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FPT UNIVERSITY

FPT University Student Research Conference

# Proceedings



FPT UNIVERSITY

Volume 2  
August 2017

**FPT UNIVERSITY**

**FPT University Student Research Conference**

# **Proceedings**

*The 2<sup>nd</sup> FPT University Student Research Conference*

*Summer Semester 2017*

*Volume 2*

August, 2017  
Ho Chi Minh, Viet Nam

**Table of Content**

<b>Introduction.....</b>	i
<b>Organizers, Faculty advisors, Program Committee .....</b>	ii
<b>Conference Program.....</b>	iii
<b>Keynote Speech 1: A Process to TurnIdea To Product and Launch It</b>	
Lam Huu Khanh Phuong .....	1
<b>Keynote Speech 2: Strengthening Research Capacity for Teaching and learning in 21<sup>st</sup> century</b>	
Pham Thi Diem.....	2
<b>Discussion Paper: "How is FPT University equipping its students to become career fighters?"</b>	
Vo Minh Hieu.....	3
<b>Technical Sector.....</b>	7
<b>Design and implementation of robotic arm with four degrees of freedom</b>	
Nguyen Quoc Tuan, Le Minh Nhat Duy, Nguyen Hong Lam.....	8
<b>The Train Warning System at the Railway Crossing</b>	
Phan Thanh Loc, Hoang Phi Hong, Vu Thanh Hai, Phan Huu Tai.....	11
<b>Barcode Order Eateries - BOE</b>	
Pham Dang Nam, Nguyen Duc Hoang, Luu Duc Phong, Nguyen Khanh Linh.....	15
<b>Drawing with Simple Brush: Making dashed image from image</b>	
Do Quoc Bao, Truong Nguyen Hong Huan, Nguyen Minh Quang, Le Hoang Long .....	18
<b>Drawing with Simple Brush: Breakdown image into drawing step</b>	
Do Quoc Bao, Truong Nguyen Hong Huan, Nguyen Minh Quang, Le Hoang Long .....	22
<b>Building a business platform</b>	
Nguyen Dinh Trung, Ly Phuoc Sang, Nguyen Thanh Phong.....	25
<b>Mobile based languages learning application</b>	
Le Ngoc Hieu, Nguyen Nhat Quang, Do Hoang Nguyen, Truong Thanh Lam .....	31
<b>Office Lunch Delivery Mobile Based Application</b>	
Ong Van Thanh, Nguyen Hoang Linh, Dinh Duc Hoang, Vu Ngoc Hai .....	35
<b>House Decor System</b>	
Cao Duc Son Ngoc, Le Dai An.....	38
<b>Virtual assistant for smart house</b>	
Luong Cong Thuan, Nguyen Thanh Van, Nguyen Van The My, Hoang Trong Thanh Tung .....	40
<b>Timekeeping and Labor Payroll Systems in factories</b>	
Dinh Huu Tai, Nguyen Huynh Duc, Do Hoang Quoc Khanh, Truong The Tho, Nguyen Hoang Tuan ....	48
<b>Economic Sector .....</b>	51
<b>Evaluating the Student's Satisfaction of On-The-Job Training Program at FPT University</b>	
Ho Thanh Xuan, Tran Ngoc Bich Hung, Ha Hoang Ngan .....	52
<b>Conference Participants .....</b>	61
<b>Awards &amp; Photos Appendix .....</b>	63

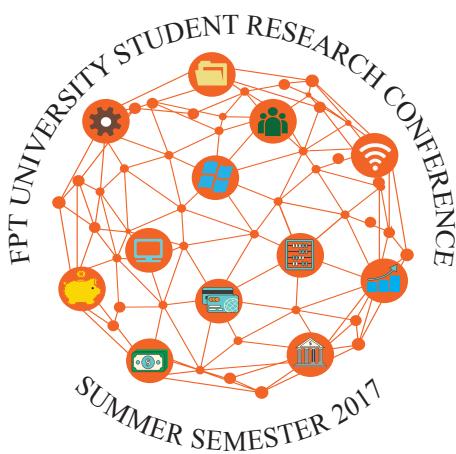
## About the Proceedings

*The Student Research Conference Proceedings is periodical publication follow every semester of FPT University.*

The Proceedings gather all the papers of the lecturers, researchers in the workshop, and the main content is the student's subject papers had defended in front of the scientific council, with a scientific content highly actual, acceptable post in the Proceedings.

At present, The Student Research Conference Proceedings was published by English language. This is published for internal circulation only.

Readers could be found it in the Library Department of HCMC FPT University and Hanoi FPT University, also found it with electronic version on DSPACE at: <http://ds.libol.fpt.edu.vn>



## Introduction

Students' scientific research is intellectual activities very important that support students to apply methodologies and methods of scientific research in studying and practicing; since, using a combination of learned knowledge to conduct research-based cognitive activity, contributing to solving scientific problems in real life and occupation. Recognizing scientific research is one of important tasks that FPT University has been step by step building, deploying and encouraging scientific research for staff, lecturers and students since the first day of establishment.

As a result of fact, The following success of the 1<sup>st</sup> Student Research Conference which was held in May of 2017, the 2<sup>nd</sup> Student Research Conference which was held in August of 2017, which the purpose of bringing environments for students to report their results of research to the Scientific Research Council; contributing to encouraging and promoting scientific research activities as well as applying results of research in reality as soon as possible. The conference is the place to receive the comments and suggestions from Scientific Research Council, lecturers and staffs to improve movement and quality in students' scientific research. Throughout this conference, FPT University hopes to promote the students' scientific research which also to raise awareness of the importance of science in improving the quality of teaching and training. In the conference, there are 13 groups with 13 different subjects belonging to two faculties: Software Engineering and Business. The Scientific Research Council has based on an evaluation process in order to select 5 topics, with strict criteria to be presented in the 2<sup>nd</sup> Student Research Conference.

The organizers sincerely appreciate the interest of Executive Board, Scientific Research Council, Head of Departments, Lecturers, Staffs and all students whom have contributed for the success of the Conference. We are thankful to Mentors who have guided students their scientific research. We would like to receive all comments and suggestions in order to develop and improve the quality of scientific research in the future.

**Organizers:**

Tran Ngoc Tuan, Ph.D. (Vice Rector of FPT University)  
Than Van Su, M.E (Head of Academic Affairs Department, HCMC FPT University)  
Kieu Trong Khanh, M.E (Head of ITS Department, HCMC FPT University)  
Dinh Tien Thanh, MBA. (Head of Business Administration Department, HCMC FPT University)  
Dinh Truong Lam (Head of Library Department, HCMC FPT University)  
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Vo Minh Hieu, MBA. (Associate Dean of Business Faculty, FPT University)

**Program Committee:**

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Dinh Tien Thanh, MBA. (Lecturer of Economic Sector, HCMC FPT University)  
Than Van Su, M.E (Lecturer of Technical Sector, HCMC FPT University)  
Nguyen Quoc Cuong MBA. (Lecturer of Economic Sector, HCMC FPT University)  
Nguyen Trong Tai, M.E (Lecturer of Technical Sector, HCMC FPT University)

**Editor:**

Nguyen Huy Hung, M.E (Head of SE Department, HCMC FPT University)

## Conference Program

*Saturday, August 26<sup>th</sup>, 2017*

<b>07:30 - 08:00</b>	<b>Welcome Delegates and Guests</b>
<b>08:00 - 08:10</b>	<b>Introduction of conference opening - Speech of Tran Ngoc Tuan, Ph.D., Vice Rector of FPT University</b>
<b>08:10 - 08:25</b>	<b>Keynote Speech 1: A Process to TurnIdea To Product and Launch It - by Lam Huu Khanh Phuong (M.E, Lecturer of IT Department, HCMC FPT University)</b>
<b>08:25 - 08:50</b>	<b>Keynote Speech 2: Strengthening Research Capacity for Teaching and learning in 21<sup>st</sup> century – by Pham Thi Diem, Director of IEG VN</b>
<b>Reports of Students from Economic Sector</b>	
<b>09:00 - 09:25</b>	<b>Evaluating the Student's Satisfaction of On-The-Job Training Program at FPT University</b> Presented by: Ho Thanh Xuan Tran Ngoc Bich Hung Ha Hoang Ngan
<b>09:25 - 09:40</b>	<b>Tea-break</b>
<b>Reports of Students from Technical Sector</b>	
<b>09:40 - 10:05</b>	<b>Mobile Based Language Learning Application</b> Presented by: Le Ngoc Hieu Nguyen Nhat Quang Do Hoang Nguyen Truong Thanh Lam
<b>10:05 - 10:30</b>	<b>Virtual Assistant Smart House</b> Presented by: Luong Cong Thuan Nguyen Thanh Van Nguyen Van The My Hoang Trong Thanh Tung
<b>10:30 - 10:55</b>	<b>Drawing with Simple Brush</b> Presented by: Do Quoc Bao Truong Nguyen Hong Huan Nguyen Minh Quang Le Hoang Long
<b>10:55 - 11:20</b>	<b>The train warning system at the railway crossing</b> Presented by: Phan Thanh Loc Hoang Phi Hong Vu Thanh Hai Phan Huu Tai
<b>11:20 - 11:35</b>	<b>Award Ceremony</b>
<b>11:35 - 11:45</b>	<b>Statements for closing Conference, Speech of Mr. Than Van Su (M.E) - Head of Academic Affairs Department, HCMC FPT University</b>

## Keynote Speech 1: **A Process to Turn Idea To Product and Launch It**

**Lam Huu Khanh Phuong, M.E**

Lecturer of IT Department, HCMC FPT University

The difference between the way of software contribution following the normal way to produce the products in normal way with Start-up is:

Example, with the big birthday cake, with normal way, we will finish all steps, prepare all the steps to make it bigger. With Start-up, the birthday cake is cup cake for the most impression. Therefore, first we will try to make the cupcake, if the cupcake is successfully, the rest of steps behind we don't need to finish all by ourselves. And if not successfully, at least we have the cupcake. So, we have the same procedure to do these steps repeatedly." Building products, measurement, product evaluation, getting result". Summing up to this observation, we usually to use this project to get the products out to the market from idea.

That is the Idea, with quick research, development of business model, hypotheses, assumptions, and next we will build the products, called "minimum value product". It means that the products only have one features that the user can use.

There are 2 situations after checking the result.

First : Using It

Second : "Axit shift" (change the way of business). It means: an assumption when we bring the products out to the market, The customer don't accept that, we will change the way of business. This process is repeated many times to make the products. Thus, the advantage of this method is faster speed, lower cost; allowing us to have a chance to study as well as testing ideas, more likely to success than fail because there are many ways to do.

- Build up many conceptual version
- Don't try to spend too much time in the products and assume that it will be completed.

Some tools, the basic technical in Turn Start-up procedure:

1. Tools can check your ideas is feasible, called Value Proposition Canvas. It means, there is 1 A4 paper, list out: who are our customers? Who are our users? What are they using? What are their obstacles? For instance: Upcoming, there is the training about software management in FPT university. So we will list out all the work that all staff in training department are doing, then find out what are the difficulties that they are facing? When they are doing that work, do they feel happy? And in that process will create the

sub-profile and move on the finishing products: the results are what difficulties we solved? What fun we create? Then we can check whether the Idea is feasible. If you see it is suitable with the problems are listed, and what the software can solve then you can submit the idea in the beginning without review.

### 2. Business Model Canvas:

It is also an A4 file that allows you to test all ideas for the Business Method, in customer segment, value, relationship with customers, characteristic of products, who is our partners. And so, within 30 minutes, we can collect this data to deploy. Try to build the minimum usability of products, limit the excess features in the products, focus to build all the significant that meaning to the customers. Conclusion: When we start business, there are a lot of worries (shortage of money, lack of motivation, and so on). The solution is: if we are really interested in the projects, please do it, and in the whole process, you will make the right decision.

**Keynote Speech 2:**  
**Strengthening Research Capacity for  
Teaching and learning in 21<sup>st</sup> century**

**Pham Thi Diem**  
Director of IEG VN

Scientific research in the university contribute greatly in the academic development of university, For the successful model, there is the theory attached with the experiences of first generation and put into practices. We can go through study, research to give out the theories, standards, or simply inherit results from opening systems of publishers. In order to achieve that results, they have spent a long time, at least 20 years, able to provide general methodologies and theories for scientific research.

The connection between school and business to ensure the students outcomes is very important factors. Industrial 4.0 or the actions to improve the quality of teaching and study contribute for the success of the quality of education and research. All the success of this model is linked to the scientific research .

The researchers, teachers, students can receive the support for completing the scientific research projects through multiple portals, in which the Sage Research Methods portal support to find the resources as well as them suitable research methods with the expectation of each researchers, there is the methodology, the scientific research programs for students. This content has been standardized internationally and put up for using.

The SRM research methodology has gained many achievements in last many years. (Ex: In 2011 was the gold medal in terms of academic, publishing, research, and search in the selection of databases of teaching programs).

When deploying the scientific research project, each person can search resources, link and checking all connections of free website, so that they can evaluate about the contents that they are doing. Normally, with 1 scientific research program or subject, the teachers often have the instruction books, share with their students research methodology and tools. But about the data, only new instructors can share for students to use or give the references.

However, with this portal, the data will be available when the teachers or students need . For this system, this portal also help to orient the research, especially for new researchers. This is great features of Sage Research Methods system. When we deploy the information on this system, it will be understood that

“a research project”, will know how to design a scientific research. If they discover a new research orientation, they can share their ideas and content with the research team for other researchers, and can watch video responses and the response of the researchers.

Discussion Paper:  
**“How is FPT University equipping its students  
 to become career fighters?”**

**Vo Minh Hieu, MBA.**

Associate Dean of Business Faculty, FPT University

## CONTENT

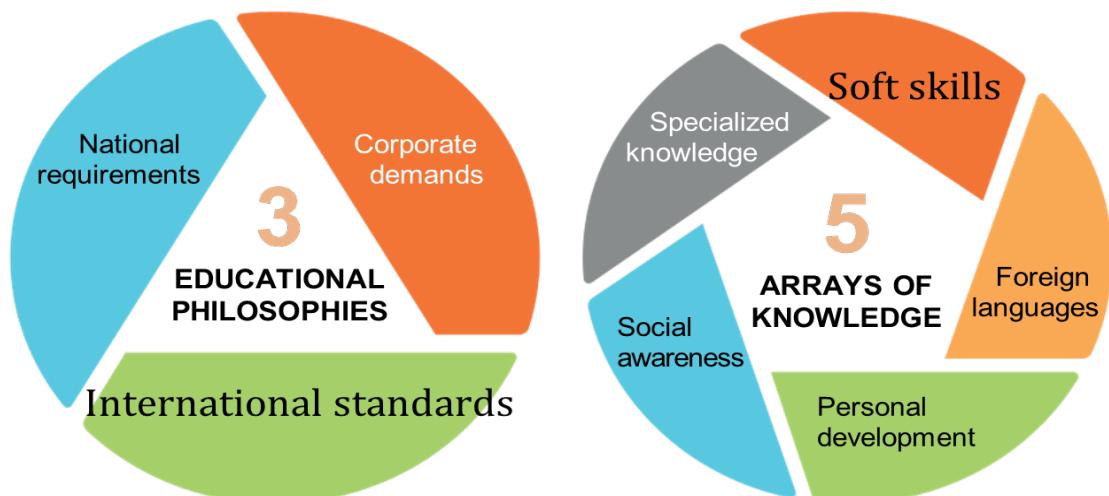
ASEAN Economic Community (AEC) was established on December 31, 2015, to transform ASEAN into a region with free movement of goods, services, investment and skilled labor and free flow of capital. The organization consists of ten member states, namely Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Vietnam, with a total population of over 615 million, including over 315 million in the labor force. Indonesia, Vietnam and the Philippines are accounting for a total 70 percent of the community's workforce (VLLF, 2016)

In 2006, FPT Corporation made a strategic decision to establish FPT University (FPTU) to build an education institute of: Practical work oriented; Flexible approaches to individual development;

Internationalization; Soft skill focuses; Equality in opportunities and the best environment for talents 'development Humanistic and creative culture - cited from Mr Truong Gia Binh - Chairman of FPT Corporation. By those guidelines, the management developing a university in three main fields that will be discussed in this paper. They are: academic, personal development and job preparation programs. Following the given guidelines, FPTU set up its own program development methods which are three educational philosophies and five arrays of knowledge (as graphic below). In the limitation of this paper, there will be some discussed highlight points. Those are corporate demands, personal development, and specialized knowledge.

### **TRAINING CURRICULUM**

Combination of 3 educational philosophies and 5 arrays of knowledge



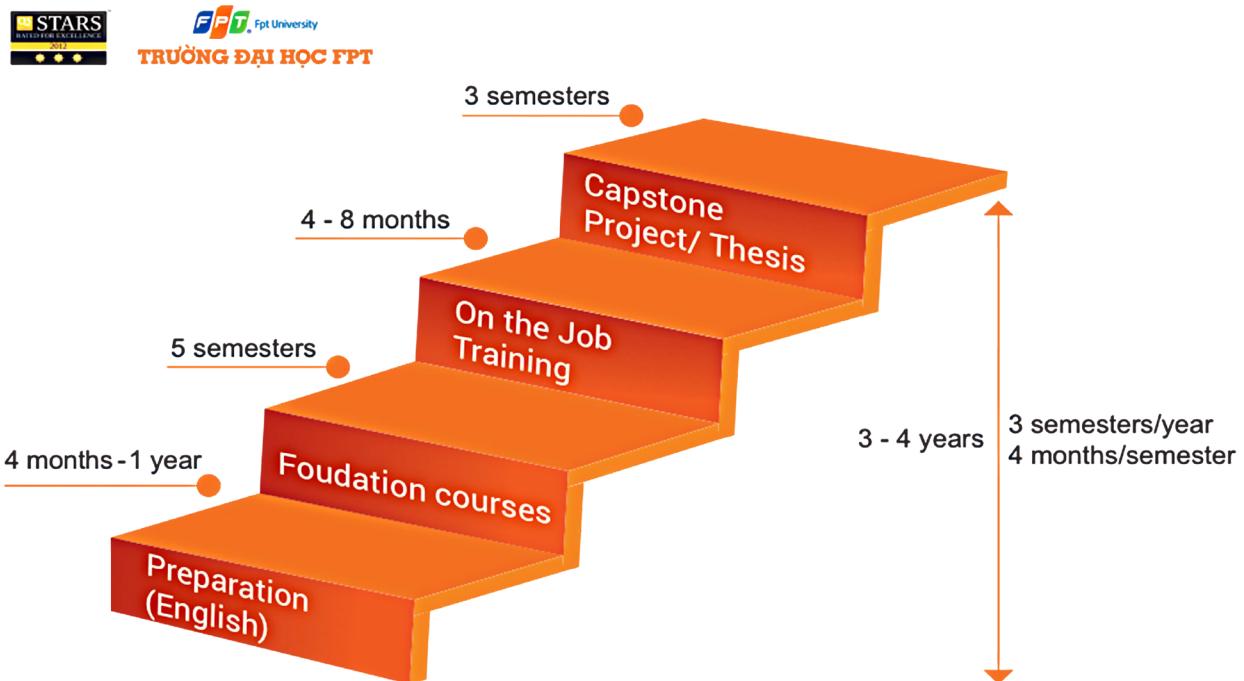
**Figure 01. Program Development Method**  
 (Source: FPT University - 2006)

Under those themes, FPTU program has been designed in a unique way, comparing to other local universities. Students are experienced their "On the job Training" semester (working as trainee in a practical business field- called OJT) right after finishing their foundation course, after that, coming back for the final studying year. The company, as an

industry partner, continuous to tie up with university to support this program by giving the students course related work assignments and expose them to actual learning experiences. By doing this, students have opportunities to understand about their study major better; consequently, they can reflex and apply their practical thoughts in their chosen specialized courses

more and more. They would feel that their study is meaningful, applicable. In addition, after graduation,

when they are back to work again, they can apply the learnt and trained knowledge to their work.



**Figure 02. FPT Program Structure**  
(Source: FPT University - 2006)

In order to implement this idea, FPTU understands that the faculty must be high professional industrial experience. The lecturers have to prepare the students in skills, knowledge and attitude before the OJT, then, helping them to reflex and consult about their practical concern after the OJT. The teaching after OJT is really excited because the method of conducting of the class is different, also, lecturers are asked many questions which they have to use their own working experience to consult. This is the reason why the faculty is not only focusing on

academic scholar development, but also developing industrial relevance.

Moreover, not only the Five-stars standards rewards to the faculty by QS- Stars the industrial practice recognized our efforts in training the students. The employers can clearly point-out big improvements between an OJT staff and a fresh graduate due to the program design. This positive outcome is partly contributed by the effectiveness of project-bases learning courses.



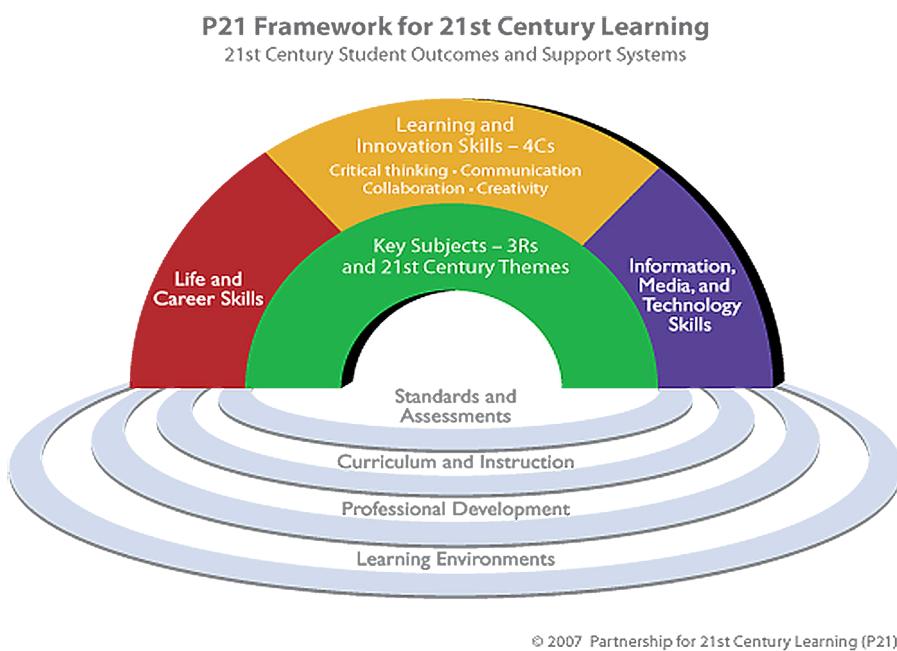
**Figure 3. OJT Program in FPT University**  
(Source: FPT University - 2006)



**Figure 04. OJT Program performance snapshot facts**  
 (Source: FPTU Employment Annual Report - 2016)

The university is aware that deeper learning outcomes like critical thinking, communication, collaboration, problem solving, self management and persistence and being able to transfer learning to new and different situations would lead to student career success. At the same time, economic forces

and critical requirements from 21st century learning (P21 Organization, 2016) that shapes outcomes for today's students drive us to reorganize learning in ways that support new economic realities and encourage deeper learning outcomes.



**Figure 5. P21 Framework for 21<sup>st</sup> Century Learning**  
 (Source: P21 Organization - 2016)

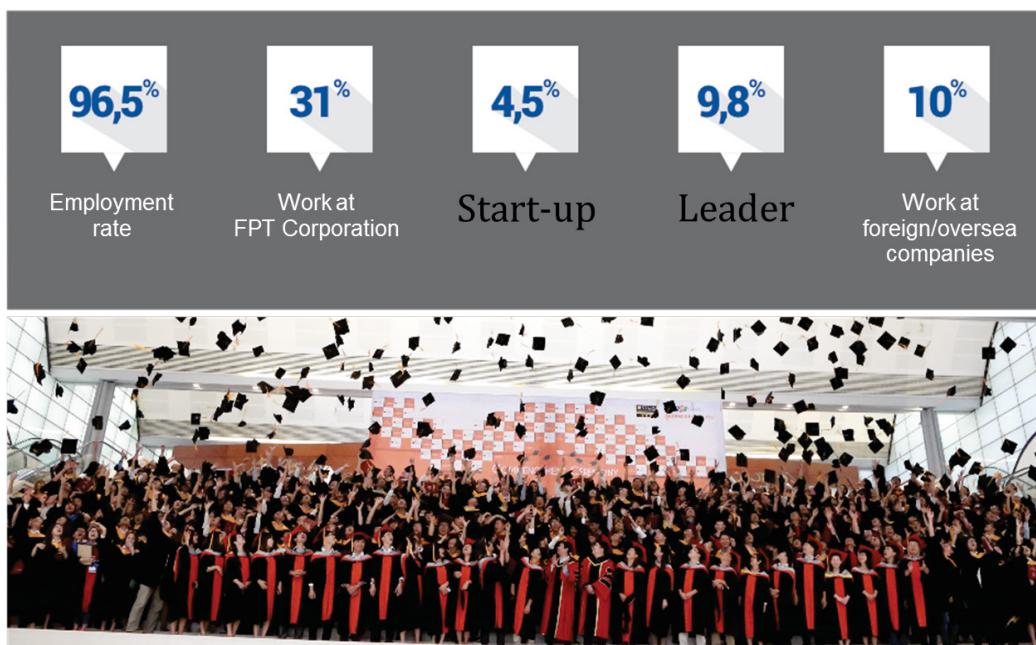
Project-based learning (PBL) is therefore embedded gradually in courses at FPTU to deepen students' learning, prepare students for academic, career readiness and lifelong learning.

In the academic aspect, faculty of business chose to import international standard programs since establishment. FPTU is one of the first local universities conducted the national recognition courses in English, including training materials,

teaching languages and assessments. According to National Centre for Vocational Education Research (2013), labor market requires fresh graduates not only academic knowledge but also skills and attitudes. To be more competitive, FPTU students are equipped at least two international languages, especially English and Chinese which are very popular business languages used over the world. The students are also trained for driving, music, martial

art besides the traditional strengths of FPT training courses are working in group, communication, negotiation, working and studying skills. For attitude training, FPTU has a compulsory military training for continuous several weeks. During this training, the students have been reformed in the attitude of army officers. They become more independent, self-responsible, self-discipline, especially confident in proving their ability in the unusual environment.

The highlighted equipment is part of the reason why FPTU students are truly job fighters in the labor market. The faculty is assisting the students to get their job before graduation. There are many events and activities such as jobs fairs, company visit, career consulting days, CV consulting days have been organized. Consequently, there are 96.5% of students who had jobs, 4.5% start up, 9.8% in managing position and other impressive figures.



**Figure 6: Job Placement**  
(Source: FPTU Employment Annual Report - 2016)

However, the most important thing that the faculty is concerning is post-graduation feedback from employers. These feedbacks are critically necessary to look back our programs that drive to action improvements to meet the employer expectations.

In conclusion, aiming to change the Vietnamese people through education is always the initial encouragement. FPTU is always changing to equip better for students in academic, personal development and job preparation programs. OJT and Project-based learning would be our current strengths that will be non-stop enhanced. Languages, skill training programs and job support are always prioritized, updated to create more value to the fresh graduates. In the future, FPTU is planning to develop to be a global/ international university to make more and more career fighters

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# Papers of Technical Sector

# Design and implementation of robotic arm with four degrees of freedom

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Ho Chi Minh, Vietnam

**Le Minh Nhat Duy**  
FPT University  
Ho Chi Minh, Vietnam

**Nguyen Hong Lam**  
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## Abstract

In this paper, we will solve 3 main problem of our project.

## Keywords

Balance part; Deadzone; Spring

## I. INTRODUCTION

In another country, automation has grown up very early, so the robotic arm manufacturing industry has achieved many accomplishments. Some developed countries have succeeded in the manufacture of robotic arms meet international standard with high accuracy and stability, helping people a lot in life.



As you see at the picture above, this robot arm funded by the Pentagon's Defense Advanced Research Projects Agency, it will (in theory) be controlled by a microchip planted on the brain of the person using it, is said to be more lifelike than any other prosthesis available. Able to rotate, twist and bend 27 different ways, the device was conceived to benefit wounded soldiers, but it could also potentially help stroke victims, quadriplegics or anyone else who has lost the use of an arm. Due to its potential, it is currently being evaluated by the FDA at an expedited rate.

## II. PROBLEM AND SOLUTION PLAN

### 1. Problem

We have 2 main problem in this project:

Mechanical Balance: Factor that affect the system when operating. The unbalanced mechanical robotic arm may be damaged by the weight or force by it produces. Robotic arm with unbalanced design can cause heavy loads on engine/motors, heating the engine, collapse when moving decrease performance of the system.

Deadzone of servo: Other factors that affect the system cause difficult to user when control the robot arm. That is the error signal when comparing two pulse of servo motor and microcontroller (control pulse and feedback pulse).

### 2. Solution

Here is the solution plan:

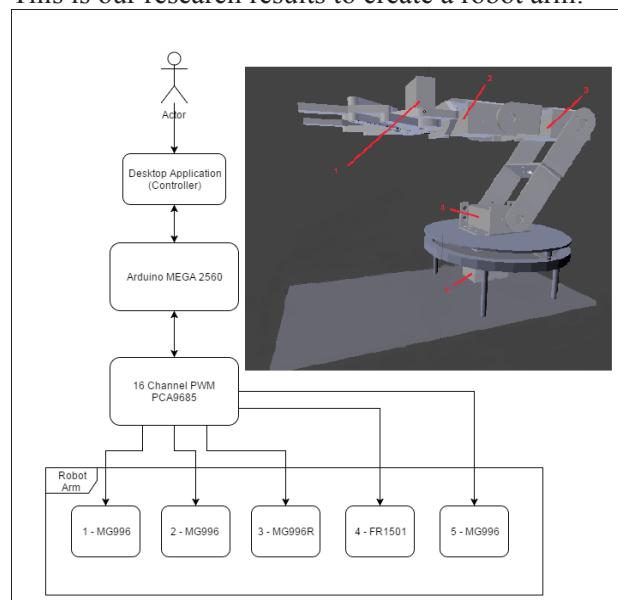
Step 1: Study about balance in mechanical to search for balance part, brake part, encoder that can avoid the collapse or unbalance of mechanic of robotic arm

Step 2: Study about how servo work and PWM, causes of the deadzone in servos.

Step 3: Solves problems according what we have study.

## III. PLAN IMPLEMENTATION

This is our research results to create a robot arm:



**Problems 1:** After we study about the balance in mechanic, we found out some ways to reduces the unbalanced effect on mechanical.

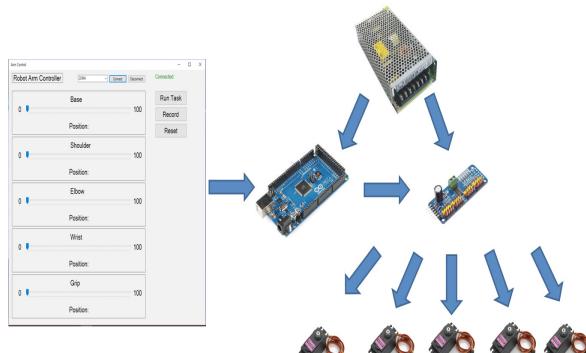
That is damper, spring and encoder. But in this project, we can't use encoder because it complex design and structures, moreover, it suitable for IR mechanical.

We look forward about damper and spring to find the other way. And damper size suitable for this project is not available so we use small steel spring to solve this problem.

**Problem 2:** After know how servo work and its operate principle. And we know what cause of the dead zone in servos. And the ways to solve this problem is to optimized code or use specialized devices.

#### IV. ANALYSIS

In order for the machine arm to operate automatically, our system includes the following components:



**1. MCU Block:** Our microprocessor block uses Arduino.

**2. Power Block:** We use two separate power supply, one with high currents to supply for the motor block. The other supply for the MCU and the driver block.

**3. Driver Block:** The drive block use PCA9685 to manage and control the motor block more easily.

**4. Motor block:** The motor block consists of 5 servos for 5 positions on the robot arm: base, shoulder, elbow, wrist, grip.

**5. Controller Block:** A control block is a software on the computer used to control the robot arm through the MCU block.

This block diagram shows the basic concept of the system in this project. The Arduino MEGA 2560 will play the main role (MCU) and servo to manipulate the robot arm, which communicate with MCU through PCA9685. The MCU connect with desktop application, provides the ability for User to control the robot arm behavior.

#### Problem 1:

As we know, the cause of unbalance in mechanical. When the engine/motor starts, it produces centripetal force and centrifugal force and each consumes each other to maintain the balance in mechanical, if the two forces is unbalance so it can't maintain its balance and lost control by its force produces, so using balance part is acceptable for this problem

to alternative method to solve this problem. We use small steel spring attached to the back of the robot arm, when one of their forces is large, the spring is stretched to reduce that force.

#### V. EXPERIMENTAL RESULTS AND CONCLUSION

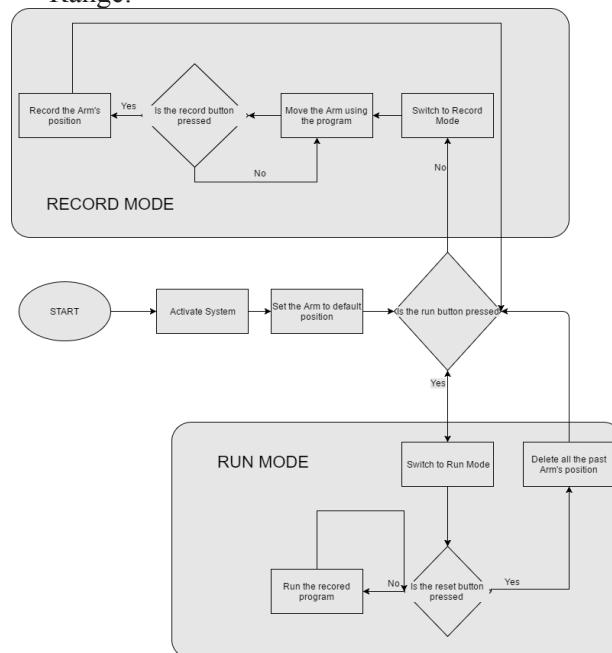
According to robotic researches, we decide to build the robotic arm with 4 degree of freedom that movement more flexible and have self-learning features. The system consists the servo to monitor the joint of the robot frame, Microprocessor and Desktop application.

After user control the robotic arm and saved their actions properly, it will save their actions in to array list and wait for the next command. If user want the robotic arm perform their moves they must press Run button on Desktop application.

In case of user want to remove or changes actions of the robotic arm, they can use Reset button to remove current actions and teach their new actions to robotic arm.

But we have some limited for our product:

- Object:
  - + Cylinder with diameter lower than 3cm
  - + Square or rectangle box with width lower than 4cm
  - + Object weight do not exceed 200g. Recommend 160g or lower.
  - + Be careful when pick up glass object.
- Range:



- + Maximum range robot arm can work is 20cm away from the platform.
- + Minimum range robot arm can work is 4cm away from the platform.
- Power:
  - + Collapse when power shut down

- Data:
- + Reset when turn off

There are no perfect solutions to solve a problems, as well as there are no perfect system. With the inexperience of our team members and time constrains, our system and project contains many issues. Below are the problems our team member encountered in this project:

- Robot Mechanic Knowledge: We are not experts in mechanical in general and robot mechanic in particular. All function and features are developed enough to serve the needs which we had identified during 4 months of research.
- Hardware Knowledge: We are inexperienced with hardware. All the hardware components chosen to be used in this project is based on our familiar with them, or based on the shortest time we need to learn how to use them. So they are only the most appropriate, not the best choice for the project.
- Single point of failure: Our robot system build with analog servo which mean when the power supply suddenly go down the robot arm frame may collapsed. Moreover, balance mechanic of the system is a main factor lead the frame to collapsed, our team members are trying hard to fix this problems as soon as possible.
- Software crash: Currently, our desktop application may cause some delay or unexpected error everytime user slide the slider too fast and consecutive.

Our future plan is try to solve these problems one by one. We design the system with separated modules to makes it easy to change one modules with less affect others many as possible and we also make another design for big scale models.

## **ACKNOWLEDGMENT**

We send our grateful thanks to everyone that helps our us to finish this project and we give special thanks to our instructor Mr. Nguyen Duc Loi for his professional guidance and the useful, constructive recommendations throughout the course of this project.

## **REFERENCES**

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# The Train Warning System at the Railway Crossing

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## Definition

*Railway crossing:*

*A railway crossing is an intersection where a railway line crosses a road or path at the same level, as opposed to the railway line crossing over or under using a bridge or tunnel. The term also applies when a light rail line with separate right-of-way or reserved track crosses a road in the same fashion. Other names include grade crossing, level crossing, road through railroad, railroad crossing, train crossing.*



**Figure 1.**

**An unprotected level crossing near Da Nang**

## I. INTRODUCTION

The safety standards of railway crossing and the urgent for automatic crossroad system in Vietnam

### Safety standards

Before researching and getting which protected model is appropriate for Railway in Vietnam, we need to find out some Regulation of Railways and Safety standards for railway crossing for people to use Vietnam railway's services:

- Regulation of Railways
- + Adopt the block system of signaling on any passenger railway.
- + Provide for the interlocking of points and signals on such railways.
- + Provide for and use on all passenger trains continuous brakes; the brakes must be instantaneous in action; self-applying in the event of any failure in continuity; capable of being applied to every vehicle of the train; and in regular use in daily working.
- Safety standards for railway crossing
- + People who nearly level crossing must be announced clearly and instantaneously to help they to pay attention more coming up situation.
- + Inform the state of barrier is closed or opened.
- + The operation of the automatic railway crossing device does not cause any congestion with the vehicle.
- + Automatic railway crossing with high traffic density should be promptly notified to the train about the obstruction on the crossroads
- + The entire system must be reliable and capable of minimizing accidents and unfortunate risks in case of equipment failure.

The urgent for automatic crossroad system in Vietnam

- The gradual replacement of manual workers on the crossroads by automation technology, high reliability, reduced operating costs of operating the system. Moreover, the railway crossing automation solution also meets the growth of road traffic on the crossroads, savings in national finance.
- The Vietnamese railways are currently striving to shorten the time between 30 hours and 28 hours north-south. Accelerating the trains will also make rail on safety more difficult. In fact, where there is a serious lack of capital investment to renovate and upgrade the infrastructure to meet the high speed of train, so that more careful consideration of investment in equipping the crossroads is a viable option.

- Among the factors hindering the speeding up of the North-South trains now are two elements of the crossroad that can be solved:
- + As the railroad runs through several large cities, large populations and large crossing traffic flow,

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resulting in limited train speed compared to the capacity of locomotives, roads, bridges and sewers.

- + The second reason is that it is difficult to maintain the cruise ship under safe conditions. Because:
- + Random accident incidents occur on the crossroads due to the weakening of level crossing device, leading to obstruction of the cruise line.
- The psychological stress factor of the train driver when running at high speed in Vietnam conditions, especially the traffic law of the people is very low

Length of rail	Crossroad	Density 's crossroad/km	Main crossroads		Local crossroad
			With fence	No fence	
2712	4854	1.8	429	73	3642

Hanoi and Ho Chi Minh are the two places with the highest crossroad density. Hanoi has 34km railway but there are 305 crossroads, or every 110m there is a crossroad. Of which there are 32 crossroads with guarded, 55 crossroads with signboards and 218 local crossroads. In Ho Chi Minh, there are about 58 crossroads.

According to statistics released by Vietnam Railways, 442 railway accidents were reported the

leading to the speed reduction when crossing the crossroads.

## II. PROBLEM AND SOLUTION PLAN

### 1. Problem

The reality of railway crossing in Vietnam At present, there are 4854 level crossing in Vietnam railway, the highest density in Asia. The local crossroads and unguarded crossroads make up 91% of the total number of railways in Vietnam.

country's railway network in 2008, having caused 190 deaths and 262 injuries; most of these accidents were said to have been caused by motorists failing to follow railway safety regulations. By way of comparison, the number of fatalities due to railway accidents was recorded as 115 in 1998, and 82 in 1988. The following table gives recent statistics for railway accidents in Vietnam:

Railway accidents in Vietnam, 2007–2011			
Year	Accidents	Fatalities	Injuries
2011	524	263	350
2010	451	211	284
2009	564	208	391
2008	442	190	262
2007	>530	230	N/A

### 2. Solution

The automatic crossroad system in the world.

In Europe, they've been around for more than 20 years and are now commonplace - in some cases, mandatory.

Through 150 years of UK railway history, the methods to ensure the safety of those working on the track have hardly changed. In the era of the microchip, flags and horns are still the most common means of red zone protection. But lookouts

cannot see in the dark or around corners. They are less effective in poor weather. ATWSs work equally well in all these conditions and take human error out of train detection. Overall, ATWSs offer the best possible protection for those working in red zones. Currently, five different systems have been approved for use in the UK. Each type of ATWS is different, with its own particular strengths. What follows is a brief assessment of those currently



- How does the automatic crossroad work? The Automatic Warning System (AWS) activates as the driver passes through signals. It is basically an auditory warning system, with a visual display reminder.

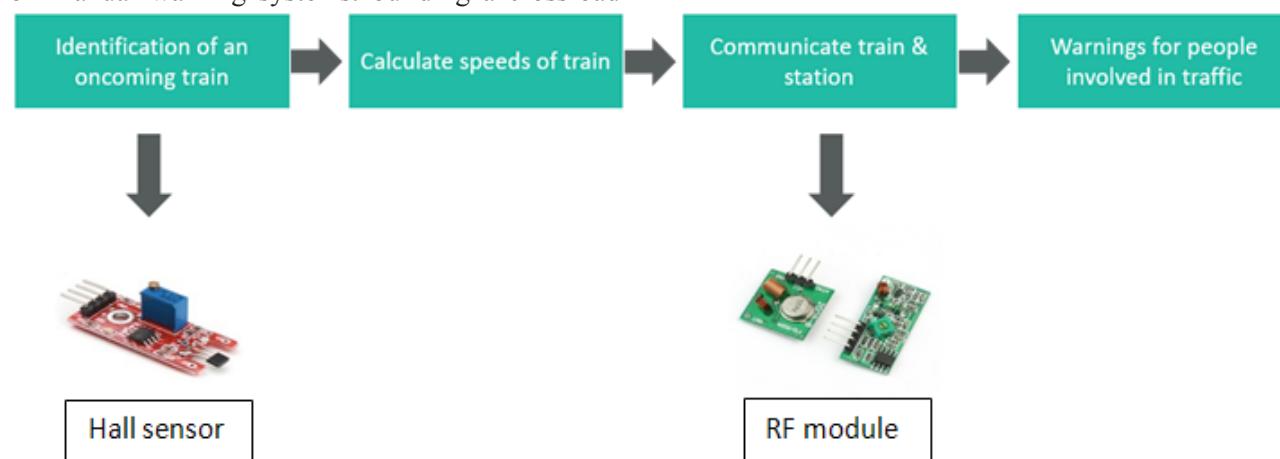
If he or she passes through a green signal, a bell goes off in the cab and no action has to be taken.

However, if the signal is any colour other than green, a claxon goes off. Signals other than green in built up areas tend to be yellow, double yellow and red. Double yellow alerts the driver that the following signal will be yellow, which in turn indicates that the following signal will be red. They tend to be placed about 1000 yards apart.

If the claxon goes off, the driver has a few seconds to acknowledge it by pressing a button. If he or she does not acknowledge, the brakes are applied automatically. And if the driver acknowledges the warning horn, a black circle on the display lights up with yellow segments. This is known to drivers as "the sunflower". The sunflower is a visual reminder to drivers that they have acknowledged going through a signal other than green, and take must take responsibility for taking appropriate action.

The automatic crossroad system in the past of Vietnam

As a result, the railroad warning system emerged as an urgent need for the railway sector. Annually, the industry has spent a considerable amount of money on manual warning systems: building a crossroad



- We setup 2 magnetics on railway. The first magnet 400m from the railway crossing. The second magnet is 200m away from the first magnet position. With an average speed of 80 km/h. Here is the main flow of our products:

#### **With simple formula:**

- Length of road = average speed \* time

- When the train crosses the location of the two

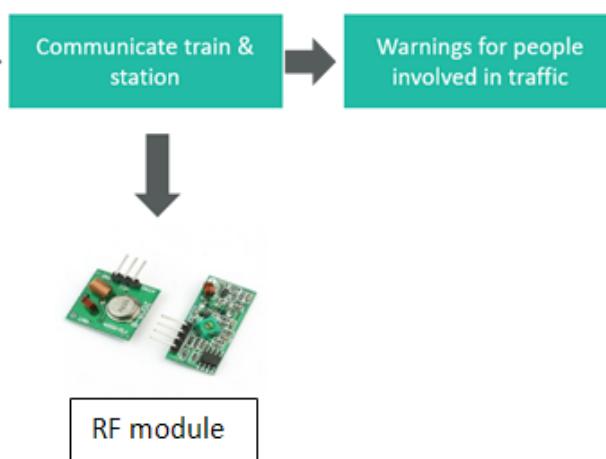
station, organizing cruise lines at these intersections. On the other hand, foreign train warning systems are imported at very high prices. Previously, the General Administration of Railways had to enter the warning system for about 180 million to 200 million for a system at a crossroads.

According to Dr Pham Hong Quang, CadPro, the railroad used the magnetic sensor solution of an Austrian company. However, after a period of use, the Austrian system had to be dismantled because of Vietnam's complicated conditions: many types of means of transportation crossed the road (from motorized vehicles such as cars, motorbikes, rudimentary vehicles such as bicycles, cattle cars ...) have caused confusion, creating false warning signals.

Another simpler solution, based on the "rail circuit" principle, was also used. This solution is based on the principle of placing contact points at the interface between two rails, when trains passing through the wheel will connect those two terminals. The shortwave signal is sent to the warning system. According to Quang, this system has been installed at nearly 100 crossroads, but only achieved 50% efficiency because of the hot, humid climate in Vietnam, the contacts are rapidly oxidized, the relay Poor exposure should be less effective.

### **III. PLAN IMPLEMENTATION**

#### **Our solution**

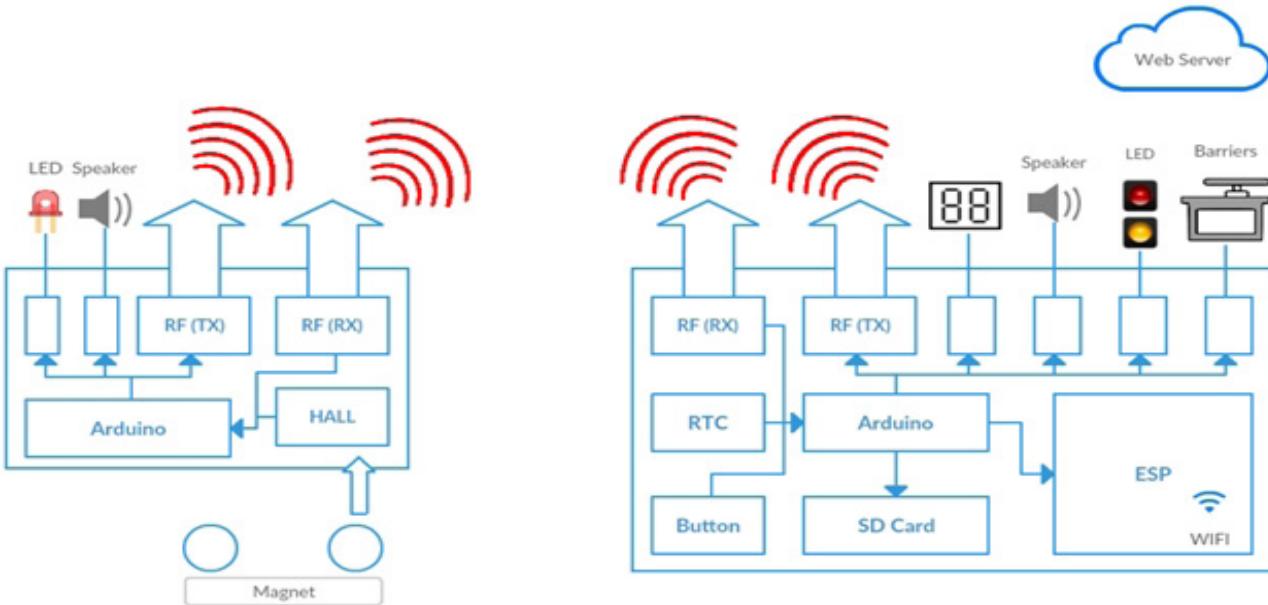


magnets, we calculate the current train speed, which predicts the length of the train to the crossroad.

- Immediately, we send the signal to the station, so that the station can activate the traffic alert system.
- Alarm system includes:
  - + Signal light: When the station receives the signal, the yellow light will warn people to quickly leave the crossroad, when the time the ship counts 15s red light will be activated and barrier will be turned down.
  - + Led 7 segment: Notice the time the train arrived at the station.

- + Speaker: repeater notification “Canh bao tau dang den” until the train has left.
- After the train crosses the station: that time will be recorded in the database in case of needed access.
- We also create a callback button: In case of

crossing obstacles, the authorized person can activate the button to send the signal to the train. The driver may then receive a signal from the warning system to take action.



The Block diagram entire system

#### IV. FUTURE PLAN

- There are no perfect solutions to problems, as well as there are no perfect systems. With the inexperience of our team members and the time constraints, our proposed solution and project contains many issues. Below are the problems encountered in this project:
  - + **Hardware Knowledge:** We are inexperienced with hardware. All the hardware components chosen to be used in this project is based on our familiar with them, or based on the shortest time we need to learn how to use them. So they are only the most appropriate, not the best choice for the project.
  - + **Security:** Currently, there is few possible problems encountered with RF, as RF is vulnerable to replay attack.
  - + **Server crash:** All the needed data for the app is stored in the server. So if server crashes, all the devices cannot work properly.
  - Our future plan is to try to solve these problems one by one.
  - We will also try to implement a sensor at crossroad to detect barriers (cars, human, animal, and the likes) when the train is coming and send that signal to Train station, handle situation with suitable solutions.

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# Barcode Order Eateries BOE

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## **Abstract**

*The problem centered on the business in restaurant. In many restaurants, employee management is inefficient. It affects business result of restaurant. We build a system bases on the advantages of smartphone and QR Code in order to support many common processes in restaurant, its name is BOE system. BOE system improves business of restaurant operate effective.*

## **Keywords**

*QR Code; Smart Restaurant; Dish,*

## **I. INTRODUCTION**

Nowadays, restaurant is popular service. The number of customers in this field increase day by day. The number of restaurants also increase, more and more new restaurants are opened. Many types of food and drink are introduced. Many creative campaigns are marketed. But there are few ideas that are implemented to improve restaurant's service process. We identified two problems that has been existing in the restaurant's service process:

Inefficient using labor: Current restaurants do not have effective management of employees. Traditional restaurants often need a waitress every time a new customer enters the restaurant. If a restaurant uses an unchanging number of employees. In rush hours, many customers use the service at the same time, the restaurant does not have enough staff to meet the demand. At a time when there are very few customers in the restaurant, many employees have no duties, they are free, but the restaurant still pays them.

Online Payment: More and more customers have Paypal account and restaurants do not support online payment. Some restaurants have used online payment, but it is not really synchronized with the restaurant process.

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The BOE system was developed to improve the process of the restaurant. The new system helps employees do their jobs better, that is a condition for restaurants to save a lot of money.

The diner ordering process is simpler. After the QR code is scanned on the table, diner can order. The latest menu of the restaurant is updated, the customer reaches the dishes

fully and exactly. The process of serving the restaurant takes place more quickly and accurately.

## **II. PROBLEMS AND SOLUTION PLAN**

Our approach contains two main problems: Real Time and Supported Payment methods.

### **1. Real Time**

Problem: Our solution is that the customer can make order by the restaurant's app installed on their smartphone. When the customer finishes making order, the kitchen department can see the dishes in order and chefs cook the dish. The notifications will be displayed on the waiter screen when the dish is cooked by the chef. Waiters have information about the dish and the table number to deliver exactly. In the process, if there are any issues related to the dish, the diners will receive a notification message from the restaurant.

Solution: The system uses the Firebase Cloud Messaging service provided by Google. Through Firebase Cloud Messaging, the system transmits data indirectly to the phone application. Ensuring real-time, reduced processing of the server. In addition, the extensibility of the system is better.

### **2. Supported Payment methods**

Problem: The restaurant must provide customers with many payment methods when they make order.

Solution: System support customer to pay indirectly through Paypal. The system receives a response from Paypal, confirming that payment has been successful.

The system also supports cash payments at the table as traditional models if the customer requests. The cashier confirms that money has been received from the customer, the ordering process is successful.

In addition, the system allows customers to pay with their restaurant account. Customers will deposit

money previously in their account. When customers pay by this method, their balance is reduced.

### III. PLAN IMPLEMENTATION

#### 1. System technology

##### 1.1. QR Code

BOE system uses QR Code to get restaurant's menu. Each table in the restaurant is tagged with a different QR Code corresponding to the table number. Customers open restaurant applications and scan QR Code on the table they are sitting. After successfully scanning, they will see the menu of the restaurant. The table number is stored in their order after they have made order. The waitress will know table number they must deliver.

##### 1.2. Firebase Cloud Message

Firebase Cloud Messaging is a free service from Google. Through the Firebase Cloud Messaging, the system can send messages quickly and securely to the phone applications of the system. In the BOE system, the Firebase Cloud Messaging is used to transmit data indirectly from the server to the chef's, waiter's and cashier's application. It is also used to announce dinner-related issues to their mobile application.

All data which are sent to chef and waiter is posted to the Firebase Cloud Messaging. The Firebase Cloud Messaging sends the corresponding data for related user. The received application automatically processes and update UI.



#### 2. Database

Each dish has the main material which is needed to cook that dish. We built a database that included dishes in the restaurant and the main material of that dish. Many dishes have the same main material. The chef has hardly controlled any dish that is not able to be cooked. Now the chef simply checks for any material and turns it off on their application then the system will automatically turn off that dish on the related applications.

Dish	Material
Bún bò	Bò
Phở bò	Bò
Mì xào bò	Bò

#### 3. Algorithms

##### 3.1. Make order Algorithm

The algorithm is used to get menu and make order through mobile application.

- Diners user their mobile to get menu and make order. The process includes: Step 1: Scan QR Code on the table to specific the table number
- Step 2: View the menu and add dish to cart
- + Step 2.1: If dish is not available, show message
- + Step 2.2: If dish is available, add to cart.
- Step 3: Diners view cart, the server checks order time in the restaurant 's serving time.
- + Step 3.1: If the order time is out of the restaurant 's serving time, the mobile screen shows message.
- + Step 3.2: If the order time is in the restaurant 's serving time, check dish is available or not.
- Step 3.2.1: If dishes are not available, show dialog.
- Step 3.2.2: If dishes are available, diners select quantity for all dish then click 'checkout'. Then check the order time and availability of dishes again.
  - o Step 3.2.2.1: If order time and dishes are not available, show message.
  - o Step 3.2.2.2: If order time and dishes are available, diners view the bill.
- Step 4: The diner selects payment method and click Pay.
- + Step 4.1: If diners select 'Paypal' payment method, redirect diners to 'Paypal' online banking.
- Step 4.1.1: If the transaction is success (Go to step 5)
- Step 4.1.2: If the transaction is fail, the application shows message.
- + Step 4.2: If diners select 'Cash' payment method, notify to the cashier to collect money.
- + Step 4.3: If diners select 'Balance' payment method, application checks money in balance is enough for payment.
- Step 4.3.1: If money in balance is enough for payment, (Go to step 5).
- Step 4.3.2: If money in balance is not enough for payment, the application shows message.
- Step 5: After payment, check the availability of dish.
  - + Step 5.1: If dishes are not available, show message.
  - Step 5.1.1: If the diner clicks 'Continue', the server do partially refund equivalent money to the diner.
  - Step 5.1.2: If the diner clicks 'Cancel', the server do fully refund money to the diner
- Step 5.2: If dishes are available, notify the order to the chef.
- Step 6: Show message order successfully.

##### 3.2. Update Material Algorithm

The algorithm is used to update materials. When materials are out of stock, chefs update material. Then what dishes have that material is highlight.

- Step 1: When materials are out of stock, chef go to material screen, then update material.
- + Step 1.1: If dishes in cooking queue are not have updated materials, the application just notify update successfully.
- + Step 1.2: If dishes in cooking queue have updated material, the application highlight those dishes and show option ‘Keep’ and ‘Reject’
  - Step 1.2.1: If chefs click ‘Keep’, the application updates dish UI to normal dish UI in queue.
  - Step 1.2.2: If chefs click ‘Reject’, the application remove those dishes from queue and notify to the server for handling.

#### **IV. ANALYSIS**

The testing for this project consists of Integration System test level. Testing the program after integrating and completing system clarifies whether the software requirements have been met. Integration testing would be performed by all member of team and approved by team leader. System testing focuses on assessing the system’s reliability. This process is concerned with finding errors that result from unanticipated interactions between components and component interface problems using blackbox testing and check list. Our system test cases include Web and Mobile Application Test Cases.

1. Web Application Test Cases
2. Mobile Application Test Cases

#### **ACKNOWLEDGMENT**

First and foremost, we would like to express our greatest gratitude to our supervisor, Mr. Kieu Trong Khanh, for his support during our 9 semesters, especially this project. Enthusiastic guidance given by him, plus insightful suggestions and feedback made it possible for us to conduct this report. This has been a great instruction in this strenuous journey. Additionally, we would like to send our special appreciation to all FPT University Lecturers who have taught and guided us from the very beginning. The knowledge and experiences they provided are valuable resources, which help us prepare for this research.

# Drawing with Simple Brush

## Making dashed image from image

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### Abstract

*Making of dash image is a common method of teaching children how to draw. This paper presents a solution to automate this process. The goal is to convert from normal image to black-white content simple dashed brush. Our solution is robust and can apply to many kinds of image.*

### Keywords

*Dash Image; Image Processing; Simple Brush.*

## I. INTRODUCTION

One method of teaching children how to draw is to prepare a dashed line picture for them to follow. This method is widely used as it is simple, require little time to prepare by human. But to automatically create dashed line image is not a simple problem, as computer do not understand lines and dash as human do. In this paper I will present a solution to make a dashed line image that is natural looking and intuitive for children to follow.

The basic idea is to choose a list of points on the line we want to make dashed, the distance from each point and its next neighbor in list is a constants. Then we proceed to delete a segment make from a point in the list and its next neighbor, repeat this process and we will have a dashed line image.

In Section II we formalize the problem and describe our approach to solving it. Section III further describes steps that need to be set up and the subsequent algorithm. We analyze and show experimental result of our algorithm in Section IV

## II. PROBLEM AND SOLUTION PLAN

We are given an normal image. Our problem is, from the given image, produce a simple black-white image with dashed line.

We breakdown our problem into 2 parts: 1: Make a simple image from a normal image, and 2: Make dashed line from simple image.

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The making of simple image can be archived using various image thresholding techniques. The problem is to find a suitable technique for our application. Our main focus is making dashed line image from simple image. Our solution based on making a list of point  $L\{p_0, p_1, p_2, p_3, \dots\}$  and draw white segments  $(p_0, p_1), (p_2, p_3) \dots$  on the simple image. The distance from  $p_i$  to  $p_{i+1}$  is exactly  $r$  which  $r$  is a user-defined parameter. This approach effectively turn simple image to dashed line image for drawing.

## III. PLAN IMPLEMENTATION

### 1. Simple image conversion

As mentioned above, converting normal image to simple image can be archived through thresholding techniques. We choose Adaptive Thresholding Using the Integral Image as in [1] since it is fast, accurate and easy to implement. The basic idea is to compute the average of an  $s \times s$  window of pixel center around each pixel. If the value of the current pixel is  $t$  percent lower than the average then it is set to black, otherwise it is set to white.



Figure 1. Normal image



Figure 2. Simple brush image

### 2. List of midpoints

We now proceed to make a list of black midpoints. A midpoint is a point in the middle of a connected region ( vertical or horizontal ). Consider the following example of a single line:



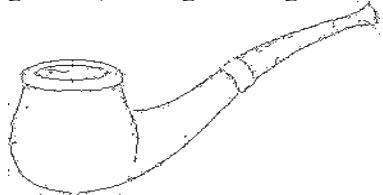
Figure 3. Simple line

This line has 2 connected regions ( separated by some white pixels ). The following show the midpoints of those regions ( in red pixels ) :



**Figure 4. Simple line with midpoints**

The following show the midpoints ( plotted on a white background ) for Fig. 2. image:



**Figure 5. Midpoints ( plotted )**

Making a list of midpoints is an important part. It speed up the searching process and also improve overall correctness of our dashed-line algorithm. Refer to algorithm 1 for the complete pseudo-code of this algorithm.

### 3. Making dashed line image

Now that we have a list of midpoints  $M\{p_0, p_1, \dots\}$ , we proceed with the following procedure:

- Step 1: Choose a point  $p(x_p, y_p) \in M$ , initiate  $L = \{\}$
- Step 2: Find a point  $a(x_a, y_a) \in M$  so that  $\text{distance}(a, p) = r$ , with  $\text{distance}(a, b)$  is the Euclidean distance of  $a$  and  $b$ . If there is no such point  $a$  satisfied the condition, proceed to DeleteSegment( $L$ ) then go to Step 1
- Step 3: Delete every point  $k(x_k, y_k) \in M$ , with  $\text{distance}(p, k) <= r/2$
- Step 4: Delete every point  $k(x_k, y_k) \in M$ , with  $\text{distance}(a, k) <= r/2$

Step 5: Add point  $p$  to list  $L$ , return to Step 2 with point  $p=a$ , repeat until  $M=\{\}$

The process to delete segments, given a list  $L\{p_0, p_1, \dots\}$  is as follow:

- Step 1: Choose the first 2 points:  $p_0$  and  $p_1$ . If the list  $L$  has only one point or no point, end the procedure.
- Step 2: Draw a white segment  $(p_0, p_1)$  on SimpleImage with segment radius =  $s_r$
- Step 3: Remove  $p_0, p_1$  from  $L$ , repeat Step 1.

With 2 procedures above, we can make a natural dashed line image from simple image. The problem is to choose the radius  $r$  and segment radius  $s_r$ . After tuning the system we find that  $r=20, s_r=5$  is most suitable for our application.

Refer to Algorithm 2 for pseudo-code of this algorithm. Note that the pseudo-code is only a simple implementation and has rooms for improvement. One possible improvement is using Set instead of List for faster searching and deleting process.

## IV. PERFORMANCE AND EXAMPLE

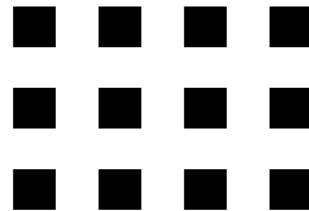
### 1. List of midpoints

With an implementation same as pseudo-code in

Algorithm 1, the complexity for making a list of midpoints is  $O(w*h)$ , with  $w$  is the width and  $h$  is the height of the simple image.

A list of midpoints reduce the number of pixels to consider when applying Making dashed line algorithm to the simple image. Assumed the number of black-pixels in simple image is  $P$  and the number of points in midpoints list is  $K$ , after tested with 1000 various images, we find that the ratio  $P/K$  is around 3 to 10.

In the worst-case scenario, that is every connected line region only consisted of one point, the the algorithm does not reduce the number of pixels. Such a scenario rarely happens in our application. Fig. 6. show an example of a worst-case scenario.



**Figure 6. Worst-case scenario, where every connected line region only consisted of one black pixel**

### 2. Making dashed line image

An implementation in Algorithm 2 pseudo-code, we use a white blank image to plot on the midpoints ( now refer to midpoints-image ). Doing so help use check if the point  $p \in M$  just by checking if  $(x_p, y_p)$  is a black pixel on our midpoints-image. Doing so reduce the complexity for checking if a point  $p \in M$  from  $O(m)$  to  $O(1)$ , with  $m$  is the length of list  $M$ . At Step 2, to find such point  $a$ , we need to iterate through a region of  $4*r^2$ , at each iteration check if point  $p$  satisfy the condition. Combined with above analysis, the complexity of this step is  $O(r^2)$ .

At Step 3 and 4, we need to delete every point in the region of  $r^2$  which satisfy the condition. Using the prepared midpoints-image, we can delete a point  $p$  by set  $(x_p, y_p)=0$  on midpoints-image, thus reduce the complexity from  $O(m)$  to  $O(1)$ . The complexity for these steps is  $O(r^2)$ .

The complexity for DeleteSegment( $L$ ) is  $O(l*r)$  with  $l$  is the length of list  $L$ . Because the  $\text{distance}(p_i, p_{i+1})=r$  for every point  $p_i \in L$ , we cost to draw the white segment is  $O(r)$  thus the total complexity of  $O(l*r)$ . With above analysis, our total complexity is:

$O(m*r*\max(l,r))$ , with:

$m$  is the number of points in list  $M$ ,

$r$  is the radius defined,

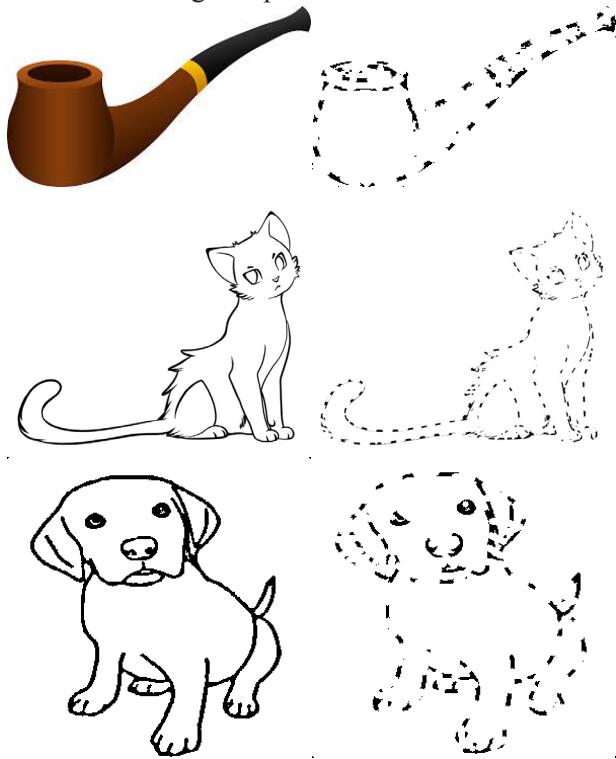
$l$  is the length of list  $L$ .

The algorithms above is tested on a 2.5 GHz Intel Core i7, 16 GB 1600 MHz DDR3 machine, with

various images of 1920\*1080 pixels, and find that the performance is measured to be about 10s to 20s. With further improvement and optimization, we can increase performance to fit with real-time applications.

### 3. Example

We now show an example for each step of the algorithm, from the normal image input to final dashed line image output.



## V. CONCLUSION

The initial results are encouraging for the proposed solution to the problem of automatically making dashed line image. Extensions along the following lines should be investigated:

1. More efficient search and delete every points inside a circle on an image.
2. A more efficient method for choosing list of points.
3. Most welcome, of course, would be a sharper theoretical analysis.

## ACKNOWLEDGMENT

The authors would like to thank Mr. Kieu Trong Khanh for his guidance and supports on this research.

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- [1] Bradley, Derek, and Gerhard Roth. "Adaptive thresholding using the integral image." *Journal of Graphics Tools* 12.2 (2007): 13-21.

Solution to the problem of automatically making dashed line image. Extensions along the following lines should be investigated:

- [2] More efficient search and delete every points inside a circle on an image.

- [3] A more efficient method for choosing list of points.
- [4] Most welcome, of course, would be a sharper theoretical analysis.

---

**Algorithm 1** Make a 2-dimension array of midpoint image

---

```

1: procedure MAKE_MIDPOINT(img, w, h)
2:   img_mid is a zeros array with shape of (w, h)
3:   for i = 0 to w − 1 do
4:     j = 0
5:     while j < h do
6:       if img[i][j] = 0 then
7:         first = j
8:         while j + 1 < h and img[i][j + 1] = 0
      do
9:           j = j + 1
10:          end while
11:          second = j
12:          midpoint = (first + second)/2
13:          img_mid[i][midpoint] = 0
14:        end if
15:        j = j + 1
16:      end while
17:    end for
18:    for j = 0 to h − 1 do
19:      i = 0
20:      while i < w do
21:        if img[i][j] = 0 then
22:          first = i
23:          while i + 1 < w and img[i + 1][j] = 0
      do
24:            i = i + 1
25:          end while
26:          second = i
27:          midpoint = (first + second)/2
28:          img_mid[midpoint][j] = 0
29:        end if
30:        i = i + 1
31:      end while
32:    end for
33: end procedure

```

---

**Algorithm 2** Make Dash Image

---

```

1: procedure MAKE_DASH(img)
2:   img is a simple input image with shape = (w*h)
3:   list_point = [], r = 20, full_list = []
4:   Make_Mid(img)
5:   img_mid is the midpoint image stored when calling Make_Mid(img)
6:   procedure ADD_POINT(p(x, y))
7:     Add point p(x, y) to list_point
8:     for every point k(i, j) where
      img_mid[i][j] == 0 and Euclid_Distance(p, k) ≈
      r do
9:       Delete every point p2(x, y) in img_mid
      that Euclid_Distance(p2, p) ≤ r/2
10:      Delete every point p2(x, y) in img_mid
      that Euclid_Distance(p2, k) ≤ r/2
11:    end for
12:  end procedure
13:  for i = 0 to w − 1 do
14:    for j = 0 to h − 1 do
15:      if img_mid[i][j] == 0 then
16:        list_point = []
17:        Add_point((i, j))
18:        if Size(list_point) > 1 then
19:          Add list_point to full_list
20:        end if
21:      end if
22:    end for
23:  end for
24:  for small_list ∈ full_list do
25:    while Still have point in small_list do
26:      a = small_list[0], b = small_list[1]
27:      Draw white segment on img from a to b
28:      Delete small_list[0], small_list[1] from
      small_list
29:    end while
30:  end for
31:  Output img as dashed image
32: end procedure

```

---

# Drawing with Simple Brush

## *Breakdown image into drawing step*

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**Abstract**

*Breaking image into step is an advanced method of teaching children how to draw. This paper presents a solution to automate this process. The goal is to breakdown simple brush images into many step images. Our solution is robust and can apply to many kinds of image.*

**Keywords**

*Step Breakdown; Image Processing; Simple Brush.*

**I. INTRODUCTION**

One method of teaching children how to draw is to prepare a set of step images in a particular order for children to follow. This method is more advanced, require a fair amount of time to prepare, and it is vary from person to person, making it even harder for computer to automate this process. This paper propose a solution to tackle this problem as a first step into researching this topic.

The basic idea is to travel from one corner to another. Choosing a corner as a breaking point between two steps is natural, as we tend to change drawing direction when we hit a corner.

In Section II we formalize the problem and describe our approach to solving it. Section III further describes steps that need to be set up and the subsequent algorithm. We analyze and show experimental result of our algorithm in Section IV

**II. PROBLEM AND SOLUTION PLAN**

We are given a simple brush image. Our problem is, from the given image, produce a set of step images to completely draw the image.

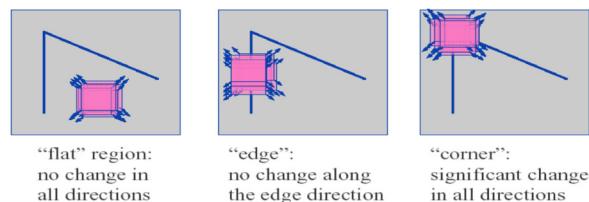
As to implement the above idea, the first problem is to find a list of corners. To determine if a point is a corner, we first choose a window around that point, then shift the window. If a large change appeared, we conclude it is a corner. The Shi-Tomasi Corner Detector [1] give a mathematical approach for such process.

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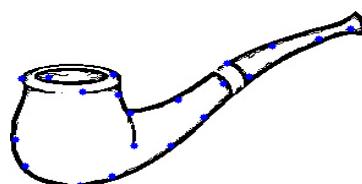


**Figure 1. Basic idea of corner detection process**

Next problem is to travel from corner to corner. A simple Deep First Search Flooding technique is simple and effective enough for this process. To determine whether a point is at corner required an error parameter  $\epsilon$ , checking the distance from  $I(x_i, y_i)$  and corner  $C(x_c, y_c) \leq \epsilon$ .

**III. PLAN IMPLEMENTATION****1. Corner detector**

Shi-Tomasi Corner Detector [1] is a widely used method for detecting corners of an image. OpenCV [2], an Open Source Computer Vision Library, implemented this algorithm with various improvement and customization supports. Below show an example of corner detection applied to a simple brush picture, dotted in blue:

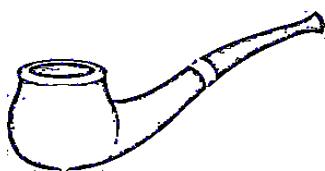
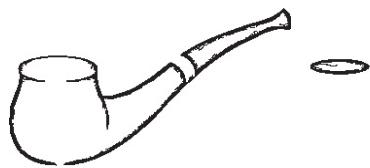


**Figure 2. Simple brush image with corners**

**2. Connected region**

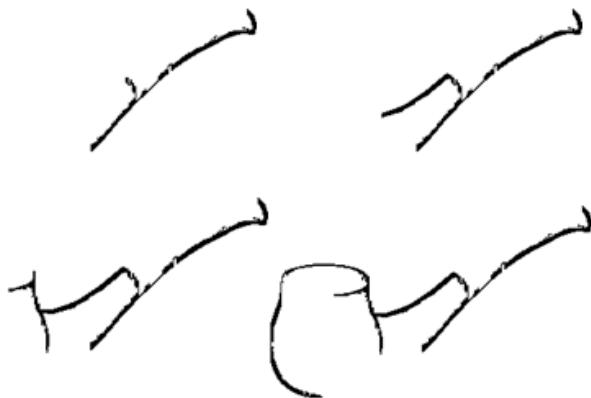
Before we travel from on corner to another, it is important to find a list of connected regions. Each region is fully connected and separated from other regions. We then consider each region separately, travel from one corner to another, make a step at each corner.

The pseudo-code in Algorithm 1., line 5 to 20 is a simple implementation using Deep First Search Flood approach to find a list of connected region. Below are an example of 2 connected regions of an image.

**Figure 3. Normal image****Figure 4. 2 connected regions**

### 3. Deep first search traversal

Using DFS, we travel from one corner to next corner, making one step each. Compare to Breadth First Search (BFS), DFS is more natural to follow. Below show an example of the result made using this approach.

**Figure 5. 4 example steps using DFS traversal**

### IV. PERFORMANCE ANALYSIS

As implemented in pseudo-code Algorithm 1., finding a connected list using DFS flood will cost you  $O(w \cdot h)$ . with  $w$  and  $h$  is the width and height of the image.

Finding a list of corner in an also cost  $O(w \cdot h)$  as the calculation for every pixel is  $O(1)$ .

The complexity of the whole process is  $O(w \cdot h \cdot k)$  with  $k$  is the number of connected region.

The algorithms above is tested on a 2.5 GHz Intel Core i7, 16 GB 1600 MHz DDR3 machine, with various images of 1920\*1080 pixels, and find that the performance is measured to be about 10s to 20s. With further improvement and optimization, we can increase performance to fit with real-time applications.

### V. CONCLUSION

The initial results are encouraging for the proposed solution to the problem of automatically break down simple brush image into steps. Extensions along the

following lines should be investigated:

1. Using corner as break point failed for circular shape in image.
2. Deep First Search Traversal is not a very good way to travel from one break point to another, as such traversal may make an unnatural step for children.
3. Most welcome, of course, would be a sharper theoretical analysis.

### ACKNOWLEDGMENT

The authors would like to thank Mr. Kieu Trong Khanh for his guidance and supports on this research.

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- [2] Opencv.org. (2015). ABOUT — OpenCV. [online] Available at: <http://opencv.org/about.html> [Accessed 10 Aug. 2017].

**Algorithm 1** Make Step Images

---

```

1: procedure MAKE_STEP(img)
2:   img is a simple input image with shape = (w * h)
3:   full_list = [], connected_list = [], min_size = 20, full_list_deleted = []
4:   img_step = array of shape (w * h), filled with 255
5:   procedure FLOOD(x, y)
6:     Add (x, y) to connected_list, img[x][y] = 255
7:     Flood(x - 1, y) if img[x + 1][y] == 0
8:     Flood(x - 1, y) if img[x - 1][y] == 0
9:     Flood(x, y + 1) if img[x][y + 1] == 0
10:    Flood(x, y - 1) if img[x][y - 1] == 0
11:   end procedure
12:   for i = 0 to w - 1 do
13:     for j = 0 to h - 1 do
14:       if img[i][j] == 0 then
15:         connected_list = []
16:         Flood(i, j)
17:         Add connected_list to full_list
18:       end if
19:     end for
20:   end for
21:   for every small_list ∈ full_list do
22:     Add small_list to full_list_deleted if size(small_list) > min_size
23:   end for
24:   for every small_list ∈ full_list_deleted do
25:     img_temp = array of shape (w * h), filled with 255
26:     for every point (x, y) ∈ small_list do
27:       img_temp[x][y] = 0
28:     end for
29:     c_list = a list of corners found in img_temp
30:     for every point (x, y) ∈ small_list do
31:       for every point (x2, y2) ∈ c_list do
32:         if (x, y) ≈ (x2, y2) then
33:           Delete (x2, y2) from c_list
34:           Write img_step as a new step image
35:           Break loop
36:         end if
37:       end for
38:       img_step[x][y] = 0
39:     end for
40:     Write img_step as a new step image
41:   end for
42:   Write img_step as a new step image
43: end procedure

```

---

# Building a business platform

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## Abstract

*Business Platform is a service provider platform which supports people build e-commerce application quickly and not too much cost. Application of businesses just connect to the platform is able to connect to all Suppliers (restaurants, shops, individuals wanting to sell products online). From there, they can perform order transactions to specific suppliers. In addition, Supplier only need to use the application platform can sell their products in as many applications of the business as possible.*

*In this paper, we present some problems that we meet when we implement the Platform and the way we solve those problem.*

## Keywords

*Http; Platform; Token; Engine; JSON; Webhook*

## I. INTRODUCTION

Today, cloud computing is growing, with many platforms coming out. For example, Firebase [1] is a platform that enables developers to build real-time applications easily by providing a real-time database. The application just needs to connect to the real-time database that is able to build real-time features without having to bother with the database and its performance. Another example is Facebook's messenger platform [2]. They built a platform so that developers can build bots that could receive messages and respond to them automatically.

Business platform support enterprise build their own e-commerce application quickly. They only need focus on build their application and sale product, Business Platform will help them manage supplier, manage transaction process, doing routine report to tracking business state, more and more.

There are two major issues our Business platform has solved:

How does the application or system of Broker connect to the platform?

The Broker's system will communicate with the Platform through the API.

The Platform will also provide a list of enough API that the broker system can trade with Suppliers.

+ API retrieves a list of suppliers according to the type of service they have registered to the Platform.

+ API view detailed information for each supplier.

+ API lists the product according to each supplier.

+ API searches for the products of the suppliers according to many criteria such as location, price, so on...

+ API allows the Broker's system to create an order for multiple Suppliers.

+ API allows the Broker's system to cancel an order that was previously created.

+ API allows the Broker's system to report an order that their customers feel dissatisfied with, or their customers do not receive the product.

Manage transactions from broker systems, and payment, profit sharing for broker and supplier.

We currently choose the payment method as prepaid. This means that when the Broker system makes an order, the Broker must pay 100% of the value of that order in advance for the system. In parallel with that, the supplier must pay the cost of receiving an order in order to accept that order.

After successful order, the supplier will receive 100% of the order value. At the same time the Broker will also receive the amount that the system calls it a commission for the broker.

On the other hand, if the order fails, the system can return the money the system receives from the Broker or Supplier. How much the refund depends on the specific circumstances, and is specified in the contract between the parties.

The system can cancel order at any time. As long as the order has not been delivered or canceled. It helps unbounded systems deal with order processing so that businesses can build their own payment regulations.

Prepaid helps the system take the initiative in making transactions. In any case, the system cannot suffer losses. (Figure 1)

## II. PROBLEM AND SOLUTION PLAN

The broker system can communicate with the platform by calling the REST APIs we have listed above. The returned data will be formatted according to the JSON standard.

One issue we need to solve here is how the system can

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distinguish requests from different broker systems. Distinguishing requests can help the system remove requests that are not from registered broker systems. To solve the above problem, we have chosen solution is to give each broker a token.

**Token API:** A token is a string that is generated immediately after a Broker account is registered successfully. Token is unique, it represents only one broker account, namely the Broker's system. Brokers who want to call the API of the platform must include a token to help the system determine the request from any broker.

The second problem is how the system can actively communicate with the broker system. For example, if the order status is changed by the supplier, the platform must notify to the Broker's system, so that the Broker system can handle the issues related to the change.

The solution we use here is to create a webhook for each broker.

**Webhook:**[3] As an HTTP callback, the broker system will define some addresses (URLs), and register that URL with the webhook. Each time an event occurs on the platform it will call the corresponding URL that the broker has registered for the event. The contents of the event will be stored in the body of the HTTP request with the format JSON.

We've come up with a solution that allows the broker to define the code itself, which we call Token Call Back to let the platform know that it is connected, and communicate properly with the Broker system the platform wants or not. Each time a communication platform transmits a message to the Broker system, the platform always sends a Token Call Back. The Broker system responding to the platform must also send back the Token Call Back to the platform so that the platform can know it is sent successfully or not. If the response returns a token call back that does not match the previously registered token, the system defines that the communication with the broker system fails.

The appendix 2 (Figure 2) describes the transactions that occurred when an order was initialized and successfully delivered. This case shows that since the order was initialized until the order's status was delivered, the system had to make many transactions. If these transactions are direct transactions through Bank System, this is not possible because bank system transfer is slow, this makes processing of order status very slow.

To solve this problem, we built a money management system for each user in the system. Each supplier or broker account is managed by the system with a virtual account, the system calls it BankAccount.

When a supplier or broker makes withdrawals or

deposits into their accounts, those transactions are made through the banking system.

For a Broker makes orders, the Supplier receives an order, the money in their system must be sufficient to meet the system requirements.

### III. PLAN IMPLEMENTATION

#### 1. Database design: (Figure 3)

##### a. BankAccount

Cash	Current money of Supplier is having in the system.
Expense	Cost of commission in a day of account.
Revenue	Revenue of Supplier or Revenue of Broker in a day
Account Receivable	Number of money will be received in a day.
Account Payable	Debt in a day.
Withdraw	Number of money is withdrawn in a day by Supplier or Broker.
Capital	Number of money is deposited in a day by Supplier or Broker.

##### b. Product

Compensation	Number of money that Supplier wants to receive when Broker changes order status from DELIVERING to CANCELED.
--------------	--

##### c. LogStatus

When there is a change of order status, the system will create a log status. LogStatus records the change information.

From Status	Order status before change
To Status	Order status after change
Type Actor	Supplier or Broker
Actor Id	Id of account – the account changes order status.

##### d. SystemTransaction

System Transaction is created when there is money transfer among 2 accounts in the system.

Sender Id	Account sends money.
Receive Id	Account receives money.
Amount	Number of money.

##### e. AccountTransaction

Record each change of money in account of each BankAccount.

Account Id	Id of BankAccount
Amount	Number of money changes.
Debit	Type of account is changed
Credit	Type of account is changed

*f. ReportHistory*

Statistics of each BankAccount in a day. Before the commit transaction of the day.

**2. Algorithm**

Trigger: Order's status change.

Step 1: System will automatically record LogStatus which contain order's status change. LogStatus include:

- FromStatus: previous order's status.
- ToStatus: new order's status.
- TypeActor: Type of user who change order's status. It includes:

Supplier	Supplier change order's status.
Broker	Broker change order's status.
System	System automatically change order's status. For example: Order is at PENDING status too long because supplier does not change order's status.

- ActorId: is supplier id or broker id.

Step 2: When LogStatus is created, System will generate corresponding SystemTransaction (Table 1, 2).

Step 3: After System create SystemTransaction, it will generate corresponding AccountTransaction (Table 1).

Step 4: Notify to Supplier or Broker

**IV. ANALYSIS**

Platform is a big system, so the design and the implementation the system is not only done one. In addition, the system maintenance is very important. We always prioritize the design of the system to make it easier to expand later.

During the design process, we have many connections with reality. For example, we build SystemTransaction table base on transfer money in the bank or we apply accounting principles for managing cash flow of each account.

**V. EXPERIMENTAL RESULTS AND****CONCLUSION**

Our system resolved some basic problems:

How to connect to Broker system.

How to handles transactions of the system in a clear, easily statistical way, and retrieve history later.

How to design a scalable system. In fact, we have changed our payment policies many times, which did not change the design of the system too much.

Besides these positive aspects, our design also has many disadvantages:

- Database does not meet standard 3NF.
- The system has not been thoroughly tested for performance.
- The security or data encryption has not been

thoroughly considered.

**ACKNOWLEDGMENT**

We would like to thank to Mr. Kieu Trong Khanh for helping us defining project scope and improving the functionality.

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- [3] <https://sendgrid.com/blog/whats-webhook/>

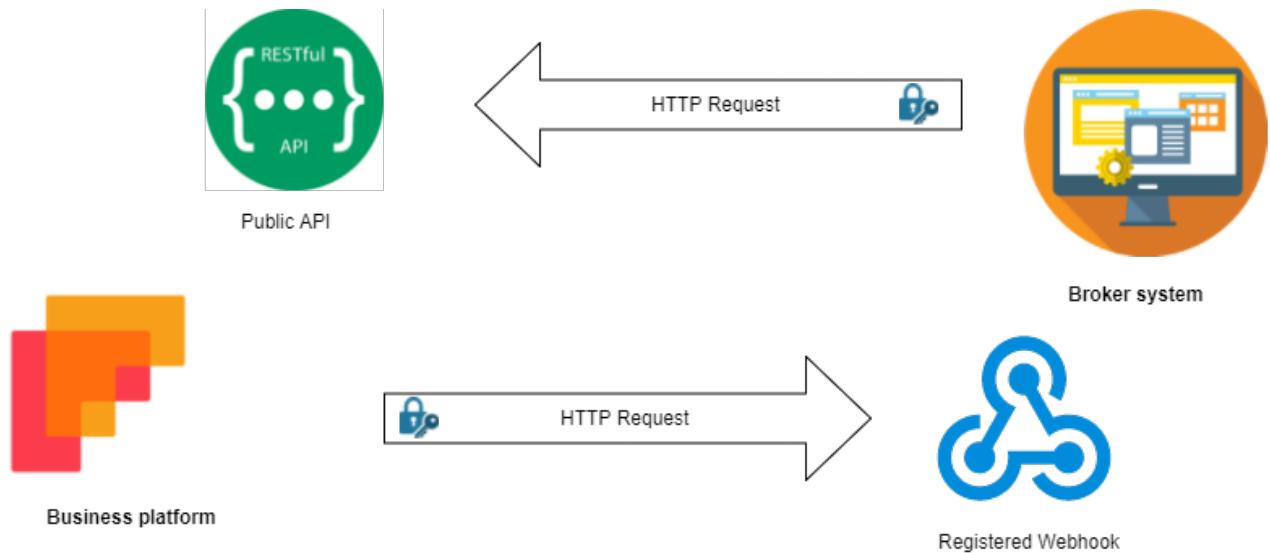


Figure 1. System architecture

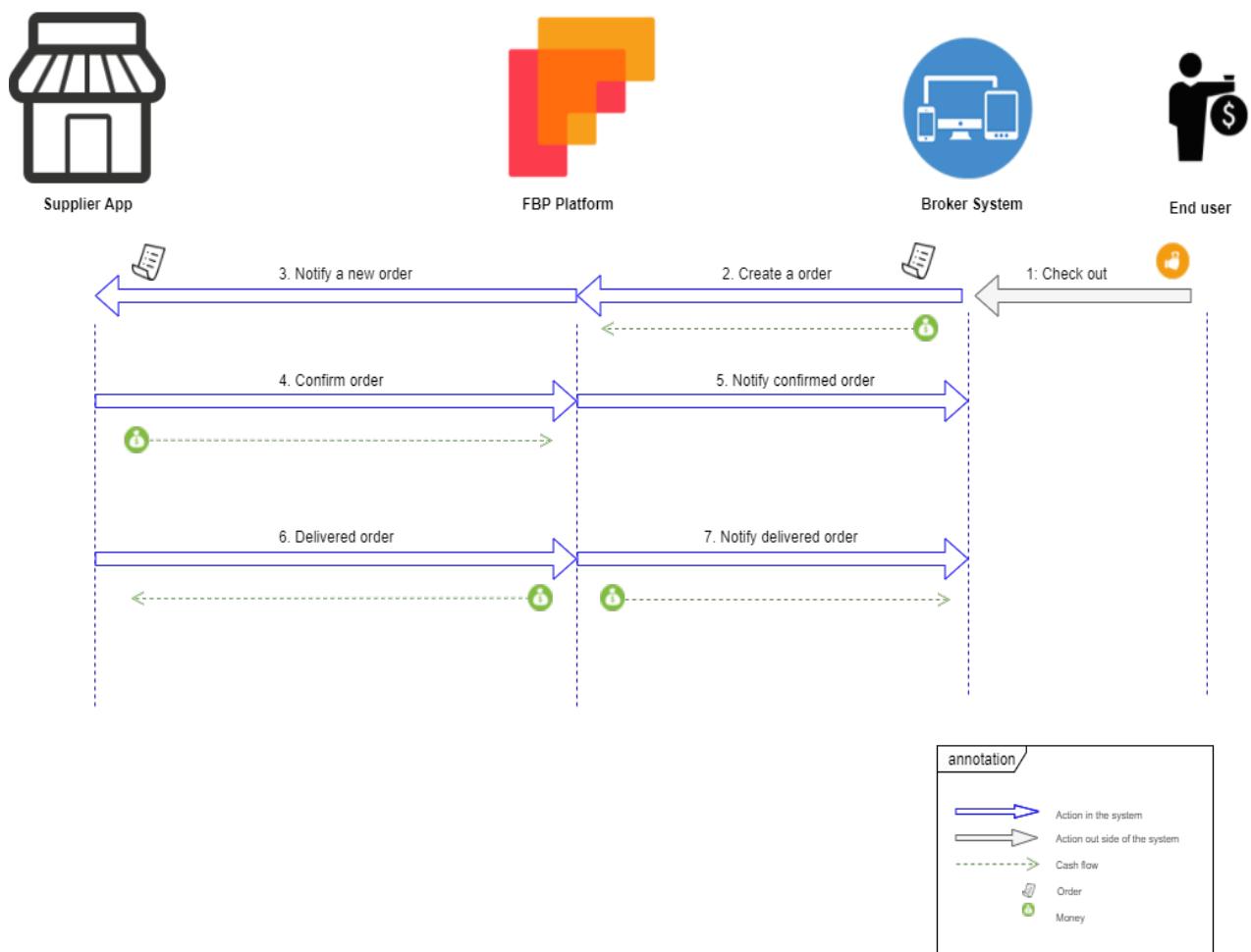
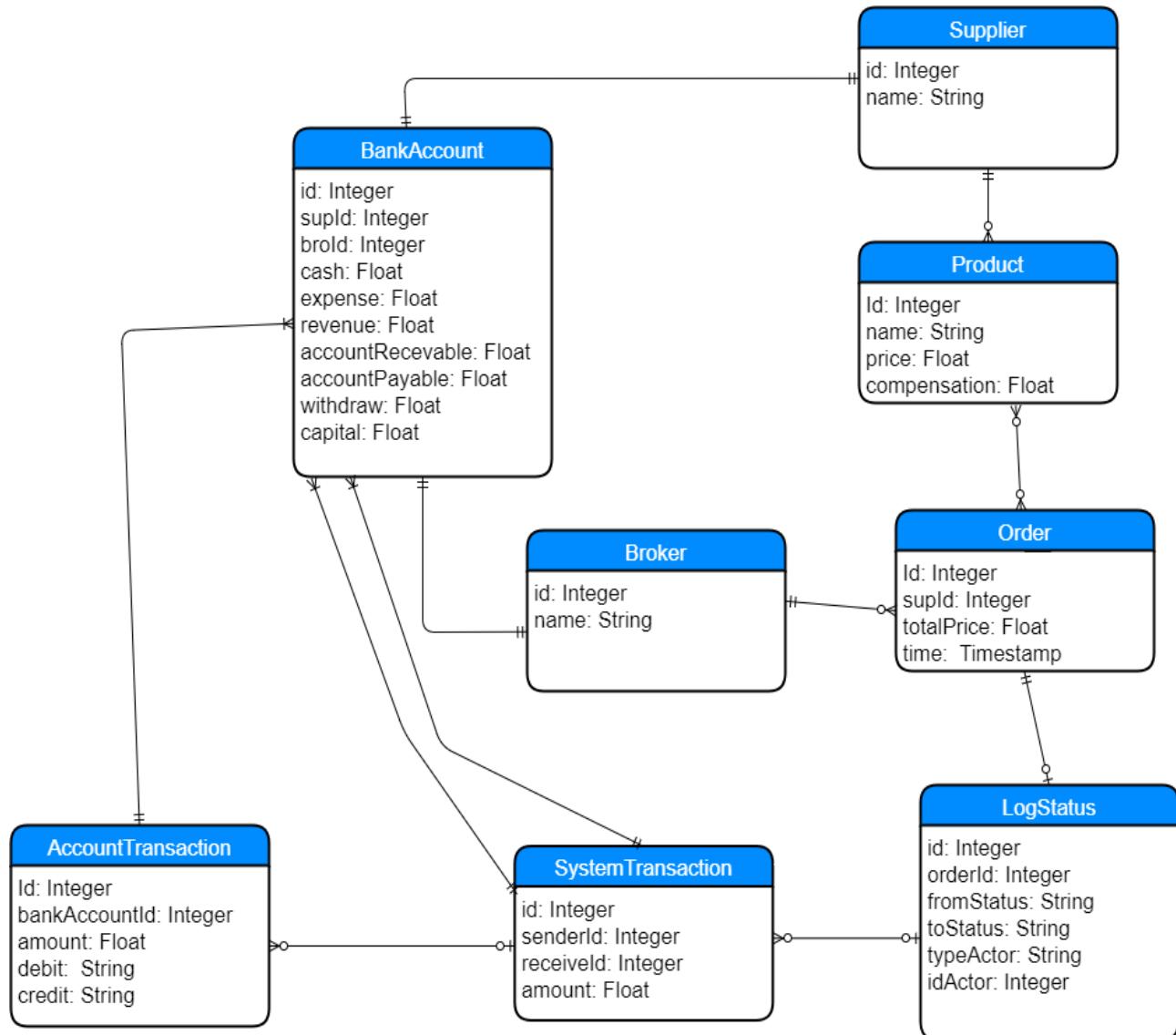


Figure 2. Order flow

**Figure 3. Database architecture**

**Table 1. Relationship of LogStatus, SystemTransaction, AccountTransaction**

LogStatus			SystemTransaction			LogStatus		
From-Status	ToStatus	From-Status	ToStatus	Type Actore	Amount (% Total Order )	Type Bank Account	Debit	Credit
NULL	PENDING	NULL	PENDING	BROKER	100	BROKER	EXPENSE	CASH
						SYSTEM	CASH	ACCOUNT PAYABLE
PENDING	CONFIRMED	PENDING	CONFIRMED	SUPPLIER	X	SUPPLIER	EXPENSE	CASH
						SYSTEM	CASH	REVENUE
CONFIRMED	DELIVERING	CONFIRMED	DELIVERING	SUPPLIER	N/A			
DELIVERING	DELIVERED	DELIVERING	DELIVERED	SUPPLIER	Y	BROKER	ACCOUNT RECEIVABLE	REVENUE
						SYSTEM	EXPENSE	CASH
			SYSTEM	SUPPLIER	100	SYSTEM	ACCOUNT PAYABLE	CASH
						SUPPLIER	ACCOUNT RECEIVABLE	REVENUE
PENDING	CANCELED	PENDING	CANCELED	SUPPLIER	100	BROKER	ACCOUNT RECEIVABLE	EXPENSE
PENDING	CANCELED	PENDING	CANCELED	BROKER	100	SYSTEM	ACCOUNT PAYABLE	CASH
CONFIRMED	CANCELED	CONFIRMED	CANCELED	SUPPLIER	100	BROKER	ACCOUNT RECEIVABLE	EXPENSE
						SYSTEM	ACCOUNT PAYABLE	CASH
			SYSTEM	BROKER	Y	BROKER	ACCOUNT RECEIVABLE	REVENUE
						SYSTEM	EXPENSE	CASH
CONFIMED	CANCELED	CONFIMED	CANCELED	BROKER	100 – Y	BROKER	ACCOUNT RECEIVABLE	EXPENSE
						SYSTEM	ACCOUNT PAYABLE	CASH
			SYSTEM	SUPPLIER	X	SUPPLIER	ACCOUNT RECEIVABLE	EXPENSE
						SYSTEM	EXPENSE	CASH
DELIVERING	CANCELED	DELIVERING	SYSTEM	SUPPLIER	Y	SUPPLIER	ACCOUNT RECEIVABLE	REVENUE
						SYSTEM	ACCOUNT PAYABLE	CASH
			SYSTEM	BROKER	100 – Z	SYSTEM	ACCOUNT PAYABLE	CASH
						BROKER	ACCOUNT RECEIVABLE	EXPENSE

**Table 2. Policy**

Price Range (VND)	Supplier	Broker
	Expense (X)	Revenue (Y)
Total-price-order < 100.0000	2.000	Depend product
100.0000 < Total-price-order < 1.000.000	5%	
Total-price-order > 1.000.000	3%	
		1.000
		3 %
		2%

# Mobile based languages learning application

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## Abstract

The world's largest taxi company, Uber, owns no cars. The world's most popular media company, Facebook, creates no content. The world's most valuable retailer, Alibaba, carries no stock. And the world's largest accommodation provider, Airbnb, owns no property. The app for learning languages, MOLA, own no schools, teachers or students, every single user is a source of knowledge. There are almost 3.2 billions people around the world connected to the internet (data in 2015), so the needs to learn, to study, and to be teach are very large. MOLA have focused on provide a system help users can learn and teach each other in any languages by stream video one to one.

MOLA provided tools help teacher can construct their courses (follow by structured or follow by topic), manage learner, manage schedule and earn money from knowledge they are selling.

For example, a foreigner want to travel in Vietnam, so he/she want to learn a few of sentences to talk with Vietnamese. MOLA will find the best native Vietnamese teacher for the foreigner to practice. Teachers and learner communicate and use tools MOLA provided for select the suitable time and practice by video call one to one.

## Keywords

WebRTC; Firewall[1]; NATs [2]; STUN [3]; TURN [4]; Collective Intelligence; Collaborative Filtering; Redis

## I. INTRODUCTION

MOLA aims to provide people around the world with a supported environment for learning languages. To achieve that goal, the application has to not only perform its business activities such as course management, scheduling and course registering, but also assist users in certain unique activities.

On learning time, MOLA concentrates on connecting the teacher and the learner via one to one video call. There are more problems around this function, as many features affect it, especially on mobile application environment.

## II. PROBLEM AND SOLUTION PLAN

When implement the MOLA system, we faded two big problems

### 1. Buy or build?

Video call is the mandatory function, so the system must be implement these things:

- Getting access input devices like microphone, webcam, camera to communicate audio and video.
- Not just audio and video, application should communicating arbitrary data in real-time.

- Connect to another endpoint across the internet.
- Bypass firewall and NAT.

At beginning, we find some platform as a services provide technology helps to communicate via video and audio in real-time. We did integrated to system and everything worked well. But soon we found the cost per minute used that services is not free, it cost \$0.003 per minutes not much, but we do some calculate when the system reach up to 1000 user, and the cost is significant.

After that, the team found WebRTC, a free open-source is supported by Google, Mozilla and Opera. WebRTC is which “enable rich, high-quality RTC applications to be developed for the browser, mobile platforms, and IoT devices, and allow them all to communicate via a common set of protocols”. We spent two weeks to study WebRTC and build a demo, it’s worked.

WebRTC provide peer to peer communication mechanism, which mean when A want to communicate with B, then A must be know the B’s address. To create a peer connection throws network between A and B, there are some limitations by firewall and NAT. STUN servers are used to get an external network address and to pass firewalls, so both A and B to determine their IP address as visible by the global Internet. If both the peers are behind the same NAT, STUN settings are not needed since they are anyways findable each other. STUN is effective when the A and B are on different networks. In the

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MOLA system, because the time restricted so we not implement own STUN server yet, currently we are using a free STUN server from Google.

## 2. Reliable Recommendation

Like other item-related businesses, MOLA needs to implement a mechanism to suggest its items – courses – to users. Collective Intelligence and Collaborative Filtering [10] can be applied to solve the problem. However, the following problems occur when the development team implements Recommendation algorithms:

- There are many factors which have influence on giving score to courses, not just plain rating. A formula is needed for balancing those factors.
- For users who do not have many interacts with the system's courses (mostly new users), an alternative method for recommendation is needed.
- It is difficult for newly created courses to approach users as they do not have many interactions. The formula needs to have some factors that create opportunities for those new courses.
- Recommending methods needs a re-organized dataset to work on. Building the dataset consumes a noticeable amount of resources. Therefore, if the dataset can be stored for later access instead of rebuild every time there is request, performance will be improved.

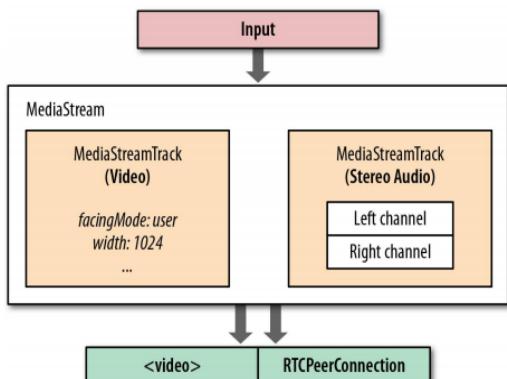
## III. PLAN IMPLEMENT

### 1. Integrating WebRTC technology

MOLA system used WebRTC implemented in JavaScript, WebRTC provided 3 main APIs:

- MediaStream (or getUserMedia).
- RTCPeerConnection.
- RTCDataChannel.

MediaStream API enables get a stream taken from camera and microphone input has synchronized video and audio tracks. Output could be passed to an html video element <video> or an RTCPeerConnection.



#### 1.1. *getUserMedia* method have 3 arguments:

- A Constraints object: such as aspect ratio, facing mode (front or back camera), frame rate, height and width video stream.
- A callback when success

- A callback when failure

When getting stream successfully, a stream result object passed in callback function, it's contains field 'label' such as:

'XUW7CLhsuHKKL2RWkW4yYKFJ5wONsgwIW9sP', and two MediaStremTracks; each has kind 'video' or 'audio' represented for either video stream or audio stream got from camera and microphone of input device.

#### 1.2. *RTCPeerConnection*

RTCPeerConnection API enables to create a connection between peers and communicate audio and video by get local media, such as resolution and codec capabilities. This is the metadata used for the offer and answer mechanism. All public API can find at Mozilla docs [5].

The RTCPeerConnection instance pc represents a WebRTC connection between the local computer and a remote peer.

Once this local data has been establish, it must be exchanged via a signaling service with the remote peer (mention as Signaling server section).

#### 1.3. *RTCDataChannel*:

RTCDataChannel allow exchange data peer to peer, in MOLA system the data is video, audio or arbitrary data.

### 2. Signaling server

The discovery and negotiation process of WebRTC peers is called signaling. Our proposed is to build a module called 'signaling server'. For two devices in different networks to find each other they need to use a central service called a signaling server. Using the signaling server two devices can discover each other and exchange metadata (describe as below). WebRTC does not specify signaling; different technologies such as WebSocket, Socket.io, XMPP or just simple done by using copy/paste.

In order for a WebRTC application to set up a 'call', its clients need to exchange information:

- Session control messages used to open or close communication.
- Media metadata such as codecs and codec settings, bandwidth and media types.
- Network data, such as a host's IP address and port.

The JavaScript Session Establishment Protocol [6] requires exchange between peers of offer and answer the media metadata mentioned above. Offers and answers are communicated in Session Description Protocol format [7], which look like this.

```

v=0
o=- 7537702454031608290 2 IN IP4 127.0.0.1
s=-
t=0 0
a=group:BUNDLE audio video
a=msid-semantic: WMS d9bb264d-9482-4a65-
9668-6f12e66f2944
m=audio 9 UDP/TLS/RTP/SAVPF 111 103 9 102 0
8 105 13 110 113 126
c=IN IP4 0.0.0.0
a=rtp;9 IN IP4 0.0.0.0
a=ice-ufrag:niwZ
a=ice-pwd:m0d9DTtBygiNr02004Usw8jx
a=ice-options:renomination
a=fingerprint:sha-256
19:4C:5F:24:C0:81:44:AD:E4:7E:4D:B1:19:1B:FE:C
0:01:27:80:D8:70:03:3C:E9:AC:71:59:62:41:EA:7C
:6D
a=setup:actpass
a=mid:audio
a=extmap:1 urn:ietf:params:rtp-hdrext:ssrc-
audio-level
a=sendrecv
a=rtcp-mux
...

```

Best solution signaling service for MOLA system is built with Socket.io on NodeJS. The design of Socket.io makes it simple to build a service to exchange messages, and Socket.io is particularly suited to WebRTC signaling because of its built-in concept of namespace and rooms.

For example, HieuLN represents the local peer (caller) and QuangNN represents the remote peer (callee). We can show the role of signaling server as diagram 1.

In diagram 1 the token is the metadata mention as above. It is an object contains SDP and some properties to recognize who are caller and callee. When step 6 finished. Signaling server's responsibility is done. WebRTC generated a connection to exchange data peer to peer.

### 3. Recommendation

#### 3.1. The scoring formula

The development team consider the following factors in determining the score of a learner to a course:

- Percentage of completed lesson by the learner on the course (called A in the formula). This will be the main factor which makes differences among users on the same course.
- Teacher rating, registration per week and price factors (called B, C and D consecutively in the formula) are stable for each course. They are also factors for new user recommendation method.

Moreover, existed time of the course (called E in the formula) will be the denominator in the formula. This not only makes an advantage for newer courses, but also motivates older courses to change for adaptation.

The standard formula to calculate the score of a

learner to a course is:

$$\frac{40\% \times A + 30\% \times B + 20\% \times C + 10\% \times D}{E}$$

The formula to calculate the score of a course to suggest for new users is:

$$\frac{50\% \times B + 30\% \times C + 10\% \times D}{E}$$

#### 3.2. Dataset Storage

Although dataset for recommendation can be processed and calculated from database, storing it would have certain benefits. For large amount of data, accessing from storage would be faster Conclusion:

After experiment many time, we conclude that WebRTC is suitable and worth for building real-time communicate applications. However, the quality of video and audio can be depend on network speed, so we not always have the highest quality and can be delay 500 - 2000 miliseconds.

Strengths:

- WebRTC has been widely used in several real-time services such as gaming, remote desktop applications, file transfer...
- Low cost for application, preinstall into browser, no need to install other plugins, add-ons...
- Peer to peer communication, no need intermediate server to transfer data.
- Encryption is mandatory of WebRTC, its implementations use secure protocols such as DTLS[8] and SRTP[9].

Weakness:

- Still under development.
- Not fully implemented for Safari browser.

#### ACKNOWLEDGMENT

This paper owes massive thanks to Mr. Nguyen Huy Hung at FPT University. He was always support us whenever we ran into a trouble or had a question about our project. He consistently allowed this project to be our own work, but steered us in the right direction whenever he thought we needed it.

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## 03#section-1.1

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# Office Lunch Delivery Mobile Based Application

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## **Abstract**

*Nowadays people's lives become increasingly busy, especially for office workers. Their lunch time is too limited, so they do not have conditions to enjoy a meal sufficiently. Currently there were some applications allow users to order food/drink online, but these applications have not resolved the problem completely. Hence, a solution is proposed: A mobile application that allows people to order food online, but more focused on the customer's office staff with a simple and convenient ordering process.*

## **Keywords**

*Office lunch; Delivery; Recommendation; Make order; Quickly; Nearby*

## **I. INTRODUCTION**

The problem that the office staff encounter here is they don't have much time for lunch. Beside spending time at lunch, people want to spend more time napping, so they do not have enough time to go to their favorite eateries. Currently, there are a number of applications that run on smart phone devices allows search for eateries or food according the user's preferences. These applications can be divided into two categories:

The application allows searching for dining places – Foody [1] - This application allows finding the restaurant, dining places by category, preferences, the user's location, along with the reviews, ratings, comments.

The application allows online ordering with delivery services – Now [2] - This application allows for searching restaurants, dining places according to the category, the address and the name of the restaurant. Then the user can order the desired dishes with a payment method (Cash on Delivery, Credit Card). Finally, the food will be delivered to the place for customers. Not only are the dishes, this application also includes items of food, flowers and cosmetics. There's also the in-home services such as laundry and maid.

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Instead of a general service and selling many types of item, we will focus more on office staff and the food. The system would give the fastest and effective service to users. To do that, the search engine is improved since getting dishes in flexible ways. The system uses 3 criteria for searching is recommended, newest, and revenue.

Besides improving search engine, the system would give a reasonable recommendation. The system recommender uses location, rating, and revenue for dish suggestion. To increase the convenience, the system suggests restaurants within a 2000 meter radius in priority. Users can choose the cuisine of many restaurants then conducted once only payment. This brings the convenience and simplicity of the ordering process instead of paying for each restaurant at once. Also the system integrates a number of online payment methods beyond traditional methods Cash on Delivery. Additionally, the application allows users to keep track of the process as well as the location of the delivery man to ensure the quality of service.

In Section 2 we formalize the problem and describe our approach to solving it. Section 3 describes the data structures that need to be set up and the algorithms. We analyze our algorithm in Section 4. Experimental results and the software used are described in the concluding Section 5.

## **II. PROBLEM AND SOLUTION PLAN**

We divided into the following main functions:

Search and Suggestions:

**Problems:** Because the lunch break of office staffs are very limited, so when need to order food outside. Requirements will be looking for the dish of the nearest restaurant. Since it can save a lot of time to wait for delivery. Additionally, each user has different characteristics, so the system difficult to suggest most reasonable dishes to the user.

**Solution:** The approach to solving this problem is gives some suggestions that help users search dish quick and easy:

- Weighted Score Recommendation: By using the Distance Matrix API (DMA) [3] of Google. This API allows calculating the distance the user's location to the restaurant. Since then filter out the list of the dishes the restaurant is located near the most users. Distance default to filter the restaurants will be 2000

meters. By the way, the system uses a rating of the dish and revenue of dish to suggest most popular dishes to the user.

- Item-based Recommendation:

This recommendation based on the similarity between dishes calculated using the user's purchase of those dishes. Based on that, users will be offered the most popular dishes that are usually purchased along with the dish.

- New Items Search Engine: This search engine given the latest dishes of the prestigious restaurant. How we define a prestigious restaurant? The prestigious restaurant has the average rating must be 3 or higher and the number of orders in the last 7 days must be over 50.

- Sales Search Engine: This search engine is based on the revenue of the food in a certain time. Thereby offering popular dishes that users might be interested.

#### **Ordering Process:**

Problem: When the user wants to order many dishes. However, these dishes belong to different restaurants. As the current applications (Now [2]) users are required to choose the dishes according to each restaurant. This means that users will have to pay for each restaurant. For example, when users order three dishes belonging to three different stores they will have to pay three times for each restaurant. Solution: Combine the dishes are ordered into a single order. Users only need to pay once. This order after sending the Server will be processed into small orders of each restaurant.

#### **Track Delivery Process:**

Problem: In the process from pending status until completion of the order. Users need to know the exact time of his/her order be delivered? How long is the delivery time?

Solution: By using Firebase Cloud Messaging (FCM [4]) which allows sending messages to smartphone devices. This allows the server to send a notification to users when their orders were changed status. In addition to support for tracking the distance and time of the user location to the location of the delivery man, we use the following solution:

- By using the Google Maps API (GMA) [5] and Google Directions API (GDA) [6]. GMA allows the use of Google's map data while GDA allows users to search and display the route on the map fairly accurately. Besides, it also provides estimates of the time and distance between two locations on the map.
- The Firebase Realtime Database (FRD [7]) is a cloud-hosted database. Allows storing data in real time. Based on that the current location of the delivery man will be stored at the FRD. Combined with the two above API users can constantly update

the location of the shipper to determine their current location.

#### **Online Paying**

Problem: In current high-tech life, online shopping becomes easier with online payment technologies. So beyond traditional payment methods (COD) application should also provide an online payment method other.

**Solution:** Integrated online payment method of PayPal allows users to easily pay when ordering.

## **III. PLAN IMPLEMENTATION**

### **1. System Architecture**

- Our system is developed based on MVC architectural style. We choose this architecture because of the following advantages:

- + We can organize the code better for maintainability, extensibility, and reusability
- + Business logic developers can build the classes, while the UI developers can involve in designing UI screens simultaneously, resulting the interdependency issues and time conservation

### **2. Database**

- MySQL
- + MySQL is very easy to use. With only a few simple SQL statements, you can build and interact with MySQL.
- + MySQL is designed to meet even the most demanding applications while ensuring optimum speed, full-text indexes and unique memory caches for enhanced performance.

- Redis is a fast in-memory NoSQL data store according to proven benchmarks. It helps:

- + High performance and linear scalability up to 1000 nodes
- + Acceptable degree of writing safety
- + Availability

In order to solve above problems, we apply technologies below, combine them into the algorithms which is described below

- Weighted Score Recommendation
- o Get the current position of the user
- o Calculate distance from user to the supplier
- o If user wants to get nearby dishes, the system will get all dishes of all suppliers which have distance from supplier to user smaller than or equal 2000 meters to be candidates. Otherwise, the system will get all of the dishes to be candidates.
- o Calculate weighted score:

$$\text{Similarity}(A, B) = \frac{|T|}{|A| + |B| - |T|}$$

Where:

a: Average rating point of dish (0 to 5)

b: Distance point of dish (0 to 5)

- 0 meter to 1000 meters: 5 points
- 1001 meters to 2000 meters: 4.5 points
- 2001 meters to 3000 meters: 4 points
- 3001 meters to 4000 meters: 3.5 points
- 4001 meters to 5000 meters: 3 points
- 5001 meters to 6000 meters: 2.5 points
- 6001 meters to 7000 meters: 2 points
- 7001 meters to 8000 meters: 1.5 points
- 8001 meters to 9000 meters: 1 points
- 9001 meters to 10000 meters: 0.5 points
- Above 10000 meters: 0 points

c: Revenue point of dish (0 to 5)

- 1/6 top revenue: 5 points
- Next 1/6 top revenue: 4 points
- Next 1/6 top revenue: 3 points
- Next 1/6 top revenue: 2 points
- Next 1/6 top revenue: 1 points
- Remain: 0 point

t: The number of hours the dish exists in the system

- + Sort recommend list by weighted score descending
- + The complexity of this algorithm is N
- Item-based Recommendation
- o Get current dishes to be recommended (A)
- o For each dish, get other dishes of the same supplier (B)
- o Count number of times A was bought, number of times B was bought and number of times both A and B were bought together.
- o Calculate similarity by Jaccard index formula:

$$Weighted(d) = \frac{0.5*a+0.4*b+0.1*c}{t}$$

Where:

A: Number of times dish A was bought

B: Number of times dish B was bought

T: Number of times both A and B were bought together

o Sort recommended dishes by similarity point descending

o In total, the complexity of this algorithm is  $N^{2-2}$

#### IV. ANALYSIS

In this section, we analysis the performance and functionality of 2 algorithms which mentioned below:

- Weighted Score Recommendation

The complexity of this algorithm is N

+ We execute Weighted Score Recommendation with environments above:

+ Data of dish's rating and dish's revenue are updated daily and stored in Firebase real time database.

+ After execution, we receive response after about 1.1 seconds.

- Item-based Recommendation

The complexity of this algorithm is  $N^{-2}$

+ We execute Item-based Recommendation and receive response after 1.9 seconds.

#### V. EXPERIMENTAL RESULTS AND CONCLUSION

Our system has solved the basic problem which is set from the beginning. Is a system that allows users to order online food along with a delivery service? The system focuses on objects as the office staff, so they can buy food from the shops outside quickly in conditions of the limited lunch break.

The system focuses on functions make useful and convenience suggestions for users. The accuracy of the data given by applying the algorithm 80% higher. Ordering process simple and convenient for users. Tracking delivery process that is less supported by other similar systems.

Besides these achievements is the system still exists some limitations: The system requires an Internet connection and the access location (GPS). The system has only been tested with a limited amount of data. So the inevitable happened capability data inaccuracies and performance when running in real-world environments with large amounts of data. Not yet implemented functions to optimize the path for delivery. Applications can only run on the Android platform, not be supported on other platforms.

#### ACKNOWLEDGMENT

We would like to thank to Mr. Nguyen Huy Hung for helping us define project scope and improving the functionality.

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# House Decor System

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## Abstract

We build the system to support customer to find home building services and home products with high quality and reasonable price. Our system also support supplier to sell more products and have more customer use services. For that reason, we create a website that achieve their requirements.

In order to satisfy customer's demand, we help them create idea books, buy products.

Customer can also make a review about the suppliers. For supplier, the system helps suppliers manage their online shop, their projects had built and notify suppliers about orders.

## I. INTRODUCTION

House is very important to everyone. In order to have a house as your wish, you will search for home services. So far, people select home service providers often through referrals of friends or relatives. This leaves the user with limited choice and more difficult in finding reliable service providers. On the service provider side, they are also limited in introducing their package services or products.

As a result, we built a system that helps people find the home service provider easier and the service provider will have more customers.

- The supplier of interior and exterior products has many, but the introduction of online products is limited because it costs to build and maintain a website.

- The problems of housing and the way of thinking in Vietnam are always carefully selected and specific authentication (for example: ask people who have just built houses, neighbors or find relatives). Private Websites are rarely found unless they are big, reputable companies.

- Customer services usually work in groups including contractors, builders, painters, electrician water. The customer only needs minor repairs, it is difficult to find the painters, electricians, service clean the house...

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## II. PROBLEM AND SOLUTION PLAN

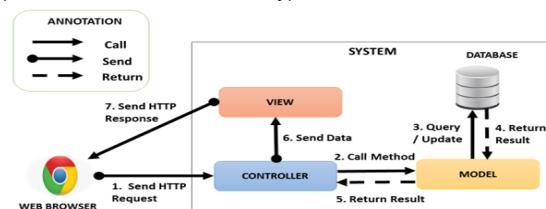
- In Vietnam, there aren't any home building services website.
- Cost to build and maintain a website is an issue that many suppliers can't introduce their products and services online.

Our proposed solution is to build a website online furniture retailer:

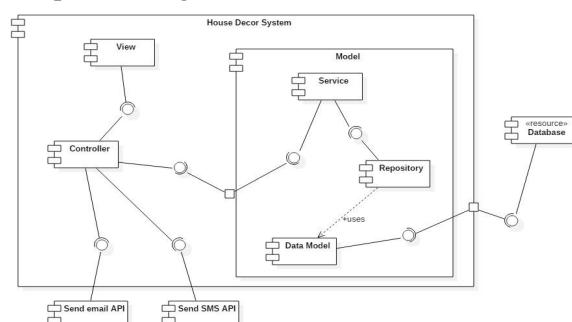
- Provide information and sell seller's products.
- Support to search for service providers: interior design, exterior, construction contractor, home repair services.
- It also supports users to upload designs, share ideas, stories related to the exterior and interior.

## III. PLAN IMPLEMENTATION

System architectural design:



Component diagram:



The algorithms are applied to solve the problems:

- Approve an idea book: (parameter: Idea book Id)
- Load all photos of the idea book by idea book id in "Idea Book Photo" table
- For all photos in photo list

If photo's status is waiting for approval then

Output: Error message

End for

End if

End for

Load the idea book by idea book id

Update idea book's status to approve.

- Tracking: (parameters: user Id, category Id)
  - Load tracking by user Id and category Id
  - If tracking is existed then
    - Update this tracking
  - Else
    - Create new tracking
    - Save new tracking to Database
  - End if
  - Load tracking is out of date by user Id
  - If exist tracking is out of date then
    - Remove tracking out of date
  - End if.
  
- Send promotion emails: (parameter: product Id)
  - Load product by product Id
  - Load category Id of product
  - Use category Id to find users matched with in “Tracking” table
  - If users are not empty then
    - Load emails of founded users.
    - Send promotion email to users
  - End if.

#### IV. ANALYSIS

In the previous sections, we described system architectural design and algorithm. In this section, we are going to introduce advantages and disadvantages of these ones. Firstly, we'll analyze benefits and limitation of using MVC architectural. Here are benefits of using MVC:

- Many MVC vendor framework toolkits are available.
- Multiple views synchronized with same data model.
- Easy to change or plug in new interface views, allowing updating of interface views with new technologies without overhauling the rest of the system.
- Very effective for developments if graphics, programming, and database development professionals are working in a team in a designed project.

Limitations of using MVC:

- Not suitable for agent-oriented applications such as interactive mobile and robotics applications.
- Multiple pairs of controllers and views based on the same data model make any data model change expensive.
- The division between the View and the Controller is not clear in some cases.

Secondly, we'll analyze advantage and disadvantage of using “Full-text search” algorithm.

Here are advantages:

- Indexing: full-text indexes can offer a lot more flexibility in terms of matching words, how close those words works together.
- Weighted result: A full-text index can encompass

multiple columns. For example, you can search for “table ZA16”, and the index can include a title, keywords, and a body. Results that match the title can be weighted higher, as more relevant, and can be sorted to show near the top.

Disadvantages of using this algorithm:

- Index can potentially be huge. For this reason, many hosted providers who offer database instances disable this feature, or at least charge extra for it.
- Full-text indexes can also be slower to update. If the data changes a lot, there might be some lag updating indexes compared to standard indexes.

#### V. EXPERIMENTAL RESULTS AND CONCLUSION

There are features be tested:

Guest: login, add product to shopping cart. (PASS: 8/9 test cases)

Member: check out order, create an idea book, add photo to idea book. (PASS: 10/13 test cases)

Professional: create a project, add photo to project. (PASS: 12/16 test cases)

Seller: create a product. (PASS: 11/12 test cases)

Admin: activate/deactivate an account, approve a photo in idea book, approve an idea book, and approve a product. (PASS: 11/12 test cases)

System: send notification to seller, send promotion to customer. (PASS: 3/3 test cases)

#### ACKNOWLEDGMENT

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# Virtual assistant for smart house

## *Deploying smart house in the current house in Vietnamese*

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### **Abstract**

In current society, Vietnamese families have chance to approach many smart devices such as air-conditioner, smart television, etc. However, smart house hasn't been widely applied in Vietnam because it's expensive and current devices in house can't apply for it. The big question is whether it is becoming popular in Vietnamese family. We were inspired by the idea that every traditional house with current devices can be transformed into smart house, so we have created a new smart house model to make it come true. We built a system with two featured functions: monitoring devices with configurations to support user's decisions and Vietnamese virtual assistant. First of all, we simulate our smart house solution on a model with some basic items as bulb, fan, bell, door to prove the possibility of the research. Then, we will develop next versions to improve our solution. There are many fields involve in our solution such as natural language processing, IoT hub controller, face detection and machine learning. Our solution is developed in Vietnam market which means provided configurations and virtual assistant are built to meet Vietnamese people needs only. In simple approach, we use small circuits attaching to house devices. The solution detail will be described in the paper.

### **Keywords**

*IoT; Microcontroller; Gateway; TF.IDF; NLP; HOG patterns; Neural Networks; Face recognition; State machine*

### **I. INTRODUCTION**

Smart house system has been implemented and provided by many different approaches. The first one is BKAV [1] smart house, which is implemented along with house construction.

By this way, new houses come up with a smart system and modern devices. However, it's quite high and hard to make traditional houses become smart without replacing devices. Another approach is using smart devices to control via smartphone. One of providers of this approach is LUMI [2]. They provide smart switch, sensor, device and house controller which supports control over smartphone. Our approach is using NLP algorithm to detect human intention in NLP sentence so house owners can control their house with natural language, specifically, Vietnamese. We also use picture analysis to detect people with purpose increasing security for house. We have a conclusion with a current solution doesn't help people, as well as an information system, can perform. For all the reasons above, we provide a solution which updates smart house system to help Vietnamese experiment industry 4.0.

### **II. PROBLEM AND SOLUTION PLAN**

We have researched all of documents about current smart house systems, analyzing their strengths and weaknesses. We find out that most of these system can't identify Vietnamese and devices which were used in smart house don't have a common connection standard. After that, we find factors and give out solutions to adapt Vietnamese. Our three key points of our system are: supporting identity Vietnamese command, applying face recognition and turning traditional houses into smart house without using smart devices or expensive system.

At first, we build a system which allows the customer to register smart house contracts. In the contracts, the smart house system will be set up as well as configurations and virtual assistant. The system will be implemented with gateway controller architect (Figure 6) and conceptual entity (Figure 7)

Our solution architecture contains a central controller which connects smart house gateways. Users can use this central to control smart house by touch or voice. We have 14 problems describe as below:

#### **1. Control device with control center**

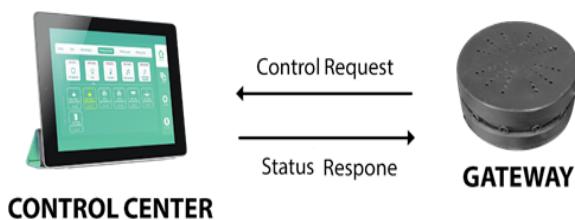
We develop control center base on an Android device but it doesn't have enough modules and features for controlling electrical devices. To solve this problem, we make a middleware device to connect these devices which called gateway:

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Defended topic in front of the scientific council of HCMC FPT University on August 23<sup>rd</sup>, 2017.

Accepted post on August 26<sup>th</sup>, 2017.



**Figure 1. Control Center and Gateway**

## 2. Control device with control center solution: Gateway

In embedded architect, gateway plays role as a device which collects and sends data to control center. Our gateway is used to control electric device and monitor sensor as temperature, lighting, etc. The gateway will connect to Wi-Fi and open a specific port for control center to collect data via TCP/IP protocol.

## 3. Control devices without remote control

Applying smart house into traditional houses means we must intervene house electricity diagram and attach a remote module on devices which have switches. This module provides a protocol that allows us toggle electric power to turn on/ turn off devices like bulb, fan, cooker, etc. All of us don't have an embedded knowledge enough to make a module for 220V electric as we need. Because of that, we have looked for some things like a smart switch. Luckily, we found TPE smart switch [3] as a solution. This is TPE module and how does it look after being inserted into traditional switch figure:



**Figure 2. TPE module**

After To control TPE, we make a sending 315 MHz RF module on the gateway. Then, we allow TPE learns control signal.

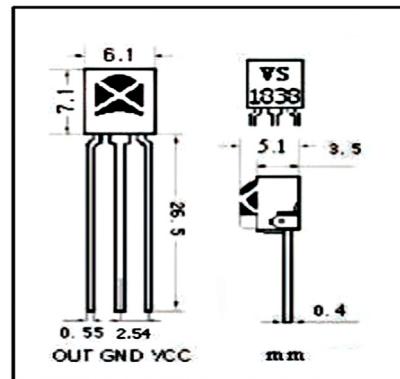
## 4. Remote module solution: TPE smart switch

TPE smart switch has 2 main items: radio frequency (RF) module and relay module. The switch uses RF module to send and receive frequency protocol and control relay to toggle the electric power. By using TPE smart switch, we can control traditional switch by any device which can send 315 MHz RF in range 50m.

## 5. Control remote devices

Remote devices have already contained modules which can receive infrared and control itself. In gateway, we use IR LED module to control these devices. However, it's hard to know protocols of

these remote devices like TPE module. To solve this problem, we use IC 1838b [4] to read infrared data. This is 1838b module pinout figure:



**Figure 3. IC 1838b**

## 6. Get infrared protocol solution: IC 1838b

IC 1838b is connected with Arduino to read infrared signal of device. This data is saved in gateway, after that we generate the same infrared signal to control that device.

## 7. Security camera detect people

Smart house does not only control device but also detects house status such as having guest visit, thief intrusion, owner arrive from home, etc. We need to implement a feature which can get pictures from security camera to detect people. Many security cameras can detect human face but they don't public API to get pictures. We decide to simulator camera by using Android smartphone.

To detect faces in a picture, we use a picture analysis algorithm. It converts the picture into object patterns and compares them with human face pattern to determine the number of faces appeared in the picture. In 4 months, we don't have enough time to implement this algorithm with high accuracy but Google Cloud Vision API [5] is a candidate for us. We build an Android application that uses it and camera API to detect human faces.

Google Cloud Vision API is based on Face Detection Concept [6]. This concept has some terms: Face recognition, Face tracking, Landmark and Classification. Face recognition automatically determines whether two faces are belonged to the same person. Any face appearing in a video can be tracked. That is, faces that are detected in consecutive video frames can be identified as being the same person. A landmark is a point of interest within a face. The left eye, right eye, and nose base are all examples of landmarks. Classification is determining whether a certain facial characteristic is present. For example, a face can be classified with regards to whether its eyes are open or closed. After receiving detected human face, we use it to detect person. First, we need to train an amount of

person, particularly, we use an analyze algorithm to split every faces into special features. Second, we repeat this algorithm to find special features with new picture. Finally, we compare the features got from new picture with existed features in the database and choose the person with the highest result. As well as the previous detect face algorithm, we do not have enough time to implement a full solution for a detect person. Then we decide to find some API which can help us to realization this solution. As a lucky charm, we found Microsoft Face API [7] which meet our requirement.

## 8. Recognition person solution

Microsoft Face API is a cloud-based service that provides the most advanced face algorithms. Face API has two main functions: face detection with attributes and face recognition.

Face Recognition is widely used in many scenarios such as security, natural user interface, image content analysis and management, mobile apps and robotics. Four face recognition functions are provided: face verification, finding similar faces, face grouping, and person identification. In our system, we use person identification function. This function can be used to identify people based on a detected face and people database [8].

People database consisted of three main terms: Face, Person and Person Group. Face: is a picture of person's face. Each person can have different face pictures present by a unified identity (Face ID), a specified region in images (Face Rectangle) and extra face related attributes such as age, gender, landmarks and head pose. Person: is a person in real life, each person is stored with a Person ID, and other attributes such as Name, a collection of Face IDs, and User Data. Each person has a maximum of 248 faces. Person Group: is a group contains many people. A Person Group comes with a Person Group ID and other attributes such as Name, User Data.

The following figure is an example of a Person Group named "nguoinha". Each group may contain up to 1,000 person objects. Meanwhile, each person object can have one or many faces registered.



**Figure 4. Microsoft Face API - Person Group**

After a person group has been created and trained,

identification can be performed against the group and a new detected face. If the face is identified as a person object in the group, the person object will be returned.

## 9. Recognize human voice

Our solution allows user to control their house by voice commands. We need to transfer human voice into words for analyzing process later. Human voice is represented in computer under frequency data so we base on that theory to make an classify algorithm which compare each input voice segment with saved segment pattern to detect which words correspond with this specific segment.

The concept is the same as identify person face concept before. We use an algorithm to analyze frequency of each words. Instead of implement this algorithm, we use Speech to text API [9] available on many Android device as alternative choice. We think its mechanism is not only similar to our concept but also accuracy and stable. With these reasons, we decided on using it to save our resource.

## 10. Recognize human voice solution:

### Recognition Google API [10]

This Google API enables developers to convert audio to text by applying powerful neural network models in an easy to use API. The API recognizes over 80 languages and variants. It will give the best result when we provided sound data with rate of 16,000 Hz or higher. The output of API is converted text. Recognizer is designed to ignore background voices and noise without additional noise-canceling. However, for optimal results, we should set microphone near speaker as close as possible [11]. In this case, we set microphone with maximum length 10cm.

## 11. Detect natural language processing intention

After converting text from human speech, we use an algorithm to detect human intention from the text. When we research about human reaction, we recognize that Vietnamese tend to use simple input sentences contain keywords. For example:

“Hôm nay ngày mấy rồi?” → ask about date

“Cậu thấy nóng hay lạnh?” → ask about temperature feeling

“Cậu bật giúp tôi cái đèn” → turn on the lamp

Depending on the research, we created a mapping algorithm which detects intention correspond to each sentence. However, it's not easy because there are many case the key word has more than one intention. For example, with “ngủ” word below:

“Cậu ngủ ngon nhé” → goodnight

“Máy lạnh phòng ngủ có bật không?” → ask about status of air conditioner in bedroom

We think that an intention should be detected by

connect all words in a sentence. Another case which helps us come up with big idea is the using of “muôn” in regions of Vietnam. In Northern of Vietnam, “muôn” is used to call a ladle but it isn’t used in Southern. In Southern, people call “vá” instead of “muôn”. The explanation for this case is factors such as geographical distance, culture, history, nearby regions, etc. Inspired by that fact, we are going to build an algorithm which calculate intention score of each word. This score will be increased or decreased by amount of training sentences At detection phase, we use “Term frequency Inverse document frequency” formula to calculate TF.IDF[12] score (which called detection point later) of each words corresponds to each intent.

## 12. Detect natural language processing intention: TF.IDF formula

This formula is a classifying term by document algorithm. In our solution, we apply term for NLP words and document for NLP intent. The formula is described as below:

TF.IDF formula:

$$w_{i,j} = tf_{i,j} \times \log \left( \frac{N}{df_i} \right)$$

$w_{i,j}$  = TF.IDF score of i with j, in which i represents term and j represents intent.

$tf_{i,j}$  = number of occurrences of term i in intent j.  
 $df_i$  = number of intent containing term i.

N = total number of intent.

In which, TF formula:

$$tf_{i,j} = \frac{\text{Occurrences of term } i \text{ in intent } j}{\text{Number of terms in intent } j}$$

## 13. Automatic configuration

In our solution, smart house means it can control itself when house owner isn’t available. Automatic configurations were defined as a standard for most smart houses and they will be customized to meet house owner’s requirements. This model contains many commands which will be triggered when house status match conditions. For example: When security camera detects stranger in house and door is opened, the system will send an alert message to house owner. In case of he/she doesn’t have any response within 1 minute, alert bell will ring.

It makes us think about state machine model. This model has many states. Each state has some automatic commands that will be triggered if user didn’t response within delay time. Then we choose it to implement for our case.

## 14. Configuration solution: state machine

There are many variable of state machine such as finite-state machine [13]. With:

**Table 1. State machine**

	Name	Delay	During
Detail	Name of state	Amount of time waiting the current state changes to new state	Amount of time exist of current state
Example	“Phát hiện cháy”	0s	forever

**Table 2. State condition**

	Name	Next-State	Previous-State	Priority
Detail	Name of condition	The state after condition executes	The state before condition executes	The weigh point allows which condition will be executed
Example	Door open	“Có người trong nhà”	“Người quen vào nhà”	1

## III. PLAN IMPLEMENTATION

### 1. Control device with control center

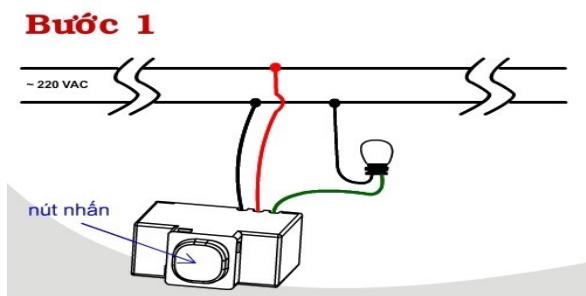
We build an android application for user to control and manage their smart house. At the first time, the application will connect to server to get smart house contract’s information that was registered before. User uses the application to control and monitor devices as well as to interact with virtual assistant. It is supposed to be a central solution for smart house. It receives information from Gateway combines with state diagram model in order to create control configurations. Our server is organized to prevent system attack. It also support customers when they want to update their smart house information automatically from server without staffs come home. Components of Control Center include: auto configurations, information of device and virtual assistant. Control Center communicates with Gateway through WiFi via HTTP protocol. It is developed based on Android so we use Face recognition and Speech recognizer API of Android. User uses an account provided with contract to sign in into Control Center. Every device which connects with Control Center has been configured by staff before provide the system for house owner.

Therefore, they can control and monitor device as soon as login first time.

Control center is developed with concept of a virtual assistant so it must be always listen user's speech to detect when user want to give command. To do that, we build a background service for detecting keywords like: "em oi", "câu à", etc. Because TCP/IP has often delay time and congestion can cause losing data package so we develop the app using asynchronous technique. Every command sent by Control Center will be pushed into stack to avoid data package congestion.

## 2. Control devices without remote control

We choose Remote control switch (TPE) with pinout schema figure below:



**Figure 5. TPE module pinout schema**

Notice that while TPE is set up, fuse must be turned off. We replace traditional switch with TPE according to the figure. Pressing button on TPE and using control center to allow gateway learning TPE turn on/ turn off signal.

## 3. Control remote devices

Control remote devices require us to get its infrared signal data. We provide a signal library on web application, which used to save and find collected infrared signal.

There are a large amount of remote on market, but at the current, we will serve only common devices such as LG air conditioner, Casio Projector, etc. Day by day, this library will have ability to serve most of devices in market.

To read infrared signal, we use IC1863B [14] chip and Arduino. IC1863B will read infrared control signal of device and do it with others common function's device. For example: with air-conditioner we have turn on/off devices, increase/ decrease temperature of devices.

## 4. Security camera detection people

In this research, we build a CameraIP Android application. This application makes use of smart phone camera to simulate real security camera. Picture is captured and sent to Control Center every fixed amount of time automatically. However, the problem is performance of system will be decrease if pictures are sent to Control Center continuously. So the application was programmed to just send picture

when it detect there is face in the picture. Control center has a mission is detecting who in the picture. Our simulator version uses real time face detection library (Mobile Vision API [15]) which can run offline on Android. It turns smartphone into camera with only one purpose is capturing picture when a face is detected. This picture is added to queue and sent to control center. Control center uses it as input of Microsoft Face Recognition API. The delay time between two shots is 1/8 second, this will avoid affecting the device and uptime application. This interval is enough for tracking a face using Google API. The application connects to Wi-Fi and transfers picture to Control Center via TCP/IP protocol. In practical, we will use HIK Vision camera [16] which can send a picture to local storage.

## 5. Face recognition

This API is used in mobile application and Control Center.

Mobile application is implemented functions: managing Faces, managing Persons, managing Groups. New Person is created and updated by house owner. Different smart house systems have different Microsoft API subscribe-keys.

At Control Center, we implement face identification. A queue is created on Control Center to receive pictures from CameraIP application. Each picture on queue is used as input of Microsoft face API. Detection phase processes in 3 steps. First, Microsoft server save new picture and returns the ID of this face on its server. Second, this API returns the person ID which detected from new picture. Finally, we use this ID to compare in local which already loaded person list from Microsoft. We decide to select only detect results which has confident rate greater than 0.65. The person list on Control Center is synced automatically when house owner updates acquaintance list on mobile application.

## 6. Recognize human voice

We use Speech Recognition API of Android with following steps: First, downloading Vietnamese language data into Android application. Second, setting up API on application to listen and recognize Vietnamese speech. Each time API is called, it returns a sentence converted from input speech. This sentence is used to process natural language.

## 7. Detect natural language processing intention

Virtual Assistant training data is stored in a spreadsheet file with 3 column structure:

**Table 3. Training file format**

Human intention	Human sentence	Intention type
String required such as showCamera, askTime, askWeekDay, turnObjectOn, etc.	String required such as “mở camera lên”, “show hình ra”, etc.	2 options value: “function”, “social”

Human intention is intention of sentence in natural language. Human sentence is a sentence in natural language. Intention type is type of intention in natural language.

TF.IDF formula is applied to calculate detection score for each letter of human sentences in data file. Calculated data are saved in database of server. Control Center downloads this data for recognizing natural language process. Server provides a feature for staff to validate data. The detection process run through steps: First, split word by word, list related intentions detection scores greater than 0 for each word. Second, sum up all detection score of detected intention, choosing intention that has highest detection score, running corresponding function in control center. Furthermore, house owner can train their virtual assistant to match their personal needs.

## 8. Configuration state machine

A state machine have 2 mains elements: state and event. In our smart house system, we define many states such as: owner in house, stranger detected, guest coming, etc. With each state, we have many conditions, each of them has a priority point and a pair key-value which stands for condition name and its value. Correspond to each state we define suitable command with specific house system. When some events which match a condition occur, house system will change state. Then, commands will execute automatically or manually depends on owner control. If owner doesn't response to configuration, commands will wait for a specific time defined in state before they execute. Finally, to avoid the system will be stuck in any state and cause some higher priority condition is missed, we define the during time in each state which make the state can roll back and check smart house status again.

## IV. ANALYSIS

In this paper scope, we implement Control Center on an Android device which has 2GB of RAM and 1GB of ROM. After doing system test we have some analyze and risk assessment below:

### 1. Gateway:

Our gateway uses ESP8266 Wi-Fi module [17] made in China. This module is not only unstable

but also having no FCC certificates. Sometimes, gateway can lose connection, this is unavoidable. There are some ways to make gateway stable for a long time but it requires many technical skills about power resource and anti-jamming. Because of our limited resources, we use the highest version of this module to decrease risk significantly.

Many sensors still connect with gateway via wire. Although it isn't very practical, it meets requirement of research scope. Wireless sensor can be replaced easily but it is expensive and doesn't make the result better.

### 2. TPE remote switch

We use third party module which is provided from a specialize company. They have done the release version of this module. Almost 100% of the time the TPE works fine. It also has reasonable price for Vietnam market.

### 3. Infrared remote control

We have tried to read infrared signal and control some popular household remote device brand as LG air-conditioner, Casio projector, Daikin air-conditioner, etc. The signal data work fine and IR module is stable but infrared only travel on straight line. Therefore, the sending module must be placed opposite devices to increase accuracy.

### 4. Security camera detect people

After testing the Google Vision API with following result table, we see that the API gives best results when:

- Distance between human face and camera is [1, 4] (m):
- Camera capture speech is 12 fps.

Then we have set up this API to get the best configuration. Our security camera is just a simulator version so we don't mention power resource problem or camera stability.

### 5. Identify person

Microsoft Cognitive API can identify person with following requirements: JPEG, PNG, GIF(the first frame), and BMP are supported; image file size should be larger than or equal to 1KB but no larger than 4MB; the detectable face size is between 36x36 to 4096x4096 pixels; a maximum of 64 faces could be returned for an image.

Our solution will connect to camera was placed in front of door where there usually capture less than 20 persons. The size of picture have scaled less than 1MB before applied API so we will get the high accuracy of identify person. We have collected the speed of this API based on internet bandwith.

Microsoft face recognition [18]

**Table 4. Microsoft Face Recognition speed test**

Network type	Speed (face recognition)
Wi-Fi Network (Ping 3ms, Download: 36.61 Mbps, Upload: 41.53Mbps)	1.386s
4G Network (Ping 18ms, Download: 8.84 Mbps, Upload: 8.44Mbps)	1.589s

**Table 5. Microsoft Face Recognition distance test**

Distance (meter)	Rate of face tracker (%)
1	96
2	91
3	85
4	80

## 6. Recognize human voice

Google Speech Recognition API is used popular in many applications as keyboard, Google translate, etc. So we think that the API will have high accuracy. Moreover, it's also support Vietnamese.

## 7. Detect natural language processing intention

TF.IDF has been used for many years as a text mining formula. So we believe in the meaning of this formula. We have done some demos which apply this formula to detect NLP. The demos met 85% our willing. The better training data is imported into system, the better system can detect NLP.

## 8. Configuration state machine

After installed configurations on smart house system, we need to make sure those configuration run exactly. Over a few test result, we recognize configuration depends too much on gateways and sensor. Once gateway or sensor not working, configuration won't run successfully. We have deploy two configurations:

- Detect fire by smoking sensor
- Detect thief via camera and door sensor. (Fig. 3)

## V. EXPERIMENTAL RESULTS AND CONCLUSION

We have done system test in a real house with 4 different TPE modules, LG air-conditioner and Casio projector.

Regarding hardware, the result of controlling device we received is described as below:

- Best range control TPE: 15m +5
- 98% of times that TPE switch is toggled
- 25% of times that gateway lost connection
- 90% of times that IR signal touch device

Considering the testing result and our mentor's opinion, we predict that the system quality could be

improved by using USA modules instead of Wi-Fi module and Arduino MCU.

In terms of personal face detection, we got the following result with previous training plan: <https://goo.gl/JpvAj6>

Even though the experiment turned out with good results, performance still has some significant problems. Used online APIs, our system is depended on the speed of internet. For this reason, we implement a local detection inside control center to fix this problem. It will cost approximately 500MB of disk memory on Android device.

About NLP detection, we have ask virtual assistant 1000 sentences and got the following results:

- 97% of times virtual assistant can reply user.
- 77% of times virtual assistant can detect what user say.

After implementing training phase and detection phase, we discovered that virtual assistant could work more effectively if its detection phase was combined with state machine. However, within the limitation of this project, we will consider to improve our solution plan in the future.

In conclusion, we create a connection between Vietnamese and smart devices via Virtual Assistant. We realized that so many people loved this new approach through video's views and project's survey. Transforming from traditional house to smart house has surprised many Vietnamese. In reality, we also see that some big technology companies have released their solutions which are closed to our idea. In case of system attack, customer could stop the system by deactivation feature or trigger safety configuration. Besides, our system is very convenient in terms of installation. It only takes 1 hour on average to set up for 3 rooms. The price is also affordable allowing people to live more comfortably with this new life style.

## ACKNOWLEDGMENT

First and foremost, we would like to express our greatest gratitude to Mr. Kieu Trong Khanh, our supervisor, for his support and guidance during this project, especially in fulfilling project requirements and improving project's quality.

In addition, we would like to send our special thanks to all FPT University Lecturers who have taught and guided us from the very beginning. This has been a great instruction in this strenuous journey.

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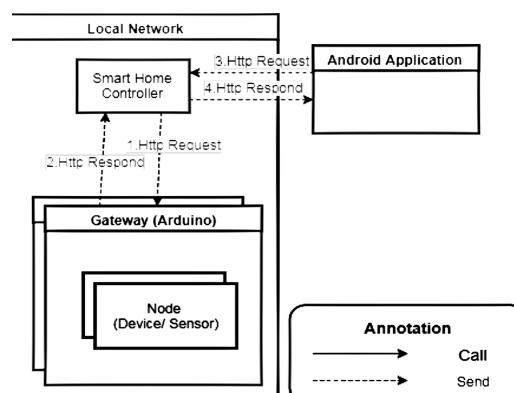


Figure 6: Gateway controller architect

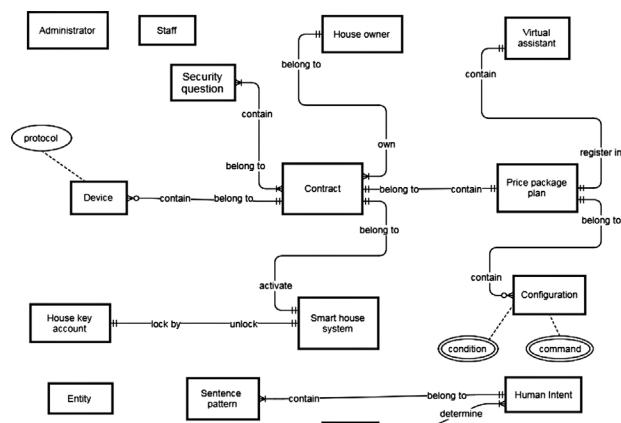


Figure 7. Conceptual diagram

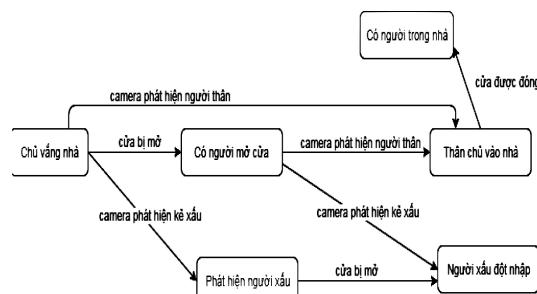


Figure 8. Detect thief via camera and door sensor

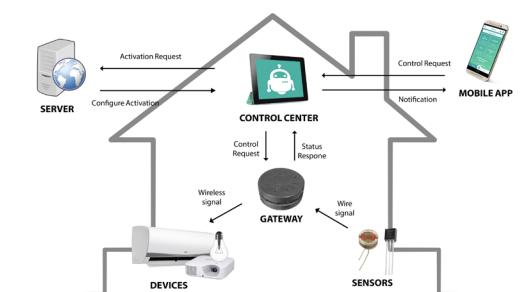


Figure 9. System Overview

# Timekeeping and Labor Payroll Systems in factories

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## Abstract

*Currently, many companies have equipped systems that help manage attendance and payroll, but it is not yet convenient to deal with regulatory or legal issues. Besides, the application and approval and settlement of absenteeism, overtime is still not flexible.*

*Our system offers solutions to such problems, making it easy for companies or factories to manage employee shifts, and flexible when payroll formulas change through the processing of files. Attendance data is included.*

## Keywords

Time keeping; Labor Payroll; Real-time Notification

## I. INTRODUCTION

Timekeeper is an important process of a company or a factory, collects employee time and attendance, collects time for work, late work, late or vacation.

In the past, factories often needed a person to stand out to record books, mark when the workers enter and leave each shift. It is very time-consuming and can not specifically measure requests such as overtime, time spent over a specified period of time, workers (or employees) seeking leave or How does shift resolution work, notify the superiors and managers how to solve it? ... There is at most much information that needs to be collected and stored to handle a lot of extra work and convenience. For the development direction of the company / factory, there should be a system to help manage employee information, reasonable and payroll, pay easily.

After a period of time finding out how to work and pay for some companies, factories, especially Intel, we have a payroll solution based on the available attendance data file and salary calculations request. At the same time, we also find a way to address the complexity of the wage formula when the laws

governing workers change, albeit in a short period of time, these factors do not change. much. In addition, the solution for taking leave, OT day conversion of employees is also included in this system, especially intuitive and well managed thanks to real-time notification. Whenever a party requests or solves a complaint, the system informs the known or resolved employee, manager or human resource.



Figure 1. HR's task today

## II. PROBLEM AND SOLUTION PLAN

During the implementation of this project to produce a complete product, we encountered many issues related to timekeeping and payroll. Not only that, the actual demand has also made us change the design many times to meet as much as possible, but can not avoid the mistake

We list the issues we encountered during the development of this system, followed by our own views to address them.

The first form of timekeeping of companies or factories is not the same. There are companies that choose fingerprints, picking cards using magnetic cards, depending on how they are managed and how they work. Here, our system only manages the “check in or check out” hours of an employee based on the attendance file available. That means we will not interfere with attendance.

Since then, attendance data files are inconsistent. There are factories that prescribe the format of this file according to their attendance system. Here, we offer a form of file save results using excel in your

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system. If the company or the factory has files in their own format, we will revise the system accordingly. Regarding the wage calculation formula, we tried to make it as flexible as possible to deal with when wage regulation changes. In the future, we will take a salary calculation into a separate function - where the administrator can add, edit or disable each item in the formula and completely save the changes. shallow.

For employee leave requests or OTs not to be missed, we recommend the “Notify” function. This function is displayed in the top left corner of the system via the “bell” icon. When the manager receives the request, the number next to “bell” is the number of forms to browse. As soon as the manager browses the form, employee will also receive a message similar to whether their form is approved or not.

### III. PLAN IMPLEMENTATION

Our system builds on the MVC design model. We chose this model for the following reasons:

- We can separate business code with Controller and View. Therefore, we can use the business code in web service without repeat the code.
- We can organize the code better for maintainability, extensibility, and reusability.
- MVC architecture makes it easier to split the big project into small modules and make it easier to assign each module.

On the algorithm, our system chooses the simplest way to solve the payroll problem based on the available formulas.

### IV. ANALYSIS

In the previous sections, we talked about the design and construction of the Time Attendance and Payroll System (TLPSC). In this section, we will explain why choosing such design methods, besides their limitations.

First, we chose the MVC model (MVC architectural) because:

- Many MVC vendor framework toolkits are available.
- Multiple views synchronized with same data model.
- Easy to change or plug in new interface views, allowing updating of interface views with new technologies without overhauling the rest of the system.
- Very effective for development of graphics, programming, and database development professionals are working in a team in a designed project.

However, the MVC model also has some limit:

- Not suitable for agent-oriented applications such as interactive mobile and robotics applications.
- Multiple pairs of controllers and views based on the same data model make any data model change

expensive.

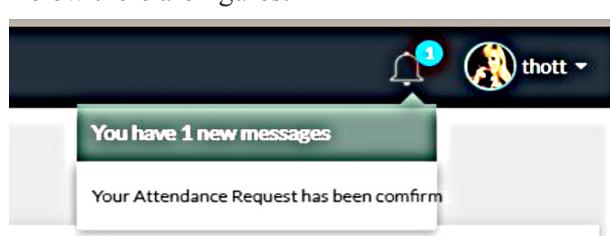
- The division between the View and the Controller is not clear in some cases

We also chose to manage requests via real-time because:

- This solves the application very intuitive and fast. Manager is currently logged on, the request will be notified immediately.
- Send or review the application are saved along with the execution time. This helps to manage the work progress better, as well as the basis for calculating the level of the manager's job or employee response time.

### V. EXPERIMENTAL RESULTS AND CONCLUSION

With the issues mentioned in section 2, we have implemented successfully some important functions such as: submit and approve applications for leave and OT through Notification; Show monthly salary chart; Payroll based on attendance file is included. Below there are figures:



**Figure 2. Real-time Notification**

### ACKNOWLEDGMENT

We would first like to thank my thesis advisor Mr. Ngô Đặng Hà An at FPT University. The door to teacher an office was always open whenever we ran into a trouble spot or had a question about my research or writing. He consistently allowed this paper to be our own work, but steered us in the right direction whenever he thought we needed it.

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Finally, we must express our very profound gratitude to my parents and to my family and our teammates for providing us with unfailing support and continuous encouragement throughout our years of study and through the process of researching and complete the capstone project. This accomplishment would not have been possible without them. Thank you.

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# Papers of Economic Sector

# Evaluating the Student's Satisfaction of On-The-Job Training Program at FPT University

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## Abstract

The study gives an overview of the internship's current situation at FPT University and proposes a model count four factors that influence the students' satisfaction forwards the OJT program, include: job characteristics, working environment characteristics, faculty advisor and contextual factors. The research method includes both qualitative research (in-depth interview and focus group) and quantitative research (survey). The valid sample size of the survey is 306, with respondents who experienced or are in OJT program. The key findings of this paper include that the FPT's student are still not satisfied absolutely with their internship semester. In addition, there are differences between the SB student and SE student in satisfaction of OJT program.

## Keywords

On-the-job training; Internship program; Student Satisfaction; Job Charatersitics; Work Environment Characteristics; Contextual Factors; Faculty Advisor.

## I. INTRODUCTION

In 1906, the first internship program was created in the United State in the Accounting Department at the University of Cincinnati. Till 1999, over 80% of university and college seniors completed at least one internship experience. The figure of colleges and universities offering co-ops or internships rises from 200 to 1,000. (Huhman, 2013) [12].

Generally, the universities in Vietnam usually organize the internship program for senior students before starting their own careers. However, particularly, in FPT University, there is a totally different internship program when it only starts for FPT students in third-year.

On-the-job training model at FPT University requires that 100% of junior student (in 6th semester) must involve in businesses from 4-8 months to gain practical experience. The difference between FPT University and other universities is that it is in close linkages with businesses, combining practical training with research and development and state-of-the-art technology. Modern philosophy and methods of education; the program is always updated and complies with international technology standards; Special emphasis on foreign language skills; Enhanced production process training, teamwork skills and personal skills. To ensure graduates have the best job opportunities after graduation.

According to DAN TRI (2017) [5], a Doctor and Chairman of the board of FPT University Le Truong Tung said: "The training program of FPT University has an "Entrepreneur" course, and there is a special course called On the Job Training (OJT – learning in a practical business environment), which is conducted after 5-6 professional semesters. OJT does not only aim to increase practical skills or workplace environment feelings, but also allow students to experience the "worker" timescale to learn how to "master" the job. Then, they will realize what they need to enhance and add some indispensable knowledge in the remaining 2-3 semesters at school". In fact, there is no the research on the level of satisfaction as well as the criteria for the practical internship programs of the universities in Vietnam. There has not been any investigation or feedback system for FPT student after returning the school from the previous to the present finished OJT course (10C course). As results, the authors will examine and point out a specific model by applying some previous researches which relate to the universities' OJT programs in several nations.

Moreover, OJT program is a part in "training program" which is one of the criterias to evaluate the ACBSP, so the purpose of this research is to develop the reputation for FPT University by understandings about students' satisfaction forward the OJT program and after that, FPT University probably creates the suitable methods to enhance and complete their OJT program for students.

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## **II. THEORETICAL BASIS & LITERATURE REVIEW**

### **1. Theoretical basis**

The student is just another kind of customer who is a consumer of the education service. Therefore, most of the literature on service marketing will apply. According to Elliott and Healy (2001) [7], the student satisfaction is generally considered as a temporary attitude which known as the final result from an evaluation of a student's education experience. Similarly, student satisfaction is described as the subjective evaluation of student to the several outcomes and experiences related to education and it is continued to be shaped by repeated the experiences in higher education life (Elliott and Shin, 2002) [8]. According to Bowman (1987) [2], "on-the-job training" is a term referred to organized instruction at the job site. Besides, Scott Snell (2007) [15] also defines on-the-job training as a method by which employees are involved in practice experience with instructions from their supervisor or other trainer. It can be seen that "internship" or "on-the-job training" is considered as a training which someone is engaged in practical working environment and gets an opportunity to apply their technical knowledge in order to perfect their skills as well as career path. So, both of these terms are interchangeable completely. For more details, in academic and research field, various definitions are provided on the concept of an internship.

Regarding benefits of internship, a study by Mihail (2006) indicated that internships help students advance the critical core skills demanded by international contexts (communication, time management, self-reflection, self-confidence and self-motivation) and identify their future career perspectives while they are still in university. Students not only learn further practical views on the subject, but they also improve their overall academic performance from the real world situations.

To sum up, according to Kaseorg and Pukkonen (2015) [13], the university department normally originates the internship program and sets the processes that are needed for student to maintain and improve through knowledge exchange. Students need to concern an internship in respect of their long-term goals and objectives, such as identifying a career in their field of interest.

### **2. Literature review**

In 2008, Bao and Fang [1] carried out a study on students' satisfaction level toward their internship experience in the hospitality and tourism industry. By using a quantitative approach, they identify the five underlying factors of their overall satisfaction (Job itself, Superior, Training and development, Pay

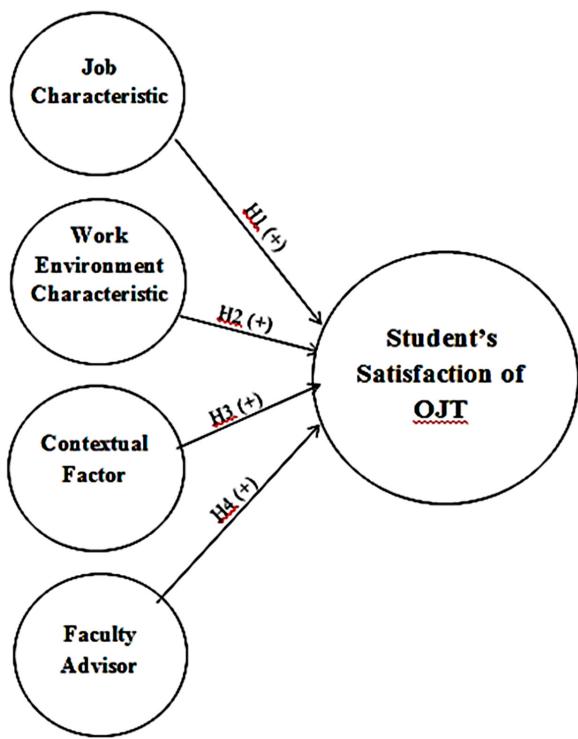
and welfare, and Peer relationship) along with 24 internship variables measuring scale. Interestingly, the student's overall satisfaction mean scores were low base on the results of this study, which means that students were dissatisfied with their internship experience, especially on the following items: coordination between schools and employers, opportunities for self-development, pay and welfare, work pressure, opportunity for work rotation, interesting and challenging work, and autonomy involved in the work.

For Student Satisfaction, it has three underlying factors: satisfaction with the project, satisfaction with the company, and satisfaction with the university. Research finding indicates that student satisfaction was the result of three process constructs: Project Progress Feedback, the Faculty Advisor Role, and the Student's Learning. The Faculty Advisor Role represents as the university's role, and Student Learning stems from the motivation by the student to learn. Moreover, the authors found the coefficient for Faculty Advisor Role is much larger than the other two. So, it reveals that faculty advisor was important individual item in determining student satisfaction such as faculty knowledge of the project and interest in the student.

In 2009, D'ABATE et al. [6] conducted "Making the Most of an Internship: An Empirical Study of Internship Satisfaction" article. They measured satisfaction of interns by looking at three big factors: job characteristics, work environment characteristics, and contextual factors, which contribute to internship satisfaction. As a result, it is crucial to understand what aspects of these experiences make them the most worthwhile.

Besides, the results of this study show that characteristics of the job (specifically, task significance and feedback) and characteristics of the work environment (in particular, learning opportunities, supervisor support, and organizational satisfaction) were the best predictors of internship satisfaction. These findings can assist business schools, faculty, and companies in making an internships experience for student as satisfying as possible.

### **3. Framework Model**



**Figure 2.1. Preliminary Theory Framework**  
(Source: authors)

### III. METHODS AND DATA

#### 1. Research Approaches

Authors deploy qualitative and quantitative research in this study.

According to Hair et al. (2010) [10], the qualitative research is a data collection method in the form of the text or image by using open-ended questions, observation of “found” data. This research often exposes unpredictable findings and reactions. It aims to reach the preliminary insights into research problems. This kind of research always collect detailed data from comparatively small sample size by asking questions or observing behaviors. Likewise, it could help define constructs or variables and suggest items that can be used to measure those constructs. Researchers will rely on open-ended questions to analyze the data. The data collected will be interpreted in the transcript and the material recorded. It will provide information for the report. Using unstructured interviews helps in gathering some research question and information to fit the topics. The results from this approach are more accurate because this method creates a comfortable atmosphere for the interviewees. Therefore, the authors could seek to the factors influence the student’s satisfaction of OJT. The main methods are implemented by in-deep interview and group discussion. After collecting that data, group research could check the meaning of the terms in the questionnaire, and adjust the meaning of the terms before conducting the Pilot Test.

Authors deploy quantitative research to predict accurately about relationship between research factors and behaviors, understand meaningful insights into those relationships, validate relationships, and test hypothesis. Finally, quantitative methods are statistically forecast to the target population of interest and relatively more reliable because every question is asked of all respondents in precisely the same way. Consequently, this research method was used after qualitative research to test the scale as well as the theoretical model and test the hypothesis in the model of student’s satisfaction of OJT program at FPT University. The data was collected through questionnaire survey and analyzed by SPSS software. The scale is verified by Cronbach’s Alpha and Exploratory Factor Analysis (EFA). Afterward, researchers determine the Linear Regression equation

#### 2. Data

In this research, the authors utilize primary data and secondary data.

There are many methods of collecting primary data: observations, mail interviews, live interviews, fixed group surveys. In the in-depth interview process, during the first week in May, 2017, researchers have several direct meetings with an expert who is Dean of Business Faculty of FPT University - one of the top 10 faculty members in the world voted by the Accreditation Council for Business Schools and Programs to implement the face-to-face interview. He emphasized on the Job Training Program (OJT) in the presentation of “How FPT University equips students to be good fighters”. Therefore, that is the reason why the group research asks for his support, contribute, ideas as well as his adjustment in a plenty of parts before conducting the preliminary research survey. At the beginning, the researchers introduce briefly about the topic, what we are going to survey about to make clearer and more specific. Then, we begin with a plenty of warm-up questions related to the OJT program in FPT University. In the ultimate step, the researchers inquire a series of opened-end questions for the expert in order to determine the major points, the overall picture of OJT program in FPT University as well as the advantages that students perhaps receive during and after the OJT program. After those meetings, those help us to adjust, add some more necessary details and translate for a complete questionnaire to conduct the survey in the next step by group discussion. Additionally, the group research conducted an in-depth interview (telephone without internet) with the former senior staff of FTICO who understood experientially the students’ perceptions of several previous internship semesters in the past. In light of being listening to

student's presentation, evaluating and supporting student's problems, she could suggest ideas for this topic.

In Focus-group interview, In the focus-group interview, group research chooses 9 selected students in FPT University who have finished the OJT program already in order to collect their individual thoughts and evaluation about if there is any gap between what they expect before interning and what they actually receive after interning to ensure that their direct answers are valid. Furthermore, selecting 9 different students from various courses will enhance the multiple data sources and avoid the bias information. Focus-group interview is carried out from May 20th to May 25th in FPT University.

**Table 3.1. Respondents Characteristics**

Features	Frequency	Percent
<b>Gender</b>		
Male	259	85%
Female	47	15%
<b>Major</b>		
SB	95	31%
SE	211	69%
<b>Course</b>		
9C Course	68	22%
9B Course	20	7%
10C Course	35	11%
10B Course	103	34%
10A Course	80	26%
<b>GPA</b>		
5.0 - 6.0	11	4%
6.0 - 7.0	121	39%
7.0 - 8.0	129	42%
8.0 - 9.0	45	15%

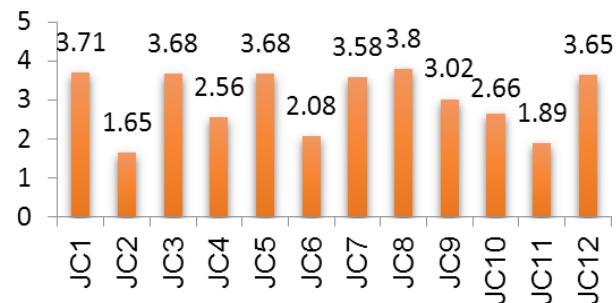
Secondary data defined as the original data that collected for a different purpose and reuse for a different research question (Thompson, 2000) [16]. It helps this study save a lot of time and money when relevant measurement scales and data are available. In this research, researchers collect data from Dan Tri e-newspaper and the website of FPT Education to provide valuable information. According to Dan Tri e-newspaper, it gives lots of information about the context of OJT program in different universities, which contribute additional details to make a comparison with the OJT program in FPT University. After many verified steps by experts and focus group, the official survey is distributed. The main data of this research is collected from the quantitative research by 306 respondents by Simple Random Sampling technique and Cochran's (1977) [4] formulas application.

### 3. Data Processing

In this research, the authors use SPSS to analyze descriptive statistics provides basic summaries of the sample; Cronbach's Alpha ratio is reliability ratio used to estimate correlation scale. Besides, the group also run Exploratory Factor Analysis (EFA) to reduce observed variables to a smaller set but still maintains almost information content. Afterward, authors run the Multiple Regressions and Independent T-test.

## IV. ANALYSIS & FINDINGS

### 1. Mean value



**Figure 4.1. Job Characteristics items statistics**

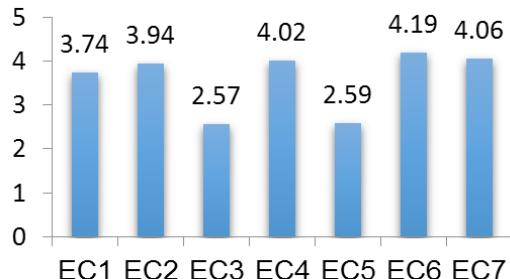
For more specifics, in the Job Characteristics, the Mean indexes are from 1.65 to 3.80. The item JC8 ("In the beginning, I had to learn about the firm before deciding upon the project") has the highest rate of agreeableness followed by JC1 with 3.71 ("The internship required me to use various skills."). The item JC2 ("The internship was not simple and repetitive") is the lowest rate of satisfaction. Moreover, regarding item JC1, group research also does statistics what required skills that internees need to have. The result is reported in the below table:

**Table 4.1. List of required skills during OJT period**

	<b>Major</b>		
	<b>SB</b>	<b>SE</b>	<b>Total</b>
Microsoft Office	93	205	298
Graphic Design	58	140	198
Programming languages	0	211	211
Working in group	60	128	188
Communication	60	120	180
Problem solving	84	195	279
English	83	185	268
Chinese	0	0	0
Japanese	1	20	21

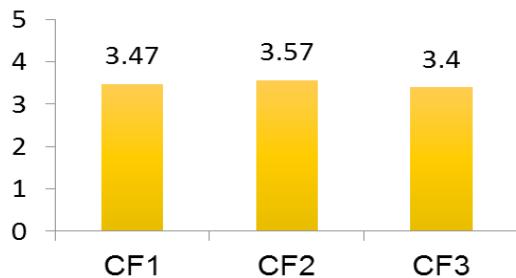
It can be seen clearly that Microsoft Office, Graphic Design, Programming Languages and English are the essential skills for internship semester. In which, the basic computer skills such as Microsoft Office

is the highest agreement, with nearly 98% agreed students in each sector. Moreover, Problem Solving and English are 2 kinds of skill that both SB and SE students also reach the agreement with around 90%.



**Figure 4.2. Work Environment Characteristic items statistics**

In the Environmental Characteristics scale, the Mean indexes are spread from 1.67 to 4.09. The remarkable point is the considerable number of item that is over than 4.0. It is more than a half of items in this group scale that gains high rate. The most satisfied is item EC1 ("My supervisor helped make my internship a pleasant experience.") with 4.09. It points that the supervisor plays an important role in the internship period. Remarkably, item EC5 ("My internship provided me with opportunities to examine a potential career field.") shows the least level of satisfaction. It portrays the large amount of student now have not seen the big picture of the sector they follow in the four-month internship.



**Figure 4.3. Contextual Factors items statistics**

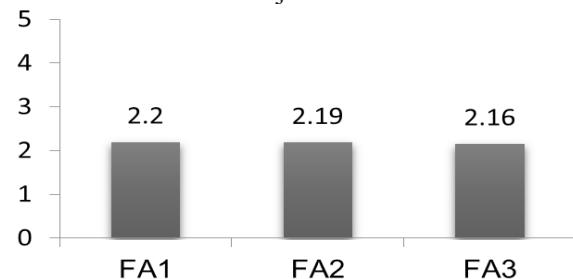
Regarding Contextual Factor, it describes the low average which is below 2.5. The scale is really low from 2.35 to 2.46. The most unsatisfied thing that students mention is related to the level of flexibility of working hours (item CF1 with 2.35). The item CF3, however, is rather low, it also has some students have reverse point of view. They believe that some benefits and welfares actually satisfy them in the internship. Those are reported here.

**Table 4.2. Welfares during OJT period**

	Major		Total
	SB	SE	
Lunch fee	65	127	298
Gasoline fee	23	53	198
Parking fee	43	111	211

Insurance	0	0	188
Mobile card fee	52	0	180

It is showed apparently in the table; the majority of FPT trainees believe that they have some benefits and welfares from intern enterprises. The most fee they are supported are lunch fee with more than 60% from both SB and SE students. Gasoline fee and Parking fee are also account for the large proportion. Like the previous pattern, Faculty Advisor has the same trend with Contextual Factor. The low rate on group Faculty Advisor shows that the support from school is not enough or does not meet the demand of students from both 2 majors.



**Figure 4.4. Faculty Advisor items statistics**

## 2. Cronbach's alpha - Reliability Test

The survey's analysis shows that all components have qualified Cronbach's Alpha coefficient (larger than 0.6). In more detail, Cronbach's Alpha of Job Characteristics is .875; of Environment Characteristics is .897; of Contextual Factor is .763 and of Faculty Advisor is .787; of Student's Satisfaction is .721. Furthermore, the Correlation Coefficient is relatively high; and most of them are larger than 0.5, with exception for Contextual Factor and Faculty Advisor (>0.3). ‘

**Table 4.3. Cronbach's Alpha Result**

No.	Component	No. of Initial items	Cronbach's Alpha	No. of Deleted items
1	Job Characteristics	12	0.875	0
2	Environment Characteristics	7	0.897	0
3	Contextual Factor	3	0.763	0
4	Faculty Advisors	3	0.787	0

## 3. Exploratory Factor Analysis

After running EFA, the result also extracts to 4 components at Eigenvalues is 1.300 and Extracted Variance is 56.593% > 50%. KMO value is 0.843 > 0.5; the Sig. value in Barlett Test is 0.000 < 0.050, so the exploratory factor analysis is suitable for investigating officially.

Besides, the Eigenvalues is  $1.301 > 1$  indicates the variability explained by each factor and that factor can represent for the whole group (Table 4.6). In addition, the extracted variance is  $56.593\% > 50\%$ . Likewise, the factor loading of all variables is more than 0.5. Both of them mean that the model is standard for factor analysis (Hair et al., 1998) [9]. Consequently, EFA coefficients are qualified

**Table 4.4. Main coefficients of KMO test  
(Independent variables)**

Coefficient	Value
KMO	0.843
Sig. in Barlett Test	0.000
Eigenvalues	1.301
Extracted Variance	56.593%

After running EFA, the result also extracts to 4 components at Eigenvalues is 1.243 and Extracted Variance is  $74.415\% > 50\%$ . KMO value is  $0.878 > 0.5$ ; the Sig. the value in Barlett Test is  $0.000 < 0.050$ , so the exploratory factor analysis is suitable for investigating officially.

**Table 4.5. Main coefficients of KMO test  
(Dependent variable)**

Coefficient	Value
KMO	0.680
Sig. in Barlett Test	0.000
Eigenvalues	1.933
Extracted Variance	64.421%

The KMO ratio =  $0.680 > 0.5$ : it is appropriate in factor analysis (Kaise-Meyer-Olkin test)

Moreover, sig. =  $0.000 < 0.05$ : generally, it shows that the independent variables have significantly impact to correlation with student's satisfaction. Besides, cumulative =  $64.421\% > 50\%$ . It represents that 64.421% data variation is explained by 4 factors. After running the EFA, authors finally identify 4 main factors that have a noticeable influence on student's satisfaction on OJT program at FPT University.

**Table 4.6. Main coefficients of KMO test**

	Component			
	1	2	3	4
JC10	.763			
JC11	.735			
JC2	.703			
JC4	.703			
JC6	.698			
JC9	.685			
JC7	.616			
JC5	.607			
JC1	.599			

JC3	.598			
JC12	.591			
JC8	.568			
EC5		.894		
EC3		.873		
EC2		.845		
EC7		.744		
EC1		.731		
EC4		.718		
EC6		.668		
FA3			.817	
FA1			.797	
FA2			.776	
CF2				.836
CF1				.806
CF3				.731

The EFA's result shows 25 observed variables are classified into four different groups, and the Factor Loadings of all variables are more than 0.5 which meets the conditions to investigate officially.

#### 4. Bivariate Correlations

**Table 4.7. Bivariate Correlation Results**

		JC	EC	CF	FA
SS	Pearson Correlation	0.046	.329	.391	.620
	Sig. (2-tailed)	0.426	.000	.000	.000

The correlation result between Job Characteristic and the student's satisfaction of OJT program that show in the table is  $r = 0.046$  ( $\text{sig} = 0.426 > 0.05$ ) which can be group into slight, almost negligible. Consequently, the Job Characteristics will be eliminated out of the regression test in light of unqualified sig. ratio. On the contrary, Work Environment Characteristics, Contextual Factors and Faculty Advisors are positively correlated to the student's satisfaction of OJT program

#### 5. Multiple Regressions

**Table 4.8. Regression Analysis**

Model	Unstandardized Coefficient (B)	Standardized Coefficient (Beta)	Sig.	VIF
(Constant)	1.410		.000	
EC	.217	.317	.000	1.084
CF	.145	.268	.000	1.243
FA	.432	.479	.000	1.221
Adjusted R2	0.502			
Sig. value in ANOVA table		0.000		

Based on the above result, the Adjusted R<sup>2</sup> = 0.502, it means that 50.2% variable degree of Student's Satisfaction is influenced by 3 independent variables in regression analysis. Although the coefficient Adjusted R<sup>2</sup> is not considerably high, group research are aware of this is the limitation of the study, mainly related to manpower and time limits. So, group research cannot return to do the research more to result in the significant statistical number. The sig value (F) = 0.000 < 0.05: the combination of 3 independent variables is capable to be explained the variation of dependent variable. Moreover, the sig. value of each value is also lower than 0.05, so the reliability and meaning of statistics are acceptable. Furthermore, the VIF coefficient of all variables is lower than 2. Therefore, the multicollinearity will not happen and badly impact on the regression analysis. Linear regression equation will be:

$$SS = 1.410 + 0.217EC + 0.145CF + 0.432FA$$

## 6. Independent T-test

This independent-samples t-test assesses whether the means of SE and SB students significantly differ on a student's satisfaction of OJT.

**Table 4.9. T-test result of student's satisfaction of OJT between SB and SE students**

Test variables	Sig. of Levene Test	Sig. of T-Test		Result
Job Characteristics	.000	Equal variance not assumed	.000	Reject
Work Environment Characteristics	.007	Equal variance not assumed	.010	Reject

Contextual Factor	.053	Equal variance assumed	.084	Accept
Faculty Advisor	.168	Equal variance assumed	.879	Accept

The result from Table 4.8 indicates there are only 2 factors have the t-test's sig value lower than 0.05, so it means that the null hypothesis is rejected and there is significant difference in the mean of satisfaction level on Job Characteristics and Work Environment Characteristics between SB and SE students.

**Table 4.10. Difference in mean between SB and SE students on Job Characteristics and Work Environment Characteristics**

Component	Major	N	Mean
<b>Job Characteristics</b>	SB	95	2.7860
	SE	211	3.0924
<b>Work Environment Characteristics</b>	SB	95	3.7203
	SE	211	3.5247

Table 4.10 shows that SB students less satisfy on Job Characteristics than from SE students with (2.7860 and 3.0924 respectively). In contrast, the pattern on Work Environment Characteristics portrays the reverse one with the higher satisfaction from SB students (3.7203) than SE students (3.5247).

## V. IMPLICATION AND CONCLUSION

### 1. Key findings

The results of the proposed model imply that all the scales reach acceptable reliability and qualified ratio after addition and adjustment. In this study, there are only three over four factors showing the significant effect on Student's satisfaction of OJT program at FPT University. Those three factors consist of Work Environment Characteristics (EC), Contextual Factors (CF) and Faculty Advisors (FA). The second key finding is the significant difference in satisfactory internship on Job Characteristics and Work Environment Characteristics between SB and SE students.

According to mentioned Hypothesis, group can also understand how these factors affect to student's satisfaction:

- Work Environment Characteristic (BETA= 0.317)
- Contextual Factor (BETA= 0.268)
- Faculty Advisor (BETA= 0.479)

### 2. Recommendation

- Job Characteristics

The data shows that most students have good respond in the student satisfaction of Job Characteristics. The JC2 item has the lowest score from the student with the mean of 1.65. There are over 50% students

reflected that the internships made them feel that it was “simply work”, and they could not gain knowledge or skills. So, the university should focus on improving this factor in their service. With Mean = 3.8, item JC8 has the highest score and it has a strong satisfaction because nearly 60% of respondents are from the level Agree to level Totally Agree. This means students feel satisfied to study and prepare the information of the company before the internship. However, based on the outcome, there are some low rated items. The item JC2 (“The internship was not simple and repetitive.”) and JC11 (“I had the opportunity for work rotation during the OJT period”) show the unpleasant feeling of students by the mean of 1.65 and 1.89 respectively. Regarding the stat from JC2 and JC11, it implies that in spite of the usefulness of the internship, there are also some drawbacks from the internship such as the work repetitiveness and low level of work rotation. Therefore, FPT University might contact the enterprises to improve this situation in the next semesters.

Regarding SB students, it can be seen clearly that Chinese language is not used commonly while SB student being on the internship period. FPT University should consider it and realize why SB students could not apply Chinese in their major. In the contrast, some soft skills such as Microsoft Office (97.89%), Problem Solving (88.42%), English (87.37%) and Working in Group (63.16%), which are applied in the internship, were rated most. It is believed establishing good training programs for interns, giving interns meaningful tasks, and empowering them to manage the tasks in a more creative way could be solutions to improve future internship programs. (Cheng et al, 2004) [3].

#### - Work Environment Characteristics

It clarifies that most of the students have good attitude with Work Environment Characteristic. The item EC3 which is “My supervisor provided me with enough support while I was doing my internship” has the lowest Mean value (2.57) and the highest Mean value is 4.19 from item EC7 which is “I got along with the people I worked with at my internship”. All other variables are quite positive.

Base on the statistic that discussed above, research group believes that item EC3 and EC are not belong to FPT University’s responsibility; however, University can also work with enterprise to improve this situation. Besides, item EC4 and EC7 with high rated also firmly point out that internship period is really helpful for student in the future career

#### - Contextual Factors

The result shows that almost students have merely average attitude to the satisfaction level of Contextual

Factors during internship period. The lowest is 3.40 correspond with variable CF3 – “I satisfy with other welfares” by the percent of Disagree and Neutral (19.00% and 47.70%) overwhelming Strongly Agree with only 25.50%. It means most of students do not satisfy with welfares supported by the companies. This average figure pointed out there still have some students do not have fringe benefit from enterprise. At the present, many companies are recruiting the internees with good benefit even monthly allowance, so in terms of this problem, FPT University could cooperate with some cooperative companies to improve some fringe benefits for internees. Besides, two variables which are CF1 and CF2 also should be enhanced in order to have a better performance and quality from the internship period. By CF1 (“I did not mind the commute to my internship”); it could be improved more by the suggested method such as having more company for students to choose to work for and easily to commute daily. In terms of CF2 (“My internship had flexible hours”), it depends on which enterprise that FPT University cooperates with that lets students choose more flexible working hours. However, FPT University could work with enterprise to consult this matter to come to the best choice.

#### - Faculty Advisor

The outcomes reveal that the students deprecate the role of Faculty Advisors during the internship. The variable FA3 - “The faculty advisor showed interest in my problems on the project” is quite low by 2.16, means that students need more indication of interest from Faculty Advisors at university. Group research could propose a solution that opening a new channel to connect internees and Faculty Advisors to follow up information from both sides directly. Besides, the variable FA2 (“The faculty advisor had knowledge that was useful to my specific project”) is also relative low by 2.19 of mean. The students being on the internship are unhappy with the support from Faculty Advisors when they are stuck in specific problems which are easy to happen in the first real job. So, group suggests that FPT University should appoint some advisors who had specialize knowledge in order to help students immediately. Furthermore, so as to improve variable FA1 (“The faculty advisor had frequent meetings with me”), group also makes a suggestion that Faculty Advisors should have more meetings that may be weekly with internship students to support or help if needed at the right time. In other part of the world, according to Mood (1995) [14], the university supporters must communicate with students on a regular basis; otherwise, students may experience high levels of frustration (Hara & Kling, 2000) [11].

### 3. Conclusion

Based on the theory and our findings, this paper suggests implications not only for FPT University but also the enterprise and student on internship. For the organization, it is important to be aware of the factors leading to internship satisfaction and incorporate them into their internship programs. Based on the results of this study, perhaps company should try to ensure that its work environment is comfortable for internees—that it provides good valuable internship chance; that it successfully connects interns with supportive supervisors; and that it turns the organization as a whole group, not just the intern's particular job, is satisfying to the intern. Therefore, it is also important for companies to ensure that the feeling of happiness for internees during the period.

For faculty advisors and schools also should be aware of these factors in order to help place students in internships with characteristics associated with satisfying experiences. During the identification, design, and approval phases of internship experiences, all parties involved should take care to ensure internships incorporate all the factors discussed above. (Interest of the students, project knowledge, the frequency of meeting with interns)

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# Awards & Photos Appendix

<b>Evaluation criteria</b>	
► The score of the review committee accounted for 60%	
► Audience at the auditorium vote account for 40%: Audience at the auditorium vote according to the criteria: Application of the subject in practice; Presentation ability of the group.	
Total score: 100 points	
<b>Level</b>	
<b>Very good (100 points)</b>	
Good (90 points)	
Normal (80 points)	
Low (70 points)	
<b>Conference Awards</b>	
<b>First Prize:</b>	
<b>Virtual Assistant Smart House</b>	
Luong Cong Thuuan, Nguyen Thanh Van, Hoang Trong Thanh Tung, Nguyen Van The My	
<b>Second Prize:</b>	
<b>Mobile Based Language Learning Application</b>	
Le Ngoc Hieu, Nguyen Nhat Quang, Do Hoang Nguyen, Truong Thanh Lam	
<b>Third Prize:</b>	
<b>The train warning system at the railway crossing</b>	
Phan Thanh Loc, Phan Huu Tai, Vu Thanh Hai, Hoang Phi Hong	
<b>Consolation Prize:</b>	
<b>1. Drawing with Simple Brush</b>	
Truong Nguyen Hong Huan, Do Quoc Bao, Nguyen Minh Quang, Le Hoang Long	
<b>2. Evaluating The Student's Satisfaction of On - The - Job Training Program at FPT University</b>	
Ho Thanh Xuan, Ha Hoang Ngan, Tran Ngoc Bich Hung	




## DESIGN AND IMPLEMENTATION ROBOTIC ARM WITH FOUR DEGREES OF FREEDOM

DuyLMN & TuanNQ & LamNH — Embedded System

**Abstract**

The problem is to serve the purpose of research and development in the field of robots.

We decided to make a robotic arm with four degrees of freedom to learn. Just "teach" your arm to know what to do then it will do exactly what you "teach". This robot arm is perfectly suited for use in production lines.

**INTRODUCTION**

There are 3 main problems in this project:

1. **Mechanic Balance:** Factors that affect the system when operating. The unbalanced mechanical robotic arm may be damaged by the weight or force it produces.
2. **Deadline of servo:** Other factors that affect the system cause difficult to user when control the robot arm.

To experience the feeling of first producing a robotic arm. We decided to make a robot arm from scratch with the materials available.

**PROBLEMS & SOLUTION PLAN**

Some details of the mentioned problems:

**Problem 1:** Robotic arm with unbalance design can cause heavy loads on engine, heating the engine, collapse when moving, decrease performance of the system.

**Problem 2:** Control the robot arm but the robot arm do nothing. That is the error signal when comparing two pulses of servo motor and microcontroller.

Here is the solution plan:

**Step 1:** Study about balance in mechanical to search for brake part,

**Step 2:** Study about how servo work and PWM, causes of voltage drop on component.

**Step 3:** Attempt to solve all the problems one by one.

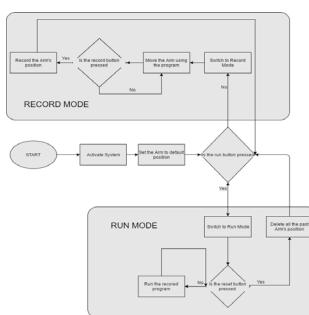


Figure 1: System Flowchart

**Acknowledgements**

**Mr. Nguyen Duc Loi**  
Capstone Project Instructor

**Mr. Nguyen Quoc Tuan**  
Capstone Project Leader

**CONCLUSIONS**

In this paper, we have demonstrate our first approach to robotic terms,

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Subject's poster "Design and implementation of robotic arm with four degrees of freedom"

## THE TRAIN WARNING SYSTEM AT RAILWAY CROSSING



Instructor: Nguyen Duc Loi  
Phan Thanh Loc - Hoang Phi Hong  
Phan Huu Tai - Vu Thanh Hai

**INTRODUCTION**

- Current systems have some problems like warning to driver on road and train's driver to be careful at the level crossing. We proposed a solution for the train warning system at the railway crossing in Vietnam and other developed countries.

**SOLUTION**

```

graph LR
    A[Identification of an oncoming train] --> B[Calculate speed of train]
    B --> C[Communicate train and station]
    C --> D[Warnings for people involved in traffic]
    HallSensor[Hall sensor] --> A
    RFModule[RF module] --> C
  
```

**ADVANTAGES**

- Suitable for infrastructure in Vietnam
- Reduce investment costs.
- Support for manual emergency response systems when unexpected situations occur.

**PROBLEM STATE-  
MENT**

- Train accident is the obsession of every person.
- Causing damage to people and property of the country.
- Difficult to exploit the full potential of the transportation sector.

**ANALYSIS**

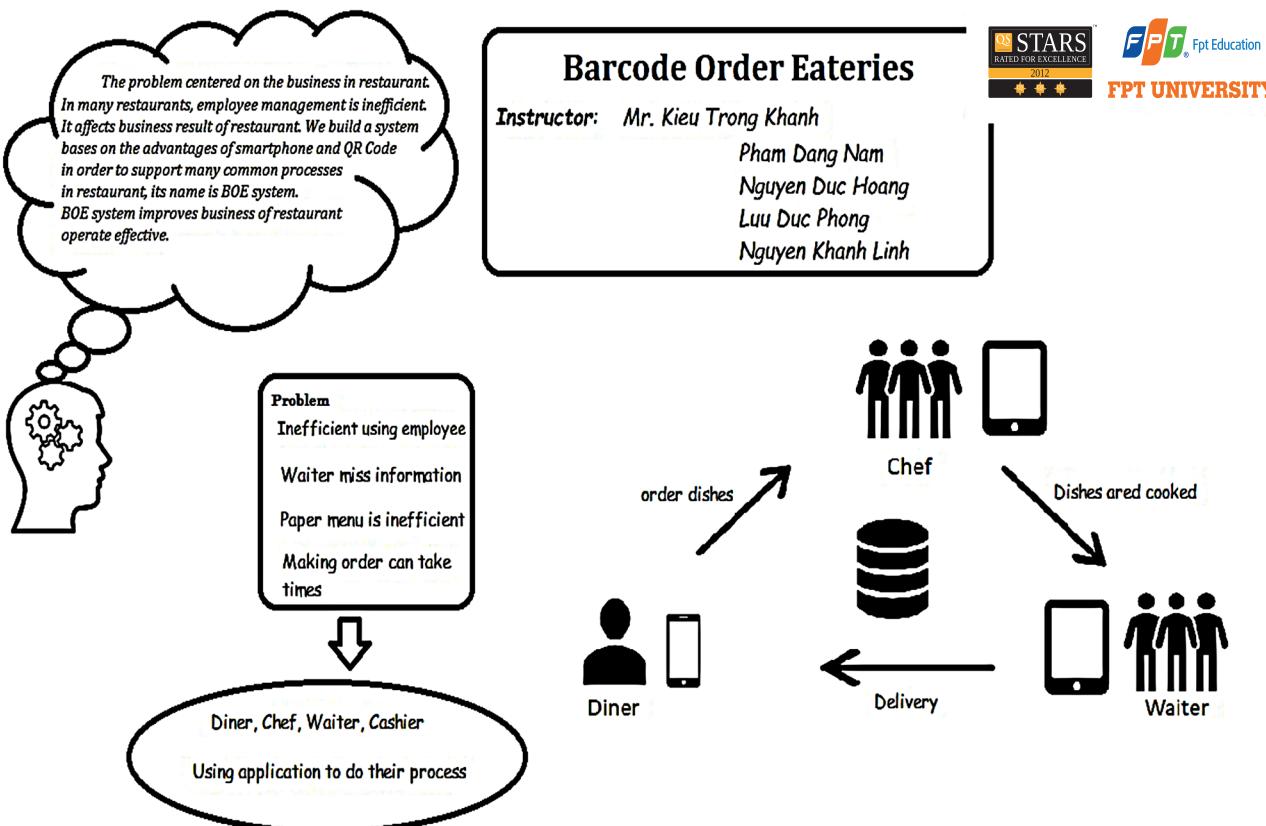
We setup 2 magnetics on railway. The first magnet 400m from the railway crossing. The second magnet is 10m away from the first magnet position. With an average speed of 80 km/h.

- When the train crosses the location of the two magnets, we calculate the current train speed, which predicts the length of the train to the crossroad.
- Immediately, we send the signal to the station, so that the station can activate the traffic alert system.

**FUTURE PLAN**

- Develops an automatic callback in case of dangerous situations.
- Optimizing the performance of the product.

Subject's poster "The Train Warning System at the Railway Crossing"



Subject's poster "Barcode Order Eateries "

## DRAWING WITH SIMPLE BRUSH

Making dashed image from image  
BaoDQ & LongLH & HuanTNH & QuangNM - FPT University

**Abstract**  
Making of dash image is a common method of teaching children how to draw. This paper present a solution to automate this process. The goal is to convert from normal image to black-white content simple dashed brush. Our solution is robust and can apply to many kinds of image.

**Introduction**  
One method of teaching children how to draw is to prepare a dashed line picture for them to follow. This method is widely used as it is simple, require little time to prepare by human. But to automatically create dashed line image is not a simple problem, as computer do not understand lines and dash as human do.

**Problem and Solution**  
We are given an normal image. Our problem is, from the given image, produce a simple black-white image with dashed line. We breakdown our problem into 2 parts: 1: Make a simple image from a normal image, and 2: Make dashed line from simple image.

**Plan Implementation**  
As mentioned above, converting normal image to simple image can be archived through thresholding techniques. We choose Adaptive Thresholding Using the Integral Image as in [1] since it is fast, accurate and easy to implement.

**Performance and Example**  
With an implementation same as pseudo-code in Algorithm 1, the complexity or making a list of midpoints is  $O(w * h)$ , with  $w$  is the width and  $h$  is the height of the simple image. A list of midpoints reduce the number of pixels to consider when applying Making dashed line algorithm to the simple image. Assumed the number of black-pixels in simple image is  $P$  and the number of points in midpoints list is  $K$ , after tested with 1000 various images we find that the ratio  $P/K$  is around 3 to 10. In the worst-case scenario, that is every connected line region only consisted of one point, the the algorithm does not reduce the number of pixels. Such a scenario rarely happens in our application.

**Conclusion**  
1. More efficient search and delete every points inside a circle on an image.  
2. A more efficient method for choosing list of points.  
3. Most welcome, of course, would be a sharper theoretical analysis

**Acknowledgment**  
The authors would like to thank Mr. Kieu Trong Khanh for his guidance and supports on this research.

**References**  
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Subject's poster "Drawing with Simple Brush" (Paper 1)

**DRAWING WITH SIMPLE BRUSH**  
Breakdown image into drawing step  
BaodQ & LongLH & HuanTNH & QuangNM - FPT University

**Abstract**  
Breaking image into step is an advanced method of teaching children how to draw. This paper present a solution to automate this process.

**Introduction**  
The basic idea is to travel from one corner to another. Choosing a corner as a breaking point between two steps is natural, as we tend to change drawing direction when we hit a corner.

**Acknowledgment**  
The authors would like to thank Mr. Kieu Trong Khanh for his guidance and supports on this research.

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**Plan Implementation**  
As mentioned above, converting normal image to simple image can be archived through thresholding techniques. We choose Adaptive Thresholding Using the Integral Image as in [1] since it is fast, accurate and easy to implement.

**Problem and Solution**  
To determine if a point is a corner, we first choose a window around that point, then shift the window. If a large change appeared, corner. The Shi-Tomasi Corner Detector give a mathematical approach for such process.

**Performance and Example**  
The complexity of the whole process is  $O(w \cdot h \cdot k)$  with  $k$  is the number of connected region.

**Conclusion**  
Using corner as break point failed for circular shape in image. - Deep First Search Traversal is not a very good way to travel from one break point to another, as such traversal may make an unnatural step for children.

Subject's poster "Drawing with Simple Brush" (Paper 2)

**FLEXIBILITY BUSINESS PLATFORM**  
Instructor: Mr. Kieu Trong Khanh  
Nguyen Dinh Trung - Ly Phuoc Sang - Nguyen Thanh Phong

**OUR PROPOSAL**

```

graph LR
    Supplier((Supplier)) -- 1. Uses --> Mobile[Mobile Device]
    Mobile -- 2. Interact --> Platform[Platform]
    Platform -- 7. Send request --> System[System / Server]
    System -- 8. Response --> Mobile
    EndUser[End User] -- 4. Uses --> Mobile
    Mobile -- 5. Request --> System
    System -- 3/6. Provide API & Communicate --> Broker((Broker))
    Broker -- Manage & Operate --> System
    System -- Provide/Build --> Mobile
  
```

**INTRODUCTION**

- E-commerce is growing fast in Vietnam.
- Supplier is hard to manage many apps for their business.
- Startup takes a lot of time and efforts to build their application.
- Flexibility Business Platform is a services provider platform which supports people build e-commerce application quickly and not too much cost.
- THIS PAPER WILL DISCUSS ABOUT HOW TO BUILD A FLEXIBILITY BUSINESS PLATFORM

**OUR PROPOSAL**

- We develop a new platform support enterprise build their own e-commerce application quickly
- The application or system of Broker can connect to the platform
- Platform Manage transactions from broker systems, and payment, profit sharing for broker and supplier.

**CONCLUSION**

Our system resolved some basic problems:

- + How to connect to Broker system.
- + How to handles transactions of the system in a clear, easily statistical way, and retrieve history later.
- + How to design a scalable system. In fact, we have changed our payment policies many times, which did not change the design of the system too much.

Subject's poster "Building a business platform"

**MOLA**  
MOBILE BASED LEARNING LANGUAGES APPLICATION

Instructor: Mr. Nguyen Huy Hung  
Student: Le Ngoc Hieu - Do Hoang Nguyen  
Nguyen Nhat Quang - Truong Thanh Lam

**EVERYONE IS THE KNOWLEDGE SOURCE**

The MOLA system helps connect people who want to teach or learn languages. We will concentrate on supporting speaking activities between teachers and learners. Practicing speaking skills with native speakers may provide learners with great improvement. In reverse, those "native speakers" teachers may be learners in other languages as well.

**WebRTC   SCHEDULE   COLLABORATIVE FILTERING**

**WebRTC**  
WebRTC is a free open-source supported by Google, Mozilla and Opera. WebRTC is which "enable rich, high-quality real time communication applications to be developed for the browser, mobile platforms, and IoT devices, and allow them all to communicate via a common set of protocols"

**SCHEDULE**

- Teachers set preferred teaching time
- Learners select available timeslot
- Learners request session to learn

**COLLABORATIVE FILTERING**  
Like other item-related businesses, MOLA needs to implement a mechanism to suggest its items – courses – to users. MOLA combines Collaborative Filtering with its own formula into a new algorithm. Besides that, alternative recommending methods are applied in certain situations.

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Toby Segaran, Programming Collective Intelligence

### Subject's poster “Mobile based languages learning application”

**Office Lunch Delivery Mobile Based Application**

**Lunchy**  
Instructor: Mr. Nguyen Huy Hung  
Ong Van Thanh - Nguyen Hoang Linh - Dinh Duc Hoang - Vu Ngoc Hai

**Introduction**  
Base on observation and analysis, along with lunchtime of office staff too short and rapid development of smartphone.

With just a smartphone have connection with wireless or 3G consumer can order anywhere, tracking order status and delivery process.

**Recommendation algorithm**

$$\text{weighted}(d) = \frac{0.5 * a + 0.4 * b + 0.1 * c}{t}$$

a : Average rating point of dish (0 to 5)  
b: Distance point of dish (0 to 5)  
c: Revenue point of dish (0 to 5)  
t: The number of hours the dish exists in the system

**Reference**

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- <https://developers.google.com/databases>
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### Subject's poster “Office Lunch Delivery Mobile Based Application”





FPT UNIVERSITY

# Online Furniture Retail

Instructor: Ms. Than Thi Ngoc Van

Cao Duc Son Ngoc – Le Dai An



House is very important to everyone. In order to have a house as your wish, you will search for home services. So far, people select home service providers often through referrals of friends or relatives. This leaves the user with limited choice and more difficult in finding reliable service providers. On the service provider side, they are also limited in introducing their package services or products.

As a result, we built a system that helps people find the home service provider easier and the service provider will have more customers.

## Subject's poster "House Decor System"

# VIRTUAL ASSISTANT

## SMART HOUSE

Instructor Mr. Kiều Trọng Khánh  
Member Lương Công Thuận  
Nguyễn Thành Văn  
Hoàng Trọng Thành Tùng  
Nguyễn Văn Thể Mỹ

### SYSTEM OVERVIEW

The diagram illustrates the system architecture. A SERVER sends an Activation Request to a CONTROL CENTER. The CONTROL CENTER receives a Control Request from a MOBILE APP, sends a Status Response back to the CONTROL CENTER, and sends a Notification to the MOBILE APP. The CONTROL CENTER also sends a Configure Activation message to the SERVER. The CONTROL CENTER is connected to a GATEWAY. The GATEWAY receives a Wireless signal from DEVICES and a Wire signal from SENSORS. The GATEWAY then sends a Control Request to the CONTROL CENTER and a Status Response back to the CONTROL CENTER.

### 2 Control remote devices: IC 1838b

IC 1838b is connected with Arduino to read infrared signal of device. This data is saved in gateway, after that we generate the same infrared signal to control that device.

### 3 Face detection and recognition

Google Cloud Vision API is based on Face Detection Concept. This concept has some terms: Face recognition, Face tracking, Landmark and Classification. Microsoft Face API is a cloud-based service that provides the most advanced face algorithms. Face API has two main functions: face detection with attributes and face recognition. Four face recognition functions are provided: face verification, finding similar faces, face grouping, and person identification.

### 1 Control center Model

We develop control center base on an Android device and gateways for controlling electrical devices.

The diagram shows a CONTROL CENTER and a GATEWAY. A Control Request is sent from the CONTROL CENTER to the GATEWAY, and a Status Response is returned from the GATEWAY to the CONTROL CENTER.

### Detect natural language processing intention

After converting text from human speech, we use an algorithm to detect human intention from the text. When we research about human reaction, we recognize that Vietnamese tend to use simple input sentences contain keywords. For example:

- "Hôm nay ngày mấy rỡ?" => ask about date
- "Cậu thấy nóng hay lạnh?" => ask about temperature feeling
- "Cậu bắt giúp tôi cái đèn" => turn on the lamp

**TF.IDF formula**  
This formula is a classifying term by document algorithm. In our solution, we apply term for NLP words and document for NLP intent. The formula is described as below:

$$w_{i,j} = t_{i,j} \times \log \left( \frac{N}{df_i} \right)$$

$t_{i,j}$  = number of occurrences of  $i$  in  $j$   
 $df_i$  = number of documents containing  $i$   
 $N$  = total number of documents

### 5 Automatic configuration

Automatic configurations were defined as a standard for most smart houses and they will be customized to meet house owner's requirements. State machine model is suitable with us.

```

    graph TD
        Start((Có người trong nhà)) --> Camera1[camera phát hiện người thân]
        Camera1 --> Cua1[cửa được đóng]
        Camera1 --> Cua2[cửa bị mở]
        Camera2[camera phát hiện cửa] --> Cua1
        Camera2 --> Cua2
        Camera3[camera phát hiện người thân] --> ThanhChu[Thân chủ vào nhà]
        Camera3 --> PhatHien[Phát hiện người xấu]
        PhatHien --> NguoiXau[Người xấu đột nhập]
        ThanhChu --> NguoiXau
    
```

**TIMEKEEPING AND LABOR PAYROLL SYSTEMS IN FACTORIES**

TaiDH - DucNH - KhanhDHQ - ThoTT - TuanNH

**Abstract**

**Problem**

**Employee**

**Introduction**

**Solution**

**Human Resource**

**Reference**

- Signal
- Coding Convention
- Wikipedia

**Acknowledge**

We wish to thank various people for helping us to finish this project, special thanks to Mr. Ngo Dang Ha An for his professional guidance and the useful, constructive recommendations throughout this project.

Subject's poster "Timekeeping and Labor Payroll Systems in factories – TLPSF"

**Evaluating the Student's Satisfaction of On-the-job Training Program at FPT University**

Xuan Ho - Ngan Ha - Hung Tran - Hieu Vo

**Abstract**

The study gives an overview of the internship's current situation at FPT University and proposes a model count four factors that influent the students' satisfaction towards the OJT program, include: job characteristics, working environment characteristics, faculty advisor and contextual factors. The key findings of this paper include that the FPT's student are still not satisfied absolutely with their internship semester. In addition, there are differences between the SB student and SE student in satisfaction of OJT program.

**Data Analysis & Results**

**Theoretical Framework and Hypothesis Results**

Test Hypothesis	Result
Job Characteristics	Reject
Work Environment Characteristics	Accept
Contextual Factor	Accept
Faculty Advisor	Accept

**Job Characteristics items statistics – Mean value**

**Work Environment Characteristic items statistics – Mean value**

**Contextual Factor items statistics – Mean value**

**Faculty Advisor items statistics – Mean value**

**Key findings and Recommendation**

**Key Findings:**

- Student's Satisfaction, which is dependent variable, is influenced by 4 independent variables: Job Characteristics (JC), Work Environment Characteristics (EC), Contextual Factors (CF), and Faculty Advisor (FA).
- Faculty Advisor is the factor that most impact on Student's Satisfaction ( $\beta = 0.479$ ), which followed by Work Environment Characteristics ( $\beta = 0.317$ ). Contextual Factors influence the least with  $\beta = 0.268$ . In contrast, job Characteristics do not impact on Student's Satisfaction
- There is significant difference in mean of satisfaction level on Job Characteristics and Work Environment Characteristics between SB and SE students.

**Recommendation:**

- Due to high work repetitiveness and low level of work rotation, FPT University might collaborate with the enterprises to improve this situation in the next OJT semesters. Regarding SB students, FPT University should contemplate why they could not apply Chinese in their OJT.
- In respect of interest in students of Faculty Advisors, a solution was come out that opening a new channel to connect internees and Faculty Advisors to follow up information from both sides directly and instantly. Moreover, group suggests appointing some advisors to help students in deep professional knowledge.

**References**

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Subject's poster

"Evaluating the Student's Satisfaction of On-The-Job Training Program at FPT University"



Tran Ngoc Tuan, Ph.D, Vice Rector of FPTU was speaking to start the 2<sup>nd</sup> conference



Team 1 was presenting subject of “Evaluating the Student’s Satisfaction of On-The-Job Training Program at FPT University”



Mr. Lam Huu Khanh Phuong was presenting Keynote Speech 1: “A Process to TurnIdea To Product and Launch It”



Team 2 was presenting subject of “Mobile Based Language Learning Application”



Mrs. Pham Thi Diem, Director of IEG Vietnam was presenting Keynote Speech 2: “Strengthening Research Capacity for Teaching and learning in 21<sup>st</sup> century”



Team 3 was presenting subject of “Virtual Assistant Smart House”



Team 5 was presenting subject of “The train warning system at the railway crossing”



Mr. Than Van Su (right) & Nguyen An Te, Ph.D, awarded certificates and congratulated to the winning teams



The contribution of Mr. Kieu Trong Khanh



Somebody take commemorative photograph with winning teams



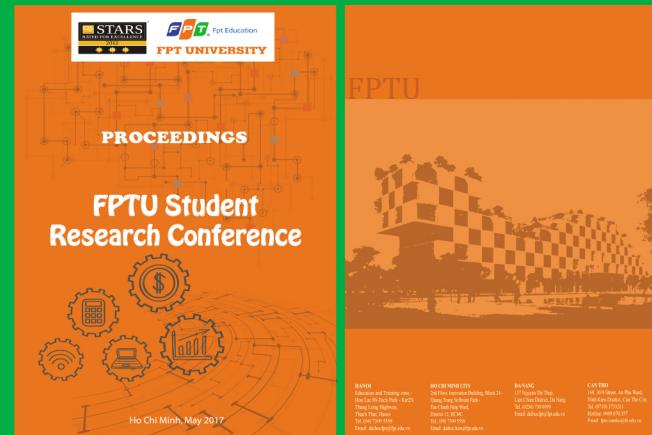
Mr. Than Van Su was giving some remarks after all teams had finished presentations



Posters were displayed at the 2nd FPTU Student Research Conference

# #FPTUSRC

The Student Research Conference Proceeding Vol. 1 was printed in May 2017. Readers could be found it in Library Department of HCMC FPT University and Hanoi FPT University, also found it on Dspace at link: <http://ds.libol.fpt.edu.vn>



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