Introduction to Internet of Things
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Lecture – 60
Activity Monitoring (Case Study) – II

Hello in this second part of the case study on activity monitoring, we will be going through a brief demonstration of a Smartphone based activity monitoring system. So, it is a very basic set up; that means, we have a Smartphone with us.

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We have a remote server and we have a network. Now nowadays Smartphone's are as good as computers, laptops, PCs. So, and in fact, in some cases they are even more powerful than traditional PCs. So, what we are planning on doing is since everyone carries a Smartphone nowadays, almost everyone is using a Smartphone nowadays. So, we are going to use the inbuilt sensors and we are going to try to transmit the data from the Smartphone sensors over the network to a remote server, on which we can visualize the incoming data. So, for this part we have not explored it that much, but judging from the preliminary successes, we predict this has a huge potential and if properly worked upon this can be easily integrated with standard or traditional IoT based technologies; even in smart homes, smart offices, smart buildings transportation and everything. So, your decision making what we are proposing,

you do the decision making at the server end we just transmitted data from the Smartphone over the network to the remote server.

Now, before beginning I would like to just brush up on a few things. So, I hope you all know that your smart phones are built in with certain sensors, more specifically you have your accelerometers which are in every Smartphone higher end Smartphone's will also have compass and a gyroscope. So, compass or magnetometer it will give you magnetic readings with respect to the true north, and your gyroscope will give you the orientation of your Smartphone. So, for example, your accelerometer will give you the readings of accelerations. So, suppose in case of certain jerks like this Smartphone is traveling with you. So, in case of certain jerks this accelerometer will generate higher impulse response.

In case of Gyroscope if your Smartphone's orientation changes even if there is a tilt or angle or any such other change, the gyroscope will record this and your magnetometer which will be responsible for locating the direction, you are moving with respect to the knot.

And additionally almost all Smartphone's are equipped with GPS. So, you have four very basic sensors found in almost all Smartphone's, your accelerometer gyroscope magnetometer and the GPS. So using a combination of these four sensors and maybe the internal clock of the sensors, internal clock of your Smartphone and the network attaching capability. That means, since your Smartphone has already been enabled with a cellular connection or a Wi-Fi connection. So, you can choose either any of these two connections to transmit your data over the network to a remote location. So, this was about the Smartphone's, we are not going into the details how we are transmitting the data which network we are choosing for this for our demonstration purpose we are choosing a local Wi-Fi network over which the server is also connected and the server is remotely located, I will be using my desktop to access that server remotely and I will be trying to log in to my remote server via an android app so that the data can be transmitted directly.

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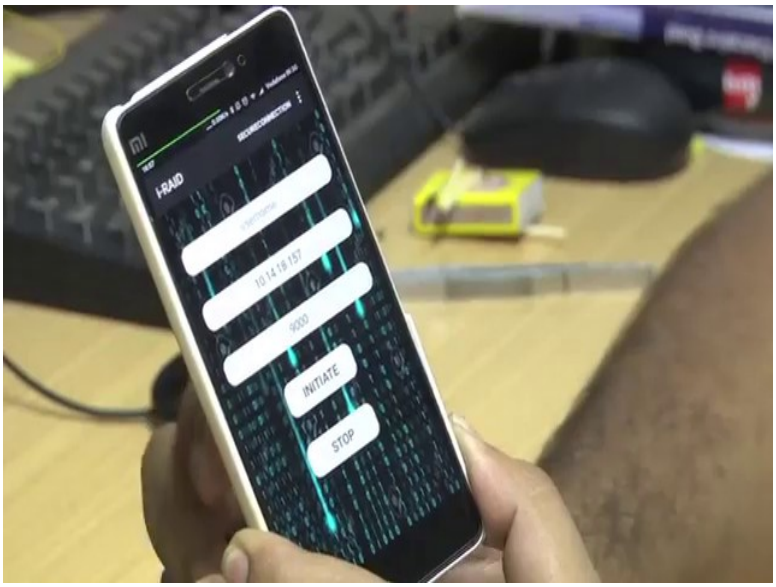

So, I have my android app I have connected it to the Wi-Fi network, I open this app you just named it I-RAID. So, it has got three fields one is username, one is the IP address of the server and one is the port. So, if you remember that those lectures on IoT with raspberry pi. So, we were also using 2 basic things one was the IP address another was the port. So, over here also we are using these 2 the IP of the server AND the port, onto which your data will be uploaded and we have got two buttons one is initiate and one is stop.

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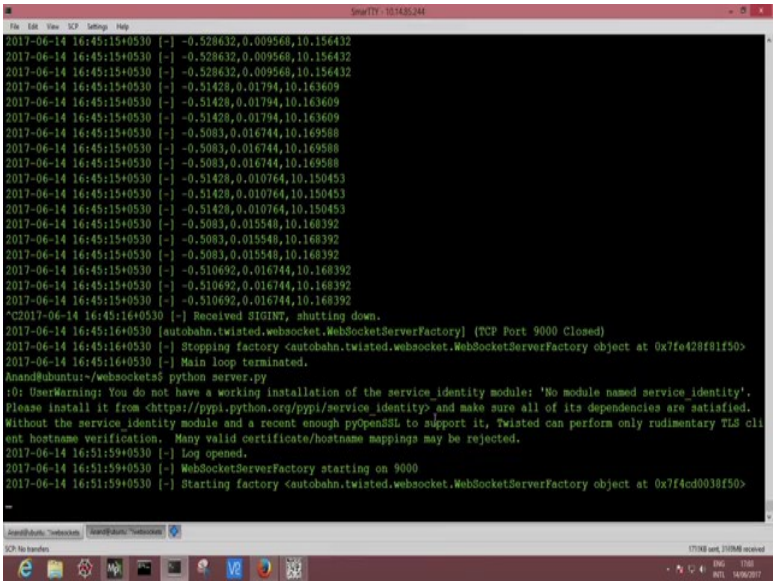

So, over at the server end I will start my python server. So, this web server was made on a library function python library function for web sockets, it is known as auto ban. And using this auto ban and the twisted framework we created this web socket server, and similarly on

this android phone the android programming for this application was done using the same manner. So, I give my server IP address as and the port name is same I will provide some username right. So, whenever I initiate my connection first you look the server is actually expecting connections.

So, whenever I initiate my connection on the Smartphone text message pops up connected, and if you focus on the server end you will see that data is being logged onto the server. So, it has got few fields first is the date field on which the data is being collected, next is the time then third fields we have kept intentionally blank, and for this demonstration purpose we are only logging the accelerometer values. So, if you see I give it jerky moments, the values abruptly change on the server end additionally we open another link to the server and we open a plotting function. So, on one thread the data is being uploaded over the network from the Smartphone, remotely located Smartphone on the other thread we are running a plotting functions.

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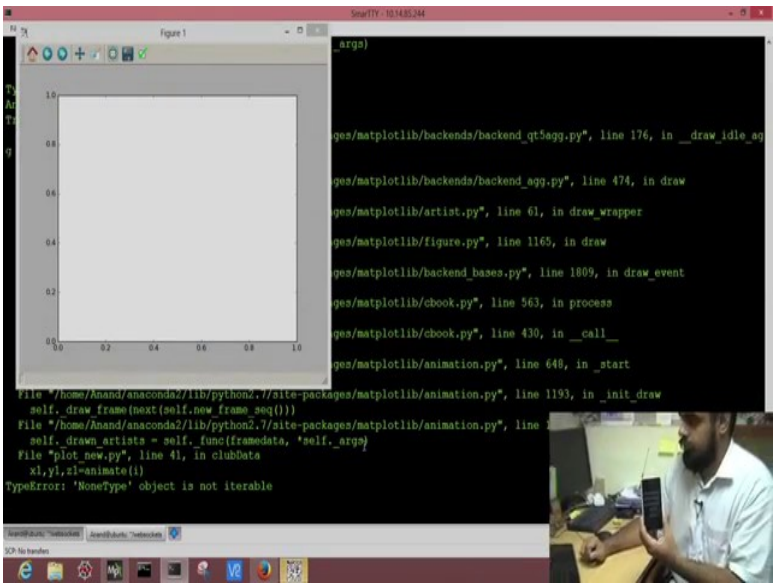

So, if you see on the screen now a plotting window pops up. So, since nothing is being plotted here, I might need to change some parameters. So, now, my data is being continuously logged on to the server. So, this is my plotting function and in the plot program again you see these three lines these denote the accelerometer xy and z readings.

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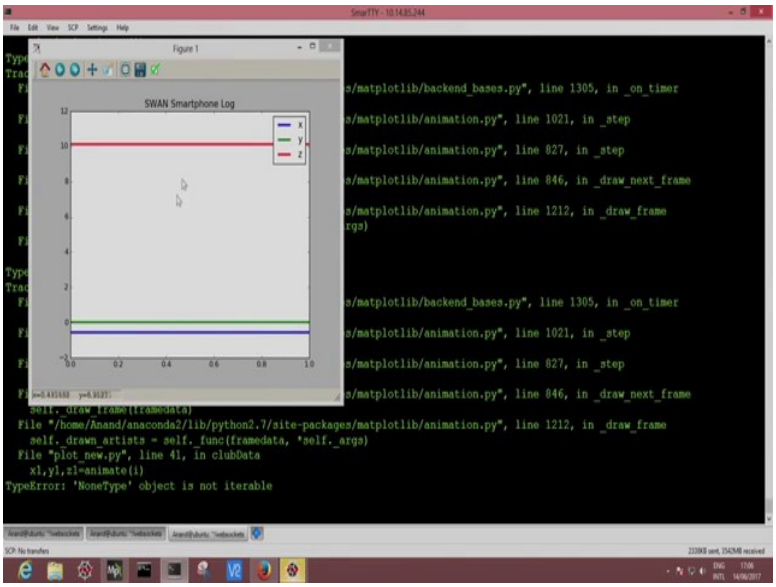

So, if you see if I move my Smartphone these lines go up and down. So, this we have not tried filtering this data you are trying to plot it as it is coming into the server, there has not been any delay element added to it nothing, just there all sensor values are being plotted.

So, one thing you can derive from this is suppose your Smartphone is kept on a level area. So, you see your x axis y axis are more or less on the same plane, nearby each other and the z, z axis gives a reading of ten. So, this basically signifies it is at certain distance from the ground right it is not at the zeroth position or the same as x and y axis. So, whenever I change my maybe I tilt my phone if you see on the screen the blue line goes up; that means, the x axis of the Smartphone changes right. Now whenever I tilt up the phone in this manner you see my z axis goes down. So, it is much more nearer to the ground whereas, my y axis goes up right. So, y-axis reading has changed. So, basic primary application which can be derived from this is maybe this can be used as a level tester to check whether your levels are correct or not, whether you are maybe you are supposed to put everything for parallel to the ground, but you needs some kind of level testing device which can tell you the measurements.

So, this may be one potential application other potential applications may include using these sensors and combining them with various machine learning algorithms. So, for that you need a prior or historical data on which your various machine learning algorithms will be trained. So, for supervised learning, on the basis of that you can go for activity detection also this is only just monitoring of activities we are not giving out any kind of intelligence whether this phone is or not whether a person holding this phone is sitting down or standing upright or lying down.

So, those kinds of things can be additionally added to this framework to make it more robust more reliable and much more functional. So, one is basic activity monitoring another application can be which can be very useful is fall detection; like we discussed in the previous lecture for medical patient monitoring you need fall detection approaches you need emergency alert approaches and so on. So, maybe using this you can detect a fall and after a fall has been detected various emergency services can be alerted you can even provide a feedback from the server after a fall has been detected, the server will ask the phone user whether you have actually fallen or not. So, that may be miscommunication from the sensor or that may have been due to an accidental jerk or sudden bump. So, if the user is in a condition to respond then it is fine. So, user says no if the user is not in the condition to respond. So, maybe something has gone wrong and emergency services hospitals relatives can be alerted.

So, these are some of the basic implications and applications which can be developed using this framework in this approach. So, it is actually limited by the by the users imagination what else can be done. So, I hope this has been useful to you.

Thank you.