

Starswave: An Intelligent Street Lamp System

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- 4 System Features
 - Commercial Potential
 - Intelligent Control
 - Strong, Efficient and Simple Algorithm
 - The Choice of LED
 - Easy Extension

Introduction

Introduction of Current Lighting Systems

- ① Huge Power consumption
 - ① Consume about 30% of the electricity in China
 - ② Cost 28,500,000,000 ¥ every year

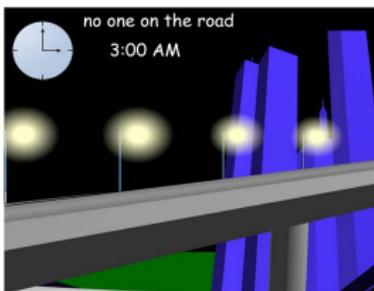
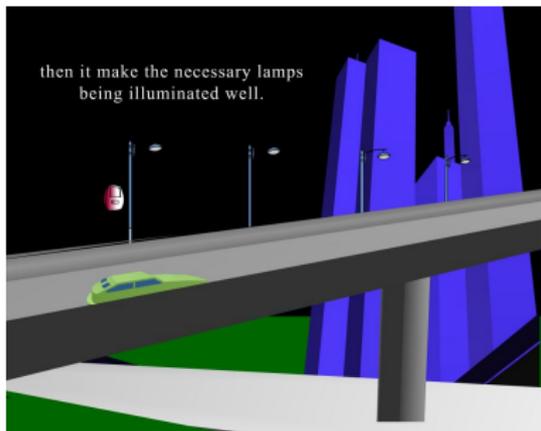


Figure: Energy waste after midnight

- ② No Intelligence
- ③ No Coordination

Introduction of Our Designing

- 1 Save energy by change on demand service
- 2 Collect data of the traffic flow
- 3 React to various weather conditions
- 4 Remote control
- 5 Enhance system maintainability



A Flash Demo

System Anatomy

System Overview

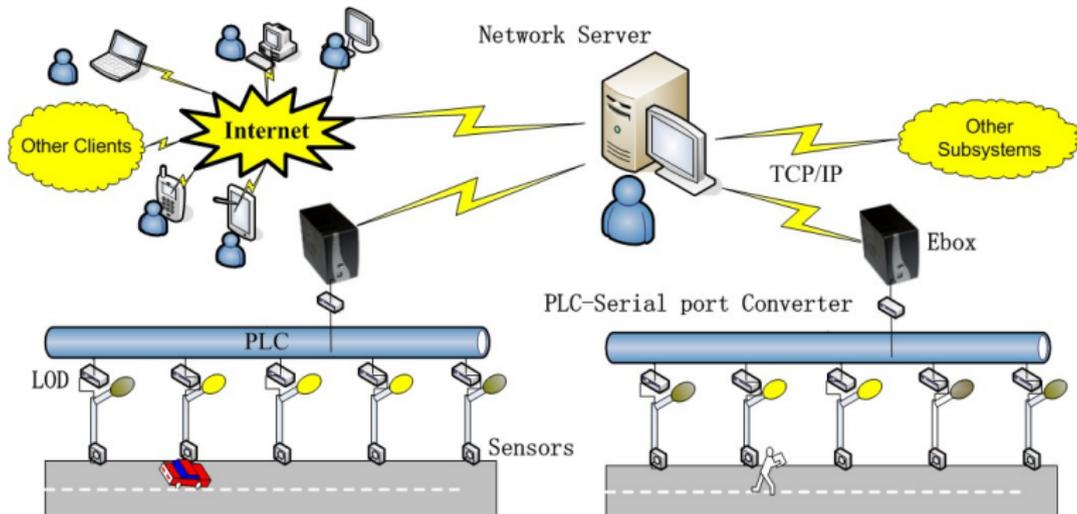


Figure: System overviews

System Components

- 1 Sensors
- 2 EBox
- 3 PLC (Power Line Communication)
- 4 LED Unit
- 5 Network Server

Sensors

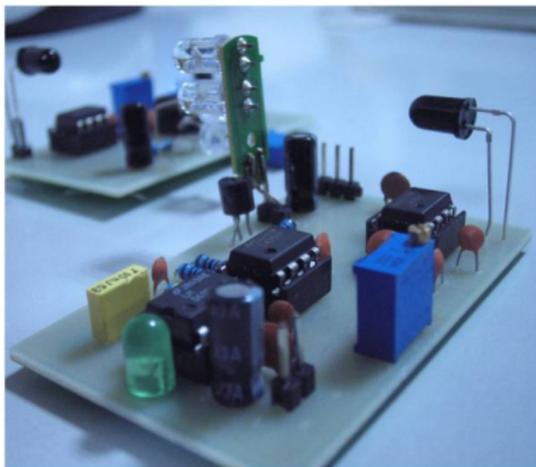


Figure: Detecting Vehicles by Infrared Module



Figure: Detecting People by Pyroelectric Module

EBox

- 1 Receiving signals from sensors
- 2 Determine status of each lamp on the road
- 3 Evaluate traffic information and upload this information to network server
- 4 Receive control command from network server and reaction to that.
- 5 ...



Figure: EBox

PLC

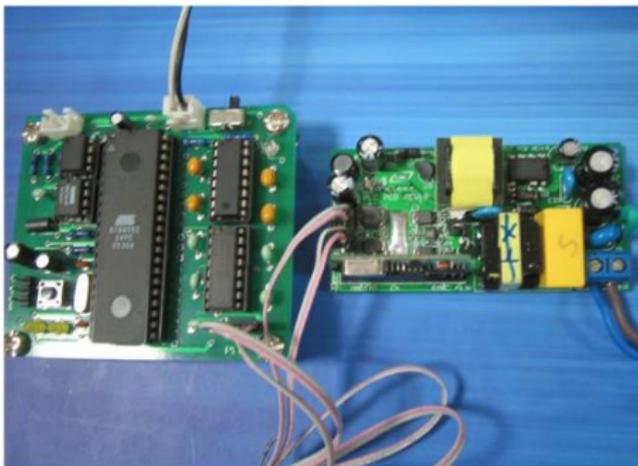


Figure: PLC

LED Unit

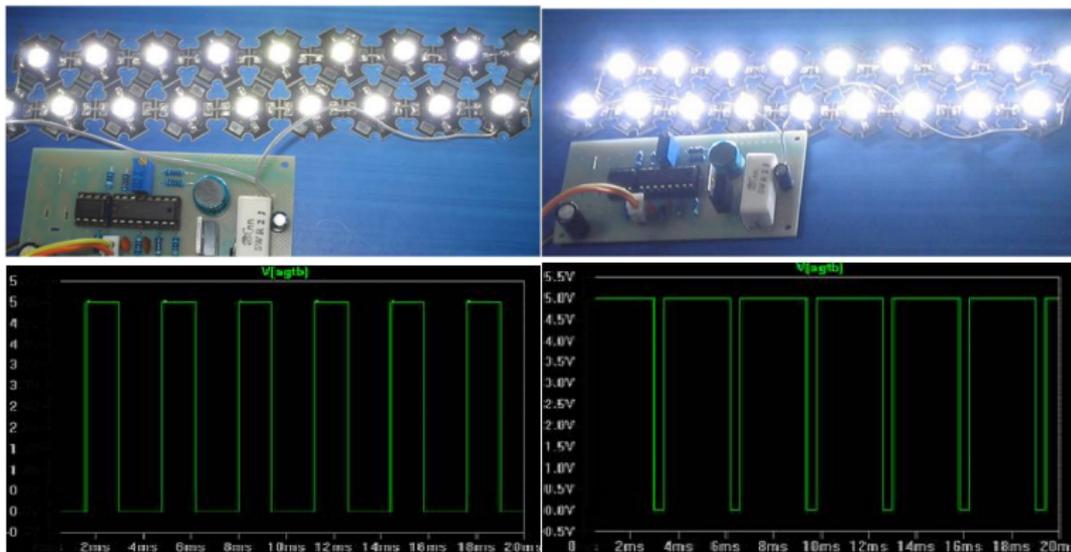


Figure: Light Adjusting Module using PWM(Pulse Width Modulation)

Network Server

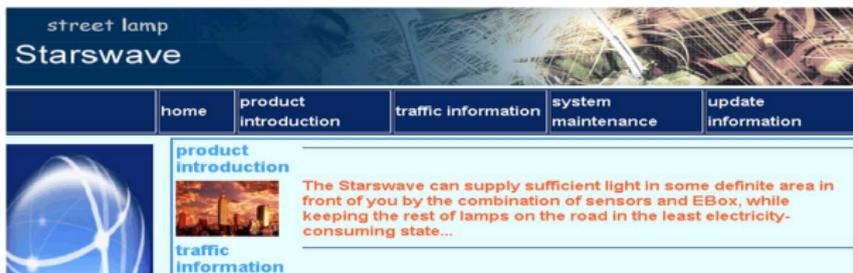


Figure: Network Server

Light on Algorithm

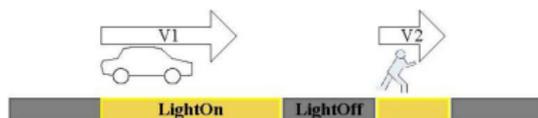


Figure: A direct way of lighting on algorithm

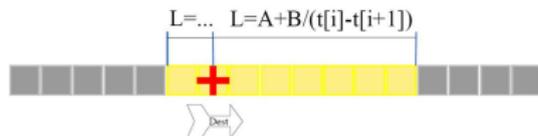


Figure: Our light on algorithm

Other Algorithms

- 1 Light off
- 2 Sensor Failure Detection
- 3 Traffic flow evaluation
- 4 ...

Experiments & Results

Large Scale Simulation Testing

1 Simulation Program

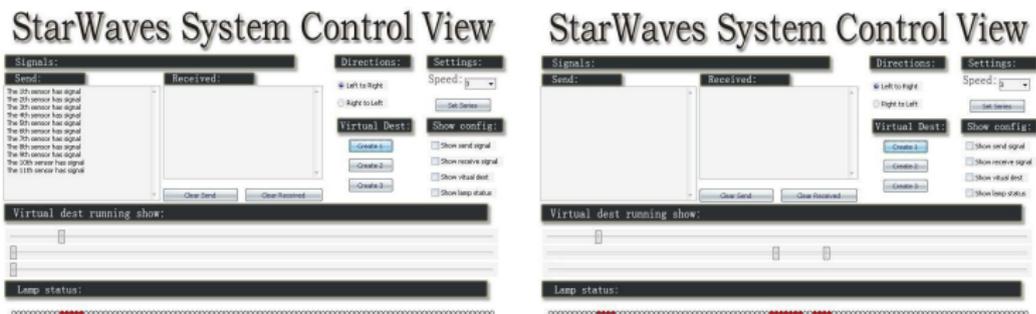


Figure: Simulation program

2 Verification of Simulation

- 1 Comparison with Physical Test Data (Ground Truth)
- 2 Multi-team Assignment

System Features

System Features

- 1 Commercial Potential
- 2 Intelligent Control
- 3 Strong, Efficient and Simple algorithm
- 4 The choice of LED
- 5 Easy Extension

Commercial Potential

① Save Electricity

- ① The **third greatest leap** in the human history of lighting.
- ② According to the Chinese Ministry of Technology, every year the lighting systems all over the country consume about **8,000 billion kilowatt hours of electricity**, **30%** of which could be saved if the installment of **LED** can cover up to 50% of the light sources, which would save **\$125 billion** each year.
- ③ U.S Department of Energy predicts that by the year of 2010, over **55%** of the light sources will be substituted by LED and it can save **\$350 billion** each year.

② Lower Cost

③ Convenient Use and Installation

Intelligent Control

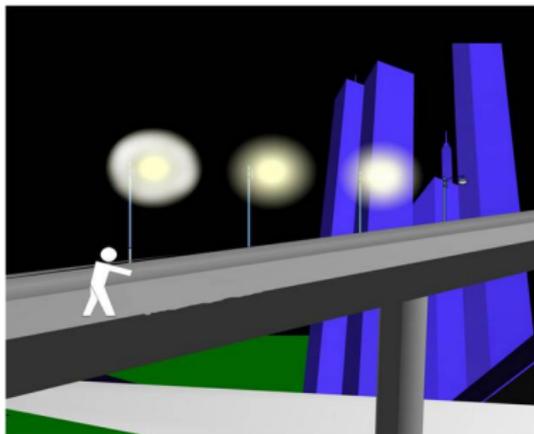


Figure: Change on demand

Strong, Efficient and Simple algorithm

- 1 Strong: Robustness to multi kinds of exceptions

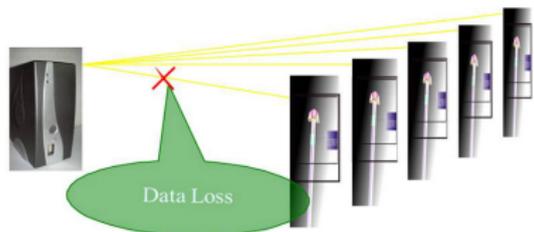


Figure: Robustness to data loss

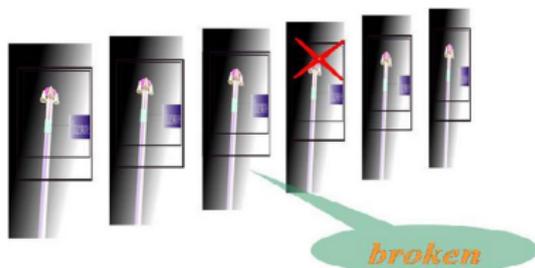


Figure: Robustness to sensor failure

- 2 Efficient: linear computation time
- 3 Simple: low hardware cost

The Choice of LED

- ① High lightness
- ② Low power consumption
- ③ Low electricity consumption during start-up
- ④ Low light attenuation and pollution
- ⑤ Long life-span

Easy Extension

① Fog

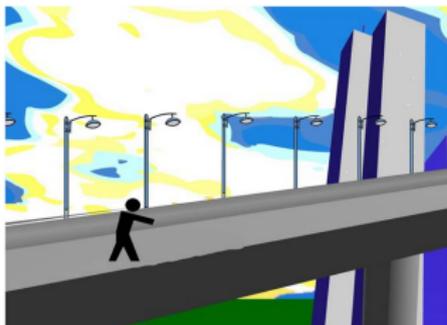


Figure: React to various weather conditions automatically

- ② Traffic information collection
- ③ Automatic exception detection
- ④ ...

Easy Extension

- 1 Fog
- 2 Traffic information collection



Figure: Collect traffic information and share by webpage

- 3 Automatic exception detection
- 4 ...

THANKS!

Q & A