Building of a Smart Gymnasium under IOT Environment

Gurjot Singh Kocher,

B.E. (Electrical Engineering 3ʳᵈ year student), Thapar University, Patiala

Abstract: IOT (Internet of things) refers to the interconnectivity of various physical systems ranging from vehicles to buildings by virtue of which these systems can collect and exchange the required data in the provided IOT environment. Smart buildings employ a wide deployment of sensors for providing optimum lighting, heating, and air conditioning besides enhancing building security by detecting employee security levels as well as entry/exit checkbesides reducing the overall environment impact. The significance of intelligent buildings relies in their constant monitoring of current operations and automatic adjustment of deviation in resources for optimum efficiency in a timely manner.IOT finds applications in intelligent green house, intelligent transportation system, power distribution grid, smart home, smart building, and smart city. Amongst such buildings, the idea of a high tech "SMART GYMNASIUM" working purely on the basis of well equipped sensors and in an IOT environment is needed keeping in mind the increasing trend of working out in the common masses of all ages. The basic purpose of this gym is to eliminate the use of a fitness trainer in order to make it cost effective as well as reduce manual effort of the trainers who guide their clients in order to perform their regular workouts and instead introduce the use of sensors to perform all the required jobs removing the client's dependency on their trainers and hence improving the precision of workout. Broadly speaking, whole of this smart system requires 3 basic sensors with a unique purpose: Fatigue sensor, Temperature sensor & Thermoplastic garment sensor. The detailed layout of the smart gym will be presented during the conference.

Introduction:

Aim:

The basic purpose of this gym is to eliminate the use of a gym trainer in order to make it cost effective as well as reduce manual effort of the trainers who guide their clients in order to perform their regular workouts and instead introduce the use of sensors to perform all the required jobs.

Built Up:

This gymnasium can be built in a building with 3 floors for : weightlifting, cardio and a body spa & massage centre respectively with the weightlifting section to be on the ground floor such that the whole building is fully equipped with sensors making it a smart building.

Undertaking & Processing:

➢ **Getting Started :**

Firstly, when a client joins the gym, he/she undergoes a retina scan on the basis of which our client can enter the building. Then a full body workout chart is to be made of the person depending upon the body type (different for male and female) listing which body part the person has to work out and on which day, and which exercises and machines he/she is required to use. eg. Men generally train their chest and triceps on Monday, so as soon as the client enters the gym after his retina scan on that day, he is automatically shown which exercises he has to perform for warm up, on which machines he has to perform the required chest workouts, in order of which they would be performed, how many repetitions, relaxation time between sets etc. He is even informed about his progress with the weights as the weight he is lifting today would be noted and be compared with the weight he is lifting on the next Monday on the same machine.

➢ **Fatigue Sensor** :

Talking about weights, sometimes the person tends to put on more than required weight for a particular set and does not reach the required number of repetitions due to intense exhaustion and fatigue. In that case, we can employ a fatigue sensor on the machines. This one automatically senses the tiredness or amount of fatigue our body is experiencing with the help of our breath/pulse. A particular level of critical rate of heart beat is setup, like if a human heart beats 70 times a minute, let us say the limit is setup to be 140 times a minute. Now above 140 the person is said to be over exhausted and as soon as the heartbeat exceeds 140, the fatigue sensor would sense it by virtue of which it would bring down the amount of weight lifted by a few kilograms say 5 kgs so that the person involved in the workout doesn't faint or doesn't suffer a sprain due to excess weight and is able to finish the repetition successfully. Henceforth, when we have this sensor, we won't be needing a spotter or a person nearby to support us if we fail to pick up the weight involved. In case of a treadmill kept in the aerobics section on the first floor, same fatigue sensor can be used to slow down the speed of the machine when the heartbeat reaches the critical level.

➢ **Temperature sensor for cost saving :**

Generally in gyms, the ACs remain ON most of the time, which not only increases the cost of maintenance of the gym, but also has a bad effect on our body, as during a workout session, direct exposure of our body to an AC can cause blockage of sweat pores and may even lead to a loss in the muscle pump. So we needed an alternative to switch ON AC only whenever required. This problem could be solved by the use of temperature sensors. Firstly, we have to set a critical temperature above which the workout can be said to become tiresome such that the sensor activates above that temperature only. Then, these sensors could be put on the various exertion based machines specifically in the aerobics section such that whenever temperature near that machine rises above the critical level, the AC ventilation nearby be switched ON to bring down the temperature to a little degrees below the

critical temperature, and after that be automatically switched OFF.

> ### Thermoplastic garment sensor :

Talking about body postures specifically for aerobics, a correct body posture for a particular workout session is really important not only to make it a success but also to prevent the body from any internal injury or sprain. For this purpose, specified trainers were required with well equipped pre knowledge about different workouts and their postures and sometimes even their clients couldn't well follow their postures. To prevent this problem, a garment prototype using thermoplastic sensor is suggested which has earlier also been under a little study. This sensor was used for measuring strain in the cloth or the body gear we wear in the gym. It helped identify correct body postures as it could be stretched to that safe extent only. Also the intensity, speed & the number of repetitions of the exercise could be obtained using the thermoplastic sensor data.

> ### Spa center :

Talking about the SPA parlor or the massage centre, an automated attendant-less spa and massage is the obvious demand of customers as it is a treatment requiring a person clothless or in very less clothes. Hence, machines involving spring water / mineral baths or massages will be attached to sensors that will guide the customer him/herself to undertake the procedure.

Requirements:

- An SCO of about 125 sqyd.
- Machines for work out
- Well equipped sensors
- Personal computers etc.