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Self Sustainable Versatile Personal Flotation Device

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ABSTRACT

The Self Sustainable Versatile Personal Flotation Device (SSVPFD) project aims to redesign and improve a life jacket from a standard life jacket to a multipurpose life jacket equipped with Global Positioning System (GPS) sensor and a pulse rate sensor, which will assist individuals who use it. This innovation is aimed primarily at flight passengers, but it may also be utilized by search and rescue teams. This innovation idea is utilizing the GPS on the life jacket to allow the search and rescue crew to make a maneuver while saving a significant amount of time. In addition, this innovation can be used to trace the victims' exact location. The pulse rate sensor is attached to the wrist loop so that it is always in contact with the victim's skin and can distinguish between critical and normal sufferers by providing an accurate pulse reading. LEDs flash according to the victims' condition based on pulse reading besides as survivor indicator during dark time. The use of solar panel in this innovation is highlighted as the usage can functions up to TEN (10) hours. The SSVPFD is capable to obtain the survival heart rate reading and at the same time the coordinate of the location through BLYNK application. As a result, the heart rate sensor and the GPS on the SSVPFD were featured to help the search and rescue team to get the real time data about the survivor's health condition and current location and coordinate. Based on questionnaire distributed to dedicated respondents shows that 92% of the respondents agreed that the newly fabricated SSVPFD can reduce the search and rescue time operation and improve the safety, meanwhile 94% respondents strongly satisfied with this new innovation.

Keywords: life jacket, global positioning system (GPS), heart rate sensors, self sustainable

1. INTRODUCTION

This innovation is to designed and developed to improve the efficiency of search and rescue (SAR) operation in searching missing victims by improving and fabricating the common life jacket to a new versatile life jacket with pulse rate sensor and GPS device as the main function as stress by Loay etl, (2019) and Alexandra (2019). SSVPFD, is a personal floatation device embedded with Global Positioning Sensors (GPS) built-in inside the jacket and the pulse rate sensor in a spring loop on one side of the jacket's arm hole to make them waterproof and easier for the passenger to put on the wrist strap with the pulse rate sensor while putting on the jacket. This innovation also is to design the life jacket with an LED to indicate the victim's health condition prior to the signal received by the pulse rate sensor to indicate the victim's condition whether the victim is critical or normal. SSVPFD is also designed with an external solar panel to support the electrical power to the power bank and can also act as the second power generator in case the main power source is broken as mention by Attia etl. (2014) and also as to sustain the power source during the emergency without using any re-used batteries.

The aims for this innovation also to carry out research regarding solar panel and battery. In order to select the suitable solar panel and battery on SSVPFD avoiding overweight on the life jacket.

2. LITERATURE REVIEW

Self Sustainable Versatile Personal Floatation Device (SSVPFD) is an advanced version of normal life jacket. A life jacket is generally a life preserver device used during the emergency situation such as during aircraft or watercraft accident. Usually, life vest on aircraft is the inflatable type, this is to because to reduce the usage of space on the aircraft. They have cartridge of carbon dioxide sewn into them to make them inflatable by pulling the tag specifically installed for the purpose. Most of the common life vest is only used as a floatation device which helps the survivors to float above the water.

The purpose of this studies is to upgrade the life vest with more additional features that will help the search and rescue (SAR) team's work on finding the survivors that is prior to be saved in case the survivors are scattered right after the accident as mention by Futch & Allen (2019). The SSVPFD is featured with the function to locate and monitor the survivor health condition at the same time. Hence, Xiong, van Gelder and Yang (2020) stressed that, it is not only will reduce the time taken for the SAR team to save the survivor but also will also help them to save the survivors in the critical condition which will result in more efficiency in saving the survivors. It is also to aid and provision to survivors who are in danger of loss of life (Abi-Zeid et al., 2011)

Basic parts which make SSVPFD works consist of:

1. GPS devices which help to locate the live location of the survivors
2. Heart rate sensor for sensing pulse or heartbeat of the survivors
3. Power supply part which consists of solar panel, solar charger and battery to power up all the electronic devices on the life vest and at the mean time to self sustained the life jacket.
4. LED on the life jacket to indicate the survivors' condition when the SAR team is nearby without relying to the system to determine the survivors' condition. and
5. Light reflector which helps SAR team to find the survivors during the night time search.

The innnovation also has common accessories which consisted of:

1. Waist strap to make sure the life vest is secured on survivors' body.
2. Oral tube to top up the air into the life vest
3. Whistle for the survivors to notify the SAR team when they are nearby.

3. METHODOLOGY

Hybrid integration systems are very popular nowadays because of time saving and cost effective but at the same time the developed circuit can be used according to different functions according to the needs of the users. This innovative product developed consists of THREE (3) main segments, namely:

1. Input supply
2. Various sensors devices and circuits
3. Output device

In addition, this innovation embedded with Global Positioning Sensors (GPS) for tracking purposes with BLYNK Application, Heart Rate Sensors to monitor the heartbeat of the victims, LED display that can prioritize the condition of the victims for fast rescue mission and also powered by solar panel battery for last lasting usage during the search and rescue mission. As a result of this hybrid innovation, search and rescue mission can be carried out effectively with the help of information from GPS, hearts beat sensors and LED indicators.

4. RESULTS & DISCUSSION

Idea by utilizing the GPS on the life jacket to allow the search and rescue crew to make a manoeuvre while saving a significant amount of time. In addition, this innovation can be used to pinpoint the victims' exact location. The pulse rate sensor is attached to the wrist loop so that it is always in contact with the victim's skin and can distinguish between critical and normal sufferers by providing an accurate pulse reading. LEDs flash according to the victims' condition based on this reading. Figure 1 show the complete SSVPF module that is attached with the life jacket.

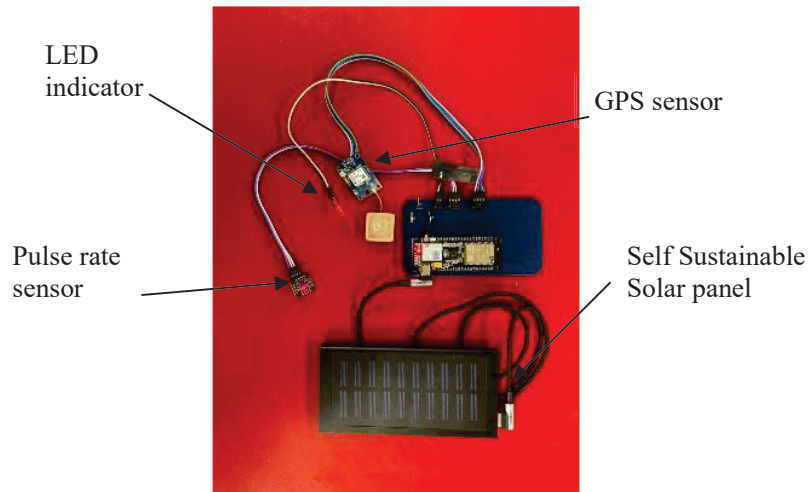


Figure 1: Complete SSVPF module

BLYNK application is used for monitoring the data from SSVPF module. Figure 2 shows the BLYNK application that also embedded with the information regarding the victim heart rate.

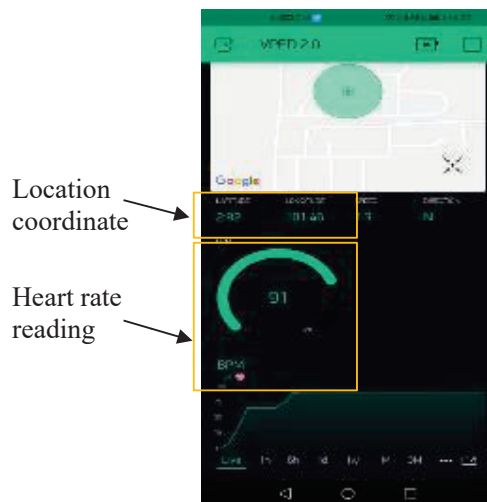


Figure 2: BLYNK application

Figure 3 show the complete life jacket that embedded with heart rate sensor, GPS detector, solar panel and LED display.

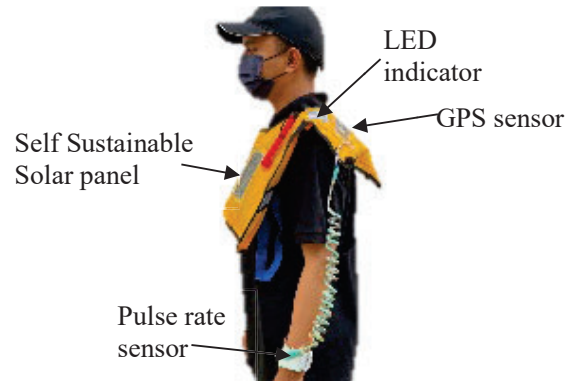


Figure 3: Complete self sustainable life jacket embedded with sensors

Figure 4 shows the complete block diagram of SSVPFD which consist of all THREE (3) main segment of the innovation.

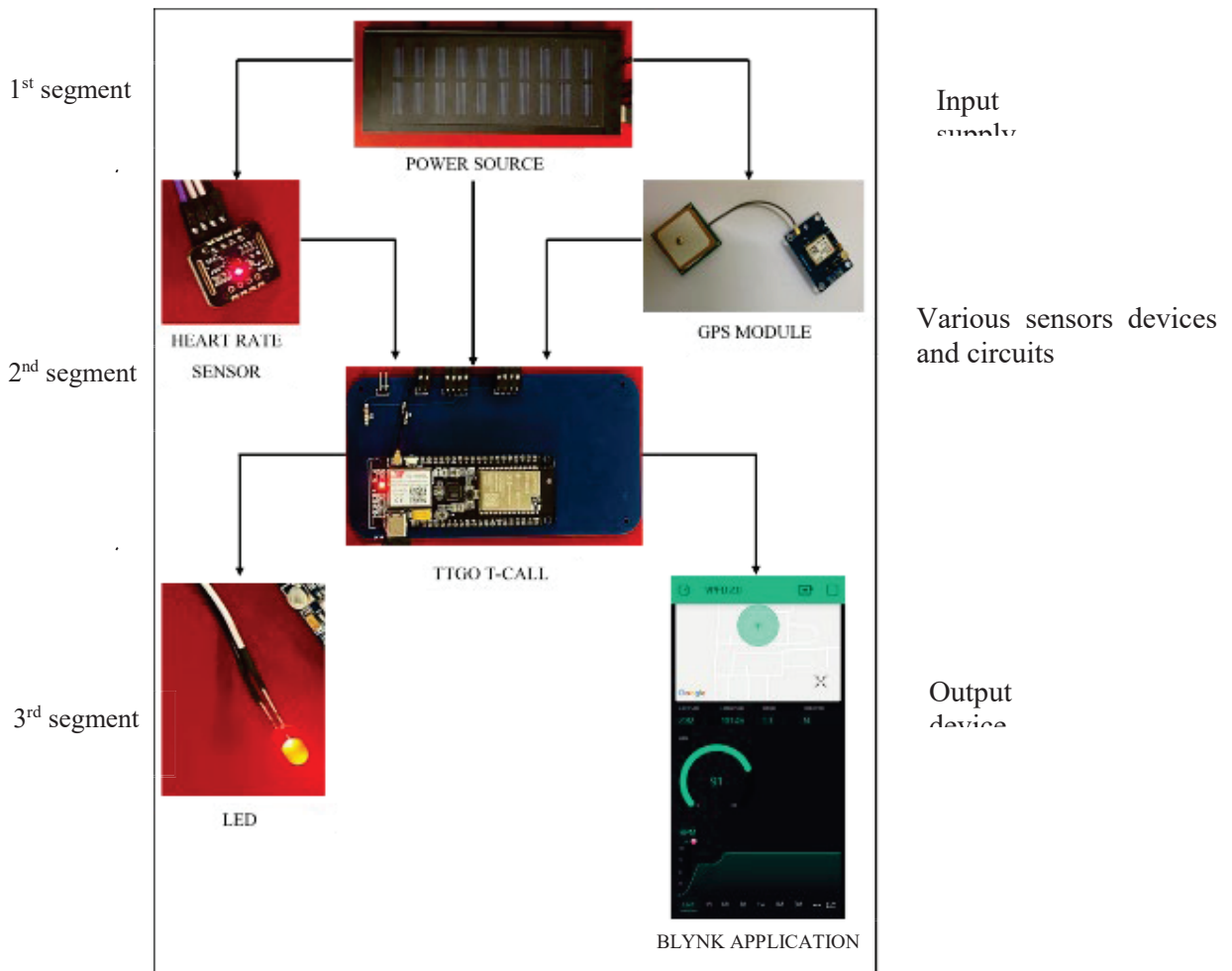


Figure 4: Block Diagram of SSVPFD

Measuring the effectiveness of this innovation, a questionnaire was distributed among students, lecturers in Politeknik Banting Selangor, and related aviation's industries personnel's. The questionnaire is separated into THREE (3) segment which are the hardware, software and overall product. Table 1 shows the tabulation of respondents.

Table 1: Numbers of respondents

Backgrounds		Number of respondents
Students	Polytechnics	25
Lecturers	Polytechnics	15
Aviation Personnel's	License Aircraft Technician	8
	License Aircraft Engineer (LAE)	2
	Aircraft Pilot	2
Total		52

Table 2 shows the results of the questionnaire distributed to respondents.

Table 2: Survey Responses

No	Item	Yes (%)	No (%)
1.	It is easy to use the SSVPFDD during emergency because it is user friendly.	40 (77)	12 (23)
2.	The additional sensors at the life jacket are high quality.	45 (87)	7 (13)
3.	The use of this SSVPFDD can reduce the Search and Rescue time operations.	48 (92)	4 (8)
4.	The information provided by the system is simple to comprehend.	45 (87)	7 (13)
5.	The system benefits Search and Rescue operation, particularly in terms of safety.	48 (92)	4 (8)
6.	It is easy to learn about the system.	40 (77)	12 (23)
7.	Is this product's innovative technology make the Search and Rescue operation easier?	45 (87)	7 (13)
8.	Do you believe this innovation will make it easier for you to complete your task?	40 (77)	12 (23)
9.	Overall, are you satisfied with this new innovation.	49 (94)	3 (6)

5. CONCLUSION

Self Sustainable Versatile Personal Flotation Device (SSVPPFD) is a credible guide for further enhancement in safety for variety field. SSVPPFD is an invented life jacket that produce an outcome of data of survival such as heart rate reading and the location that helps in search and rescue operation. Furthermore, in the methodology section, it is clearly demonstrated the features and functionality of SSVPPFD that have safety features and designated for the use in increasing the safety of the user. In addition, the innovation of the heart rate sensor in the life jacket that works along with the LED indicator which can instantly note by the rescue team to determine which survivals that need to be safe first. Furthermore, by using the build in solar power battery panel can also self sustain the operational of the life jacket up to TEN (10) hours of usage and also contribute towards the green environment. This is supported by questionnaires distributed to 52 respondents in which 92% of the respondents agreed that the newly fabricated SSVPPFD can reduce the search and rescue time operation and improve the safety, meanwhile 94% respondents strongly satisfied with this new innovation.

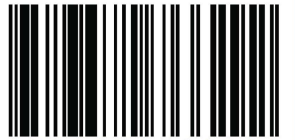
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