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Human Oversight Due to Usage of Smartphone Prevented By using an AR-H.U.D in A Helmet

B. Lalithadevi, Anand Sasidharan, Dharmesh Kumar Singh, Nilesh Dangi

Abstract: ***It is difficult to manage a smartphone for useful purposes on the road by a motorcyclist rather than a motorist. A H.U.D or a Head up Display makes it much easier and less hazardous for a motorcyclist to attain proper usage of various on road features provided by a smartphone like navigation, etc. In this paper, a study comparing the usage of a Head up Display unit in a helmet over the smartphone has been conducted. The H.U.D has decreased unnecessary glances and it is conclusive that peripheral vision allows maintaining a better cognizance. Also, the user interface is easy to learn and use and does not require visual attentiveness from the user.***

Index Terms: Augmented Reality, Head-Up Display, Nearest Neighbour Search, Random Sample Consensus

I. INTRODUCTION

An A.R HUD in a helmet shows all necessary details exactly in the front sight of the driver. The user gets details such as speed, obstruction warnings, navigation, call notifications, etc.

The AR HUD is designed in such a way that it doesn't obstruct the view of the driver. This is what makes it stand out from the conventional HUD. The amount of light that is perceived in the visor of the helmet is negligible so that the display doesn't become an unnecessary distraction to the driver. The helmet has the same fit and size as the conventional helmet just with some extra equipment added on for the better usage of the helmet.

II. LITERATURE SURVEY

An AR-HUD is a device which consists of an Augmented Reality Head-up Display, i.e., a display which showcases necessary details without the user to look down. The device uses a three dimensional

tracking system to acquire the necessary details from the surrounding in order to display it on to the

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* Correspondence Author
B. Lalithadevi, Department of Computer Science and Engineering, SRM IST, Chennai, India. Email: blalithadevi@gmail.com
Anand Sasidharan , Department of Computer Science and Engineering, SRM IST, Chennai, India. Email: anand03111998@gmail.com
Dharmesh Kumar Singh, Department of Computer Science and Engineering, SRM IST, Chennai, India. Email: anandlucky12345@gmail.com
Nilesh Dangi, Department of Computer Science and Engineering, SRM IST, Chennai, India. Email: nilesh21098@yahoo.com

HUD display. This three dimensional system involves two steps: initial background observed

acquisition and registration of AR in the real environment. The observed background acquisition is made possible by a camera unit fixed in the helmet. The registration of AR in the real environment is done using a holographic technique. The algorithms used to observe the objects and measure the mean distance between each object is done using two methods, namely IST(Irregular Segment Tuning) and CCS(Closest Companion Search).

III. EXISTING SYSTEM

The existing system is an AR-HUD display for a four-wheeler vehicle. In this, the HUD is present on the windshield of the car. The HUD displays the speed, at which you are travelling, the directions from a navigation app, and all the necessary details required by a car. AR is being used. It consists of: an optical display system, a tracking and registration mechanism, a real-time interaction. The display uses the Holographic technology which is made successful using a micro-lens array and a CCD (charged coupled device) array or a camera array. The existing model uses full colour holographic lenses and lens array functions that provides full colour image in a 3D virtual optical transmission AR system. The main drawback of the existing model is that it is only available for four-wheelers. Since the AR-HUD is present on the windshield of the four-wheeler vehicle and since a two-wheeler doesn't support a windshield, the existing model is not suitable for two-wheelers.

IV. PROPOSED SYSTEM

The proposed system is an AR-HUD on a helmet used for two-wheelers. The proposed model has a similar design to the existing model. This also uses an optical display system, a tracking and registration mechanism, a real-time interaction. The only difference is that, this is built on the visor of the helmet. The investigation for the above process went as follows: firstly, by getting real-time data from the environment, i.e., real-time objects positions, drivers' position and the virtual plane where the information has to be projected. A camera is used for the above investigation. Secondly, a real scene is required to obtain accurate registration. The problem faced here is the estimation of transformation matrix at different moments. To solve this problem, this scene/image should have minimal details to reduce the processing time. After extracting the details, a FLANN (Fast Library for Approximate Nearest Neighbours) algorithm to match the details is to be showcased in the environment.

Then use RANSAC (Random Sample Consensus) to remove redundant points. Thirdly, the image presentation in the real-world environment is done using a Hologram technology using a micro-lens array and a camera array. The main advantage is that it can be used for two-wheelers and four-wheelers. It also prevents a lot of accidents which are caused due HDD (head-down displays) commonly known as our mobile phones. Plus, it also encourages the use of helmets especially in a country like India where the helmets are only used by 43% of the population. It is also very helpful in the delivery system as it reduces the time consumption and allows a hands-free experience.

The different parts of the device include:

OPTICAL DISPLAY SYSTEM: The display uses the Holographic technology which is made successful using a micro-lens array and a CCD (charged coupled device) array or a camera array. The model uses full colour holographic lenses and lens array functions that provides full colour image in a 3D virtual optical transmission AR system.

CAMERA: The camera unit is present in order to observe the surroundings and return necessary data to the display system. The camera will have an optical image stabilization system for better data input.

MICROPHONE: A Bluetooth microphone is used. The microphone is present for audio output which is required for navigation, call notification and obstacle warnings.

MOTION SENSOR: The motion detector/sensor is present to detect user movement and to detect the speed of the vehicle.

AMBIENT LIGHT SENSOR: The light sensor is present for a proper lit user interface so that the display is neither too bright that it obstructs the view of the user, nor too dark that the user isn't able to see anything on the display.

PROXIMITY SENSOR: The proximity sensor is a very useful module. It's the most important module in obstacle detection system. The proximity sensor detects the obstacle and also returns the distance of the user from the object of obstruction.

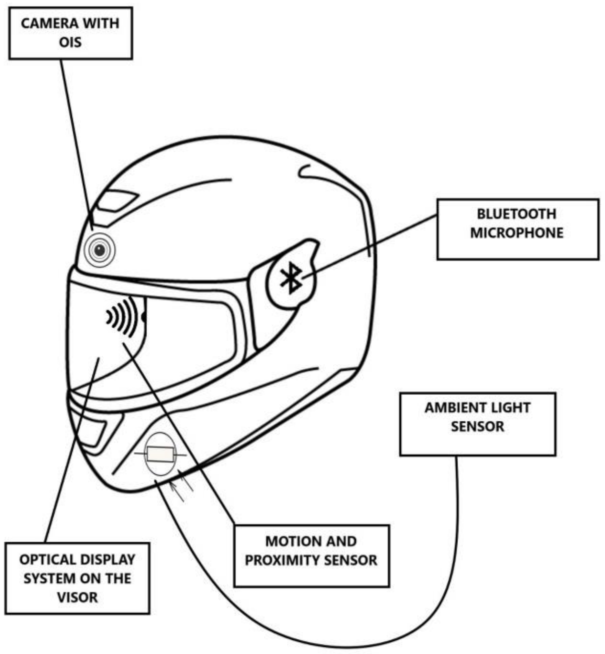

Figure 1: Architecture of the Ar Hud Helmet

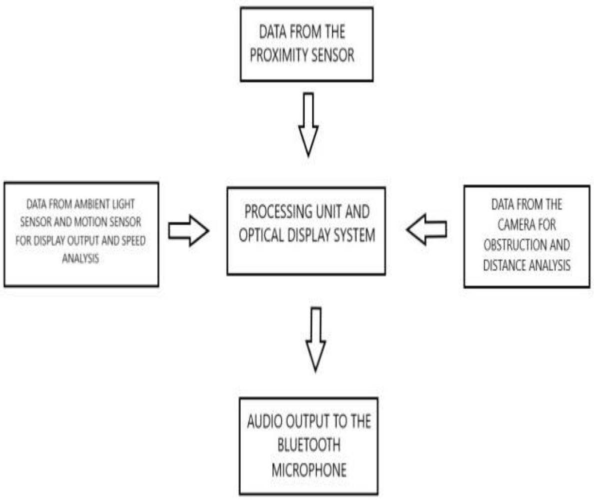

Figure 2: Units of The Ar Hud

V. ALGORITHM

To make an AR-HUD system for helmet to reduce the distraction caused by handheld devices (generally mobile phones) using the following algorithms:

1. IST- IRREGULAR SEGMENT TUNING is a repetitive method to estimate boundaries of a mathematical clone from a set of observed data that contains points outside the area, when these points do not affect the observed values.
2. CCS- Closest Companion Search CCS), as a searching technique, is the upgradation problem of finding the point in a given set that is closest (or most similar) to a given point.

Some additional components which will be used to implement this system are Optical Display System, FLANN, Cameras, Tracking and Registration Mechanism, Real Time Interaction. The main objective is to create a helmet which displays all notifications like navigation, call log, etc. of your mobile phone on its visor. The second objective is to display the speed of the vehicle on the visor and also display the necessary warnings on over speeding. This also includes a proximity sensor which displays the distance between the user and the obstacle. This feature is extremely useful when there is a visibility issue. The third objective is the most important objective, that is, increase the usage of helmets.

A. IST (Irregular Segment Tuning)

It is a repetitive method to estimate boundaries of a mathematical clone from a set of observed data that contains points outside the area, when these points do not affect the observed values.

ALGORITHM FOR IST

1: Select irregular number of points required to find the clone constants. 2: Solve for the constants of the clone. 3: Determine how many points from the set of all points fit with a predefined toughness. 4:

If the fraction of the number of points lying inside over the total number points in the set exceeds a predefined threshold ᴪ, re-estimate the clone constants using all the identified points inside and remove them. 5: Otherwise, repeat steps 1 through 4 (maximum of T times).

The number of iterations, **T**, is chosen maximum to ensure that the probability **x** (usually set to 0.99) that at least one of the sets of irregular segments does not have anything outside. Let **a** represent the probability that any selected data point is a point lying outside and **b = 1 − a** the probability of observing a point lying outside. **T** iterations of the minimum number of point's denoted **R** are required, where

$$1 - x = (1 - a^R)^T$$

and thus with some manipulation,

$$T = \log(1 - x) / \log(1 - (1 - b)^R)$$

B. CCS (Closest Companion Search)

Closest Companion Search, as a searching technique, is the upgradation problem of finding the point in a given set that is closest (or most similar) to a given point. The formula for closest point is given by:

$$X_c = D(in)/0.5(a/n)^{½}$$

where

Xc- Value of the closest companion

D(0) – Observed closest companion distance

a- The area where all the points are present

n- total number of points

More formulas used are:

The Average Closest Companion ratio is given as:

$$ACC = D_0/D_1$$

where D_0 is the observed distance between each point and their closest companion:

$$D_0 = (\sum_{i=1}^{n} d_i)/n$$

and D_1 is the required distance between each point and their closest companion:

$$D_1 = 0.5/(n/A)^{½}$$

The ACC score for the statistic is calculated as:

$$Z_{a}cc = D_0 - D_1 / P$$

where:

$$P = 0.26/(n^2/A)^{½}$$

VI. IMPLEMENTATION, RESULTS AND DISCUSSIONS

FACILITATION: The HUD helmet is useful to the person adopting it because it gives a hands-free usage to the user, therefore leading to a smaller number of accidents.

UNDERSTANDING: The helmet is a much higher modification to the HUD in four wheelers, since it is fitted on a helmet and also since it is made for two wheelers.

ABILITY TO MAKE CHANGE: The user interface for the display can be changed by the user. The unit of speed can be changed. The destination and starting point for navigation is user input. The user cannot change the inbuilt modules but there is option to add additional modules.

APPROVAL: The Helmet can be made popular with the support of the two-wheeler companies. If the helmet is provided free exclusively on the purchase of a new vehicle, the sales of the two-wheeler and helmets will complement each other. A number of awareness campaigns can also be organized in order to promote the usage of HUD helmet and how it is a step up from the conventional helmet.

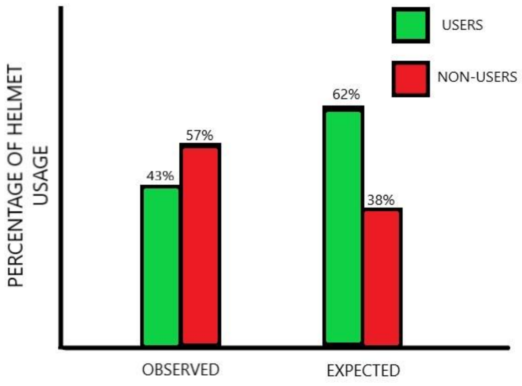

Figure 3: Graph Showing Usage Of Helmets Before And After Introduction Of Ar-Hud

VII. CONCLUSION

In this paper, we have presented an AR HUD helmet model which is much better than the conventional helmet. The helmet has been designed keeping the human thought process in mind. The AR HUD helmet is an extremely useful add-on to our day to day life. The number of accidents reduces in substantial amounts with the usage of this helmet.

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AUTHORS PROFILE

B.Lalithadevi received her M.E Degree in Computer Science and Engineering from Anna University, India, in 2009. She is currently an assistant professor at SRM IST, Chennai.

Anand Sasidharan is an undergraduate student of SRM IST, India. He is pursuing his B.Tech Degree in Computer Science and Engineering at SRM IST, Chennai. His area of interest lies in Data Structures and programming.

Dharmesh Kumar Singh is an undergraduate student of SRM IST, India.
He is pursuing his B.Tech Degree in Computer Science and Engineering at SRM IST, Chennai. His area of interest lies in Algorithm Design and analysis.

Nilesh Dangi is an undergraduate student of SRM IST, India. He is pursuing his B.Tech Degree in Computer Science and Engineering at SRM IST, Chennai. His are of interest lies in programming and microprocessors and microcontroller modelling.

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