

## Development of microcontroller experiment kit PIC16F877 / 16F84 With the industry of cylindrical type steel sorting machine

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### Abstract

The objective of this research is to develop and find the efficiency of the experimental kit, PIC16F877 / 16F84 microcontroller, industrial work, cylindrical type steel sorting machine. Appropriate for the experimental set for experts and satisfaction questionnaires for the sample group Bologna's 4th year, Department of Computer Engineering Vocational Courses Registration Robotics Engineering Course CT.419 first semester of the academic year. 2562, number 35, using a specific selection method. The research instrument consists of a microcontroller experiment kit PIC16F877 / 16F84. With industrial work, cylindrical type steel sorting machine, work quality evaluation form, achievement test, performance evaluation model And the statistics used in the research are mean and standard deviation

The results showed that using a microcontroller experiment kit PIC16F877 / 16F84 with industrial work, a cylindrical type steel sorting machine developed through evaluation from 5 experts at a very good level of satisfaction assessment through a very good student assessment and the efficiency of the generated experiment set. The value is 82.14 / 86.54 which is found to be close to the standard criteria set by the overall picture. 80/80 is suitable for effective development of microcontroller learning courses

**Keywords:** Experiment and Microcontroller

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## Introduction

Teaching in science and engineering subjects, teachers and learners must interact with each other, so that the instructor will be able to know how much the students understand the content, especially the course. Electronics Engineering Microprocessor Can be seen from the application and development, there are more and more every day, whether it is industrial work, business in the tools, toys Experimental teaching, such as training series on microcontrollers and basic robot applications of Aniwat Pholrak and Somsak Aktimakul, teaching subjects The Crow's Egg Processors of Nautical diamond creation and performance suite. Operation of the filter circuit of the optometry and IC circuit of Yutpichai Klaikan The development of a microprocessor connection test kit, DSP's digital signal processor. Hiranpanich Development of teaching sets on channel circuits Narrow in the pipe, Direk Maniwan, Phinij Khenpirom and Somsak Aktimakul, color television set experiment, Watcharin's LCD display , Wisut Soonthornkanokphong and Peerawut Suwanchan and AVR microcontroller experiment kit ATMEGA32 Master of Industrial Education Program King Mongkut's Institute of Technology Ladkrabang of Premchai Kongtan, Wisut Soonthornkanokphong and Peerawut Suwannachan, which can motivate learners to be interested in learning and able to show on the circuit, explain various principles of operation And see the results of the experiment with ease and speed As well as being able to summarize lessons simultaneously with the learner.

From the results of teaching quality assessment for the past 5 years since the 2013 academic year 2561 found that the content of the course was complicated, difficult to under-

stand, and the amount of content was large, the teaching materials were not varied. There are not enough numbers for students and not easy to use. Causing learners to lack practical skills and when inquiring for undergraduate students Year 4, Computer Engineering, Faculty of Engineering, Kasembundit University, found that students have a need for media that helps to build practical skills due to the robot engineering course, the subject code CT.419, the topic of connection, input and output as the subject. The basics that lead to further applications in other courses and problems with language structures, computational programs Some of the learners that will be written and used with the microcontroller Found that most learners are not experts in the structure of programming languages The computer and still do not understand the complete equipment that will be used to connect with the microcontroller completely, causing problems in the connection between the microcontroller and the external device, and in some cases, cannot solve the problem of the hardware that is connected. Can be connected to the microcontroller, and the finished device used to connect external to the microcontroller, even if not The price is as high as in the past, but there are a lot of pieces, some of which are equipped with more than used to study, resulting in higher prices. As a result, the overall cost with these external devices has this cost. Pay high overall and have to buy a lot.

From the history and importance of such problems to encourage students to apply knowledge from theory to practice. Therefore, in this research, the researcher has studied the development of the PIC16F877 / 16F84 microcontroller experiment kit with industrial work, cy-

lindrical type steel sorting machine for teaching and learning of the fourth year undergraduate students. Department of Computer Engineering, Faculty of Engineering, Kasembundit University, who registered robot engineering courses, subject code CT.419, 1st semester, academic year 2019, and research work to improve teaching and learning and develop the media to be consistent with current technology throughout Until the lesson can be concluded at the same time with the learner.

### Research objectives

1. To develop the microcontroller experiment kit PIC16F877 / 16F84 With the quality of the cylindrical type steel sorting machine
2. To find out the efficiency of the PIC16F877 / 16F84 microcontroller experiment kit with the development of industrial cylindrical type steel sorting machines

### Research hypothesis

1. PIC16F877 / 16F84 microcontroller experiment kit with industrial quality, cylindrical type steel sorting machine with better quality (x 50 3.50)
2. The efficiency of the PIC16F877 / 16F84 microcontroller experiment kit with the industry of cylindrical type steel separator or E1 / E2 not less than 80/80

### Related research

Research on creating and testing the efficiency of the microcontroller training package and basic applications are intended to create and test the efficiency of the training package on microcontrollers and basic robot applications for those interested in the microcontroller. The

research process consists of 4 steps: studying the issues of learning problems on microcontroller, analyzing data to create a training package consisting of 2 day 12 hour training plan, training manual consisting of leaf, content, and worksheet. Basic robots, presentation programs and tests, quality assessment of training sets created by a number of experts 5 people applied to the experimental group to find the efficiency and satisfaction of the trainees with the training package using students at the vocational certificate level in the electronic field, Khok Samrong Vocational College, Lopburi Province, enrolled in the semester. 2/2555 and a total of 20 interested parties The results of the research showed that the training set was constructed at the highest level. The students had the highest level of satisfaction with the training set that was constructed at the highest level and the average training set was 78.16 / 75.0 percent. Which was found to be close to the standard set 80/80, which can be used to train this training effectively? Research on the creation of microprocessor instruction the research aims to create a microprocessor instruction set to compare the learning achievement of the sample group using the teaching package with the control group and to assess the learner skills according to the objectives of the program. Students enrolled in microprocessor courses in the 1/2002 semester of 41 students and the control group were students. Enrolled in the semester 2/2544, 51 people. Statistics used in the research were mean and z – test. To test the difference of the average results of the research, a set of teaching materials that consisted of leaves, knowledge, work materials, teaching materials with complete contents as per the course can be used to teach well according to the opinions

of experts. The learning achievement of the experimental group is significantly higher than the control groups .01 Students who have used the experimental set have skills According to the objectives of the course.

### How to conduct research

This research is the development of a PIC16F877 / 16F84 microcontroller experiment kit for industrial applications in a cylindrical type steel sorting machine. Experts and satisfaction questionnaires for the sample group, namely, 4th year undergraduate students in Computer Engineering, Faculty of Engineering Kasembundit University who registered robot engineering courses, course code CT.419, 1st semester, academic year 2562, number of 35 people

### Research plan

This research, the main principle is the development and efficiency model of PIC16F877 / 16F84 microcontroller experiment kit with industrial work, cylindrical type steel sorting machine at the 4th year undergraduate students in Computer Engineering, Faculty of Engineering. Kasembundit University, who registered the robot engineering course, code of course CT.419, 1st semester of academic year 2562, number 35, can determine the problems and needs about the robot engineering course to find problems, including guidelines and methods to solve problems. And analyze course courses in order to know the objectives of the curriculum, the structure of the course, the content of the course Which has set the behavioral objectives to be used as data for the creation of research tools, then bring the tools created to assess the suitability by the advisors and experts to make im-

provements according to the recommendations and bring the tools to test the effectiveness from Non-sample group to find the quality of the microcontroller experiment kit, then apply to the sample group. Family gathering test data obtained from analysis to implementation, the research has defined the concept a step below Figure 1.

### Sample

The sample group is the fourth year undergraduate students in Computer Engineering, Faculty of Engineering. Kasembundit University, who registered the robot engineering course Course code CT.419, 1st semester, academic year 2562 number 35 people.

### Research tools

The creation of the PIC16F877 / 16F84 microcontroller experiment kit with industrial applications, a cylindrical type steel sorting machine with a color check sensor consisting of the following:

1 set of 5 cylindrical steel sorting experiments

2 trial work sheets, 7 work sheets

Worksheet 1: Writing commands to control the motor with 1 position sensor as input

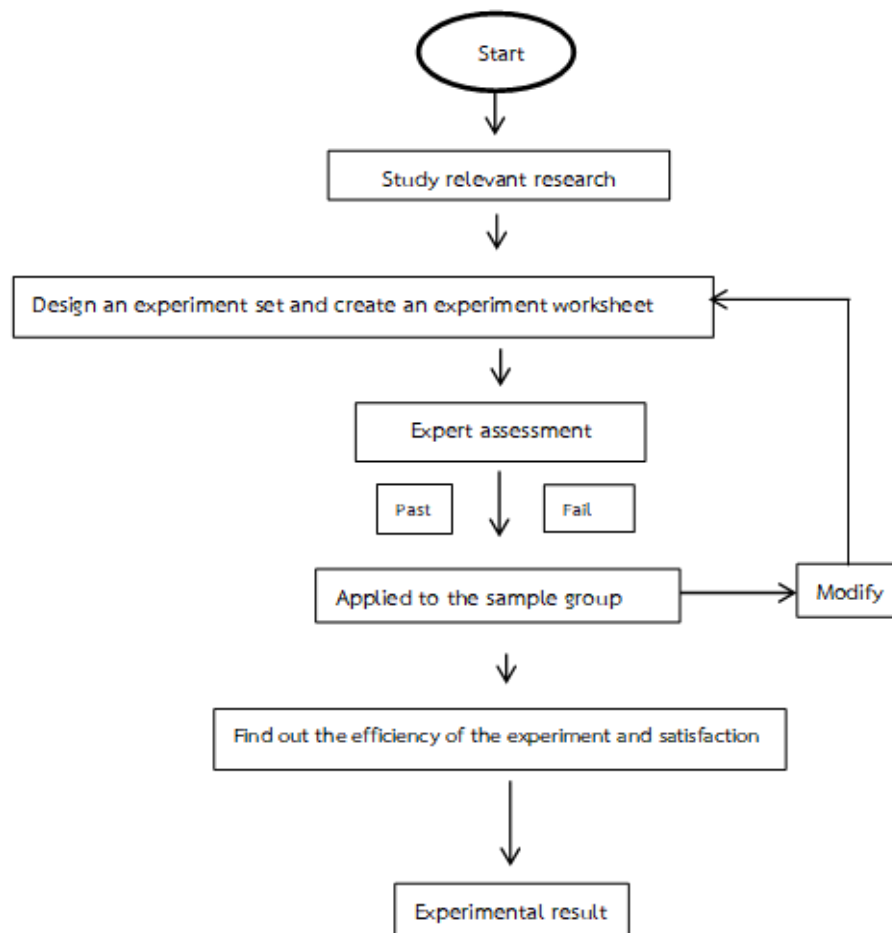
Worksheet 2: Writing motor control instructions 2 Working 2 strokes working

Worksheet 3: Writing motor control instructions 2 Working 4 strokes working

Worksheet 4: Writing commands for controlling 2 motors, running 4 strokes, working with 1 position switch as input

Worksheet 5: Writing commands, controlling 2 motors, running 4 strokes, working with 3 sensors as input

Worksheet 6: Writing commands



**Figure 1** Plan for creating and finding quality test kits

to control the steel separation system

Worksheet 7: Writing commands

to control cylindrical steel sorting systems

3 quality assessment form

3.1 Quality evaluation form for experimental set

3.2 Assessment form for quality of work content

3.3 Student satisfaction assessment form

4 Experiment and data collection After the researcher created the PIC16F877 / 16F84 microcontroller experiment kit with industrial work, the cylindrical type steel sorting machine using the color check sensor. Completed, the experts have evaluated the experiment and the work sheet whether it is appropriate or not, then ap-

plied to the sample group to find the efficiency of the experiment set and assess the satisfaction from the students using the experiment set using Total time 5 3 weeks per week for conducting experiments and collecting data.

### Research result

Development of microcontroller experiment kit PIC16F877 / 16F84 With the industry of cylindrical type steel sorting machine Has been evaluated by 5 experts and evaluated satisfaction by students 35 people, then find the efficiency of the experiment set created as follows.

### Expert evaluation results

This research uses the evaluation form for the development of the PIC16F877 / 16F84

microcontroller experiment kit with the industrial work of a cylindrical type steel sorting machine by 5 experts.

**Table 1** Evaluation results of the experts in the experiment set

| Evaluation list  | $\bar{x}$   | S.D.        |
|--|-------------|-------------|
| 1. Suitable for learners                               | 4.46        | 0.78        |
| 2. Results are accurate.                               | 4.24        | 0.70        |
| 3. Easy to use and convenient                          | 3.87        | 0.85        |
| 4. Appropriate for the content and teaching objectives | 4.45        | 0.84        |
| 5. able to encourage learners to learn                 | 4.54        | 0.69        |
| <b>Total average</b>                                   | <b>4.35</b> | <b>0.84</b> |

From Table 1, the results showed that the experimental set had an average score of  $\bar{x} = 4.35$ , S.D = 0.84, which was very appropriate.

**Table 2** Assessment results of the work professionals

| Evaluation list  | $\bar{x}$   | S.D.        |
|--|-------------|-------------|
| 1. Suitable for learners                               | 4.45        | 0.68        |
| 2. Results are accurate.                               | 4.44        | 0.68        |
| 3. Easy to use and convenient                          | 4.63        | 0.87        |
| 4. Appropriate for the content and teaching objectives | 4.68        | 0.78        |
| 5. able to encourage learners to learn                 | 4.45        | 0.68        |
| <b>Total average</b>                                   | <b>4.65</b> | <b>0.65</b> |

From Table 2, the evaluation results showed that the average work score was equal

to  $\bar{x} = 4.56$ , S.D = 0.65, which was very appropriate.

### The results of the performance analysis of the experiment set

Determining the efficiency of the experimental set by applying the designed work sheet with the experimental set to be used with the sample group of 35 people. The results of the data analysis are shown in Table 3 and 4.

**Table 3** Results of learning progress from work (E1)

| worksheet            | $\Sigma x$ | $\bar{x}$ | S.D. | E1           |
|----------------------|------------|-----------|------|--------------|
| Story 1              | 138        | 8.26      | 1.11 | 81.36        |
| Story 2              | 141        | 8.21      | 1.18 | 82.25        |
| Story 3              | 143        | 8.39      | 1.10 | 81.55        |
| Story 4              | 144        | 8.49      | 1.04 | 82.22        |
| Story 5              | 144        | 8.52      | 1.09 | 81.54        |
| Story 6              | 146        | 8.42      | 1.13 | 81.13        |
| <b>Total average</b> |            |           |      | <b>82.14</b> |

From Table 3, the results showed that all 35 students of the sample group made both experimental sets 6 work sheets, therefore the efficiency of the work sheet is 82.14 which is higher than the set criteria 80/80.

**Table 4** Achievement of Learning Efficiency from Worksheet (E2)

| worksheet            | $\Sigma x$ | $\bar{x}$ | S.D. | E1           |
|----------------------|------------|-----------|------|--------------|
| Story 7              | 151        | 8.92      | 0.95 | 86.54        |
| <b>Total average</b> |            |           |      | <b>86.54</b> |

From Table 4, the results showed that all 35 students in the sample group made the work sheet, subject to No. 7, so the efficiency of the work sheet was 86.54 which were higher than the criteria set 80/80.

From Table 3 and 4, summarizing the results of the development of the PIC16F877 / 16F84 microcontroller experiment kit with the cylindrical steel sorting industry, it appears that the generated model has the efficiency of 82.14 / 86.54 Which over the specified criteria.

#### Student satisfaction assessment results

The researcher used the experimental set that was created to be used with the sample group at the fourth year undergraduate level in Computer Engineering, Faculty of Engineering. Kasembundit University registered the robot engineering course, subject code CT.419, 1st semester, academic year 2562, number 35, from after teaching with microcontroller experiment kit PIC16F877 / 16F84 with the cylindrical type steel sorting industry, it is found that students have more understanding and satisfaction of students towards the PIC16F877 / 16F84 microcontroller experiment kit with industrial cylindrical type steel sorting machine. Very good level

**Table 5** Results of student satisfaction assessments

| Evaluation list  | $\bar{x}$ | S.D. |
|--|-----------|------|
| 1. Suitable for learners                               | 4.47      | 0.78 |
| 2. Results are accurate.                               | 4.65      | 0.67 |
| 3. Easy to use and convenient                          | 3.67      | 0.58 |
| 4. Appropriate for the content and teaching objectives | 4.15      | 0.68 |

| Evaluation list                        | $\bar{x}$   | S.D.        |
|--|-------------|-------------|
| 5. able to encourage learners to learn | 4.23        | 0.74        |
| <b>Total average</b>                   | <b>4.34</b> | <b>0.82</b> |

From Table 5, the results showed that the students' satisfaction with the experiment set had an average score of  $\bar{x} = 4.34$ , S.D = 0.82 was very good.

#### Summary and discussion of research results

This research article presents the development of the PIC16F877 / 16F84 microcontroller experiment kit with industrial cylindrical type steel sorting machine. The results are as follows:

#### The evaluation results of the experiment set by experts

This research article uses the appropriateness of the development of the PIC16F877 / 16F84 microcontroller experiment kit with the industrial work of a cylindrical type steel sorting machine by 5 experts. The results of the research revealed that the evaluation of the experimental set had an average score of  $\bar{x} = 4.35$ , S.D = 0.84 with a very good level of suitability, and the results on the work sheet had an average score of  $\bar{x} = 4.56$ , SD = 0.65 is very appropriate. The results of the study are consistent with the research and research on the development of training sets for installing satellite dishes on satellite communication systems according to the vocational certificate program. In 2003, the Office of the Vocational Education Commission, which found that the quality of the suit was very good, with an average of 4.60, standard deviation equal to 0.29. The trial is at a good level. Has an average of 4.60, standard deviation is 0.23

Results of student satisfaction assessment for the development of the PIC16F877 / 16F84 microcontroller experiment kit with industrial cylindrical type steel sorting machines. Students are satisfied with the development of the PIC16F877 / 16F84 microcontroller experiment kit with industrial applications. Cylindrical steel sorting machine after being used in teaching in robot engineering courses, course code CT.419, 1st semester, academic year 256 2 35 people with an average score of  $\bar{x} = 4.34$ ,  $SD = 0.82$ , which is very suitable at the level that is consistent with the research. The research and development of the experimental set and the application of the microcontroller board with the object sorting work, which has an average score of 4.03, is equal to 0.61 is very appropriate

The results of the analysis of the development of the PIC16F877 / 16F84 microcontroller experiment kit with industrial applications, a cylindrical type steel sorting machine, the determination of the efficiency of the PIC16F877 / 16F84 microcontroller experiment kit with industrial work, cylindrical type steel sorting machine Applying to the sample group of 35 people by considering the learning achievement of the sample group. It was found that the development of the PIC16F877 / 16F84 microcontroller experiment kit with the industrial work of a cylindrical type steel sorting machine has efficiency equal to 82.14 / 86.54. Overall, the developed experimental set is at a good level. Appropriate for applying for the development of teaching and learning in microcontroller subjects, which is consistent with the research that has been researched on the development of waste circuit

training sets. Audio Diploma course followed. The Department of Electronics Technician, Office of the Vocational Education Commission, with the results of the experiment to find efficiency with 20 samples.

### **Suggestion**

Suggestions from the research results of the development of the microcontroller PIC16F877/ 16F84 experiment kit with industrial applications.

#### **1 suggestion from research**

1) Teaching and learning in practice before allowing students to take action Instructors should demonstrate knowledge about using the development of the PIC16F877/16F84 microcontroller experiment kit with industrial applications, cylindrical type steel sorting machines and explain precautions while performing for the safety of learners.

2) Students should carefully read the details of each step of the work manual before proceeding. The instructor then supervises the operation, gives advice and evaluates the performance according to the evaluation form. Of each work will help the teaching and learning by using the development of microcontroller PIC16F877 / 16F84 test kit With the industry of cylindrical type steel sorting machine for higher efficiency

#### **2 suggestions for further research**

The development of the PIC16F877 / 16F84 microcontroller experiment kit with industrial work, a cylindrical type steel sorting machine to be used with a sample group that is a learner in a short course. For further development in the future.



## Reference

- Research and Educational Quality Assurance Division Phayao University. 2016. Thailand 4.0 model driven blueprint Thailand to prosperity, stability and sustainability. Search 17 June 2018 from <http://www.libarts.up.ac.th/v2/img/Thailand-4.0.pdf>.
- Wiwat Meesuwan. 2016. Internet for Things and Education Internet of Things on Education. Journal of Social Communication Innovation. 4 (2), July - December, 83 - 92.
- Phisit Hengchinda. 2013. Development and study of the efficiency of the sensor control experiment with the LabVIEW program. Thesis Master of Industrial Science Electrical Engineering Department of Electrical Education Graduate School, King Mongkut's University of Technology Thonburi.
- Donson Pong Pha, B.E. 2007. PIC Microcontrollers and Applications Bangkok: Technology Promotion Association (Thai Japan).
- Aniwat Pholrak and Somsak Aktimakul. 2013. Construction and efficiency search for training kits on microcontrollers and basic robot applications Faculty of Industrial Education King Mongkut's University of Technology North Bangkok.
- Adithep Khaipetch. 2003. Creating a microprocessor instruction set Faculty of Industrial Education Rajamangala Institute of Technology.
- Yuthapichai Klaijan. 2003. Creating and searching for performance sets, filter circuits, elective frequencies, op amp and ICs High Vocational Certificate Program, 2003. Master of Industrial Education Degree Thesis Electrical Communication Engineering, Graduate School King Mongkut's Institute of Technology Ladkrabang.
- Thanin Sinjaru. 2012. "Research and analysis of statistical data with SPSS and AMOS", type 13 SR Printing Mass Products. Bangkok.
- Jarawat Manisri. 2009. Subject Development of training set for satellite dish installation, satellite communication system According to the Diploma course Thesis in Electrical Communication Engineering Faculty of Industrial Education King Mongkut's Institute of Technology Ladkrabang.
- Supawit Muang Charoen. 2016. Development and construction of a test kit for the application of microcontroller boards and object sorting tasks. Faculty of Industrial Education Rajamangala University of Technology Suvarnabhumi.
- Natthaphong Kaewwong. 2010. Development of audio amplifier circuit training kit for audio subject-according to the principle Professional Diploma formula. Thesis in Electrical Communication Engineering Faculty of Industrial Education King Mongkut's Institute of Technology Chao Khun Ladkrabang.
- Direk Maniwan, Phinij Khiangpirom and Somsak Aktimagul. 2015. Development of instructional packages on Strait circuits in waves Faculty of Industrial Education King Mongkut's University of Technology North Bangkok

Watcharin Suksawang, Wisut Soonthornkanokpong and Peerawut Suwannachan 2013. Color television set, LCD display Faculty of Industrial Education King Mongkut's Institute of Technology Ladkrabang

Premchai Kongtan, Wisut Soonthornkanokpong and Peerawut Suwannachan. 2012. AVR ATMEGA microcontroller experiment kit 32. Journal of Industrial Education. 11 (2), Nor. 113 - 137.