EasyChair Preprint

№ 8432

Smart Advertisement Display Board Using Raspberry Pi

K A Shashikumar, L S Shravani, Gnyaneshwari Adaki and S Ranjitha

EasyChair preprints are intended for rapid dissemination of research results and are integrated with the rest of EasyChair.

July 10, 2022

“Smart Advertisement display board using Raspberry pi”

Shashikumar K A[1], Shravani L.S[2], Gnyaneshwari[3] , Ranjitha[4]

Electronics and communication department, Visvesvaraya Technological University

Belguam, India

[1]shashikumarka.ec19@bmsce.ac.in, [2]shravanils.ec19@bmsce.ac.in, [3]gnyaneshwari.ec19@bmsce.ac.in,

[4]ranjitha.ec19@bmsce.ac.in,

Guide : Mrs. Harshitha B, Assistant Professor

harshithab.ece@bmsce.ac.in

Reviewer : Dr. Madhusudhan K.N, Assistant Professor

madhusudhankn.ece@bmsce.ac.in

Abstract— Today, advertisements are online so, the traditional advertisement display exhibits no feature which informs the user intention. The owner just predicts the advertisement effectiveness based on the product selling. Therefore, there is a requirement to detect user attention and enables to record it instantly.The main idea of the project is to develop an embedded system to know how many visitors have looked into a particular Ad for a specified amount of time and keep a counter to determine how many people were interested in it and charge the organisation based on view counts instead of traditional way of charging based on number of days/months the ad was displayed. The ads here are those displayed on electronic displays in and around public places and public transports. The paper is to investigate the effect of targeted advertisements in offline mode.

Keywords— Advertisement, Electronic Display, User attention AI and ML, Raspberry pi.

I. INTRODUCTION

The most business people consider offline advertising a thing of the past, it’s not something that should be ignored. This form of advertising can help support your web presence, just as online marketing can promote offline businesses. If you refuse to complement your online advertising strategy with specific offline marketing techniques, you may be missing out on a significant amount of traffic and revenue. The key, as with any marketing strategy, is to measure and analyze what’s working to reap the rewards.

Therefore, we can considered offline advertising through the smart advertising display is useful for both businessmen's and public customers .here, The main idea of the our project is to develop an embedded system to know how many visitors have looked into a particular Ad for a specified amount of time and keep a counter to determine how many people were interested in it and charge the organization based on view counts instead of traditional way of charging based on number of days/months the ad was displayed.

The ads here are those displayed on electronic displays in and around public places and public transports. The method helps to analyze the behavior of people in a given region and display ads accordingly for increasing business.

Example: if a region X has higher view count for product M then for product N, then there is a greater business potential for product M in that region. therefore, we can decide that Product M cost will be decreases based on the viewers count.

Philip Kotler presents that there are three primary methods to pre-assess the advertisement. .The first is consumer feedback method. The feedback on this context is the system which gives a certain advertisement pattern and the pattern selected is the one which is suitable for the target user Advertisement pattern in this study is list of advertisement contents which in the same label. It is executed by asking a consumer reaction to the advertisement which is going to be promoted. Secondly, a portfolio assessment, it is executed to observe the advertisement performance for being unique and easy to be remembered based on consumer assessment which collects consumer ability to remember the advertisement shown in limited time. Lastly, a laboratory assessment is conducted to estimate physiologic reaction to know the user intention to the advertisement by using parameters such as heart rate, blood pressure, pupil widening, etc.

The laboratory observation estimates the advertisement performance related to its ability to make a user intention. However, it does not expose anything related to a believing an outlook and an intention to the advertisement [2] Based on all the three presented, especially, according to laboratory assessment, the study of the system for recognizing the target user intention directly to the advertisement is going to be executed. In this study, the screen monitor as a media is going to be performed so it can show more than one advertisement. Normally, the thumbnail on the advertisement display acts repeated constantly in every time and does not provide any further information. Therefore, this study is going to elaborate the thumbnail pattern which acts smartly (by supplying supplemental information in detail which maintains a similar pattern to the advertisement).

The goal of thumbnail pattern implementation is to create the system which has an ability to give a feedback to the user target like an additional and suitable pattern with the user intention. The way how to sense the intention by detecting the existence of a face and eyes of the potential consumer .They are detected by using the attached cam on the top of the screen display. This design of smart display board advertising is going to use Open CV which has a library that can be used to operate image processing [3] [4] Open CV is performed to detect a face and eyes of human [3] [4] [5].

So that, the first method operated is face detection [5].The face detection is used to find face features in the frame to detect the area defined as a face by the system. The second method operated is eyes detection [5]. Both the first and the last method are performed by the system to gather more accurate sense for consumer intention to the advertisement Since the system detects the presence of an intention, then the system is going to offer feedback to the consumer by displaying the advertisement pattern like the advertisement details which are suitable and loved by the user.

For example, a display shows all advertisement categories randomly. As an assumption, some categories are woman bag. woman cloth and women trouser and all the data are stored in the local drive. Since the user target is detected expresses an intention to the pattern related to

the bag category, then the system is ready to display all the advertisement affiliated to the bag details owned by the system collection.
Based on the elements explained, one of the study goals is to create the digital signage which demonstrates the potential intention detection feature by using the facial and eyes detections. The other goal is to deliver the information about which the most popular advertisement seen by the user.

II. RELATED WORKS

Reference [2] states the advertisement performance can be measured by the response of target users who sight it, such as by measuring their physiological reactions. However, it does not necessarily reveal their beliefs, attitudes, and intentions related to the advertisement.

In [6] states digital signage advertising is more flexible than the offline advertisement or catalog. It can collect latest updated information based on direct feedback received from the customer.

In [4] presents the face detection method by using Haar Machine Learning Feature-based approach, in which a cascade function is trained using a sample that contains a lot of positive and negative images. The flowchart of the method can be seen in the following figure.

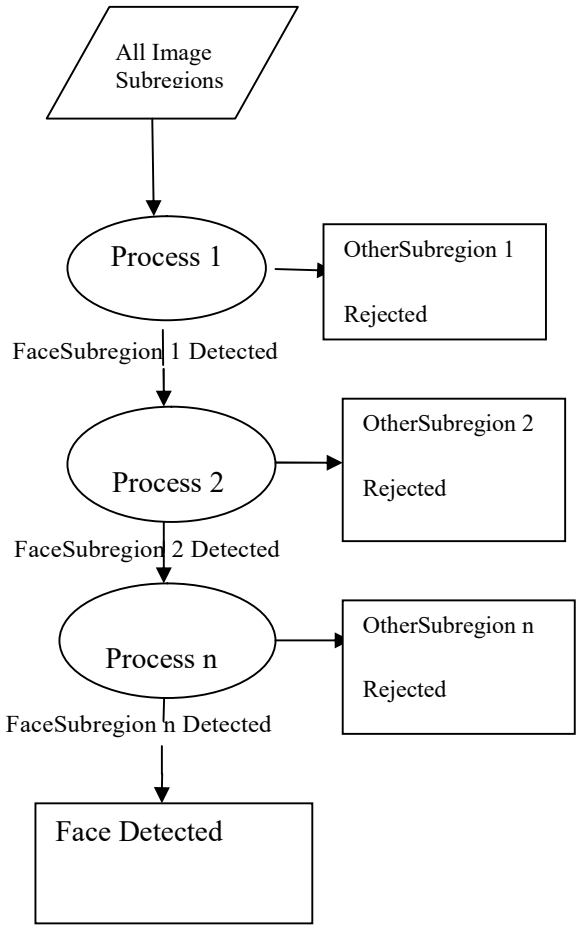

Fig. 1. The Cascade Processes of Haar Feature [4].

The way how to detect a human face by using Haar Cascade Classifier is built by using OpenCV [3] [4] [5]. Eyes detection can also be identified by this tool [5]. Therefore, face detection and eyes detection can be used concurrently by using OpenCV.

In [7] explains the time required for the user to express an intention related to the advertisement received. It states the time is around 870 ms. In this study, the time employed is going to be rounded as 1 second.

In [8] exhibits that the monitor display can be used to gather data directly related to the most popular advertisement show seen by the user. This feature is feasible and still can beenhanced.

With the references above, this study is ready to build a smart display monitor. It can recognize the user intention directly and can publish a response directly too by showing suitable advertisement details with the intention of the user.

The system employs two methods. The first is face detection. It is performed to find features defined as face parts in the image frame. The second method eyes detection is used concurrently with the first method for determining the consumer intention accurately by measuring appearance rate. The appearance rate is the comparison between the detected facial images captured and all images captured in one second after the potential intention defined. If the appearance rate of the frames is more than 0.5, then it is detected as the user expresses an intention to the advertisement. On that occasion, the system offers feedback to the user such as displaying advertisement details suitable to the user.

A. *Raspberry Pi 4 Model B technical Specifications:*

- Model-Raspberry Pi 4 Model-B with 4 GB LPDDR 4 SDRAM
- Quad core 64-bit ARM-Cortex A72 running at 1.5GHz
- 1, 2 and 4 Gigabyte LPDDR4 RAM options
- H.265 (HEVC) hardware decode (up to 4Kp60)
- H.264 hardware decode (up to 1080p60)
- Video Core VI 3D Graphics
- Supports dual HDMI display output up to 4Kp60
- 2.2 Interfaces
- 802.11 b/g/n/ac Wireless LAN
- Bluetooth 5.0 with BLE
- 1x SD Card
- 2x micro-HDMI ports supporting dual displays up to 4Kp60 resolution
- 2x USB2 ports
- 2x USB3 ports
- 1x Gigabit Ethernet port (supports PoE with add-on PoE HAT)
- 1x Raspberry Pi camera port (2-lane MIPI CSI)
- 1x Raspberry Pi display port (2-lane MIPI DSI)
- 28x user GPIO supporting various interface options:
- Up to 6x UART
- Up to 6x I2C
- Up to 5x SPI
- 1x SDIO interface
- 1x DPI (Parallel RGB Display)
- 1x PCM
- Up to 2x PWM channels
- Up to 3x GPCLK outputs

B. *Raspberry Pi Camera*

This study operates the Raspberry Pi camera to capture the image. The image is processed such as to get the face features for face detection. The Pi cam acquires several elements which are [12]:

This study uses Raspberry Pi camera to capture the image. The image is processed such as to get the face features for face detection. The Pi cam has several elements which are [12]:

- It is compatible with Both the Model A and Model B of Raspberry Pi.
- 5MP Omnivision 5647 Camera Module
- Resolution: 2592 x 1944
- Video: Supports 1080p @ 30fps, 720p @ 60fps and 640x480p 60/90 Recording
- MIPI Camera Serial Interface has 15 pins and it can be Plugs Directly into the Raspberry Pi Board

III. PROBLEM DEFINITION

Because traditional advertisements often use a printed poster, the advertisement displayed is rigid. The use of digital signage becomes fashionable in the following years, allowing advertisements to be updated on the go without incurring any costs. Digital signage and advertisement-based monitor displays, on the other hand, are not interactive. The purpose of this interactive is to allow the target user who sees the advertisement to provide input. Furthermore, static digital signage is unable to provide any information about the effectiveness of advertisements when it comes to manipulating that topic. As a result, the advertiser is unable to determine which advertisement is the most popular among the target audience.

The display monitor will be used in this experiment to show many advertisements. In general, every ten seconds, the commercial thumbnail acts are repeated. However, if the system detects a prospective intention utilising facial and eye detections, the system will proceed to calculate the value of the appearance rate. The other benefit is that it provides information about the most popular advertisement that the user has marked.

IV. PROPOSED SYSTEM

The creation of smart display board advertising is carried out in this study employing Raspberry Pi and a Pi cam affixed to the display board's top.

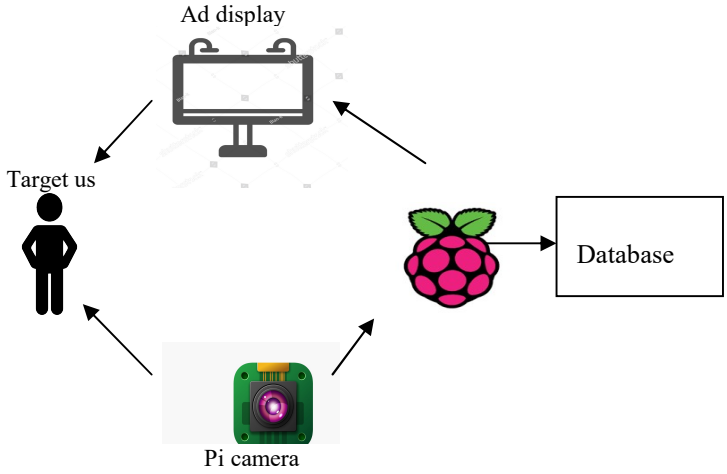

Fig2. The proposed system architecture

The Pi camera captures the picture of the target user. The photograph is uploaded to a Raspberry Pi and analysed for facial and eye recognition. If all of those characteristics are present, it indicates that a user intention may exist. If the system detects that the user has a possible desire, it calculates the appearance rate for one second. The system will then examine all frames taken during that time period to determine the appearance rate value. The value is calculated by comparing the collected face photos with all other photographs. The system will designate the prospective intention as an absolute user intention if the appearance rate is more than 0.5.

Based on the empirical theory of probability, the value of 0.5 was chosen as a threshold. If the probability value of chance is more than 0.5, it indicates that the possibility of being presented again is more likely than if the value is less than 0.5.

All adverts will appear at random in a continuous period based on the advertisement show. The extra information linked to the present display will be displayed after the intention has been identified.

The summary of the explanation can be followed by seeing the next flowchart:

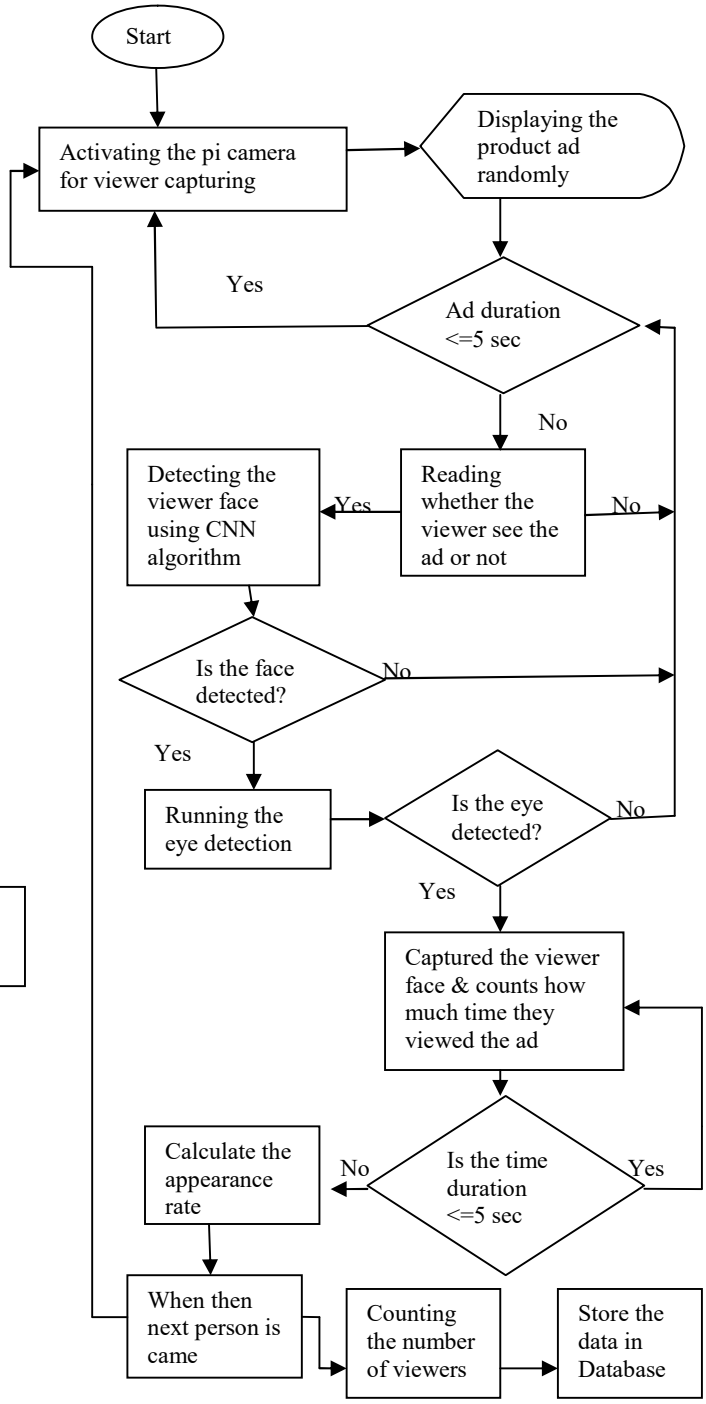

Fig. 3. The process summary of the proposed system

The flowchart explains the first step completed by the system. It is activating the pi camera for viewer capturing function. The next step is displaying the advertisement randomly from the list saved in the local storage. While displaying, as long as the advertisement duration is less than 5 seconds, the system is going to execute the following step. It is reading whether the viewer see the ad for the detection of the face(s) and followed by the detection of the eye(s). Otherwise, the system is going to check the advertisement duration to ensure whether continuing the current displayed advertisement or displaying random advertisement from the list again. If the eye(s) can be detected, the system is going to captured the viewer's face and count's how much time they viewed the advertisement.

The intention check feature consists of a system looping. The looping is done for reading frames from captured video, executing face(s) detection, and executing eye(s) detection. If the face(s) and eye(s) can be detected in one second then the system is going to calculate the appearance rate. If the appearance rate value is more than 5 sec, the system is going to do if the next person is come to view the ad then, it is going to back again for checking the current advertisement duration. Otherwise, the system is going to directly check the current advertisement duration bypassing to display the supplement information and counts the number of viewers and then finally it's stores the data in database.

V. ANALYSIS AND DISCUSSION

Based on the captured data, the number of images captured represents 20 pictures and they are stored in the database system.

The captured image is the picture of the target person detected considers an intension to the smart advertisement.

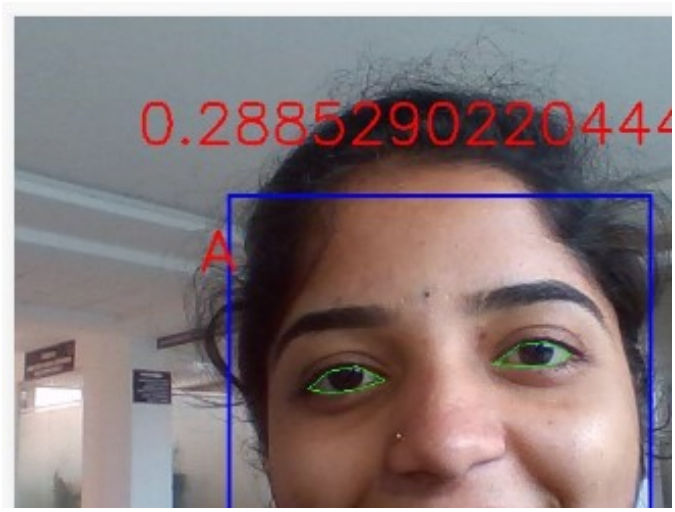

Fig. The image stored in the database system of the person detected

The above figure is an example image stored in the database. When the person appearance rate of the image (with the face and eyes detected) is more than 0.5 and they held 1sec (or more) to be recognized by the system as that the person is intentionally watched, then the database system marked that the person possesses a desire to the ad.

The outcome of user intension can be seen in the table below:

The image file name stored in the system	Total faces(persons) detected	Total faces (persons) looked into the ad	Specified amount of time spent in sec
Images-1	Person-1	Person-0	-
Images-2	Person-2	Person-1	5:15
Images-3	Person-1	Person-1	6:30
Images-4	Person-4	Person-2	7:40
Images-5	Person-6	Person-4	5:60
Images-6	Person-3	Person-1	5:10
Images-7	Person-2	Person-0	-
Images-8	Person-8	Person-3	10:50
Images-9	Person-5	Person-4	7:45
Images-10	Person-2	Person-1	8:33
Images-11	Person-3	Person-3	5:55
Images-12	Person-9	Person-5	4:38
Images-13	Person-10	Person-5	9:58
Images-14	Person-2	Person-1	6:27
Images-15	Person-5	Person-3	7:46
Images-16	Person-3	Person-2	5:20
Images-17	Person-4	Person-0	-
Images-18	Person-8	Person-3	6:18
Images-19	Person-7	Person-5	7:29
Images-20	Person-5	Person-2	8:49

The above table shows the persons intention rate related to the advertisement. By using 20 captured images, it is showed that the number of user intention is 45 out of 90 then, the success rate for detecting user intention is 50%.

Ad1	Ad2	Ad3	Ad4	Ad5
8	12	9	5	11

It can be decide that the Advertisement 2 is the most viewed advertisement by the target users. Therefore, the popularity of that particular advertisement rate is increased in the market.

VI. CONCLUSION

The smart advertisement display is operationally possible, according to the assessment results. It can accurately display the frequency of advertisement patterns viewed by target visitors. It can also identify a target visitor who is interested in the advertisement and its details. The rate of success is 50 percent. The system's intention-checking function might be improved further, such as by determining the proper value for the appearance rate threshold (which this study uses 0.5).

The system use facial recognition, according to the research. As a result, counting various users and by calculating the amount of time spent on particular advertisement will decide the intention of the users. Furthermore, this research is carried out in commercial purpose.

VIII. REFERENCES

[1] W. Verbeke and J. Viaene, "18 effect of communication (advertising or news) on sales of commodities," Food, People and Society, Berlin: Srpinger, 2001, pp. 299–315, 2001.

[2] P. Kotler, Marketing Management: Millenium Edition. Prentice Hall, 1999.

[3] W. F. Abaya, J. Basa, M. Sy, A. C. Abad, and E. P. Dadios, "Low cost smart security camera with night vision capability using Raspberry Pi and OpenCV," in Humanoid, Nanotechnology, Information Technology, Communication and Control, Environment and Management (HNICEM), 2014, pp. 1-6.

[4] W. S. Yuwono, D. W. Sudiharto, and C. W. Wijiutomo, “Design and implementation of human detection feature on surveillance embedded IP camera,” in International Conference on Sustainable Information Engineering and Technology (SIET), 2018, pp. 42-47.

[5] P. Ian Wilson and J. Fernandez, “Facial feature detection using Haar classifiers,” J. Comput. Sci. Coll., vol. 21, no. 4, pp. 127–133, 2006.

[6] G. R. Kiani, “Marketing opportunities in the digital world,” Internet Research, vol. 8, no. 2, pp. 185–194, 1998.

[7] T. J. Olney, M. B. Holbrook, and R. Batra, “Consumer responses to advertising: the effects of ad content, emotions, and attitude toward the ad on viewing time,” J. Consum. Res., vol. 17, no. 4, pp. 440-453, 1991.

[8] K. Yin, H. Wang, D. Yang, and J. Wu, "A study on the effectiveness of digital signage advertisement," in International Symposium on Computer,

[9] Warner, T. L. (2013). Hacking Raspberry Pi. Que Publishing.

[10] McManus, S. (2014). Raspberry Pi for dummies. John Wiley & Sons.

[11] A. Pajankar, Raspberry Pi Computer Vision Programming. Packt Publishing, 2015.

[12] S. Purbaya, D. W. Sudiharto, and C. W. Wijiutomo, “Design and implementation of surveillance embedded IP camera with improved image quality using gamma correction for surveillance camera,” in International Conference on Science and Technology-Computer (ICST), 2017, pp. 110–115.

[13] “Raspberry Pi Camera Board v1.3 (5MP, 1080p).” [Online]. Available: https://uk.pi-supply.com/products/raspberry-pi-camera-board-v1-3-5mp-1080p. [Accessed: 25-Oct-2018].