IMPLEMENTATION OF COMPUTER VISION USING OMNI DIRECTIONAL WITH CANNY EDGE DETECTION TO RICE MICE IN ENHANCE AGRICULTURE PRODUCTION

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Abstract— **Indonesia is one an agricultural country. But currently the development of agricultural technology in Indonesia is still low then there must be innovation related to the implementation of new technology in agriculture. Rice mice are one of the causes of low agricultural production. Rice mice can attack 161,000 hectares each year. Farmers expel pests using chemicals that can damage the wetland ecosystem. Therefore the implementation of computer vision technology tools is expected to be a powerful pest repellent tool and keep the ecosystem stability in the fields. This innovation uses camera omni direction to detect the existence of pests such as rats, birds and others. Then after the pest can be detected it will be controlled by Arduino Mega Arduino controller to turn on the frequency generator. It will produce ultrasonic sound 40 KHz that very effective for drive rice mice out. This technology utilizes solar electric energy that can save electricity usage from farmers, using a title of 48 solar cells capable of producing 24.2 volt voltage. So it can be a source of electrical energy omni vision by reaching 360 vision as far as 25 meters. This innovation is expected to be an effective and efficient agricultural technology to enhance agricultural production.**

Keywords: omni directional, pest, agriculture technology

I. INTRODUCTION

Indonesia is a fertile agricultural country and located along the equator, where most large people live from generation to generation as farmers. In the speech of President Soekarno during the inauguration of the IPB faculty of agriculture building in 1953, he stressed that the biggest problem facing the Indonesian nation is how to provide the population with a large quantity of food. Therefore, farmers are placed in a position responsible for feeding the population, while still having to meet the needs for themselves and their families. Farmers hold significant positions in the life of nation and state.

The Ministry of Agriculture targets Indonesia to become a world food baron by 2045. The target can be achieved through the food self-sufficiency program that has been rolling since 2016 ago. To achieve the target of becoming a world food barn, the government has gradually stopped importing some food commodities. In the past two years, the government has succeeded in halting imports of corn, rice and onions from Argentina, the United States, and Thailand. This success proves that Indonesia has great potential to realize food self-sufficiency in the near future. In 2019, the government targets self-sufficiency in garlic, as well as consumption sugar.

Paddy production in Central Java is very dominant compared to other food crops because the condition of land, irrigation, and climate of Central Java is very suitable for rice cultivation in paddy fields. In 2015, total rice harvest in Central Java increased 0.05% from 1,804,556 ha from 1,717,270 ha in 2014. The average productivity of paddy rice in 2015 also increased by 60.99 ku / ha from previously 54.14 ku / ha. With the harvested area and the average productivity of rice, rice production in 2015 reached 11,006,570 tons significantly increased from the year 2014 which reached 9,294,475 tons

But often in an effort to increase rice production there are several obstacles encountered. The most fundamental obstacle is the decline in the number of rice productions due to natural factors such as extreme weather, floods and pest attacks, or human factors such as land conversion, and limited agricultural production facilities. The presence of pests is a serious cause in decreasing the amount of rice production. Pests that become serious problem from year to year is the rice field rat (Rattus argentiventer). This pest is the main pest of rice crops and the most dominant species that cause the greatest losses in Indonesia (Singleton et al., 2004, Jacob et al. 2010, Sudarmaji et al. 2010). Rice mice can strike 161,000 ha / year, resulting in a loss of 555 million kg of rice, equivalent to 6.3 million Indonesians a year.

Rice mice can attack rice in all phases of planting, ranging from seedling vegetative stage until the generative stage until the harvest. The population of these rats will be more developed if there is willingness of feed, breeding, and the existence of the habitat of the place. Rice mice can give birth three times in one planting period, with the number of children as young as 10 per birth (Sudarmaji et al. 2007, Sudarmaji and Herawati 2008).

ISBN 978-602-53524-0-9

Sudarmaji et al. (2005) and Jacob et al. (2010) states that the dynamics of rat wetland population on rice planting pattern is influenced by the availability of rice crops as the main feed. Rice mice usually live in irrigation dike habitat, bunds near the village, roads in rice fields, and rice field embankment. Rice mice have extensive cruising range to obtain feed in their environment (Brown et al. 2003, Hadi et al., 2006). In the absence of sufficient feeding conditions, mice migrate large amounts of rice, and are able to reach a feed source that is between 3-5 km in one night (Sudarmaji et al. 2010). Therefore, pests of mice are always a threat to rice cultivation in every growing season.

In a study conducted by Melhanah in 2011 on the attack of mice in the rice fields of Central Kalimantan, showed damage caused by these wet rice pests more occur in the rainy season than the dry season. Based on the analysis of Melhanah, in the dry season, endemic areas include in Kapuas and Pulang Pisau districts, while in the rainy season endemic areas include in Kotawaringin Timur, Barito Selatan and Barito Timur. Rice damage caused by rice field rats that reached thousands of hectares was first reported in 1915 in Cirebon, West Java, then every year there is an increase in damage to rice plants with the intensity of attacks by 35%. The appropriate control for the present moment is integrated pest rod control with technical, biological, mechanical, and chemical control components. (Kemtan, 2013)

In general, the handling of wet-rice pests is done by using methods *gropyokan*, *emposan*, as well as poisonous feed in the form of rodentisida. However, the three methods are considered less than optimal because of the rapid growth of pest populations that make farmers must still consider a big loss of rice production. Gropyokan method is done by dismantling the rat house in the rice field. This method of gropyokan will damage the physical soil and damage the rice plants because trampled by farmers when chasing or killing rats. While the way of emposan is done by boring the mouse house ground pit. This second way impacts on polluting the soil and endangers the health of farmers. The use of this rotensida kills other animals that are not actually enemies of farmers. In addition, the use of rodenticides in excess of the dosage can lead to greater selection of selection teams and the development process of faster resistance. On the other hand, the dose is too low it will provide tolerance to the pest. If the dose is too excessive, the pest will die, but it does not rule out that other living creatures are also poisoned. Natural ecosystems will be damaged, soil and water may be poisoned.

Another option to face rice mice problem is using ultrasonic pest repellers. Ultrasonic pest repellers as the name implies, use ultrasound which basically means sound of more than 20,000 Hz. This frequency of sound is practically undetectable by the human ear. Ultrasonic sound is thought to cause certain symptoms in pests such as confusion, convulsions, and even death which is known as an audiogenic seizure response. Pests are then supposed to leave the area that causes this type of distress for a friendlier environment. Based on research by Dusenbery study in 1992, best frequency for mice repellers is 40KHz. But, this option have some negative impact, like using too much electrical energy. Besdie, th cost is high too.

Therefore, a new way of handling pest mice is needed and does not give negative impact to the farmers and the environment. Along with the development of advanced technology, then there must be agricultural technology innovation adequate to handle pests of mice. Expected technology is an effective and efficient technology and minimal negative impact generated. Therefore a technological innovation called agricultural technology with omni direction using solar power to drive rodent pests as an effort to support food security in Indonesia.

II. METHOD

A. Computer Vision Using Omni Directional

The method used in this tool is to use the computer vision method with the omni vision camera sensor, Computer vision is an automated process that integrates a large number of processes for visual perception, such as image acquisition, image processing, recognition and decision making. Computer vision tries to imitate the workings of a truly complex human vision system. To that end, computer vision is expected to have a high level of creativity as a human visual.

Computer Vision is often defined as one branch of science that studies how computers can recognize observed objects. This branch of science together with artificial intelligence (Artificial Intelligence) will be able to produce visual intelligence system (Visual Intelligence System). Computer Vision is a combination of Image Processing and Pattern Recognition that the relationship between the three, image processing is the initial process of computer vision, while pattern recognition is the process of interpreting the image.

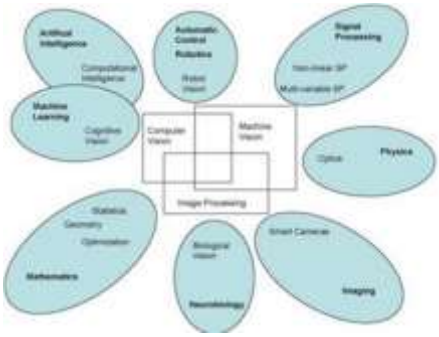

Figure 1**.** Interaction of computer vision

B. Canny Edge Detection

Edge detection is important in image processing. Edge detection using the canny operator is better than other operators because the canny-edge-detector is equipped with various additional features such as smoothing effects, and improving signal to reduce noise in the image . Detection of the edge of Canny has the disadvantage of the weakeshholding lack ability. But this can be minimized by changing the equation in to

$$\prec = \frac{c\ x\ \sigma\ x\ \sqrt{2lnN}}{2^{j-1}}$$

Which

σ: noise standard deviation

ISBN 978-602-53524-0-9

j: decomposition scale
c: the most effective denoising numbers
After detect rice mice, the program will turn on the frequency generator to repell that mice.

C. Flowcart.

Omni vision used to reach 360º vision as far as 25 meters so as to be able to detect the entire surface in the area around the fields. How it works is using the omni webcamp camera that has been programmed through Arduino Mega microcontroller with the detection of objects in the form of mice. Detection rice mice is is done using Canny Edge Detection. So when the rats are in the rice field area it will automatically be read by the camera vision, then controlled by the microcontroller. Once the object of a mouse pest has been detected it will automatically turn on frequency generator. Then the rats in the fields will go away from the rice fields.

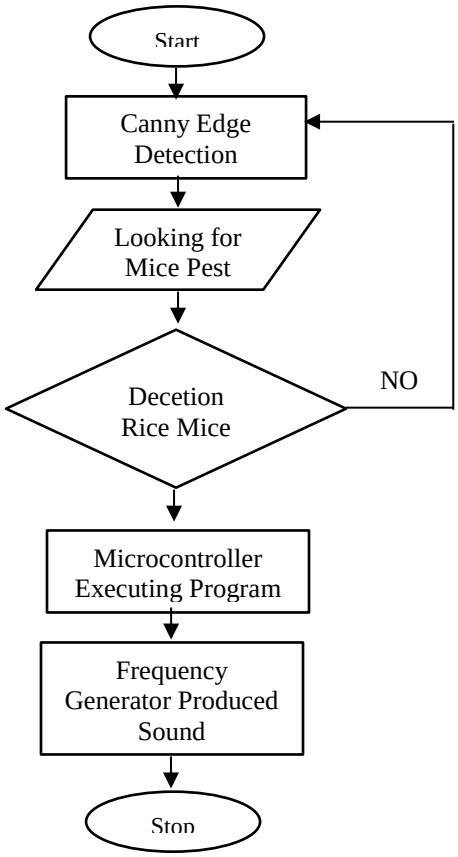

Figure 2. Flowchart Program and Hardware

D. Mechanical Design

Mechanical design is to utilize the work system of omni directinal camera that can reach fully as far as 25 meters, then this tool will be placed in the middle of the field, making it easier to detect pests mice around him. The tool is built with a omni directonal camera placed in the center, then on it is put solar panel system that can utilize sunlight as electrical energy for resources from omni directional. Then under it there is a sound generator to repell the rice mice. The sound generator will get the energy from solar system so it didn't waste of unrenewable resources like battery.

Figure 3. Mechanical Design Omni Direction

III. RESULT AND DISCUSSION

A. Device

- Camera Omni Directional

Omni directional camera is a camera that can see 360 degrees, so it can detect the full object that is around the camera. This camera can be used as a sensor that can provide data in the form of computer vision that can be used to detect certain objects, such as pests of rats. With the program controlled by arduino mega microcontroller it can automatically detect the mouse pest, which is recorded with object detection and color that has been calibrated by the program.

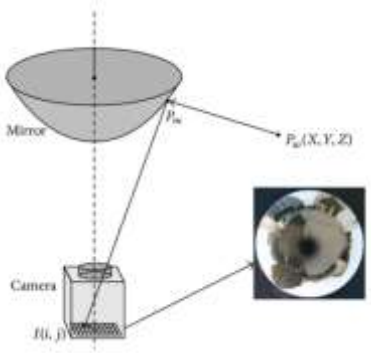

Figure 4. Omni Direction Consept

- Microcontroller Arduino Mega

Arduino Mega 2560 is an Arduino-based microcontroller development board using ATmega2560 chip. This board has a lot of I / O pins, some 54 digital I / O pins (15 pins of which are PWM), 16 pin analog input, 4 pin UART (serial port hardware). The Arduino Mega 2560 is equipped with a 16 Mhz oscillator, a USB port, DC power jack, ICSP header, and reset button. This board is very complete, already has everything needed for a microcontroller. With a fairly simple usage, by connecting power from USB to computer or through AC / DC adapter to DC jack.

ISBN 978-602-53524-0-9

Figure 5. Microcontroller Arduino Mega

- Solar Panel

Solar Cell or Solar Cell is a device or component that can convert solar light energy into electrical energy by using principle of Photovoltaic effect. Photovoltaic Effect is a phenomenon in which the emergence of an electric voltage due to the connection or contact of two electrodes connected to a solid or liquid system when obtaining light energy. Therefore, Solar Cells or Solar Cells are often referred to as Photovoltaic Cells (PV). This Photovoltaic effect was discovered by Henri Becquerel in 1839.

Electric current arises because of the solar photon energy it receives successfully liberates the electrons in the N-type semiconductor junction and the P type to flow. Just like Photo Diodes (Photodiode), Solar Cells or Solar Cells also have Positive feet and Negative feet that connect to circuits or devices that require a power source.

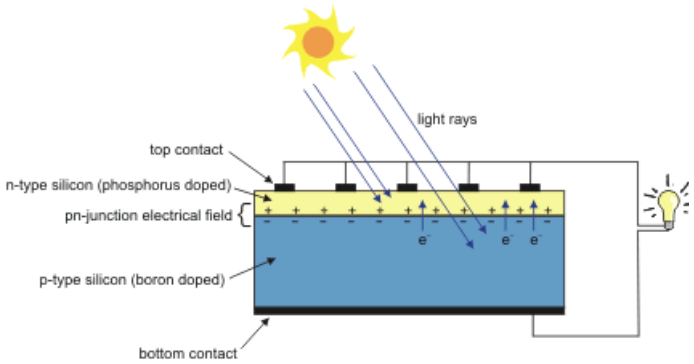

Figure 6. Solar Panel System

Basically, Solar Cells are Photo Diodes (Photodiode) that have a very large surface. The wide surface of the Solar Cell makes this Solar Cell device more sensitive to incoming light and produces stronger Voltage and Flow than the common Photo Diode. For example, a Solar Cell made from a silicon semiconductor material can generate a voltage as high as 0.5V and a current as high as 0.1A when exposed to sunlight.

- Sound Generator

The Sound Generator can generate a sound based on volume, pitch, and duration. This sensor can also overwrite settings during a tone to change how it sounds, change the volume, or to extend the duration of the tone.

Sensor Type	: Four Wire I2C Sensor
Default I2C Address	: 0x34
Sensor ID Code	: 0x53
Dimensions	: 32 mm x 32 mm x 19 mm
Mounting Holes	: 24 mm x 24 mm
Power	: 5 V DC, 20 mA max.

Register Function	
0x00	Sensor Firmware Revision
0x01	Manufacturer Code
0x02	Sensor ID Code
0x04	Sound Level
0x05/0x06	Pitch (lsb/msb)
0x07	Duration

Figure 7. Sound Generator

The order if the 4 control bytes, Sound Level, Pitch low, Pitch high and Duration are arranged such that a signal 4-byte write can be used to initiate a tone.

B. Result

Omni directional innovation is an efficient tool used in rice fields because it is designed to utilize solar power as an environmentally friendly alternative energy, so that this tool can be used in rice fields far from residential areas without having to install electrical lines. The solar panel system used is a solar cell module based on 36 solar cells that can generate a voltage of 21.4 volts so that it can be utilized as a source of electrical energy in omni vision to detect pests of mice, as well as a source of energy to drive motor repellent rat mice, so that it can reduce pests of rice field rice and can increase agricultural productivity in Indonesia.

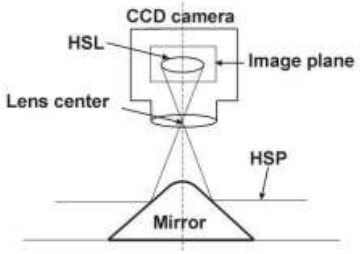

Figure 8. Structur Omni Direction Vision

Widely generated from camera omni directional long range camera (r)
r : 25 meters

ISBN 978-602-53524-0-9

$$L = \pi . r^2$$

$$L = 3.14 . 25^2$$

$$L = 1.964\, m^2$$

Area that can be detected by omni directional cameras is an area of 1964 m^2, so it is able to keep the plants from widespread rice mice. Because the mice can attack 161,000 hectares in one year, resulting in the loss of 555 million kilograms of rice, which is equivalent to a ration of 6.3 million Indonesians for a year. So when using this innovation it will cease the loss of 161,000 hectares of rice field attacks. And able to increase agricultural production.

IV. CONCLUSION

This innovation is designed to ward off pests of mice because it is one of the highest factors causing the decline of agricultural products. With this tool it can save 161,000 hectares of farmland that is attacked by rodents. So as to increase the yield of rice farming of 555 million kg of rice, which is equivalent to the allocation of 6.3 million Indonesians for one year. Agricultural technology innovation of Omni directional-based Plant Guards is expected to contribute to the development of infrastructure in agriculture production.

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ISBN 978-602-53524-0-9