IJCSE International Journal of Computer Sciences and Engineering Open Access
Research Paper Vol.-7, Special Issue-14, May 2019 E-ISSN: 2347-2693

AWK: Arduino Wearable Keyboard

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DOI: https://doi.org/10.26438/ijcse/v7si14.152157 | Available online at: www.ijcseonline.org

***Abstract*—** Traditional typing methods have become quite outdated nowadays and there is a need to constantly upgrade this technology. AWK: Arduino Wearable Keyboard is an ergonomic input device which is wearable. Arduino Wearable Keyboard is a device whichallows users to effectively communicate by providing various input letters present inthe English Alphabet. This is made possible without using the traditional QWERTY keyboard setup; and rendering an immediate display ofthe output. AWK is highly effective for communication on the go, especially for people with speech disorders. The components used to meet this are Arduino Uno Board, LCD Screen, Bread Board, Push Buttons and Resistors. It makes use of these push buttons to reciprocate interactions during "key" taps or pressesto provide a response of an immediate display of a letter on given the LCD Screen; and reduce the accuracy needed in various positions of hand while typing on a traditional QWERTY keyboard. Thereby, eliminating any need for a traditional QWERTY keyboard.

***Keywords*—**Arduino Wearable Keyboard, QWERTY Keyboard, Multitap, Input Language, Arduino UNO

I. INTRODUCTION

QWERTY keyboards are the backbone of any typing scenario. People all across the globe use it traditionally in almost every industry. They have such a huge impact on the society, that we rarely see anyone using any alternative keyboard devices.

Finding ways to connect ourselves to the machine world in minimal, economic, natural and discrete ways is what AWK: Arduino Wearable Keyboard is all about. We can type on any solid, flat surface, from our kitchen dining table to our daily metro train. Finally, we can type anywhere, even by simply tapping our fingers on the side of our leg, making AWK highly tactile.

AWK uses push buttons to reciprocate the interactions occurring when any "key" is clicked or pressed (imitating a haptic technology mechanism) to provide a response of an immediate display of a letter corresponding to the key pressed on the LCD Screen.The utilisation of one-handed text input devices such as AWK helps in improving input speed and diminished the mistake rate.

AWK makes use of the universal binary bit representation mechanism. All the letters of the English Alphabet are accessible via making letter-corresponding finger taps. Each set of finger taps lead to the display of a unique letter.

Whenever a user taps a letter, it gets stored and is automatically displayed on the LCD screen.

The block diagram given below serves as the basic overview of the proposed system:

Figure 1. Block Diagram

AWK, apart from its increased typing flexibility and efficiency, it has a profound socio-economic impact. Considering, the current alarming level of pollution caused by plastic, the major pollutant, we aim at reducing the plastic use. Unlike traditional keyboards, which require our hands to be at a certain position with respect to the body, AWK allows flexible, convenient angles to type, which can be useful for people facing various physical challenges and speech disorders or speech impediments. Also, the use of push buttons makes AWK highly cost effective and budget friendly.

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II. RELATED WORK

1. Universal Keyboard Using Chording Gloves[1]

This is a gadget based on glove-type interface, utilizing both thumbs and every one of the joints of the four fingers, which works universally, for both text and input in Braille.Thisgadgetcurrently is capable of working on numbers, characters in Korean language, and mode transformation on Braille characters.

The input switch was made of silicon ink which is conductive in nature, and isreally simple to apply to any enduring, light or surface. Considering the finger drive and the exhaustion from rehashed finger movements, the testing with following was evolved: One, demonstration of executionby blind subjects with a Braille keyboard. And two, demonstration of execution by non-blind subjects with a keyboard for Korean language. However it was subordinate as compared to traditional keyboard. The performance of subjects' demonstrated that around 122 Braille characters/minute and 108 words/minute in characters of Korean language.

The chording gloves created here relied upon to be utilized with normal computing gadgets, for example, personal computers and personal digital assistants. They aimed to supplant regular devices with this, providing an affordable processing for Braille users.Input can be initiated by having contactbetweenkeyspresent on the other phalanges or fingertip the thumb tip. Chording is conceivable by having contacts between the thumb tip and at least two fingertips present simultaneouslyin parallel. There are twelve keys present on each fingertip, similarly on the phalanges. These keys are made of silicon ink which is conductive in nature, and are connected with the help of a rectangle to each part present between the finger joints.

2. A Glove-based gesture interface for wearable computing application [2]

This illuminates the glove gadget utilized for input, the software used for recognition of features and the combination of the gadget into application programming, which comes with the assistance of a context framework. The framework has been utilized in various applications, running from work area applications to the controlling of a portable robot.

The execution of a gesture interface based on glove, which speaks to an initial move towards a UI, is depicted. This includes chronologies of learnable motions which may be implemented irrespective of any direct mechanism for feedback. The gadget can also be utilized for various purposes like controlling desktop applications and other real world devices.

3. Areal-time wearable device for human-computer interaction: Hand Data Glove[3]

Human-Computer Interaction (HCI) is a real time interaction device which uses K-NN algorithm and classifierfor gesture recognition. HCI is moving towards being increasingly common and so an instinctive approach hasbeen utilized. The gestures are arranged as pointing, rotating, clicking,and dragging. Perceiving these various gestures and significant moves are made, for example,3D sketching, air composing and by following the way supporting virtual augmented reality (VAR).

For the most part,central focus is around the information from the glove and precisely and effectively getting a handle on all the activities of real-time input/output. Hand Data Glove is a gadget furnished with sensors that independently detect hand and finger movements. And then, pass those developments to the PC constantly, in either analog and/or digital signal form. Consequently,now hand data gloves are being utilized in various fields of researchsuch asrobotics, virtual reality,character recognition and verification, gaming, and in shopping applications.

We are mapping the finger motion with the 3D mouse pointer to sketch something useful on the computer screen. Basically the mapping is between the real world and the digital world, connecting each other. The data glove used for the experiment is an electronic device with motion capture sensors, i.e., flex sensors, capturing the movements of each individual finger from physical world and converts them to digital signal using analog-to-digital convertor. This digital signal is then passed to the computer to further process and paints the digital or virtual world, as it is the mimic of physical or real world.

4. Aone-handed wearable keyboard glove: Argot[4]

Argot regards the ever spreading and pervasive challenge of enabling text input in wearable applications without fully occupying the hands. Existing approaches to wearable text input like the Twiddler chording keyboard often require that a device be held and/or strapped to the hand. While this naturally prevents the hand from being used for other purposes while typing, a hand-held device can also cause add-on usability effects as the device must be retrieved prior to use, stowed following use, or held when not in use. Approaches that don’t rely on button-presses, such as gestural input devices, often require that the user learn a new vocabulary or input language.

Wearable input device that allows a user to type all English letters, numbers, and symbols without use of a traditional keyboard. The device design considers variables and constraints such as dexterity, feedback, mobility, learnability, speed of input, errors and false inputs, permanence, and comfort, as well as previous user knowledge. Argot utilizes a

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simpler input language, and usesconductive thread and textile conductive patches to improve user comfort.

Argot utilizes highlights like the KITTY plan. Moreimportantly, the idea aims at utilization of electrical connection between fingers instead of various pressesof buttons. In any case, as it depends on a traditional QWERTY console, KITTY needs input from two hands. The Argot glove facilitates this need while it still utilizes earlier learning by applying a text prediction method or multi-taptechnique.

5. GestureWrist And GesturePad[5]

Here, two input gadgets for wearable PCs, called GestureWrist and GesturePad were demonstrated.

Both these gadgets are intended to be as inconspicuous as they could be, so that they can be utilized under different social scenarios and settings. These two gadgets enable clients to communicate with wearable or adjacent PCs by utilizing gesture based commands.

GestureWrist, the primary gadget, perceives hand motions and lower arm motions; is a wristband-type input gadget. In contrast to,DataGloves or any other hand motion input gadgets; all detecting components are inserted in an ordinary wristband.

GesturePad, the second gadget, works as a sensing or detection module that can be attachedto or within the garments, and clients can associate with this module all things considered, from outside. It changes a regular garment into an intelligent gadget without changing the visual aspect.

6. The Chording Glove [6]

The keys of a chord keyboard are mounted on the fingers of a glove. A chord can be made by pressing the fingers against any surface. Shift buttons placed on the index finger enable the glove to enter the full ASCII character set. The chording glove is designed as a text input device for wearable computers and virtual environments.

7. Wearableinput device and input method:Keypad gloves[7]

A simple yet, extremely helpful glove-based text input gadget for wearable PCs. The proposed gadget employs one of a kind operator-to-key mapping technique, key-to-symbol mapping technique, and straightforward algorithm. The proposed glove-based text input gadget utilizes the hands as the keyboard instead of any specific gadget. This gadget makes use of the phalanges of the fingers on one hand as the keys of a phone keypad, as on account of the Finger-Joint Gesture wearable keypad (FJG). While the fingers of the other hand are utilized to work the gadget. In this way, there are 12 discrete keys on the three phalanges of every one of the four fingers and two discrete keys are accessible on the phalanges of the thumb.

These two keys are employed as mode switches. The five fingers, on the other hand, are used as operators. Therefore, this gadget can deliver up to 180 (3 phalanges 4 fingers 5 operators 3 modes) particular characters at the control unit. At the control unit, the client can predefine the number of keys that produce characters and change the key-to-symbol mappings into a desired design.

8. Using LabVIEW for Wearable Device with Gestural Augmentation [8]

This gadget lets us move with the information by simple hand signals. The acknowledgment of signals is the essential thought behind this gadget. The primary point of our task is to bring advanced and natural worlds closer, for all intents and purposes together. This work utilizes a camera which catches the motions, processes it utilizing a RT processor (myRIO) with theLabVIEWsoftware.

The utilization of this gadget incorporates: One, A gestural camera that grants r taking pictures by confining the finger signals. Two, The information can be replicated from the physical world, similar to a passage on a printed paper with a hand signal and paste them on a computerized gadget, i.e., signal based pick from a real paper and drop on a computerized PC screen, as opposed to composing. And three, substitution of the physical console by printed paper.

9. A Wearable Device with Bone-Conductive QWERTY Keyboard: Oinput[9]

Oinput has interaction plans, including voice input, inertial measurement unit based input or acoustic based information, all require a stable environment, which is basic for a wearable gadget. This proposes a stable QWERTY console contribution for wearable devices dependent on bone-conduction models. Utilizing the qualities of human anatomy, minimal effort and high exactness content input framework, named Osteoacusis input (Oinput), with the assistance of human bones. The initial research includesarrangement of bone-conduction hypotheses.

This arrangement of hypotheses and joining a strong anti-noise cyclic neural system is used to accomplish a high-accuracy QWERTY console acknowledgment for content input. Besides, in request to improve the client experience, there exists aslightly influenced keyboard format changing, dimensionality and feature selection to lessen the power utilization while protecting the comfort and steadiness.

10. A Wrist-Wearable Devices for Elderly Computer Learners: WristEye[10]

This includes a computer learning framework furnished with wrist-wearable gadgets to support old computer learners as

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they perform learning assignments and actions. TheWristEye System can observe and investigate learners' attitude, responses, and behaviors as they take an interest in PC education classes.

In the WristEye, a kinematic sensor connected to a learner's wrist can identify contrasts in wrist orientation and vertical acceleration and figure out which learning PC activities are in process, i.e., coordinating the mouse, hitting the keyboard, inactive, and arbitrary undirected movement of the mouse. Also, a remote backend server gets the distinguished flag from the wearable unit by a remote sensor system and afterward breaks down the relating PC learning viability to deliver results.

III. METHODOLOGY

Hardware and Software Requirements for AWK include:

A. Arduino Uno Board [11]

- It comprises of 14digital input/output pins. Amongst these 14 pins, 6 pins can be used as PWM outputs, Rest of the pins are: 6 analog inputs, an ICSP header, a reset button, a power jack, a USB connection and a 16 MHz quartz crystal.
- It can be associated to a PC with a USB link or powered with an AC-to-DC connector or a battery.

B. Bread Board

- Bread Board is the most fundamental piece to build a circuit.
- It connects the LCD Screen to AWK system.

C. LCD Screen

- LCD is an electronic displaythat consists of segments of a liquid crystal which shows varied reflectivity in accordance to the applied voltage. [12]
- This comprises of two lines and 16 characters, and shows the corresponding display of the pressed button.

D. Resistors

- Resistors help in adjusting the brightness of the LCD Screen.
- Resistors also act as a fuse in the circuit.
- If there is any fault in the circuit, maybe excess current, the resistor will dissipate it.

E. Push Bottons

- Push Buttons play a key role in this system as each button helps to represents an English letter.
- They are directly connected to the Arduino UNO Board.

F. Jumper Wires

- Jumper wires are merely wires or cables used to connect two or more pins.

G. Arduino IDE [13]

- Arduino Software (IDE) is an open source Integrated Development Environmentwhich helps in making it easy to write code and then, uploading it to the board.
- The IDE environment is well written in Java and it supports a variety of programming languages.

The following system is a prototype that provides proof of concept that such a system can be executed in a broad manner:

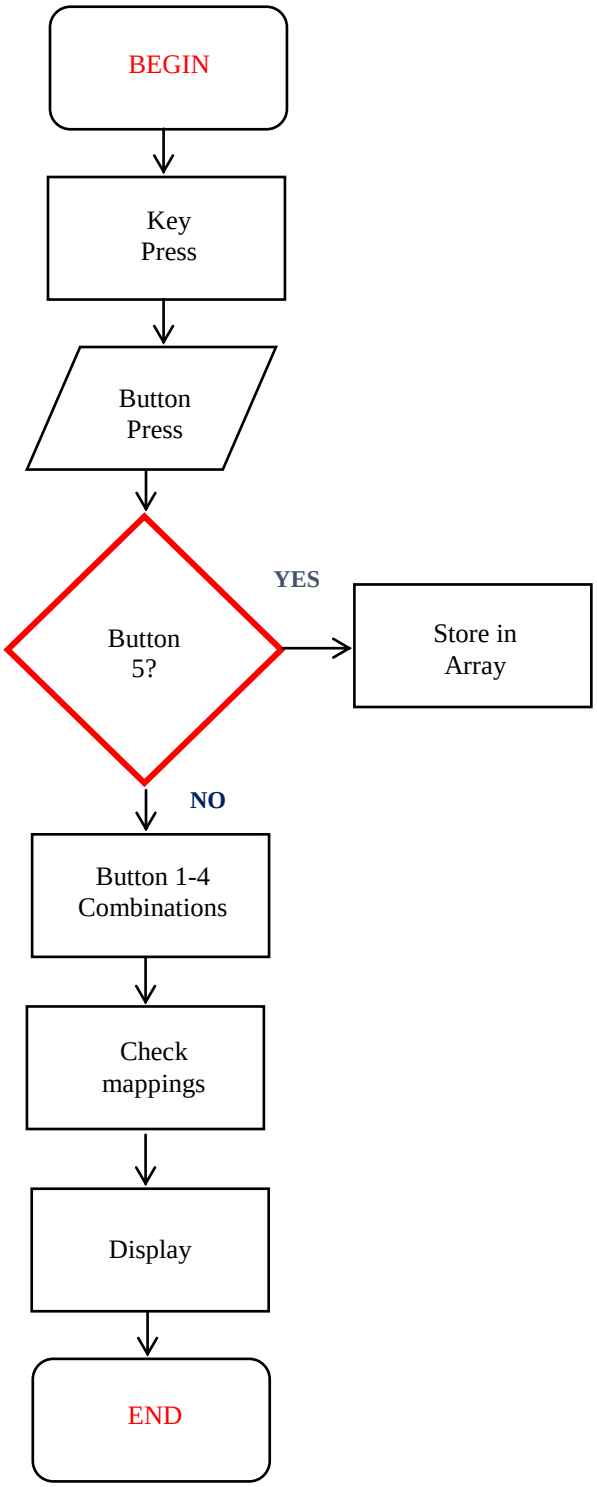

Figure 2. Data Flow Diagram of the proposed system

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The goal of this proposed model is to provide flexibility, convenience and efficiency during typing. The proposed system has been discussed in the following points:

1. Function mapping is done to map the key press combination to the respective letters.
2. The mappings are loaded into the Arduino and the program is executed.
3. The system checks if key 5 is pressed which if true then stores the following key presses into the array to be displayed, otherwise the letters are not stored in the array and directly displayed on the LCD Screen.

The Circuit Diagram given below represents all connections made for the proposed system:

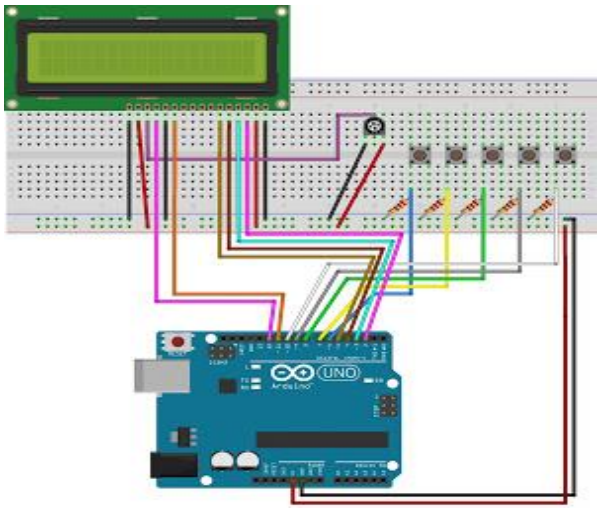

Figure 3. Circuit Diagram

AWK makes use of the universal binary bit representation mechanism. All the letters of the English Alphabet are stored in an array. Here, we must note that, the array can comprise of any sequence of letters. But, for simplicity and ease of working, we have taken 'A' as the first array element followed by other English letters in the standard sequence.

Now, we have established that array is a collection of items; here it is a collection of English letters. Each letter in the array is represented by certain index numbers. We have chosen One-based Indexing for easy understanding wherein the first letter, 'A' is represented by 1; the second letter, 'B' is represented by 2; the third letter, 'C' is represented by 3 and so on.

The table given below shows this representation:

Letter	Array Index	Binary Equivalent
A	1	0001
B	2	0010
C	3	0011
D	4	0100
E	5	0101
F	6	0110
G	7	0111
H	8	1000
I	9	1001
J	10	1010
K	11	1011
L	12	1100
M	13	1101
N	14	1110
O	15	1111

The index numbers of respective letters are converted to its corresponding binary combination. And this binary combination represents the user-made push button combination to attain result. The correct push button sequence combination gives the desired letter as output on the LCD screen and thus, we obtain a successful result.

IV. Results and Discussion

AWK is a wearable Arduino based keyboard which successfully uses an array mechanism to display the English Letter associated with the button pressed. The prototype makes use of the LCD Screen to display the output.

A. Uploading the Code

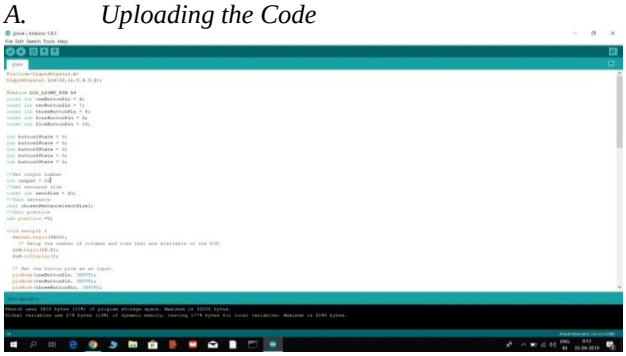

Figure 4. Uploading the Code on the Arduino IDE

The above figure shows code programmed using C Language being uploaded on the Arduino IDE.

B. Typing a word: Failure

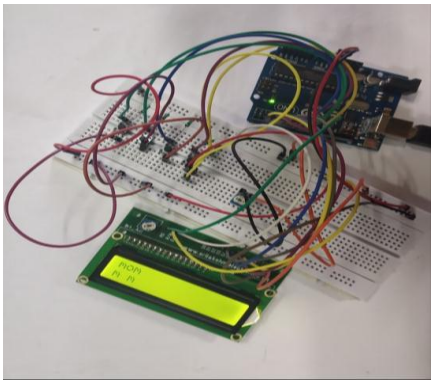

Figure 5. Typing a word: Failure

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In this case the word entered by the user does not get displayed on the LCD screen due to poor and incompetent locally available connections.

C. Typing a word: Success

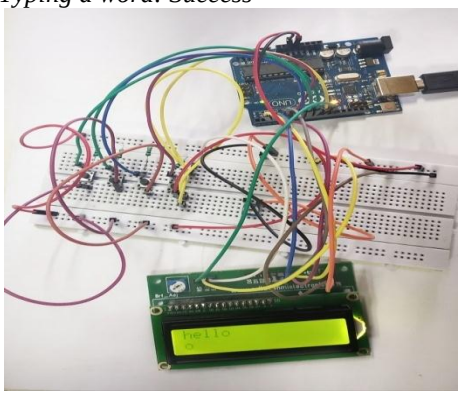

Figure 6. Typing a word: Success

In this case the word entered by the user gets promptly displayed on the LCD screen.
The advantage of the proposed system, AWK over other existing systems is that, it is simple to understand; with little or no training, people of various environments can master it. And, using push buttons has an edge over the usual haptic flex sensors as push buttons are readily available, easy to use and budget friendly.

The limitation of this system, as it is just a prototype for one hand, is that it only ranges from letter A-O. Further improvements can be made by including all letters of English Alphabet, all necessary punctuations, numbers from 0-9 and spaces. All this can be mapped out by using this system on both hands. Further, the user will have to get familiar with various binary representations as all respective combinations of push buttons corresponding to each letter are unique, distinct and necessary.

V. CONCLUSION AND FUTURE SCOPE

The aim of this paper is to provide anevidence of concept. The result shown from this proposed system provides an alternative way of typing than the use of the traditional QWERTY keyboard which can be handy for differently abled people.

AWK helps in minimizing pollution as it isn't plastic based like regular QWERTY keyboards, thus having a big socio-economic impact. Also, the use of push buttons makes AWK highly cost effective and budget friendly. AWK can render device control specialization and flexibility; and soon with some practice it can be used without looking!

Also since it is attached to the hand, it becomes difficult to lose. It is highly advantageous for physically-challenged people, some people who cannot manage the motions necessary for typing on a traditional keyboard, or some people who only possess the use of one of their hands, The AWK's design is such that it can overcome many of these issues and give back some computational power to these people. Also, this can be implemented in various fields like Virtual Reality.

The extension of this system can be implemented on both the hands in the form of gloves. Further extension can be done to make it multilingual and portable.

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Authors' Profile

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