

# WHITE PAPER – Need for Gesture Recognition

April 2014

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## Abstract

Gesture recognition is the process of understanding and interpreting meaningful movements of the hands, arms, face, or sometimes head. It is of great need in designing an efficient human-computer interface. The technology has been in study in recent years because of its potential for application in user interfaces.

Gesture recognition is one of the main areas of research for the engineers and scientists. It is the natural way of human machine interaction. Today the industry is working on different application to make interactions more easy, natural and convenient without wearing any extra device.

There are many key top players in gesture recognition systems who have marketed their solution for various facets. The key vendors in gesture recognition space include Cognitec Systems GmbH, eyeSight Mobile Technologies Ltd., GestureTek Technologies Inc., Omek Interactive Ltd., PointGrab Ltd., PrimeSense Ltd., and SoftKinetic Inc. Some more to name are Intel Corp., Qualcomm Inc., and Thalmic Labs Inc...

In this paper we present what gesture recognition technology is all about and conceptualizing an ideal approach for gesture recognition.

## What is Gesture Recognition?

Gesture recognition is to recognize specific human gestures and process them to control device. In gesture recognition, the human gestures are transmitted via special glove or read by a camera. The captured data is processed and used as an input to handle applications or devices.

On the basis of data acquisition, the gesture recognition is categorized into Glove based and Vision based gesture recognition system.

A **Glove-Based** Gesture Recognition system consists of glove or sensors for data processing and power supply. The glove which is worn by the user extracts the configuration of user's hand along with the motion. The users are required to wear additional equipment which may feel cumbersome and disturbing, burdening the actual interaction. Because of which they are unfit for spontaneous interaction due to the high overhead of engagement.

Example, "Acceleglove" created by George Washington University translates American Sign Language gestures into text. There are a series of accelerometers on each finger of the glove and other sensors on the shoulders and elbows to send electrical signals to a microcontroller. It then interprets the action associated with the gesture.

**Vision-based** techniques use visual inputs like camera to extract the features to be used in the gesture recognition.

Vision-based techniques do overcome the problem of Glovebased techniques, but are occupied with other problems. Portability is an issue for most vision systems that require still placements of the video cameras. Processing video information has several problems as they are highly dependent on environment, light conditions, video camera settings.

For example, in Kinect for Windows applications, the user can interact naturally with the computer using simple gestures. Xbox Project Natal allows the user to interact with the display without requiring any controller which gives a feeling of natural interaction. To kick a ball on the screen, the user will have to perform a kick motion.

## Market Trends

The market is changing rapidly due to evolving technology and more and more OEM's are moving towards gesture recognition technology adoption.

As per a report published by Markets and Markets, the gesture recognition market is estimated to grow at a healthy CAGR from 2013 till 2018 and is expected to cross \$15.02 billion by the end of these five years. Analysts forecast the Global Gesture Recognition market to grow at a CAGR of 29.2 percent over the period 2013-2018.

If we talk in terms of industry, then currently consumer electronics application contributes to more than 99% of the global gesture recognition market.

As per the report published, the Healthcare application is expected to emerge as a significant market for gesture recognition technologies over the next five years.

The automotive application for gesture recognition is expected to be commercialized in 2015.

Eye movement is emerging as a new sensing modality for gesture recognition. The data is captured using an electrooculography (EOG) system.

Cybernet released NaviGaze using which users can handle applications mouse with eye movement. The clicking of mouse is handled with eye blinks.

As per a report generated by Biometrics Research Group, Inc., eye gesture movements will have major role in future mobile applications.

- Current solutions are specific to underlying hardware
- Pre-defined camera in a solution
- Solutions designed for specific OEM

## Factors driving the need for a Solution

There are many solutions provided by top vendors which cater to the business need of gesture recognition. Each solution comes with one or more shortcomings.

The solutions available are closely coupled with the underlying hardware. It allows almost no flexibility for using it with any other hardware. This is one of the major factors which makes it impossible to port gesture recognition application developed on one platform to another.

Solutions available in the market today come up with a list of pre-defined cameras. The camera interface is either integrated into the solution or is supported by the solution. Gesture recognition applications built using these solutions are bound to use the specified set of cameras. The applications are highly dependent on camera capability and the application development is limited by the set of features camera is offering.

There could be a situation where the hardware (camera) is already in place but the solution required to build the gesture recognition application does not support the camera which results in extra hardware cost. Today's solutions are highly dependent on camera and do not allow the flexibility to use any other camera.



Gesture recognition is spanning its wings across various industries like automobile, healthcare, media etc. Solutions available today are targeting specific market area. The leading vendors are offering solutions which cater to the need of specific OEM. If the solution is designed for developing gesture recognition application for automobile, it will have the SDK designed specifically for automobile gesture recognition applications. If a solution is targeting healthcare, it will have gesture detectors specifically for developing healthcare gesture recognition applications.

- Multiplatform
- Standardized APIs
- Scalable
- Shortened time to market
- Saves development time and effort

## The Solution

A Solution for ALL that revolutionizes the human machine interaction. It aims at overcoming the pitfalls of the solutions available today and caters to the market need.

One such concept has been proposed by the HCL Practice. The concept behind it is to create a library of gesture recognition algorithm implementation that can be exposed through standard APIs. Unlike other in-market solutions which are tightly coupled with the underlying hardware, this kind of solution should be supported on multiple hardware platforms and hence provide hardware scalability. The solution is a middleware which acts as a glue between the underlying hardware and gesture recognition application. It offers the flexibility of porting the application developed on top of the solution to another hardware platform.

This solution aims at assisting development of video-based gesture recognition applications. It therefore will not require any markers or special gloves to obtain the input from the user.

Today's solutions support only a set of pre-defined cameras. This solution will support many widely used cameras and will allow the developers to use camera from a wide range of choice. The application developed is not restricted with the

camera capability. It therefore allows full usage of the capabilities of the camera like depth-sensing, short-range.

This solution should aim at reducing the development time and effort. This in turn makes the application ready for market in a short span of time. The solution allows the developer to focus on the application and the underlying algorithm implementation is taken care by the solution.

There is always a need of more in every aspect. The solution should be scalable to cater to everybody's need. This can be achieved by designing the solution in such a way so as to add more and more gesture detectors in future.

The solution designed should cater to the need of majority of the market. The interfaces of the solutions need to be implemented in a way that facilitates its usage across various industries like automobile, healthcare.

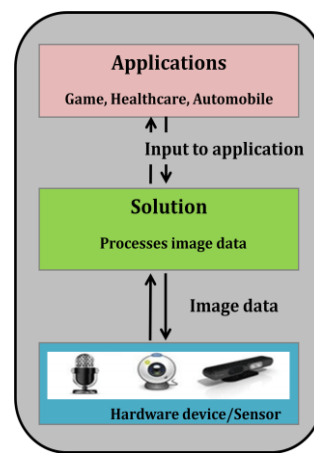
- Layered
- Glue between the hardware and gesture recognition application

## Architecture

The solution should act as a middleware to form glue between platform and application.

A sensor collects and sends raw data to the solution.

The solution is a middleware that sits between the platform and application.



It receives raw data from the sensors, processes and sends high level data to application.

Various vision based gesture applications for markets such as TV, automobile, healthcare, and many others can be built on top of the solution.

## Solution implementation

- ✓ Acquires input from widely used/supported cameras.
- ✓ It is vision-based and hence does not require markers, special gloves
- ✓ Does not require calibration
- ✓ Gesture recognition applications built on top of the solution takes advantage of the APIs provided by the solution to convert the gesture into deterministic inputs.

## Solution Offerings

- ✓ The aim of this solution is to reduce the complexity of using gesture recognition algorithms.
- ✓ Provides the developer with easy-to-use APIs for gesture control.
- ✓ Shifts the focus of application developer from algorithm complexity to usage of these algorithms
- ✓ Allows users to intuitively interact with the device.
- ✓ No mouse, no keyboard and no controller needed. Simple hand and face gestures are used to communicate with the device.
- ✓ Provides scope to develop a wide range of applications using natural gesture control.

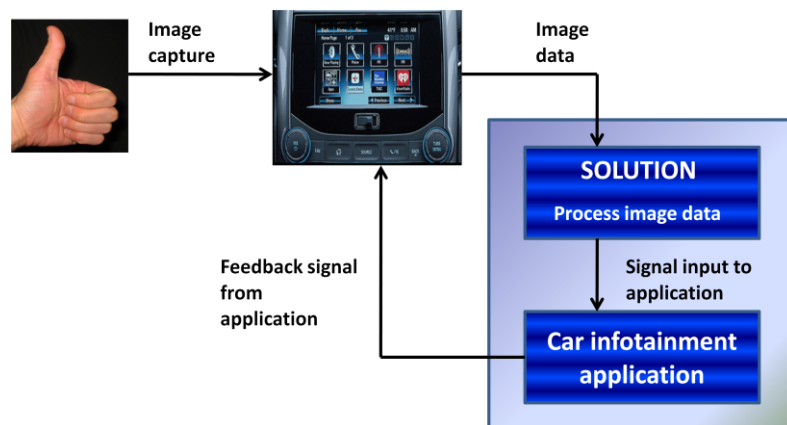
One can think across the boundary to use the solution in video-based gesture recognition application.

## Application Development

The solution effectiveness is judged by the solution usage.

The aim of the solution will be to allow developers to easily create a variety of natural gesture control applications such as games, consumer electronics, and car infotainment solution.

Let us consider the application example of car infotainment solution to illustrate how effectively this ideal solution will be used. Automobile manufacturers are benefitted with gesture recognition as the technology is adding more value to their offerings. Intuitive car infotainment solutions enable the user to explore maps, toggle menus and radio stations using simple gesture control.



The solution will serve as a wrapper in developing car infotainment applications. We are developing car

infotainment solution that allows the user to toggle radio station menu using simple hand gestures.

The hand gestures used to access the car infotainment system is listed in the Table 1. There is one-to-one mapping of hand gesture with the radio station menu function.

Hand gesture input	Car infotainment application output
Thumb down	Decrease volume
Thumb up	Increase volume
Left to Right	Select previous song
Right to Left	Select next song

Table 1: Hand gesture for car infotainment solution

The solution will aim to provide high level APIs allowing the development of car infotainment application easily and quickly.

Since, the solution will not be camera dependent, it offers the vendor the flexibility to choose from a wide range of choice.

## Conclusion

According to the Markets and Markets analysis, the growth of gesture recognition is going to be huge. So, we have a huge opportunity to play in this technology.

The end user is now moving towards a whole new path of human machine interaction. This is creating a demand for enabling gesture recognition in every facet of market.

The solution we are proposing will have a mammoth place in gesture recognition market. Using the solution, we can develop easily and quickly gesture recognition applications for various industries. The solution will aim to develop business tie-ups with major OEMs.



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## Author Info



Harsha Vachher has been working with the ERS Practice Team as a Technical Lead, helping to drive forward a number of new internal initiatives.



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