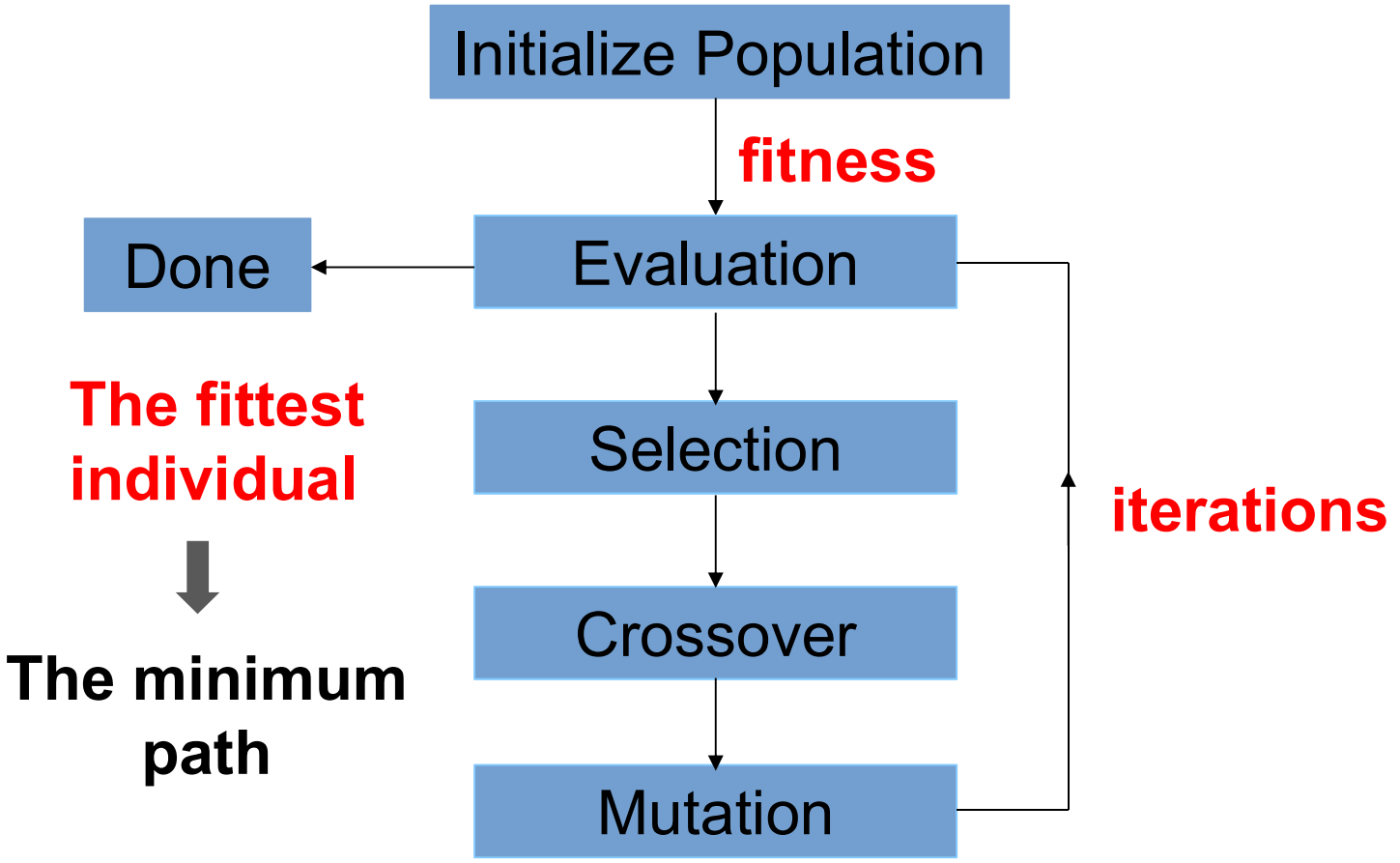
**Mechanical Engineering**
**Anhui University of Technology**

（2013.9～2015.6）

➡ **Path Planning for Unmanned Ground Vehicle and Modeling Simulation Based on Improved Genetic Algorithm**

1. Proper environmental modeling methods
2. Efficient algorithms

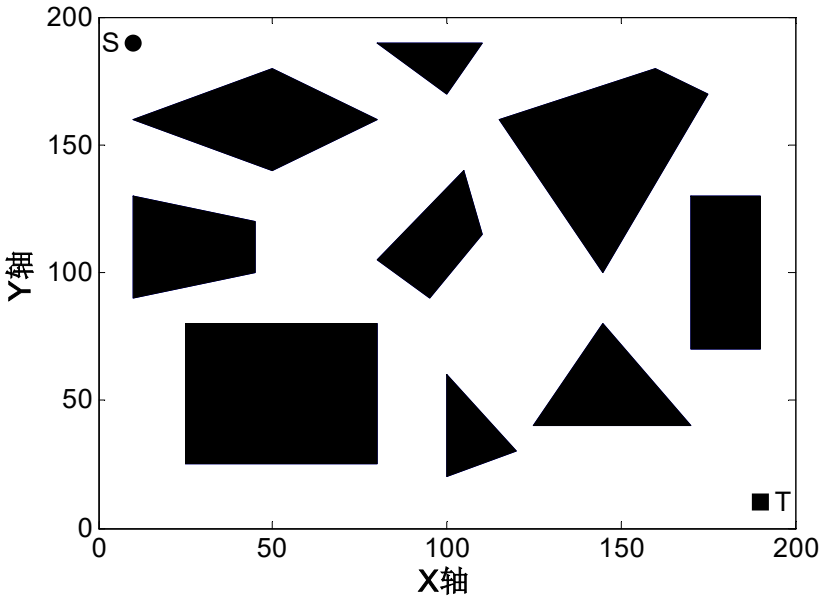
# Genetic Algorithm: Simulate evolutionary processes

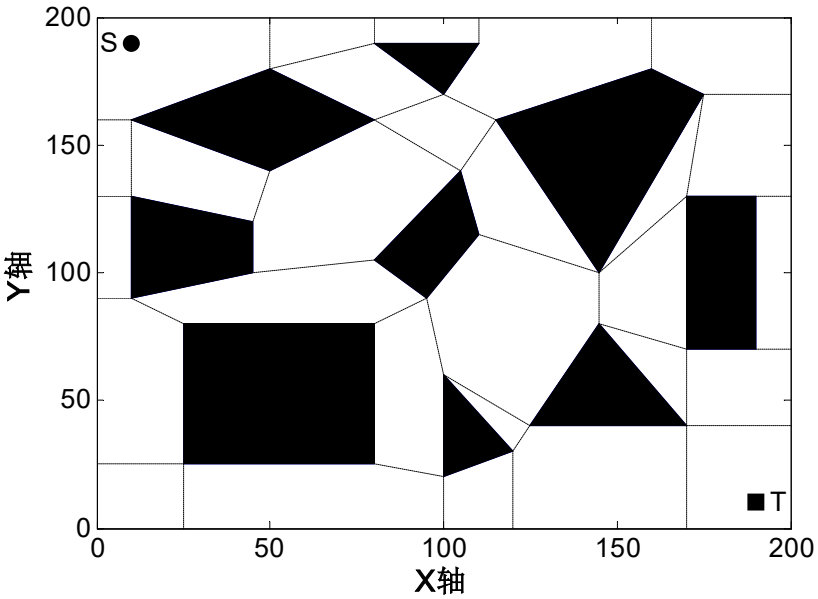


## ◆ An improved hybrid genetic algorithm based on the free space method

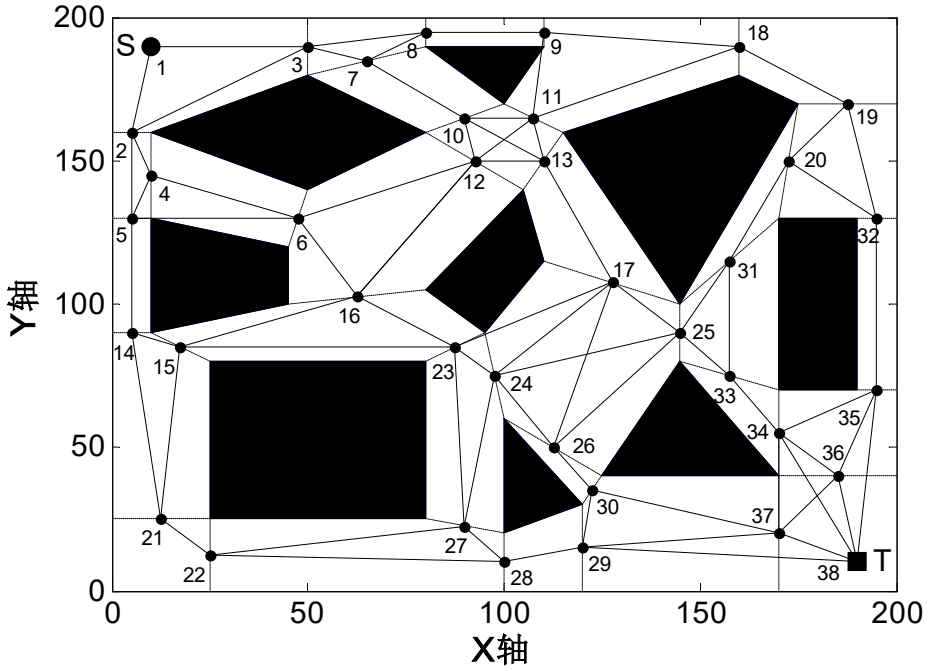
**Free space method :**

- The environmental modeling method always used in **not complicated environment which objects place relatively concentrated.**



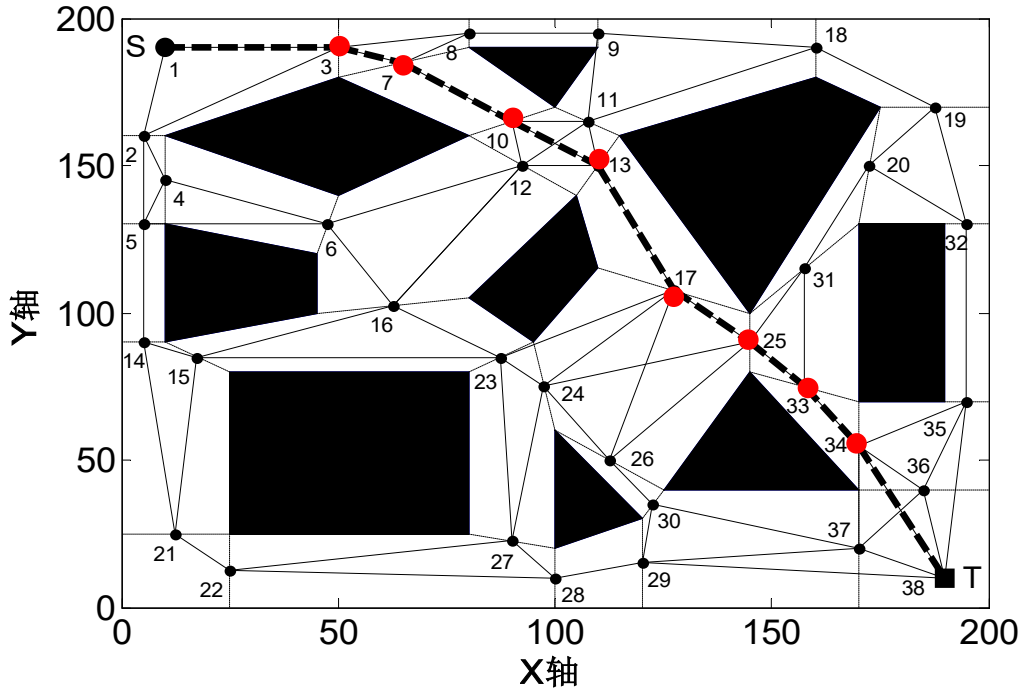




**Free space method （Maklink graph method）**



# The improved algorithm :

- The roughly shortest path in the connected graph could be searched by the Bellman-Ford Algorithm.



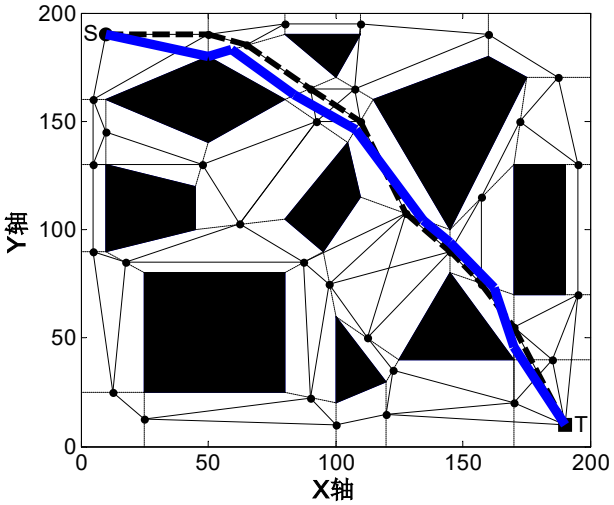

The distance of roughly shortest path is 275.8930

● **The genetic algorithm of king-crossover mechanism could be used to optimize the path.**

- ✓ **Add king-crossover mechanism**
  - ➡ **Increase the convergence rate**
- ✓ **Optimizing mutation operator**
  - ➡ **Maintain species diversity, and prevent premature convergence**

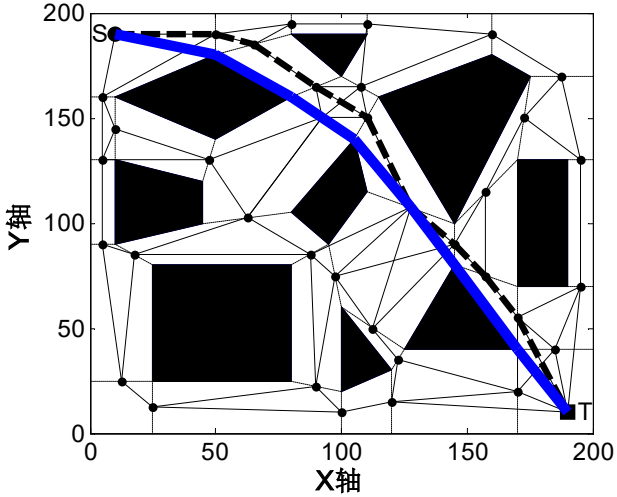
# Simulation :

- **Optima**



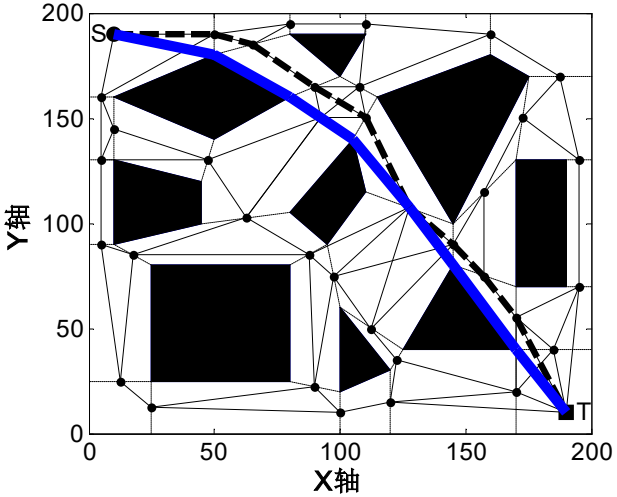

General GA

The shortest path:265.7323
The average path:277.4022




Genetic algorithm with elitist strategy

The shortest path: 264.6521
The average path: 269.9015

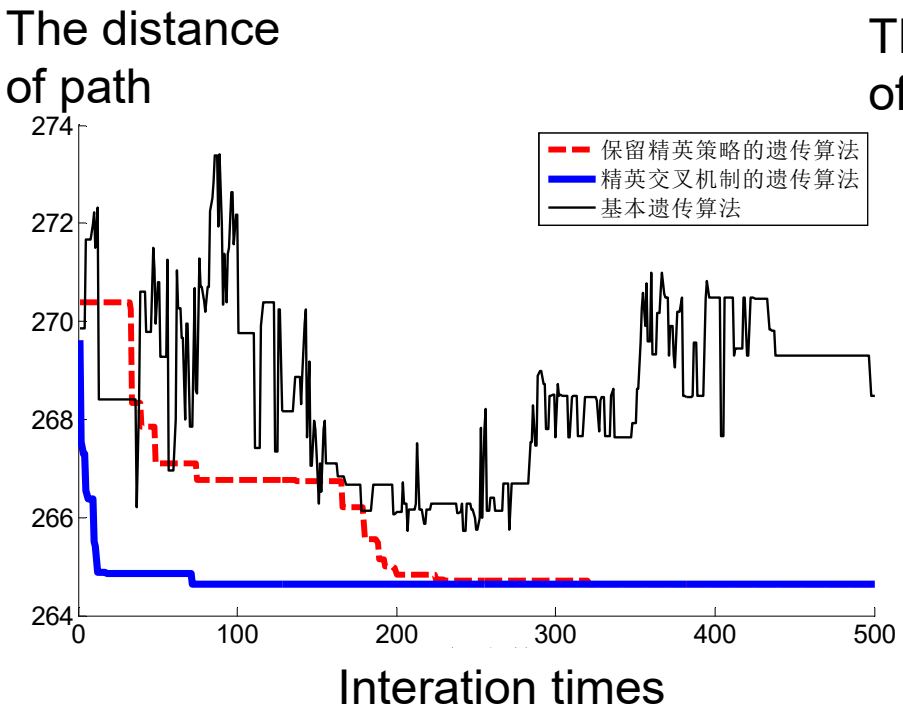



Improved hybrid genetic algorithm

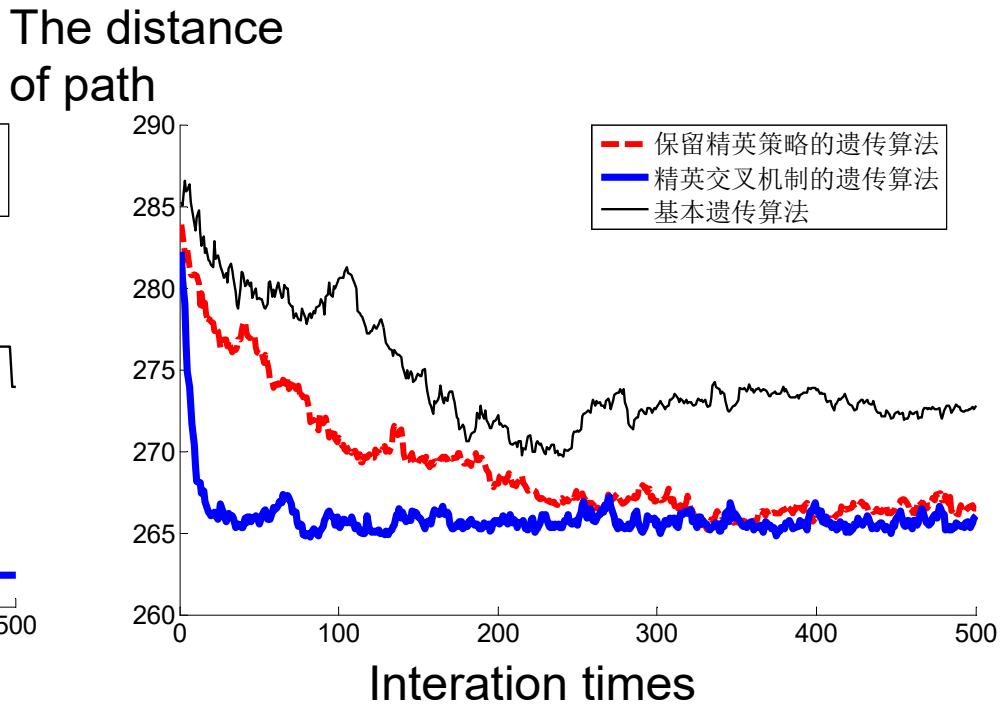
The shortest path: 264.6521
The average path: 266.4557

## Simulation :

- **Optima**
- **Convergence rate**




**Convergence curves of optimal path obtained by the three algorithms**

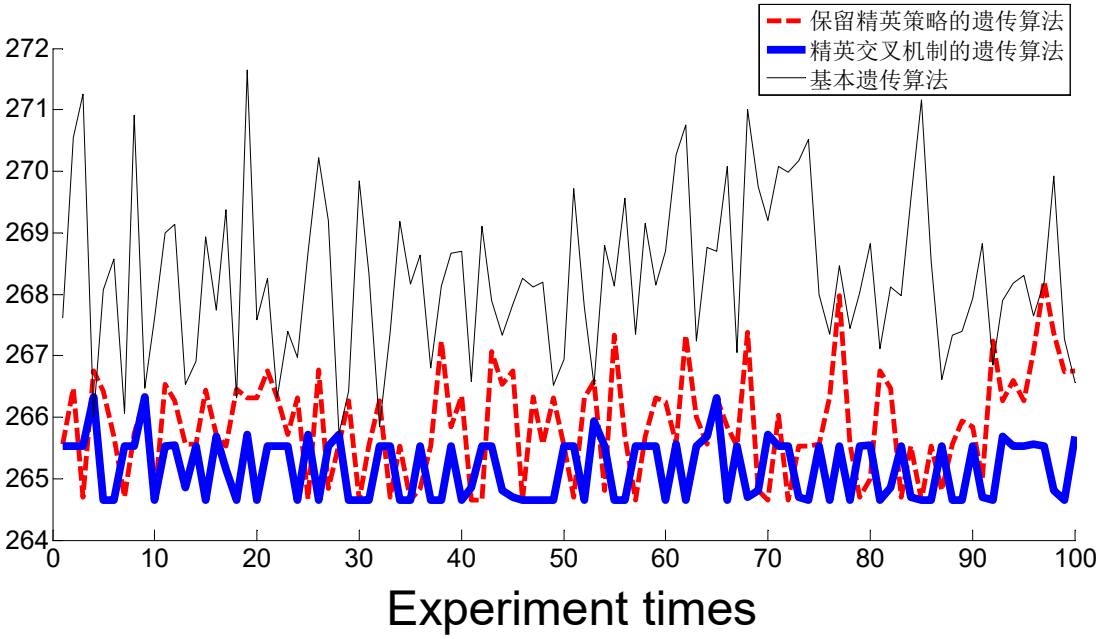



**Convergence curves of average path obtained by the three algorithms**

## Simulation :

- **Optima**
- **Convergence rate**
- **Stability**

The distance of shortest path

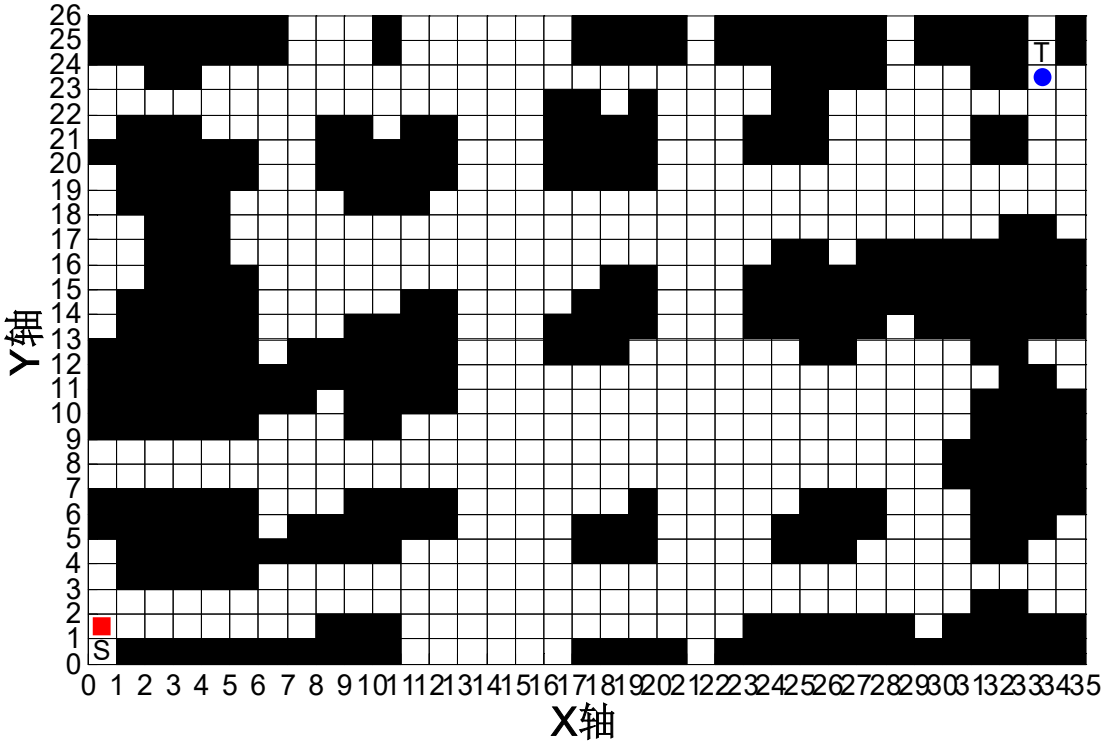



**Fluctuation of optima in 100 experiments obtained by the three algorithms**

# An improved genetic algorithm with elitist strategy based on the grid method

**The grid method :**

- The grid division
- Completely rasterization



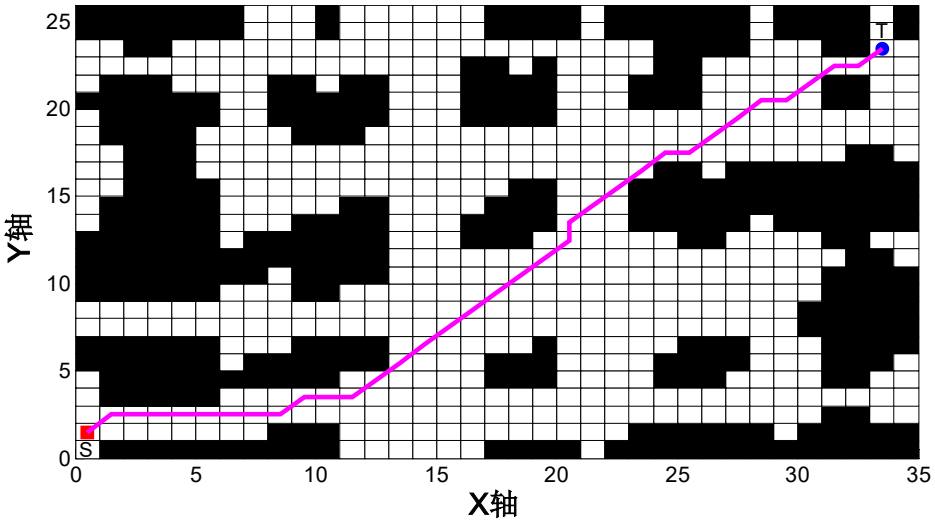
## An improved genetic algorithm with elitist strategy based on the grid method

**Five improved aspects:**

- Generating the initial path
- Integrating the initial path
- Effectively choosing the elite individual
- Improving hybrid crossover operator
- Optimizing mutation operator

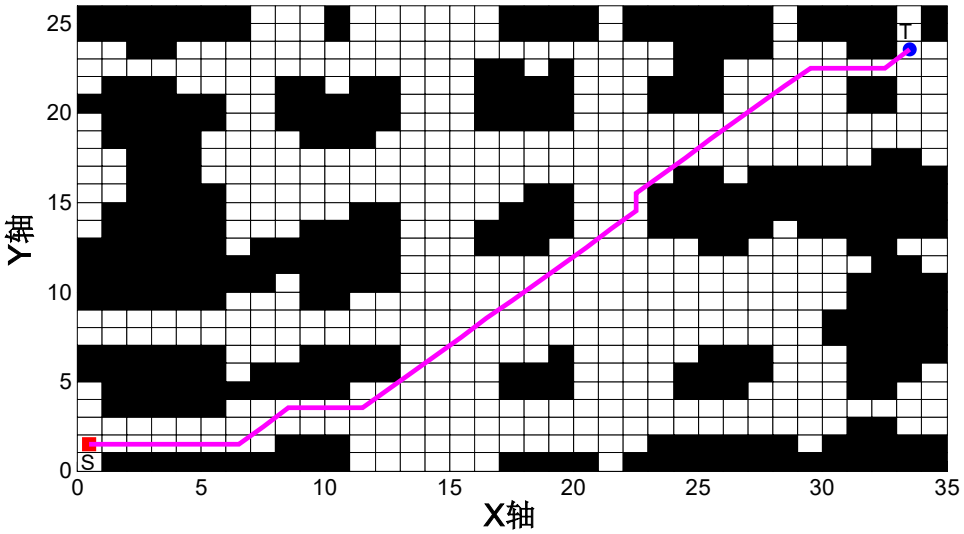
# Simulation：

- **Optima**




**Genetic algorithm with elitist strategy**

**The shortest path: 42.6985**
**The average path: 52.1328**
**Path turning: 12 times**



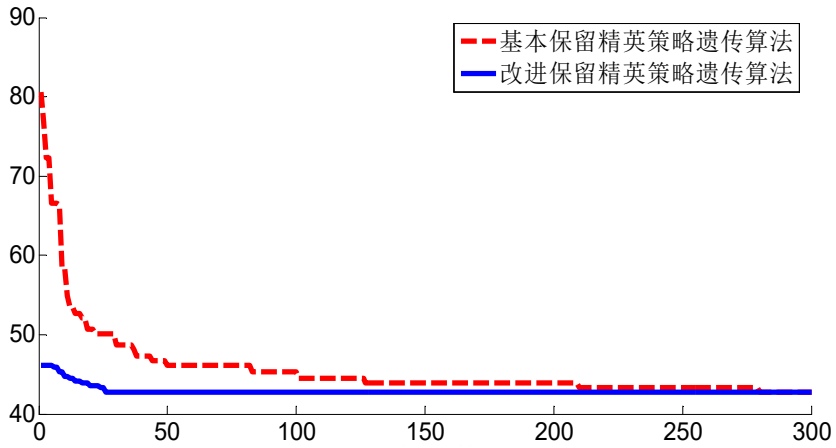

**Improved genetic algorithm with elitist strategy**

**The shortest path: 42.6985**
**The average path: 44.4777**
**Path turning: 7 times**

## Simulation :

- **Optima**
- **Convergence rate**

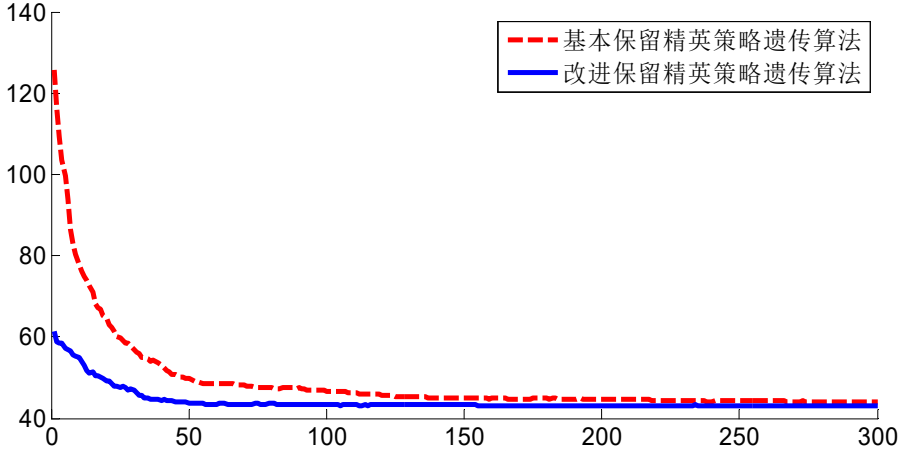
The distance of path




Interation times

**Convergence curves of optimal path obtained by the two algorithms**

The distance of path

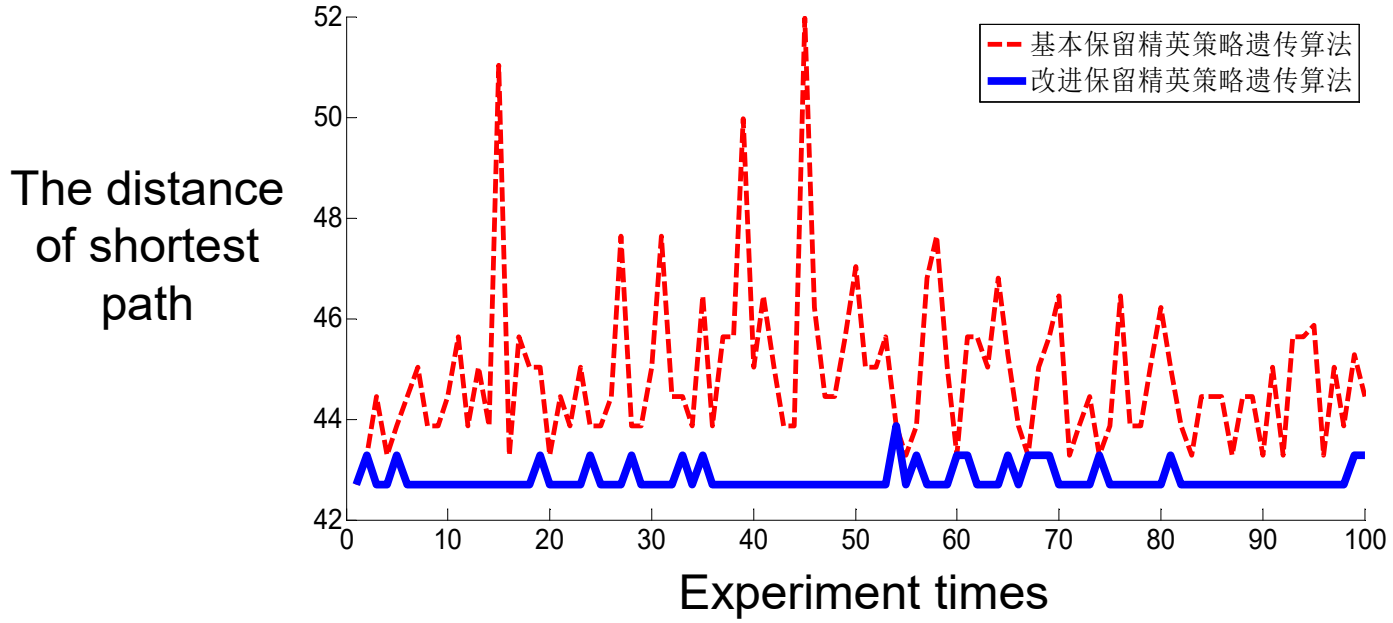



Interation times

**Convergence curves of average path obtained by the two algorithms**

## Simulation :

- **Optima**
- **Convergence rate**
- **Stability**




**Fluctuation of optima in 100 experiments obtained by the two algorithms**

# Work Experience

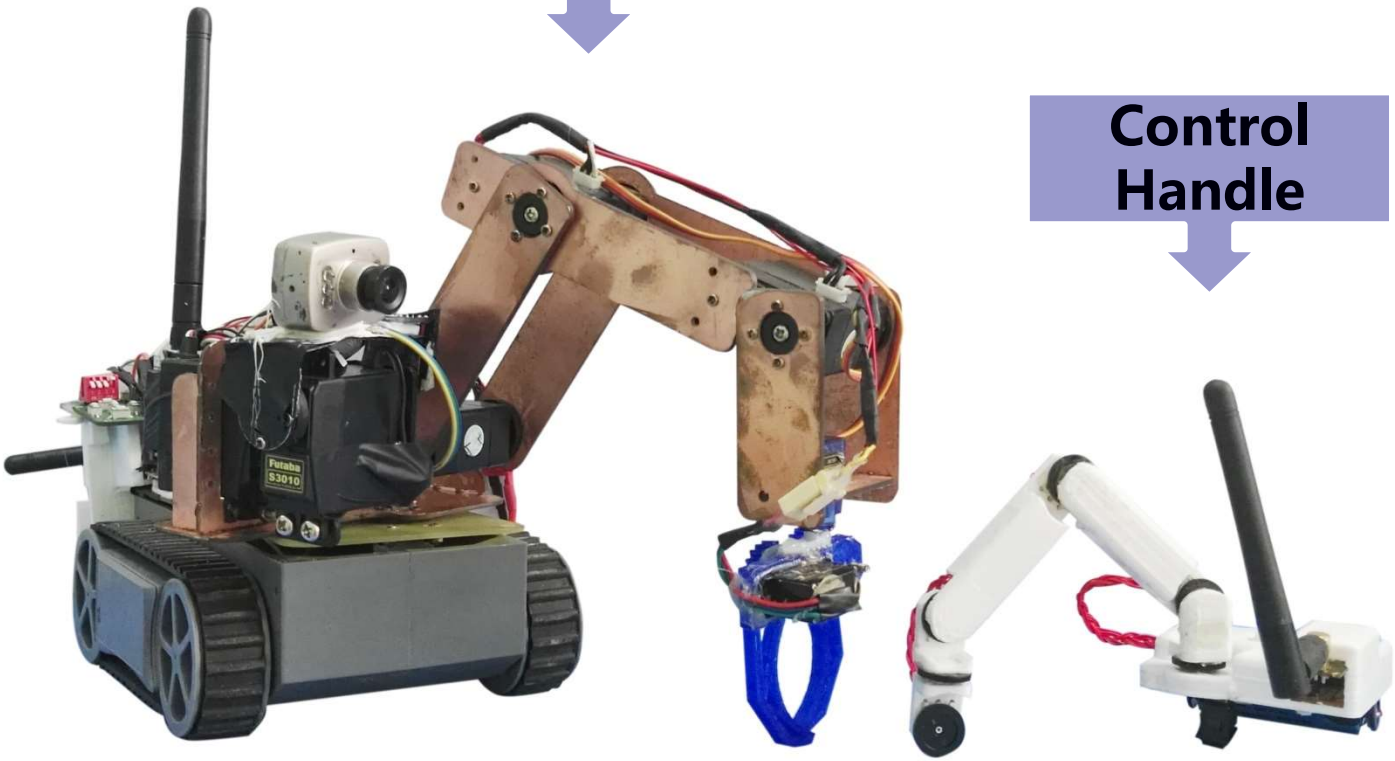
**Lecturer**
**Fuyang Normal University**

**（2015.8～2017.2）**

- **Responsible for teaching of C Programming, Virtual Instrument, Computer Network, Robot Sensing and Control Technology and other courses;**
- **Guided students to participate in the International Contest of Innovation (1rd Prize)**
  - **Work Title :EZ Controller**

Robot Arm

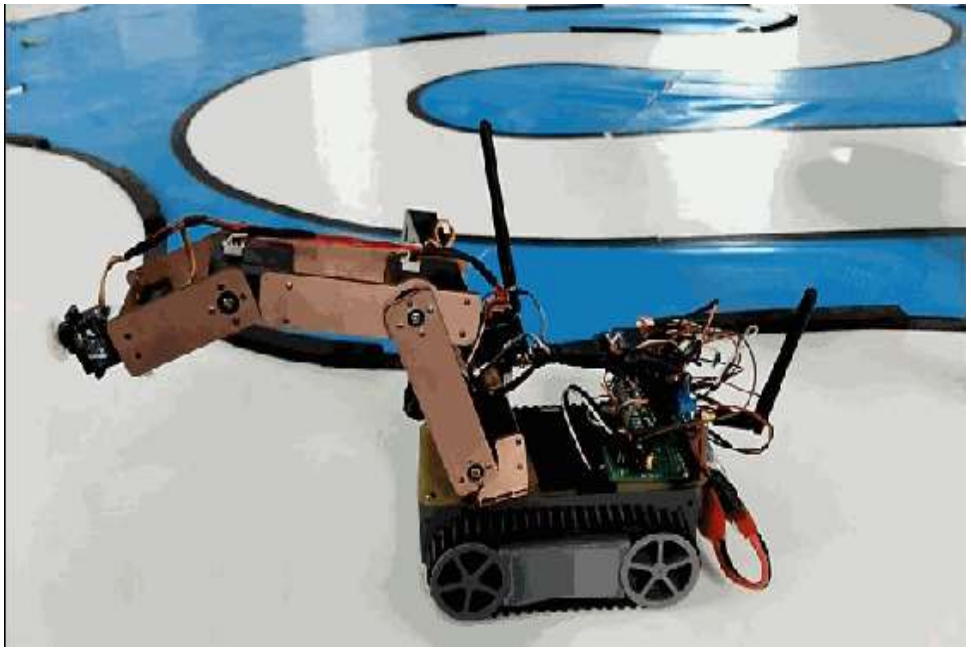
Control Handle




# EZ Controller

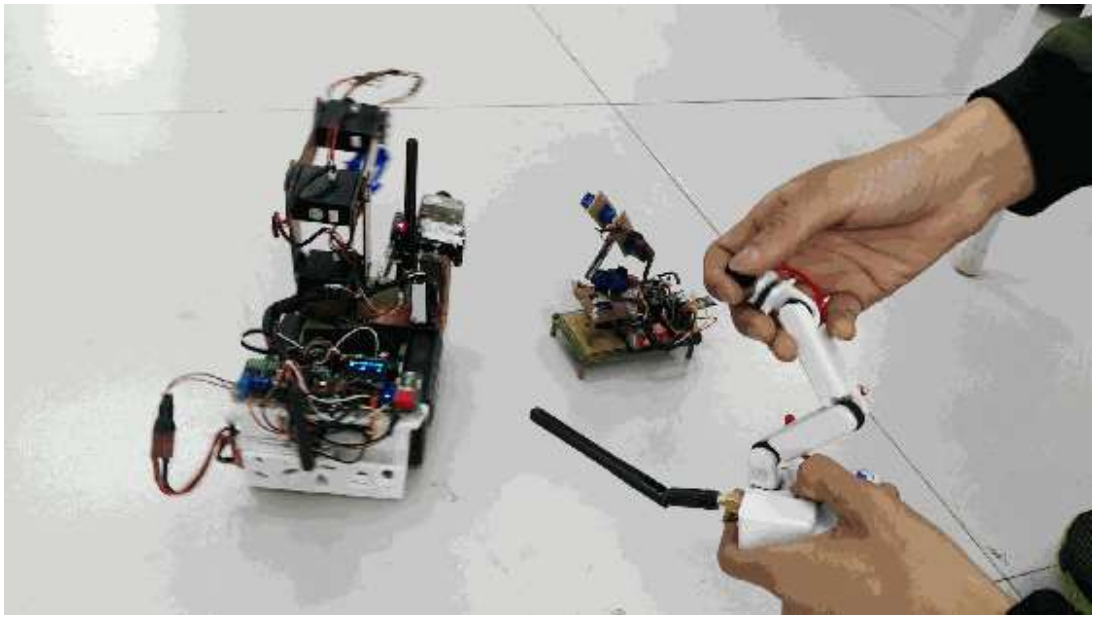
# Imitation

**The executive robot arm automatically follows and imitates the movements of the control handle.**



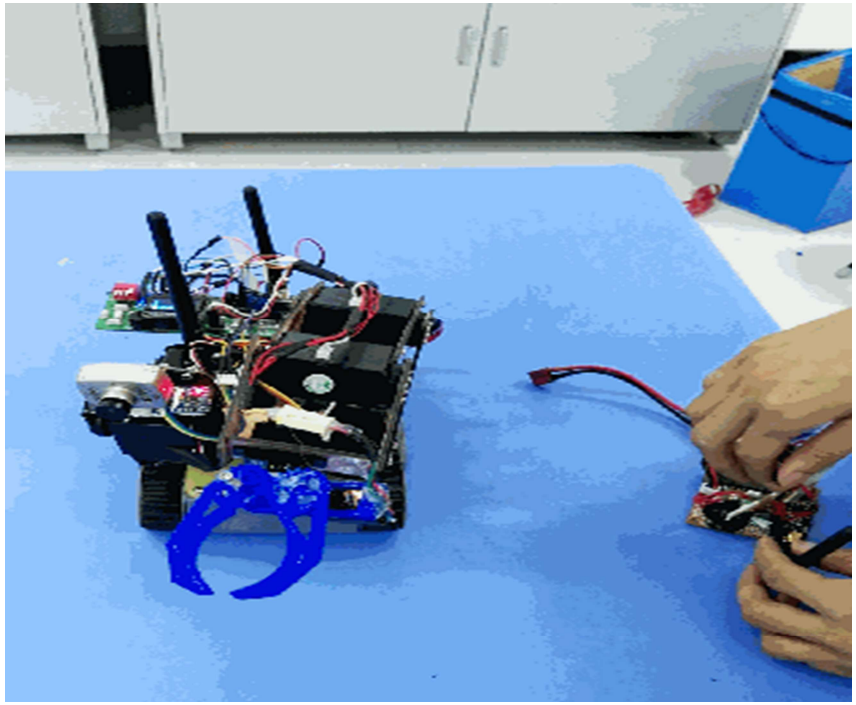
# Imitation

**The executive robot arm automatically follows and imitates the movements of control handle.**



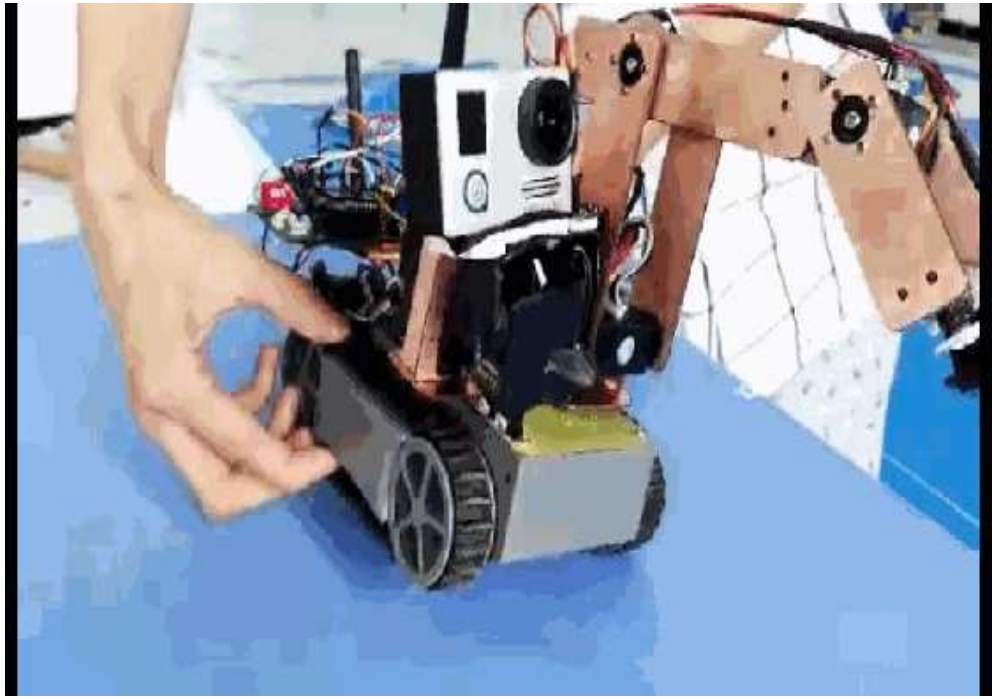
# Variability

**The executive end can transform  different tools according to needs of users.**



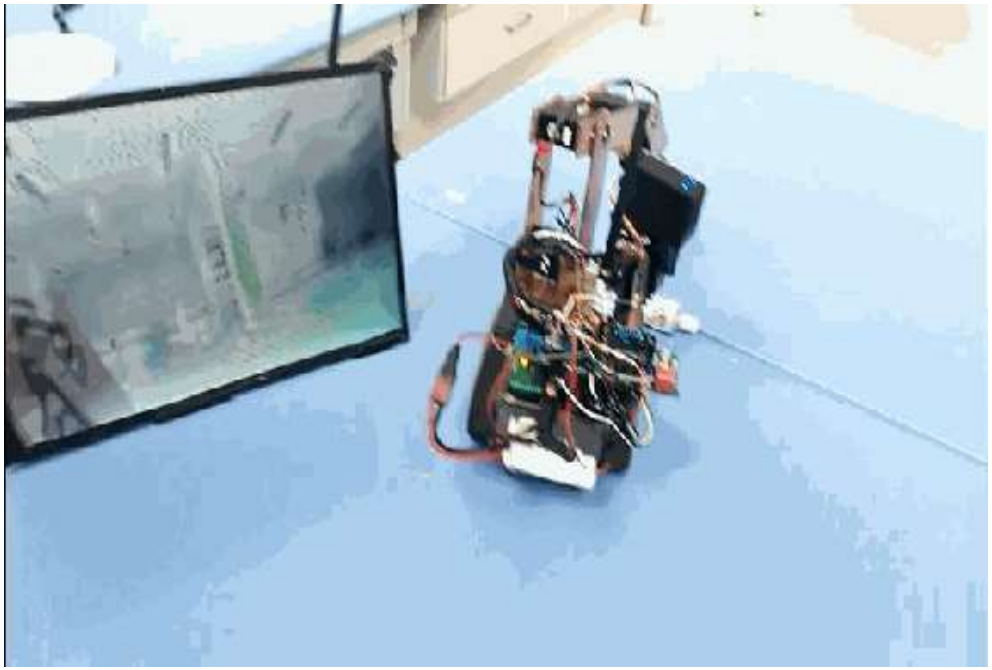
# Stability

**By using the self-stable pan-tilt by the gyroscope, this system is able to realize the stable operation of the monitor equipment, and capture high quality of images in real time.**

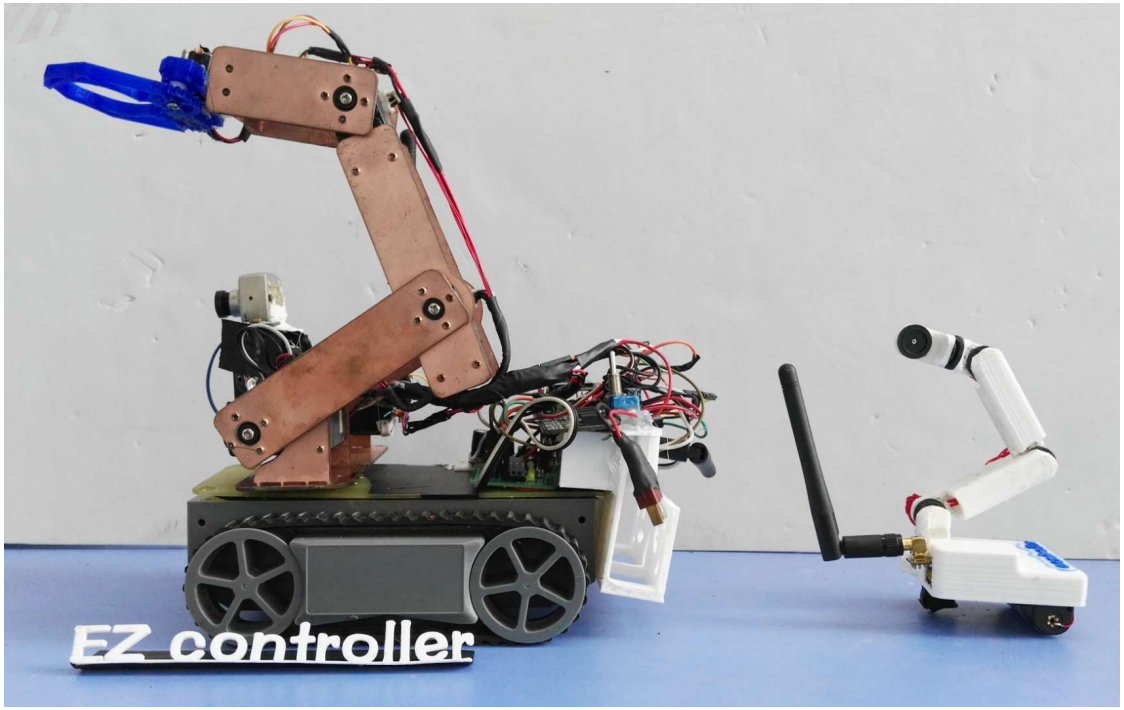


# Flexibility

**It’s flexible to perform plane movement through the belt on base.**



# EASY CONTROL!



# Future Plan

- Create useful model or multimodal manipulation skills operating by learning algorithms, based on multimodal data sources;

- Big challenge: how to fusion multimodal data sources greatly.

Universität Hamburg
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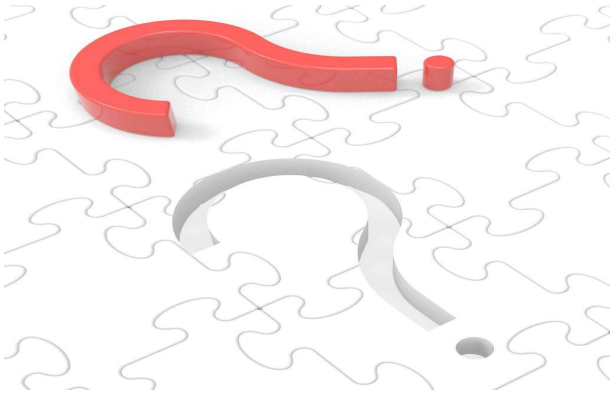
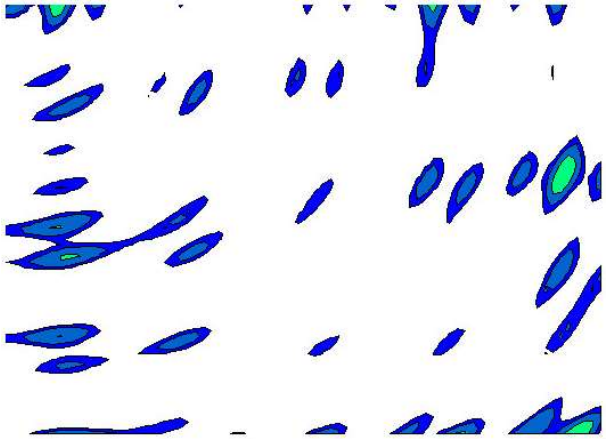
# Thank You

**Shuang Li**

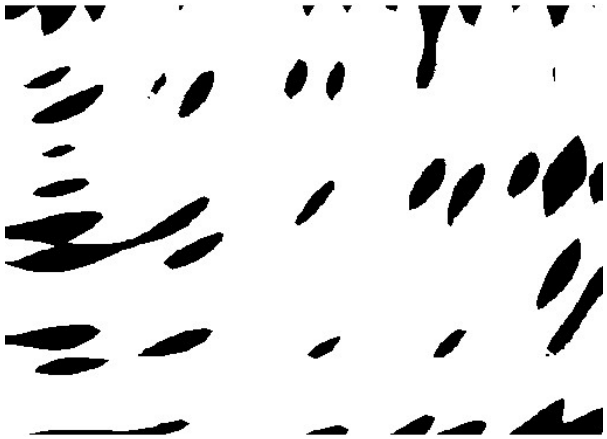


TAMS

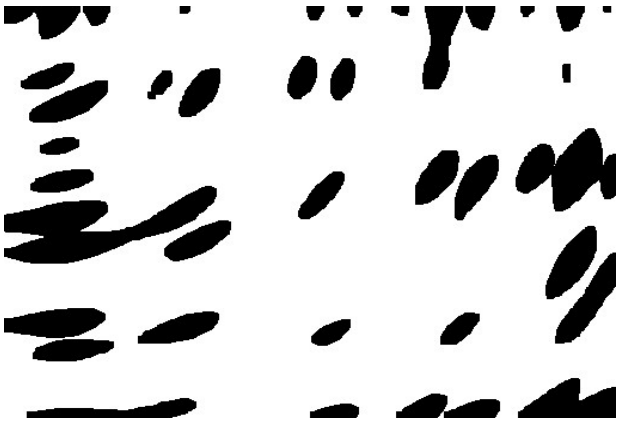
# The Grid Division



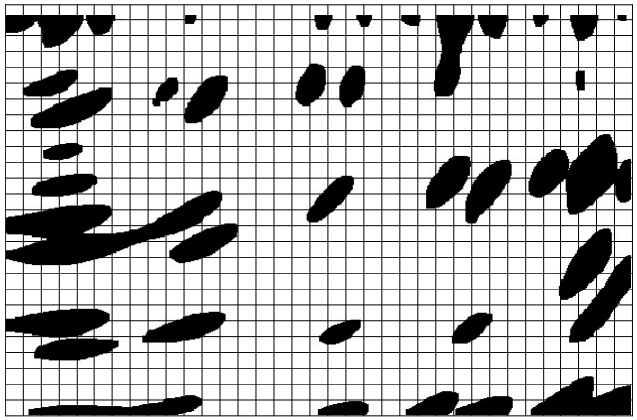
Raw environment from sensor



Environmental map in binary modality

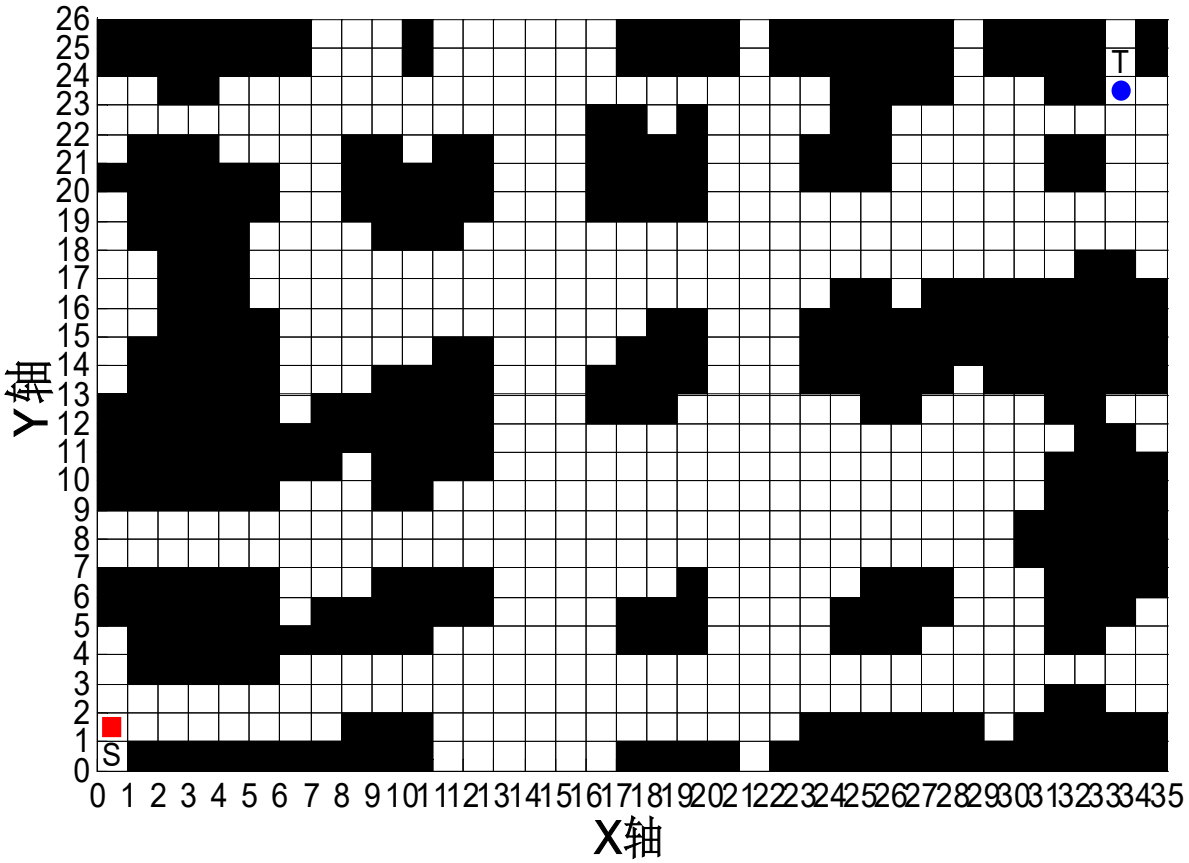


Enlarged map



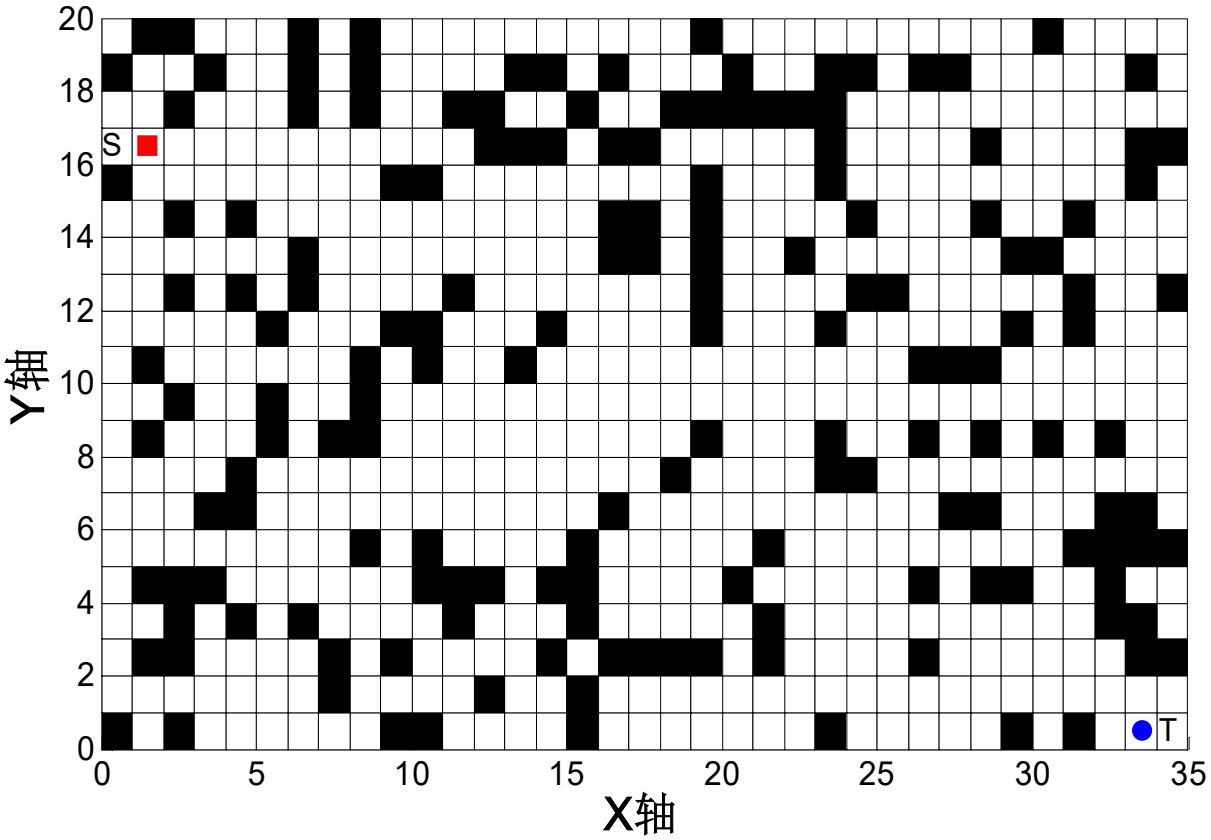
Divided map by choosing proper grid size

# Complete Rasterization




Complicated environment with multiple obstacles and scattered distribution

# Complete Rasterization




**Scattered obstacles**