REALCAM: A Pedagogical Tool for Learning Basic Videography

Harshit Agrawal
Department of Design
IIT Guwahati
harshit@iitg.ernet.in
+91 7896360442

Arka Bani Maini
Department of Design
IIT Guwahati
a.maini@iitg.ernet.in
+91 8876559353

Abhinav Krishna. A
Department of Design
IIT Guwahati
a.aadiraju@iitg.ernet.in
+91 7896172433

Tushar Chhabra
Department of Design
IIT Guwahati
c.tushar@iitg.ernet.in
+91 7896173020

Keyur Sorathia
Department of Design
IIT Guwahati
keyur@iitg.ernet.in

ABSTRACT
We introduce a novel concept of a tangible camera to be used as a teaching tool for beginners of videography. The tangible camera can be interfaced with any 3D modeling/animation software with a built in camera tracking application to allow for its direct, real-time manipulation using our tangible camera. This gives the user ample scope to explore various camera shots, angles and movements using the physical camera over the virtually modeled scenarios on the 3D platform without having to use a real physical camera which is expensive and not often portable. The tangible camera provides a cost effective, easy to use and portable device to explore various basic concepts of cinematography freely. In this project we explore the possibilities of this concept using 'Autodesk Maya 2014' – an industry standard software used by professionals for 3D modeling and animation. We discuss the need for better interactive ways to teach basic videography, the lack of enough equipment for all the students of the subject due to the high cost of equipment, and how this small device would help in providing an inexpensive yet highly interactive platform for students to grasp the concept of videography in much better way than it is currently done today. We explain how this tool can help students as a pre-visualization aid to quickly build up rich storyboards that ultimately help them hone their skills of videography.

Author Keywords

Pedagogy, Tangible User Interface**,** Basic Videography**,** Tangible Camera**,** Storyboardi**n**g**,** Camera shots**,** Camera Angles**,** Camera Movements**,** Zoom**,** Pan**,** **T**rolley**,** Tracking**,** Tumbling**,** IR Sensor**,** **A**ccelerometer, Potentiometer**.**

ACM Classification Keywords
H.5.2 [Information interfaces and Presentation]: User Interfaces
H.1.2 [Models and Principles]: User/Machine Systems – **human factors.**

General Terms
Human Factors; Design; Measurement.

INTRODUCTION

Cinematography or Videography is one of the primary skills or professions related to film making[1]. Studying cinematography or film making in general is a costly affair. As found in our research of major institutions (names undisclosed), the primary reason for the high costs in teaching introductory videography courses is providing proper equipment. Even after paying a huge lump of money, lack of exposure to equipment and practical, physical exercises is always an issue resulting in improper grasp of concepts.

UNDERSTANDING THE COURSE

For our literature review, we looked into the various courses on film making that are offered to students. We searched for film schools and universities with courses and degrees or diplomas in film-making to better understand the course structure for a new student of cinematography or film making in general.

Looking into the course structure [2] we found out the following basic concepts that were more or less taught in all the schools as part of basic understanding of cinematography:

Shots: Establishing shots, Medium shot, Long shot, Close up, Extreme Close up.

Angles: Eye Level, Low angle, High Angle.

Movements: Pan, Tilt and Zoom.

We looked into the methods of teaching these core principles and found that the medium of teaching is often theoretical; through text books and instructional workbooks [3].

RESEARCH AND INSIGHTS

Primary research was conducted among 20 students who had recently completed the course "Introduction to Videography" taught in a premiere Indian institution. The interviews were done with the motive to understand the way the course was taught in terms of medium of instruction, the problems faced by the students in the course, get an understanding of how clear their concepts in videography were, how comfortable they were with their concepts of videography and to determine if a better medium of education was actually needed**.**

Research Insights

For the research analysis phase of the project, we gathered all our information and understanding from literature review and primary research. We understood from the student user survey the following key points:

- They were not fully confident about their understanding of basic videography. This was mainly because of lack of enough practical (hands-on) exposure.
- The lack of proper knowledge and the inability to explore with a real camera reflected on their storyboards which were restricted to using bare minimal camera angles and shots as they were not confident about exploring more.
- Even if they explored with a new idea in their storyboard, they were not successful in translating that concept into reel, mainly because they didn't know how to do it! Again, the primary reason here was the lack of experience and not enough exposure to practical equipment.
- Most of them were encouraged by their instructor to get their own camera as the department did not have enough equipment to provide every student. Most of them, however, could not afford the same due to its high price.
- While issuing a camera from the department they had to take extra precautions about handling the camera as it was very fragile and they did not have enough experience about operating it. This did not allow them to explore and play with new ideas, which is very essential for a cinematographer.

An interview with the instructor of an introductory course in videography was carried out to identify new areas of interest and to validate the insights that were deduced from initial literature review.

The interview gave us insights into the methodology employed in teaching an introductory course in videography and also the problems faced by the teachers and the department while teaching it. The following insights were generated:

- The main medium of instruction is presentation slides and notes. As our primary research revealed, and also as found out in literature study, these mediums were not very effective in clearing the concepts of students if they are not exposed to a medium where they can practically (i.e. in a hands-on manner) explore the various concepts [4].
- The department in general does not have enough equipment to teach a batch of 30 students. The department of the instructor in question had 2 cameras which had to be used between 30 students. This ratio clearly indicates how hard it is for any student to get enough opportunity to explore concepts in a hands-on manner.
- Being responsible for the equipment, the instructor tends to feel insecure in allowing students to directly use professional cameras due to their fragility and the high cost of damage.
- Many camera techniques are taught only through text and videos because of unavailability of most equipment like crane, steady cams et cetera. So students generally find it difficult to grasp and apply these concepts in assignments they are given later.
- Not enough collaboration between students and teachers throughout the course is observed because of the course structure being more theoretical than of hands on learning.

DESIGN CONCEPT

Based on the research insights gained – we decided that the path employed for the output should mainly be inspired by the following traits:

- Covering the entire range of basic videography concepts
- Inexpensive
- Effective shot visualization for accurate understanding of concepts
- Interactive pedagogy tool to encourage collaborative learning
- Enable experiencing the actual physical feel of using a camera
- Encouraging discussion and collaboration
- Tangible device
- Non fragility to allow free exploration
- Direct Manipulation and real-time feedback
- Easy to explore and providing capability to experiment with freedom

STUDENT BENEFITS

The design concepts described above will result in the following benefits:

- RealCam will be an efficient tool for introductory videography courses as it is capable of covering the entire range of basic shots described in the 'understanding the course' section mentioned above.
- As it is inexpensive, institutions will now be able to cater to the needs of a any class strength.
- Being an interactive tangible tool, it can help support collaborative learning. For example, Stanton et al. discuss the benefits of tangible interfaces and how they can be used collaboratively [5].
- Physical manipulation with real time output will result in better learning of how the camera is practically used (in terms of its various movements) in comparison to handling the camera virtually.
- Students will have the freedom to play around without worrying about damaging the device because it is inexpensive. This supports the argument put forward by Duckworth [11] that cognitive growth can only take place optimally in an atmosphere that invites the student to take (reasonable) risks-without fear.

WORKING OF FINAL PRODUCT

The design solution for RealCam is a portable, handheld camera that is able to sense changes in its various degrees of freedom i.e. translation and rotation in the three axes, confined in a space defined by an open three-planed platform, and can be used to directly manipulate the virtual camera of the 3D software (Autodesk Maya) via a Python-based plug-in. In order to sense the position and translation of the camera, three IR Range sensors (with a range of 10 to 150 cm) have been used, one situated on each of the three axial faces of the camera. They sense the distance of the camera from the three planes of the platform which are normal to the three axes, giving the X, Y and Z co-ordinates of the camera. After this is fixed, for sensing rotation in the horizontal XY plane, a potentiometer is used with a rotating knob, rotating which will virtually rotate the camera around in the horizontal plane. For the vertical axes, an accelerometer measures the acceleration in the vertical direction and has been calibrated to give readings of angle of tilt in the vertical plane. (Fig 1) The synchronized measurement values generated by the accelerometer, potentiometer, and the IR sensors (with a suitable pass filter to account for minor handshakes) is sent to Arduino over a serial port (where processing of raw values from sensors takes place to convert to angles and distances) and then to Maya through a command port Python script written in Maya.

All this is in reference to a dummy character/object placed on the platform, the distance and angle relative to which is calibrated in the software. The result is a full analogy between the physical camera and the virtual camera, and precise duplication of the physical camera's manipulation in the virtual camera. Thus, direct manipulation of the tangible camera gives a real-time feedback on the shot visualization (Fig 2-6) created by manipulating the built in camera of Autodesk Maya

No other equipment is needed for the above primary function, and the absence of any actual camera lenses or light sensing setup inside the camera greatly aids the economical production of the system, making it available to the average individual user. The system allows multiple further possibilities such as augmenting the camera with miniature tripods and mounts which enable the capture of a wide range of smooth camera motions. The choice of the software package, Autodesk Maya, is owing to its wide use in the film, animation, and visual effects industries, as well as its popularity among students of these fields [6].

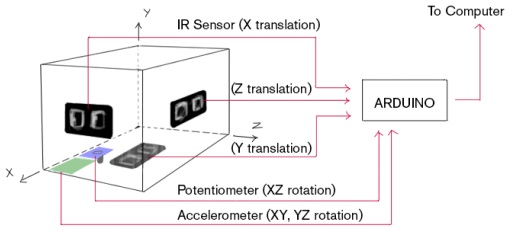

Figure 1. Circuitry of RealCam device

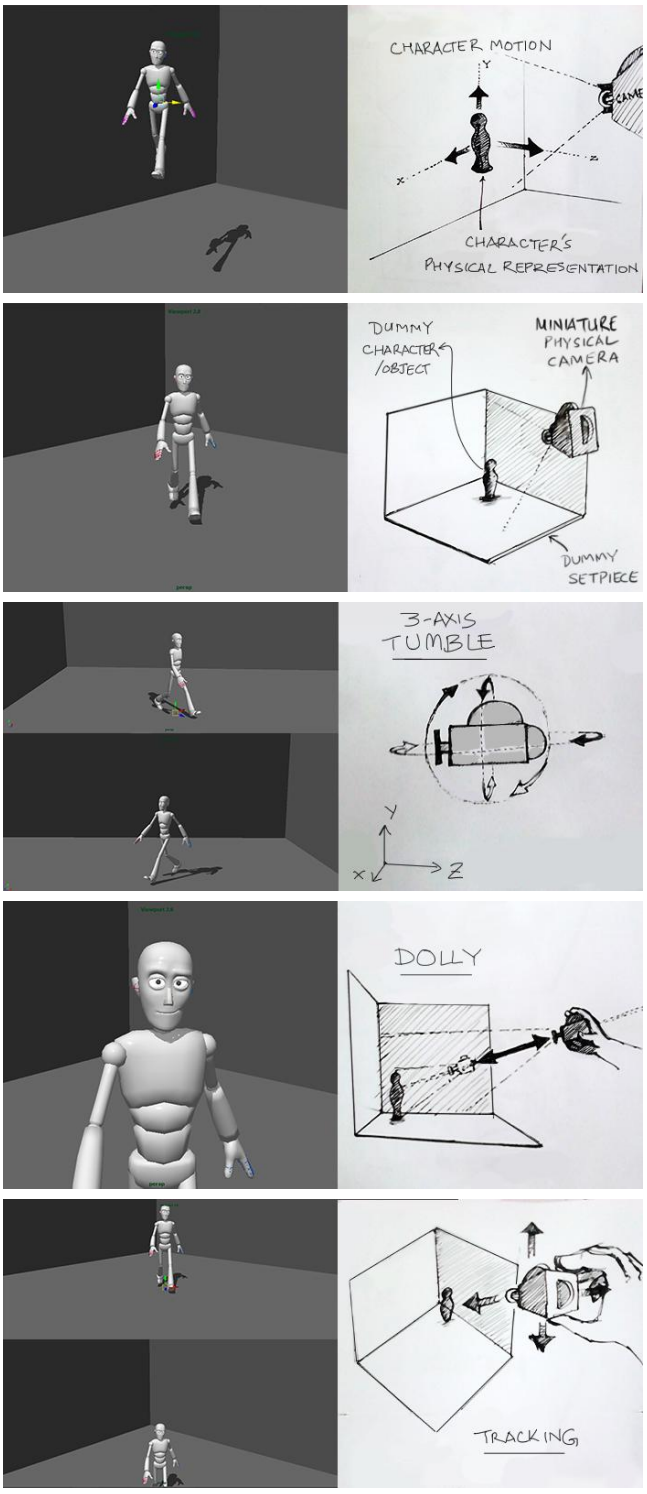

Figure 2-6: Direct Manipulation and feed back

IMPLEMENTATION AS AN EDUCATIONAL TOOL

RealCam, in its present state (Fig 7) is intended to be used as an educational tool that will complement the current methodology deployed in teaching introductory videography. By adding this robust, inexpensive, easy to use and interactive tool that provides hands on experience, it will add a new dimension of understanding to the students. They will now be able to instantly and easily try out concepts presented to them. This tool will also greatly aid students in exploring with more camera shots to develop richer storyboards as they now have the complete freedom of quickly iterating between various camera shots.

Figure 7: Final Model of RealCam

RELATED WORK

Multiple tangible user interfaces (TUIs) have been developed for education and learning, sharing a common view that hands-on activity and physical manipulation provides benefit for learning [7]. In addition, the support TUIs provide for collaborative work makes them especially appealing for learning. For example, Stanton et al. discuss the benefits of tangible interfaces and how they can be used collaboratively [5]. Specifically, they mention the use of physical size and physical props to encourage collaboration. The use of hand held devices, like projectors to manipulate surrounding objects has been used in the past by Cao X. et al. in their development of PICOntrol [8] and to encourage collaborative play by Shilkrot R. et al in their development of PoCoMo [9]. RealCam is a similar interaction paradigm with a hand-held device acting as a means of generating camera shots with reference to a physical object.

FUTURE WORK

A. Evaluation Plan

We hypothesize that RealCam makes an engaging and effective teaching tool. We intend to evaluate its usability and effectiveness with actual users and apply the results in future prototypes. A comparative study that includes RealCam and the current methods of teacher demonstrations, slides and presentations may provide additional insights regarding how RealCam weighs against the current methods of instruction.

B. Next Steps

As an immediate future step, the physical reference objects will be made into auto calibrated devices that could be connected to any virtual object in Maya similar to the camera so that the user does not physically need to calibrate it. Thus, moving this physical object around in the real world set will move it accordingly in 3D space in the software simulation. This will enhance the power of RealCam to be able to create shots with inter-relation of different objects and experimenting various combinations of physical placement of objects/ characters and how the shot could be perfected.

A feature to store and playback the output sequence of the camera movements can be implemented. This can then help a mentor in monitoring the student's progress; making the process of providing feedback easier. Also, this fits well into the iterative cycle of building creativity as one can now imagine a shot, create it, play, share, reflect and imagine again! [10]

The form of the product could be worked upon to enhance the overall usability and experience.

Various small, low cost, dummy equipment could be developed for this camera like tripods, cranes, trolleys etc. to allow more opportunities for creative exploration with the device and give capabilities that would otherwise be extremely costly to develop and require high skill levels for use. These will now be accessible to all.

CONCLUSION

As a novel interactive platform, RealCam provides a unique and effective solution to the related problem of lack of equipment due to expensive cost of cinematography education and the consequent absence of hands-on exploration of various concepts in an introductory videography course. Our platform achieves the concepts laid out in the design concept section as it provides an inexpensive, portable, hand-held device through which one is enabled with the capability to explore all the various basic videography concepts. It provides a way for more student – teacher and student – student collaboration due to a more hands on learning environment [5, 7] and a powerful tool for teachers to teach the concepts better by easy demonstration. The device is robust and can be used without worrying about the costs that would have to be incurred if damaged (often the case with real cameras). This allows for much greater freedom of exploration. Linking it with a 3D modeling/ animation software results in the capability of direct manipulation of the software's virtual camera through a tangible one and real-time feedback to the user on shots' visualizations.

The RealCam as a tool has wide possibilities for extending it to many uses. Proper development can lead it to become an industry standard pre visualization tool. Professionals can use RealCam as a physical handle to manipulate various aspects of the camera tool of a 3D software. We thus propose the RealCam and its implementation in a wide range of use scenarios.

REFERENCES

1. Kris Malkiewicz, 2005, Touchstone-Cinematography : 3rd Edition
2. Joseph V. Mascelli, 1998, Silman-James Press - The Five C's of Cinematography: Motion Picture Filming Techniques
3. Teresa A. Miller, 2012, Journal of Legal Education, Vol.62, No.2 : *Encountering Attica*: Documentary Filmmaking as Pedagogical Tool
4. G. Conole, M. Dyke. M Oliver, J. Seale, 2004, Elsevier : Computers & Education, Vol.43, Issues 1-2, *Mapping Pedagogy and Tools for Effective Learning Design*
5. Stanton D., Bayon V., Neale H., Ghali A., Benford S., Cobb S., Ingram R., O'Malley C., Wilson J., and Pridmore T., Classroom Collaboration in the Design of Tangible Interfaces for Storytelling, in *Proceedings of Conference on Human Factors in Computing Systems (CHI '01),* ACM Press (2001).
6. Dariush Derakhshani, 2012, Wiley : Introducing Autodesk Maya 2013
7. Marshall P., Do tangible interfaces enhance learning? In the proceedings of TEI 2007.
8. D Schmidt, D Molyneaux, X Cao: PICOntrol: using a handheld projector for direct control of physical devices through visible light, UIST '12 Proceedings of the 25th annual ACM symposium on User interface software and technology, Pages 379-388
9. Roy Shilkrot, Seth hunter and Patricia Maes. "PoCoMo: Projected Collaboration using Mobile Devices. " To appear in the proceeding of the 13th International Conference on Human-Computer Interaction with Mobile Devices and Services (Mobile HCI 2011), August 30, 2011.
10. Sowing the Seeds for a creative Society, Mitchel Resnick, 2007, ISTE (International Society for Technology in Education), 1.800.336.5191 (U.S. & Canada) or 1.541.302.3777
11. Duckworth, E. (1972). The Having of Wonderful Ideas. Harvard Educational Review Vol. 42 No. 2 May 1972, 217-231.