# Supporting Collaborative Multi-User Interactions in a Video Surveillance Application Using Microsoft Tabletop Surface

By

SHAKHNOZA KHAMDAMOVA

Dissertation submitted in partial fulfillment of the requirements for the

Bachelor of Technology (Hons)

(Business Information System)

FINAL YEAR PROJECT II

SEPTEMBER 2014

Universiti Teknologi PETRONAS

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CERTIFICATION OF APPROVAL

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Approved:

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(Dr. Suziah Sulaiman)
Project Supervisor

UNIVERSITI TEKNOLOGI PETRONAS

TRONOH, PERAK

## CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

Shakhnoza

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Shakhnoza Khamdamova

# ABSTRACT

This report examines the progressing exploration done on my chosen subject, which is A Multi-touch Interface in a Video Surveillance System. It discusses method of early prototype interacting with security surveillance footage using natural user interfaces instead of traditional mouse and keyboard interaction. Current project is an evidence of idea on exhibiting that multi-touch interfaces are helpful in a video surveillance system to specifically control the surveillance videos, both of the live or of recorded. In case of any occurrence, this proposed system of interaction may require the user to spend an extra time amounts time obtaining circumstantial and location awareness, which is counter-beneficial. The framework proposed in this paper show how a multi-touch screen and natural interaction can empower the surveillance observing station users to rapidly recognize the area of a security camera and proficiently react to an occurrence.

One of the main objective of this project is to engage more than 1 user to perform moving, scaling, rotating ,highlighting and recording on a surveillance video in the meantime, particularly during emergency periods. Furthermore, the scope of study for this project is to improve user collaborative interactions on Microsoft tabletop surface .A methodology was developed based upon a combination of the available literature and the experiences of the authors, who are actively involved with the development of multi-user interactions. This will cover many parts such as surveys, data gathering from respective Subject-Matter Experts, focal points, and analyzing information. It is intended to have a Surveillance application with user friendly collaborative touch on surface and eye-catching interface to reflect the quick paced nature of today's correspondences and better advertise its new activities and accessible assets. The future improvements and plans have been recommended and discussed in the recommendations section. Up to now, this research report has been run for twelve (12) weeks and going to be continued running for sixteen (16) weeks with a specific end goal to attain project primary objectives.

# ACKNOWLEDGEMENTS

I would like to take this opportunity to express my appreciations and acknowledgements to the following people for their support and assistance through my first part of Final Year Project.

The special acknowledgments go to my supportive supervisor, Dr. Suziah for guiding and supporting me to complete my Final Year Project. Her supervision and support contributed truly help the progression and smoothness of the FYP I & II and its elements.

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# TABLE OF CONTENTS

**LIST OF FIGURES**

# CHAPTER 1

## INTRODUCTION

## 1.1Background of Study

From the earliest starting point of the machine time, human-machine interfaces are one of the perspectives that never got genuine advancement in time. These days, the majority of the activities performed with the aid computer are still fulfilled by keyboard and mouse. Regardless of the possibility that they were loyal associates for a long time, they confine and keep the advancement of human-computer collaboration, on the grounds that such gadgets tie clients to adjust to them. It would be simpler in the event that we could utilize all the five senses when we need to relate with a machine frameworks, for instance manipulate the images by the fingers or making a surgical operation through a touchable and sensible to the weight screen. Numerous examines uncover that the utilization of fingers would be a most effective include route contrasted with traditional gadgets. There is an entire exploration territory that studies the relationships among brain and fingers and arm muscles. Card et al. demonstrate that the fingers' muscles are controlled by a vast region of cerebral cortex committed to the engine framework. As backing of this exploration, Zhai et al. present an analysis in which they uncover that person have the capacity finish an activities, in the same way as move a 3d cursor in excess of 3d figures in a space, utilizing just the muscle gatherings of fingers, rather to utilize the muscle gatherings of arms. Moreover, studies by Balakrishnan et al. demonstrate that the after effects of Zhai et al. are reachable with the co-operation of a few fingers. Therefore, the significance of another sort of collaboration with computers, the multi-touch interaction.

Instead of reacting to the vicinity of a solitary finger, multi-touch technology screens can take after the directions of numerous fingers at the same time. Multi-touch registering could one day

free us from the mouse as our essential machine interface, the way the mouse liberated us from keyboards.In 2006 multi-touch innovation demonstration, Jeff Han revealed the natural user interface as the future of computer interactions .The 2007 presentation of the apple iphone which concentrated altogether on multi-touch connection, set another standard for organizations such as Google, Microsoft to offer the new collaboration strategies in their future items, i.e. android based cell telephones, the Xbox kinect, Microsoft surface, Google glass. As the natural user interface adoption is growing quickly so we have to center our consideration of how we can actualize natural interaction system with vigorously utilized frameworks such as video surveillance. In a paper from Kin , it was presumed that assignments on a computer were finished quicker with a multi-touch screen contrasted with a mouse and keyboard communication. Actually, there was a 80% expansion of productivity with the utilization of a natural interaction compare to current mouse and keyboard based connection. Sulaiman et al, have investigated the utilization of multi-touch surface to control video surveillance footage. In their examinations, they give the client a multi-touch table as the intends to connect with surveillance videos. After user testing, clients agreed that natural user interfaces ought to be actualized to cooperate with video surveillance systems. The analysts have likewise watched an increment in productivity of finishing undertakings, for example, moving, scaling features on multi-touch surface as expected to the current mouse and keyboard interaction.

From past studies, it was distinguished that the worldwide business for video surveillance system is relied upon to develop by additional than 80% by 2018.However , this fact is not astonishing because of the upgrades in computer software and lessened expenses of assembling and executing such system . Video surveillance is a key apparatus for securing individuals and property all day night. The expanding accessibility along these lines, lower expense of higher-quality cameras makes enhancement of the viability in video more competitive. Because of the competitiveness of high quality surveillance systems, which are fit for distinguishing numerous peculiarities of an environment than in the later past, has seen numerous organizations, of all shapes and sizes, embedding these frameworks to expand security and diminish loses. In the act of video surveillance system, it is by and large acknowledged that time mitigates danger, implying that over the long period the dangers are lessened. High-hazard occasions are distinguished rapidly and could be responded upon rapidly, though generally safe occasions may

take weeks to figure it out. Lower-hazard occasions, for example, slip-and-fall cases, can even be documented months after the occurrence. Nonetheless, the expense of putting away observation information stays consistent from the very beginning, driving up capacity necessities and plan. The more extended kept information, the more storage required, which makes the expense higher. This strengths retailer into exchange offs for high storage expenses, grainy feature, or prematurely erased information.

Another nonmotion information innovation called Motion Optimized Recording (MORe) takes the discovery to the following level by taking out the requirement for record on movement. This disposal spares cash while giving full assurance to the retailer. This video storage method figures out whether there is movement. On the off chance that no movement is distinguished, the framework applies much higher layering and lower casing rates to these nonmotion periods of feature, drastically decreasing the span of the video. In this manner, the capacity required is likewise lessened. This makes the putting away of nonmotion-arranged feature practically free (i.e. adding short of what 3% to the required storage room). Retail surveillance users are able to get the security of holding everything with more noteworthy storage funds than "just record on movement" without the danger of untimely video information cancellation. Recent investigation into video surveillance system has so far been as well centered on automation and 3D visualizations. Video surveillance automation has been discussed from different points of view, from recognizing persons, suspicious items activities and anomalies. On the other hand, research into 3D visualizations, has concentrated on setting the video surveillance camera as a 2D plane onto 3D models, and all the more as of late mixing the perspective of a camera on the surfaces of 3D models. This Market is a novel methodology for future, as computerized reasoning later on may be produced enough to uproot the requirement for a human info. However, this is not valid for the not so distant future, in spite of the fact that there is an agreeable expands in the abilities of workstations, it is important to have a human enter currently recognizing what's more making important moves to determining an occurrence. With current advanced technology, we can observe that IP-based video surveillance in substantial utilization. IP based technology makes it possible to access the video features in current time without the requirement for exceptional equipments which was once needed. The adaptability of using live feeds either over by regional standards organized frameworks, or Internet-based frameworks permit us to make applications, which might be embraced rapidly by the business. With the utilization of natural user interfaces,

it is possible to permit users to rapidly pick up situational awareness during an occurrence and permit them to arrange a reaction based on data accessible to them.

The GUI of my project application is similar to a control focus giving few numbers of videos windows (contingent upon the amount of camera inputs) on a screen demonstrating live video from distinctive camera inputs. It will consist of main menu slide that provide user drag the videos from slide on touch bases respectively.GUIs of this application will contain some buttons that allow users to start/stop the motion detection, start/stop the recording, highlighting the suspected area in a video, play and search for the recorded video, and more. The GUI is user-friendly and simple-to-use.Since the 1980s, the persistent innovative work in touch empowering innovations has made it conceivable to outline and create different multi-touch delicate presentations utilizing distinctive advances, i.e., resistive, surface acoustic wave (saw), capacitive, and machine vision (Izadi et al., 2007; Moeller and Kerne, 2010 and Buxton, 2011). There is no doubt that the improvement in touch sensing advances, decreases in expense, and different elements have made multi-touch information gadgets getting to be more prevalent and basic in numerous commercial ventures.

All in all , advantage insightful, the Touch smart technology is getting to be exponentially helpful in all zones including business , education ,commercial and so forth .Users of touch screens can appreciate all the beneficial side that innovation offers, such as ; able to support video chats with each other, message, e-mail ,oversee contacts, update calendars, send photographs and many more ,all without the aid of a mouse or keyboard. Moreover, touch screens can be used to maximize their display capabilities without needing to increase their size. Most likely in public places, shopping malls, universities, hotels tend to have always multiple users at once. It may not be feasible having touch screen that allows only a single touch in mentioned crowded places as users needs to hold up for their turn. Rather, the interfaces ought to help collaboration with different clients at the same time. This has made the utilization of multi-touch interfaces expand essentially lately.

## 1.2 Problem Statement

Based on my observation and conversation with my supervisor, I have brought these into being a problem for this project:

- Video surveillance application conventionally was not accessible on the term of multi client collaboration
- Multi-touch tabletop might not be always user friendly collaborative touch on surface
- The absence of user feedback related to multi-touch innovation

Previous work (Kho, 2010) has demonstrated a proof of concept on the usefulness of multi-touch interface in a video surveillance system to directly manipulate the surveillance videos. Such a positive result leads to a need for a more detailed investigation on understanding the collaborative work among the users when interacting with the video surveillance interface. The collaborative aspect of the multi-user interactions, that has not been addressed earlier, is a key component in any multi-user environment. This aspect is central to the study in this project.

In order to ensure public safety, video surveillances have existed since long time prior. If video surveillance application interface does not support collaborative multi-user interaction, it will not be able to ease monitoring or permit users to rapidly pick up situational awareness during an occurrence and arrange a reaction according to emergency utilize cases. Usually surveillance videos are too small to be visually examined and it can be a problem to enlarge the live videos on the screen simultaneously. Despite the fact that some CCTV frameworks permit a broadened screen of a live feature after we press a catch, it can't show other videos in the meantime. On account of crisis, in the same way as interruption, it is imperative that few administrators can watch an expanded size of the live features which move their suspicion in the meantime .this allows the suspicious individual to be caught in the briefest time conceivable.

## 1.3 Objective and Scope of Study

Development and growth of information these days is at amazing rates. This productiveness is blooming to this changing atmosphere. From time to time, new systems and disciplines are being advanced and the diversity of accessible systems to assist manage this information spread is growing speedily. Appropriate information and proficiency is enormously important .Especially it will benefit to security sector accordingly by providing video surveillance system to be on multi touch based application It will enable the respective officers to investigate the suspicious case in a collaborated manner .Moreover, live videos will be streaming for their investigation and allowing the user to manipulate video in a different way such as : play, record, highlight the suspected area ,resize , rotate, record . It enables users to perform their work more effectively and prevent any possible damage by using the accurate information and expertise in good time.

- To develop a video surveillance application interface that supports collaborative multi-user interactions
- To test the functionality of the interface
- To evaluate the users' experience while interacting with the system

Visual C# WPF Application is required in order to obtain the proposed application. It will enable me to get live feature from webcam that allow that easily manipulate on multi- touch collaborative surface .Also, multi-touch application reaction to the touch on the screen is being investigated respectively.

## 1.4 Project Feasibility

Feasibility Analysis is the most required part in every project or study. It defines and helps you to make a decision whether to develop or not with the project that you are going to take care of. This video surveillance application could be recommended to be utilized as a part of UTP Security Department framework to guarantee the safe and rapid response toward their daily work.

**Technical Feasibility:**

This application is being developed on Microsoft Tabletop surface. This hardware is available in UTP for student research and development. This application is expected to be user friendly. In order to develop Video Surveillance application, I shall use C# as mentioned above earlier. The development tools and the programming code can be referred through open sources.

- Understanding tools, such as Microsoft Tabletop surface
- Project's Research and knowledge is adequate
- To find and use the right development tools for the implementation

**Time:**

Video Surveillance application is estimated to be completed within the timeframe since the time allocated for project development, which is twenty-eight (28) weeks. As there are several and various stages of development, Rapid Application Development and Waterfall models were chosen for the methodology and development. They contain stages such as:

- Analysis
- Development
- Integrating
- Testing
- Implementation
- Documentation and the concept where the product can be developed faster and of higher quality due to the time constraint

**Cost:**

With the help of using RAD methodology and open source development tools, such as Visual C# WPF Application, the development of application will be able to minimize the cost by eliminating consultancy services. Moreover, to implement the mobile application, user required to use Android Microsoft Tabletop surface to run the application, where this devices are quite affordable comparing to other devices in technology market.

# CHAPTER 2

# LITERATURE REVIEW

## 2.1 Video Surveillance System

Surveillance video analysis has been extensively studied. It has gotten an incredible consideration as to great degree dynamic application-arranged exploration regions in machine vision, computerized reasoning, and picture transforming. Kind of video is utilized as a part of two key modes, looking for known dangers progressively and scanning for occasional events that might occur sometime later. Ordinarily, constant cautioning is a restricted capacity, e.g. air terminal security focus on getting respond to a "border rupture caution", while examinations regularly have a tendency to incorporate countless circulated cameras. While applying feature examination to give ongoing cautioning focused around foreordained occasion definitions, such as "tripwire," has been investigated both in the researches and commercial sectors. The conventional video surveillance systems – regularly called Close-Circuit Television (CCTV) – was damaged and exorbitant since they were conveyed by security groups to watch occasions in the scenes by means of visual display . Sometimes later, computerized video surveillance systems use incorporation of ongoing and more viable machine vision and knowledge strategies.

Subsequently, computerized feature observation frameworks succeed to aid security staffs by producing ongoing cautions and legal sciences examination because of help progressed feature investigation strategies. These days, numerous analysts have endeavored to give successful and fitting video surveillance services by proposing and actualizing system framework, client interface, and middleware parts. There are two sorts of security cams frameworks, Analog and IP (some of the time referred to as system cams). Here is an extremely fundamental clarification of how they function and what the real contrast is between *Analog surveillance systems* and *IP cam* frameworks.

### *I. Analog Surveillance Systems:*

Most security cams available today are standard simple security cams joined specifically to an advanced feature recorder. The cams are this sort of framework comprise of a lens, DSP chip (computerized sign transforming chip) and lodging. The cams are just the window utilized by the digital video recorder (DVR). The cams are joined with the DVR utilizing transmission links. There are numerous sorts of links, yet they will all have an association straightforwardly to the DVR. It is the heart of this framework. The security advanced feature recorder gets the video from the cam, packs it and stores it on a hard drive to be recovered later. Most DVRs likewise change over the simple feature to advanced organization and have the capacity stream that feature over the web utilizing a constructed as a part of web server. In this situation, the DVR is in charge of compression, stockpiling and streaming of all the video that originates from every cam. Moreover, the DVR is the intelligence behind the cams which in charge of all the movement identification plans, notices, caution inputs and etc.

At last, this kind of surveillance system is normally less expensive because of the cams are simple and only unit that does all the snort work, the DVR.

### *II. IP Surveillance Systems:*

IP or system security cam frameworks are altogether different from analog systems in light of the fact that every cam does the work of the DVR. Basically, an IP cam is a standard security cam that can compress the video, change over the feature to advanced configuration and stream it over Ethernet. Thus every cam is essentially its own particular DVR. Some IP cams likewise have SD card openings so they can store feature straightforwardly onto a SD card. IP cams are at times associated with a NVR (system feature recorder) rather than a DVR. Since the video is packed and converted to advance feature at the cam, the cam can stream the feature over a system to a PC or NVR that will record the compacted video. The profit of IP cams is that it is

not difficult to add extra cams to the system and there are higher resolutions accessible than analog surveillance systems. There are a few difficulties confronting IP cam frameworks. To profit from the higher determination accessible with IP cams places more noteworthy request on both data transfer capacity and storage. Likewise, in light of the fact that every cam essentially must have its own particular implicit web server, they are a great deal more costly. At this point, just around 10% of observation surveillance systems are IP systems. Sooner or later, when engineering makes up for lost time with itself and has the capacity tackle the transfer speed and expense issues, IP cam frameworks will start to take a greater amount of the CCTV piece of the overall industry.

Video Surveillance system performance evaluation which needs a correlation of the calculation results named ground truth (GT).Prior to the features of GT era are examined, a procedure which does not oblige GT is advanced. The decision of feature groupings on which the observation calculations are assessed has an expansive impact on the results. Some deliberate assessment strategies are accessible for surveying the created video analysis strategies by applying ground truth (commented information) and selecting an estimation distance to survey separation between the ground truth and the created framework's reactions.

A few of these frameworks are listed below:

- TRECVID
- CREDS
- PETS
- FRVT
- i-LIDS

**Text Retrieval Conference Video Retrieval Evaluation (TRECVID):** are in advancement workshops dispatched by the National Institute of Standards and Technology (NIST). These workshops focus on different range of data recovery investigate in video content recovery.

**Challenge for Real time Event Detection Solution (CREDS):** make it conceivable the execution assessment by predefined occasion recognition.

**Performance Evaluation of Tracking and Surveillance (PETS):** This offers chance to the scientists to submit their calculations for online assessment.

**Face Recognition Vendor Tests (FRVT):** it use for face distinguishing.

**Image Library for Intelligent Detection Systems (i-LIDS):** it has been launched by the UK government to aid the assessment and improvement of feature examination frameworks.

### 2.1.1 Evaluation without ground truth

Erdem et al. combined color and motion together instead of GT. There have been made few assumptions for example, object limits continually agreeing with shade limits .Moreover, the foundation must be totally stationary or moving comprehensively. All these suppositions are disregarded in numerous genuine situations; then again, the monotonous era of GT gets to be redundant. Most importantly, the results tend to be similar between their methodology produce and GT-based measures.

### 2.1.2 Ground truth

The necessities and important arrangements to create GT are talked about in the accompanying subsections. File formats and other assumptions and designs for GT information are introduced. Diverse GT era strategies are, although presents GT innovative tools**.** One of the other most critical point in a video surveillance is a camera motion. It is the enabling wander for moving objects location. Nikitidis et al., proposed an alternate arrangement for parametric camera movement estimation on concentrated vector field model. This framework handles both smooth and quick camera motion. Current procedure predicts the future camera motion focused around present and earlier perceptions.

## 2.2 Multi - touch software architecture

At the point when looking at the huge group of related work regarding multi-touch technology, a few similarities emerge. A significant number of these frameworks are part into an info handling and an application part, joined by a system join. There are a few methodologies to add multi-touch support to existing tool compartments and gadget sets. Taking into account these perceptions, the general design is displayed below in Figure 1.

The input hardware considered as a lowest layer which produces tracking data in the form of a video stream or electrical field measurements. This data is then transformed by the hardware abstraction layer. The main task is to stream of positions of fingers, hands and/or objects from the crude information, depending on the capacities of the fittings.

The next layer is transformation layer which changes the position information from device to screen coordinates. This is accomplished with a perspective transformation which is acquired in an alignment system. Thus, the position information is prepared for interpretation. This layer is able to translate the movement of hands and fingers into gestures .To do along these lines, this layer needs learning about regions on the screen. A list of gestures are match for each region .At the point when the right occasions happen within a region , the relating gesture is activated and passed to the following layer. This last part of the system is the widget layer. It is assigned to enroll and update regions with the interpretation layer and afterward follow up on recognized gestures by producing noticeable yield.

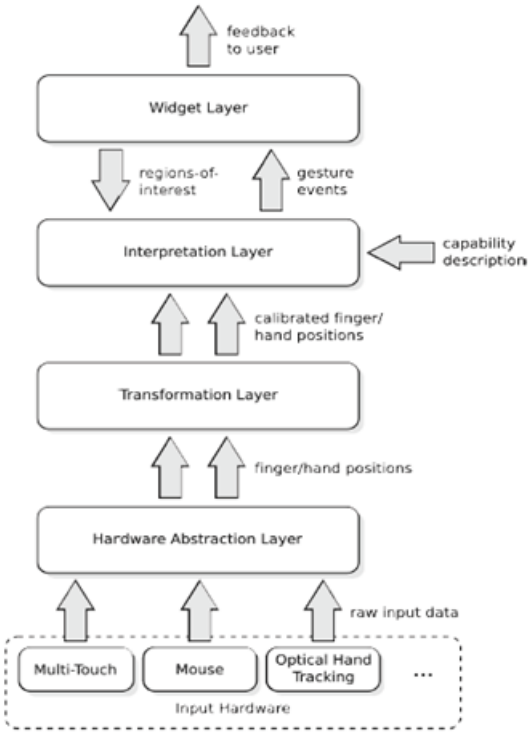



Figure 1: Multi - touch software architecture

## 2.3 Touch technologies

There are few technologies that suggested using for construction multi-touch surfaces:

- Touch Surfaces Based On Resistance
- Touch Surfaces Based On Capacity
- Surface Wave Touch Surfaces (SAW)

### 2.3.1 Touch Surfaces Based On Resistance

Touch Surfaces based on resistance for the most part comprise of two conductive layers that are covered with substances, for example, indium tin oxide. An insulating layer, that normally made of small silicon spots divide the layers. Touch surfaces' front board is ordinarily made of an adaptable hard covered external film and the back board is regularly made from glass. Exactly when clients touch the screen, the conductive layers are joined, making an electric current that is measured once uniformly, vertically with a particular final objective to center position of a touch.

This kind of touch surface clarity is low contrast with others. Moreover extra screen insurance can't be connected without affecting on their functionality. More itemized data about classical resistance based multi touch surfaces can be found in below given Figure 2 in precise order:

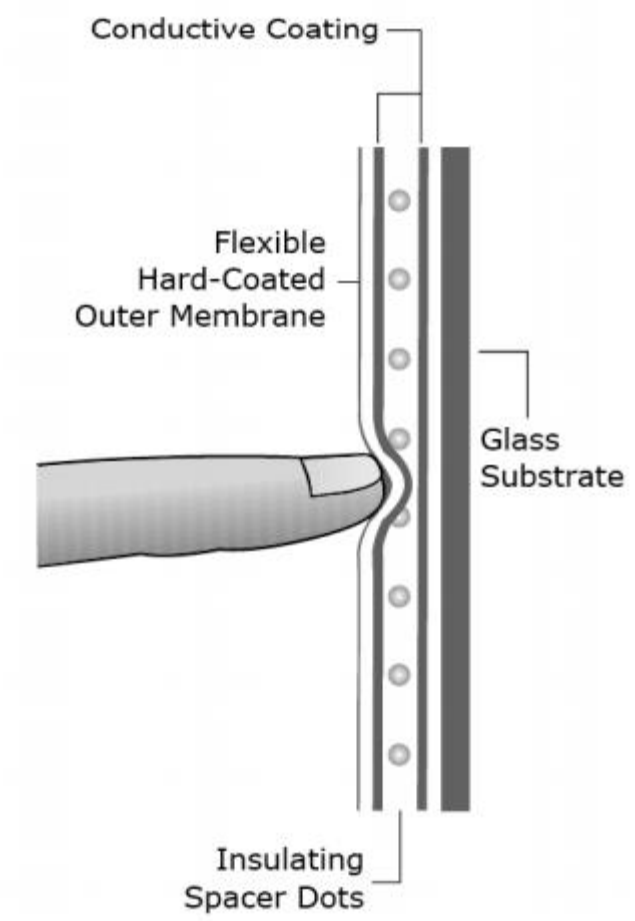



Figure 2: It represents the touch surfaces based on resistance

### 2.3.2 Touch Surfaces Based On Capacity

Capacitance based multi- touch surfaces could be subdivided into an alternate two classes:

- Surface Capacitance
- Projected Capacitance

Both above mentioned procedures were initially produced for single touch interaction.

The high clarity is one the point of interest capacitive touch when it comes to testing with other technologies .It is making capacitive touch surfaces extremely suitable for utilization in numerous sorts of touch shows past basic touch pads. Capacitive touch screens can likewise be worked by any conductive gadget and are thus not constrained to finger based association. Notwithstanding, capacitive touch boards are moderately lavish produce in spite of the fact that they show high toughness and dependability. Thus, capacitive based frameworks are regularly favored for utilization in unpleasant environments. It is possible to use such frameworks for multi-touch surfaces; in any case commonly the measure of synchronous touches .Surface capacitive touch boards has a glass layer that has conductive covering. Contrasted with resistive innovations, a much higher clarity could be accomplished by utilizing indium tin oxide as a leading material. As human fingers play a role as an additionally electrical gadgets fit for putting away charge also displaying electric fields, as a result of touching the board ,it will get electric charge from the board. This type of surface capacitive touch is a very detailed and precise.

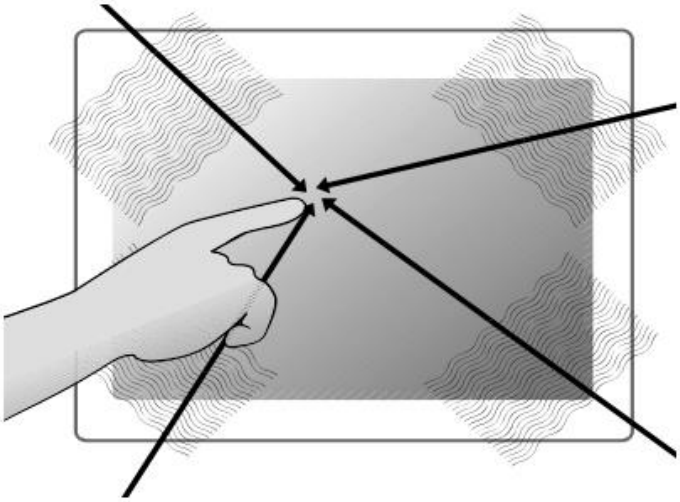


Figure 3 : Surface capacitive touch

As it has been mentioned in the researches, project capacitive touch gadgets are the most extravagant to deliver. Exactness of anticipated capacitive engineering is like surface capacitive innovation albeit light transmission is superior on the grounds that the wire grid could be developed in a way that is visible. This kind of system is additionally exceptionally suitable for tough situations, for example, open establishments; a protective layer such as thick glass may be included without radically diminishing the affectability. At last, various multi touch interaction could be all the more effectively deciphered contrasted with surface capacitive based innovation.

## 2.4 Touch Surfaces based on Optical

Both optical and cam based-methodologies have the same idea of handling and filtering captured images. As effectively examined various frameworks are based on infrared light and thus can suffer interference from encompassing light in the nature's domain. Because of their basic configuration optical methodologies have the potential to be extremely powerful.

### 2.4.1 Frustrated Total Internal Reflection (FTIR)

In 2005, Jeff Han had uncovered the Frustrated Total Internal Reflection (FTIR) multi-touch gadget that can be seen as a beginning stage for optical multi-touch technology. This innovation is about how an optical total internal reaction works within an interactive surface. It is an optical multi-touch framework that permits many users as possible to collaborate on a screen at once. It is comprised of a transparent acrylic sheet with a casing of LEDs around the side to give infrared

light. An agreeable surface film and a back projection film are put on top of the acrylic plate although an infrared camera is placed underneath it. The light escapes and is reflected at the finger's purpose of contact when a users touch the project film. The infrared Polaroid can distinguish the scattered light. At that point, the machine vision's procedures are connected to camera pictures to focus the area of the contact point (T. Cuypers, J. Schneider-Bames, J. Taelman, K. Luyten, & P. Bekaert, 2007). The camera pictures are first preprocessed to uproot any perpetual parts utilizing history subtraction. A related portions computation finds splendid regions in the retrieved picture. It considered as a touch zone. Post-handling includes discovering comparing touches in diverse Polaroid edges and changing the Polaroid directions to screen directions (Schoning et al., 2008). As the acrylic is straightforward a projector can be found behind the surface (close to the cam) yielding a back-anticipated touch sensitive display. The general set-up of a FTIR framework is shown in Figure 4:

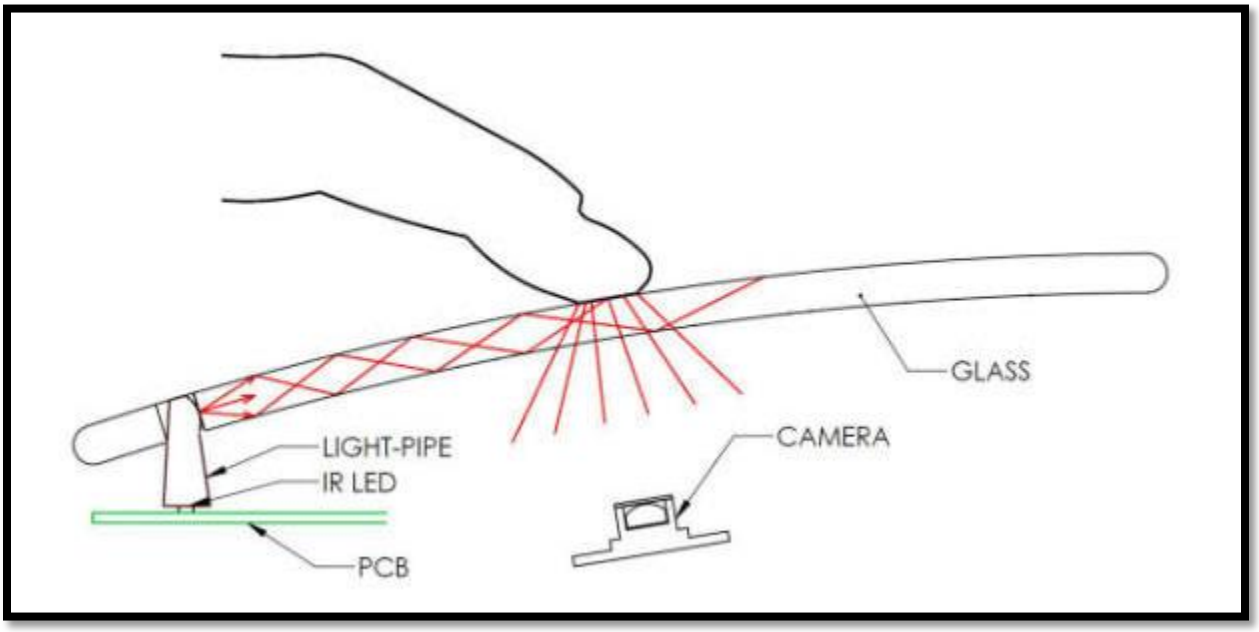



Figure 4: FTIR framework

### 2.4.2 Diffuse Illumination (DI)

The fittings for Diffuse Illumination (DI) system are very similar to FTIR. It can be observed that infrared sensitive camera and projector is placed behind a projection surface in both systems. On the other hand, for DI, the infrared lighting is additionally set behind the projection surface. This causes the zone before the surface to be brilliantly lit in the infrared range. Thus, the cam grabs all objects around there by their response of infrared light. This incorporates the objects in proximity to and items touching the surface. Touch discovery misuses the way that the projection surface diffuses light, it cause the image of object appear blur at a distance .Rather than FTIR, DI permits identification of items, tracking and in addition fingers. Objects can be recognized by utilizing their shape printed on their base surfaces. Moreover, any transparent surface like safety glass can be set between the projection screen and the user sensing does not depend on surface contact.

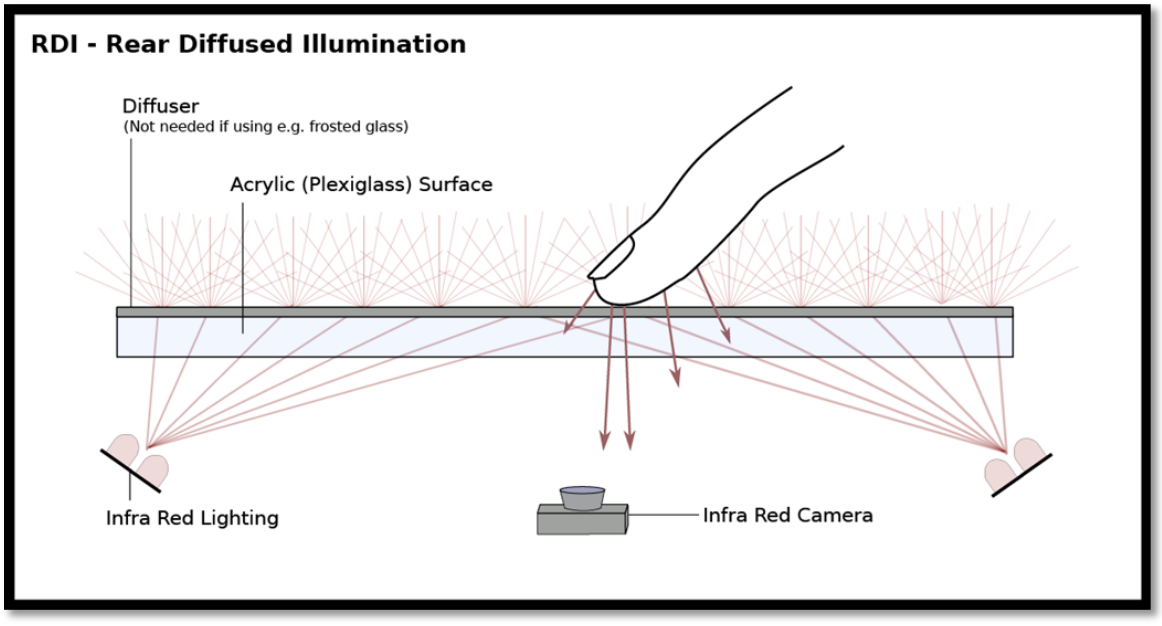



Figure 5: Diffuse Illumination (DI)

### 2.4.3 Diffuse Surface Illumination (DSI)

Diffused Surface Illumination (DSI) provides an even circulation of infrared light over the screen surface. An assignment which is normally accomplished in DI set-ups by utilizing a little number of (a few) Infrared Illuminators. It was proposed the utilization of an exceptional acrylic that fuses little particles to act as a tiny mirror. The moment IR light sparkles into the edges of this material it is redirecte d and equally spread over the surface.

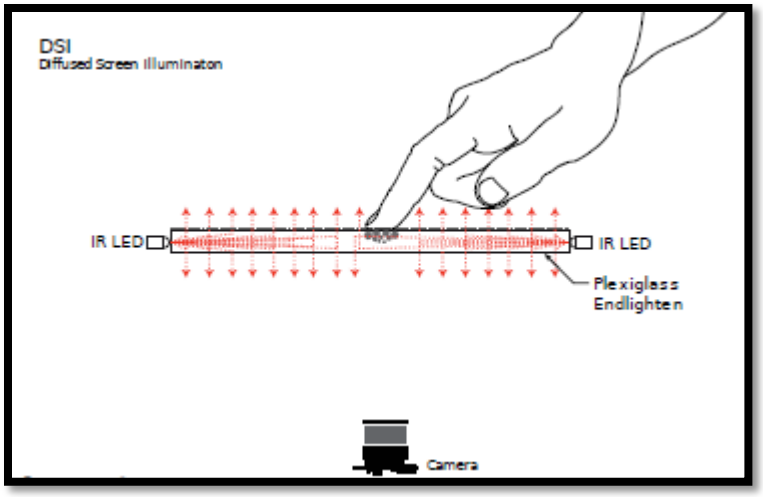



**Figure 6: DSI system architecture**

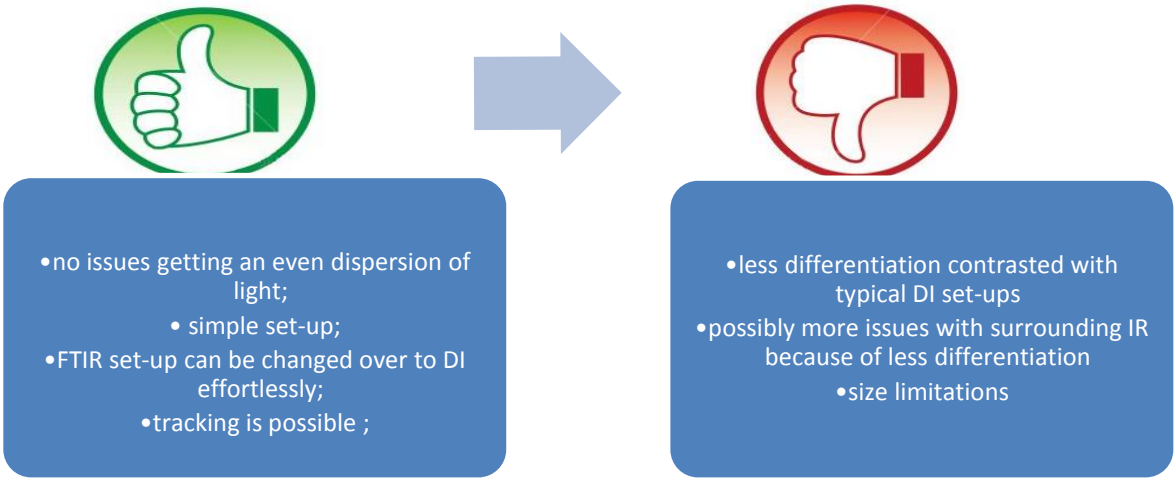



Figure 7: Pros & Cons of DSI

## 2.5 Natural User Interface (NUI)

A Natural User Interface (NUI) is a kind of machine interface that permits individuals to rapidly control on ‑ screen applications or substance through moderately natural physical gestures with the aid of body or hands, utilization of this kind of interface makes mouse and keyboard unnecessary .It is a developing mechanism for the collaboration , It is like that of a graphical user interface ,as the user still sees a graphical representation of genuine articles, generally known as the desktop representation , on the other hand it evacuates the utilization of mouse and console collaboration and replaces this with a more regular, motion based association, for example, a multi-touch screen, voice what's more full body signal based connection.

On the other hand , (NUI) can be explained as an interaction that focuses on conventional human abilities, for example, touch, vision, speech, motion, handwriting . Most importantly, they are all larger amount procedures such as creativity, cognition and investigation. The point of NUI is to repeat certifiable situations by using rising innovative capacities and sensing results which will take into account more precise and advanced association in the middle of physical and computerized items.

An interface is natural if it "*exploits skills that we have acquired through a lifetime of living in the world*." (Bill Buxton, 2010)

A natural user interface is "*a user interface designed to use natural human behaviors for interacting directly with content*" (Joshua Blake, 2010).

According to Joshua Blake (2010), this definition contains 3 important points for defining NUI.

## 2.6 DiamondTouch

Diamond touch is the unique multi-client touch system, and it meets expectations differently in contrast to other touch innovations. Conventional multi-touch systems are focused on pressure; however these just permit a single touch. Mostly touch technologies are optical, utilizing cams or infrared locators. Some of these permit multiple touches, however they are not multi-client. It is a multi-client touch schema for tabletop front-anticipated displays. It empowers a few diverse individuals to utilize the same touch-surface at the same time without interfering with one another, or being influenced by other items .It likewise permits the machine to recognize which individual is touching where.

The technology of DiamondTouch meets all the below mentioned requirements:

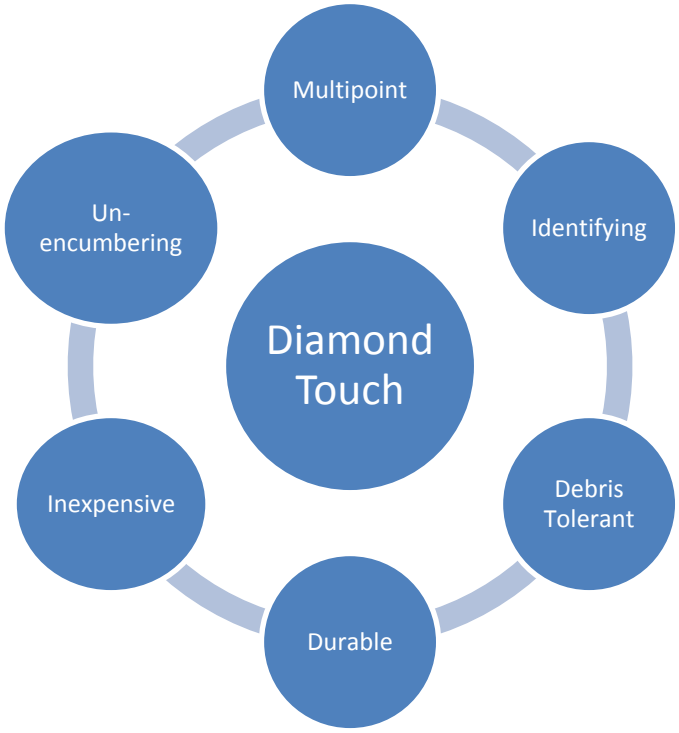



Figure 8: The advantages of DiamondTouch

Diamond Touch meets expectations by transmitting signs through antennas. These signs are capacitive go through the clients and vice versa to table, which recognize the parts of the table each client is touching. Above mentioned data can then be utilized by a computer in the same route as mouse or tablet information.

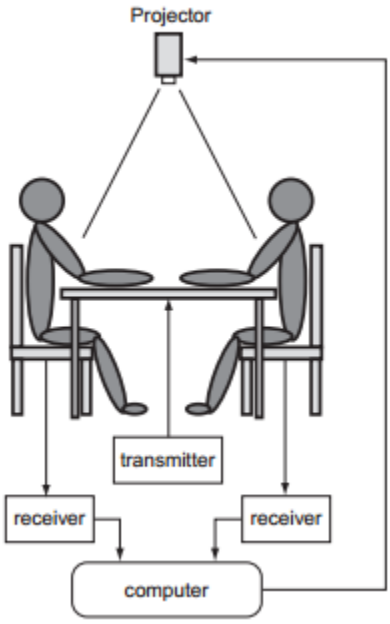



Figure 9: DiamondTouch schema

The surface of table is a developed with a set of inserted antennas which can be of subjective shape and size. The electrically conductive material that is an antennas are protected from one another. The antennas are additionally protected from the clients as the signs of coupling to the client are carried out capacitive, and the whole table surface can be secured by a layer of protecting, defensive material as demonstrated *in Figure 10.*

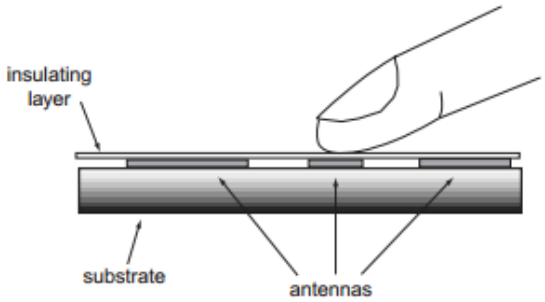



Figure 10: The design of DiamondTouch

Each antenna is driven by transmitter so that it can be recognized from the signs of alternate antennas. At the point when a client touches the table, a capacitive coupled circuit is finished. Through the touch point, transmitter runs the circuit on the table surface, through the client to the client's recipient and over to the transmitter. With the aid of acceptable design, DiamondTouch system can be very dependable through human body.

## 2.7 Gestures

So as to attain the natural interactive courses specified above, little a number of motions are considered. The ones concentrated here were as expressed prior; Rotate, Move Select / MultiSelect and Scale. When these motions are deciphered as a class objects, the effortlessness of collaboration will come clear. Usually Move and Rotate doesn’t require any presentation. Let's visualize the movements of gestures as a paper needed to rotate or move the piece of paper on the table. Multiselect and Scale notwithstanding, are things not for the most part anticipate that as achievable on a paper sheet.

### 2.7.1 Selection & Multi-Selection and Scale

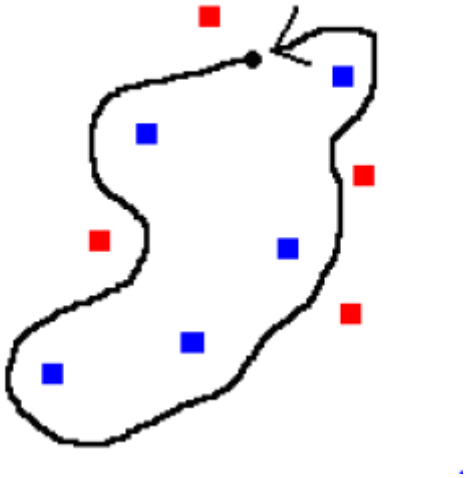


Figure 11: Selection by Single Finger

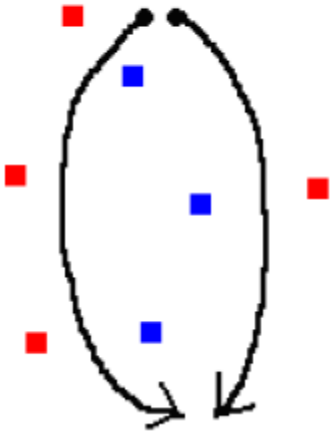


Figure 12 : Selection by multi finger

Various objects are arranged onto the screen. The selected objects are the one drawn the line by the finger, the outside dots are considered not selected. To choose what move to make, an occasion is sent to the application. As a matter of fact, scaling requires no less than two fingers

and is a sample of synchronous inputs. In order to scale an on screen objects, hold it with the fingers and unite them to scale down, or separate them to scale up. The scale occasion is sent to the application with data of the evaluation of the scaling and additional item that's influences. Faster scaling requires quick finger motion on the screen.

### 2.7.2 Gesture library

The objective of the gestures library was for it to be not difficult to keep up, and in addition effectively versatile regarding adding new motions to it. The applications ought to likewise be divided from Touchlib, so they simply will need to listen to signals, separated from tuning in to motion - and finger occasions. The motion library listens to finger occasions and gives the application with the motions it identifies.

.

## 2.8 Multi-touch Development Framework

Other than computer vision frameworks, there are several software development systems that can be used to develop multi-touch technology applications. The literature review for this section gives history on 2 development frameworks, which are ActionScript 3.0 & Flash and WPF with .NET 3.0 and additionally clarifying on how they cooperate with workstation vision structures and libraries.

# CHAPTER 3

METHODOLOGY

## 3.1 Research Methodology

Prior to designing and implementation of the project, intensive study regarding literature review and background studies were carried out via various available sources such as internet sources, books and journals. These sources are accessible personally as well as from our IRC (Information Resource Center). Interviews and questionnaires regarding the proposed topic will also be conducted both with post-graduate students' and undergraduate students'. Data gathering and analysis is to be performed intensively to support the study before the project is to be implemented. Last but not least, after the implementation of the system, feedbacks and comments are to be collected from users to ensure the efficiency of this system.

Hence, the methodologies mentioned below are used for this project. This covers many parts such as surveys, data gathering and analyzing information from respective Subject-Matter Experts and focal points.

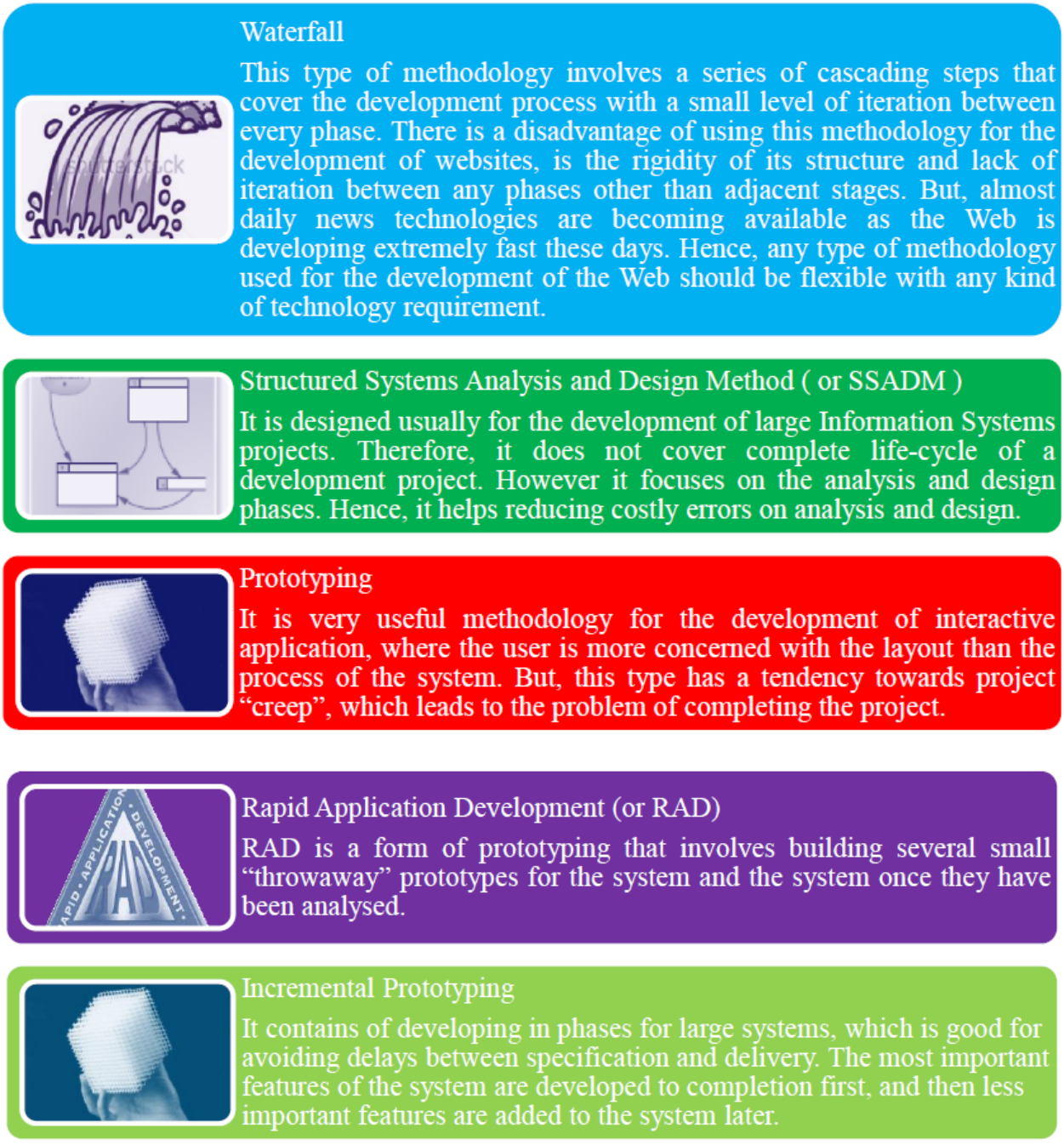



Figure 13: Table of various traditional methodologies

However, Rapid Application Development methodology is chosen as the main methodology for this project . Rapid Application Development is a development lifecycle designed to give much faster development and higher-quality results than those achieved with the traditional lifecycle. It is designed to take the maximum advantage of powerful development software that has evolved recently. RAD compresses the step-by-step development of conventional methods into an iterative process. The RAD approach thus includes developing and refining the data models, process models, and prototype in parallel using an iterative process. User requirements are refined, a solution is designed, the solution is prototyped, the prototype is reviewed, user input is provided, and the process begins again.

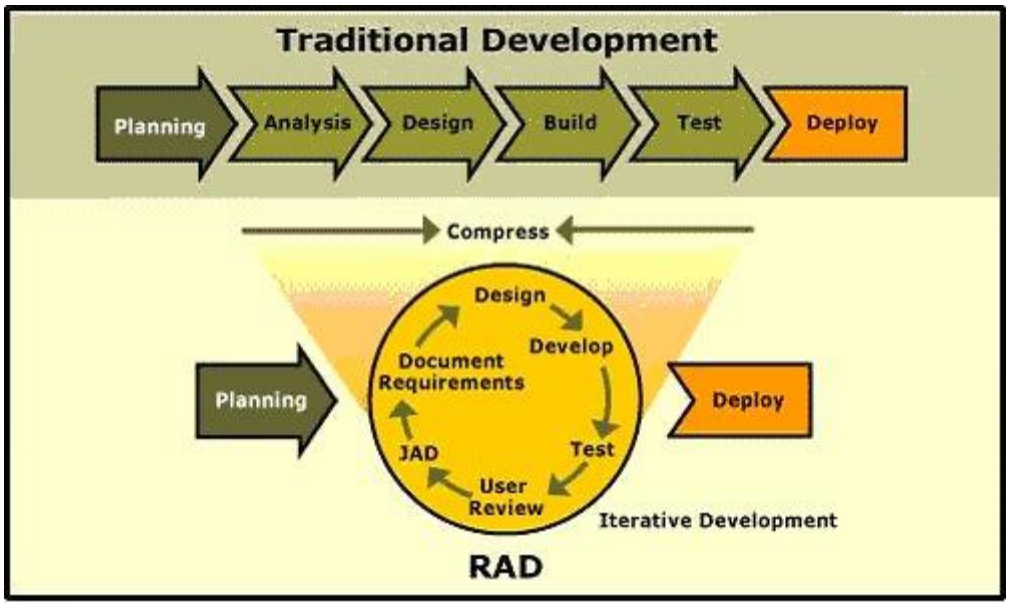



Figure 14: Traditional development and RAD

### 3.2 Project Phases

The development of the video surveillance completed on four-phase activities with sub phases, which are:

- **Planning**

This phase includes elements of traditional planning and analysis phase. The process in this phase is to determine all the system requirements. The process in this phase is to determine all the system requirements such as being able to present collaborative multi touch video surveillance application.

- Identify problem statements, objectives, scope of work
- Create a Gantt Chart to plan and schedule the project

- **Analysis**

- Identify the right programming language (Visual Basic/Visual C++/ Visual C#) for creating the video surveillance application as well as for multi-touch functionality
- Identify the suitable project type (WPF Application/Windows Forms Application)
- Conduct literature review to find out the previous works which are related to FTIR multi-touch

- **Design**

Subsequently, identifying completely the requirements, a design was developed based on necessities; identifying completely the requirements, a design includes video panels and picture box where it can be manipulated accordingly .Accordingly the preferred programming language was chosen : by using Microsoft Visual Studio 2010 ,WPF Multi –touch Framework

- **Development**

The following step is developing the design, which covered sub phases such as **Review**, **Testing** and **Defect Review**.

Functionalities need to be tested :

- ✓ Rotate
- ✓ Zoom
- ✓ Scale
- ✓ Save

- **Concluding Video Surveillance Application launch**

The concluding step after all the above phases completed successfully. This phase includes launch application and conclude user experience via questionnaire.

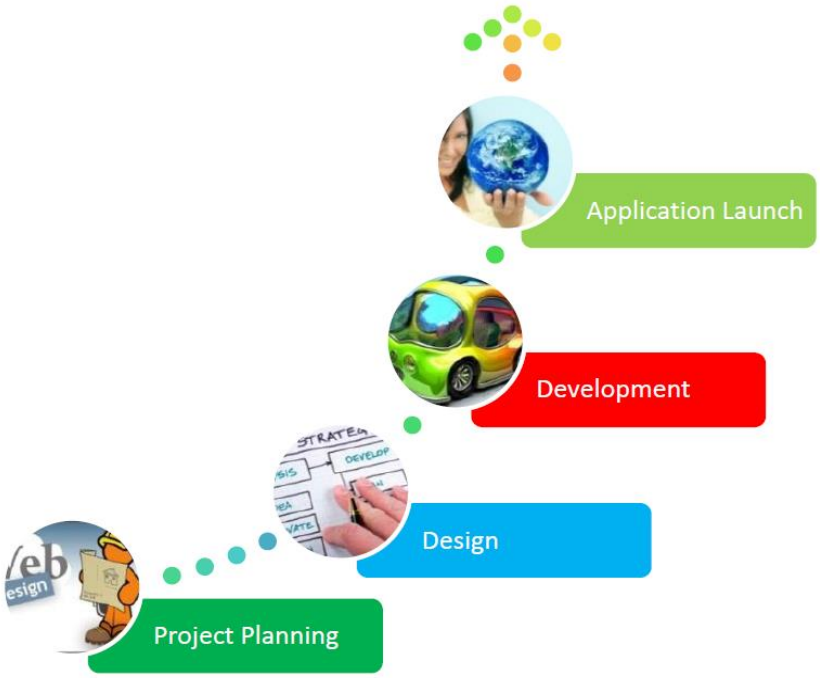



Figure 15: Project Phases

## 3.3 Key Milestones

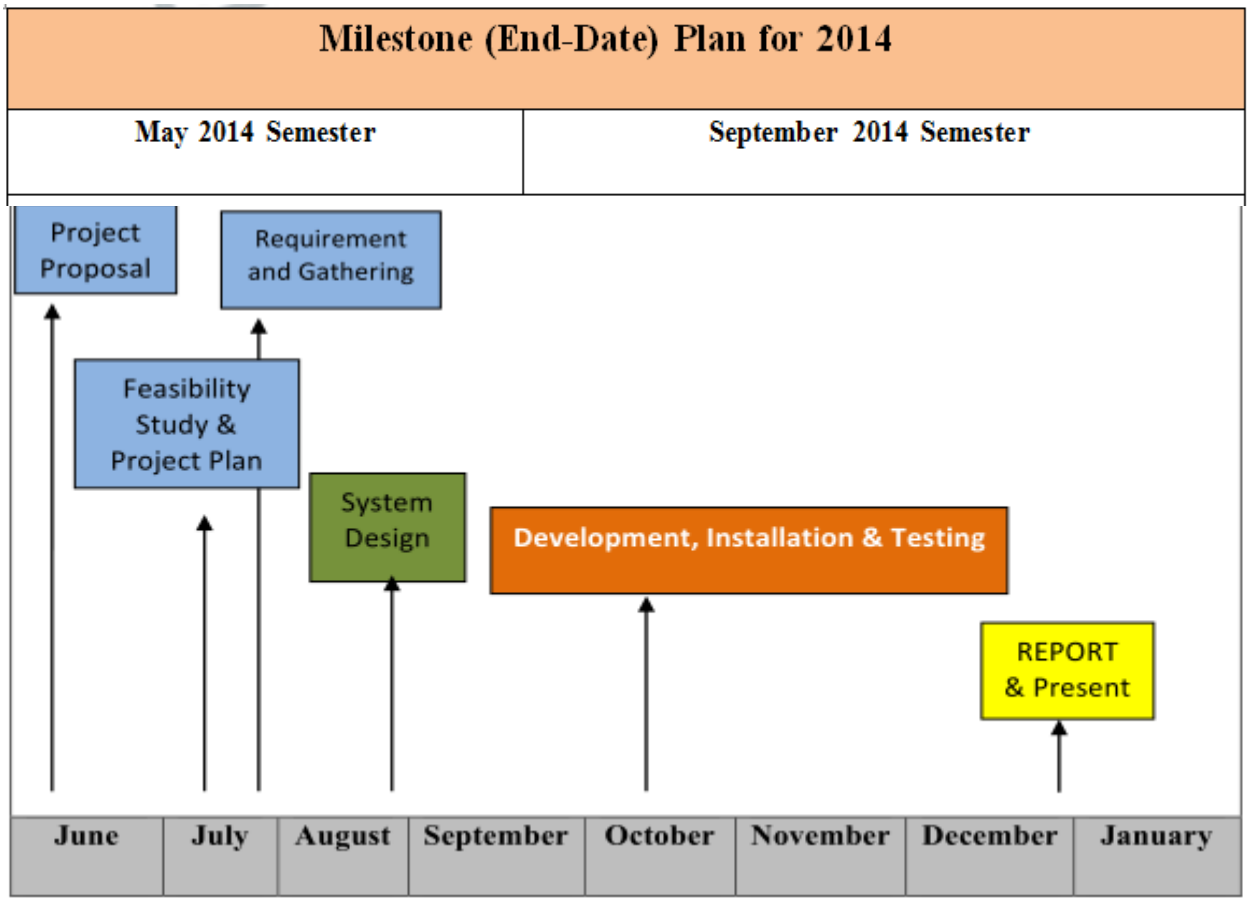
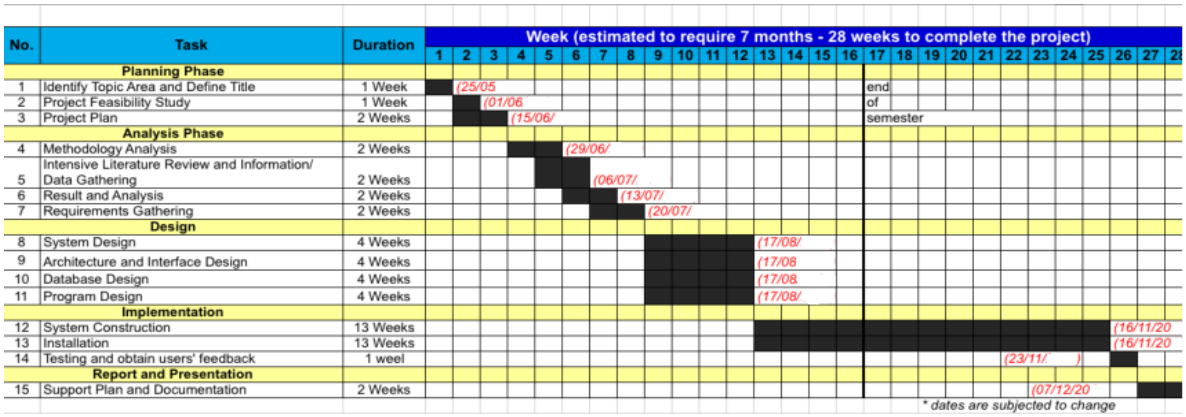



Figure 16: Key Milestones

## 3.4 Gantt Chart

Figure 17 is a Gantt chart showing the estimation of time needed for each tasks in order to complete the project. As shown, the project is completed in about 7 months' time (two semesters).



| No. | Task | Duration | Week (estimated to require 7 months - 28 weeks to complete the project) |
|---|---|---|---|
| | **Planning Phase** | | |
| 1 | Identify Topic Area and Define Title | 1 Week | (25/05 |
| 2 | Project Feasibility Study | 1 Week | (01/06 |
| 3 | Project Plan | 2 Weeks | (15/06/ |
| | **Analysis Phase** | | |
| 4 | Methodology Analysis | 2 Weeks | (29/06/ |
| 5 | Intensive Literature Review and Information/ Data Gathering | 2 Weeks | (06/07/ |
| 6 | Result and Analysis | 2 Weeks | (13/07/ |
| 7 | Requirements Gathering | 2 Weeks | (20/07/ |
| | **Design** | | |
| 8 | System Design | 4 Weeks | (17/08/ |
| 9 | Architecture and Interface Design | 4 Weeks | (17/08 |
| 10 | Database Design | 4 Weeks | (17/08 |
| 11 | Program Design | 4 Weeks | (17/08/ |
| | **Implementation** | | |
| 12 | System Construction | 13 Weeks | (16/11/20 |
| 13 | Installation | 13 Weeks | (16/11/20 |
| 14 | Testing and obtain users' feedback | 1 weel | (23/11/ ) |
| | **Report and Presentation** | | |
| 15 | Support Plan and Documentation | 2 Weeks | (07/12/20 |

end of semester

* dates are subjected to change

Figure 17: Gantt chart

# CHAPTER 4

# DISCUSSION AND RESULTS

This section evaluates the progress results of the project until the end of project.

## 4.1 Data Gathering and Results

Acquainted methods were used for the collecting and investigating the information in order to process this study project:

**Analysing Materials:**

Subsequently collecting all the related information, the exploration is made to realize the real subject matter, what is the actual issue on Microsoft Tabletop surface and further make more enhancements. The actual way of discovering keys for the subject matter is the discussion and exploration. The benefit of providing discussion allows us to get more user needs and analyses of the current subject matter. I have conducted a survey among several students who has already use Microsoft tabletop surface.

### 4.1.2 System Flowchart

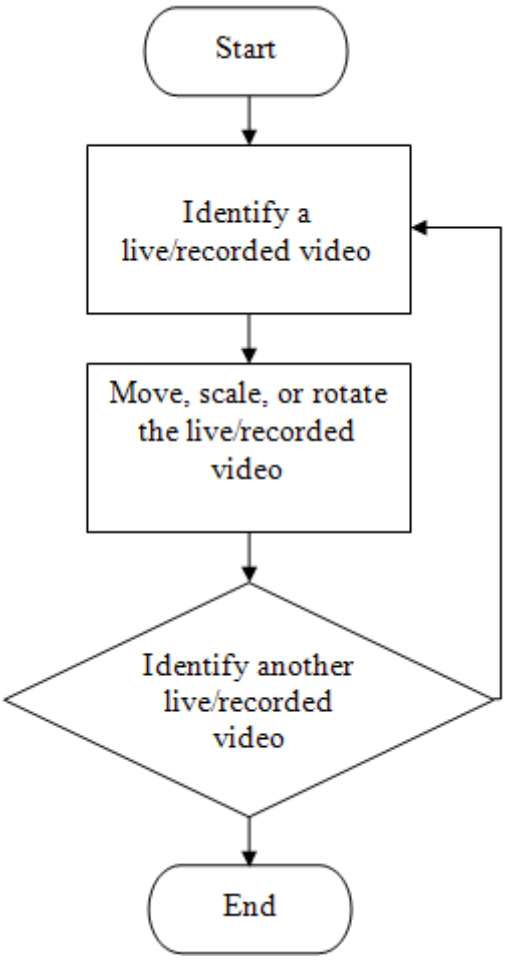



Figure 18: System Flowchart

To interact with the system, users identify 2 recorded surveillance videos and then perform translate, rotate, scale , zoom ,save the capture from the video . Users may directly manipulate other videos as well .

### 4.1.3 System Use-Case

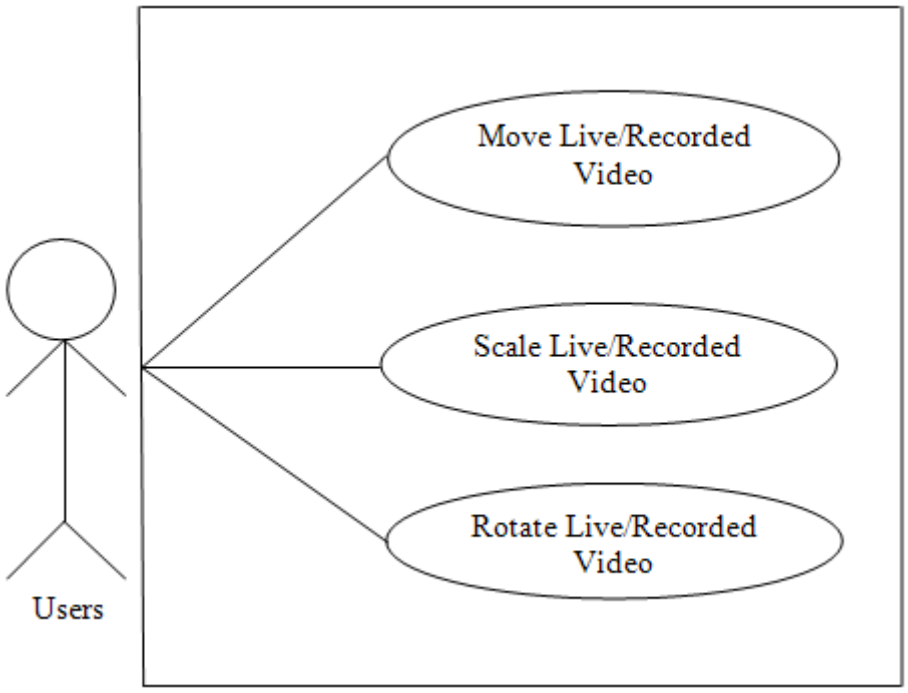



Figure 19: System Use-case

In this system, users can move, rotate, and scale a particular live/recoded surveillance video.

## 4.2 The earlier Proposed Graphical User Interface ( GUI)

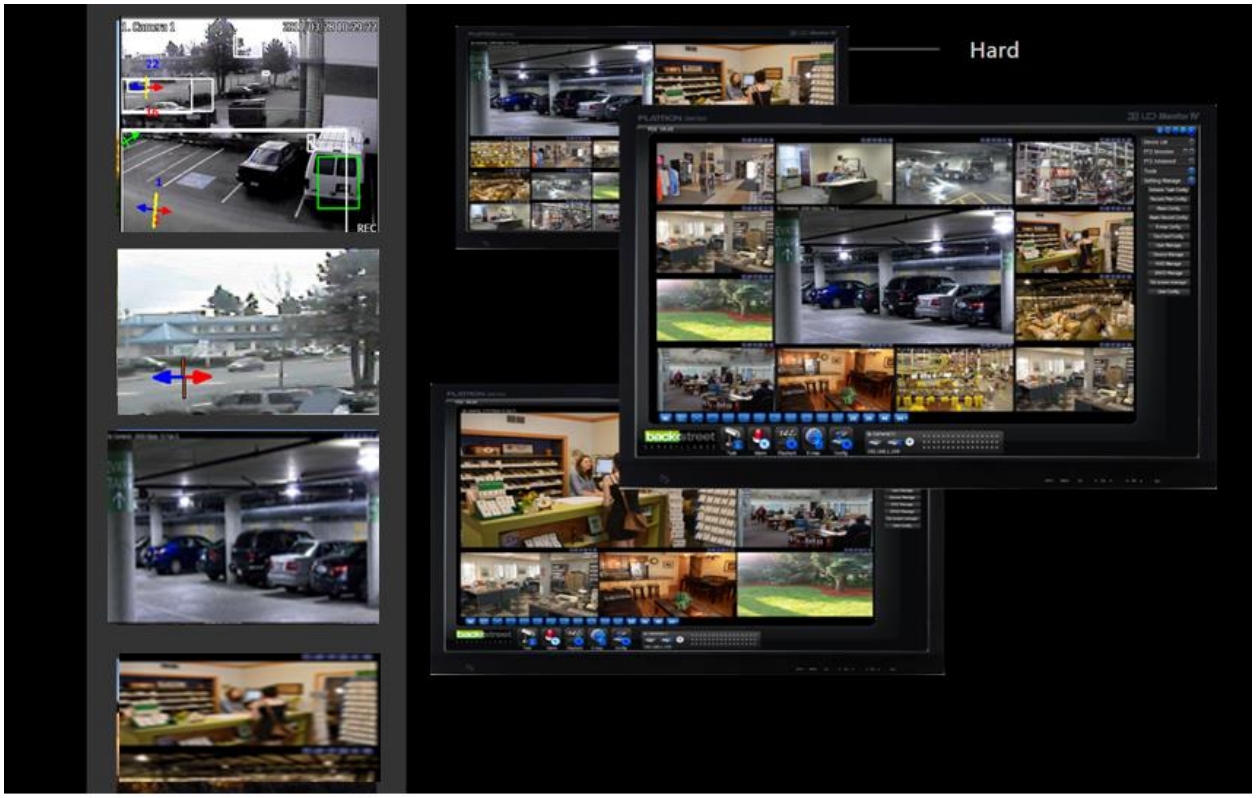



Figure 20: Proposed GUI

## 4.3 Discussion on the first term work progress:

I have created a surveillance application that supports multi user interaction in the first term of my project course. However, there were few problems faced while launch the program. As earlier mentioned these are part of my project objective:

- ✓ To test the functionality of the interface
- ✓ To evaluate the users' experience while interacting with the system

The first program brings some difficulties while interacting with Tabletop in terms of touch events. I have placed the dot buttons ● order to retrieve the video. However the user faced major troubles interacting with the surface. It required user touch the dot button for several time in order to bring the recorded surveillance videos to the screen.

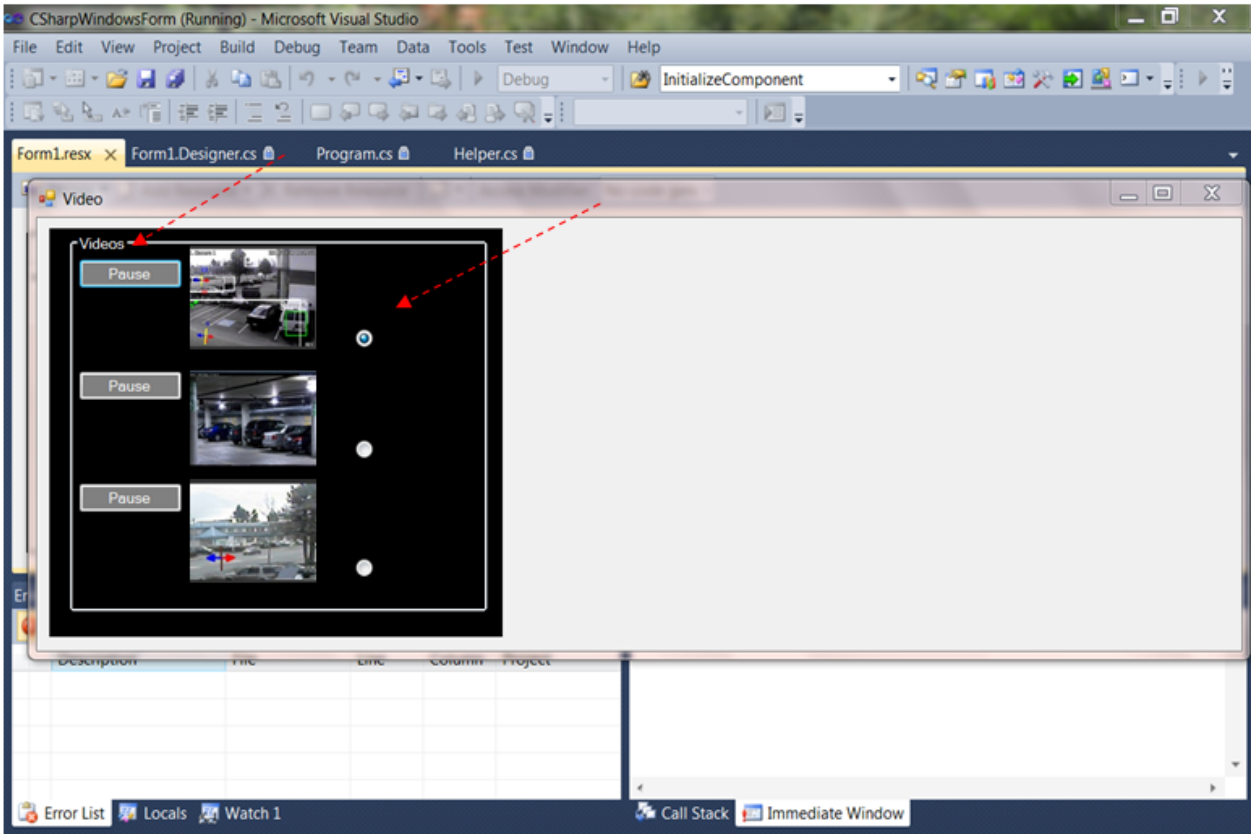



Figure 21: The image of 1st Application

The other issues encountered while using the main characteristics of the video surveillance program: rotate, zoom, scale, save, select, multi-select and etc. Development of my program coding was done on my laptop. However, it is totally different scenario when it comes to testing on surface technology. I have used the mouse events in C# WPF in order to get the functionality of my program. As a result of testing, it was observed that multi touch manipulation events only can be applied to Microsoft Table-Top Surface.

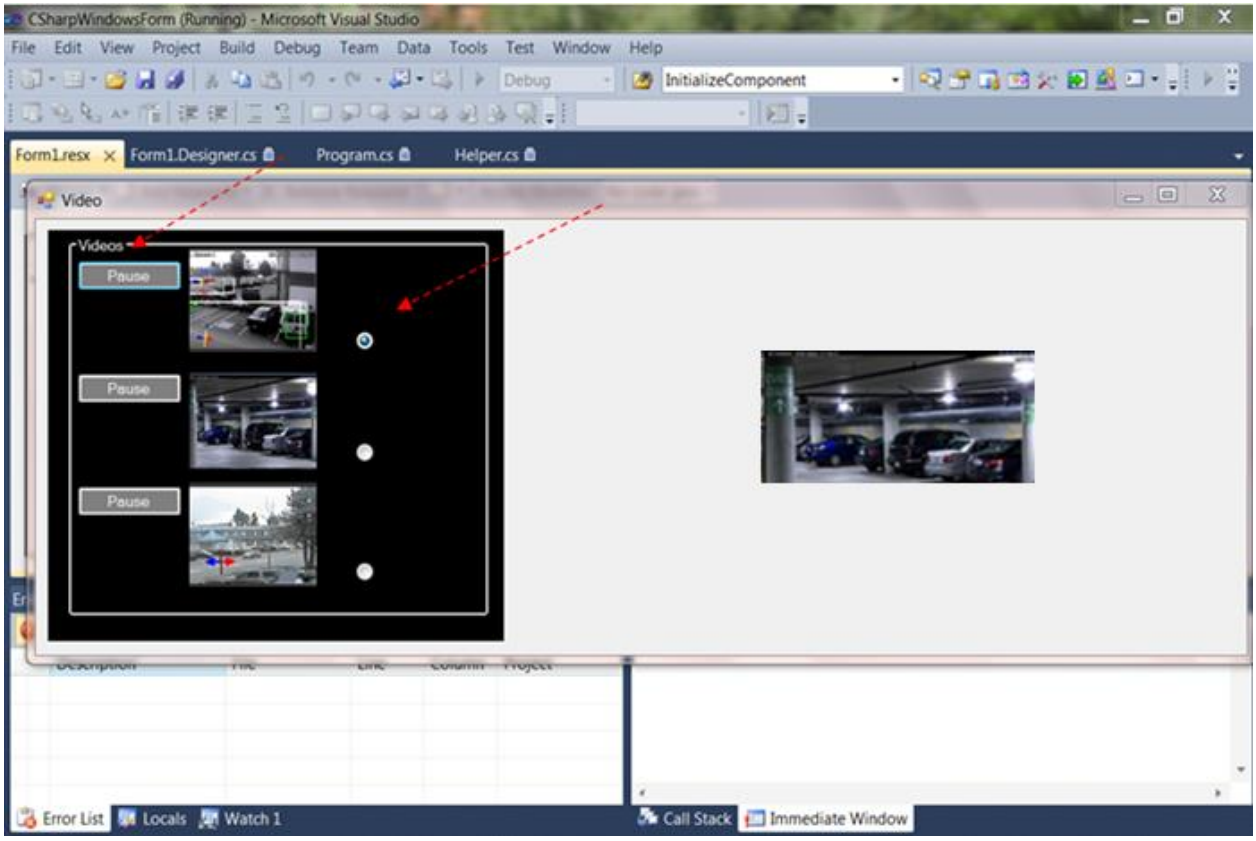



Figure 22 : Testing of 1st application

## 4.4 Discussions on the second term work progress.

I have done many searches and studying on WPF Multi-touch manipulation coding in order to create my video surveillance program with all the above mentioned functions such as rotate, zoom, scale, move and etc.

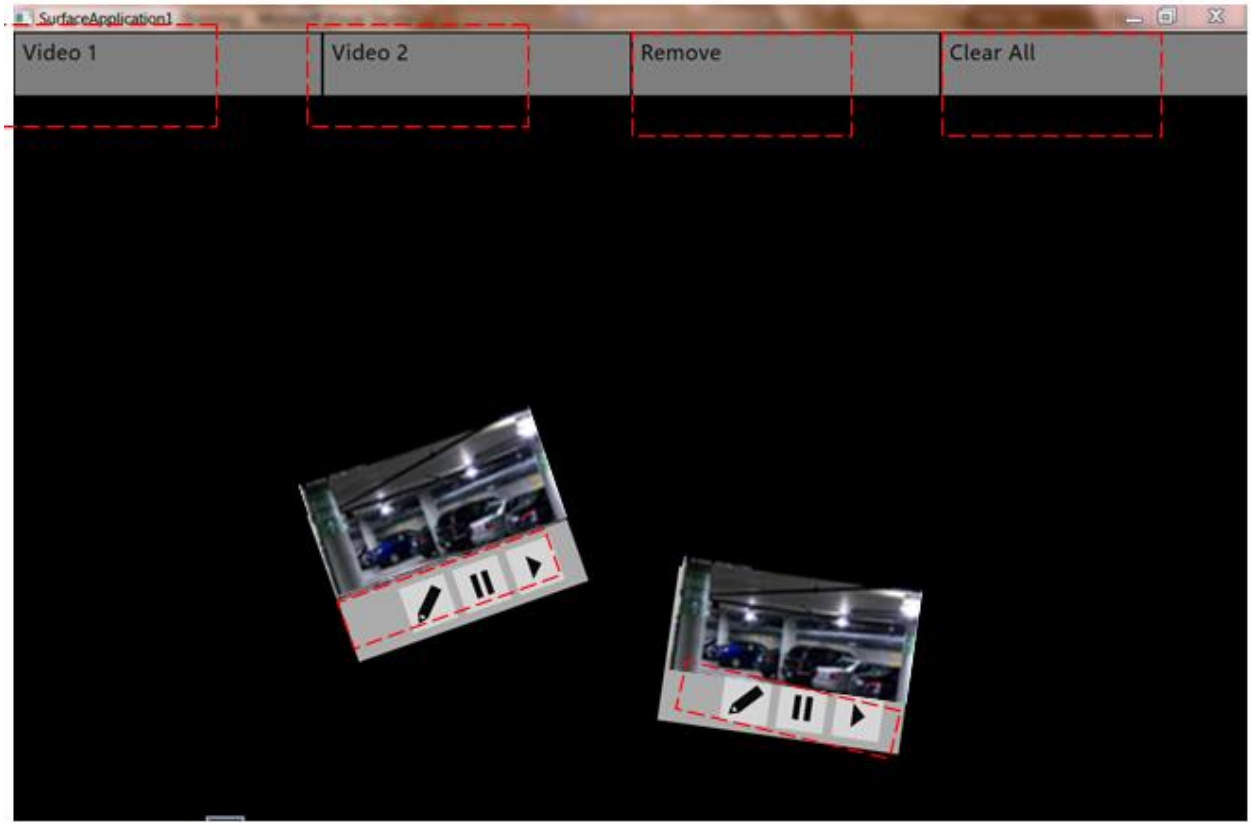
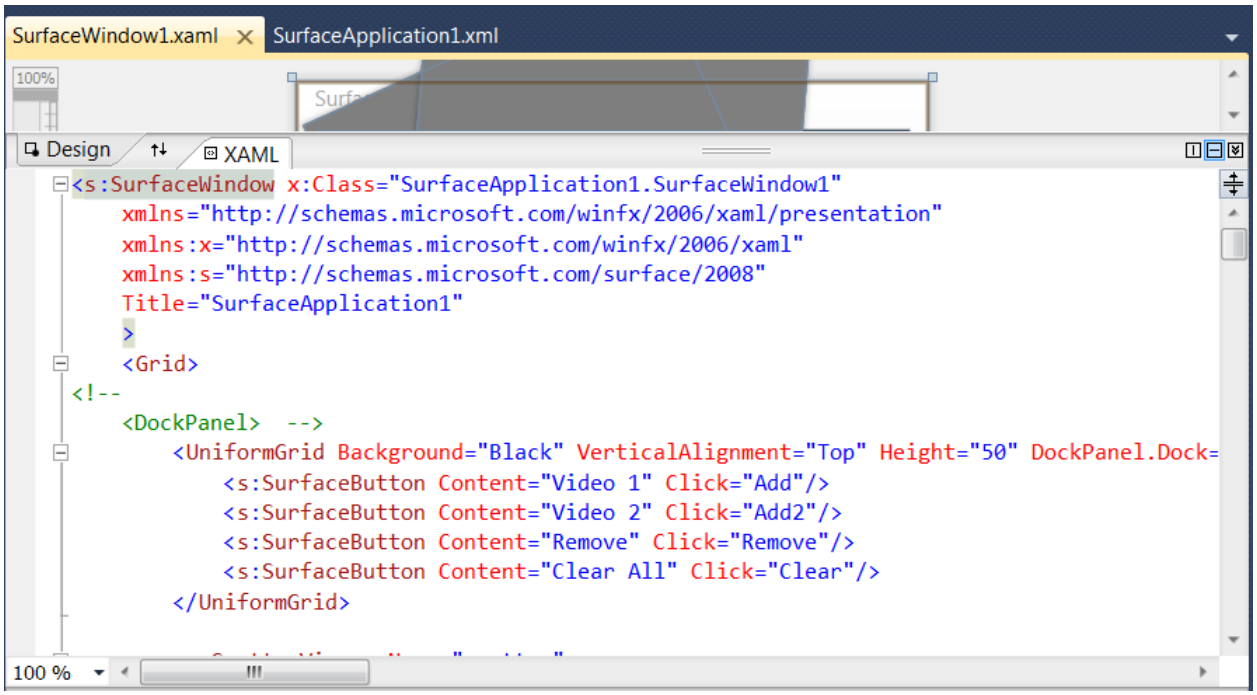
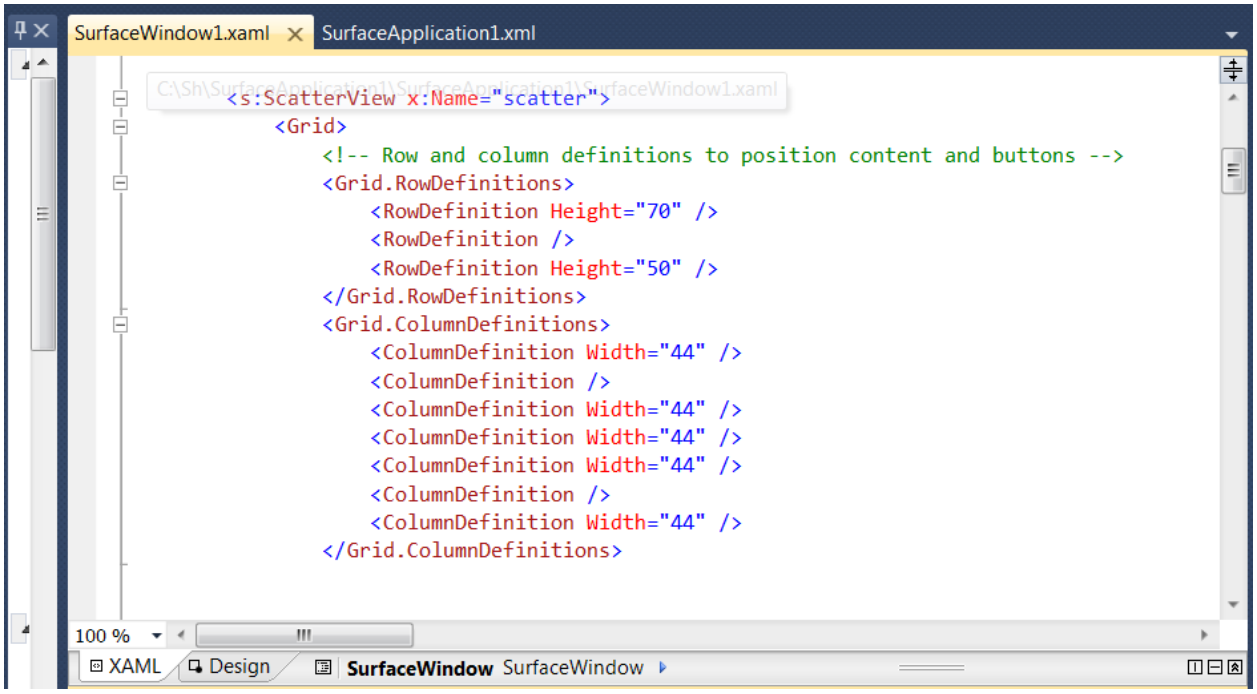



**Figure 23: 2nd Application Screenshots**

## 4.5 XAML Code Snapshots of Video Panels in Video Surveillance Applications



## 4.6 XAML Code Snapshots of ScatterView in C# WPF applications




## 4.7 Design of Gesture Library system

Each new kind of signal is simply included as another sub class to the Gesture base. Particular item registers automatically at Gesture handler after being inherited from the class of Gesture

listener. The class considered closest to the hardware is the Gesture Analyzer class. The main function of this class is that The TouchLib being inherited which plays a vital role model for further examinations. If one does not exist, Gesture Analyzer will imply as the occurrence of the class. Gesture handler carry special characteristics that each application enlists as a listener from where is generally made. Moreover it serves as an interface between the Touchlib and application.

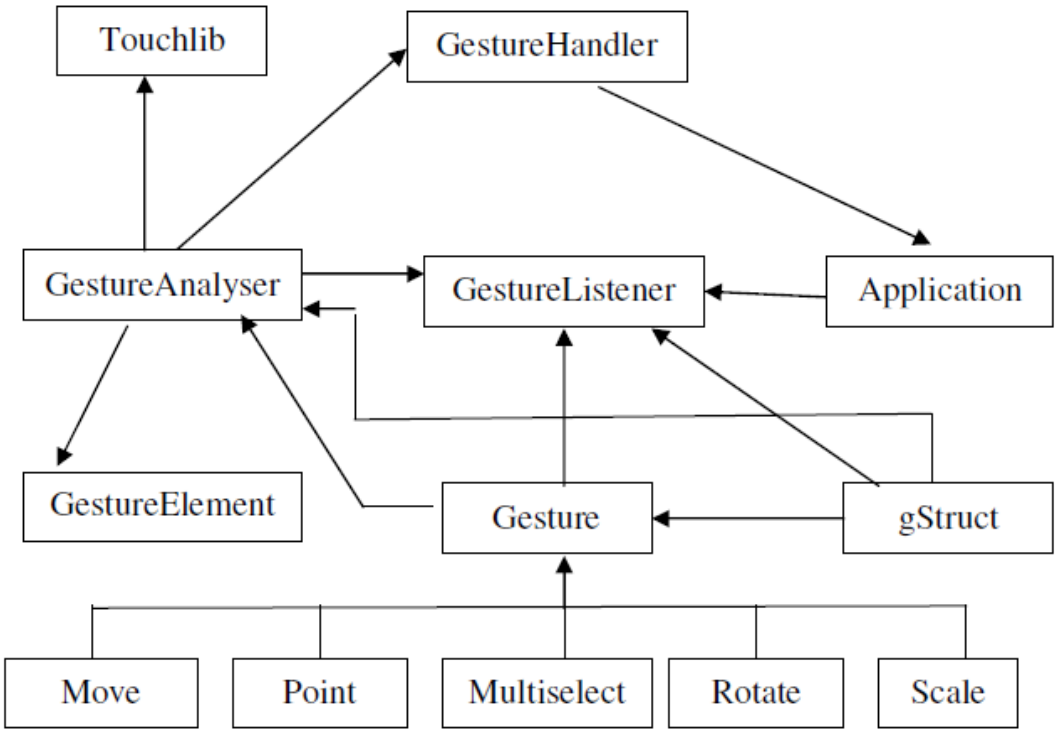



Figure 24: The gesture library design

Here is the conditions are described as an implementation for current project characteristics.

- Move


Figure 25: Move Action

To move a video, only 1 finger needs to touch it and drag it to any place within the screen area. This is illustrated through Figure 25.

- Resize

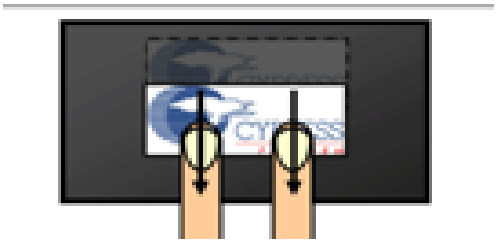


Figure 26: Resize

To resize a video, at least 2 fingers have to touch it. Then, the 2 fingers drag out of each other. This is illustrated through Figure 2

- Rotate

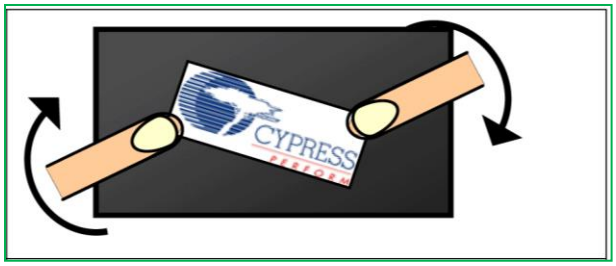



Figure 27: Rotate

To rotate a video, at least 2 fingers have to touch it as well. Then, the 2 fingers perform an arch in opposite direction. This is illustrated through Figure 27.

## 4.8 Discussion on Questionnaire Results

The actual way of discovering keys for the subject matter is the discussion and exploration. The benefit of providing discussion allows us to get more user needs and analyses of the current subject matter. Subsequently collecting all the related information, the exploration is made to realise the real subject matter.

**HAVE YOU EVER USE THE MULTI TOUCH DEVICES?**

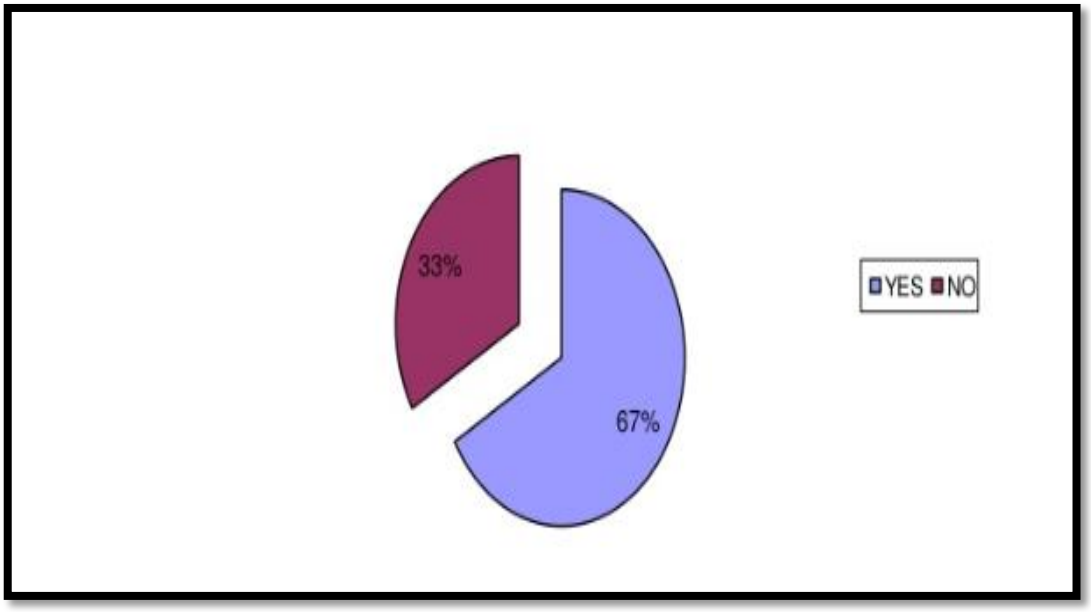



Figure 28: Have you ever use the multi-touch device?

67 % percent of users have used multi touch technology before. From the above shown results we can observe that multi touch technology is widely used and popular nowadays.

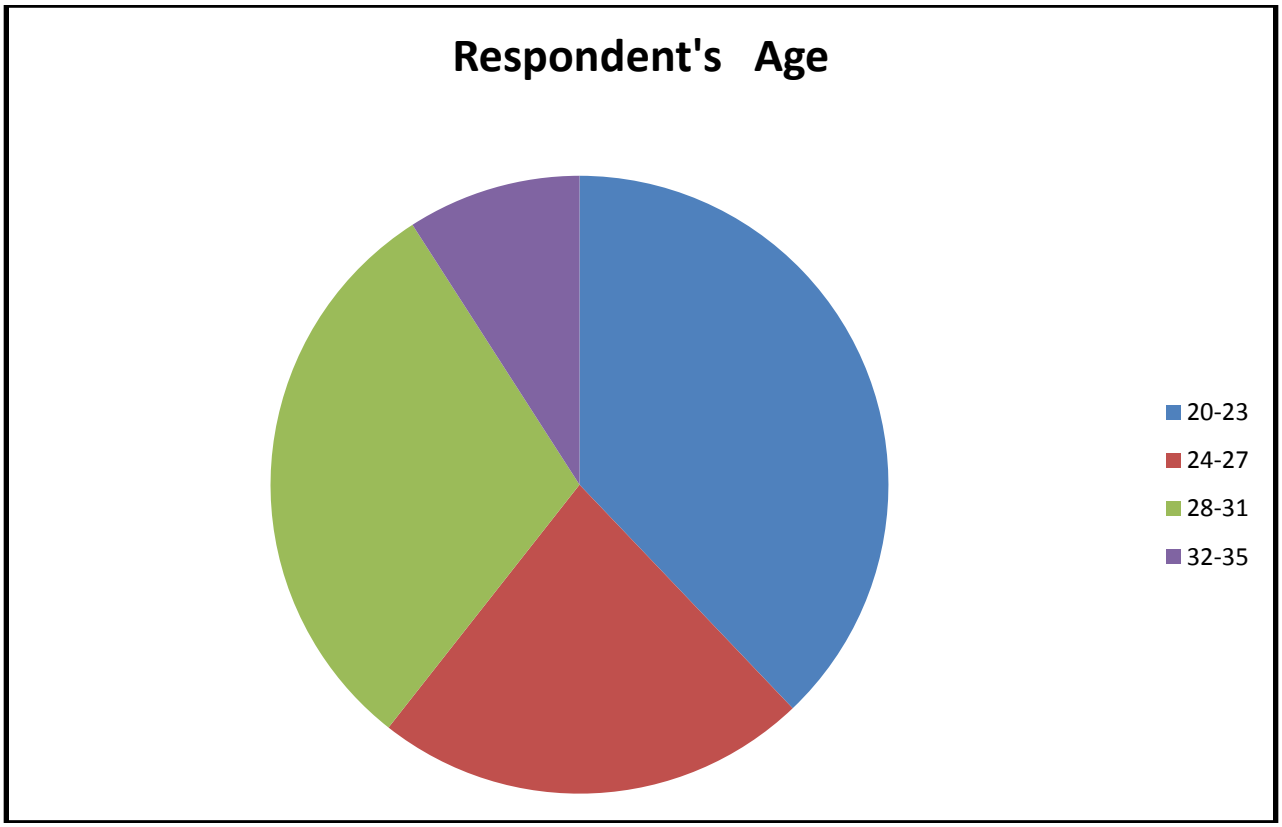



Figure 29: Respondent's Age

The survey received responses from a diverse group of students and employees. In general demographics, more than nearly 50 % of respondents' age is around 20 to 23, and others' is around 24 to 35.

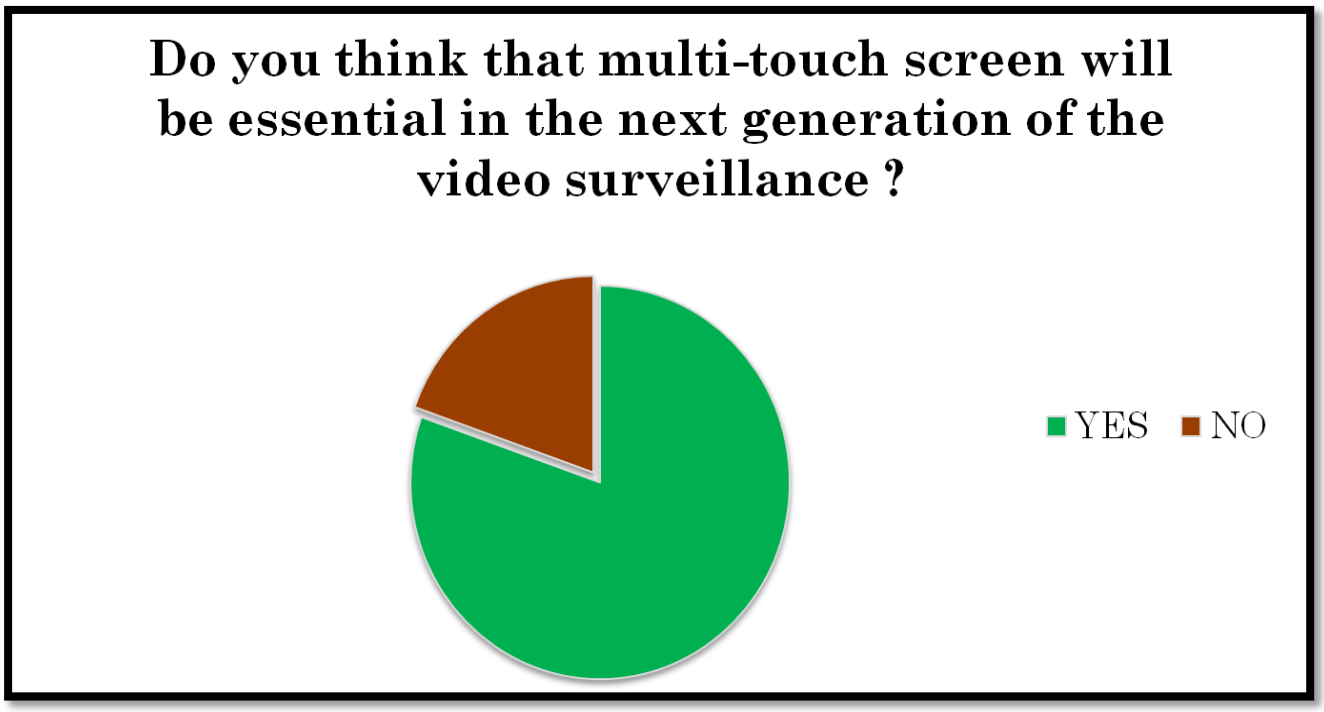



Figure 30: Pie chart on essentiality of multi touch screen in the next generation of video surveillance

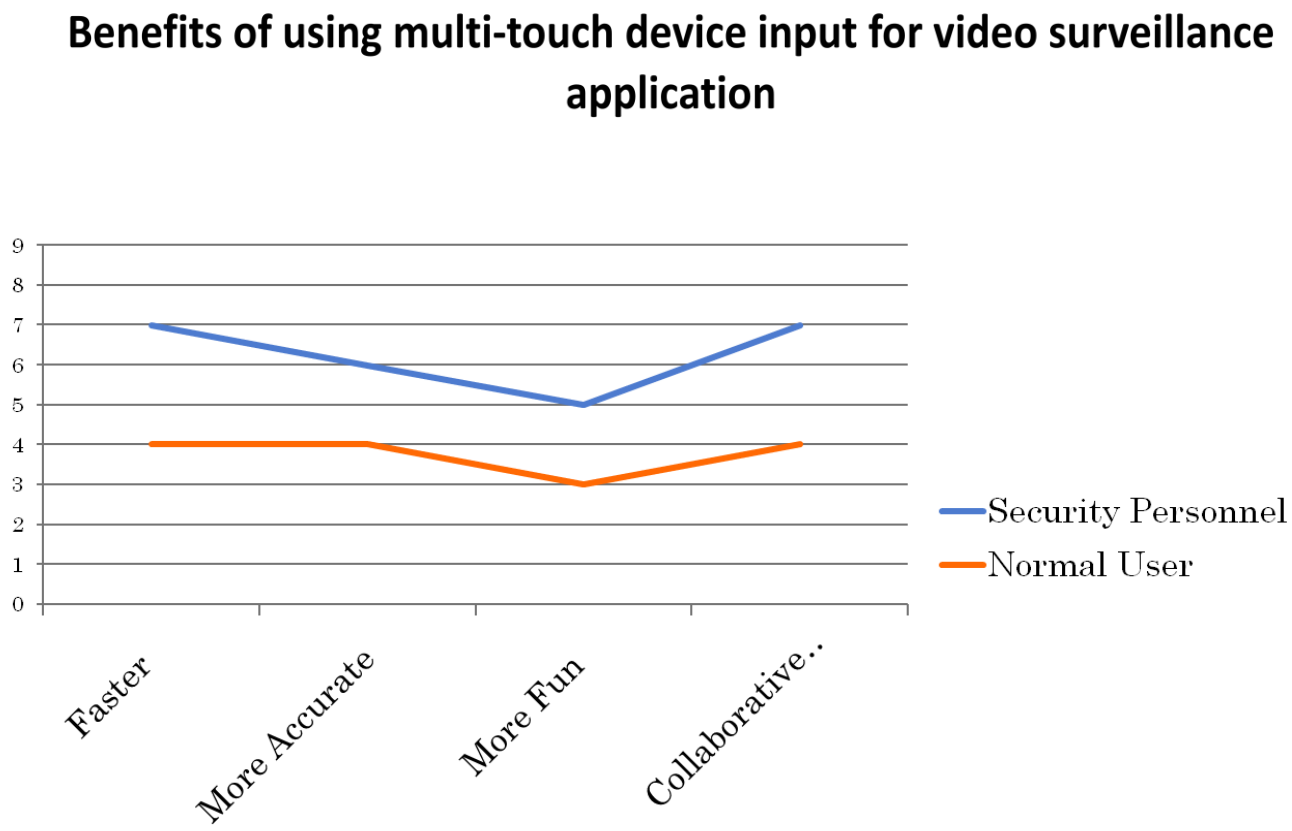



Figure 31: Benefits of using multi-touch device

In conclusion, the testing result shows that multi-touch interface is useful in a video surveillance system as users can perform moving, resizing, and rotating on a particular surveillance video to obtain a clearer view. As a matter of fact, despite the age and gender of users they likely to be familiar with the touch technology .This can increase the efficiency in monitoring the behaviours, activities of surreptitious people or objects. On the other hand, moving, resizing, and rotating operations are actually natural acts of humans and they are easy, faster, more accurate, more fun even for a first time user of a multi-touch application. Therefore, it is fairly sensible to conclude that a multi-touch interface is able to gain support from the public especially in video surveillance applications.

# CHAPTER 5

## CONCLUSION

Simply to say, this project find that multi-touch interface is useful in a video surveillance system as it allows multiple users to directly manipulate the surveillance videos at the same time. The whole multi-touch application will be written in Visual C# WPF Application, while the multi-touch framework used is WPF multi-touch framework, using Microsoft Visual Studio 2010. With WPF multi-touch framework, users can perform 4 operations on the videos, which are move, resize, and rotate, scale.

For the recommendation, it is suggested that a frame is built for the FTIR system to make it portable. Besides, with the frame, the position of the screen, camera, and projector will be fixed and the calibration will need not to be redo every time the position of one of the gadgets change.

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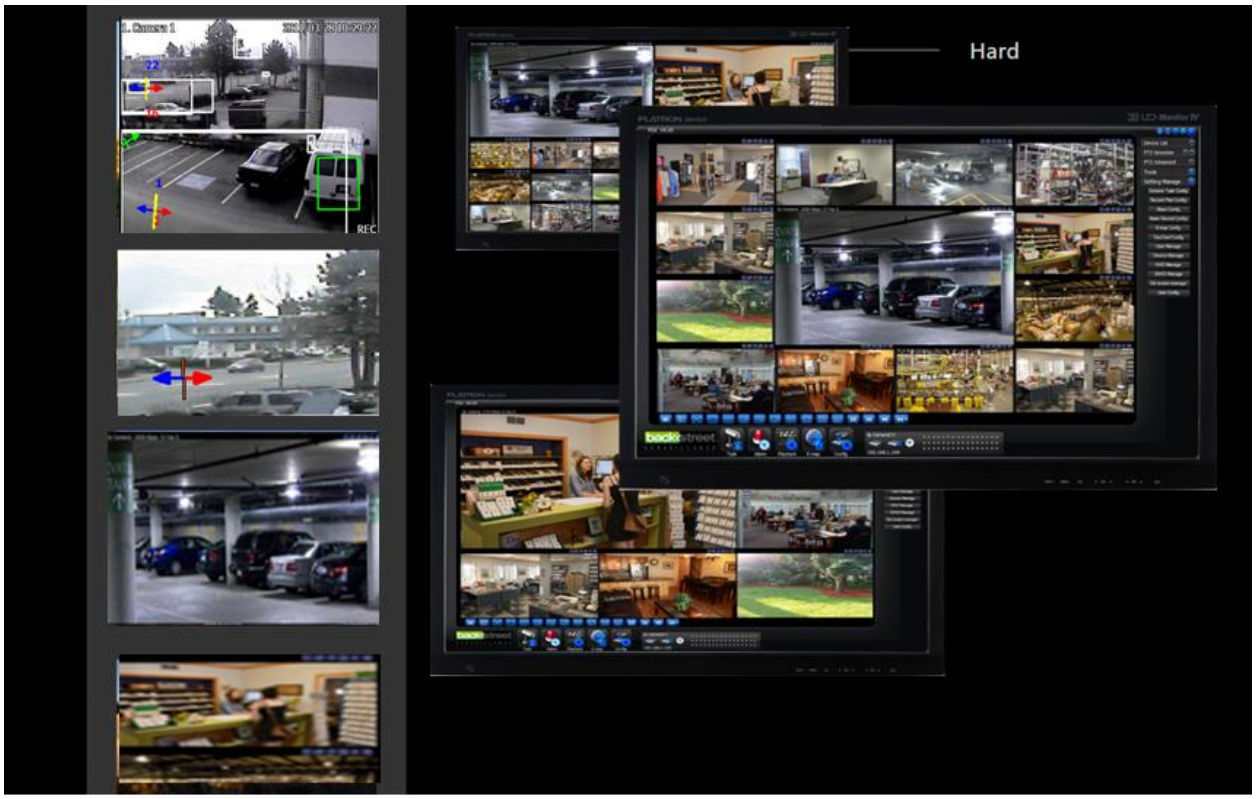
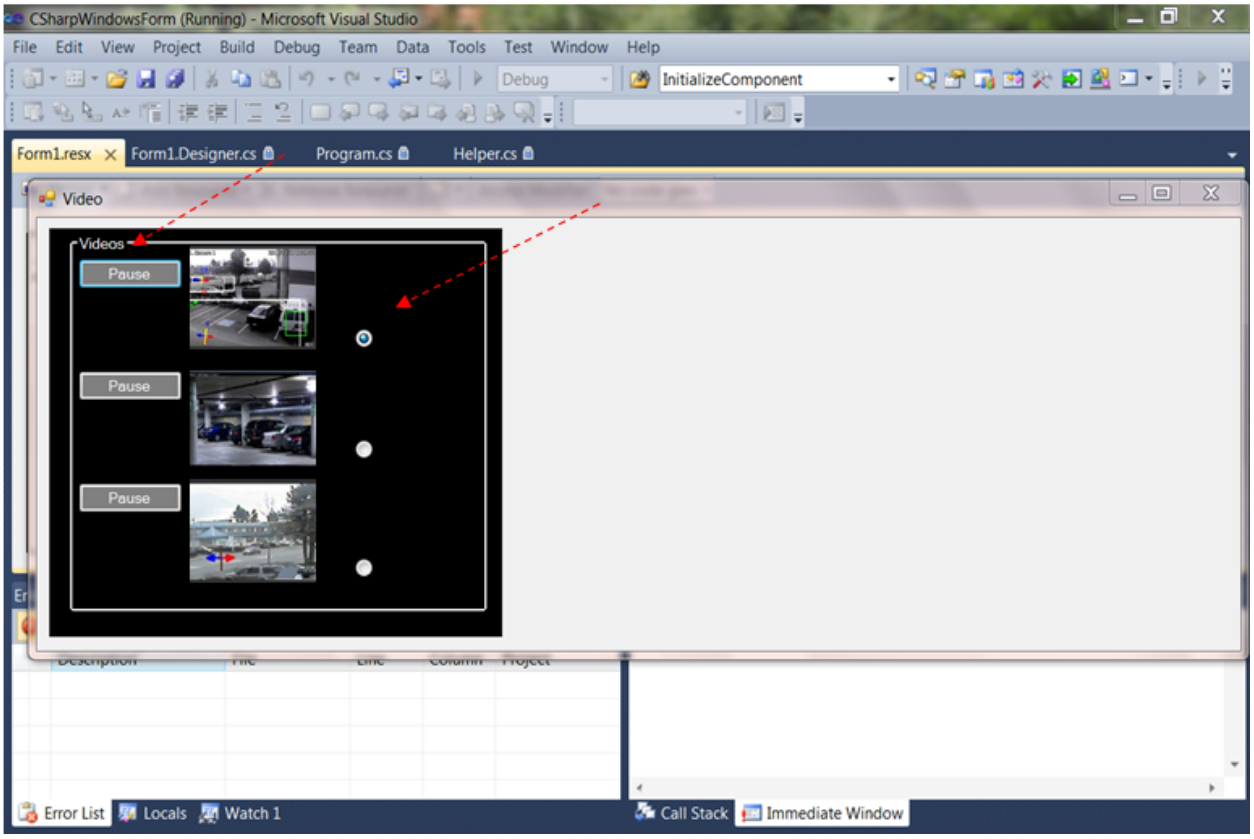
# APPENDIX

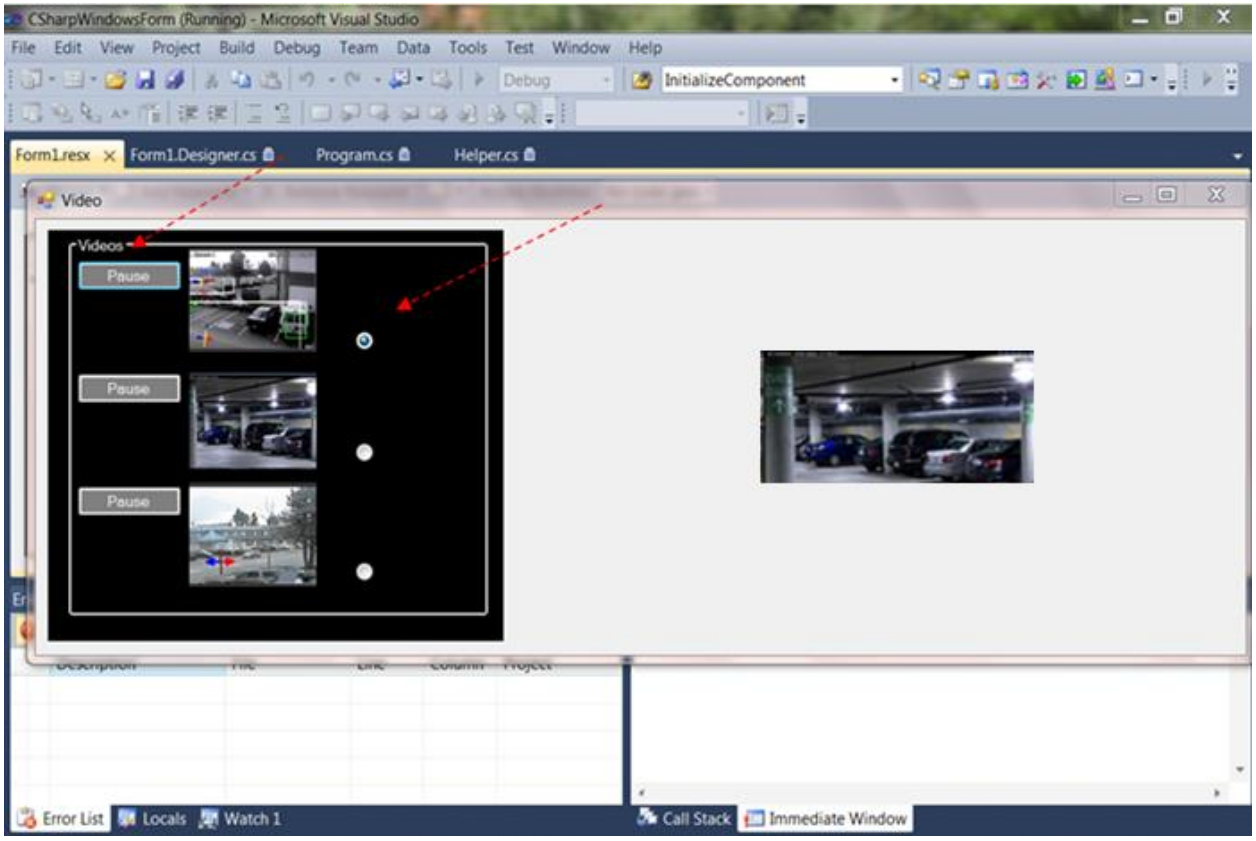
## Earlier Proposed Grahpical User Interface (GUI)



# The Image of 1st Application



# Testing of 1st Application



## Second Application Screenshot