

Mobile Robot Programming Experimental Sets for High School Education

Patiyuth Pramkeaw, and Chaiyapon Thongchisuratkrul

Abstract—This research proposes the Experimental Sets of Mobile Robot Programming for high school education. The main objective of research is to transfer a skill on how to operate the robot. In this experimental set, the experimental set consists four mobile robots and five designed testing experiments which are used in assessing the students' programming skills on our designed topics: Goals, fundamental knowledge for practicing, Theory supporting experiment, tools and materials, proper practice procedure and risk prevention, experimental procedure and result conclusion. In a final state of Mobile Robot Programming, the proposed experimental set will receive all data generated from experiment for controlling robots and then showing all operating condition.

Keywords— Mobile Robot, Experimental set, line tracking robot

I. INTRODUCTION

IN the present, high school education of Thailand has learned in career and technology, which is necessary skills for living and each technology, in contrast the learning hasn't had a test equipment of new technology yet.

The high school education in Career and Technology hasn't had the test equipment that affected to producers and they've realized that Daruna Ratchaburi School has the GIGO jigsaw which the student has well – known familiarly in addition to the producers created a mobile robotic control experiments by the GIGO that is shaped to robot structures with Micro controller (PIC, 16F887) and then it connected to other sensors in order to make Robot automatic operation. And it consists of 4 functional model within a single robot. Furthermore, it can be able to download program for control the work as required of learners [1].

As above-mentioned, the problem is Career and Technology hasn't had a test equipment of new technology for high school students in the present. Therefore, the producers created a mobile robotic control experiments and learning papers that make the students has a new technology ideas. Moreover, it affected to happen the inspiration of their work for the future with a way to daily applied.

Patiyuth Pramkeaw, and Chaiyapon Thongchisuratkrul, are with Department of Teacher Training in Electrical Engineering, Faculty of Technical Education, King Mongkut's University of Technology North Bangkok, Thailand.

II. METHOD DESCRIPTION

Before designing in each part, it's the most important to analyze and search the information for developed connection. The information is arranged by the producers as follow as:

A. Microcontroller PIC 16F887

Microcontroller from 2 word that one is Micro which means tiny and another is Controller which means a controller equipment. As a result, the word 'Microcontroller' is the small controller equipments that it has capabilities similar to a computer system in addition within the microcontroller involved in CPU, memory card, and Port that is the main consisting of computer [2].

B. R-TRACKER, R-LIGHT S5, R-SOUND S5 and Ultrasonic sensor

R-TRACKER is the sensor circuit which is line detector by using to reception and transmission of the infrared circuit that has 3 points of infrared sensor modules (R-TRAC-KER 3) and (R-TRC1). It relies on the reflection of infrared signals that doesn't reflect in objects or black texture. As a result, it can be able to assay or separate between black or white surfaces. In the contrast, each places have the different concentrates and quantity of light that affected to the infrared working. Therefore, the circuit designing be able to adjust the sensitivity of detection to adapted with adjustable resistor to 10 k Ω for flexibility in each place easily.

R-LIGHT S5 is light sensors which uses to detect the reflection of light and applies to non-contact collision detection sensors or robot detection sensor. It works as light dependent resistor (LDR) that connects to the voltage divider circuit with adjustable resistor to 10 k Ω and it be able to adjust the sensitivity signals.

R-SOUND S5 is sound sensors which applies to sound detector or the robot voice controlling. R-SOUND S5 takes output signals to analog voltage signals that the voltage varies by the volume of incoming via condenser Microphone.

Ultrasonic sensor

HC-SR04 modules or Ultrasonic sensor is module for measured spacing with ultrasonic waves. There're vary using depends on the manufacturer, quality and price. It can be able to applies as, a mobile robot obstacle detection, trialing the Module HC-SR04 measured a spaces with ultrasonic waves and Arduino board or PIC [3].

C. Kia-Motors and IC Driver L293D

Kia-Motors, using is dc motor 3-6 volts, uses the magnetic fields and generated by electric current to rotate the motor

which is connected to shafts. The energy transmitted from the rotor to the shafts and mechanical power, and then sent to the device. The mechanical power is used to rotate the gear ratios as 48: 1 while the motor rotated 1 round affected to the enhanced torque of the motor, meanwhile the speed of the motor is reduced.

D. Principles of learning papers

Learning papers is order papers that are especially useful in competition. This lead the students be able to test or experimental demonstration and proving of scientific principles. Although, the papers is valued in the competition, teachers can use the same technique to helps the students to learn a theorem proving. Another way is the papers helps the students to participate in lessons and activities in the assessment teaching. Moreover, they have to follow the clarification in the papers as a result as it is the assessment teaching as guide the students to follow the requirement of lessons.

III. THE DEVELOPMENT PROCESS

Design and create experimental Sets of Mobile Robot Programming for high school education are divided into main parts there are Main menu, usability and Screen design.

A. Information studying and courses

The operated creating of mobile robot programming for high school education is uses in career and technology which the producers have to study the student's courses to guidelines the experiment designs, robot working and learning papers. Therefore, the producers took the course of basic education of the Ministry of high school education in career and technology to study and analyze as a results to experimental Sets of mobile robot programming for high school education are consistent with the second course in technology design and details are as follow:

Code – Subject name: Design and Technology, Career and Technology

Standards of Learning / indicators

- Standards of Learning / indicators

Understand technology, technology designing processes, and creating supplies or implement of creative technology processes, using creative technology for life, social and environment, and participated to manage sustainable technologies.

- Indicators

Described and connected the relations between technology with each other.

By the standard of learning and indicators of Design and Technology in Career and Technology from above mentioned. Thus, the producers designed experimental Sets of Mobile Robot Programming for high school education.

B. Mobile robots Programming

- mobile robots Programming uses light sensors (R-LIGHT S5) to light detector that the sensor is located at the end of robot and designed to robot there're working as [4] ;

Step1: Open switches, As a result, the robot doesn't work.

Step2: Brings lights and shine to light sensor (R-LIGHT S5), As a result, the robot walk forward.

Step3: Stop light to the light sensor (R-LIGHT S5), As a result, the robot walk stop.

- Line tracking by line tracking sensors (R-TRACKER) to detect line that is located at the end of the robot and designed to robot there're working as ;

Step1: Open switches, As a result, the robot work forward.

Step2: Left sensor middle and right detects no the black lines. As a result, the robot walk forward.

Step3: Left sensor doesn't detect the black lines, Middle sensor detects the lines and, Right sensor doesn't detect the line. As a result, the robot walks forward.

Step4: Left sensor detects the black lines, Middle sensor doesn't detect the lines, and Right sensor doesn't detect the line. As a result, the robot turns left.

Step5: Left sensor detects the black lines, Middle sensor doesn't detect the lines and, Right sensor doesn't detect the line. As a result, the robot turns left.

Step6: Left sensor doesn't detect the black lines, Middle sensor doesn't detect the lines and, Right sensor detects the line. As a result, the robot turns right.

Step7: Left sensor doesn't detect the black lines, Middle sensor detects the lines and, Right sensor detects the line. As a result, the robot turns right.

Step8: Left sensor detects the black lines, Middle sensor detects the lines and, Right sensor detects the line. As a result, the robot walks forward.

- Sound working by Sound sensor (R-SOUND S5) to detect sounds that is located at the end of the robot and designed to robot there're working as ;

Step1: Open switches, As a result, the robot doesn't work.

Step2: Clap the hands 1 time, As a result, the robot walks forward.

Step3: Clap the hands 2 times, As a result, the robot walks back.

Step4: Clap the hands 3 times, As a result, the robot turn left.

Step5: Clap the hands 4 times, As a result, the robot turn right.

Step6: Clap the hands more than 4 times, c.

- Barrier elusiveness uses ultrasonic sensor to detect the barrier that is located at the front of robot designed to robot there're working as;

Step1: Open switches, As a result, the robot doesn't work.

Step2: Robot walks forward and find the barrier, As a result, the robot walks back and turn right, and then go forward again.

C. Testing program

Testing C language program which is designed by Proteus in 4 designs of the simulated working of circuits.

D. Robot designing

Robot designing has 3 wheels which the fronts drive to 2 wheels and the back is one. Drive wheels is Kia motor because it make a speed move to suitable and can support the weight of the car. The robot structure is GIGO because it has durable

and can be disassembled easily. In the sensor parts that shown the figures as:

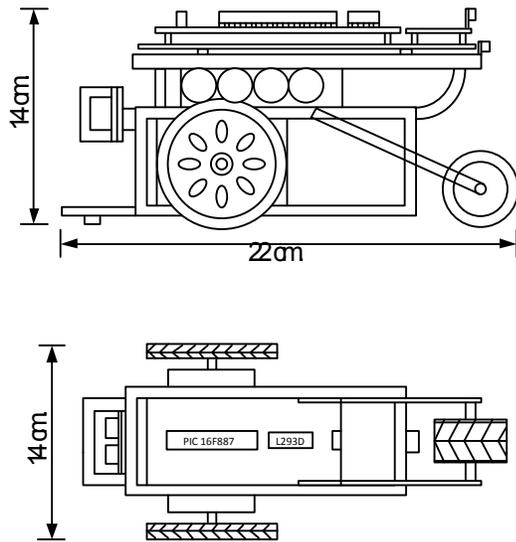


Fig. 1 Design quality structure and size

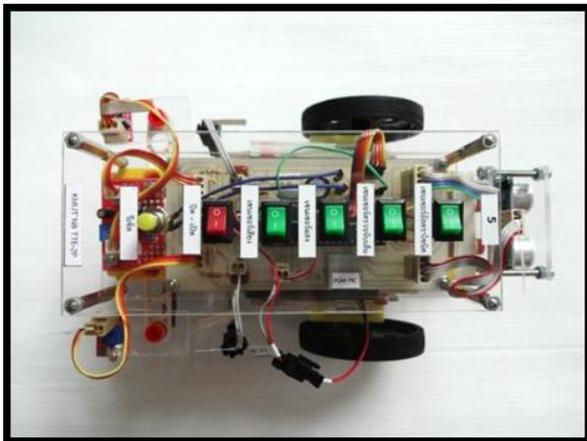


Fig. 2 Shows quality structure and composition of mobile robot on top

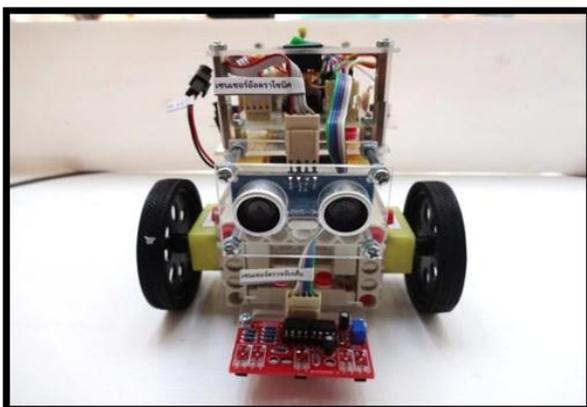


Fig. 3 Shows quality structure and composition of mobile robot on front

E. Learning papers designing

From consideration, factors that affect the competition is learners level, safety, and teacher. The producers estimated a content that relates to more education requirement to most safety and can replace the teachers. From the suitable competition forms is conventional Type, likely the competition, it provides information of the implementation and work-self information which tells the purposes, work steps as well as a summary of the results. This competition will help weak-students replaced the teachers, helps to the capabilities of working plans as the system, to easy for measurement and assessment, to easy for working controller that all affects to safety while work.

IV. PRELIMINARY RESULT

Mobile Robot testing will test as 4 works types that each type is tested by the work condition. And it will test a total of 5 times per 1 condition which follow as:

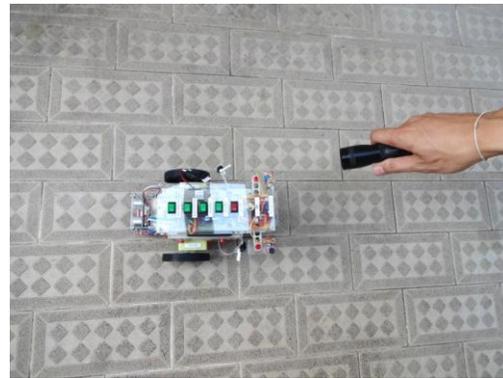


Fig.3 Mobile Robot testing

From the condition testing of robot that results the summarized in Table 4.1

TABLE 4.1
THE CONDITION TESTING OF PHOTOPHOBIA ROBOT

No	Reports	Testing result									
		T1		T2		T3		T4		T5	
		T	F	T	F	T	F	T	F	T	F
1	Brings lights and shine to light sensor (R-LIGHT S5), As a result, the robot walk forward.	✓			✓	✓		✓		✓	
2	Stop light to the light sensor (R-LIGHT S5), As a result, the robot walk stop.	✓		✓		✓		✓		✓	
3	Open switches, As a result, the robot doesn't work.										
4	Clap the hands 1 time, As a result, the robot walks forward.	✓		✓		✓		✓			✓
5	Clap the hands 2 times, As a result, the robot walks back.	✓			✓	✓		✓			✓
6	Clap the hands 3 times, As a result, the robot turn left.	✓		✓		✓			✓		✓
7	Clap the hands 4 times, As a result, the robot turn right.		✓	✓		✓		✓			✓
8	Clap the hands more than 4 times, c.	✓		✓		✓		✓			✓
9	Open switches, As a result, the robot doesn't work.	✓		✓		✓			✓		✓
10	Robot walks forward and find the barrier, As a result, the robot walks back and turn right, and then go forward again.	✓		✓		✓		✓			✓

V.CONCLUSION

The experimental sets of mobile robot programming for high school education, the feature of experimental set consists four mobile robots and five designed testing experiments which are used in assessing the students' programming skills on our designed topics: Goals, fundamental knowledge for practicing, Theory supporting experiment, tools and materials, proper practice procedure and risk prevention, experimental procedure and result conclusion. The study has been conducted for the hardware, set blocks (GIGO) light sensors, sound sensors, line detector, ultrasonic sensor and microcontroller. Field software by using program PIC C Compiler and program PIC kit2. The executing program is used to control mobile robot, test program and design hardware kit which divides into two parts. 1) The structure of the robot. 2) Integrated control of the robot and the robot controller.

ACKNOWLEDGEMENT

This study has been financially granted by the Department of Teacher Training in Electrical Engineering, Faculty of Technical Education, King Mongkut's University of Technology North Bangkok, Thailand

REFERENCES

- [1] Yusuke MAEDA, Nanako ISHIDO, Haruka KIKUCHI and Tamio ARAI, "Teaching of Grasp/Graspless Manipulation for Industrial Robots by Human Demonstration", Proc. of 2002 IEEE/RSJ Int. Conf. on Intelligent Robots and Systems (IROS 2002), pp. 1523-1528, 2002.
- [2] PIC16F87XA Data Sheet
http://ww1.microchip.com/downloads/en/DeviceDoc/395_82b.pdf
- [3] Ultrasonic Receiver Circuit
<http://www.ecelab.com/circuit-ultrasonic-r.htm>
- [4] International Federation of Robotics (Ifr), [online], Available:
<http://www.ifr.org/index.asp> [1 October 2007].