Design and Fabrication of a Calculator with GPS System

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Abstract

Calculators are being used to perform basic as well as complex calculations. Most of the modern day calculators being used are advanced and can perform calculations in fraction of seconds. Also few of the graphing calculators even show the graphs for the calculations performed on the device. This paper purposes a new design of calculator which is designed to solve a problem of losing a calculator mistakenly at some place. The calculator designed can be tracked by GPS device which is connected with the android mobile phone through bluetooth.

Keywords: Scientific calculator, GPS system, STL format, 3D Printing.

Introduction

Calculators are portable devices which can perform arithmetic operations. In the contemporary world the calculators are changing which are cheap, small in size and also with built printers as compared to the calculators when invented in mid 1970s. Calculators now can perform the basic calculations and complex calculations like exponential equations, trigonometric functions, hyperbolic functions, stats, complex roots and many more. If compared the basic calculators are cheap whereas the scientific and graphing calculators are still costly.

The various components of calculator device are input buttons, output displays, memory to store the results, variables to perform some complex operations or to construct formulas to solve the equations, power source which can be used to operate calculator. The power source can be batteries or the solar panel which can be attached on the calculator or the combination of both. Such calculators can help to operate when the battery is down.

Apart from this the researchers are thinking to improve the design of the calculators to attract the users. The main usage of calculators are by the University students. In most of the courses the use of calculator is compulsory which can help students do the complex calculations and can get the results. Although the most of the calculations can be done using computers at stores but in exam centres the computers are not allowed.

There are lot of patents available based on the design of the calculators. The researchers are changing the design of the calculators to make them user friendly and easy to carry. The problem in the existing calculators is that they cannot be tracked. Most of the students forget their calculators in exam hall, in their class room when they leave the place. Also the calculator design are almost same which can be easily exchanged. There is no way to identify the calculator if it is lost.

So the problem to the solution is the tracking device that can be installed in the calculators which can help track the calculators if are left somewhere by a person. The GPS (Global Positioning System) device are very small in size and are very cheap as well. If they can be installed in the calculators one can easily identify the calculator if it is left.

Design of calculator

To design a calculator the case of the calculator should be designed in such a way that its size is not going to increase. The main challenge is the source of battery. The calculator and the GPS both require a power source. The life of the batteries used for GPS device has a life span of approximately 6 months whereas the battery life for calculator can last long for a year depending on its usage. To overcome this problem the solar panel is attached with the GPS device and the calculator which can be alternate source of power to the mentioned devices.

The other challenge is the GPS device needs the Subscriber Identity Module (SIM) connection which is used for the tracking. The working of the GPS device is as explained in Figure 1.

Figure 1. Working of Global Positioning System.

From the figure it is clear that to track some device using GPS system the SIM connections are important. But as mentioned in the problem that the main use of calculators is by University students. When SIM is installed in the calculator it can be as similar to that of the mobile phone and student can misuse this technology. So that alternate of this problem is the Bluetooth connected GPS device. One can connect the GPS device which is installed inside the calculator to their mobile phone and can be used to track. Also the user application can be made for the device which can make the GPS device location on and off. The GPS device is connected with the mobile phone of the user through Bluetooth technology. As soon as one forget the calculator the mobile phone starts transmitting signals to the calculator and it starts beeping. Also the last location of the calculator is shown on the mobile phone which can be located using google maps. The same can be turned on or off through the user application on the android based mobile phones.

Design

The problems mentioned are the battery and the location of GPS device inside the calculator. The size of the solar panel is increased which can be power source to both the calculator and the GPS device. The part model of the calculator is made in the SolidWorks which can be saved as STL (Standard Triangle Language) format and can be used for the 3D printing of the case of the calculator. The isometric view of the modified calculator are as shown in Figure 2.

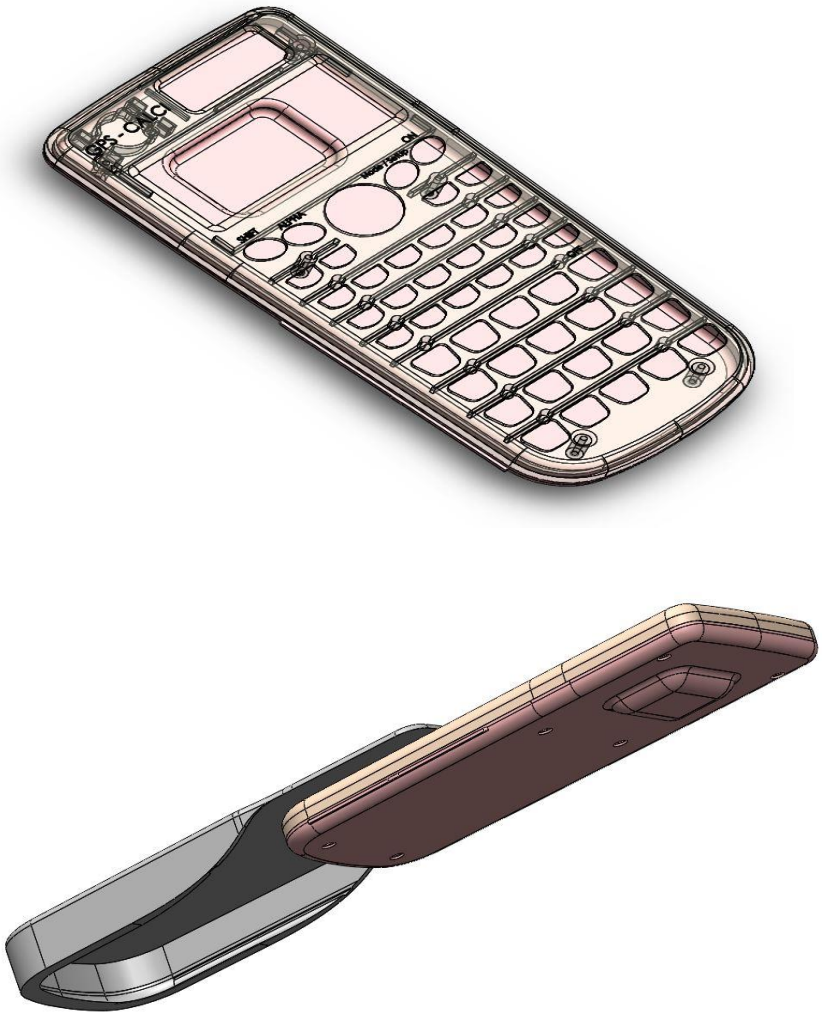

Figure 2. Isometric view of the modified calculator.

The main design objective in our problem is that it should be user friendly and cost effective. GPS device should be light in weight and small in size. Also the working of calculator should not be disturbed. The production cost should be less and it should be environment friendly also.

Working of GPS

The working of GPS device used in the calculator is as discussed.

Connection: The "iTag" GPS device connects automatically when its power is on. On the android phone app, if it is showing disconnected, click on the connect icon to connect the device with the mobile phone. The interface is shown in Figure 3.

Figure 3. Connection of devices.

Do not disturb mode: This interface will turn off the alert function of the device. The interface is shown in Figure 4.

Figure 4. Do not disturb mode in System settings

Anti-lost feature: On the "Device" interface which is shown in Figure 5, will help to send alert on the mobile device if the connection between the device and the mobile phone is lost.

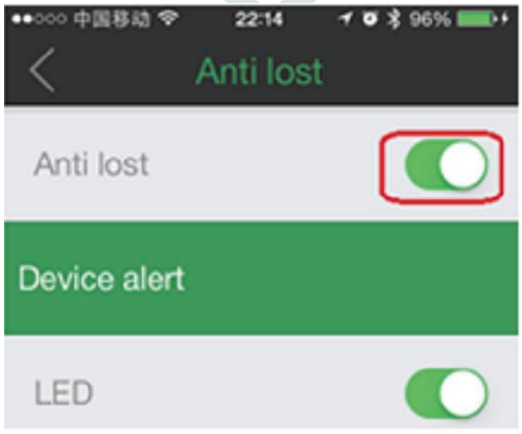

Figure 5. On/off of Anti lost feature.

Setting for alert: As shown in Figure 6, when the red icon is clicked it will start the beeping of the device which will help to locate the calculator.

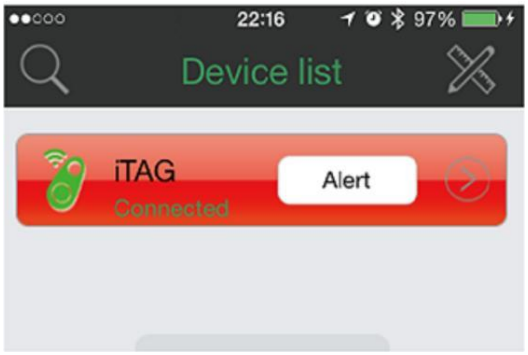

Figure 6. Setting for Alert.

Location: As shown in Figure 7, the location history can be checked.

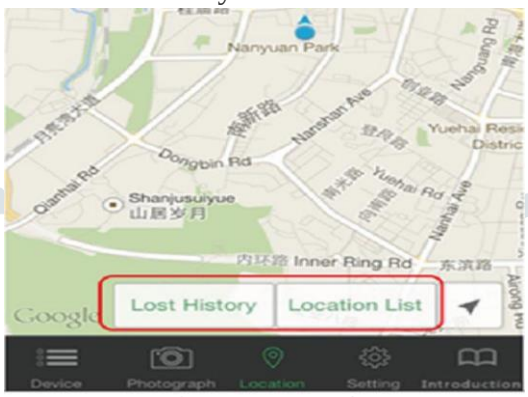

Figure 7. Lost history location

Location list: When the iTag icon is clicked it will locate the coordinates of the device on the map application and will help to give directions for the lost device.

Figure 8. Location Map

Cost to make device: Table 1 shows the cost of the components to prepare the GPS enabled calculator. The below mentioned cost is for one unit. The cost will be reduced when the production of the devices is done in bulk quantity.

Table 1. Cost of the components.

Component	Quantity	Unit Cost	Cost
GPS Tracking device	1	300	300
Battery	1	100	100
Solar Panel	1	500	200
3D Printing Cost per hour	3	100	300
Buttons	1	50	50

Display	1	80	80
Total			Rs 1030

Case Study

The above device is made on the basis of case study which was carried in the campus of Lovely Professional University. The problem is based on the engineering students of first year of batch 2018. There are more than 10000 students in the engineering school. According to the feedback by final year students they say that they buy 4 – 5 calculators in 4 years because they lost their calculator due to number of reasons. From the survey we came to know that this happened with 80% of the students and rest 20% students keep their calculators carefully. So, the calculations are shown for the calculator CASIO 991-ES whose cost is approximately Rs 900/- and is used by majority of students approximately 90%.

Number of first year student = 10000

Cost of 1 calculator = Rs 900/-

Total revenue to the company = 10000 x 900 = Rs 90,00,000/-

The total revenue generated by the company is Rs 90 Lac, if student purchase 1 calculator. If student buy 4 calculators in 4 years of engineering which is clear that the revenue will be four times.

Revenue for a company if 4 units are sold = Rs 90,00,000/- x 4 = Rs 3,60,00,000/-

If we consider that 80% students will keep their calculators, even then the revenue will be Rs 2 crore 88 lac in one university and the number of students in engineering is more than the figure which is discussed in the case study.

To analyse the cost of GPS enabled calculator the cost is comparatively more by Rs 100/- but still it will be beneficial for the 80% of students those lose their calculators mistakenly. Now those 80% student will buy only one calculator.

Bibliography

1. USD462084S1, USD533894S1 patent on the ornamental design for an electronic calculator.