

## **An improved application package for mobile devices on Symbian Platform**

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*Abstract- This paper focuses on the growing trends in the processor speed of mobile devices<sup>[18]</sup>, which has already touched 2GHz and the huge internal and external memory available in the form of Micro SD cards, with supportable communication technology like 3<sup>rd</sup> Generation Mobile Telephony. The mobile devices<sup>[18]</sup> shall be out casting the Personal Computers in the coming decade as they are becoming sophisticated general purpose computers<sup>[14]</sup>. In this paper application development of an executable Application package has been done on a mobile device<sup>[18]</sup> (Nokia E71), on Symbian 3.0 Real Time Operating System, thereby developed Bluetooth and Camera functions of the said mobile device<sup>[18]</sup> by means of python programming language for S60 platform.*

### **I. INTRODUCTION**

Five years<sup>[15]</sup> back the mobile phone processor was much weaker in comparison to their personal computer counterparts. The major areas in which a mobile phone processor differed from a personal computer processor have been shown in the Table 1a. The major attributes of differentiation include:

- Processor Speed
- Associated Memory
- Peripheral Device Support
- Performance
- Computation Capacity

S.No	Attribute	Mobile Processor	PC Processor
1	Processor Speed	Low(100-400MHz)	High (1.6-3.2 GHz)
2	Associated Memory	Low(~30 MB RAM/ ~256MB ROM)	High(1-4 GB RAM/ 40-160 GB ROM)
3	Peripheral Device Support	No	Yes
4	Performance	Low	High
5	Computation Capacity	Low	High

Table 1a

Over the years<sup>[15]</sup> with many folds advancement in the fields of Very Large Scale Integration, Embedded Systems and Real Time Operating System the Mobile Processor has started giving a neck to neck competition

to the Personal Computer processor. The same have been highlighted in the Table 1b as shown below

S.No	Attribute	Mobile Processor	PC Processor
1	Processor Speed	High* (0.4-2GHz)	High (1.6-3.2 GHz)
2	Associated Memory	High*(.2 56-1 GB RAM/ 2GB-32 GB ROM)	Higher(4-8 GB RAM/ 160-500 GB ROM)
3	Peripheral Device Support	Yes*	Yes
4	Performance	High*	High
5	Computation Capacity	High*	High

\*New improved features.

Table 1b

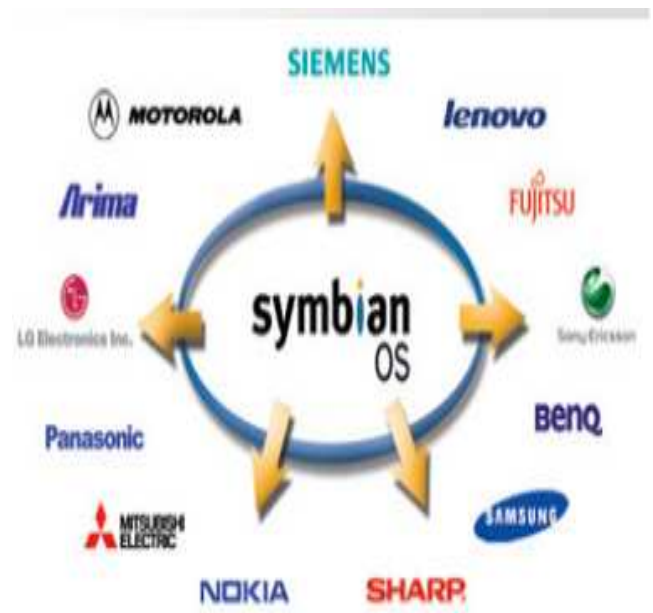
The Five major platforms which are used for programming on mobile devices<sup>[18]</sup> are:

1. Symbian
2. RIM
3. Windows CE
4. Maemo
5. Android

Symbian<sup>[13]</sup> was chosen for the application development because of the following reasons

The major market leaders in the field of Mobile Phone have a fair share in Symbian Consortium, thus making it an industry oriented and user friendly platform for application development. Thus this platform is not confined to a specific section of end user community instead it reaches the major portion of same. The same can be seen from the following share holding data:

- Ericsson (15.6%)
- Nokia (47.9%)
- Panasonic (10.5%)
- Samsung (4.5%)
- Siemens (8.4%)
- Sony Ericsson (13.1%)



Figure<sup>[3]</sup> 1

Thus an application developed by using Symbian 3.0 Real Time Operating System can operate over 50 mobile hand

sets available in the market amongst various price bands. Therefore the developed application package can work on plenty of devices irrespective of their vendors.

Over the years<sup>[15]</sup> there has been a tremendous increase in the market share of Symbian based phones. As per the latest findings the smart phone market share comprises of following contributors:

1. Symbian 46.90%
2. RIM 19.90%
3. iPhone 14.40%
4. Windows 8.70%
5. Linux 4.70%
6. Android 3.90%

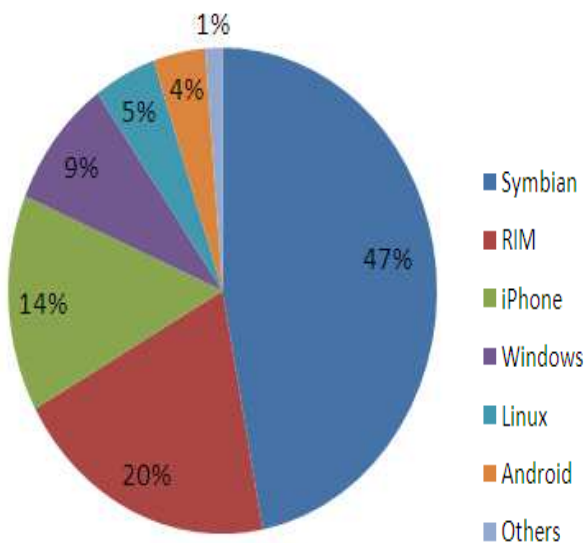


Figure 2

There are various ways to develop an application for a mobile processor. The same can be developed using one of the following:

1. Python for S60<sup>[15]</sup>
2. Java<sup>[18]</sup>
3. Symbian<sup>[15][16][17][18]</sup>

The same can be seen in the Figure 3

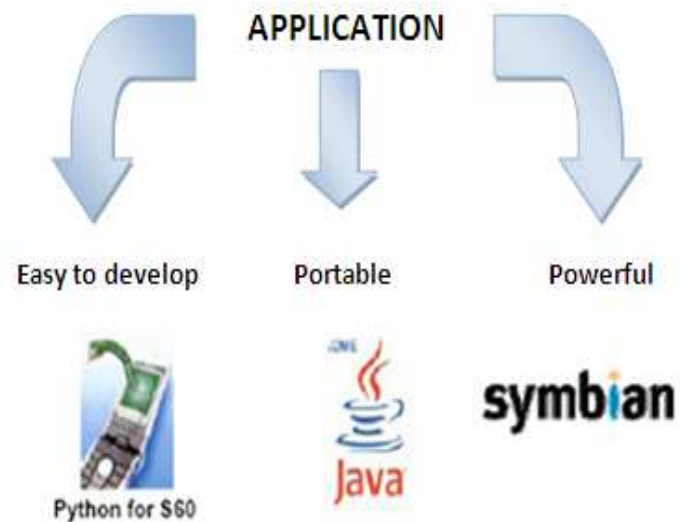


Figure 3

Python is developed by **Guido van Rossum** and Python for S60<sup>[15]</sup> is an adaptation of same.

Advantages of using python for S60<sup>[15]</sup> platform are:

1. Small Software Development Cycle
2. Compatible With Symbian Platform
3. Easier Hardware Implementation
4. Highly optimized in terms of:
  - a. Small and Powerful Code.
  - b. Lesser Memory Consumption.
  - c. Supports Peripheral Devices like
    - i. Scanners
    - ii. Printers
    - iii. Speakers
    - iv. USB Driver
    - v. Camera
  - d. Power Efficiency.
  - e. Design Reusability
5. Python for Series 60<sup>[15]</sup> brings the Python programming language to the Series 60 Platform, Nokia's "modified/enhanced" version of the

Symbian Operating System<sup>[18]</sup> platform for Mobile devices<sup>[18]</sup>.

6. Currently Python for Series 60<sup>[15]</sup> is based on Python 2.2.2 is used as available
7. It Supports many of the Python Standard Library modules but has on top a few mobile platform specific modules as enlisted below:

- Bluetooth
- GPRS networking
- GSM Location information,
- SMS Messaging,
- Access to camera

Symbian has three major working platforms namely:

1. User Interface Quartz<sup>[13][14][16][17][18]</sup>
2. Mobile Phone Oriented Application Part
3. S60<sup>[13][17][18]</sup>

**Symbian Based Platform<sup>[13][17]</sup>**

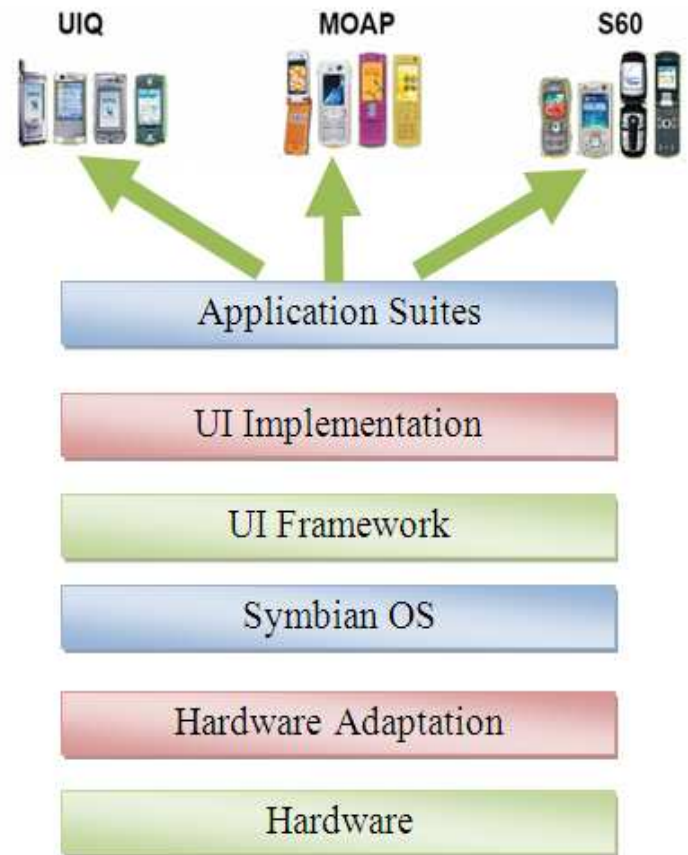


Figure 4

S60<sup>[13][17][18]</sup> was chosen for application development because of the following advantages

- S60<sup>[13][17][18]</sup> is available in more than 50 mobile hand set devices at present available in the Indian Market
- The Symbian OS<sup>[15][16][17][18]</sup> is the leading mobile operating system in the "smart mobile device"<sup>[18]</sup> market. Symbian OS<sup>[15][16][17][18]</sup> runs exclusively on ARM processors and has evolved from Psion's EPOC which was developed as a rudimentary operating system for early electronic organizers. The main advantages of it is Symbian Operating System<sup>[15][16][17][18]</sup> is the latest OS, the old ones are this j2me which have the files format of JAR but in Symbian OS<sup>[15][16][17][18]</sup> we have SIS format, that

means this is a third party software- anybody can develop software in this OS and we also have fast browsing and a fast operating system. There are many advantages now in Symbian OS<sup>[15][16][17][18]</sup> as they also provide touch screen phones such as, UIQ<sup>[13][14][17]</sup> phones.

- S60<sup>[13][17][18]</sup> consists of a suite of libraries and standard applications, such as telephony, PIM tools, and Helix-based multimedia players. It is intended to power fully-featured modern phones with large color screens, which are commonly known as smart phones<sup>[16]</sup>.
- The S60<sup>[13][17][18]</sup> software is a multivendor standard for smart phones that supports application development in Python. Originally, the most distinguishing feature of S60<sup>[13][17][18]</sup> phones was that they allowed users to install new applications after purchase. Unlike a standard desktop platform, however, the built-in apps are rarely upgraded by the vendor beyond bug fixes. New features are only added to phones while they are being developed rather than after public release. Certain buttons are standardized, such as a menu key, a four way joystick or d-pad, left and right soft keys and a clear key.

**Symbian OS<sup>[15][18][17][18]</sup> Architecture<sup>[16][18]</sup>**



Figure 5

The application package has been designed and implemented on Nokia's E-71.



Figure<sup>[5]</sup> 6

**Main features of Nokia E-71 which had been used in this paper:**

1. QWERTY Keypad
2. ARM 11 369MHz Processor
3. Display 16 M colours, 320 x 240 pixel, 2.36 inches
4. Memory
  - a. Internal: 110 MB storage, 128 MB RAM
  - b. External: up to 8 GB micro sd card
5. OS: Symbian OS<sup>[15][18][17][18]</sup> 9.2, Series 60 v3.1 UI
6. Camera: 3.15 MP
7. Data Support
  - a. GPRS
  - b. EDGE
  - c. WLAN
  - d. Bluetooth

We will concentrate on the ARM microprocessor and its Architecture.

The ARM is a 32-bit reduced instruction set computer (RISC) instruction set architecture (ISA) developed by ARM Holdings. It was known as the Advanced RISC Machine,

As of 2007, about 98 percent of the more than one billion mobile phones sold each year use at least one ARM processor. As of 2009, ARM processors account for approximately 90% of all embedded 32-bit RISC processors. ARM processors are used extensively in consumer electronics, including PDAs, mobile phones, digital media and music players, hand-held game consoles,

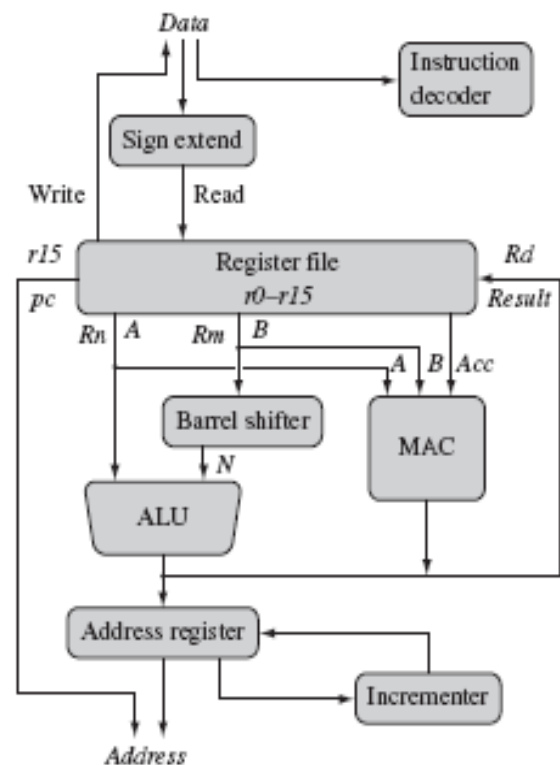
calculators and computer peripherals such as hard drives and routers.

Here underneath a brief introduction is given to the exemplary ARM Architecture, in the form of its data model where a diagrammatic description is given of how the data enters the ARM core.

The processing is done in a parallel fashion on 32 bit registers, but to save computation time, memory and clock cycle while computing 16 bit and 8 bit data, ARM processor supports three instruction sets namely.

1. ARM (32 bit instruction set)
2. Thumb (16 bit instruction set)
3. Jazzele (8 bit instruction set)

**ARM core dataflow model**



Figure<sup>[4]</sup> 7

1. Architecture:

It comprises of:

a) Instruction decoder:

It decodes the incoming instructions.

b) Sign Extend:

It changes the incoming 8-bit and 16-bit data into 32-bit data.

c) Register file:

It comprises of sixteen 32-bit registers.

d) Barrel Shifter:

Used for instruction pre processing

e) Multiply and Accumulator:

It multiplies and accumulated the result in a single clock cycle thus speeding up the operation.

f) Arithmetic and Logic Unit:

It performs the arithmetic functions like addition, subtraction, multiplication and division along with logical operations like ANDing, ORing and XORing.

g) Address Register:

It stores the addresses.

h) Incrementer:

For load and store instructions the it updates the address register before the core reads or writes the next register value from or to the next sequential memory location.

i) Registers:

a. Source Register: ARM instructions typically have two source registers,  $Rn$  and  $Rm$ ,

b. Destination Register: ARM instructions have one destination register,  $Rd$ .

## I. VARIOUS MODULES IMPLEMENTED

The various modules developed for this application are:

### A. Clicking photograph and sending through Bluetooth

In this application a photograph from a Symbian based mobile phone is taken. Firstly a compatible Bluetooth device is searched and on connection the clicked photograph is sent to the device.

### B.SMS Assistant

On reception of a SMS from a mobile phone to a Symbian based mobile a predefined text message will be send to that mobile. A very useful application when one is busy and not in a position to answer back.

### C. Connect to internet

The Symbian based mobile phone is connected directly to internet, but the same requires an access point to connect to the internet. Hence it connects to the infrastructure based network

### D. System information

It displays various hardware and software details of a Symbian based mobile phone such as RAM, ROM, model, make, version of OS etc, which cannot be generally seen otherwise

### E. SMS Spammer

It can send n number of SMS to a particular mobile which can be taken as input from user, more useful in sending multiple SMS's to a single person and can be used by the advertising firms for targeted clientele.

#### F. File browser

It is used to browse any file from ROM and RAM of the mobile device<sup>[18]</sup> present in various drives such as C,D,E and Z drive. Its USP is that drives D and Z are inaccessible by the normal inbuilt File browser but we can even access the hidden files using it. The same has been optimized in terms of accessing the files and provides lesser delay in accessing the files over its inbuilt counterpart

#### G. Stop watch

Stopwatch is implemented on the Symbian based mobile where start and stop are controlled by user. Was designed keeping in mind dearth of it in Nokia E71.

#### H. Bluetooth SMS Sender

SMS are sent between two phones via, Bluetooth, thus saving monthly SMS cost bear by the customer

## II. INTEGRATION OF MODULES

Various modules developed above are combined to form a single menu driven based application developed using python programming and run on Symbian OS<sup>[15][18][17][18]</sup> based mobile phone having Bluetooth and Camera as peripherals.

## III. ALGORITHM

### 1. Bluetooth Photo Sender

1. Camera is Switched ON to take the photograph.
2. Photograph is stored in the predefined location in the memory card.

3. OBEX is invoked, which initiates the Bluetooth device searching mechanism.
4. Devices are paired up.
5. Photograph is transferred to the selected device.

### 2. SMS Assistant

1. The content of the message that has just arrived are read.
2. The content is displayed inside a pop up note.
3. Selection list is created.
4. Action is triggered on the index selection.
5. The program is made to wait for the incoming message

### 3. Connect to Internet

1. Access point menu is invoked.
2. Access point is selected on user discretion.
3. Then you can use urllib as much as you want without the phone bugging you to pick an access point.

### 4. System Information

Predefined functions in Python for S60 are used to print the following information.

1. Available RAM and ROM memory
2. Firmware Version



3. Operating System Version
4. Processor Speed
5. Display Resolution
6. Display Size

### 5. SMS Spammer

1. Firstly the function to send multiple SMS to the same number with the same text is created.
2. Secondly the function to send multiple SMS to the same number with a different text is created.
3. Available options are enlisted as follows:
  - a. Same Text
  - b. Different Text
  - c. Exit

### 6. File Browser

1. The function to display all the available drives is created.
2. The function to access the drives is created.
3. After the drive is being accessed another function is created to open and delete the file.

### 7. Stop Watch

1. A canvas is created.

2. Minute, Second, Micro Second are defined and placed on the canvas.
3. Reset option is created to reset the stopwatch.
4. Besides the navigator key is authorised to start and stop the watch

## IV. RESULTS

### 1. Bluetooth Photo Sender

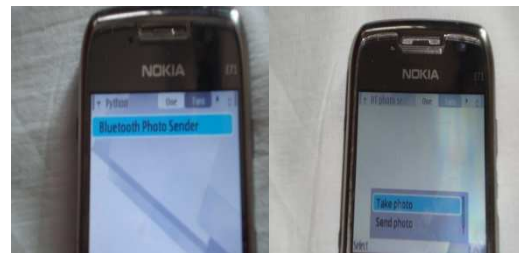


Figure 8a

Figure 8b

Two options are provided when Blue Tooth Photo Sender is selected (as shown in Figure 8b).

1. Take Photo: The photo is clicked
2. Send Photo: Bluetooth Device Searching Mechanism is initiated

### 2. SMS Assistant

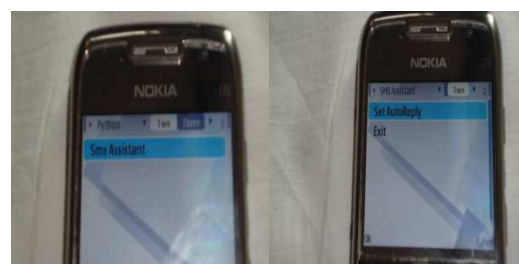


Figure 9a

Figure 9b

1. A canvas is created.

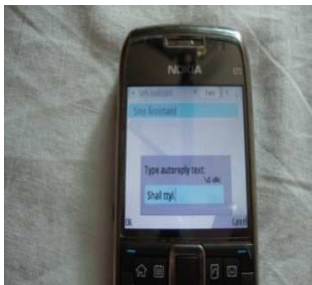


Figure 9c

SMS assistant allows the potential user to set Auto Reply option (as shown in Figure 9b). The auto reply text is to be written in the provided space (as shown in Figure 9c). The incoming message shall be replied with the Auto Reply option.

### 3. Connect to Internet

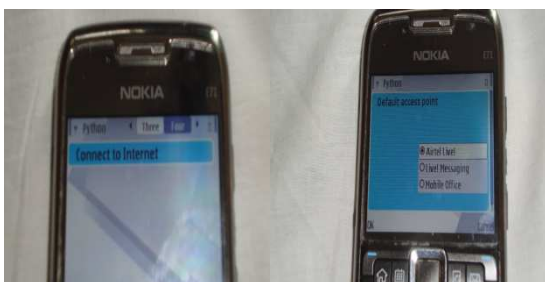


Figure 10a

Figure 10b

The internet connection is being made using this module, it searches the available access points (as shown in Figure 10b) and allows the user to select any one of them and get connected to internet.

### 4. System Information

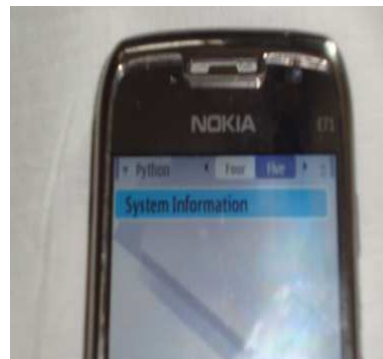


Figure 11

To develop any application, a programmer needs to have some idea about the internal system information, in terms of:

1. Available RAM and ROM memory
2. Firmware Version
3. Operating System Version
4. Processor Speed
5. Display Resolution
6. Display Size

The same can be procured by click of the button using this application

### 5. SMS Spammer

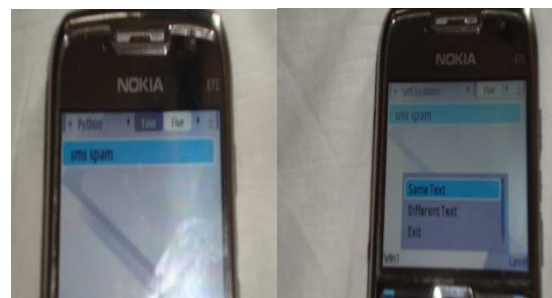


Figure 12a

Figure 12b

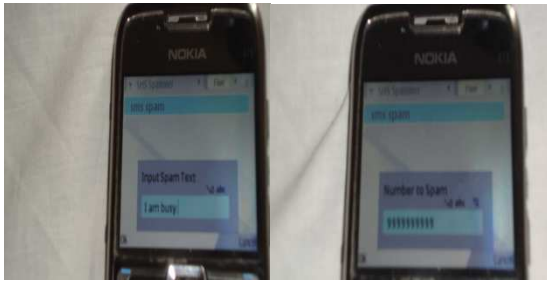


Figure 12c

Figure 12d

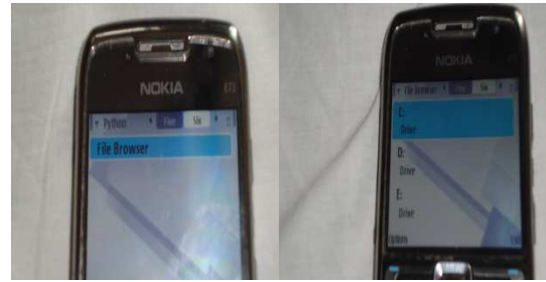


Figure 13a

Figure 13b

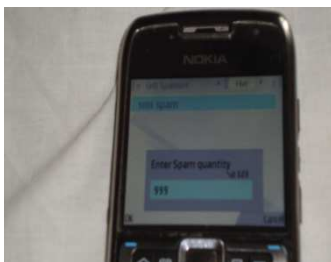


Figure 12e

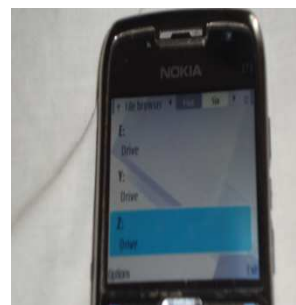


Figure 13c

The SMS spammer works in four steps:

1. Firstly we need to select(as shown in Figure 12b) from:
  - a. Same Text
  - b. Different Text
  - c. Exit
2. The message to be spammed is entered (as shown in Figure 12c).
3. The desired number to which spam messages have to be spammed is fed (as shown in Figure 12d).
4. The quantity of spam messages is fed (as shown in Figure 12e).

## 6. File Browser

This file browser allows access to following drives in the mobile device<sup>[18]</sup>:

1. C
2. D
3. E (Memory Card)
4. Y
5. Z

The same have been shown in Figure 13a, 13b and 13c. Unlike normal browsers which are available in mobile phones, provide access to only D and E drive, using this browser even the hidden files can be accessed by the user.

The hidden files can be modified i.e. they can be:

1. Edited
2. Deleted

3. Saved

## 7. Stop Watch

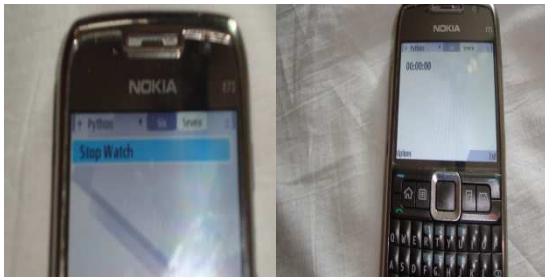


Figure 14a

Figure 14b

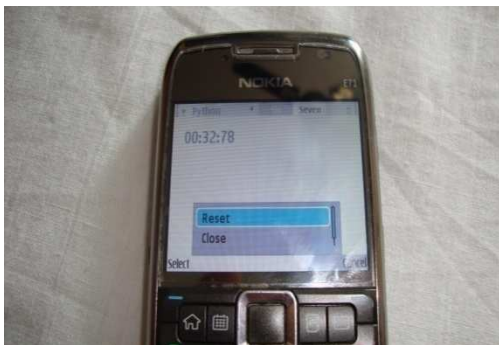


Figure 14c

Nokia E71 does not has a stop watch in the preloaded software package the same has been developed keeping in mind its dearth in the device.

The stop watch is accurate to microseconds (as shown in Figure 14b). The reset option is available (as shown in Figure 14c), it can be reset by the user when required

## IV. CONCLUSION

With increasing processor speeds (touching 2 GHz) and huge external and internal memories available, soon mobile phones will outcast PC's. Till present day the mobile phones were used for the following purposes:

1. Communication
2. Text Messaging
3. Multimedia Messaging
4. Browsing Internet
5. Playing Songs and Videos
6. Sharing Data.

But with the advent in Mobile Phone processor technology all the above mentioned purposes shall become primary mobile phone functionalities and a new set of secondary functionalities will be performed by these devices which can be one or in combination of the following:

1. Database Access
2. Desktop GUI
3. Scientific and Numeric
  - a. Bio-informatics
  - b. Physics
4. Network Programming
5. Software Development
6. Game and 3D Graphics
7. Academics

This will deal in conducting experiments in the following fields on the mobile phone device<sup>[18]</sup> itself:

- a. Object Oriented Programming
- b. Operating Systems
- c. Computer Graphics
- d. Signal Processing
- e. Digital Electronics
- f. Embedded Systems
- g. Data Structures
- h. Mobile Communication
- i. Software Engineering

At present all Mobile Phone Devices<sup>[18]</sup> have a JTAG port which is locked at the time of manufacturing by the manufacturers. If the mobile phone manufacturers keep this port open after the manufacturing process then each mobile phone will be able to act as a Embedded System Design Kit. Thus allowing programmers to create, edit, test and debug codes on the mobile phone devices<sup>[18]</sup>

**V. PERFORMANCE IMPROVEMENTS**

The previous sections had discussed the various applications which were developed. The enhancements which these applications brought in the Nokia E71 are being highlighted in the following table

1.	Camera could only click the snap but cannot instantly transfer the image via Bluetooth, to other mobile device <sup>[18]</sup>	Camera could click the snap and also instantly transfer the image via Bluetooth, to other mobile device <sup>[18]</sup>
2.	Incoming SMS could not be auto replied.	Incoming SMS could be auto replied.
3.	System Information was not accessible to the user.	System Information is accessible to the user and using same analysis can be done while future applications are being created
4.	Bulk SMS could not be sent to a particular user. As at a time only one SMS could be sent to one user.	Bulk SMS could be sent to a particular user. At a time multiple SMS could be sent to one user.
5.	Using existing file browser only files of drive 'D' and 'E' could be accessed. Hidden Files Could not be accessed	The new file browser had made files of drives 'C', 'D', 'E', 'Y' and 'Z' not just accessible but also modifiable . Hidden Files could be accessed
6.	Stop Watch not pre loaded in E71.	Stop Watch loaded and accurate to Microsecond Level.

Table 2

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