I. system for implementing internet of things, since

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CONTIKIContiki has been the go-to operating system forimplementing Internet of Things, since its inception in the year 2002, becauseit is an open source operating sytem which is lightweight and mature. It allowsrapid prototyping and easy shift between different hardware platforms. This OSis preferred mainly because the developer need not design the underlyingoperating system for the internet-connected devices. Using this platform, almostany device can be connected to the internet even when the device is placedunderground or in an enclosed space. The inventor of Contiki has managed to fitan entire operating system , including a graphical user interface, networkingsoftware and web browser into less than 30 kilobytes of space, which makes iteasier to run on small, low-powered chips. Devices with limited memory, power, processing power and communication bandwidth can be run using Contiki. TheContiki system includes a network simulator called Cooja, which simulatesnetworks of Contiki motes (sensors). Contiki provides IPv6 networking forrelaying datagrams across network boundaries.

It contains the Routing Protocolfor Low power and Lossy Networks (RPL), an Internet Protocol (IP) optimized forwireless sensor networks. Contiki is implemented in the C language and can beported to a number of micro controllers such as MSP430, Atmel AVR, Arduino, CC2430, etc. The applications are implemented using Constrained ApplicationProtocol (CoAP) which is an application layer protocol that provides powerefficient operation through low radio duty cycling mechanism. CoAP adoptspatterns from HTTP but unlike the latter, CoAP uses UDP.

II. COMPARISON OFTOPOLOGIESThe remote sensors (motes) can be arranged in anumber of topologies according to the required application. The mote typedetermines the type of sensor hardware and which Contiki applications are to besimulated. In the case of Smart City concept, the major concern would be powerconsumption and the transmission-reception delay. To determine the topology inwhich power consumption is minimum, motes were placed in different topologieswith different transmission ranges and payload. The three major topologies arelinear, ellipse and random. In this example, IPv6 routing with RPL isconsidered.

Therefore, arpl-border-router with three clients and servers aresimulated using Cooja simulator. Figure 1. shows the various topologies Figure 1a. Linear topology 1a. Linear 1b. Ellipse 1c. RandomToevaluate the power consumption, Tmote Sky mote was used in different topologiesand the following graph (Figure 2.

) was obtained from the average power valuesof each topology. From Figure 2. it is inferred that power consumed duringtransmission and reception between motes is less in random topology. Figure 2.

Power for various topologiesTransmissionrange of the various motes also affect the amount of power consumed. Therefore, we increase the transmission as well as interference ranges of the motes toexamine the power consumption. From figure 3. it can be observed that forvarious transmission ranges, the motes in random topology has consumed lesspower over its counterparts. Figure 3. Range Vs PowerThenext concern is the amount of data, ie.

, payload, sent by the servers duringtransmission of signals. Figure 4. plots the power consumed by the nodes withincreasing payload. It can be seen that for random topology, the power consumeddecreases drastically with increase in payload. Therefore, random topology canbe used even when large amount of server data has to be transimitted. Figure 4. Payload variation The payload alsoaffects the end-to-end delay of the nodes.

Hence, an experiment is conducted byincreasing the payload and determining the corresponding power changes. Fromfigure 5, it can be inferred that as the payload increases, transmission-reception delay also increases. When the topologies are compared, linear topology has been found to have lesser delay. Figure 5. Payload Vs DelayFrom all the abovecomparisons, it can be observed that random topology can be used for practicalapplications.