Coffee Groping Control System using tcs 3200 Sensor Based on xbee

Sarjana¹, Emilia Hesti² and Sholihin³
¹Electrical Engineering, Politeknik Negeri Sriwijaya, Jalan Srijaya Negara, Palembang, 30139, Indonesia
²Electrical Engineering Department, Politeknik Negeri Sriwijaya, Jalan Srijaya Negara, Palembang, 30139, Indonesia
Corresponding authors: sholihin@polsri.ac.id

Abstract. Lots of inventions as well as all the uses of technological advances that are very helpful in alleviating human work, especially in the field of industry that cultivate fruit crops with small size. This paper provides a method of accelerating the use of TCS3200 color sensors for color quantization, it was done with various images and showed that the modifications have been able to show that the TCS3200 color sensor is also very competitive as the color quantization of images, both in terms of effectiveness and efficiency. On the other hand, this system will use the pattern by knowing the coffee grouping control system with the wireless signal using Xbee pro module, where the XBee Pro module is to set the remote control with wireless network assisted, so the farmers do not have to bother to controlling from close range. Furthermore, the database will be built for several colors of fruit coffee and the comparison of fruit shape to be made with a control system grouping the fruit of coffee will be done using servo motors, so that when the tool works will be in line with the use of color sensors that can detect the color of the coffee beans.

Keyword: artificial intelligence, embedded system, microcontroller, sensor, and transducer xbee pro

1. Introduction
In general, we choose the fruit at the Industry with the manual way, it takes a long time and also need human resources, so we need a device that can grouping the fruit based on color with an automatic system to help the worker to be more effective. In the era of globalization, everything is developing rapidly. This development is support by the development of technology that really important for all the development in all sector [1]. Especially in Electronics and Telecommunication sector. As we can see, that there is so many modern equipments that can help people to help their daily activity. There are so many inventions in Technology that can help people, especially on Industry that can process the plantation result, for example, the small fruits. It motivated people to make a device that can use with the automatic system.

In general, to choose/pick the coffee fruit in Industry, we do it with the manual way, it takes a long time and also human resources, With the electronic application, me as an author hoping that can make a device that can help the workers to do their job easily in choosing fruits based on it colors.
This device made with a color sensor as a detector and Microcontroller as a controller center which based on Arduino Xbee Pro to control the machine wirelessly. This Controller system using the color sensor (TCS3200 Sensor) as a reader, so when the fruit touch/contact the sensor, with automatically the sensor will get the database. And then the database will send it to the Arduino Microcontroller to trigger/turn on the servo motor with xbee pro for wireless control. The fruit will follow the Conveyor until it reaches the container which equipped by the servo motor. The servo motor will send the coffee fruit to the container that matches with the coffee fruit color based on the program that already made. So the fruit will enter any container that sensor chose.

The investigator also use the xbee pro as a wireless signal device to control the coffee fruit grouping from far away (wireless)

2. Supporting theory

2.1. Applied technology
On the application of this coffee grouping, there is no device that can separate the coffee fruit color. Usually the farmer directly grinds the coffee fruit without separate it. In this case, the investigator interested to separate the coffee fruit color with the color sensor. The applied technology is the control technology color sensor on the embedded system, this controller is using the algorithm if...then with the conditions [2,3].

2.2. Sensor
The sensor is the component to detect the physical magnitude to the electrical magnitude so that it can be analyzed with the certain of the electrical circuit. Almost every electronic device have a sensor on it. On this day, every Industry makes a sensor with tiny size. That size makes it easier to use and also energy saving (less energy to use). Sensor is the part of transducer that have a function to do sensing or “Feel and catch” if there is an external energy transformation that will enter the transducer input, so the transformation of energy capacity that catch by the sensor will send to the convertor from transducer to be transformed to electrical energy [7].

2.3 Photodiode sensor
Photodiode sensor is one of a sensor that sensitive with the light (photodetector), this sensor will have the resistance transformation when it receives the light intensity and it will discharge the electric current by forwarding as another diode. The phototransistor is the same kind of sensor. Photodiode will discharge the electric current with the linear function form to light intensity that received. In general, this electrical current is tidy to the power density. Comparison between the output and the power density is called current responsitivity. The electrical current that refers is when photodiode illuminated. The frequency of photodiode sensor isn’t that large. From that sensitivity, the photodiode sensor has the best sensitivity to infrared, exactly to the light that has 0,9um wavelength [9].
2.4. TCS3200 color sensor
The TCS3200 color sensor is the sensor that already programmed with the 64 of photodiode as a light intensity detector to color object, and also a frequency filter as a transducer which have a function to transform the electrical current to be frequency. This sensor has a focus lens that very useful for the photodiode to detect the light intensity with 2mm range from the lens [10].

2.5. Arduino UNO
On this monitoring robot design, it’s using the microcontroller as a processor and also as a command maker to run/start the robot, the type of microcontroller that used in this project is Arduino UNO, which Arduino UNO is a type of A VR Atmega328 Microcontroller. To make a command to Arduino, it uses the Arduino IDE Application. Arduino is an open source platform which use to make an electronics project.

Arduino is consist of 2 important parts, first is The physical circuit board (Microcontroller) and a software/IDE (Integrated Development Environment) that run on a computer. This Arduino IDE used for write and upload code from the computer to Arduino physical board (Hardware) [10.13].
2.6. **Embedded system**
Embedded system is a special purpose on a computer system that design to do one or any special function with a real time condition for math problematic. The embedded usually packaged as a complete device, including hardware and other mechanic parts. The embedded system control use for the general device. The embedded system is designed to do some certain task. The control system with remote, this device is installed permanently. Especially, the router takes advantage of the connection [13].

2.7. **Xbee pro**
Xbee pro devices is RF module that design with IEEE 802.15.4 standard protocol and suitable with a simple requirement for sensor network. Xbee pro just needs low energy to be operated, and the physical dimension is small that makes it simple to put it on. This module operated on 2.4 GHz frequency [13].
3. Result and discussion

The results of this research will measure the output of the sensors for coffee beans, red sensors for red coffee beans and green sensors for green coffee beans, while the blue colored sensor for brownish coffee beans. Furthermore, in this paper we will also show the results of motor servo motion measurements with oscilloscopes, and with remote control with experimental range test with xbee pro.

| TCS3200 Sensor | Freq.(Hz) | Osciloscope V/div (Volt) | Time/div (ms) | Amplitude |
|----------------|-----------|--------------------------|---------------|-----------|
| Red            | 785       | 5.00                     | 10 ms         | 4.80      |
| Green          | 513       | 5.00                     | 10 ms         | 4.80      |
| Blue           | 459.8     | 5.00                     | 10 ms         | 4.80      |

Figure 5. Xbee pro. [13]

Figure 6. Result of measurement of coffee beans with color sensor TCS3200.
Figure 7. Measurement of Xbee signal strength at a distance 1 meter.

Figure 8. Measurement of Xbee signal strength at a distance 5 meter.

Figure 9. Measurement of Xbee signal strength at a distance 7 meter.
4. Conclusions
The TCS3200 color sensor is active when the sensor detects objects or colors on the coffee passing through it. Color sensor readings can be viewed based on frequency variables that can and output (output) color sensor frequency in the form of the pulse wave. Servo motors will work if given pulses on the input data in the servo motor. Giving a large pulse from the microcontroller determines the angle of rotation of the right and left degrees on the servo motor. While the Arduino microcontroller is the control center on the color coffee fruit grouping tool is automatic. In Xbee range test experiments for a range of 1 meter to 20 meters using the X-CTU program, it was found that the largest signal strengths were at a distance of 1M by -39dBm (Tx), -38dBm (Rx) and in the absence of package loss, Figure 3.1, while the weakest signal strength is at a distance of 20 meters with -53dBm (Tx), -52dBm (Rx) and there is 1 package loss, can be seen in Figure the presence of packet loss and signal strength difference, far Transmitter distance from the Receiver, the weaker signal is also acceptable to the X-Bee module.

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