

Smart Devices for Athletes to Monitor Running Speed in Marathon Race with IoT

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ABSTRACT:

Physical health is a state of fitness and well being and, extra specifically the ability to perform elements of sports activities. If the athlete is not fit then the person may concerns with knee injuries, controlling blood pressure etc., To overcome this fitness issues in marathons giving proper physical training and knowing the blood pressure of the athlete. A system based on the acceleration, gyroscopic sensors and the parts-dependent heart rate adjustment approach was suggested. The goal is to track the operating pace during the human activity in real time, informing users that they need to correct the pace when coaching. The coaches and the doctor transmit the wireless data at the same time. The experimental result shows that athletes are running at speed. This leads to a safe running habits and encourages urban life and balanced activity for the growth of athletes. The main objective of this project is to reduce the injuries while giving training and monitoring the data of the athlete and also observing the heart rate of the athletes.

Keywords: Acceleration Sensor, Gyroscopic Sensor, Marathon, Heart rate

1. INTRODUCTION:

Marathon sports pay attention to uniform speed, they can have better pay to their strengths in a uniform state. Many runners pay attention to controlling speed. They figured out their marathon scores ten thousand meter results multiplied by marathon endurance coefficient, And then the marathon scores correspond to the speed , trying to run in the same pace throughout the same pace. Grasp the pace can be based on the sense of speed, Watch your time when you are running at ordinary times, connect the actual speed to pace. You can also use a mobile phone or watch sports software movement while training and competition, these watches or software are with GPS positioning function, according to the GPS data average speed for the athletes can be calculated the to adjust their running speed.

Through Marathon sports, they exert their strength more efficiently in a specific setting, taking account of uniform speeds in marathon sport. Most drivers are responsible for speed control. The running process is always unsatisfactory and not complete due to its insufficient speed. The sport accidents involved are caused in spite of the runner's excessive speed. A sensor-based approach is applied. The goal is to track run speed in real time, while WLAN provides data on user acceleration and the heart rate of athletes that can effectively improve athletes' running pace, accelerate spectator trains and also control cardiac pace of Physi.

2. LITERATURE REVIEW

ZhangBo ,GuoJinBao&XuDanDan (2018), author proposed a system for monitoring and implementing the runge-kutta algorithm of the running sprrd and for generating power with piezoelectric material.

Emma M. Kidman ,Mattwe JA D' Souza & Surya P.N. Singh(2016),author proposed system that is a wearable device with inertial motion tracking and vibro-tactile feedback the system consists of wearable sensor module and a smart phone application for coach , the wearable sensor module receives the control command and acts accordingly.

Dhruv R Seshadri, Colin Drummon& John Craker(2017), author proposed paper gives a brief overview of new technologies which helps athletes to understand new technologies in real time. Wearable devices have been documented to be able to identify and monitor the effects of interactions in the research and development phase. The incidence of congestion of sportsmen would probably be one of small wearable goods.

sachinMenon and dhanammajagli (2016), author proposed report "IOT implementations in the sport environment" explains how iot is used in sports.iot in a broad scale, but is carried out in small-scale sports due to certain limitations and studies. The application explains how iot technology is linked with sportsmen.

Li Jiayi, Liu Dongxu, Zhu Jianjum& Liu Tao(2019), authors proposed system gives in assessing the state of motion using wearable devices.This program is strongly anti-interference capable, contains time information and guidelines for the assessment of cardiopulmonary performance.

KENNETH LI MINN ANG & JASMINE KAH PHOOL SENG(2019), author presented paper the emergent field of the device specific Internet of Things summarized the emerging field and provided fundamental taxonomy for further research into interoperability, energeticalperformance, edge / fog learning models and security / privacy challenges for the Internet of Things specifically for application.

In KittichaiTharawadeepinuk&YodchananWongsawat(2014), author presented paper they observe the brain activity of Asian athletes before the match and also they studied the anxiety symptom showing on the brain via QEEG maps.

In GuoHao(2010),author presented paper they studied about the positively correlated between the groups compatible index and the team's performance and also they observed the factors like ability, personality, etc.,

In Jonathon G. Neville, David D. Rawlands, James B. Lee & Daniel A. James(2016), author presented paper demonstrates a method in which accelerometer data gathered from competition and training data was used to determine over ground running speed on an individual athlete basis for use during elite competitive sport.

PROPOSED METHOD:-

This section provides the method used for this mission. IoT powered wise system for sportsmen" is the solution. This is a technique based entirely upon Particle Argon which uses sensors to monitor athletes' moments.

Particle Argon:

Particle Argón is the main part of a network which is fitted with Nordic nRF5240 and Espressif ESP32 processors and is compatible with the Bluetooth mesh platform. The Argon features an integrated charging circuit, which enables the contact and communication of a Li-P0 battery with sensors, drives and other electronic devices.

MPU6050 SENSOR:

The MPU6050 module is complete with a 6-axis motion tracking device. It combines in a small package all 3-axis gyroscope, 3-axis accelerometer and digital motion processor. It has I2C auxiliary bus to communicate with other sensors such as pressure sensors etc. With Micro Electro Mechanical System (MEMS) technology, the 3-axis gyroscope detects rotational velocity along the X, Y, Z-axis and provides a full-scale output of ± 250 , ± 500 , ± 1000 , ± 2000 . The 3-axis Accelerometer is with Micro Electro Mechanical System(MEMS) Technology which used to detect angle of tilt or inclination along X,Y and Z-axes and give the output in the scale range of acceleration are $\pm 2g$, $\pm 4g$, $\pm 8g$, $\pm 16g$ where it measured in g(gravity force) unit.

MAX30100 SENSOR:

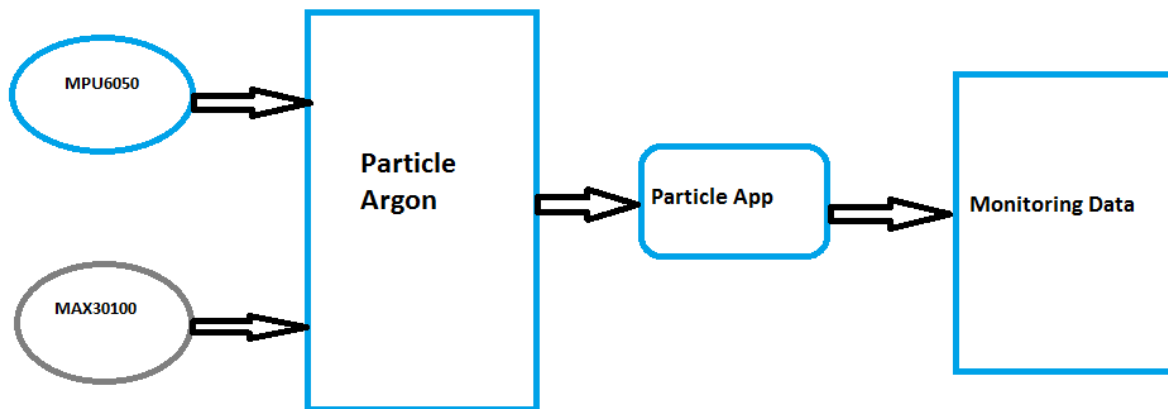
The MAX30100 is an integrated heart rate and pulse oximetry monitor system which operates from 1.8v and 3.5v power supplies and can be used mainly in medical monitoring systems with low-standby software.

Bluetooth HC-05 Module:

The HC-05 is a Bluetooth SPP module, designed for the transparent installation of a wi-fi serial connection. The frequency band uses 2.45 GHz. The relationship may be factor-to-factor or

multiple, with 10 meters being the largest variation. The price is 1Mbps for statistical move. It also offers a shifting mode between grasp and slave, so it can neither obtain nor pass on information.

METHODOLOGY:-



The proposed system consists of particle argon and other parameters including the 3-axis gyroscope, the 3-axis accelerometer and the heart rate are the main control factor. The system is controlled by the first sensors are connected according to the pin description to the particle argon board as a point. This contact is achieved by a software program, which is a Particle Web IDE or a VS workbench between hardware components. The first step is to connect the components to the Particle Argon. Power the Particle Argon and open the particle web IDE and login to that website and code should be run in this ide and then flash the code to the system. After flashing the code to the system, download the Particle App in the App store and login to the app and connect the system to the app and we can monitor the data of the athlete in the app.

ALGORITHM:-

Step1: The sensors are linked to the Particle Argon Network

Step2: Provide the device with the power supply.

Step3: Build a Particle Web IDE account.

Step4: Write the code to the Particle IDE and then flash the code to the device.

Step5: Download the Particle App to mobile device.

Step6: Build an account in the Particle App and log in to Particle Argon.

Step7: Once the system is set up, the data will be monitored in the Device.

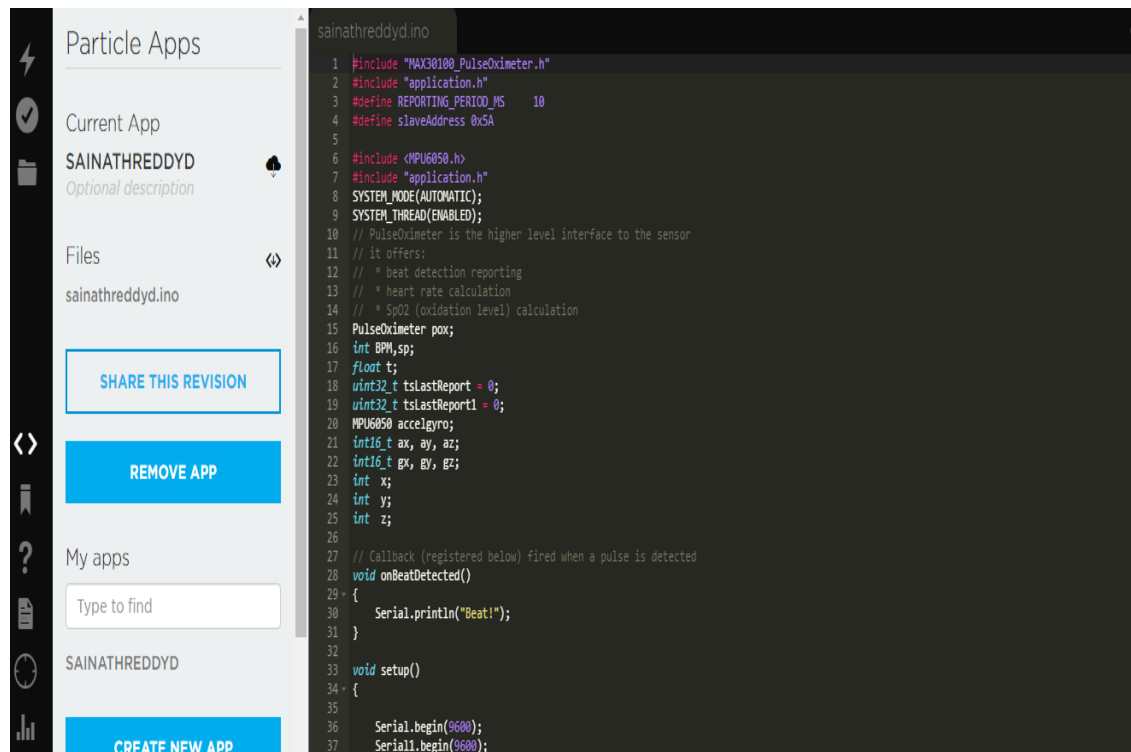
Step8: The Bluetooth module is attached to the network that provides the data to be controlled on the Arduino Serial board.

Step9: All values are shown in the Particle App and in the Serial Monitor.

Result:

Getting live data through Bluetooth:-

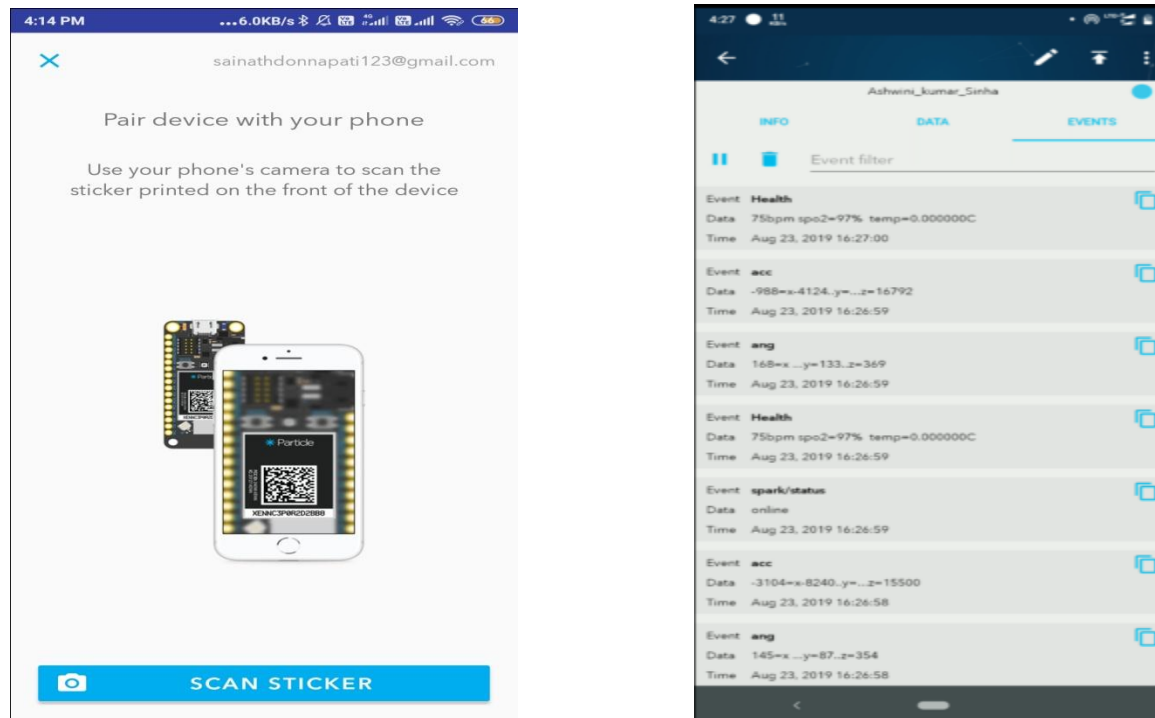
The system is first connected to the Particle web IDE and there login to the IDE and necessary code should be done and verify the code and then flash the code to the system. And check the port connections in the Arduino to monitor the live data in your PC.



After connecting the system with the Wi-Fi router that is our connection status is shown in the Particle web IDE will show online. Now open the Arduino IDE in your PC and connect the Bluetooth HC-05 to your PC. After checking the Bluetooth Com PORT Number and change the port to that port . Now open the Serial port where you can see the live sensor data of the athlete.

Device	Location	Time	Temp (°C)	Humidity (%)	AQI	PM2.5 (µg/m³)	PM10 (µg/m³)	CO (ppm)	NO2 (ppb)	O3 (ppb)	Solar Radiation (W/m²)	Wind Speed (m/s)	Wind Dir (°)	Bar Pressure (hPa)
Station 001	Indoor	2024-01-01 10:00	22.5	65	45	12	25	0.5	10	5	150	2.5	135	1013.2
Station 001	Indoor	2024-01-01 10:05	22.8	66	46	13	26	0.5	11	5	155	2.6	136	1013.3
Station 001	Indoor	2024-01-01 10:10	23.0	67	47	14	27	0.5	12	5	160	2.7	137	1013.4
Station 001	Indoor	2024-01-01 10:15	23.2	68	48	15	28	0.5	13	5	165	2.8	138	1013.5
Station 001	Indoor	2024-01-01 10:20	23.5	69	49	16	29	0.5	14	5	170	2.9	139	1013.6
Station 001	Indoor	2024-01-01 10:25	23.8	70	50	17	30	0.5	15	5	175	3.0	140	1013.7
Station 001	Indoor	2024-01-01 10:30	24.0	71	51	18	31	0.5	16	5	180	3.1	141	1013.8
Station 001	Indoor	2024-01-01 10:35	24.2	72	52	19	32	0.5	17	5	185	3.2	142	1013.9
Station 001	Indoor	2024-01-01 10:40	24.5	73	53	20	33	0.5	18	5	190	3.3	143	1014.0
Station 001	Indoor	2024-01-01 10:45	24.8	74	54	21	34	0.5	19	5	195	3.4	144	1014.1
Station 001	Indoor	2024-01-01 10:50	25.0	75	55	22	35	0.5	20	5	200	3.5	145	1014.2
Station 001	Indoor	2024-01-01 10:55	25.2	76	56	23	36	0.5	21	5	205	3.6	146	1014.3
Station 001	Indoor	2024-01-01 11:00	25.5	77	57	24	37	0.5	22	5	210	3.7	147	1014.4
Station 001	Indoor	2024-01-01 11:05	25.8	78	58	25	38	0.5	23	5	215	3.8	148	1014.5
Station 001	Indoor	2024-01-01 11:10	26.0	79	59	26	39	0.5	24	5	220	3.9	149	1014.6
Station 001	Indoor	2024-01-01 11:15	26.2	80	60	27	40	0.5	25	5	225	4.0	150	1014.7
Station 001	Indoor	2024-01-01 11:20	26.5	81	61	28	41	0.5	26	5	230	4.1	151	1014.8
Station 001	Indoor	2024-01-01 11:25	26.8	82	62	29	42	0.5	27	5	235	4.2	152	1014.9
Station 001	Indoor	2024-01-01 11:30	27.0	83	63	30	43	0.5	28	5	240	4.3	153	1015.0
Station 001	Indoor	2024-01-01 11:35	27.2	84	64	31	44	0.5	29	5	245	4.4	154	1015.1
Station 001	Indoor	2024-01-01 11:40	27.5	85	65	32	45	0.5	30	5	250	4.5	155	1015.2
Station 001	Indoor	2024-01-01 11:45	27.8	86	66	33	46	0.5	31	5	255	4.6	156	1015.3
Station 001	Indoor	2024-01-01 11:50	28.0	87	67	34	47	0.5	32	5	260	4.7	157	1015.4
Station 001	Indoor	2024-01-01 11:55	28.2	88	68	35	48	0.5	33	5	265	4.8	158	1015.5
Station 001	Indoor	2024-01-01 12:00	28.5	89	69	36	49	0.5	34	5	270	4.9	159	1015.6
Station 001	Indoor	2024-01-01 12:05	28.8	90	70	37	50	0.5	35	5	275	5.0	160	1015.7
Station 001	Indoor	2024-01-01 12:10	29.0	91	71	38	51	0.5	36	5	280	5.1	161	1015.8
Station 001	Indoor	2024-01-01 12:15	29.2	92	72	39	52	0.5	37	5	285	5.2	162	1015.9
Station 001	Indoor	2024-01-01 12:20	29.5	93	73	40	53	0.5	38	5	290	5.3	163	1016.0
Station 001	Indoor	2024-01-01 12:25	29.8	94	74	41	54	0.5	39	5	295	5.4	164	1016.1
Station 001	Indoor	2024-01-01 12:30	30.0	95	75	42	55	0.5	40	5	300	5.5	165	1016.2
Station 001	Indoor	2024-01-01 12:35	30.2	96	76	43	56	0.5	41	5	305	5.6	166	1016.3
Station 001	Indoor	2024-01-01 12:40	30.5	97	77	44	57	0.5	42	5	310	5.7	167	1016.4
Station 001	Indoor	2024-01-01 12:45	30.8	98	78	45	58	0.5	43	5	315	5.8	168	1016.5
Station 001	Indoor	2024-01-01 12:50	31.0	99	79	46	59	0.5	44	5	320	5.9	169	1016.6
Station 001	Indoor	2024-01-01 12:55	31.2	100	80	47	60	0.5	45	5	325	6.0	170	1016.7
Station 001	Indoor	2024-01-01 13:00	31.5	101	81	48	61	0.5	46	5	330	6.1	171	1016.8
Station 001	Indoor	2024-01-01 13:05	31.8	102	82	49	62	0.5	47	5	335	6.2	172	1016.9
Station 001	Indoor	2024-01-01 13:10	32.0	103	83	50	63	0.5	48	5	340	6.3	173	1017.0
Station 001	Indoor	2024-01-01 13:15	32.2	104	84	51	64	0.5	49	5	345	6.4	174	1017.1
Station 001	Indoor	2024-01-01 13:20	32.5	105	85	52	65	0.5	50	5	350	6.5	175	1017.2
Station 001	Indoor	2024-01-01 13:25	32.8	106	86	53	66	0.5	51	5	355	6.6	176	1017.3
Station 001	Indoor	2024-01-01 13:30	33.0	107	87	54	67	0.5	52	5	360	6.7	177	1017.4
Station 001	Indoor	2024-01-01 13:35	33.2	108	88	55	68	0.5	53	5	365	6.8	178	1017.5
Station 001	Indoor	2024-01-01 13:40	33.5	109	89	56	69	0.5	54	5	370	6.9	179	1017.6
Station 001	Indoor	2024-01-01 13:45	33.8	110	90	57	70	0.5	55	5	375	7.0	180	1017.7
Station 001	Indoor	2024-01-01 13:50	34.0	111	91	58	71	0.5	56	5	380	7.1	181	1017.8
Station 001	Indoor	2024-01-01 13:55	34.2	112	92	59	72	0.5	57	5	385	7.2	182	1017.9
Station 001	Indoor	2024-01-01 14:00	34.5	113	93	60	73	0.5	58	5	390	7.3	183	1018.0
Station 001	Indoor	2024-01-01 14:05	34.8	114	94	61	74	0.5	59	5	395	7.4	184	1018.1
Station 001	Indoor	2024-01-01 14:10	35.0	115	95	62	75	0.5	60	5	400	7.5	185	1018.2
Station 001	Indoor	2024-01-01 14:15	35.2	116	96	63	76	0.5	61	5	405	7.6	186	1018.3
Station 001	Indoor	2024-01-01 14:20	35.5	117	97	64	77	0.5	62	5	410	7.7	187	1018.4
Station 001	Indoor	2024-01-01 14:25	35.8	118	98	65	78	0.5	63	5	415	7.8	188	1018.5
Station 001	Indoor	2024-01-01 14:30	36.0	119	99	66	79	0.5	64	5	420	7.9	189	1018.6
Station 001	Indoor	2024-01-01 14:35	36.2	120	100	67	80	0.5	65	5	425	8.0	190	1018.7
Station 001	Indoor	2024-01-01 14:40	36.5	121	101	68	81	0.5	66	5	430	8.1	191	1018.8
Station 001	Indoor	2024-01-01 14:45	36.8	122	102	69	82	0.5	67	5	435	8.2	192	1018.9
Station 001	Indoor	2024-01-01 14:50	37.0	123	103	70	83	0.5	68	5	440	8.3	193	1019.0
Station 001	Indoor	2024-01-01 14:55	37.2	124	104	71	84	0.5	69	5	445	8.4	194	1019.1
Station 001	Indoor	2024-01-01 15:00	37.5	125	105	72	85	0.5	70	5	450	8.5	195	1019.2
Station 001	Indoor	2024-01-01 15:05	37.8	126	106	73	86	0.5	71	5	455	8.6	196	1019.3
Station 001	Indoor	2024-01-01 15:10	38.0	127	107	74	87	0.5	72	5	460	8.7	197	1019.4
Station 001	Indoor	2024-01-01 15:15	38.2	128	108	75	88	0.5	73	5	465	8.8	198	1019.5
Station 001	Indoor	2024-01-01 15:20	38.5	129	109	76	89	0.5	74	5	470	8.9	199	1019.6
Station 001	Indoor	2024-01-01 15:25	38.8	130	110	77	90	0.5	75	5	475	9.0	200	1019.7
Station 001	Indoor	2024-01-01 15:30	39.0	131	111	78	91	0.5	76	5	480	9.1	201	1019.8
Station 001	Indoor	2024-01-01 15:35	39.2	132	112	79	92	0.5	77	5	485	9.2	202	1019.9
Station 001	Indoor	2024-01-01 15:40	39.5	133	113	80	93	0.5	78	5	490	9.3	203	1020.0
Station 001	Indoor	2024-01-01 15:45	39.8	134	114	81	94	0.5	79	5	495	9.4	204	1020.1
Station 001	Indoor	2024-01-01 15:50	40.0	135	115	82	95	0.5	80	5	500	9.5	205	1020.2
Station 001	Indoor	2024-01-01 15:55	40.2	136	116	83	96	0.5	81	5	505	9.6	206	1020.3
Station 001	Indoor	2024-01-01 16:00	40.5	137	117	84	97	0.5	82	5	510	9.7	207	1020.4
Station 001	Indoor	2024-01-01 16:05	40.8	138	118	85	98	0.5	83	5	515	9.8	208	1020.5
Station 001	Indoor	2024-01-01 16:10	41.0	139	119	86	99	0.5	84	5	520	9.9	209	1020.6
Station 001	Indoor	2024-01-01 16:15	41.2	140	120	87	100	0.5	85	5	525	10.0	210	1020.7
Station 001	Indoor	2024-01-01 16:20	41.5	141	121	88	101	0.5	86	5	530	10.1	211	1020.8
Station 001	Indoor	2024-01-01 16:25	41.8	142	122	89	102	0.5	87	5	535	10.2	212	1020.9
Station 001	Indoor	2024-01-01 16:30	42.0	143	123	90	103	0.5	88	5	540	10.3	213	1021.0
Station 001	Indoor	2024-01-01 16:35	42.2	144	124	91	104	0.5	89	5	545	10.4	214	1021.1
Station 001	Indoor	2024-01-01 16:40	42.5	145	125	92	105	0.5	90	5	550	10.5	215	1021.2
Station 001	Indoor	2024-01-01 16:45	42.8	146	126	93	106	0.5	91	5	555	10.6	216	1021.3
Station 001	Indoor	2024-01-01 16:50	43.0	147	127	94	107	0.5	92	5	560	10.7	217	1021.4
Station 001	Indoor	2024-01-01 16:55	43.2	148	128	95	108	0.5	93	5	565	10.8	218	1021.5
Station 001	Indoor	2024-01-01 17:00	43.5	149	129	96	109	0.5	94	5	570	10.9	219	1021.6
Station 001	Indoor	2024-01-01 17:05	43.8	150	130	97	110	0.5	95	5	575	11.0	220	1021.7
Station 001	Indoor	2024-01-01 17:10	44.0	151	131	98	111	0.5	96	5	580	11.1	221	1021.8
Station 001	Indoor	2024-01-01 17:15	44.2	152	132	99	112	0.5	97					

After login to the App, connect the system to the App by scanning the QR code on the system to connect to the particular system and give the event name to the system and also password to the system



To get the data from the device cloud Open the console and copy the URL and paste it in any browser then it will show data with event name. This data can be accessed from anywhere over internet no matter how far you are from the device and the live data of the sensors can also be accessed from Particle App.

CONCLUSION:-

The IOT framework the objective of the proposed system is to track the data of athletes during training and competition. The data obtained will help the coaches practice better and will also allow us to know the heart rate of the athlete. In future various sensors can be used such as the athlete's glucose level, and also add piezoelectric material that can produce electrical energy, and the same energy can be used to power the device.

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