Inspiring Excellence

Project Based Assignment

CSE360, Section: 02

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Human Power Generator and Fitness Analyzer

Introduction:

The process of generating electric power from primary energy sources is known as power generation. Because electricity is not readily available in nature, it must be converted from other types of energy. Human power is a type of energy generated by the physical body. And we're using the same concept to generate electricity by moving our bodies through a specific mechanism.

Exercise is a voluntary activity of our bodies that is beneficial to both our physical and mental wellbeing. Regular exercise strengthens our muscles and bones while also lowering our blood pressure and cholesterol levels. With the use of technology, we can not only generate electricity but also maintain a healthy lifestyle by monitoring vital signs such as heart rate and BMI.

Application Area:

We can contribute to two separate sectors of our country with the help of our Human Power Generator and Fitness Analyzer. One is Bangladesh's Health and Family Welfare sector, while the other is the country's electricity industry.

Bangladesh is a developing country with a limited number of resources. There are numerous constraints in the realm of power generating. High system losses, delays in the construction of new plants, low plant efficiency, unpredictable power supply, electricity theft, blackouts, and a lack of cash for power plant maintenance are all issues in our electric power sector.

Obesity and overweight are both considered noncommunicable diseases in Bangladesh and a major risk factor. Obesity and overweight, according to physicians, increase the risk of cancer, diabetes, and cardiovascular disease. People are going to various gyms all around the country to reduce the effect. The majority of these gyms employ spin bikes and treadmills as their principal pieces of equipment, which are also suitable for use at home.

We can create at least 200 watts/hour on the spin bike mechanism, and we can also conduct a comprehensive fitness checkup in a few minutes with the use of a polarized heart monitor and an oximeter, all without the need of any other foreign equipment. It will finally offer us our blood oxygen level, heart rate, BMI, and other information.

Technology and Tools:

1. Spin bike

2. Heart rate sensor

3. Speed sensor

4. Oximeter sensor

5. Arduino UNO R3

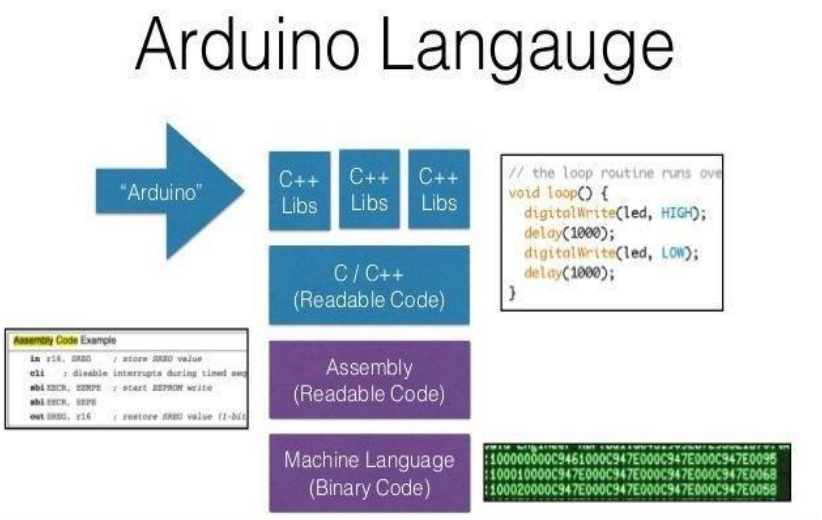
6. LCD display (16*2)

7. Generator

8. Battery

Programming Language:

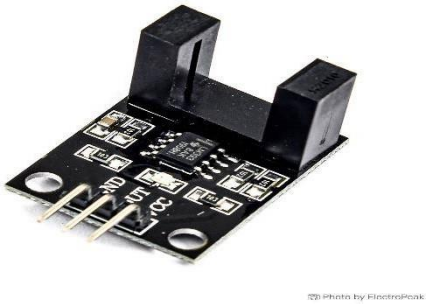
Since we're using an Arduino UNO R3, the only programming language that works is C.



Working Mechanism of the Sensors:

SPEED SENSOR(LM393):

The LM393 Speed Sensor Module is a combination of an infrared light sensor and a voltage comparator IC. In essence, the suggested microcontroller-compatible motor speed sensor module is a simple device that produces processed pulse trains when the optical sensor's visual path is physically obstructed by a slotted wheel or equivalent mechanism. It will provide us with information on rotation speed, distance traveled, and other metrics to monitor.



HEART RATE SENSOR:

The heart rate sensor operates on a fairly basic concept. The light emitting diode and ambient light sensor are coupled on the first surface of this sensor.
Similarly, the circuit responsible for noise cancellation and amplification is connected to the second surface. The LED is placed above a vein in the human body, such as an ear tip or a fingertip, but it must be placed immediately on top of a layer. When the LED is positioned on the vein, it begins to emit light. There will be a flow of blood within the veins after the heart starts pounding. As a result, if we examine the blood flow, we can also assess the heart rates.

If blood flow is detected, the ambient light sensor will get more light since the flow of blood will reproduce it. Our pulse rates can be determined by examining the slight changes in acquired light over time. We can use the sensor to calculate a person's fitness level by measuring heart rate, BMI, cholesterol level, and other factors.

OXIMETER SENSOR (MAX30100):

The MAX30100 is a sensor system for pulse oximetry and heart rate monitoring. It detects pulse oximetry and heart rate signals using two LEDs, a photodetector, improved optics, and low-noise analog signal processing. Here, we're utilizing a pulse oximeter to check the person's fitness level by measuring blood oxygen levels.

We can confirm the accuracy of our individual heart rate sensor we utilized with the Arduino because it can also measure heart rate.

Connection with ICs:

We are using 3 sensors: heart beat sensor, MAX 30100 pulse oximeter, speed sensor (LM393). Besides we are using 2 I/O devices: LCD and buzzer. We are also using a potentiometer (PC16S). For interfacing we are using Arduino uno. Now, we need to connect these sensors and I/O devices with the Arduino to make our project successful. Now we are going to describe how these devices are connected with Arduino uno.

MAX 30100 pulse oximeter: It has 5 pins and how they are connected with Arduino uno are given below:

MAX 30100 pulse oximeter's pins	Connected pins of Arduino uno
VIN	3.3 V
GND	GND
SCL	A_5
SDA	A_4

LCD: We are using an LCD that has 2 rows and 16 columns for displaying our outputs. How pins of LCD are connected with Arduino uno are given below:

LCD pins	Connected pins of Arduino uno
1(GND),5(RW),16(Cathode)	GND
2(V_{cc}),15(Anode)	5V
4(RS)	9
6(EN)	8

11(D_4)	7
12(D_5)	6
13(D_6)	5
14(D_5)	4

Here the 1E pin of the Potentiometer (PC16S) is connected with GND. Besides, LCD pin 3(Bright) is connected with 1S. Finally, 1A is connected with 5V.

Speed sensor (LM393): We are using LM393 as our speed sensor. How pins of LM393 are connected with Arduino uno are given below:

LM393 pins	**Connected pins of Arduino uno**
V_{cc}	5V
GND	GND
D_0	11

Heartbeat Sensor: Now we are describing how pins of LM393 are connected with Arduino uno are given below:

Heartbeat Sensor	**Connected pins of Arduino uno**
S (Signal pin)	A0
$+V_{cc}$	5V
-GND	GND

Buzzer: For buzzer we need to use a resistance. There are 2 wires of a buzzer. One will be connected with pin 10 of Arduino uno and another one will be connected with GN

Data Flow:

We use many sensors in the proposed system, including a heart rate sensor, a pulse oximeter, and a speed sensor. Aside from that, we use a variety of I/O devices (LCD display and buzzer). The Arduino board serves as an interface IC for all of these devices. Let's talk about how data moves across devices.

The sensor detects the environment and converts the information into a usable format. The data is then transferred to the Arduino, where it is processed further. The Arduino received data from all of the sensors.
The data is shown to the output device or display after further processing.

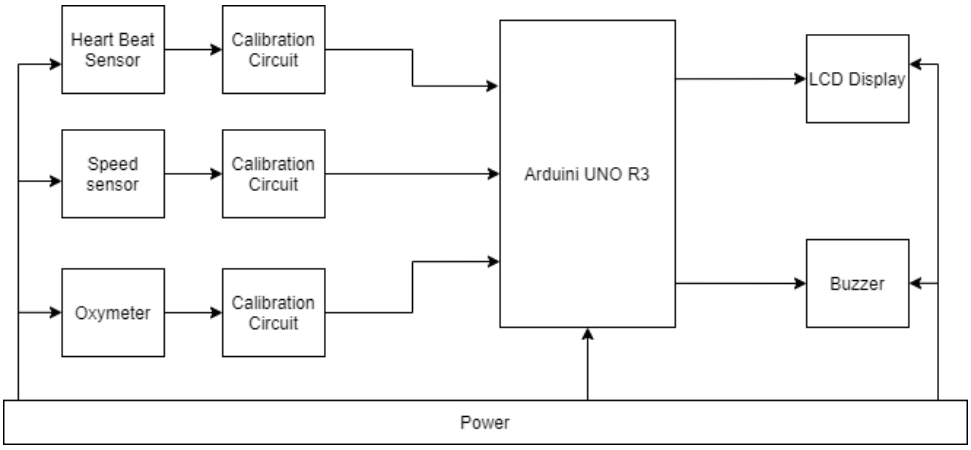


Figure: Data Flow Diagram for the Proposed Project.

Estimated Cost Analysis:

After searching some online websites like to techshopbd.com, daraz.com and a few more, we gathered estimated cost of the devices which are used in our project:

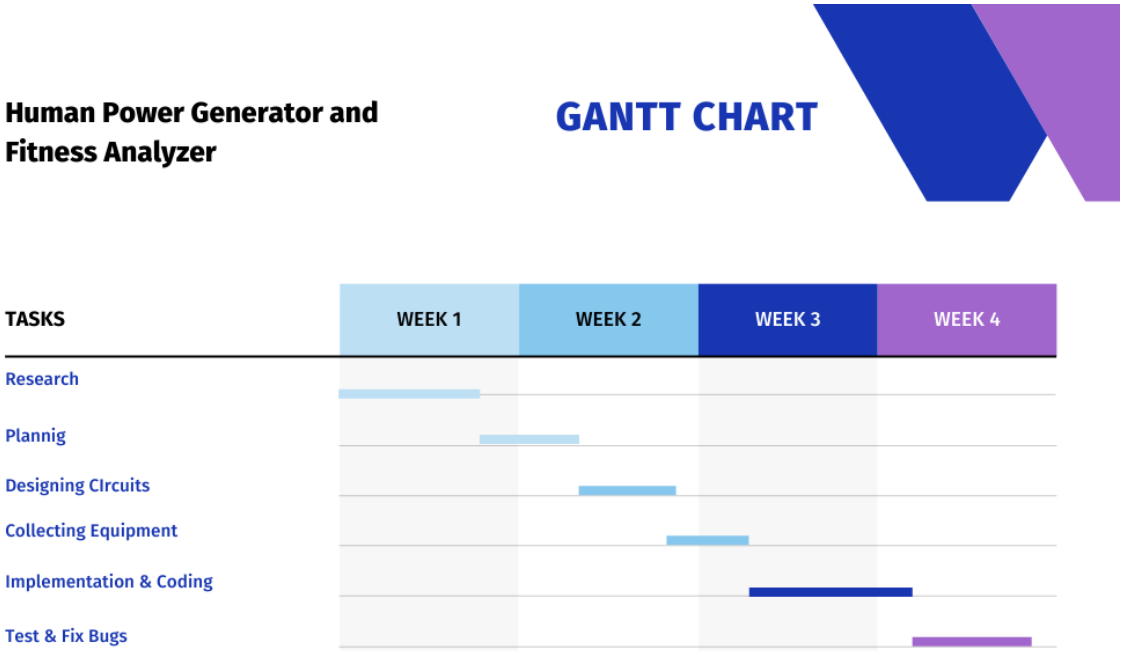
Product	Cost
Heartbeat Sensor	871.83 BDT (~872 BDT)
LCD	230.14 BDT (~231 BDT)
Jumper Wire Set	149.89 BDT (~150 BDT)
Buzzer	54.00 BDT
Buzzer	28.00 BDT
Breadboard	90.00 BDT
LM393	15.40 BDT (~16 BDT)
Arduino Uno (Arduino Mega R3 2560 Official with Cable)	1250.00 BDT

So, estimated cost almost BDT 2556.

Here, we want to mention that we will use the spin bike of a gym. So, no money is needed in this case for that.

Work Plan:

Initially, we will conduct research into the problem and its solutions. We'll begin developing the circuits after we've successfully planned the entire project. After that, we'll gather all of the essential equipment and begin implementing hardware as well as software work, which includes coding. In addition, we'll be testing and correcting any bugs that arise.



Conclusion:

Our Human Power Generator AND Fitness Analyzer can be used for the greater good of our society and individuals because it can generate electricity from human energy and measure a person's fitness level at a low cost. A power generation cum fitness analyzer has been built in this paper using Proteus software. It can be connected through Android smartphones near us after it is created on a real-world basis. The data from the sensors is fetched and transferred to the IO devices as parameters, allowing us to calculate and display the amount of power generated, heart rate, BMI, calories burned, blood oxygen level, battery condition, speed, and other metrics on an LCD display. We can reduce our electricity scarcity as well as our country's obesity problem by implementing our project.

Responsibilities of each member:

All of us helped each other in each part. But specifically, we can say we individually focused mainly in these parts of the project:

1. Nowshin Tasnim (19101655): Arduino and proteus part.
2. K.A.Mukit (1830104): Arduino and proteus part.
3. Eftykhar Rahman (18301041): Proteus and LabVIEW part.
4. Anika Rahman Tonny (18101569): Proteus and LabVIEW part.

Our Resources:

1. https://www.thedailystar.net/health/obesity-increasing-in-bangladesh-younger-generation-1637107

2. https://how2electronics.com/interfacing-max30100-pulse-oximeter-sensor-arduino/

3. https://www.electronicshub.org/interfacing-lm393-speed-sensor-with-arduino/

4. http://www.iosrjournals.org/iosr-jeee/Papers/Vol2-issue3/A0230104.pdf