ELECTRONIC HANDWRITING CHARACTER RECOGNITION (E-HWCR)

Priyanka.M[1],S.Ramakrishanan[2] and N.R.Raajan [3]
[1]M.Tech (Embedded Systems), School of computing, SASTRA University, India
[2]Assitant Professor, School of Computing, SASTRA University, India
[3] Senior Assistant Professor, School of EEE, SASTRA University, India
Email: priyanka.mp08@gmail.com, srk@ict.sastra.edu, nrrajaan@ece.sastra.edu

Abstract: **With the advancement of electronics, the different technologies used in computer vision, helps to recognize a hand written character more effectively and yields a reliable output. Password protection is a current challenge and it has various methods involved in it. On-line hand writing character recognition using accelerometers is the basic proto-type for all the latest technologies. In this project, the recognition process is done by using a micro-electromechanical device (MEMS) Accelerometer and Microcontroller within built ADC and using I2C interface. The system uses processor to store the characters and it is interfaced to the computer for recognizing the data with any of Integrated Development Interface (IDE) as Visual Basic. There are advance techniques in research of password by studying blood veins of a person's palm, such as bio-metric techniques works on accelerometers in built.**

Key words: Accelerometers, Character Recognition, Handwriting, I2C, MEMS, Password

I. INTRODUCTION

Handwriting Recognition (HWR) is performed by computer systems to security and authentication purposes. Generally, a handwritten character is recognized by two methods. They are (1) Offline recognition and (2) Online recognition. Offline recognition is based on recognizing characters from a paper, pictures or from any hand written material, etc. This method involves a process of extracting information by evaluating the style, shape of character, edges, and curves of hand written material. Processing is done by Mat lab tools like image processing and stroke recognition. This whole system is effective but agonizingly slow manner process.

They are systems using bio-metric methods like finger print recognition process and advance systems by Intel labs of recognizing process of scanning a person's palm blood veins. Though this processes are quite responsive but yet costly.

The proposed system is an online hand writing character recognition. The character recognition is done by an MEMS accelerometer. This accelerometer is a 3D axial digital output and gives response for every slight deflection or movement in the system. It is developed by using MEMS technology. Micro Electro Mechanical System (MEMS) which is a multi chip approach using both sensing element on one chip and signal conditioning electronics on another chip. It is effective and gives high performance solution. The manufacturing process of MEMs describes both the type or device or sensor. There is a wide-scale acceptance of MEMS motion sensors like accelerometers, gyro meters and magnetometers used in automotive industry.

The system uses accelerometers motion axes values, to detect the slight variation in tilts of hand writing and send to the microcontroller. The controller here is Arduino UNO board. Arduino is a free source platform and it is developing environment. It is simple, clear and easy to program. The Arduino Uno is 1.0.3 released version. It has AVR Atmega328controller which runs at 16MHz. The microcontroller receives the tilt angle values and displays them using Visual basic or an LCD display. A simple character tilt values are stored and processed first and it compares regularly for the original value and displays every comparison matching in the Visual basic.

II. LITERATURE SURVEY

Accelerometer based gesture recognition is one of the widely implemented method in the recognition scenarios [1][2][3][4][6]. The gestures based systems are used for recognition of characters and gesture path of the hand. Accelerometer based systems are reliable, low in cost and highly effective. The authentication purpose based methods are also implemented using accelerometer. The gestured based device are done by using embedding accelerometer on a pen, camera, etc. The recognition system used many algorithms like hidden markov model algorithm. This algorithm is widely used in all the earlier survey work and to identify the algorithms. The gesture based system used in camera, by accelerometer also has used factors like feature extraction, applied for tracking the precise gestures. A mere application extended applications using wireless systems like GPRS, GSM, etc. The process of flow of this systems are created by studying different characters by hand gesture way of representing them. Certain characters are studied by interfacing them with accelerometers analyzing its

acceleration values. The three different acceleration values are positive, negative and zero. The flow of these values makes the system to identify and give feedback to the user. The other algorithms used for gesture based systems are cluster mapping, dynamic marking and soon. Thus, the related earlier works forms the base for the system to recognize the characters and detailed study of the system.

III. SYSTEM PROCESS

The Electronic hand writing and character recognition (E-HWCR) is a system in which works online pattern recognition. The system uses the accelerometer as the main sensor which collects the information of tilt while writing by human hand. The accelerometer here used is an ADXL345 from analog devices. It is a 3-axis digital output sensor. It is a small thin, low power which measures up to ±16g. It has both SPI and I2C bus supporting features. The output of any axis is analog voltage which is directly proportional to the acceleration in that axis. Acceleration values can be positive, negative or zero. So, the output voltage has a zero bias output. The output given at this point means zero acceleration in that particular axis. So, the zero point voltage is greater than output voltage, it indicates the negative acceleration.

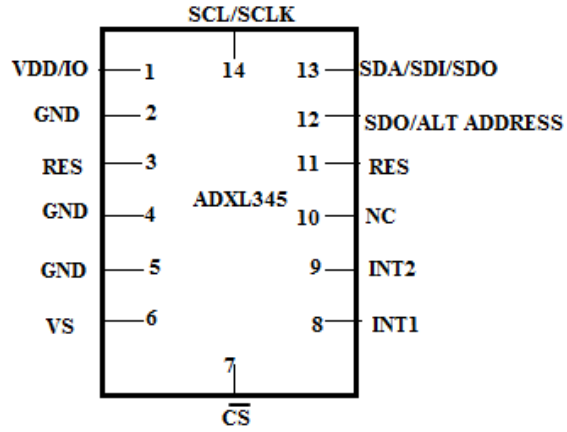

Fig. 1. Accelerometer pin diagram

The general gravity of earth is 9.81 m/s^2, thus the gravity accelerates at 1g or at 9.81 m/s^2. If the movement is upward 1g, then the sensor will detect 2g. Acceleration is measured relative to earth's gravity; hence acceleration showed in freefall is zero. For calculating the maximum acceleration it includes a maximum values from all axis =$\sqrt{X2 + Y2 + Z2}$. Tilt measurement is done when an object is tilted with respect to ground. The accelerometer works with three modes, they are Standby mode, auto sleep mode and Low power mode. In this project the ADXL345 is used as slave as I2C communication is used. The I2C bus is enabled only if the CS bit is enabled and made into active high to VDD/IO. It supports both the single and multiple byte reads/writes, with the ALT Address pin high, the 7-bit address for I2C device is 0X1D, followed by R/W bit. An alternate I2C address of 0x53 followed by R/W bit can be chosen by grounding the ALT address pin (12). This translates to 0xA6 for write and 0xA7 for read.

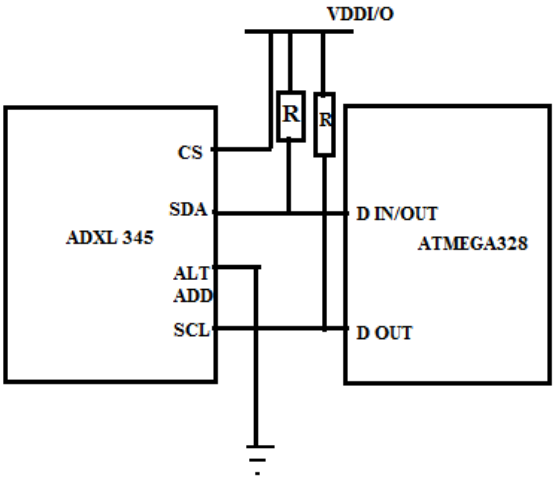

Fig. 2. I2C connection (0X 53 addresses)

The microcontroller used for processing is an AVR Atmega328 which is an 8-bit RISC controller which supports 10 bit resolution and 8 ADC channels and supports Twin Wire Interface (TWI) I2C bus communication. It has 23 general purpose lines and 32 general purpose registers. The micro controller is interfaced on Arduino board. This is a physical platform on which it has 14 input and output lines can be connected. The board will supports from 7-12volts of power supply, the sensor interfaced with the Arduino board uses only 3.3V of supply. The TWI pins are SDA and SCL pins of I2C bus communication. The Arduino is a free open source which helps in providing all the predefined library functions. So, for I2C communication the wire library will be used. The wire library has nine predefined functions like begin (), request from (), write (), etc depending on the usage of application. The IDE of the Arduino platform is a free source which can be easily downloadable for each board and latest version can be used. Every program has two main functions which define the complete initializing and processing of the application code. They are setup () and loop () functions.

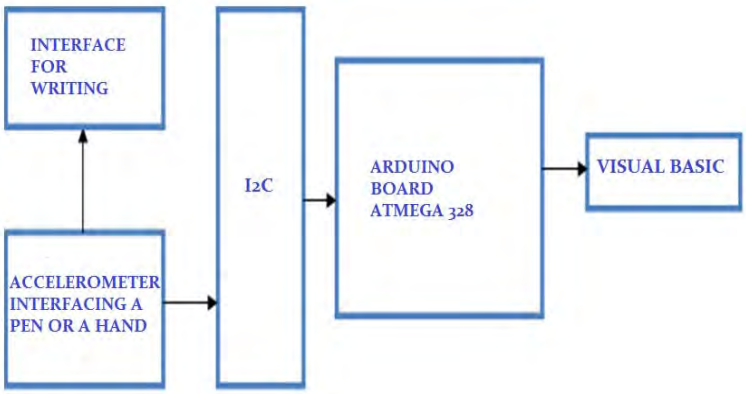

Fig. 3. Block diagram

The display is an Integrated Development Environment (IDE) is the Visual basic. It exhibits tilt angles of the accelerometers X, Y and Z axial movement changes and gives the comparative result.

IV. FLOWCHART

The flow chart given above explains the project flow in three different steps.

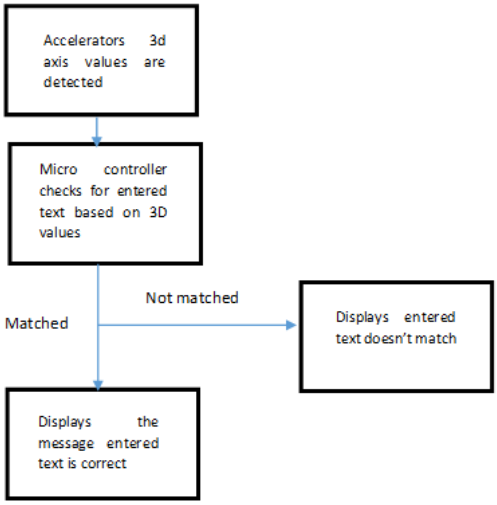

Fig. 4. Flow chart

Step1: In this step, the accelerometer is given power-supply it gets ON and upon the movement of the accelerometer it will provide various tilt angles in X, Y, Z axis respectively. Acceleration values can be zero, negative and positive. After getting accelerating value the sensor will send data to the microcontroller.

Step2: The microcontroller compares the current value with the stored value for a certain character.

Step3: This step, compares the values of tilt in microcontroller to the present value, if they matches then it is correct authentication. If any change in display will gives error in character entered or written.

V. RESULTS AND IMPLEMENTATION

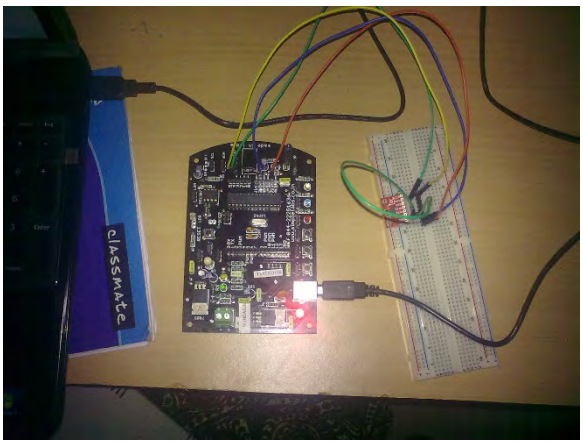

Fig. 5. Picture showing complete module setup

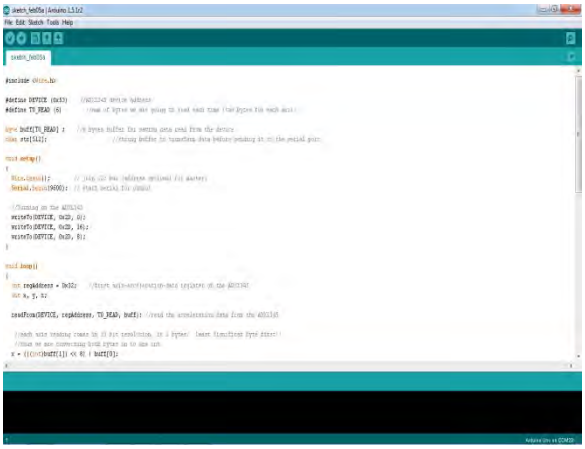

Fig.6. ARDUINO UNO stimulator

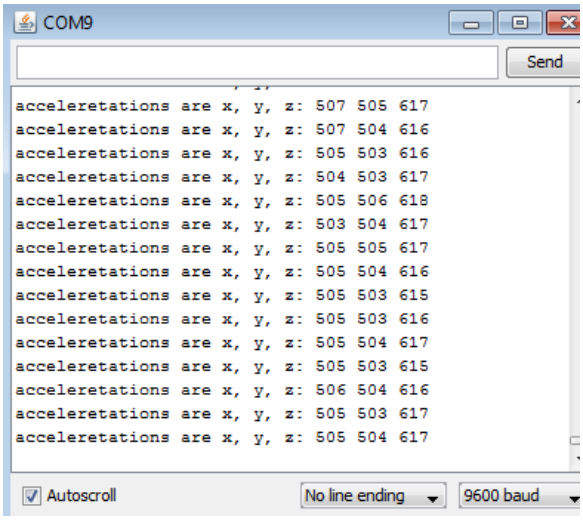

Fig.7. Accelerometer values in serial port of Arduino

VI. CONCLUSION

The advance technologies in the field of security system of verification of passwords exists and using hand writing in this process of recognition helps the user in making free from use of keypad and unique code. The usage of a simple sensor for this process helps for better, simple, and accurate way of verification.Existing

techniques are also unique but they are costly and implementation requires higher complex systems. As the system as both online and offline process of recognition it is an efficient and provides strong protection.

VII. REFERENCES

[1] Ruize Xu, Shengli Zhou, and Wen J. Li, Fellow, IEEE," MEMS Accelerometer Based Nonspecific-User Hand Gesture Recognition", IEEE sensors journal, vol. 12, no. 5, 2012.

[2] Ahmad Akl, Student Member, IEEE, Chen Feng, Student Member, IEEE, and Shahrokh Valaee, Senior Member, IEEE "A Novel Accelerometer-Based Gesture Recognition System", IEEE Transactions on signal processing , vol 59, no. 12, 2011.

[3] Xiang Chen, Xu Zhang, Zhang-Yan Zhao, Ji-Hai Yang, Vuokko Lantz, Kong-Qiao Wang," Hand Gesture Recognition Research Based on Surface EMG Sensors and 2D-accelerometers", Wearable Computers, 2007 11th IEEE International Symposium, pp: 11 - 14 ,2007.

[4] Xu Zhang, Xiang Chen, *Associate Member, IEEE,* Yun Li, Vuokko Lantz, Kongqiao Wang, and Jihai Yang," A Framework for Hand Gesture Recognition Based on Accelerometer and EMG Sensors", IEEE Transactions on Systems, Man and Cybernetics, Part A: Systems and Humans, pp: 1064 – 1076,2011.

[5] Jeen-Shing Wang, *Member, IEEE,* and Fang-Chen Chuang," An Accelerometer-Based Digital Pen With a Trajectory Recognition Algorithm for Handwritten Digit and Gesture Recognition", IEEE Transactions on Industrial electronics pp: 2998 – 3007, 2012.

[6] Sigal Berman, Member, and Helman Stern, Member," Sensors for Gesture Recognition Systems", IEEE Transactions on sysytems , man and cybernetics, pp: 277 – 290,2012.

[7] Zhang Xu, Chen Xiang,Wang Wen-hui, Yang Ji-hai, Vuokko Lantz, Wang Kong-qiao," Hand Gesture Recognition and Virtual Game Control Based on 3D Accelerometer and EMG Sensors", Proceedings of International conference on Industrial user interface,pp:401-406,2009.

[8] Jiayang Liu Lin Zhong, Jehan Wickramasuriya,Venu Vasudevan," User Evaluation of Lightweight User Authentication with a Single Tri-Axis Accelerometer", Proceedings of the 11th International Conference on Human-Computer Interaction with Mobile Devices and Services, pp:109-473,2009.

[9] Christoph Amma, Tanja Schultz," Airwriting: Demonstrating Mobile Text Input by 3d-Space Handwriting Recognition" Proceedings of International conference on Industrial user interface, pp: 319-320,2012.