

The IoT Based Exercise Cycle

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Abstract—The "IOT Based Exercise Cycle" project incorporates a wide range of technologies, both computer hardware and software, to give cyclists another modern home exercise solution that makes the user feel immersed in his or her environment. Therefore, a cyclist can monitor online with a web page some of the most important training parameters, especially speed, distance covered by the cyclist, heart rate, and oxygen level of the cyclist during exercise. Also, a cyclist can see flashing images on a web page depending on the peddling. This cycle is connected with heart rate and temperature so that the cyclist can monitor his/her BPM(Heart Beats Per Minute) and the temperature of body.The system is made up of both hardware and a software unit. Hardware is responsible for collecting, measuring, converting, and sending data from sensors. On the software side, there is a server, which contains a Front-End Web page that displays and controls data for cyclists. Finally, there is a web page that shows all the parameters with the help of which the cyclist can monitor the ride. **Index Terms**—IOT, Virtual Reality

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I. INTRODUCTION

As times exchange, technology evolves and those migrate from fieldwork to deskwork, a brand new fitness hazard arises: the sedentary way of life. To combat this phenomenon, fitness looks like an available answer, specifically for the benefit of getting an IOT-based smart cycle that can reveal the pastime and assist us to paintings throughout the schooling. The IoT-based totally exercise cycle is today's answer, as it's far provided in. however, most cyclists either amateurs or experts no longer have this opportunity, making it harder to enhance and reach precise desires. This seminar report proposes a technical answer supposed to conquer this difficulty, by means of the usage of sensors, and microcontrollers to study, ship, keep and display statistics at the net web page. therefore, any bike owner can screen applicable cycling records collected from the sensor in real-time. records series from sensors is extensively used nowadays. however, all the records are centered on sharing device development, sensor network implementation, protection, clever town development, or smart manipulation implementation. a sequence of awesome results are posted considering the positioning method of the sensor device, structural fitness tracking, and smart automobile. No studies that specialize in IoT (net of factors) and clever motorbike IOT primarily based cycles for training has been published.

nowadays, in cycling, the most not unusual training method is by the sheet. This sheet can be custom-made through a teacher for one or more riders and holds a training plan by means of days, weeks and even season durations. but, this vintage and inflexible approach has a better hazard of failing to attain its purpose. The design of IoT based totally workout cycle retrieves and transmits over the net the rate, and distance and also flashes photographs continuously in keeping with pedaling speed output each to a server-hosted database and to a web web page, so we will compare and notify viable mistakes made by using the bicycle owner at some stage in the journey. furthermore, by persisting statistics to a server, the cyclist can go back over the last through keeping a document of rides. The rider additionally has the possibility to control the system via beginning, pausing or ending the experience with the assist of a webserver.all of the technology used within the presented IOT based workout cycle-assignment serve the following functions:

- Collection of data from sensor.
- Computing the velocity, pedaling charge(rpm) and distance covered by the bicycle owner from accumulated statistics.
- Measure the Heartrate,Oxygenlevel and Temperature of cyclist.
- Aggregating and sending facts to the web web page for on line tracking.
- Allowing user to the monitoring system through a web page.

II. LITERATURE SURVEY

With the global economic increase, health membership is developing unexpectedly within the international. in the meantime, the fitness industry is booming particularly for city white-collar populace. inside the situations of Covid-19, everybody must have better immunization strength to build their fitness. on this challenge, we layout an internet of factors (IoT) based exercising cycle to offer feel of actual global cycling the use of digital reality which encourages humans to do cycling or exercise. when biking the workout cycle, the facts is amassed via sensor. eventually, this records is processed to discover specific parameters like pace of cycle, distance covered by using the bike owner and pedaling charge. these parameters can be despatched to web site the use of

protocols wherein these parameters are displayed. The pics which might be saved in database are tagged with every distance and displayed continuously on webpage. And, that offers the texture of virtual truth to the bicycle owner. on this mission, we will describe the info of the device and similarly reach out to the implementation technologies. The design of this form of gadget is a trend for the destiny virtual fact programs.

III. OBJECTIVES

- To offer biking fans with a modern opportunity solution for training by way of developing a virtual reality and permitting them to get pleasure from the outer environment by way of sitting at home.
- Also tracking their performance during the training by measuring the parameters like speed, total distance traveled during the workout, and pedaling rate i.e rpm of the wheel.
- Using a heart rate sensor module to monitor the heart-beat, and also calories burned by the cyclist during the workout.
- Also using temperature sensor measure temperature of cyclist body.
- To flash the images of the locations from where the cyclist will be traveling during his/her journey.

IV. METHODOLOGY

The cycling monitoring function of the cyclist should have increased mobility and should be easy to access and interact with. To meet these needs, a web page has been created. This can be achieved by anyone, including cyclists, who have pages and functions designed for a particular type of user. On a web page, a cyclist can access a list of parameters such as speed, distance, location, and heartbeat and can view blinking images according to speed. Last, but not least, the user can access a page where he can view his personal data. A cyclist can see his performance in real-time, having access to monitoring boarding data. From a hardware perspective, the project has three modules: 1. The first is in charge of reading data from the IR sensor, measuring rpm and inserting a formula to calculate speed and distance based on cycle wheel data sent to the second module via a wireless channel and displayed on the Website. Also, the BPM and Temperature of cyclists are Measured by the different sensors displayed on the Website. 2. The second module contains, which is responsible for reading and processing data both from sensors, and the first module and the laptop that receives this data, converts it into a standard message format and sends it to a web page via the Internet. 3. Last, but not least, the third module is a small open computer that handles the end of the web server and HTTP server. Dual power sources enable the first two modules, and a hybrid module requires internet access provided by a mobile hotspot or Internet Stick. The whole system is built on three levels: hardware level, application level, and network level.

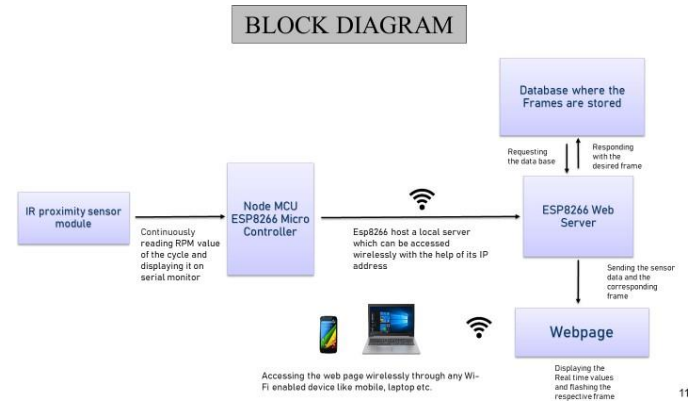


Fig. 1. Block Diagram

V. ALGORITHM

- Tachometer is been used to determine the speed of the cycle and also calculate the distance travelled by the cyclist.
- IR proximity sensor is interfaced with Node MCU ESP8266 microcontroller.
- In Tachometer, a black screen will be attached to the rotating wheel which will be detected by the IR beam of the IR proximity sensor.
- The reflection and absorption of the IR beam from the white and black surface respectively will determine the speed of the cycle. Further this speed can be analyzed to determine the distance travelled by the cyclist.
- The data collected by the sensor is then displayed on the serial monitor of the Arduino IDE.
- Time difference between two successive pulses is taken to calculate angular velocity. (angular velocity = width of black screen / time difference)
- Then time is found out by using simple formula,
- $\text{Time} = 2 \times \pi \times \text{radius} / \text{angular velocity m/s}$
- Later rpm is calculated by dividing 60,000 by time. (time converted from millisecond to minute and then rpm conversion)
- To find speed we use the formula,
- $\text{Speed} = 2 \times \pi \times \text{radius} \times \text{RPM} / 60 \text{ m/sec}$
- Distance is found out by,
- $\text{Distance} = \text{speed} \times \text{time} / 1000 \text{ meter}$
- Heart rate sensor Max30100 is been used to determine BPM and Oxygen level of cyclist.
- Temperature sensor DS18B20 is been used to determine temperature of cyclist body.

VI. HARDWARE AND SOFTWARE REQUIREMENT

A. ESP8266(Wi-Fi Module)

Wi-Fi module (ESP8266) connects to a small controller via a serial connection. It can also access the Internet if it is connected to the login area of the Internet service provider. This module retrieves the data from the specified web page and

transfers that data to the subfolder. It also loads the data sent from the subfolder to the specified webpage.



Fig. 2. ESP8266(Wi-Fi Module)

B. IR Sensor

The IR sensor module consists mainly of the IR Transmitter and Receiver, Variable Resistor (Trimmer pot), output LED in brief. Working Mechanism: In this circuit, the IR sensor module is interfaced with Node MCU to measure speed of cycle, distance covered using RPM. The calculation is done on this basis. After 1 second Node MCU calculates RPM using the given formula. $\text{rpm} = (60000)/(\text{total time}) * 10$ (time in ms to minutes and then to rpm conversion step)



Fig. 3. IR Sensor

C. Heartrate and Temperature Sensor

The module functions the MAX30100 – a modern-day, included pulse oximeter and heart charge sensor IC, from Analog gadgets. It combines LEDs, a photodetector, optimized optics, and coffee-noise analog signal processing to discover pulse oximetry (SpO2) and heart rate (HR) signals. on the proper, the MAX30100 has LEDs – a crimson and an IR LED. And on the left is a completely sensitive photodetector. The concept is that you shine a single LED at a time, detecting the amount of light shining again on the detector, and, based on the signature, you may measure blood oxygen stage and coronary heart fee. The DS18B20 is a 1-cord programmable Temperature sensor from maxim integrated. it's far extensively used to measure temperature in difficult environments like in chemical solutions, mines or soil and so on. The constriction of the sensor is rugged and additionally can be purchased with a water-resistant option making the mounting manner smooth. it could degree a wide variety of temperatures from -55°C to +125° with a decent accuracy of $\pm 5^\circ\text{C}$. every sensor has a

completely unique deal with and requires the best one pin of the MCU to transfer data so it is a superb choice for measuring the temperature at more than one factor without compromising much of your digital pins on the microcontroller.



Fig. 4. MAX30100



Fig. 5. DS18B20

D. Web Server

A web server is an online resource that stores and delivers files. Clients can request such a file or other piece of data, and the server will then send the correct data / files back to the client. Requests are made using a different protocol such as HTTP, MQTT, etc. Hyper Text Transfer Protocol or HTTP is good for things like downloading web pages, uploading images, etc., but it is slow. For IoT, the HTTP protocol is selected. It is a great lightweight publishing and subscription program where anyone can publish and receive messages as a client. We used an HTTP server for this project.



Fig. 6. Web Server

E. Web Page:

From each net enabled a tool that may get entry to the professional website's tracking net web page can carry out Web Server the duties of tracking the sub-station device's present day popularity and control the gadget.

VII. APPLICATIONS

- The most well-known application of IoT based exercise cycle is in gyms and the fitness business.

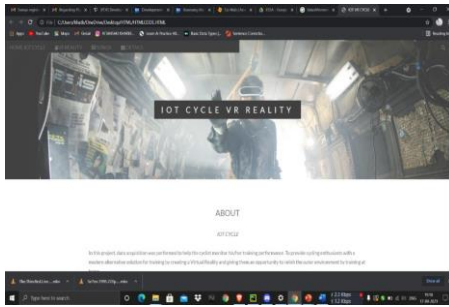


Fig. 7. Web Page

- In our project we have created a virtual reality for the cycle but with more advancements we can use this VR for Car Simulation, Airplane simulation etc.
- VR also have wide applications in the field of Gaming.
- VR can simulate actual workspaces for place of business occupational safety and health functions, educational purposes, and education functions.
- VR can be used to provide beginners with a virtual environment in which they are able to increase their capabilities without the actual-world outcomes of failing.
- VR has been used and studied in number one schooling, anatomy teaching, army, astronaut training, flight simulators, miner education, architectural layout, driving force education and bridge inspection.

VIII. FUTURE WORK

- Track the cyclist's position in actual time via reading latitude and longitude from the GPS module or GPS string
- Implementing an internet server that permits the rider to create a brand new experience, begin or terminate the modern one, and additionally obtain data on the state of the bike's body module.
- To make an app and proportion it on a worldwide server.
- Implant virtual reality on an advanced basis.
- Similarly upgrades to show facial expressions, sweat, and panicking conditions may be carried out via studying the facial trends, body developments the use of esp32-cam and system getting to know.

IX. CONCLUSION

The IOT-based workout Cycle was born out of an actual problem encountered by both newbie and professional cyclists. This problem consists of the restrictions present in modern training strategies. on this assignment, a wide variety of techniques can be used, beginning from the electronics and hardware side and to the internet and cell applications. setting all those collectively, a prototype of an entire solution could be created to help cyclists and facilitate trainers and additionally monitor their performance during the training with the aid of measuring the parameters like speed, overall distance traveled during the workout, pedaling rate i.e. rpm of the wheel, To flash the pictures of the places from in which the bike owner

could be touring all through his/her journey. Also monitoring heartbeat and temperature of cyclist.

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