TRAFFIC JAM DETECTION SYSTEM USING CLOUD COMPUTING

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ABSTRACT

We examined the benefits of embedded systems on cloud computing. Specifically, we tend to left solely minimum functions (controller and communication) within the finish device whereas implementing remaining functions (other controller / processing / storage) into the server on cloud computing. As associate experiment, we tend to develop a system capable of recognizing automotive variety plate. Leveraging cloud computing permits U.S.A. to get such edges as sleek performance, reduced development time, easier embedded system and potential of practicality and performance that were thought not possible. Through developing the amount plate recognition system, we tend to square measure convinced of realizing such potential.

Keywords: ARM, Camera, GPRS

I. INTRODUCTION

An "embedded system" may be a word created by shortening "computer embedded system" that means a system product or a device into that a pc has been integrated [1]. Therefore, "embedded system" may be a general term for any system product and device that comes with a pc. Game consoles, digital still cameras, and car navigation system square measure fashionable merchandise for embedded systems. Most of those merchandise, so far, are running alone and not closely connected to the net. During this chapter, we are going to make a case for the event of system merchandise and electronic devices from the point of view of programmer. Once within the past, the programmed of electronic devices was nothing over an easy power switch. Then, it first became an easy programmed like a dial or a switch. Next, by employing a microcontroller, it developed into a more complicated programmed having a show device and a keyboard. Now, it's mature up to become a sophisticated User Interface running on the SoC (System on Chip) by exploitation net setting. In the development of SoC that is a vital a part of electronic devices, there square measure variety of things that increase the value, including, method value, IP cost, code development and verification value, and Internet-security cost. Therefore, so as to pay off the event value, we've to focus on worldwide market in order that we are able to sell the products in sizable amount. On the opposite hand, however, in today's setting wherever development time has become longer than ever as a result of client demand becomes a lot of numerous and sophisticated and keeping differentiation from the competition becomes harder, it's clothed that it's now not attainable to form a profit by following the conventional business means of simply chasing once the size advantage of production in giant quantities [2] [3].

II. ANALYSIS OF EMBEDDED DEVICE

To date, embedded devices have evolved into a lot of complicated systems, reckoning on the appliance by exploitation electronic circuit, logic circuit, microcontroller and SoC during this chapter, we are going to analyze the structure of internal function of associate embedded device similarly as affiliation between the device and also the outside. Currently associate embedded device consists of the hardware structure of the computer circuit board with the employment of semiconductor parts like ASIC, microcontroller and SoC the appliance is enforced in code. This code was enforced in period OS that permits execution of over one task and in period Linux setting wherever real time operates was fine-tuned. Embedded devices may be roughly divided into a controller unit, a knowledge process unit, a storage unit, and a user interface unit [4]. In recent years, the communication unit is usually additional to the preceding units. Fig.1 shows a typical example of basic structure of a current embedded system device. As input and output of the device, it has a sensor input and management output like a motor, and as a programme, it's given a show unit (LCD) and a keyboard. Recently, as a result of M2M (Machine to Machine) and IoT (Internet of Things) has become wide used, embedded system has become a lot of typically connected to the network.
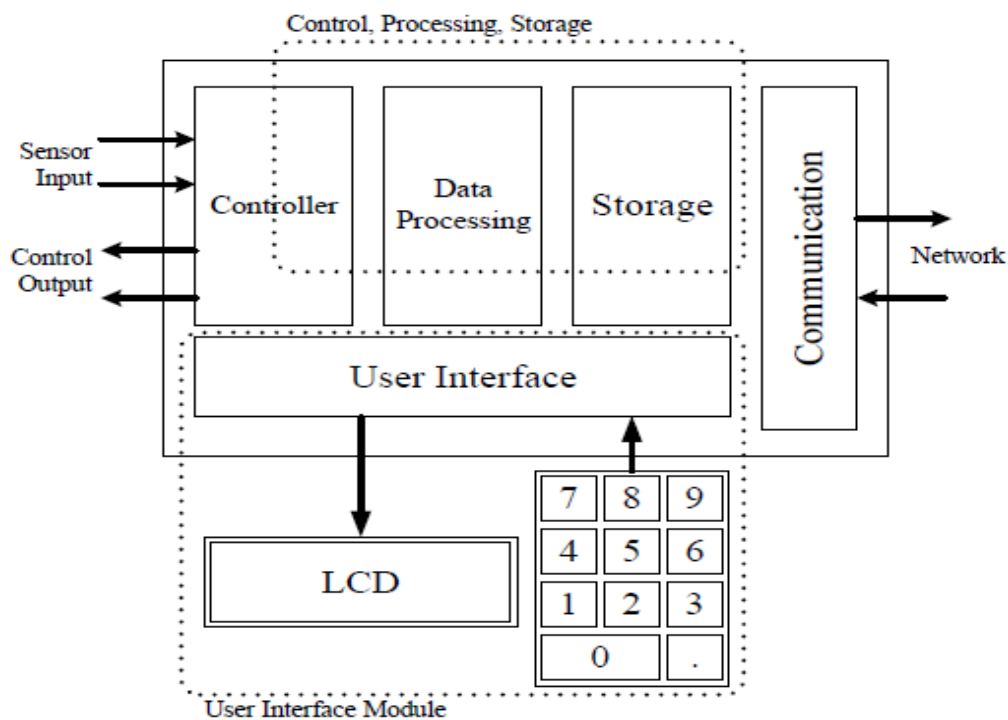

Fig 1: Modern Style Embedded System

III. EMBEDDED SYSTEM ON CLOUD COMPUTIG

Along with evolution of semiconductor technology and code technology, associate embedded system has been expanded by implementing numerous functions and performance. In recent years, the network has progressed because the communication infrastructure becomes widespread and also the interaction with server system becomes necessary issue. So far, protocol / information processing affiliation to the server and embedded devices is for media 2 ways in which. The first may be a technique that contains a protocol / information

processing stack in embedded devices themselves. The second may be a technique of communicating via (to translate communications of finish devices) "gateway". additionally, in recent years, the communication via the smart phones and tablets has become conjointly common. And within the future, we are able to get swish area for communication and also the communication value is additionally getting to decrease. therefore we do not create discussion on the issues of the infrastructure of communication. For the composition of server system, there square measure some ways, as an example, setting server in house, setting server in outside knowledge center and cloud computing. This cloud computing may be a model for enabling omnipresent, convenient, on demand network access to a shared pool of configurable computing resources (e.g., network, servers, storage, applications, and services) that may be apace provided and discharged with token management effort or service provider interaction. And as this performance (e.g., computer hardware performance, size of memory, speed of network, amount of storage) can increase, the value of cloud computing are low-cost and its sensible resolution of technical resource. There square measure 3 sorts of implementation of cloud computing. "IaaS (Infrastructure as a Service)" provides the infrastructure. "PaaS (Platform as a Service)" provides a platform. "SaaS (Software as a Service)" provides the software. during this paper, on the belief that the availability is formed at cheap, we are going to discuss the implementation of IaaS. There square measure some reports of approach that connects cloud computing to embedded devices. HaaS proposes a method of accessing a network via virtual hardware devices [6]. additionally, while not modifying existing applications, proposal to form show over the network has conjointly been created [7]. And reports of cloud computing corresponding to specific case applications running on Windows Azure, the face recognition method of machine learning exploitation Kinect have conjointly been created [8]. So far, since the technique of embedded devices, is in a district become independent from the technology used for network or the server, there have been many alternative necessities for hardware you're exploitation, software setting, artificial language, etc. as a result of they were merchandise of various regions that were closed to each different and albeit there was an opportunity of obtaining used at identical time, they evolved on an individual basis, therefore there has not been several reports. In this chapter, we are going to specially counsel a brand new general configuration between associate finish device and cloud computing for making a brand new embedded system. on the strategy of realization, we advise that the minimum functionality and performance be unbroken within the finish device whereas all different functions and performance (that has been in embedded system) be enforced on the cloud computing.
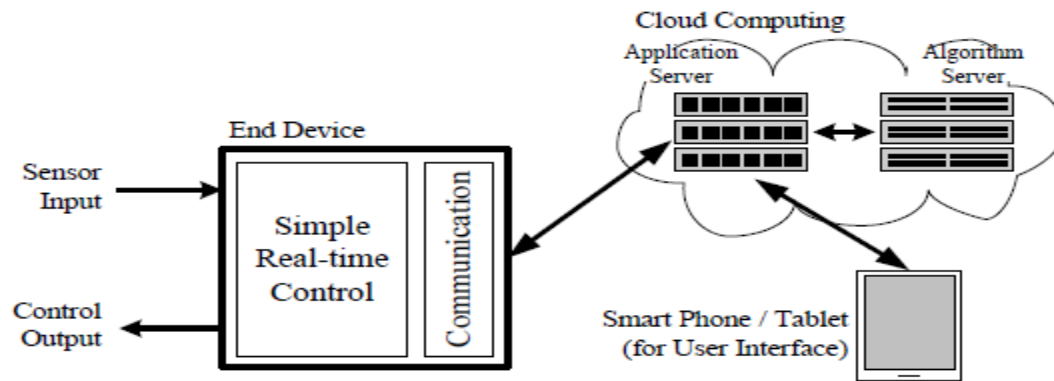
Fig 2: Embedded System on Cloud Computing

3.1 Separation of Programme

In the past, owing to restricted resource value, programme of associate embedded system attended have a show device that wasn't sufficiently big having restricted expression capability associated a device having not enough range or functions. Additionally, a lot of typically than not, the programmers responsible of developing controller developed the user interface similarly once they might realize the time. to form things worse, so as to understand complicated necessities of user interface during a restricted operation resources, the "mode" technique exploitation totally different modes was additional, leading to more difficult user operation and a lot of difficult operation program on the device. As a result, making user manuals or "help" functions to elucidate the operations to users became necessary and verification of the check things to be verified for the operation program became terribly difficult. In recent years, since a lot of and a lot of folks will have sensible phones, pill and different devices intrinsically devices become a lot of refined, by transferring most functions of programme of the topic embedded system into such sensible phones and pill devices, the embedded system may be created easier to use and perceive for users and the cost and issue of development associated with programme of embedded system may be reduced at identical time.

3.2 Cloud Computing of Application

The conventional embedded system, in most cases, contains a and a memory and main process of the embedded system is dead by the computer hardware of its own. This has been an honest means therein it will scale back the event amount by using code for completion of the assembly of such off-the-peg sort merchandise that square measure troublesome to bug-fix once they are once sold-out. Here, we might prefer to contemplate the thanks to understand development, operation and maintenance of most a part of application by swing the most method in cloud server and creating the embedded system execute the sub method that was separated from the most method. By setting the most method of application into cloud server, additional improvement may be realized in most a part of operate and performance, therefore demands from users may be met during a timely manner. Also, by exploitation this fashion, we are able to flee from the biased concept that just one operate is implemented during a hardware. Also, we are able to improve dependability as a result of bug fix may be created anytime. Further, we can start providing a brand new services supported the chance of change and upgrading the operate and performance.

3.3 Cloud Computing of Real Time

While it's clear that the foremost necessary operate of associate embedded system is real time management, if we are able to separate user interface operate that has been control by embedded system up to now, most of the tasks that require to be responded in a time span of a number of mS would become now not necessary. Therefore, we tend to assumed that the majority of the remaining real time operates apart from solely such function requiring to retort during a time span of a few μS, may be performed in cloud computing instead of directly controlled on the a part of embedded system. supported this assumption, we have created the subsequent model: initial, dividing the latency into multiple classes; second, develop the operation that requires high speed to be performed within the finish device, and eventually transfer every remaining operations not requiring high speed into adequate place within the cloud system.

3.4 Cloud Computing of Information Process

In most cases, embedded systems have several limitations on resources (CPU process capability, memory size ,bus/memory speed, etc.) to perform functions attributable to the need for low power consumptions and low prices. As such, the embedded system itself typically has its limitations even in functions and performances owing to limitations within the selection and range of algorithmic rule similarly as in performances like accuracy of calculation, conditions of calculation, range of parameter, and range of repetition of calculation. By moving processing (algorithm) operate that has had several restrictions onto the cloud server, we are able to utilize enough computer hardware resources in cloud server. Since algorithmic rule developers will profit the computer hardware operation capability extraordinary that of laptop utilized in developing the prototypes by creating coinciding operations below the marginally totally different parameters and attempting different types of algorithms and more creating use of the ends up in the embedded systems, the embedded system is expected to become a lot of convenient to use. additionally, relating to algorithms, instead of implementing them in each embedded system from scratch, by getting ready them beforehand as algorithmic rule libraries in middleware accessible for use on a coffee royalty rate or royalty-free basis, numerous sorts of operations that weren't attainable to be realized under the traditional embedded system together with application actively combining over one algorithms, simultaneous operations of algorithmic rule below slightly totally different parameters for the aim of rising recognition precision, coinciding operations of various algorithms and also the result's adopted below democracy supported the above advantage, the new services and suggestions square measure currently accessible.

IV. TRAFFIC JAM DETECTION SYSTEM USING CLOUD COMPUTING

In order to verify our advised theory, we've enforced a neighborhood of our advised system and compared such implementation with different implementations created in standard ways in which. The implementation example is "Traffic Jam Detection System" with a camera application to be put in on the dashboard during a automobile. In this application, initial of all, whereas you're driving a automobile, the knowledge on range plate of another automobile running previous you or passing your automobile is mechanically taken by the camera. the knowledge on the amount plate, location recognized by GPS, and also the time is shipped through net to the

server. the knowledge on the number and knowledge on the placement and temporal arrangement is hold on within the knowledge Base. Then, during this application, by process the hold on knowledge as therefore known as "Big Data", the tie up info in each road is to be displayed in such devices as sensible phones and tablets. Fig. three shows the summary of the tie up detection system. First, the image knowledge captured by the Image Capturing square measure processed within the range Plate Recognition block consisting of 2 blocks: range Plate Detection block and range Recognition block. Then, information on the recognized range, info and placement and time is registered on the info. By mapping the number plate, location and time info hold on within the info on the map and hard statistically the speed of every range plate, you'll be able to acknowledge the degree of traffic between bound points on the map and you'll be able to tell however engorged the traffic is. The experiment we tend to conducted now was implementing "automobile range plate automatic recognition system" that's such a part of functions of the tie up detection system ranging from capturing the image of number plate and ending with recognizing info on range plateon the algorithm for recognizing range plate, we tend to originally created the program specifically tailor-made for the four digit numbers utilized in Japanese range plate by employing a program in public accessible as associate open supply. This algorithmic rule was created by exploitation 2 sorts of machine learning: SVM (Support Vector Machines) and Neural Network [9]. In our experiment, we tend to created implementation in 3 ways in which: 2 standard ways and a technique creating use of the cloud computing.
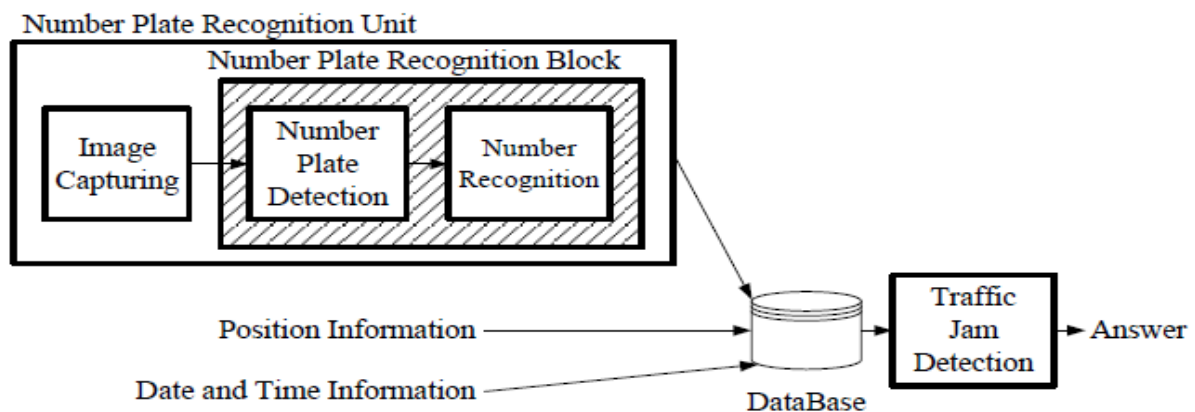

Fig 3: Overview of Traffic Jam Detection System

4.1 Implementations Exploitation Standard Technology

4.1.1 Implementation Exploitation Laptop

Since the program describing algorithmic rule exploitation Open CV needs sufficient computer hardware capabilities and memory size, it is typical that a general laptop is usually used for the operation. Thus, implementation setting is formed by either laptop or table prime PC. The specification having Intel Processor as a computer hardware and a memory having the dimensions of 2GByte or a lot of is usually applied. For this experiment, we tend to put in OpenCV (ver.2.4.6.1) and designed the amount plate recognition program onto raincoat OS X (Intel Core i7 two.8GHz 16GByte RAM) and dead the program. 4.1.2.Implementation exploitation embedded UNIX Recently, given the progress of the semiconductor technology, SoC for embedded systems has become accessible at a comparatively cheap worth. as an example.

Raspberry Pi is associate embedded UNIX equipment often used for research and education functions. The description of the system had ARM11 700MHz, a thirty two bit computer architecture computer hardware and 512Kbyte memory. during this experiment, we tend to put in OpenCV onto UNIX on Raspberry Pi and dead the amount plate recognition program performing on UNIX during a laptop.

4.2 Implementation Exploitation Cloud Computing

In order for associate embedded system to be enforced into the cloud computing, we tend to came up with, made and actually operated the new system not exploitation such standard technology as laptop or UNIX however having a structure consisting of associate finish device (image sensor), cloud server, and a smart phone. during this system, cloud server had UNIX OS and variety plate recognition application utilizing OpenCV is therefore enforced that may be started from net server. We created a sequence during a script written in machine-readable text pre-processor (PHP) that runs within the we tend to be Server (Apache). Specifically, the image sent from Image Capture Unit via 3G is captured by net servers within the cloud computing side, and its hold on as a picture file. once storing the image file, PHP script starts the amount plate automatic recognition program. At first, this program initializes the interior memory, and it reads the machine learning knowledge from classification system. Next, it reads the image knowledge from classification system. After that, it executes the popularity method. As the recognition method, first, it finds out regions of a car place form from the image knowledge. The regions square measure separated into four characters, and these characters square measure recognized as every range by OCR method that uses machine learning algorithms. The results square measure displayed by PHP script, and that we will see range plate info (Fig.4). we tend to use a Smartphone and a pill as a UI (User Interface) device during this experiment. additionally, we did not have to be compelled to develop any program for sensible phone as a result of we tend to create the setting of directly accessing net Server on cloud server by application. For the top device, we tend to used "3G still image camera unit" consisting of a camera module, acard, and a 3G modem.
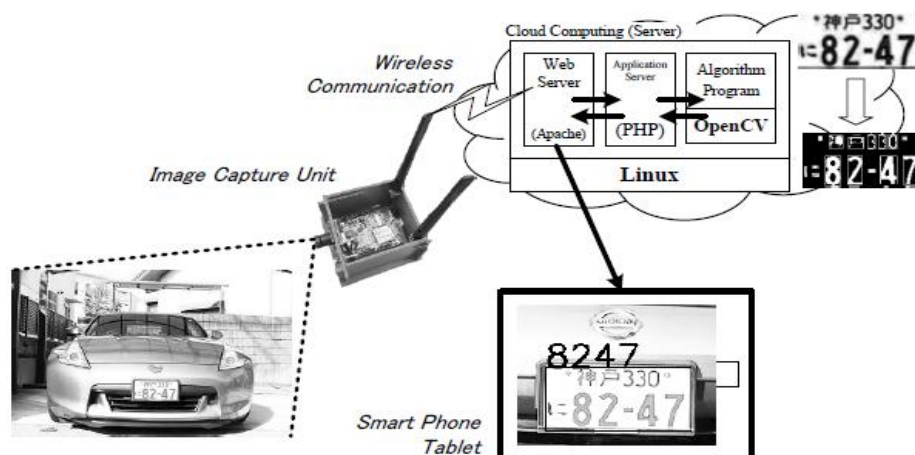

Fig 4: Number Plate Recognition System on Cloud Computing

The camera module outputs the JPEG image info within the VGA size of 640*480 by UART of 115.2kbps and is connected to the card. The card contains 32bit computer hardware with the clock frequency of 96MHz mounting RAM of 128Kbyte and a 1MByte non-volatile storage for program [10]. Also, 3Gelectronic equipment mounts AGPS and is capable of getting location and time info (Fig.5). In this experiment, no OS was

used for the top device program. Comparatively tiny scale of specification was successfully enforced exploitation program code size of concerning ninety seven.8Kbyte, 4Kbyte RAM for handling tasks, and SD memory card for image buffer. Therefore, this hardware structure is incredibly cheap as associate embedded device
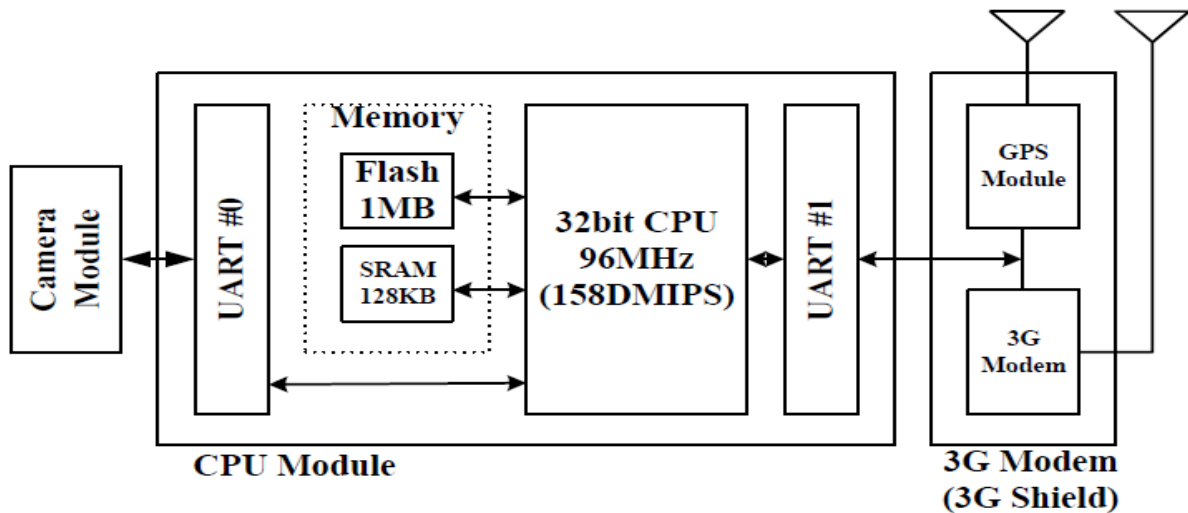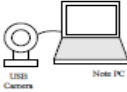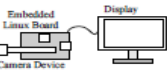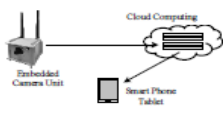

Fig 5: Block Diagram of Image Capture Unit

4.3 Results

As a results of comparison among 3 sorts of implementations: Desktop laptop (PC), embedded UNIX(EL), and embedded +cloud computing (EC) on the aspects of value, battery life, performance, quantifiability, specialty device, and reliability, the strategy exploitation the cloud computing did best in implementation and verified to be most helpful in virtually all aspects and effective in overall analysis. (Table 6) For value, world organization is only, owing to simplified hardware and code being capable of relying its main functions and performances on cloud computing and once it comes to production stage, even larger result may be expected. In terms of battery life, EC's advantage is outstanding. EL did worst on performance, taking concerning fifteen seconds or a lot of for the method, compared with concerning 1.3 seconds taken by laptop and world organization. On quantifiability, world organization is that the best as a result of operation is completed on the facet of network and more, by creating use of the ample capability of computer hardware, is in a position to understand the functions and performances that have been not possible to attain up to now. on special device, world organization is comparatively during a higher position as a result of world organization will respond to special occasions. though every type will have dependability, given the belief that every one devices square measure connected to network, world organization still contains a higher position as a result of it will trot out any downside on the facet of cloud server. In the implementation of world organization, despite terribly tiny specification of the hardware of the top device that's considered to be placed on a automobile (program within the finish device having solely two,700 lines), by utilizing cloud computing, the performance of the appliance that's by no suggests that inferior to laptop, may be realized. In terms of development amount, though we tend to used computer hardware and memory with restricted capability, we tend to might end development during a matter of simply a number of weeks while not feeling a lot of issue of

system development, as a result of finish device in world organization needed an easy tasks of taking within the image knowledge and causation it to the net Server.

Table 1: Evaluation of Each Implementation

Type	Structure	Cost Effective	Battery Life	Performance	Scalability	Special Sensor	Reliability	Score Total
Desktop PC (Mac) [PC]		D	D	B	C	C	B	6
		0	0	2	1	1	2	
Embedded Linux [EL]		C	C	C	C	B	B	8
		1	1	1	1	2	2	
Embedded Cloud Computing System [EC]		B	A	A	B	B	A	15
		2	3	3	2	2	3	

SCORE: A=Best(3), B=Better(2), C=Good(1), D=not good (0)

V. CONCLUSION

The next generation embedded system that we tend to propose, to that communication with server on the cloud computing is important, has clothed to be a far a lot of advantageous system compared with the traditional embedded systems in numerous aspects starting from worth, power consumption, performance, to quantifiability, among other things, by realizing the most functions and algorithmic rule managing complicated processing within the conventional system on the cloud computing and by utilizing Smartphone and pill for UI (user interface) . Although we tend to centered on processing within the implementation on each embedded device and cloud computing.

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