Intuitive Vision Robot Kit
For Efficient Education

OH SangHun[a], CHO SungKu[b], YU BaekWoon[c], Ji Hyun Park[d]
Yonsei University[a] & Kwangwoon University[b]
Sanghun_oh@yonsei.ac.kr, pot1213@naver.com, bwrew2@gmail.com, jihyunpark8912@gmail.com

Abstract

This article presents the features of "Luxrobo Kit", the intuitive robot kit for image processing. It explains the trends of current robotics education, and advantages of "Luxrobo Kit" over existing educational robots. Through Luxrobo Kit's vision (image processing) ability intuitive robot education is possible.

I. Introduction

Despite advancements in robotics, educational robot kits still remain outdated. The aim of robot competitions is to promote study in robotics, and the robot industry. Consequently, robot competitions introduce new categories as new technologies emerge. In recent years, increasing number of robot competitions have included new games that implement image processing using vision sensors. However, there aren't any robot kits and learning programs in the existing market that effectively teaches image processing. Therefore, we analyzed and solved the problems of the existing robot kits, and designed a new robot kit with image processing ability.

II. Body Text

2.1 Trends of Educational Robots and Definition of "Luxrobo Kit"

In the 21st century, advances in technology have put robotics into spotlight. As robots became an important part in our everyday life, such as factory automation, disaster relief, and space exploration, interest in robotics education have steadily increased. However the level of robotics education falls behind the level of technology we have. Most students learn basic level of sensor manipulation, and detection of distance and color through IR sensors. Thus, robot kits and education of advanced level of robotics, such as image processing are hard to find.

Luxrobo suggests a new robot kit, the "Luxrobo Kit" as a solution for teaching image processing, sensor and motor control, and firmware and software programming. Since visual information is provided through camera, students can intuitively understand and learn how the robot recognizes an object, and design how the robot will judge its next movement according to position and type of the object. The robot has cameras for image processing, 3 large DC motors with built-in PID controller, and can control up to 255 different components including sensors, servomotors, and small DC motors.
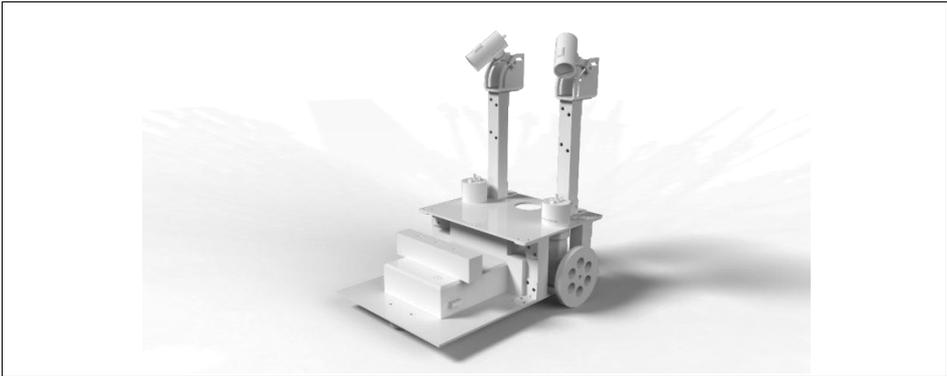
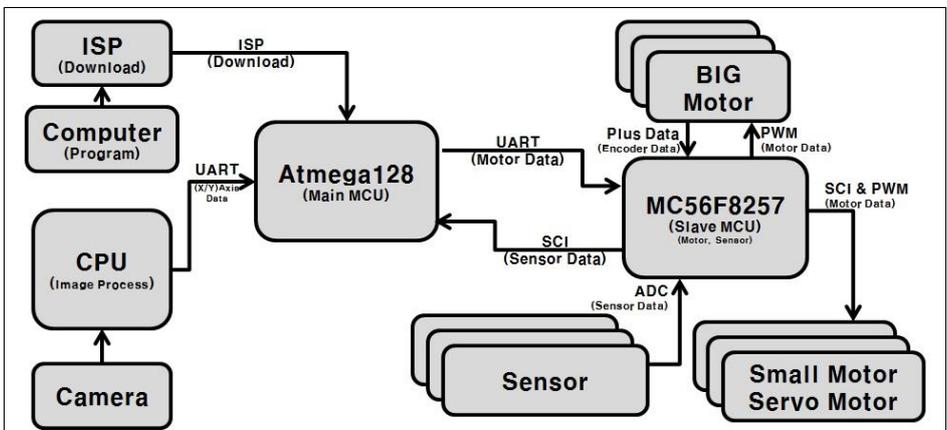Fig. 1. 「Luxrobo Kit」 (Prototype)

Fig. 2. Block Diagram of 「Luxrobo Kit」

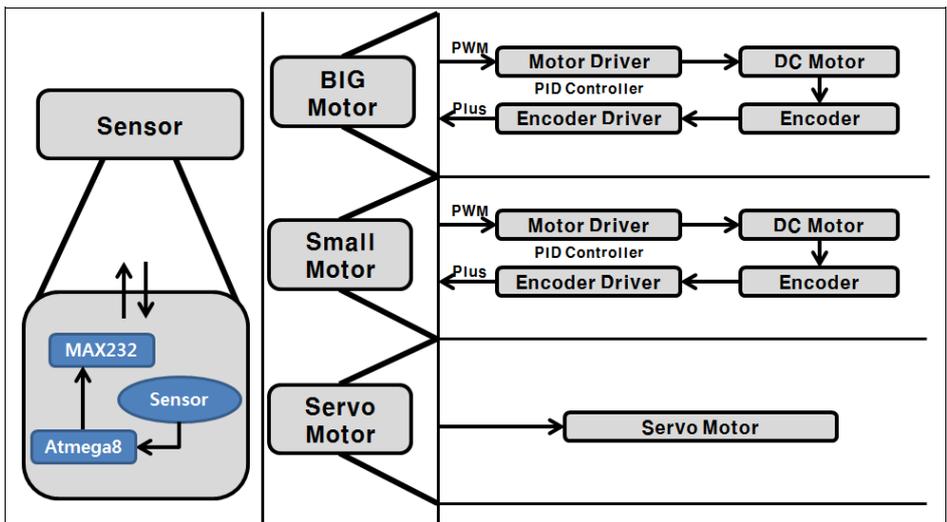User can only program with Atmega128 and CPU.

Fig. 3. Sub Block Diagram of 「Luxrobo Kit」

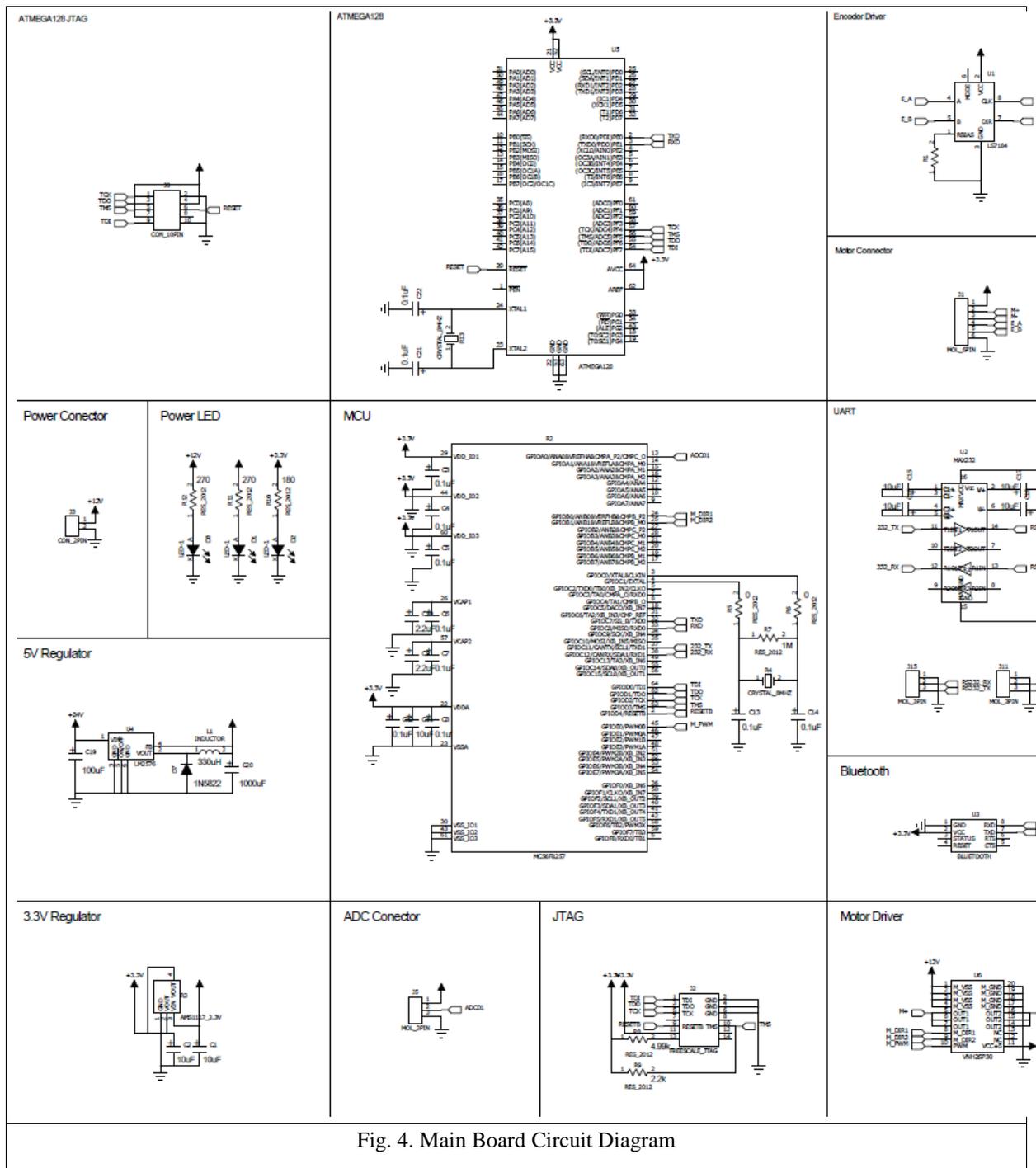User can add extra sensors and motors to the robot.
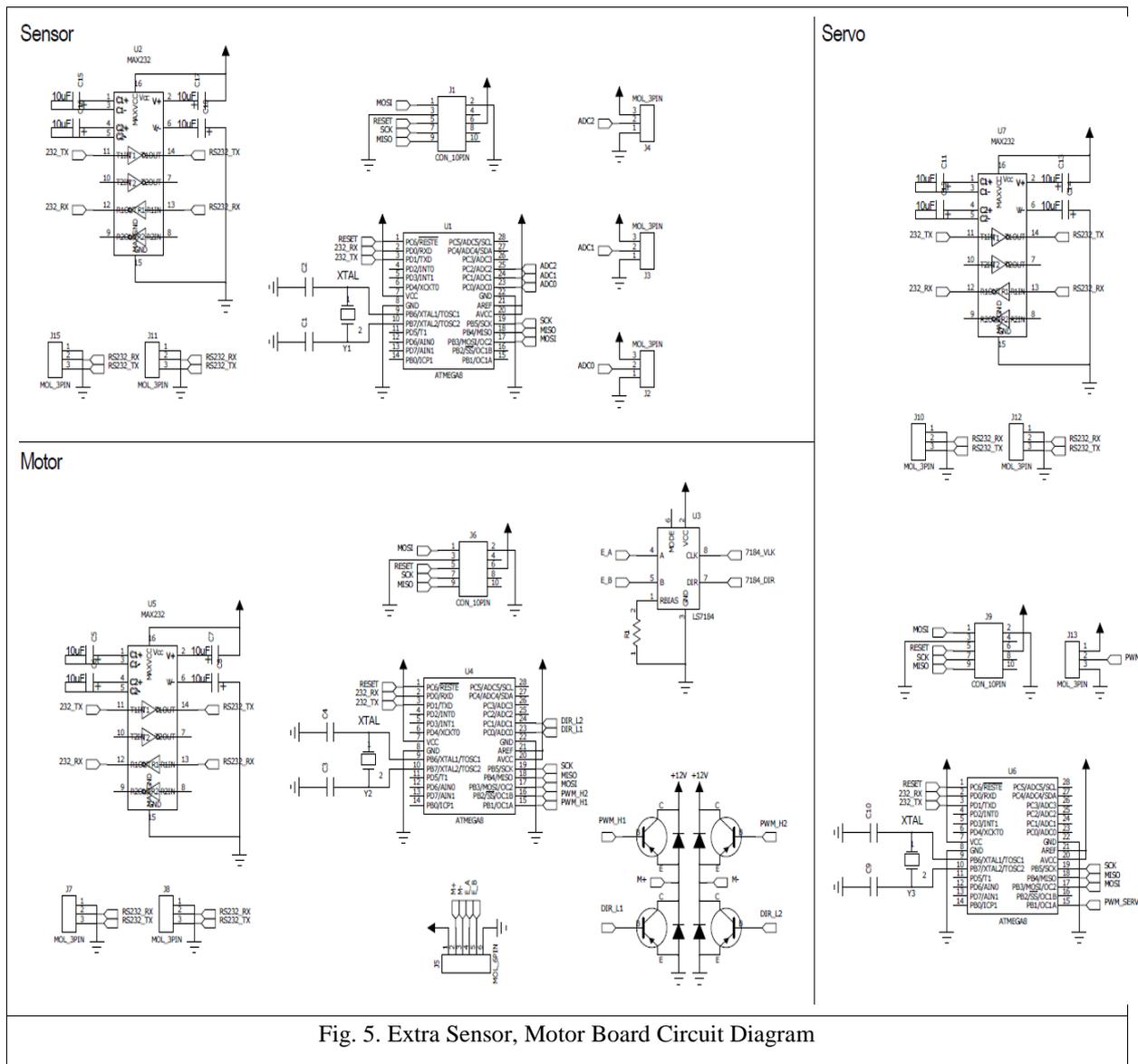
Fig. 4. Main Board Circuit Diagram

Fig. 5. Extra Sensor, Motor Board Circuit Diagram

2.2 Difference between "Luxrobo Kit" and Existing Educational Robots

Existing educational robot kits can install up to 4 motors and sensors. Since the number of motors and sensors are limited, the robot's functions were also limited, and impossible to run the robot with stable control. The existing robot kits adopt main controller with 16Mhz, ADC 8PIN, SCI 1PIN, PWM 4PIN, so the robot didn't perform well. Recently the price of 1Ghz mobile CPU has decreased and its performance improved. So we found opportunity in the current market and developed a new educational robot kit (Luxrobo Kit) that follows the trend of technology.

The number of motors, precision, and speed of "Luxrobo Kit" are higher than other existing robot kits, and they allow more freedom in robot movements. "Luxrobo Kit" can also perform subtle movements, because it has more sensor units and sensor resolution. Through camera vision, robot can detect object's shape, distance between the object, and determine its current position and angle, and robot can possibly use artificial

intelligence and vision navigation.

 "Luxrobo Kit" uses Linux as its operating system. Wireless internet and USB is supported and every possible environment in computer can be applied. Through remote access, such as SSH, remote program development, remote control, and remote management are possible. In addition, program development of artificial intelligence and image processing algorithm is possible, using GCC.

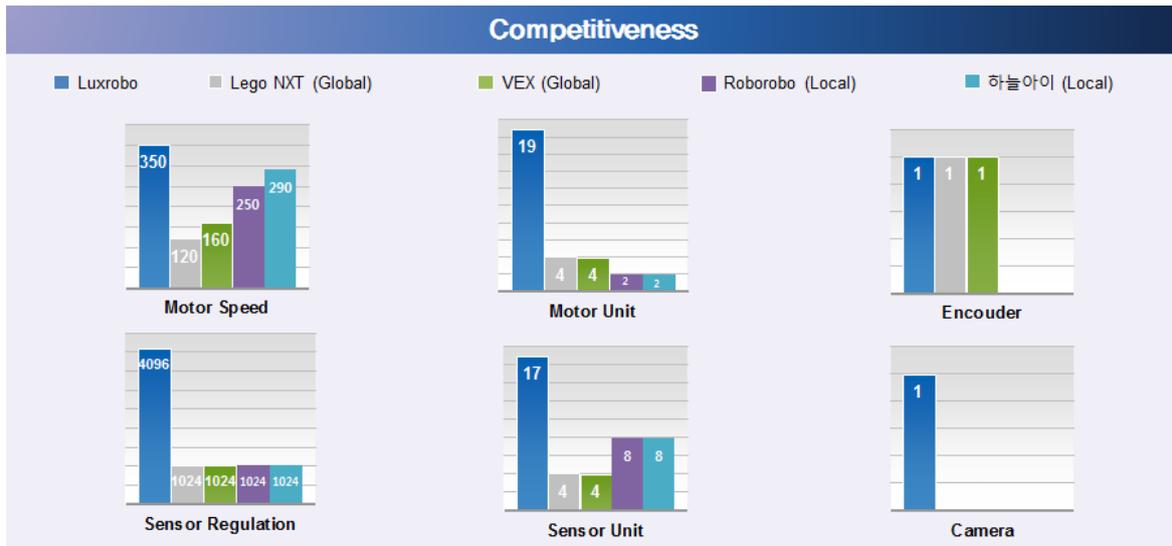Figure below shows the comparison between "Luxrobo Kit" and other robot kits.
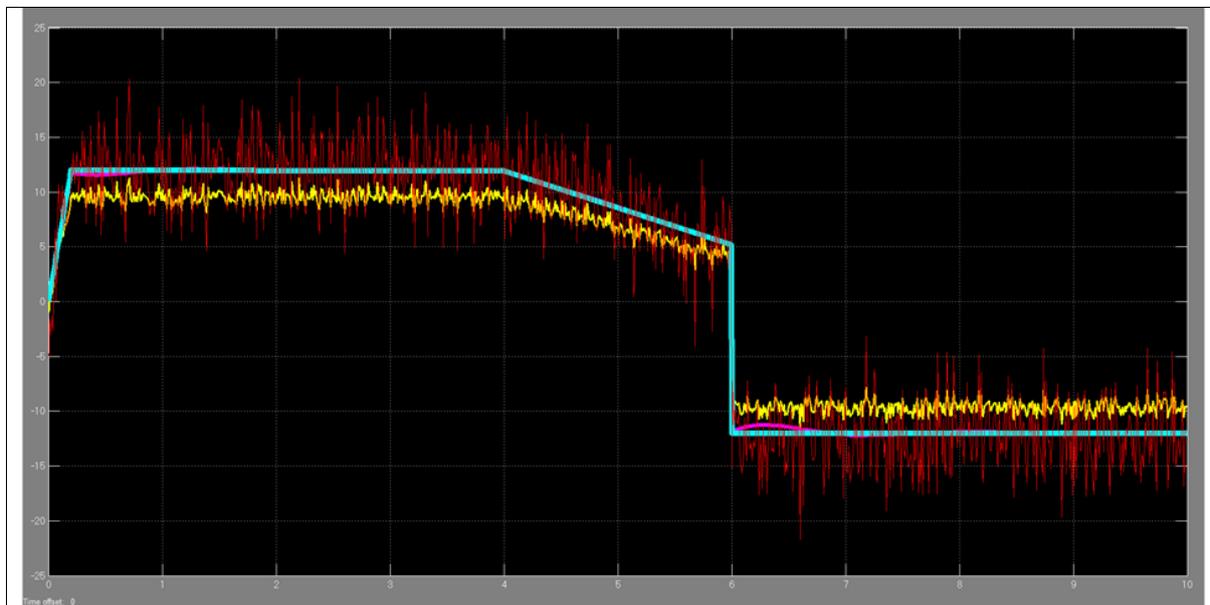

Fig. 5

Fig. 6. Result Value of Luxrobo's Motor PID Control And Company A's Motor Speed Control When Noise Is Added			
Red	Noise	Yellow	Motor control of Company A
Blue	Input Value	Purple	Motor control of Luxrobo Kit

Compared to company A, the result value of Luxrobo's PID control matches input value with better precision. Thus, "Luxrobo Kit" is noise-resilient, and can delicately control position, speed, and current. It makes robot easy to maneuver.
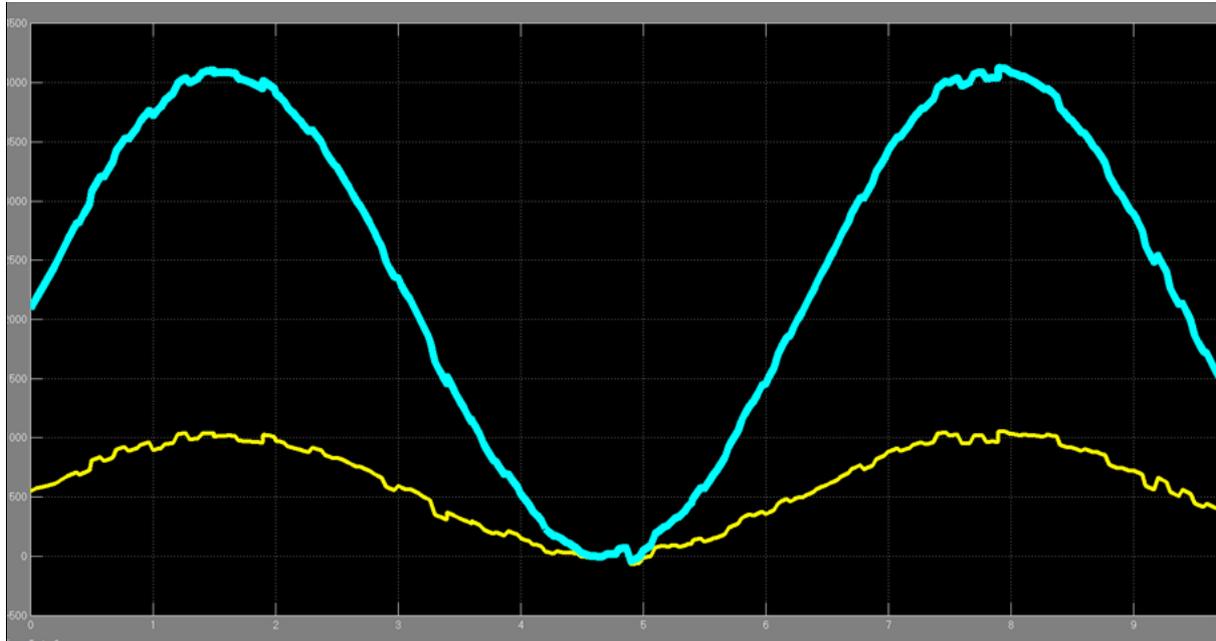

Fig. 7. Difference in Sensor Resolution Value

Blue	Luxrobo	max. 4095	Yellow	Company A	max. 1023

Luxrobo Kit's sensor resolution is 4 times faster than exiting robot kits. Consequently, the precision of vision is also 4 times higher. User can control the robot with higher accuracy.

III. Conclusion

"Luxrobo Kit" can be applied in many different areas, using its high performance motors with precision control, 255 I/O PIN, big capacity for sensors, and image processing through camera. "Luxrobo Kit" gives more freedom with robot control, and allows wide range of education. Since, 90% of motor runs with PID control, students can learn PID control. It uses Linux as its operating system, so program can be written in graphic environment, and is open to higher degree of freedom. Therefore, Luxrobo Kit will give opportunity for students to develop creative and innovative thinking, and high level of robotics education.