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Rat Trap Electronic Device (RTED)

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ABSTRACT
RTED was created for pest catching especially rats. It was operated with IR sensor which acts as a motion detector thus sensing the present of pests and a motor to open and close the trap door. It has three types of IC which are NE 555 functionally as a timer, L293D as the motor controller and CD4013 as motor switch. A 9V battery was used as a power supply for motor circuit while the power supply for sensor transmitter and receiver is a 6V battery. The transmitter and receiver produce output approximately 5V and motor circuit around 8V. The result indicates that motor will rotates clockwise or counter clockwise either to open or close the trap door when there is interruption at PIR sensor. Hence, with combination of motion sensor and motor circuit, pest population especially rat is possibly reduced.
***Keywords*:-** IR sensor, DC motor controller, Rat Trap.

I. INTRODUCTION

Rats whether in cities, farms or stalls, commonly known to live close to human habitats. Rats can be found anywhere regardless of well-develop city. Rats are also known as household pests. Rats are considered as filthy animals. They carry bacterias all over their body and their digestion system. They live in a dirty place and eat dirty things. As a result, they are the bacteria carriers. Rats will eventually affects someone's healthy lifestyle and ultimately ruin the view if found scattering around. This is dangerous especially for human because those bacterias can pollute our food and will effects our health.

There are plenty of cases about rats which proof that rats contributes to too many dangerous diseases. Rats are also a kind of pest whom causes wrecked garden crops and damaged home appliances such as electrical devices, books or even clothes. To overcome these cases, rats must be reduced affectively in large quantity which means to eliminate them constantly.

For a long period ago, people would prefer to use poisons to kill these rats. Some people would like to use a killer trap. Both of them are dangerous alternatives, especially if kids occupying together. Although there might look like a simple trap; which catch the rats by using bait, but still they need to be check time by time for safety reasons. People these days do not have time even to rest due to their busy schedule, thus where could they find spare time to check the trap.

RTED was built to provide a better, comfortable and healthier life to the human without the presence of pests in their homes, especially rats. In addition, it help users to save their time because RTED is automatically program to catch and keep rats without the need for user to open and close for the purpose of catching another rat. Furthermore, users do not need to worry about the safety since it is an eco-friendly device for not using any poison or any harmful material or substances that might be dangerous to the user.

II. METHODOLOGY

This section will discuss on the implementation of the circuit, the movement of this project, the steps, the overall process and also the flowchart. Identifying problems regarding health and safeties' surrounding is the first step in building this project. When problems were identified, idea(s) was generated and discussed between teammates. After a suitable project was chose, the reference circuits, components need to be used, and operation of each part were first researched. Based on the research, simulation was created to modify the circuits using Proteus 8 Professional. After simulation was successful, components used for the project were surveyed to complete an early circuit on the breadboard. After that, problems occurred were troubleshot and alternatives were brained to make the circuits functionally. Next, PCB layout was design on Proteus 8 Professional to be printed on PCB board. Then, components were constructed onto the PCB. Lastly, circuit was implemented to the prototype.

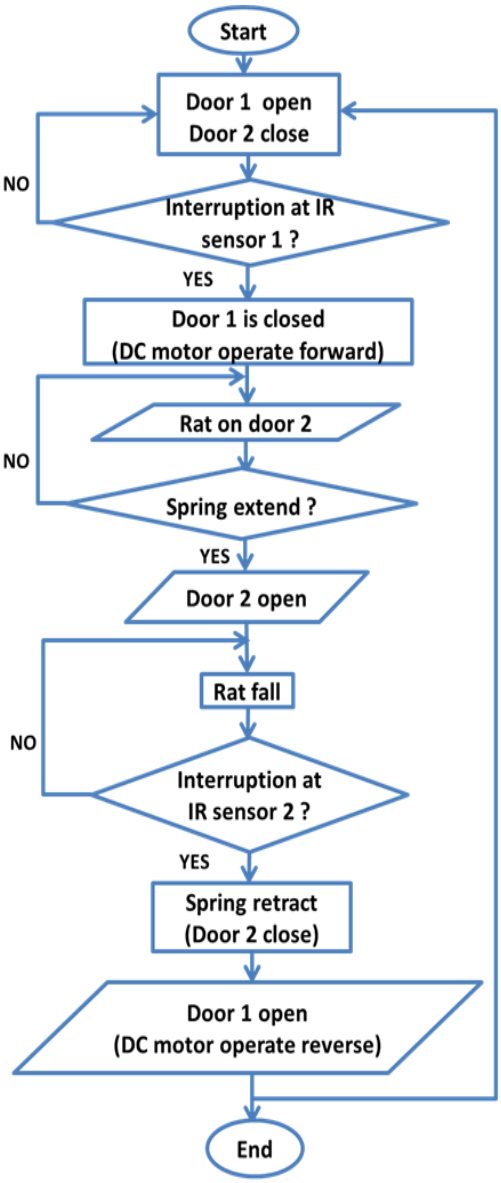

Fig 1 Flowchart of RTED

During starting system, Door 1 was initially open and door 2 will be closed. When there is a presence of motion, sensor 1 will detect the appearance. This interruption will force sensor 1 to send signal to the motor and eventually close door 1. At this phase; assuming that the motion is a rat, it will be trapped at the upper cage. When the rat reaches door 2, it will eventually fall due to mass itself. The spring will extend, the rat will fall into the below cage, and the spring will retract closing door 2. The falling of the rat will interrupt sensor 2. Sensor 2 will send signal to motor to open door 1 to catch the other rats. This cycle will repeat as shown in Fig. 1.

III. RESULT AND DISCUSSION

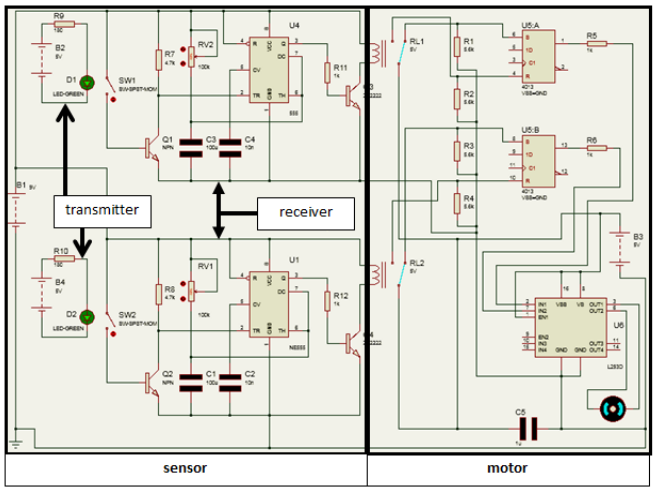

Fig 2 Circuit Connection between Sensor and Motor

From Fig. 2 displays the results simulation using software Proteus to simulate the connection between sensor and motor. Sensor circuits have two parts which are transmitter and receiver. Both transmitter and receiver receive 6V power supply each and the output will be approximately 5V. Receiver has timer IC, NE555. This part was constructed from a monostable timer circuit. This timer will produce a time period for output when there is a trigger at pin 2. The output's time was calculated by using this equation.

$$t = RC\ln(3) \approx 1.1RC$$

This output will energize the relay where relay acts as the motor switch. From the schematic, NO of the relay 1 was connected to R2 and NO of relay 2 was connected to R4. R2 here, acts as a switch to rotate motor in counter clockwise while R4 clockwise. The NCs for both relays were connected to R1 and R3 which function is to stop the rotation of the motor. Initially, relay will be at R1 and R3, which means motor will not operates. The motor will rotate as long as the relay energized and the relay was energized as long as the receiver gives output. Hence, time taken for the motor is equal to the time produce by the timer. Lastly, when the time end, the relay will retract like initial and motor circuit will stop rotate.

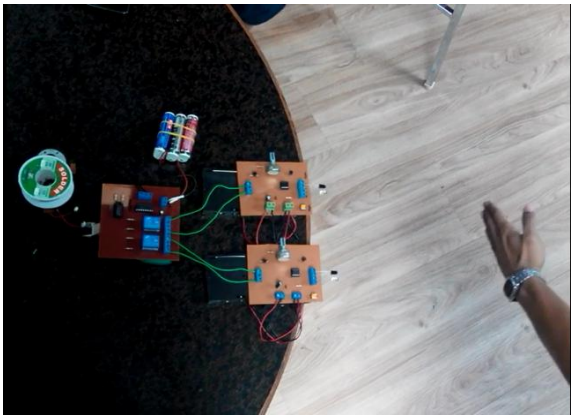

Fig. 3 PCB testing

Fig. 3 exhibits the PCB testing when making sure transmitter and receiver to operate accordingly for RTED to works. It shows that the test was using a movement made by hands to imitate the rat and the result was checked using a double sided tape as the door. In this test, it shows that the RTED was successfully functioning and can be proceed to the development of the hardware.

TABLE 1 reveals the overall results of RTED depending on the inputs. It possesses two sensors which were functioned perfectly to send signal to motor thus open/close the door. At initial condition, door 1 will always open and door 2 is always close. When there is interruption at sensor 1, door 1 will close (motor forward moving) while when there is no interruption at sensor 1, door 1 will stay at initial condition (motor not moving). Door 2 will always closed as long as there is no interruption at sensor 2 .At door 2, when the spring extend, indicates that there is interruption at sensor 2 which send the signal to motor to open door 1 back and the spring will retract back to closed door 2.

TABLE 1
RESULT OF RTED OPERATION SYSTEM

INPUT	PROCESS	OUTPUT	
		DOOR 1	DOOR 2
SENSOR 1	No interruption, motor is not moving	Open	Closed
	Interruption, motor forward moving	Closed	Closed
SPRING	Extend	Closed	Open
SENSOR 2	Interruption, motor reverse moving	Open	Open
SPRING	Retract	Open	Closed

In Fig. 4, a picture of the RTED prototype with the circuit connection is included and in Fig. 5, all the complete circuit and functionality of the project are displayed.

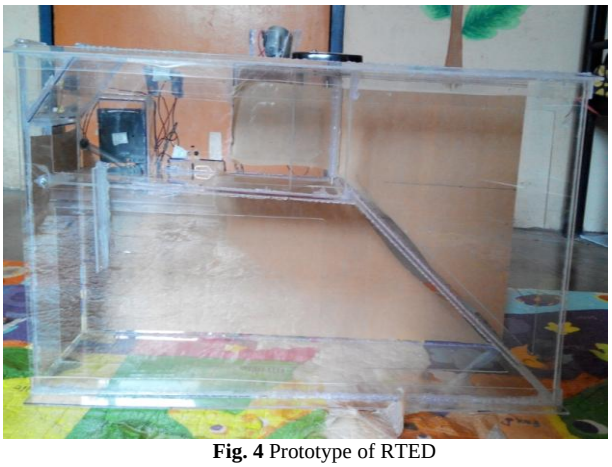

Fig. 4 Prototype of RTED

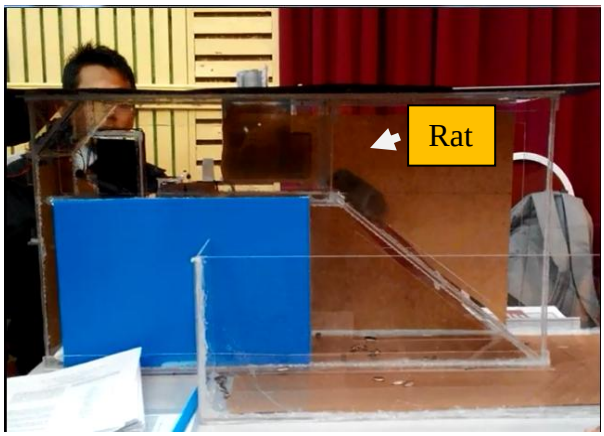

Fig. 5 Rat Trap Electronic Device (RTED)

IV. CONCLUSIONS

As a conclusion, this final year project is to improve and apply the skills to construct any electronic device. Besides, this automatic eco-friendly pest's catcher will give a lot of benefits to public. When this project operates perfectly, the pest population especially rats probably will decreased. Public can live in a healthier lifestyle in a cleaner and better environment. Problems regarding pests especially rats will be terminated in public life. This project can also save public time. The problems with pest such as damaged valuables, books, electrical components, house furniture and even clothes will be no more. This project will significantly serve a big impact on safety and health issues for future generation.

In the future, this project can be upgrade and improve with new ideas. The first enhancement for this project is adding a buzzer to produce a short alarm. This alarm functionality is to signal the user when there is rat trapped. This means that in every caught, alarm will produce sound. From this enhancement, a second improvement can be made which to implement a counter. The counter will display the number of rat in the cage. Its' functionality is to make it easy for user to know how many rats there are in the cage without opening it. Next advancement can be made to this trap is the level sensor which detect the fullness of the cage. This advancement is suitable for user that wants to check the trap after a long period of time. But still it has a negative side effect which is the probability the rat dies inside the cage is high. Lastly, a small improvement but give a big impact is the design of the trap itself.

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REFERENCES

[1] Robert L. Boylestad, & Luois Nashelsky, Electronic Devices and Circuit Theory, Eleventh Edition, Pearson Education, 2013.
[2] Boylested, R.L., Introduction to Circuits Analysis, 10th Edition, Prentice Hall, 2003
[3] Nilsson, J.W. & Riedel, S.A., Electric Circuits, 7th Edition, Addison Wesley, 2005.
[4] Zulzilawati Jusoh, Syila Izawana Ismail, Hasnorhafiza Husni, Suziana Omar, Rina Abdulla "Implementation of embedded system design in student's final year project using problem based learning approach". In In Engineering Education (ICEED), 2017 IEEE 9th International Conference on, pp. 201-205. IEEE, 2017. (2002) The IEEE website. [Online]. Available: http://www.ieee.org/
[5] Abdul H M. Smart automatic dual function lawn mower with infrared and metal sensor. Degree thesis, Melaka: Universiti Teknikal Malaysia Melaka.
[6] Mason, C. R. "Art & Science of Protective Relaying, Chapter 2, GE Consumer & Electrical". 2011
[7] Mors Smitt A Wabtec Company website [online] Available: http://www.morssmitt.com/railway/signalling-infrastructure/signalling-relays/q-style-br930-signalling-relays/qbca1-ac-immune-dc-biased-contactor-relay/
[8] Cronin M. J. Smart products, smarter services: Strategies for embedded control. England: Cambridge University Press, 2010
[9] Ohio Electric Motors. DC Series Motors: High Starting Torque but No Load Operation Ill-Advised. Ohio Electric Motors, 2011.
[10] Renner, Don and Renner, Barbara. Hands on Water and Wastewater Equipment Maintenance. Technomic Publishing Co. 1999. Page 55
[11] Bakshi.V.U. and Bakshi. U.A. Electrical Machines. Technical Publications Pune. 2007. Page 4-13
[12] Heil, Oskar, "Improvements in or relating to electrical amplifiers and other control arrangements and devices",