Braille Smartphone keypad

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***Abstract*—In this project the aim was to construct a device which can make life of common people easier. So finally a device was made that can help blind people to overcome their difficulty in typing especially on a smart phone. This project uses basic electronic device Atmega-32u4 and few push to on buttons for operation. Going through this project several mistakes and unexpected outputs were encountered and resolved through guidance.**

I. Equipment used

TABLE I
COMPONENTS

S.N	Components	No. of components
1.	Atmega-32u4	1
2.	Jumper wires	12
3.	Push Button	8
4.	PCB board	1
5.	USB cable	1
6.	OTG Power cable	1
7.	A Smart Phone	1

II. Introduction

AS an engineer, it is expected to look onto every aspect of the society. Efforts must be to improve the life style of each and every person of the society. A major problem that has crept in with the advent of technology is that of smart phones. Each and every smart phone has become compatible with new feature and people have learned to use it effortlessly but what about a blind person. A thought was made to put up an effort to make a device available for them too and that too at a reduced and affordable cost.

The following project is a writing device that converts braille language to normal English and enables writing feature on a smart phone. By doing so they can use every smart phone ably by making it compatible towards the writing feature. According to a study it was stated that $\frac{8}{10}$ blinds wanted to use smart phone but they are not able to use it because they encounter typing disability and auto speech feature which doesn't work for regional language in a smart phone. This device solves that problem too.

***ATMEGA ARDUINO Board*:-**

Arduino is an open source computer hardware and software that enables us to pass commands through an interface having variety of micro controllers and processors. The processor code is just like any other language for example C++ or C. All needed is to upload a code and run it through a software of Arduino. Particularly speaking about atmega-32u4, it is a chip in Arduino board that serves basic features such as encoding messages and transferring it to various forms of devices. [1]

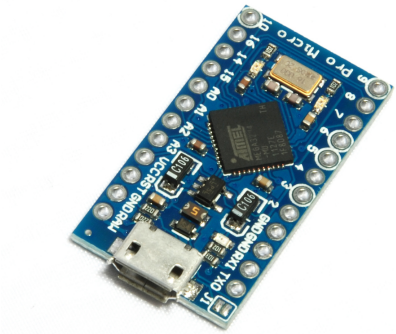

Fig.1. Arduino board [2]

ATMEGA low-power Microchip 8-bit AVR RISC-based microcontroller having 32KB self-programming flash program memory. Other features include:

- 2.5KB SRAM
- 1KB EEPROM
- USB 2.0 full-speed/low speed device
- 12-channel 10-bit A/D-converter
- JTAG interface for on-chip-debug
- ATMEGA achieves up to 16 MIPS throughput at 16 MHz.
- The voltage for regular operation is 2.7 - 5.5.
- USB 2.0 Full-speed/Low Speed Device Module compatible.

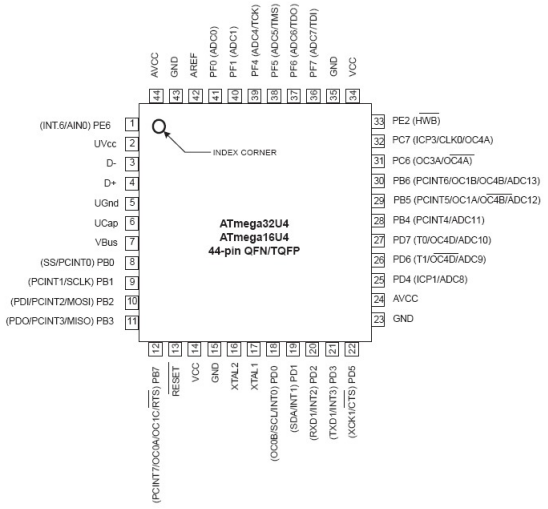

Fig.2. [3]

III. Concept and Working

On completely analyzing the structure in which a braille script was formed, it was realised that a braille script consists of 3x2 matrix i.e. it has 3 rows and 2 columns and that several symbols are made by different combinations of these keys. Every alphabet has a completely different symbol this lead to the concept of analyzing those points by sensing the pushing points. Thus those pushing points will be the ones which will lead to formation of such braille symbols. It can be easily understood by the following figure.

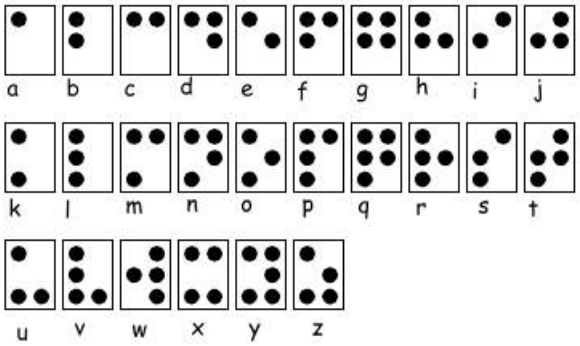

Fig.3. Braille English Alphabet [4]

This 3x2 matrix can be represented in the form of switches 6 switches correspond to 6 dots of braille script. And every upright portion of braille in respective letters correspond to every pressed witch in the project. Analyzing those pressing points can be done by the help of Atmega-32u4 as mentioned above it was used to analyze the pressing point and that responds by returning binary value and thus every binary value and its combination can be put in conditions to identify particular alphabet. The combination of various binary value is given below.

These combinations can be converted to normal alphabets by using $< keyboard.h >$ library in Arduino. Thus several combinations can be converted into normal letters. And this device can be connected to every smart phone using an OTG cable and the talk back feature of the smart phone can be used to recheck the words entered.

TABLE II
Binary code

S.N	Characters	Binary value
1.	'a'	100000
2.	'b'	110000
3.	'c'	100100
4.	'd'	100110
5.	'e'	100010
6.	'f'	110100
7.	'g'	110110
8.	'h'	110010
9.	'i'	010100
10.	'j'	010110
11.	'k'	101000
12.	'l'	111000
13.	'm'	101100
14.	'n'	101110
15.	'o'	101010
16.	'p'	111100
17.	'q'	111110
18.	'r'	111010
19.	's'	011100
20.	't'	011110
21.	'u'	101001
22.	'v'	111001
23.	'w'	010111
24.	'x'	101101
25.	'y'	101111
26.	'z'	101011

IV. Procedure

1) First, eight push-to-on buttons are connected on the printed circuit board.
2) Then according to the code, the corresponding terminals of the buttons are connected to the atmega-32u4.
3) The other terminals of the push buttons are set as common ground with the ground of atmega-32u4.
4) Then the code is transferred to the atmega board.
5) The whole circuit is covered to give it a shape of a keypad with eight push buttons on the top.
6) The keypad is connected to any smart phone by an USB and an OTG power cable.
7) With the corresponding combinations of the buttons pushed simultaneously, the respective letters are printed on the screen with an additional feature of space, delete and enter.
8) With each letter printed, the voice of that printed letter is also heard with the talkback feature of the smart phone.

V. Precautions

1) The Push button should be common grounded using solder carefully.
2) The wire connect to Arduino atmega-32u4 must not be shorted.
3) The Push button must be fitted into the PCB (Printed circuit board) and pushed gentally.

VI. First prototype

The circuit of the first prototype is as follows:-

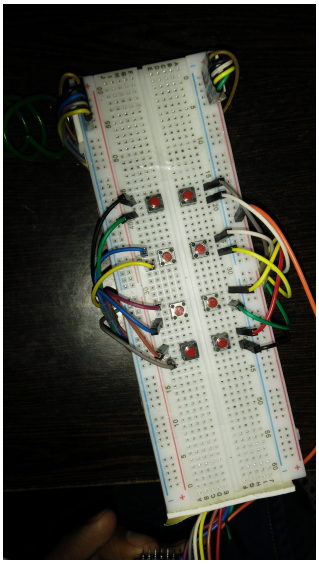

Fig.4.

VII. Conclusion

After making the first prototype, plenty of faults were discovered. An update product was made. This product is very compact and is able to type all the English alphabets and it can be heard by the talkback feature of the smart phone. The messages can be send and read as well. Any USB or an OTG cable can be used to connect it thus reducing any extra cost.

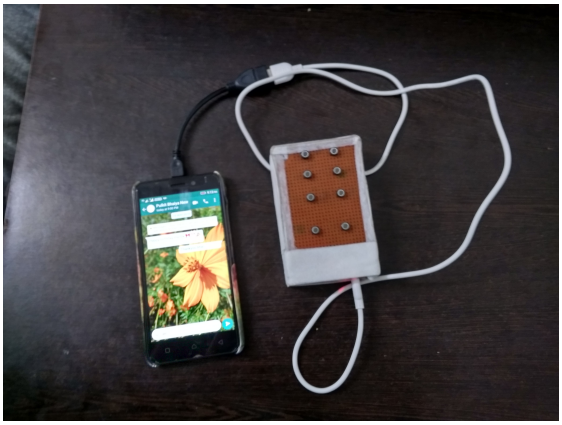

Fig.5. Final project

The main feature of the product is that it is very cost effective. If this project is made on a manufacturing basis it will cost only 600-650 rupees.

VIII. Challenges Faced

The cost of this keypad was considered as a challenge and it was solved accordingly. The main challenge was to make it compatible, easy to handle and most of all light weight. To make it light weight cardboard was used instead of Galvanized iron sheet for its case. The circuit was soldered on a PCB board instead of using breadboard to make it compatible. To make it easy to handle idea of carrying at the back of the smart phone was considered.

At last the challenge is to make a interface(app) for this braille keypad so a blind person can do all his tasks on that.

IX. Upgradation

There is never a product made which has no demerits. Every product needs some modifications. Same is true for this one.

- It could type numbers and special characters too along with alphabets.
- It could be fitted into the back cover of the smart phone increasing comforts of its usage.
- An additional push button could be added to open the Google-assistant to guide the blind person for the usage of smart phone.
- Bluetooth module could also be installed on the device to allow the user to use it wireless.

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References

[1] Atmega-32u4 theory [online] Available: https://bit.ly/2IXwRnI
[2] Arduino board image [online] Available: https://bit.ly/2wYNWc5
[3] Atmega chip [online] Available: https://bit.ly/2s1yLt0
[4] Braille English Alphabet [online] Available: https://bit.ly/29ign3r