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Development of Environmentally Friendly Wild Boar Repellent by Using Blast Explosion Sound Technique

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ABSTRACT

This paper presents the development of blast explosion sound jig to be used as wild boar repellent in oil palm plantations. The wild boar is a common problem to farmers, especially in oil palm plantations. Until now, there is still no efficient approach to overcome this problem aside from traditional methods such as hunting and trapping the animals. The proposed jig was designed by using SolidWorks 2018 and Proteus Professional 8.7 and fabricated with low-cost material. Experimental work had been carried out to study the effectiveness of the developed jig to produce the significant blast sound that can be used to scare off the wild boar. It was shown that the developed jig able to produce 88.77 dB to 100.14 dB at the area of 0.26 to 9.35 acres. These values were in between the hearing of wild boar sensitivity range. Hence, based on recorded sound analysis, it was believed this jig can be used to repel the wild boar effectively.

Keywords: blast, efficient, innovative, methanol, prototype, spark

1. INTRODUCTION

This project focuses on the development of an environmentally friendly tool to repel wild boar in the oil palm plantation by using a blast explosion sound technique It is known that the wild boar is a common problem to farmers especially in oil palm plantation [1]. Up until now, there is still no efficient approach to overcome this problem aside from the traditional methods such as hunting and trapping the animals [2]. A few researches in the literatures can be found discussing about the repellent of wild boar [3-6]. Some farmers used plastic sheets to wrap around the oil palm seedling. But this technique was not sustainable in covering a wide area as well as tedious particularly in assembling the plastic manually [1]. Others were using fence to guard their oil palm plantation, but this method was not cost-efficient as well as less practical for large area of farm [7].

In addition, some of the farmers also use the reflection of light by using compact disc (CD) to drive away the wild boar. However, the efficiency of this technique is degrading as the CD will be covered with dirt over time. Hence, it affects the light reflection efficiency [8]. Aside from the limitation of each of the previous work that has been highlighted, the main common problem is the limited area of coverage to repel the wild boar as well as the functionality of their approach is very specific to the location of the device. In this project, a method to repel the wild boar at a wide area of coverage is proposed. This works was based on the fundamental approach of solving the wild boar problem by pointing out the strength of wild boar as their weakness. A

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study had been done by Rickye S. Heffner and Henry E. Heffner about the hearing in domestic pigs and they found that the wild boar showed a good sense of hearing within the range of 250 Hz to 16 kHz [9]. In a range of these frequencies, the intensity of sound was reported around 42 dB. By amplifying the sound at these range frequencies, it can produce a high blast sound that can scare off the wild boar [10]. Therefore, a prototype of a jig that can produce a high blast sound that mimicking an explosion was proposed in this paper.

2. MATERIAL AND METHODS

The prototype can be classified into 3 parts, control system box, barrel stand, and barrel. For the system control box, a strong and long-lasting material like stainless steel that is coated with paint was used. The use of stainless steel makes the control system box to become more durable when used in an oil palm farm that sometimes full of wild animals. For the barrel stand, a strong but light material like coated iron was used. The use of light material makes the stand more mobile but possesses strong capability to hold the barrel before and after the explosion. For the barrel, a lightweight and cylindrical material like tin was used. The use of tin for the barrel is reasonable because the tin of the lightweight and can withstand the explosion. The prototype design was planned, and the drawings were produced to show the function and purpose of the prototype before it was built [11].

The prototype design can be considered as a preview of the final prototype and it was made according to the objectives that were needed to be achieved. The components of the pest repellent can be mainly categorized into two parts, the barrel and control system box. Figure 1(a) shows the barrel and the control system box with an overall dimension of 141 cm × 43.5 cm × 67 cm. Figure 1(b) shows that the details of the control system box.

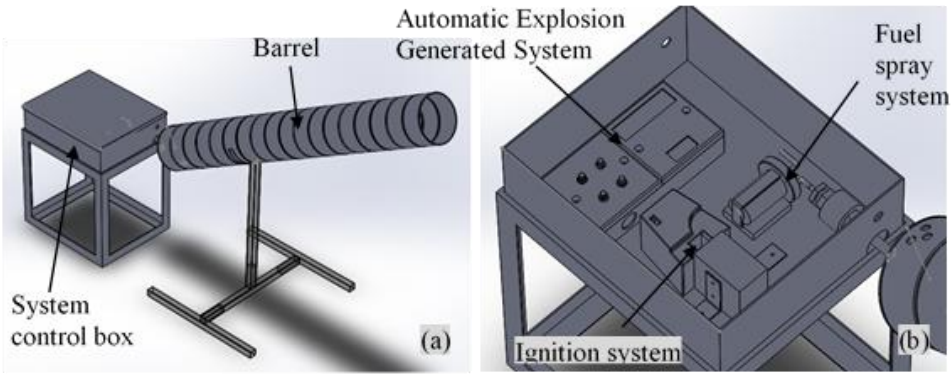


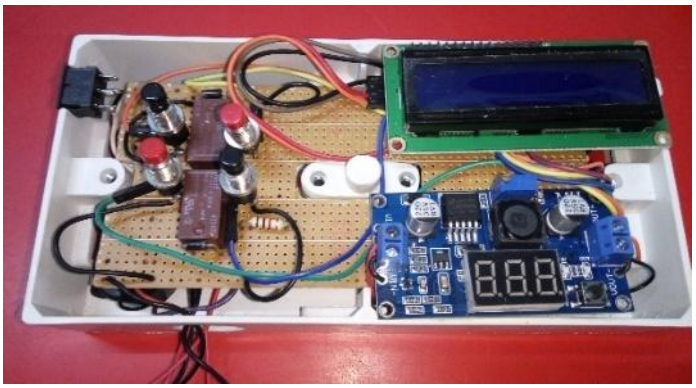
Figure 1. The assembly drawing of the pest repellent, (a) the barrel and the control system box and (b) the details of the control system box.

To produce a blast sound, six recycle tin were arranged in series. The main process used to fabricate the barrel was the drilling process. The first tin became the primary combustion chamber, the second to fourth tin cans were designed as the obstacle, while the fifth and sixth barrels were the extension by making a through-hole on the tin can. Lastly, all the tin cans were joined together by using the soldering method. Figure 2 shows the fabrication process of the barrel.

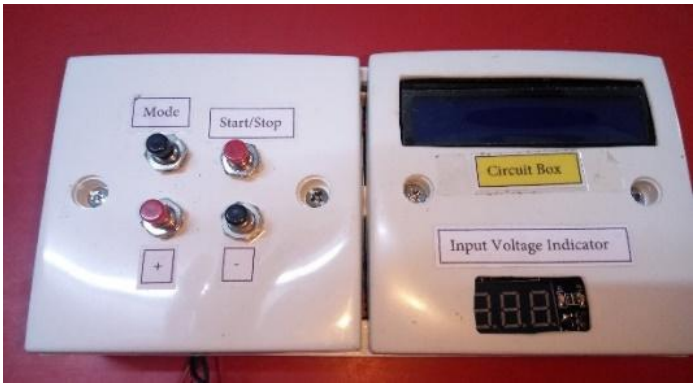
Figure 2. The fabrication process of the barrel, (a) the hole at the side of the first tin can for the lighter neck holder after drilling, (b) the hole at the bottom of the first tin can for the sprinkler holder after drilling, (c) the screws and nuts were attached on the tin can, (d) the screws and nuts were soldered on the tin can, (e) the bottom of the tin can be drilled for the second, third and fourth tin can and (f) the assembly of six tin cans.

From Figure 3, the timer of the countdown can be set easily before the explosion. To set the timer, firstly, the "start" button needed to be pressed. Then, the "mode" was pressed and the timer unit was selected. For common practice, the second unit was usually used. Then, "+" button was pressed to select the value of the countdown in unit of second. Finally, the "start" button was pressed to initiate the operation. The Arduino will start the countdown and after the countdown finished, the explosion started. So, the produce of the explosion sound was depending on the timer of the countdown. The automatic explosion-generated system was used to control the time for the mini water pump, the time for the methanol to react with oxygen, and the time for the cycle to repeat. In this project, the Arduino Uno was used to control all the timers. As similar to

many hydrocarbon derivatives, methanol undergoes combustion when combined with heat and oxygen. This reaction releases energy, carbon dioxide, and water[12].



(a)



(b)

Figure 3. The automatic explosion generated system, (a) the circuit board and (b) the circuit cover.

3. RESULTS AND DISCUSSION

As shown in Figure 4, the maximum loudness of the prototype is 102.31 dB at the surrounding of the prototype. As the area of coverage increases, the loudness values are also decreasing. This is because, when the area increases, the distance that the sound needs to travel is increasing. So, the sound becomes quieter at the long-distance as compared to the short distance. From the result, the loudness is dropped to 90.83 dB at the area of 6.49 acre and it is further dropped with the increase of area. According to the typical sound level, the loudness of 90 dB is the same as the sound generated of the rock drill at 50 inches, the subway train at 20 inches, dump truck at 50 inches, and textile weaving plant at the operator's position [13].

Therefore, the result showed that the sound has enough loudness to scare the wild boar at the plantation with the area of 6.49 acre when the prototype was placed at the center of the of plantation area. Table 1 shows the comparison of a different method in controlling the pest. By comparing the traditional method with this prototype, it is obvious that the prototype is a time-saver, energy saver, and cost saver. If comparing with the existing pest scaring device, the product cost is significantly lower for this prototype but can perform the same function.

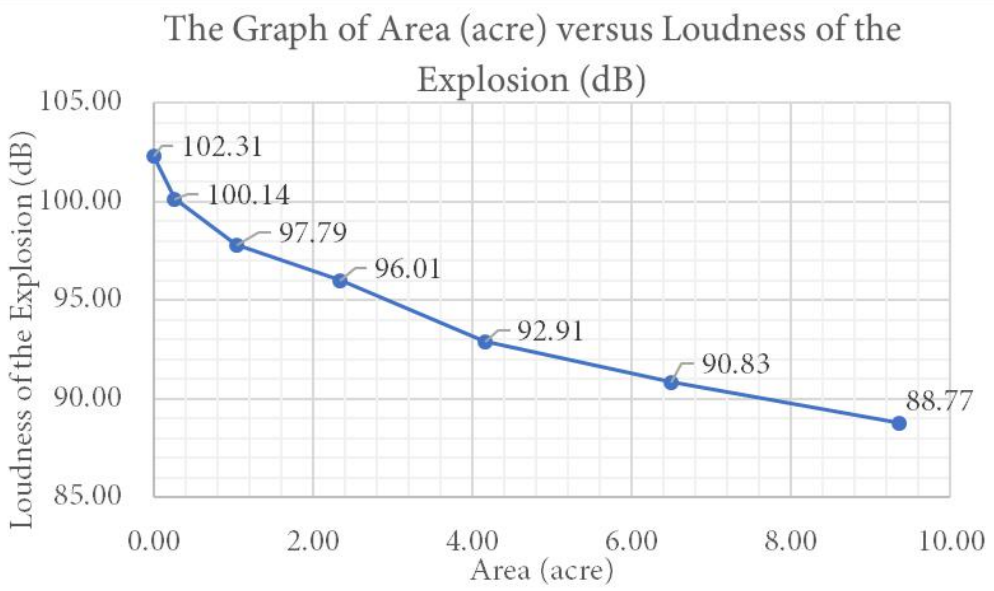


Figure 4. Loudness of the explosion versus the area.

Table 1. The comparison of different methods at the different aspects

Area of oil palm plantation: 6 acres (Time for comparison: 1 year)			
Method / Aspect	**FYP prototype**	**Traditional method (Zinc sheet as a barrier)**	**Pest scaring device (Zon Mark 4 Propane Cannon)**
Person involved	1 operator	3 worker	1 operator
Time of work	Within minute	One day	Within minute
Labor cost	NO	RM50 per person	NO
Product cost	RM 481.35	NO	RM 1291.10
Material cost	Methanol RM42.38 for one year	Zinc sheet RM 8250 for 6 acre	Propane RM 36.50 for one year
Energy saving	Yes	No	Yes

4. CONCLUSION

In conclusion, this project had been completed by applying both mechanical and electrical technology in producing the oil palm pest repellent. It is focusing on the new farmers that recently started in the oil palm industry. The main objective of this project is to protect the oil palm tree and repel the wild boar from attacking the assets of the farmers. After the test, the developed prototype can generate the sound with the loudness of 101 dB at the 9.35 acre of oil palm plantation. This loudness is enough to scare and drive away the wild boar. The increase of area of coverage reduces the effectiveness of the system. For the alternatives, other devices such as sensors with lights, noises, or water sprinklers can be used to scare away the feral pigs.[14]

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