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Fingertip Infotainment: A Way to Secure Information

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Abstract: Modern hand held devices such as smart phones and tablet are being used extensively and their demand is increasing rapidly. A situation may arise in future where every daily activity is performed using a device like smart phone. Technology is improving in a way that it allows many technical components to be interconnected and interactions are made possible to ease the work as much as possible. Internet of things is one such technology where different components such as software, sensors, actuators, networks that enable them to collect and exchange data. It aims at bringing together multiple devices and providing services in various fields such as transport, health care, smart cities, energy resource consumption and saving etc. This paper demonstrates a device called Finger-tip infotainment which is a sub-component of Internet of Things stream. The device mainly acts as a virtual object which enables media control of a mobile device without handling mobile device physically. This device creates enabling environments by offering people with disabilities, assistance in information access and communication. The prototype used in the device makes it easy for people with impairment to carry out daily activities without much effort.

Keywords: Arduino Uno; Bluetooth Transceiver; Flex Resistor; Internet of Things; Media control.

I. INTRODUCTION

FingerTip Infotainment is a device that fits on the hand of the user, similar to a glove, which helps control mobile phone actions. The current prototype enables the control of media play/pause on your cell phone without explicitly handling the cell phone device. Fingertip Infotainment consists of a flex resistor connected to an Arduino which interacts with the mobile phone via Bluetooth and cloud interaction.

The degree to which the flex resistor is bent corresponds to a resistance value which is communicated to the cell phone through the Bluetooth module. The received resistance value is then matched with the threshold values stored in the cloud by the mobile phone. Depending on whether the received value is above or below the threshold, the android application triggers increase or decrease of the audio volume.

This paper addresses the overall problem of controlling media without actual physical operation of the mobile phone. It operates on Bluetooth module and cloud which is used to play, pause or change media volume. This device mainly is built on an open hardware development board and flex resistor. The action based on the degree to which the flex resistor is bent corresponds to the resistance value which is custom defined to suit the needs of the user. Bluetooth technology is used to communicate the inputs and implement the actions between a cloud and the fingertip infotainment device. This device imbibes the Internet of Things concept to serve as an aid for visually disabled people primarily [1].

A. Objectives

The main objective of the device is to provide virtual objects. This device acts as a virtual model to play, pause and control media volume in mobile device. This device creates enabling environments by offering people with disabilities, assistance in information access and communication. The prototype used in the device makes it easy for people with impairment to carry out daily activities without much effort. Another objective of this project is to enable smart device control. Interaction between a cloud and infotainment device is made easy by using a Bluetooth module. This wireless interaction makes it easier to access information without handling a mobile device physically. This project also facilitates and supports internet-connected objects by using cloud as main component to store vast real-time data and to access the information easily and by maintaining security. Security protocols and standardizations are used to keep the data private and secured.

B. Deliverables

The main deliverable of this project is a working prototype of Finger-tip Infotainment which successfully implements user defined actions based on degree to which flex resistor is bent. This interacts with flex resistor used to determine the resistance value by measuring the degree of angle bent by the user and cloud to access corresponding data via Bluetooth module that helps to play, pause and control media volume in a mobile device.

C. Current and Future Scope

The current prototype can be extended to take the form of a glove which contains pressure sensors. These pressure sensors could be arranged on the glove to simulate a numeric keypad. The user may then press the appropriate section of the finger to dial the desired number. The smart phone recognizes the number being dialled and places the call. This device primarily facilitates the handling of smart phones for visually impaired people thereby making an easy access for their daily activities. AI and machine learning algorithms can be incorporated in this prototype to add voice recognition mechanism to perform various other functions to provide a virtual smart-phone.

II. BACKGROUND

Although at first sight it might seem fairly straight-forward to devise intervention programs to train parents and teachers in appropriate modes of responding, this has proven to be far from straight-forward and not particularly successful.'

The above quote is an excerpt from a report by Collis and Lewis (1997) in which the authors conclude that it is very hard for a sighted individual to identify with the needs and problems faced by a blind or partially-sighted person. Their

report focuses on assistance for children, but the above assertion's basic premise is applicable across all ages of people experiencing sight loss.

The ability to 'see' is taken for granted by many. The environment surrounding us is a rich source of visual 'cues' which we have learnt since childhood to 'read' to enable us to go about our everyday lives. However, partially sighted and blind individuals must learn to adapt their behaviours to live in a world designed by sighted people [2].

Through this report, we want to showcase how technology can help to ease the lives of normal and disabled people alike. Fingertip Infotainment is purposed to make use of hand gestures to output actions in an easy and simplified manner. This device is even more beneficial to the blind. Using this idea we can expand the span of actions that can be implemented without needing to look at the screen to perform them.

III. DESIGN

A. *Hardware and Software*

FingerTip Infotainment is a combination of both software and hardware modules. These are as listed below:

1) Arduino Uno:

Arduino Uno is an open-source electronics platform based on easy-to-use hardware and software. It can read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. By sending a set of instructions to the microcontroller on the board certain actions will be performed. In this project, Arduino is uses to input the values using flex resistor which is connected to Arduino board and these input values are transferred to android device using a Bluetooth module which is also connected on Arduino board [3].

2) Flex sensor:

Flex sensor is a variable resistor. The resistance of this sensor increases as the body of the component bends. They can be used as door sensors, robot whisker sensors, or a primary component in any gesture recognition projects. This variable resistor is connected to Arduino board. With increase in amount of bend degree, resistance value increases and this value is sending to android device with the help of a Bluetooth transceiver.

3) Bluetooth transceiver:

The Bluetooth transceiver used in this project basically acts as a generic serial COM port. It connects Android application to Arduino to control various functions. This connection can be useful in applications where the Arduino reads sensors then pass their values via serial Bluetooth to a PC or an android device for processing the data. In this project, the Bluetooth transceiver sends the resistance value from the flex sensor to android device for further processing.

4) Android device:

Android device is a model used to launch a music application and control it by playing or pausing the music application depending on the values of flex resistor. Android device receives resistance values from flex resistor through a Bluetooth transceiver. It then queries database for corresponding value of resistance. Response is received and music is played or paused depending on the value of response.

B. *Architecture Design*

The architectural design is the design of the entire software system. It consists of an Arduino microcontroller connected with flex resistor and Bluetooth module. The resistance values from flex resistor are sending to android device with the help of Bluetooth transceiver. Android device receives this resistance value and query the cloud database for its corresponding value. The response from cloud is sent to android device and specified action is performed. The architecture design of the system is shown in Fig. 1.

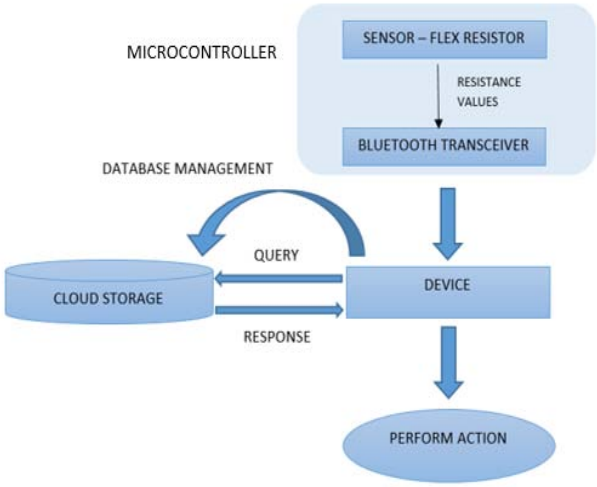

Fig. 1: System Architecture of FingerTip Infotainment.

C. *Graphical User Interface*

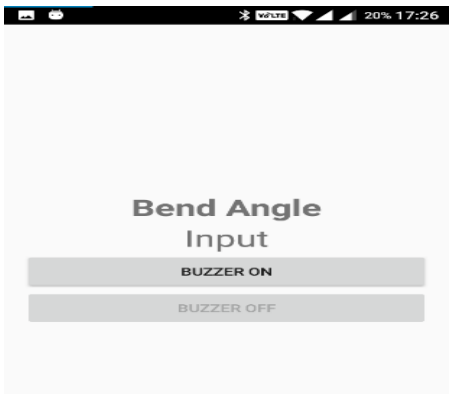

Fig. 2: Graphical User Interface on Android.

The graphical user interface used in this project is an android application as shown in Fig. 2 above that displays bent angle in degree of the flex resistor. It also displays the time at which the resistor is bent. This time is saved in the database and is used to launch music application on android device there by playing or pausing the music according to the bent degree [4].

IV. IMPLEMENTATION

The implementation makes use of tools such as: Arduino Uno, Flex Resistor, Bluetooth Transceiver, Piezo buzzer, LCD module, Android Device. The technological aspects are: Bluetooth and Cloud storage (Firebase RealTime database) as a Platform Service (PaaS).

The device is programmed in Java where the code is split into two major modules: one for the Arduino IDE, and the other for the Android application.

A. Arduino IDE

Using A0 analog pin as input for the resistance provided by flex resistor, we find the bend angle by dividing the base resistance and resistance when the sensor is bent by 90 degrees. The angle is then cast to an integer and the angle is printed onto the serial monitor. The same information is transmitted via Bluetooth. Messages received are monitored to function the buzzer.

B. Android Application

The code of application consists of using inbuilt functions to create a socket connection to the Bluetooth module on breadboard. Authentication to the Firebase storage and database is established. Next a file containing the rules or settings is fetched from the cloud service. This contains the sensitivity values and the key code for event to be performed upon reaching the bend angle.

The information containing the angle is received via the socket created and using Firebase SDK, we record the angle and current time on database and cloud storage. The user selects the sensitivity (in degrees) and based on that, the play/pause function is implemented whenever the sensor is bent to that angle. These angles are sent to the cloud database where the analytics takes place [5].

Once the necessary actions have been performed and recorded on the database, the Bluetooth socket connection is closed. The Firebase database is committed and closed. Local storage containing desired user settings is overwritten.

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V. RESULT

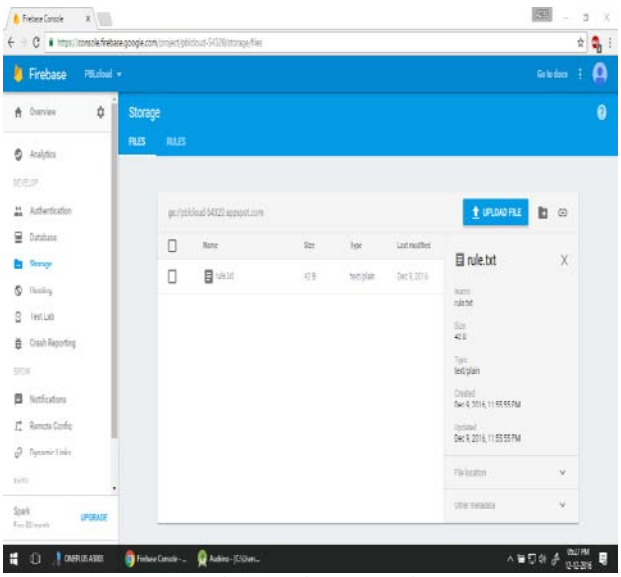

Fig. 3: Successful read of "rules.txt" from Firebase.

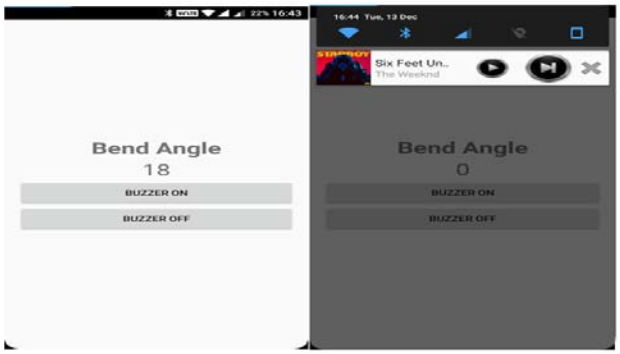

Fig. 4: Bend Angle Received by Android Application,
Music Paused on Android Device Based on Selected Sensitivity.

VI. SOCIAL IMPACT

This section of the paper elaborates on the social impact of the Internet of Things and our device. It also addresses issues like privacy, sustainability, and economics of computing, security policies, computer crime and laws [6].

A. Social Issues

New technologies such as social networks, mobile internet, Internet of Things (IoT), Internet of People, and cloud computing have affected people's daily lives deeply. These technologies can also work together for consumers' benefit. The convergence of these technologies makes some new social interactions promising for building a smarter world, such as social IoT (SIoT) and social cloud (SoC). SoC improves on social networks to cooperatively provide computing facilities through social interactions, which will produce new resource sharing relationship mapping. The issues having a critical impact on IoT include security issues, privacy issues, Inter-operability standard issues, Legal Regulatory and Rights issues, Emerging economy and development issues and Storage management.

B. Privacy

Fingertip infotainment being a sub-part of Internet of Things focuses particularly on security and privacy problems. Pressure sensor and blue-tooth sensor used here; affect the physical world by controlling the smart device which is connected. Clearly, there is a need for security and privacy protection. It is taken care that these privacy and civil liberties are met. It includes authentication and authorization mechanisms in each application. Devices used here work on wireless connections which offer high bandwidth and large amount of memory modules. Processors used are powerful enough which thereby increase performance. Proper measures are taken to control privacy and security. Security and privacy mechanisms used are standardized and configured. This helps in increasing performance parameters thereby decreasing vulnerable attacks and loss of data.

C. Sustainability

A very basic step an IoT enabled gadget should do is sense data. At the heart of device is the flex resistor (sensing device) which is used for getting input from the environment. Iot enabled devices vary in sizes from wearable's to large stations. Our device contains dead cells and batteries you throw away with other garbage contain lead that easily mixes with underground water, making it unfit for direct consumption. As

of now, there are no proper methods being implemented even in the first world to eliminate the problem of e-waste. The two methods for proper treatment of e-waste are recycling and refurbishing. For recycling, there may be products that cannot be recycled completely. Our device is not of one such product. Our product is manufactured with recyclable materials so that the e-waste is converted into something that can be used again without harming the planet and its inhabitants. Thus, one of the major factors in treating e-waste is to compel manufacturers to use green elements. If electronics are refurbished, they can be sold again at a lower price. Thus, both the society and environment will benefit.

D. Economics of Computing

With the advent of globalization and computing reaching new heights each day, an important aspect needs to be considered – the economics of computing. Several questions need to be answered while designing and implementing a new product such as what could be the consequence of globalization of the product, what pricing strategy needs to be adopted, what is the effect of difference in access to resources required to build the product, considerations in terms of manufacturing and acquiring components, creating new employment opportunities, the network effect etc.

The economics that comes into play here is commonly called the network effect. The network effect is when the value of a product gets higher each time it attracts a new user. A classic example if the telephone invented by Alexander Graham Bell. The more number of people began to use them, the dearer it got, and hence began to become a platform on its own for new business opportunities which may never have been foreseen at first. Now that a larger number of devices are being made to form networks among themselves, the possibility of newer platforms emerging is greater, thus boosting the economy. In our project, we see the interaction of a sensor (flex resistor), with a mobile device via a Bluetooth and cloud interface.

E. Security

Security is one of the main issues to be addressed in technology. Protection of data from vulnerable threats is very important to avoid misuse of data for illegal purpose. Hence security plays a key role in technology. The main component used in the project is cloud. Several security threats are associated with cloud data services like eavesdropping, denial of service, abuse of cloud services etc. Security requirements that should be met in cloud data service to avoid such threats are Data confidentiality, Data access controllability and Data integrity. It is important to integrate security across all the clouds to avoid data loss and unauthorized access.

F. Computer Crimes and Laws

Our device falls in the category of devices under the Internet of Things (IoT). Iot has been on a major incline in the past couple of years due to the various services invented for the sole purpose of making devices ‘smart’. The evolution of Information Technology (IT) gave birth to the cyber space wherein internet provides equal opportunities to all the people to access any information, data storage, analyze etc. with the use of high technology. One of the majorly used services is cloud service. A cloud is online storage facility where the hardware is stored somewhere in the world by the company hosting the service. This cloud service is a major component of our device. We have used the Firebase cloud, hosted by Google, to retrieve a database which links the action to the bend angle. The database is updated so that to maintain consistency and provide security updates for the device. But cloud service is not 100% safe. All devices under IoT face threats under computer crime [7].

VII. CONCLUSION

Mobile ecosystems are maturing which is increasing demand for connected devices. By integrating such devices, it is possible for smart-entertainment in mobile devices. Services in internet-connected devices are increasing. This ensures that there will be increase in demand for smart-devices. Fingertip infotainment is one such device. The current prototype helps to play, pause and control media volume of a mobile device by interacting with cloud using Bluetooth module. This avoids the use of mobile device physically to control media functions.

The device has a high scope for future developments and improvements. The single functionality ring can be extended to take the form of a glove to form a virtual keypad on the fingers. In the era of smart phones with touch screens, the visually impaired population does face a certain disadvantage as opposed to the buttoned mobile phones in the market a few years ago. The enhanced device would enable this section of the society to handle smart phones with ease and carry out basic functions such as place and receive calls.

Designing and implementing novel devices for the benefit of the society is definitely progress. However, focusing on the technology aspect alone is not enough. Conforming to established laws and regulations, upholding privacy of users while providing security to their device, ensuring that the product is sustainable and has a positive social impact adds to its economic value and renders it more feasible. Although the usage of cloud as storage medium has potential advantages such as easy maintainability, pay-per-use, lesser energy consumption etc., the vulnerabilities to surface attacks, supplier stability and accessibility also need to be considered. It is important to find a balance between the feasibility of the device, its economic value and most importantly customer satisfaction.

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