GESMO- MOtion GESture based Mobile Application

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ABSTRACT

There has been number of android mobile apps available for clients to solve their daily problems. This paper presents a Motion Gesture based mobile (GESMO) app in Android which allows user to draw gestures in the air resulting opening of a desired app assigned to corresponding gesture. This gesture may be the first letter of an app name which is to be launched. In order to start the motion, user must press and hold any point on the screen until the motion is completed. Once motion completes, it is released. For sensing the motion, we used two built-in sensors from mobile devices: accelerometer and gyroscope. The paper proposes a two-stage approach for spotting and recognition of generated stroke gesture. The spotting stage uses a Support Vector Machine (SVM) to identify data fragments containing one stroke gesture. The recognition stage uses Hidden Markov Models (HMM) to generate the text representation from the motion sensor data. With this technique, you can successfully receive 70-80% accuracy in detecting an air gesture for mobile devices.

General Terms

Mobile Application Development, Pattern Recognition et. al.

Keywords

Motion Sensors, Air Gestures, Support Vector Machine (SVM), Hidden Markov Models (HMM).

1. INTRODUCTION

Mobile computing is the most interesting and enterprising topic in the current era of research and innovation. Mobile computing is defined as a computation on mobile devices such as mobile phones, tablets and smart phones. In present times, everyone is addicted in using mobile devices; however they are useful in our daily life to accomplish needful tasks by sitting at home on finger touch. Almost from child to adult people rely on these devices to complete their work. These mobile devices require operating system to run their applications. There are number of mobile operating systems available like Google's Android, Nokia's Symbian, Apple's IOS, Microsoft's Windows Mobile, Palm OS, Samsung's Bada, etc. But Google's Android is the most popular operating system for mobile devices all over the world [1]. In actual, Android was developed by Andy Rubin in 2003 at a small start-up company named Android Inc. In July 2005, Google purchased Android and in collaboration with Open Handset Alliance (OHA) released their first official version in 2007 called Cupcake. This OHA consists of more than 80 companies including Motorola, Sony, etc. and it is led by Google Inc. Android comprises not only operating system but also middleware and key applications. The latest release of Android operating system is Marshmallow 6.0

2. RELATED WORK

Gesture recognition in the air is very famous and innovative area of research in the field of computer science and language technology; also it added many applications in ubiquitous computing environment.

Ankita Saxena et al. presented [2] technique for gesture recognition which uses artificial neural network among back propagation algorithm. This technique consists of five phases: image acquisition, image preprocessing i.e. image detection, thining, hand token, training data and recognition. They used Sobel detector for detecting edges of an images.

Jiahui Wu et al. proposed [3] an acceleration based gesture recognition approach called Frame Based Descriptor and multi-SVM (FDSVM) which needs only a wearable 3-D accelerometer as a requirement. This system has four main components: acceleration data acquisition, feature extraction, training phase, and recognition phase. This paper concluded stating SVM gives better results than other four methods including HMM in user- independent and user-dependent cases.

Sandip Agrawal et al. proposed [4] technique to mimic a pen called PhonePoint Pen for giving input to mobile devices. They tested this technique through Nokia 95 Model and detected the alphabets created in the air. They defined new metric called Character Recognition Accuracy (CRA) and tested this accuracy for model.

Po-Kuan Huang et al. proposed [5] stereo matching model which optimized for 3D hand gesture recognition system. They implemented gesture mouse application which accepts depth map video stream. This enables user to give finger clicks and use regular mouse functions.

Christoph Amma et al. presented [6] new input method for mobile device by creating air gesture with the use of inertial sensors at the back of hand. They used HMM in recognition phase to generate the text representation from the motion sensor data. A statistical language model is used to enhance recognition performance and restrict the search space.

Meenaakumari and Muthulakshmi presented [7] Micro Electro Mechanical Systems (MEMS) accelerometer for character gesturing sensing and sent information to computer for trajectory algorithm. This algorithm consists of information assortment algorithm, signal preprocessing. etc. After completing the above survey, we decided to provide innovative input methodology to mobile devices.

3. MOTION GESTURE BASED MOBILE APPLICATION (GESMO)

3.1 Requirements

We implemented GESMO using Android SDK 4.3, Eclipse IDE and testing done on MicroMax A106 smart phone. This application requires accelerometer and gyroscope sensors in mobile phone to run it.

3.2 Architecture & Flowchart of GESMO

Figure 1. shows the block diagram of GESMO application. The main stages of this app are detection and recognition of gesture made in the air, assign desired app to made gesture, compare and open the desired app. Initially, this detects and recognizes the gesture in which the user desires to make in the air, and then assign this gesture for any app. Next store that pattern and application in SQLite database for future comparison as shown in Table I consisting application name, package name and air gesture pattern. Then if user wants to open a particular app, he must gesture or draw that pattern in the air; at this moment system compares this pattern with predefined gesture from the SQLite database. When both the gestures match, open the desired application. We represented the above discussion using flowchart given in figure 2.

Table 1. Patterns in Database

Id	Application Name	Package Name	Air Gesture
1	whatsapp	com.whatsapp	w
2	MX player	com.mxtech.vedeoplayer.ad	m
3	---	---	---

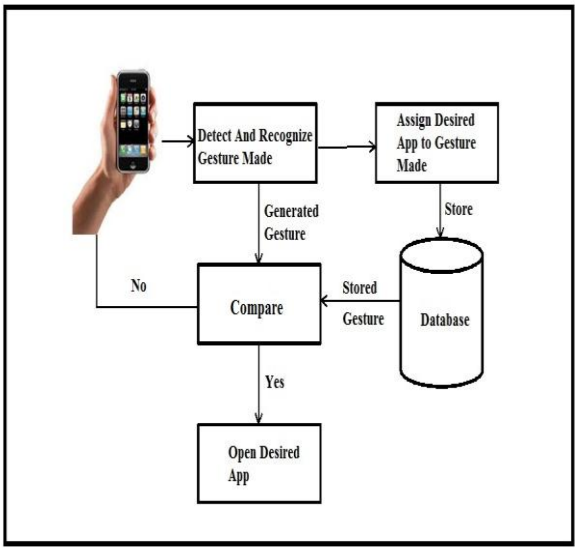


Fig. 1. Block Diagram of GESMO

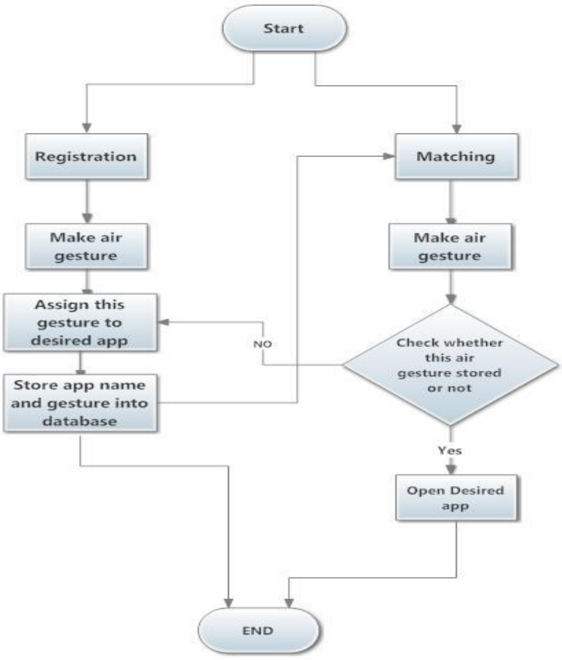

Start
Registration
Matching
Make air gesture
Make air gesture
Assign this gesture to desired app
NO
Check whether this air gesture stored or not
Store app name and gesture into database
Yes
Open Desired app
END

Fig. 2. Flowchart of GESMO

For GESMO, we make use of in-built accelerometer and gyroscope sensors from the mobile devices. Here an accelerometer and gyroscope sensors are hardware sensors. An accelerometer measures linear acceleration (eg. Shake) and gyroscope sensor measures angular acceleration (eg. tilt). Accelerometer sensor provides continuous data as we require this sensor data further. For classification we used the Support Vector Machine (SVM) algorithm. To collect sensor data for SVM we used the touch event. When user holds touch screen event till one releases their finger from the screen, all the continuous stream of sensor data are to be stored in arraylist. At the end of this, sensor data and application name is stored into database. To open the required app, we used Hidden Markov Model (HMM) algorithm in recognition phase [6]. When user creates gesture in air then this gesture pattern compares with all gesture pattern stored in the SQLite database. Suppose SQLite database contains 5 stored gestures and when user creates a gesture in air then this gesture is compared with the all 5 stored gestures and calculates the percentage of matching. If percentage of matching is greater than 70% then required application will be launched.

4. RESULTS AND DISCUSSION

4.1 Accelerometer reading

This section presents graph showing values generated by Accelerometer sensor in the mobile device. Figure 3 shows the graph of accelerometer sensor values. Accelerometer sensor contains the three dimensional axes i.e. x, y, z. Using these axes we plot a graph in which red lines shows the x axis, green lines shows the y axis and blue lines shows the z axis.

x - Red
y - Green
z - Blue

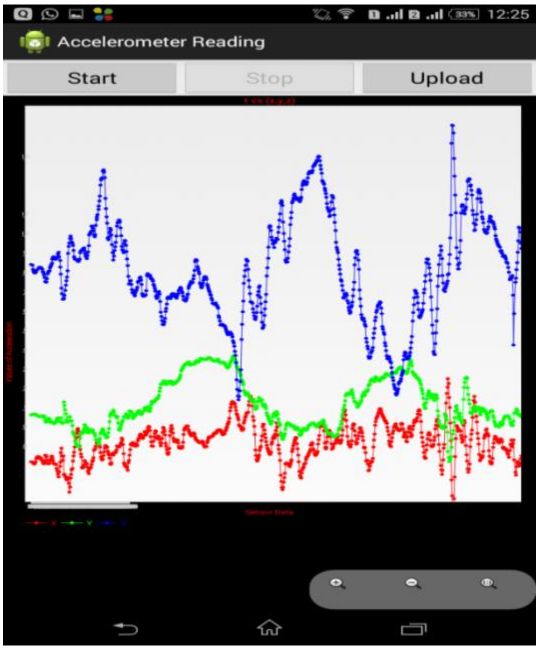
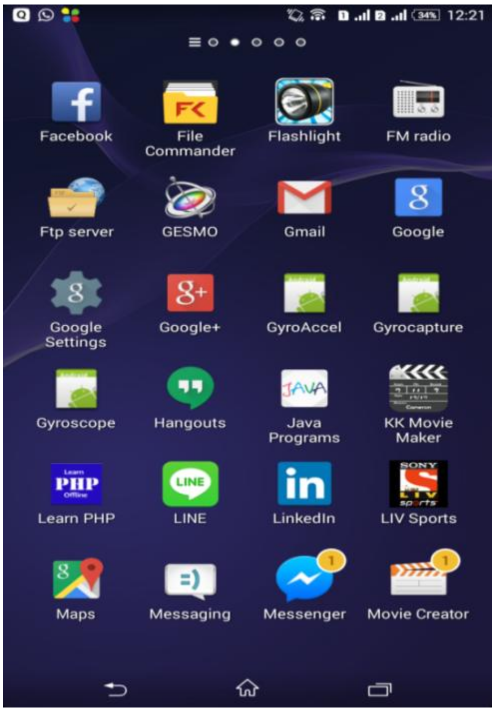


Fig. 3. Accelerometer Reading

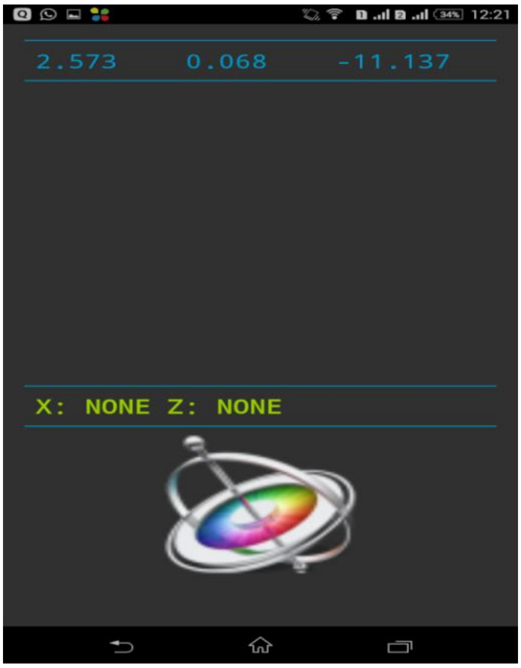
4.2 Snapshots of GESMO application

Figure 4 i) shows the launcher icon of GESMO. After clicking this icon of app on app screen, home screen of GESMO is displayed to user. This GESMO icon indicates that GESMO app is successfully installed in smart phone. This icon gives shortcut to user to launch this application.



GESMO launcher activity

Figure 4 ii) shows the home screen of GESMO android application. At the top of this screen, values of x, y, z axes of an accelerometer are displayed. Below these values we provided one list view that shows the air gesture stored for the said application. The list view displays name of android application and inside the square bracket we display initial letter of application. At the bottom of home screen, it provides the touch event so that user can touch on this screen to make gesture in the air. When user releases the finger from screen air gesture it will be stored into the database.



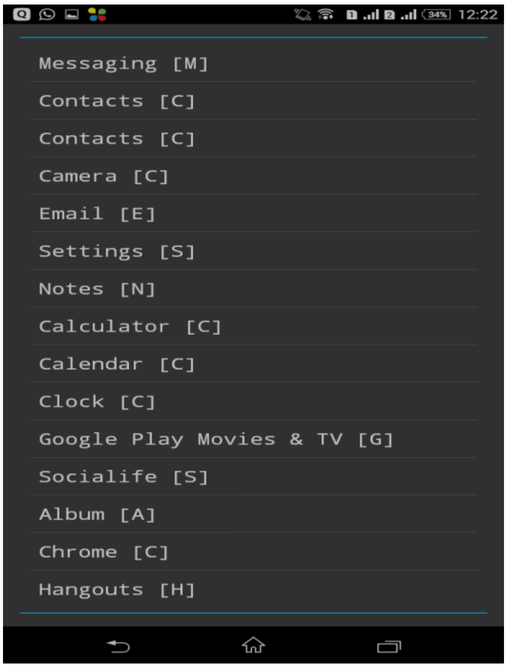
```
2.573        0.068        -11.137

X: NONE  Z: NONE
```

ii) Home Screen

Figure 4 iii) shows the single screen i.e. Activity. This Screen displays the list of all android applications pre-installed in smart phone. This screen appears after the above screen and

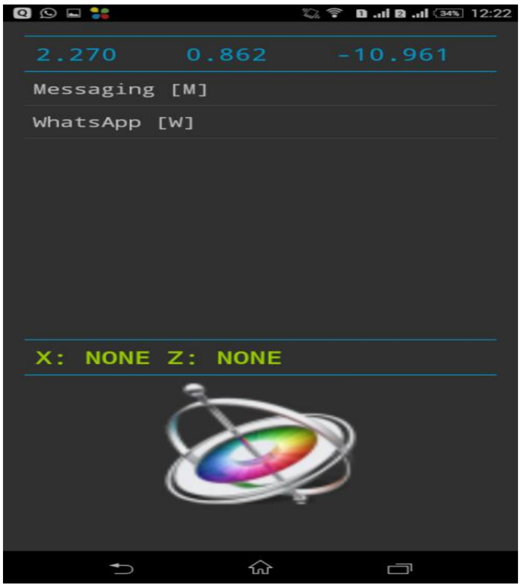
here, user selects one particular application from the list. The name of the application and air gesture is stored into the database.



```
Messaging [M]
Contacts [C]
Contacts [C]
Camera [C]
Email [E]
Settings [S]
Notes [N]
Calculator [C]
Calendar [C]
Clock [C]
Google Play Movies & TV [G]
Socialife [S]
Album [A]
Chrome [C]
Hangouts [H]
```

iii) List of installed App

Figure 4 iv) shows the current status of GESMO indicating that the air gesture M is stored for launching Messaging application similarly air gesture W is stored for launching WhatsApp application. If user wants to delete this applications from GESMO database then this name of application and air gesture pattern is deleted by simply clicking on this list view. Figure 4 v) and vi) shows Messaging application and WhatsApp are successfully launched by using GESMO application.



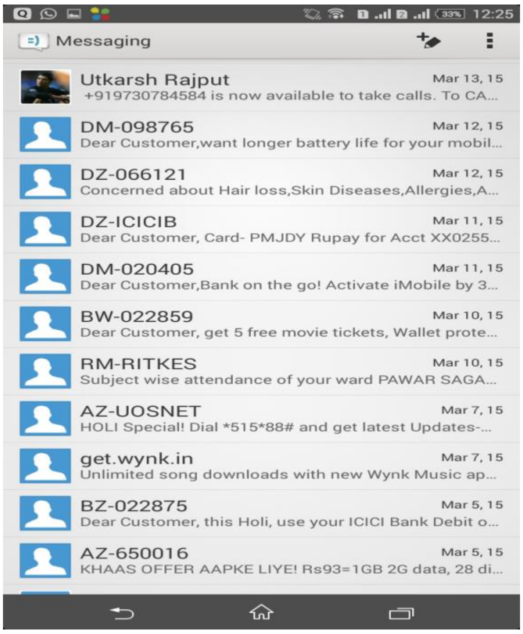
2.270 0.862 -10.961

Messaging [M]

WhatsApp [W]

X: NONE Z: NONE

iv) Home Screen with Defined Gesture



Messaging

Utkarsh Rajput — Mar 13, 15
+919730784584 is now available to take calls. To CA...

DM-098765 — Mar 12, 15
Dear Customer,want longer battery life for your mobil...

DZ-066121 — Mar 12, 15
Concerned about Hair loss,Skin Diseases,Allergies,A...

DZ-ICICIB — Mar 11, 15
Dear Customer, Card- PMJDY Rupay for Acct XX0255...

DM-020405 — Mar 11, 15
Dear Customer,Bank on the go! Activate iMobile by 3...

BW-022859 — Mar 10, 15
Dear Customer, get 5 free movie tickets, Wallet prote...

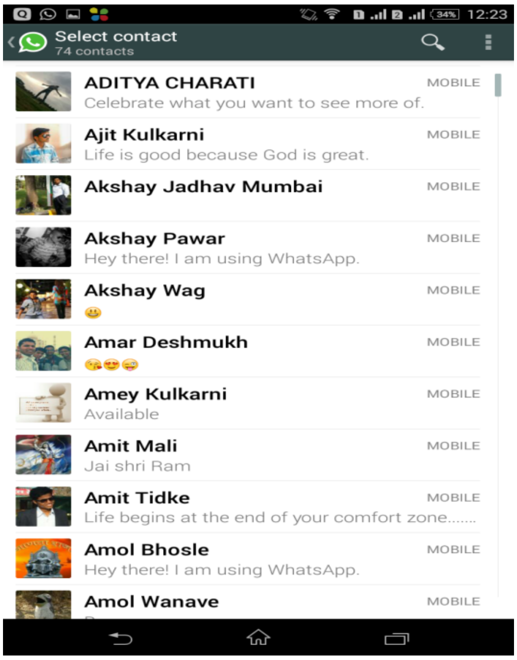
RM-RITKES — Mar 10, 15
Subject wise attendance of your ward PAWAR SAGA...

AZ-UOSNET — Mar 7, 15
HOLI Special! Dial *515*88# and get latest Updates-...

get.wynk.in — Mar 7, 15
Unlimited song downloads with new Wynk Music ap...

BZ-022875 — Mar 5, 15
Dear Customer, this Holi, use your ICICI Bank Debit o...

AZ-650016 — Mar 5, 15
KHAAS OFFER AAPKE LIYE! Rs93=1GB 2G data, 28 di...



Select contact
74 contacts

ADITYA CHARATI — MOBILE
Celebrate what you want to see more of.

Ajit Kulkarni — MOBILE
Life is good because God is great.

Akshay Jadhav Mumbai — MOBILE

Akshay Pawar — MOBILE
Hey there! I am using WhatsApp.

Akshay Wag — MOBILE
😃

Amar Deshmukh — MOBILE
😘😍😜

Amey Kulkarni — MOBILE
Available

Amit Mali — MOBILE
Jai shri Ram

Amit Tidke — MOBILE
Life begins at the end of your comfort zone.......

Amol Bhosle — MOBILE
Hey there! I am using WhatsApp.

Amol Wanave — MOBILE

v and vi) Launched Applications

Fig. 4 Snapshots of GESMO app

5. ADVANTAGES AND DRAWBACKS OF GESMO

- Helpful for blind people.
- It feels more natural and cool app.
- New Technology for launching android application.
- User can store single stroke English letter as an air gesture for launching android application as well as user can store alphabets in Marathi and shapes e.g. Triangle, square.
- Useful in emergency without display screen.

To run GESMO, there must be accelerometer, gyroscope sensor embedded in your Smartphone. There is scope to improve this input technology by using other type of sensors.

6. CONCLUSION AND FUTURE WORK

The paper presents a mobile application which attempts to exploit the inbuilt mobile sensors accelerometer and gyroscope to detect one stroke gestures made in air with the help of mobile. In order to identify start and end point of motion, we provide press and hold mechanism. Hence user is able to draw one stroke letter in an air to open a corresponding app. Here the recognition rate of most of the gestures is between 70-80 % which is an acceptable range. Also, we have given flexibility to user that in which they can decide letter for his app. This is useful when there are more than one applications starting with same letter. In near future we will be aiming to recognize multi stroke letters and words which will be more complex. Also, for authorization we are planning to support signature gestures to get the secure access of mobile device.

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