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VRM-Energy Accumulating Stationary Bicycle with Sim800c GSM Module Linked CSMSV1.2 Sweat Detector

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SDG 7: Affordable and Clean Energy
(Efficient Equipment=Cleaner Environment)

Abstract:- The study aimed to harness the Vibration-Energy through piezoelectric transducers, Radiant-Energy through solar panel, mechanical to electrical energy through stationary bicycle that device-charging utilization that linked to capacitive moisture sensor V1.2 as sweat detector that display in monitor through Liquefied Crystal Display (LCD) which received by the athletes through the used SIM800C GSM indicating the equivalent glasses-volume of water drunk by the athletes. The data were collected, tabulated, and analyzed using the SPSS (version 14) statistical tools: mean and percentage.

From the study conducted, it was found that the capacitive soil moisture sensor V1.2 as sweat detector was effective under the Arduino Uno Code program that relates to the LCD (Liquefied Crystal Display) monitor that displayed during actual EPSB (Electricity-Producing Stationary Bicycling) sweat detection with SIM800C GSM sending text to the athletes reflecting the equivalent glasses-volume of water to be drink by the athletes that linked to VRM-Energy accumulating Saddle under EPSB (Electricity-Producing Stationary Bicycling) was effective in accumulating the following: Vibration-Energy through piezoelectric transducers, Radiant-Energy-Harnessing through solar panel, and Mechanical-Energy to Electrical Energy conversion through Electricity-Producing Stationary Bicycle in device-charging utilization.

Keywords:- *Capacitive Soil Moisture Sensor; Arduino Uno; Liquified Crystal Display (LCD); Electricity-Producing Stationary Bicycling, Piezo Electric Transducer.*

I. INTRODUCTION

There are six concepts in the study: **(1)** focuses on Vibration Energy, Radiant Energy, Mechanical Energy (VRM-Accumulating Electrical Energy) under Electricity-Producing Stationary Bicycling; **(2)** Capacitive Soil Moisture Sensor V1.2 (CSMSV1.2) as tool for sweat detector; **(3)** Liquefied Crystal Display (LCD) that display the amount of sweat detected during the Stationary Bicycling; **(4)** SIM800C GSM MODULE as mediator in sending the text messages showing the percentage of the sweat detected in which informing the Athlete to drink water based from the table indicated amount of water drink; **(5)** Health aspects serves and program reminder to the athlete to stay hydrated and replenish with water in sustaining water hydration; **(6)** Biological and chemical process occurs as the athlete exerts effort thus consuming energy and expel bodily waste fluids in the form of sweat which causes the body to be in unbalance state. To maintain homeostasis, CSMSV1.2 detects the amount of the expel sweat and through SIM800C GSM MODULE, the athlete receives a text message to the amount of water intake to replenish the expel body fluids.

II. LITERATURE REVIEW

- *Accumulating Energy and Electric Producing Stationary Bicycle*

The phenomenological theory of heat (Fourier law) energy transfer are successfully describes heat transfer and energy flow at the phenomena contain many-body, multi-scale and even quantum mechanical aspects which significantly addressing the energy transfer [1]. Which was related to the concept of energy transformation in light-energy signal to permit subsequent longated energy fiber under solar panel bearing [2].

In the Energy transfer (relaxation), phenomena stationary bicycle abruptly diffuses the tensioning energy during the driving process to accelerates the latter toward the fastening bicycling-mechanism, which in turn supplied by a battery. The device was characterized by the energy transfer apparatus that comprises an electric motor, with which the energy stored in the mechanical energy store can be converted into electrical energy and supplied to the control apparatus [2,3]. Moreover, during the stationary bicycling [15] biological and chemical process occurs as the athlete exerts effort thus consuming energy and expel bodily waste fluids in the form of sweat which causes the body to be in unbalance state [14].

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➢ *Capacitive Soil Moisture Sensor and Liquefied Crystal Display*

Florida and California in the United States nursery irrigation water usage had been monitoring using soil moisture sensor under agricultural and farming irrigation water management [4,5] which can be a critical strategy without soil moisture sensor affects decision making and crop production under diverse soil-climate conditions [6,7,8]. The Analog Capacitive Soil Moisture Sensor measures soils moisture levels by detecting its moisture content within its soil parameters by capacitive sensing [9], that the capacitive sensor was providing greater accuracy in comparison with the old resistive soil moisture measuring sensor [10].

On the other hand, the concepts of the capacitive sensor electrode where linked liquid crystal display by providing display of information from the soil sensor during the detection [11,12] of the free wireless desk phone Gsm Sim Wireless [13].

However, this study seeks to device and integrate whether the capacitive soil moisture sensor specs with Arduino Uno Core processor by detecting the amount of sweat dropped of the athlete during the stationary bicycling as preliminary prototype application of the integration with LCD monitor information displayed mediating through SIM800C GSM MODULE as mediator in sending the text messages showing the percentage of the sweat detected in which informing the Athlete to drink water based from the table indicated amount of water drink under biological and chemical processes expel of bodily fluids in the form of sweat.

➢ *Research Objectives*

The **objectives** of the study therefore are the following: **(i)** determine the accumulated vibration energy, radiant energy, and mechanical-electrical energy through a type of device-charge utilization **(ii)** the effectiveness of capacitive soil moisture sensor v1.2 as sweat detector and sensor under Arduino Uno Core code processor **(iii)** to relate the LCD (Liquefied Crystal Display) monitor of the computer in reflecting and in determining the amount of sweat detected during the stationary bicycle performed by the athletes **(iv)** SIM800C GSM MODULE as mediator in sending the text messages showing the percentage of the sweat detected in which informing the Athlete to drink water based from the table indicated amount of water drink; **(v)** Health aspects serves as the program reminder (SIM800C GSM) to the athlete to stay hydrated and replenish with water in sustaining water hydration; and **(vi)** biological and chemical processes through the volume amount of glasses water that the athlete to drink from the biological expel bodily waste fluids in the form of sweat which causes the body to be in unbalance state.

➢ *Significance*

This study benefited the following dimensions in terms of **(i)** the capacitive soil moisture sensor as alternative polarity sweat detector **(ii)** the used of LCD monitor as determining factor in detecting the amount of sweat during the stationary bicycling **(iii)** the used of Arduino Uno as core processor in relating the capacitive soil moisture sensor to LCD monitor as alternative polarity sweat detector **(iv)** the use of recycled mobile phone holder as improvised prototype designed holder-embedding the necessary components of the gadgets **(v)** the used of power-bank in sustaining the portability of the gadget for stationary bicycling, running, workouts and other related sports that detects the sweat dropped during the different workouts and **(vi)** the capacitive gadgets as alternative polarity sweat detector that reminded the athletes and other person who work-out to replenish the body with water due to detected sweat dropped during sports work-out under the recycled electricity-producing stationary bicycle (EPSB).

III. METHODOLOGY

This study composed of three phases: **Phase I** – Gathering and Assemble of Prototype Gadget with Electricity Producing Stationary Bicycle (EPSB), **Phase II** – Preliminary Testing of the Assembled Prototype Gadget with EPSB, and **Phase III** – Data Collection and Analysis.

Fig A. List of Materials Needed: figure 1 arduino uno core board, figure 2 LCD (liquefied crystal display) monitor & GSM SIM800C, figure 3 capacitive soil moisture sensor, figure 4 female and male wires, figure 5 laptop, figure 7 cable connectors, and figure 8 assemble parts.

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Fig B. figure 10-A back view, figure 10-b front view of VRM-energy accumulating EPSB.

➢ *Phase I – Gathering and Assemble of Prototype Gadget with Electricity Producing Stationary Bicycle (EPSB).*

- *Gathering of Materials for Prototype Gadget.*

The following materials were gathered in establishing the prototype gadget.

Table 1 List of Materials Needed

Figure	Materials	Quantity
1	Arduino Uno Core Board	1pc
2	LCD (Liquefied Crystal Display) Monitor & GSM SIM800C	1pc
3	Capacitive Soil Moisture Sensor	1pc
4	Female & Male Wires	11pcs
5	Laptop (Netbook, Notebook)	2pcs
6	Power Bank	1pc
7	Cable Connector	1pc

- *Assemble of Materials for Prototype Gadget.*

After gathering the necessary materials, you should have to established the (1) *Arduino Uno Core* (Board) processor with the (7) *cable connector* to the (5) *laptop* for the compatibility in running the program-code with the (3) *capacitive soil moisture sensor* connected to Arduino Uno core which was also connected to the (2) *LCD monitor* for the display of the sweat detected during the bicycling of the athlete and all of the connection were connected using (4) *female and male wires* (Refer to Figure A-8).

- *Encoding the Codes.*

The moment the set-up materials were established and connected. Encode the program code using Arduino Software, make sure to verify first the coded-program before uploading-sketch in order to run the code on purposed (Refer to figure 8).

- *Creation of the Prototype.*

The creation of modified capacitive soil moisture sensor devised with LCD monitor with SIM800C GSM sending text on sweat detected with equivalent volume-glasses of water, power-bank, with and Arduino Uno core processor with its program code were connected and intertwined (Refer to Figure 10).

- *Creation of the VRM-Energy Accumulating EPSB.*

The following materials were gathered in establishing the prototype gadget. After completing the materials, the researchers assembled the EPSB through series of adjustment to the item and its necessary functions. The researchers used the recycled bicycle from the junk-shop embedding the following items order to add heaviness during the bicycling of the athletes (Refer to Figure C-11).

Table 2 List of Materials Needed for VRM-Energy Accumulating EPSB

Item Number	Materials	Quantity
1	12 Volt Battery (Electrical Energy Stored)	1pc
2	Alternator	1pc
3	Aligator Clips	2pc
4	Stationary-Metal Base	1pc
5	Solar Power Inverter (12 Dc-230 Ac)	1pc
6	Solar Panel (9 Volts)	1pc
7	Saddle-Piezoelectric-Transducers & Power Bank Circuit Board	30pcs

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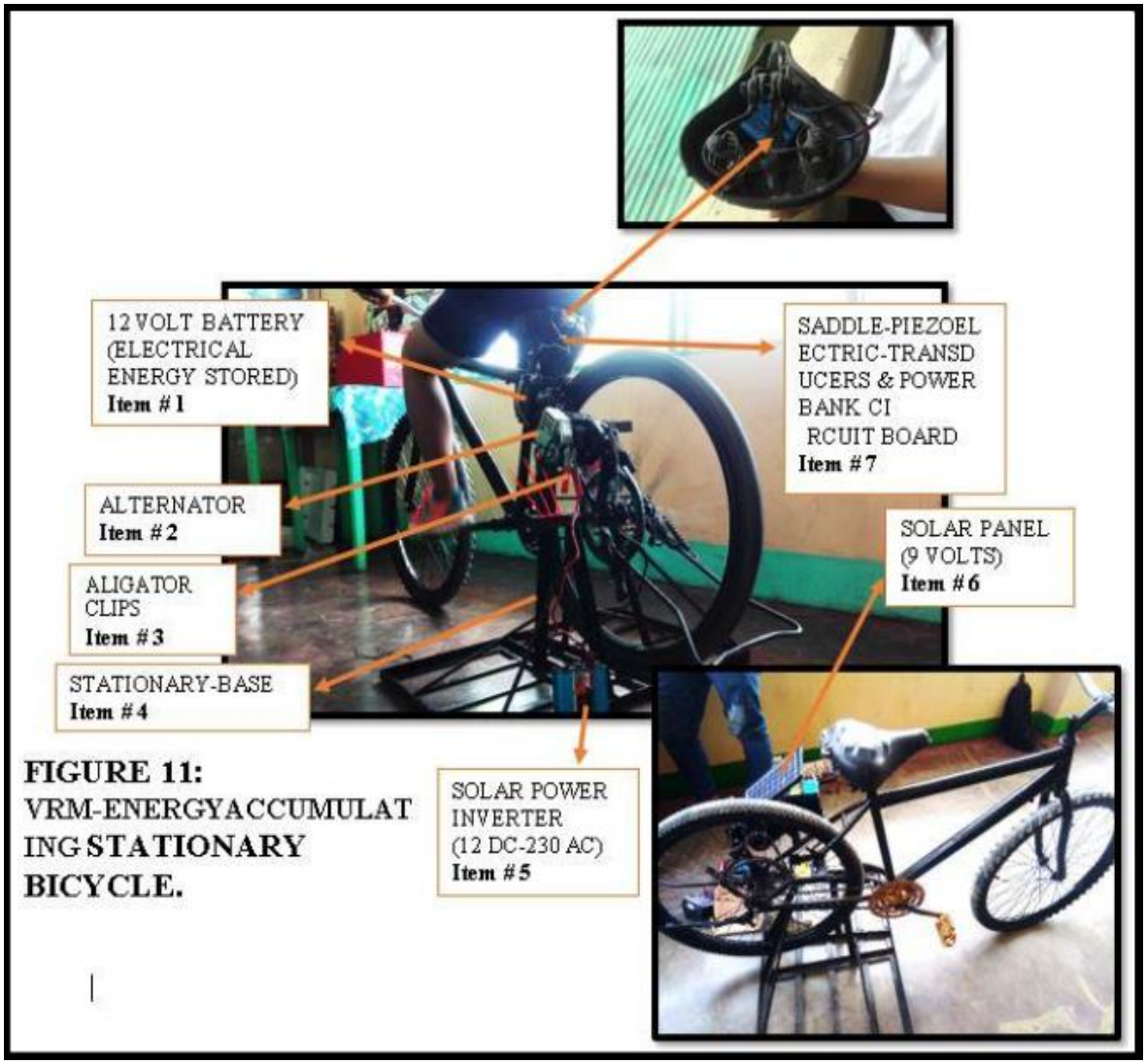

Fig C. Figure 11 Display Prototype of the VRM-Energy Accumulating Stationary Bicycle

➢ *Phase II – Preliminary Testing of the Assembled Prototype Gadget with EPSB.*

- *Preliminary Testing of Codes.*

Before integrating and running the codes to the stationary bicycle with the athlete, ran first the codes by testing and dropping it to the Beaker (250ml) the capacitive soil moisture sensor if the codes are running its polarity in detecting the water content or wet volume inside the beaker with the LCD monitor linked to SIM800C GSM testing for texting the athlete (Refer to Figure 12) under the electricity-producing stationary bicycle or EPSB including item number 1 to 7 (Refer to figure 11). The researchers do perform a series and multiple testing in order to achieved the suited codes for running the system under capacitive soil moisture sensorv1.2, SIM800CGSM, LCD with ITEM number 1 to 7in figure 11 and with the consultancy of the electrical engineer in our school, our information technology teacher before running to actual testing with athletes.

Fig D: Testing and Programming the Sensors (Soil Moisture Sensors, LCD with Arduino Uno Core Board).

➢ *Phase III – Data Collection and Analysis.*

- *Selection of the Athletes.*

The researchers select athlete with the same weight (kg) as one of the basis for performing the stationary bicycling under and all of them are female athletes of these parameters. These are the athletes that are qualified for DAVRAA, which already undergo a medical check-up by the government physician.

- *Athlete Time for Stationary Bicycling.*

The athlete number 1 **(A_1)** to athlete number 4**(A_4)** were in sequence in performing the stationary bicycling for thirty (30) minutes each.

- *Athlete Time for Stationary Bicycling Number of Replication.*

The athlete number 1 **(A_1)** to athlete number 4**(A_4)** has done three (3) replication stationary bicycling performance for three (3) days at the same time of the day from 3:00 pm to 5:00pm for the muscle and hydration recovery enough for the second and third replication of stationary bicycling.

- *Gathering of VRM-Energy Accumulator. 10-A:*

The athlete number 1 **(A_1)** to athlete number 4**(A_4)** during their stationary bicycling, the researcher recorded the accumulated vibration-energy from the piezo-electric transducers under the saddle of the bicycle as friction from the athlete keep moving with the used of voltmeter. ***10-B:*** While the athlete performing, at the time harnessing the radian-energy through the use of Item number 6 (Solar Panel 9volts) attached to the stationary bicycling. ***10-C:*** The bicycling of the athlete able to generate mechanical energy converting to electrical energy through the use Item number 5 (Solar Power Inverter 12 DC-230 AC) and the researcher use the Item number 1 (12-volt battery to store electrical energy) during the stationary bicycling of the athletes' number 1 to 4.

- *Embedding Prototype Gadget to the Athlete. 11-A:*

The researcher attached the prototype to the athletes' hip (the lateral projecting region of each side of the lower or posterior part of the athlete) in detecting the sweat or expel body fluid using capacitive soil moisture sensor V1.2 as sweat detector program under Arduino Uno processor codes. ***11-B:*** The researchers used LCD to monitor the amount sweat detected from the capacitive soil moisture sensor 1.2 under Arduino Uno processor. ***11-C:*** The researchers use SIM800C GSM to informed the athlete through text message about the expel bodily-fluids indicating the amount of volume-glasses of water to drink while performing the stationary bicycling in sustaining the biological and chemical processes under homeostasis state of the body condition. ***11-D:*** The research used capacitive soil moisture sensor V1.2 as a tool for detecting the sweat as to use in the basis of converting the percentage detected to the amount of volume-glasses water to drink by the athletes during stationary bicycling.

- *Statistical Analysis or Tabulation of Data.*

The data were collected, tabulated, and analyzed using the SPSS (version 14) statistical tools: mean and percentage. The researchers used mean to express the total volts gathered during the athlete stationary bicycling under VRM-Energy Saddle frequencies and EPSB. The capacitive soil moisture sensor V1.2 sweat detection was expressed in mean and percentage from the different athletes performed the EPSB. And the capacitive soil moisture sensor detection was quantified through the LCD monitor information with the used of Arduino Uno Program Code on soil moisture sensor and LCD detection display during the detection-process under EPSB that send text message through SIM800C GSM.

IV. RESULTS AND DISCUSSION

Table 3 Shows the VRM-Energy Saddle Frequencies Test Result during the stationary Bicycling of the athlete in Item number 1 to 7 in figure 11. The gathering of the data was. Performed at Grade 10 STEM Zircon for three days experimentation at exactly 3:00pm to 5:00 pm at Heracleo Casco Memorial National High School, Poblacion, Sta. Maria, Davao Occidental, Philippines. It was found out that VRM-Energy Saddle Frequencies' result under stationary bicycling of the athletes' suggested the equivalent gadget-device-charge utilization.

Table 3 VRM-Energy Accumulator Saddle Frequencies Test Result

Athlete	**Weight (kg)**	**VRM-Energy Accumulator Saddle Frequencies Test Result (Objectives 1, 2, & 3 in the Study)**			**T**	**Ave**	**Gadget/Device-Charge Utilized**
		R1(5)	R2(10)	R3(15)			
A_1	70	0.87 V	1.6 V	2.04V	4.51V	1.53V	Light Bulb (1.5V)
A_2	70	1.14 V	2.55V	3.56V	7.25V	2.42V	Mobile Phone (5V)
A_3	70	2.00 V	3.86V	5.66V	11.52V	3.84V	Mobile Phone (5V)
A_4	70	2.00V	3.69V	3.56V	9.25V	3.1V	Mobile Phone (5V)

The average VRM-Energy Accumulator Saddle Frequencies under stationary bicycling was good enough to device-charge utilization of the mobile phone gadgets and a light bulb within thirty (30) minutes athletes stationary bicycling or the EPSB.

Table 4 shows the Capacitive Soil Moisture Sensor V1.2 Detection in percentage. This indicates that the Capacitive soil moisture sensor V1.2 was effective in detecting sweat that through the display of information from the LCD able to monitor the biological and chemical processes of bodily homeostasis in describing the degree of hydration condition of the athletes during stationary bicycle with Arduino Uno Core Processor as mediator in connecting the three (3)

components (CSMSV1.2, LCD, and SIM800C GSM) that allows the SIM800C GSM sent text message to the athlete to drink the equivalent volume-glasses of water to stay hydrated and prevent dehydration during the stationary bicycling.

Table 4 Capacitive Soil Moisture Sensor V1.2 Detection (Percentage or %) and Liquefied Crystal Display (LCD) with SIM800C GSM Sending Text Message to the Athlete (Objectives 4, 5, and 6)

Athlete	Capacitive Soil Moisture Sensor V1.2 Detection (Percentage or %) & LCD Display with GSM Sending Text to the Athletes			T	Ave	Conversion (Percentage to Milliliters	Equivalent Glass of Water (Volume)	Biological & Chemical Processes (Remarks)
	R1	R2	R3					
A_1	75%	75%	77%	227%	75.67%	756.7	5.11 glasses	Dehydrated
A_2	77%	67%	85%	229%	76.33%	763.3	5.16 glasses	Dehydrated
A_3	83%	73%	88%	244%	81.33%	813.3	5.50 glasses	Dehydrated
A_4	74%	85%	91%	250%	83.33%	833.3	5.63 glasses	Dehydrated

The result was significant since the equivalent glasses-volume of water confirmed the biological and chemical processes of the athlete during the stationary bicycle. The average result reflecting the converted percentage to milliliters which means that the overall remarks of the biological and chemical processes were dehydrated.

This results interpret that some of the athletes that were not aware of the condition of their bodily-fluid expels homeostasis. Therefore, this prototype was essential tool for helping the athletes to be reminded that hydration is essential in maintaining the bodily-homeostasis through capacitive soil moisture sensor V1.2 linked to LCD with SIM800C GSM as mediator in sending text through Arduino Uno Core Processor.

V. CONCLUSION

From the study conducted, it was found that the capacitive soil moisture sensor V1.2 as sweat detector was effective under the Arduino Uno Code program (Refer to table 4), that relates to the LCD monitor that displayed during actual EPSB sweat detection with SIM800C GSM sending text message to the athletes reflecting the equivalent glasses-volume of water to be drink by the athletes. On the other hand, the VRM-Energy accumulating Saddle under EPSB (Electricity-Producing Stationary Bicycling) was effective in accumulating the following: Vibration-Energy through piezoelectric transducers, Radiant-Energy-Harnessing through solar panel, and Mechanical-Energy to Electrical Energy conversion through Electricity-Producing Stationary Bicycle in device-charging utilization. (Refer to Table 3).

RECOMMENDATION

➢ *From the Objectives of the Study, the Researchers Recommend the following Additional Concepts of:*

- Sanity condition of the athletes through detecting the facial expression-condition of the athletes through “program camera”, that sends signal to the processor indicating to play anti-stress music through audio-headset.
- Additional LCD monitor, for the continuous display of accumulating electricity in front of the athlete under stationary bicycling in order the athlete to keep moving for electricity accumulation.

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