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SMART EYE

AKANSHA JAIN[1], KUNAL PARASHAR[1], PRAGYA VARMA[1], VISHAL RAGHAV[1]
AVADHESH KUMAR SHARMA[2]

[1] B.Tech Student, ECE Department, HMR Institute of Technology & Management, New Delhi.
[2]Head of Department, ECE Department, HMR Institute of Technology & Management, New Delhi.

ABSTRACT

"SMART EYE" is the wearable pair of glasses inspired by Google Glass. It is a GPS enabled smart gadget with mounted cameras and has the intended purpose of monitoring and surveillance for security purpose with various advantages like face detection and recognition, location tracking, distance measurement, temperature, humidity, blood pressure sensing .It has remote control and voice control for various operations.

Keywords --- Smart Eye, Google Glass, Ulo, Smart Eyeglass, Matlab, Background Subtraction Algorithm, Motion Detection.

1. INTRODUCTION

SMART EYE is a wearable glass having cameras that are used for moving object detection, object recognition, distance calculation of the objects from the person wearing to the incoming object that would help blind person wearing it by giving it proper direction and warning about the objects in front of him. It is also loaded with various sensors like humidity and temperature sensors that would update humidity and temperature information of the environment around the person wearing it.

It is a GPS enabled smart widget that will be used for location tracking and can help blind person if he loses his track. Using simple simply cameras for these tasks makes it simple to understand as well as implement. It is inspired from various technologies present in the market today. For its physical appearance major inspiration is Google Glass. Google Glass is a headset, or optical head-mounted display, that is like a pair of eye glasses. It is develop by Google in Google x laboratory in the California to use the android operating system. It captures the pictures, video interface between them in Personal contact, map, and personal data. [1] For motion Detection, Picture capture and video recording 'Ulo' is the

inspiration. Ulo is a home security camera shaped like an owl. It can record and stream in 1080p FHD resolution with a 127^0 wide-angle field of view. [2] For voice command, GPS and other sensors used in 'SMART EYE' are the result of latest technology called 'Smart Eye glass' developer version by Sony. Sony's introduction of SmartEyeglass follows similar efforts to bring computerised eyewear to market. It features camera, accelerometer, gyroscope, electronic compass and brightness sensor. It supports wireless LAN and offers Bluetooth compatibility with Android devices. SmartEyeglass' built-in sensors and camera technology can enable users to experience augmented reality. [3] It uses voice commands for various functions; controller has the microphone for the voice input.

Fig1. GOOGLE GLASS [13]

Fig2. ULO [14]

2. TECHNOLOGY

WEARABLE GLASSES

Wearable glasses will be used on which other hardware (like cameras) will be connected.

MATLAB: The Language of Technical Computing

MATLAB is a high-level language for numerical computation, visualisation, and programming. The study on image processing toolkit using computer language Matlab was conducted to perform moving object detecting technical processing on video images. The results showed that using computer language Matlab to perform moving object detecting algorithm has favourable effects. [4]

ATMEGA MICROCONTROLLER

The Atmega microcontroller is based on a new RISC architecture that has been developed to take advantage of semiconductor integration and software capabilities. It uses a Harvard

architecture, where the program memory space is separated from the data memory space. Program memory is accessed with a single level pipelining. It consists of 32 x 8-bit general purpose working registers. [5]

USB ENABLED CAMERAS

They are used in original sense of a video camera connected to the pc continuously for an indefinite time, rather than for a particular session. A video camera that feeds or streams its images in real time.

RF MODULE

An RF module (radio frequency module) is a small electronic circuit used to transmit and receive radio signals on one of a number of carrier frequencies. RF modules are widely used in electronic and designing radio circuitry. RF modules are most often applied in medium and low volume products depending on consumer applications such as wireless alarm systems, industrial remote controls, smart sensor applications, and wireless home automation systems. [6]

HT12E ENCODER & HT12D DECODER ICs

The HT12E Encoder and HT12D Decoder ICs are series of CMOS LSIs for Remote Control system applications. These ICs are paired with each other. The encoder converts the parallel inputs (from the remote switches) into serial set of signals. These signals are serially transferred through RF to the reception point. The decoder is used after the RF receiver to decode the serial format and retrieve the original signals as outputs. [7]

TEMPERATURE SENSOR

A temperature sensor is exactly what it sounds like – a sensor used to measure ambient temperature. This particular sensor has three pins – a positive, a ground, and a signal. This is a linear temperature sensor. A change in temperature of one degree centigrade is equal to a change of 10 millivolts at the sensor output. [8]

3. WORKING OF SMART EYE FOR MOTION DETECTION

Motion detection is usually a software-based monitoring algorithm which will signal the surveillance camera to begin capturing the event when it detects motions. This is also called activity detection. [9]

Background Subtraction Algorithm

Background subtraction, also known as Foreground Detection, is a technique in the fields of image processing and computer vision wherein an image's foreground is extracted for further processing (object recognition etc.). Identifying moving objects

from a video sequence is a fundamental and critical task in video surveillance, tracking, monitoring and analysis, human detection and tracking, and gesture recognition in human-machine interface. Common approach to identifying the moving objects is background subtraction, where each video frame is compared against a reference or background model. Pixels in the current frame that deviate significantly from the background are considered moving objects. Theses "foreground" pixels are further processed for object localisation and tracking. [10] Videos are in reality sequel of images, each of which called is a frame, played in fast enough frequency so that human eyes can percept the continuousness of its content. An image, generally from a video stream, is distributed into two complementary groups of pixels. The first group includes the pixels which correspond to foreground objects while the other and complimentary group includes the background pixels. This result which is the detected object is often showed as a binary image or as a mask. [11]

Video to frame conversion: The camera will take continuously capture the images. Directly processing on the video is not easy it is difficult. So the conversion of the video into frame is done. It will give the frames at different time period.

Pre-processing: After the video to frame conversion pre- processing is done on each frame to reduce the noise which is present in frame. The pre-processing is done using the mean filter, convolution filter and median filter. The mask of the filter will multiply with the frame and noise will get removed so that the result is accurate.

Background frame initialisation: For obtaining the initial background image we take the first frame of the as the background directly, or the average pixel brightness of the first few frames to estimate background parameters.

Background subtraction: After the background frame is initialised the subtraction of the current frames and the reference frame is done for the moving object detection. The subtraction will be done pixel by pixel(x,y) of the both frames. The simple version of this scheme where a pixel location (x,y) in the current image f(x,y) is marked as foreground if

$$\left| f(x,y) - B(x,y) \right| > t_d$$

where t_d is predefined threshold.

Segmentation: The subtracted image is then segmented using the threshold value which is practically set. It is done by

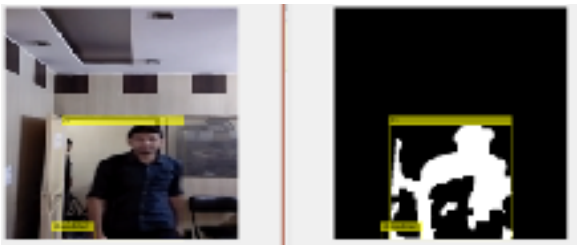
$$D_k = 1 \, for \, |f(x,y) - B(x,y) > t_d$$

$$D_k = 0 \quad for \quad others$$

If the subtracted pixel value is greater than the threshold value then it will represented by the 1 and if not greater then represented by 0. In image processing the value of 1 is black and 0 is white. So the segmented image gives the moving object in white and the background is black. It will detect the moving object in the frame.

Morphological filtering: The segmented frame is now given to the morphological filtering for reducing the noise. The function of the morphological filtering is removing the small regions probably created by noise; fill up unnecessary cavities, smoothing boundaries, extracting edges.

Motion detection: After the segmentation and morphological filtering the moving object is clearly seen in the frame and that will be the output of the system which is display on the monitor. [12]



4. FUTURE SCOPE

SMART EYE is a futuristic gadget like Google glasses we've seen in recent times. It's limited in scope right now, but the future, we believe, is bright and the device itself is "incredibly compelling". It can contribute remarkably in the area of defence also. Future work will be directed towards achieving the following issues: implementation of above algorithm using external USB cameras, distance measurement and type of object identification using cameras, humidity and temperature sensing, face detection and recognition of individuals, mounting projector on the glasses for displaying pictures and videos on a big screen, addition of mini display screen on the glasses itself.

5. CONCLUSION

SMART EYE is basically wearable glasses that uses the evolving familiar technologies that brings the sophistication and ease of monitoring for security purposes and information access

even for the physically challenged class of people. Motion Detection by keeping the background at rest has been done using MATLAB simulation. The proposed algorithm extracted the background from the all frames of video and detected the foreground effectively. This algorithm also dynamically updating the background frame by frame .This algorithm can also identify the shadow of the moving object. This algorithm also identifies even small object by adjusting the threshold values. Even the smallest, slowest, fastest, of a moving region is detected accurately by selecting the proper threshold value of the objects. Voice Controlled commands, distance evaluation of the object from the person wearing it, sensors installation and enhancement of algorithm considering real environment with the proper hardware implementation is in the process.

REFERENCES

[1] GOOGLE GLASS: PROJECT GLASS, Volume 3, Issue 10, October 2014, ISSN 2319 – 4847, International Journal of Application or Innovation in Engineering & Management (IJAIEM)

[2] Article 'ULO – An Interactive Security Companion', accessed on 20/01/2016, and published at http://www.securitygem.com/ulo-an-interactive-security-companion/

[3]Article on 'Sony Gets Glassy-Eyed', accessed on 20/01/2016, published on 17/02/2015 at http://www.technewsworld.com/story/81715.html?rss=1

[4] Application of Matlab in Moving Object Detecting Algorithm, Dept. of Electron. Inf. Eng., Nanjing Univ. of Inf. Sci. & Technol., Nanjing

DOI: 10.1109/FBIE.2008.108

[5] Dr. Gaute Myklebust, "The AVR Microcontroller and C Compiler Co-Design", Retrieved 2012-09-19, accessed on 20/01/2016.

[6] International Journal of Scientific and Research Publications, Volume 4, Issue 2, February 2014 ISSN 2250-3153

[7] International Journal of Thesis Projects and Dissertations (IJTPD) Vol. 2, Issue 2, PP: (4-8), Month: April–June2014

[8] Tutorial 'SIK Experiment Guide for Arduino - V3.2', accessed on 25/01/2016, published at https://learn.sparkfun.com/tutorials/sik-experiment-guide-for-arduino---v32/experiment-7-reading-a-temperature-sensor

[9] MOVING OBJECT DETECTION USING MATLAB ,International Journal of Engineering

Research & Technology (IJERT) Vol. 1 Issue 6, August - 2012 ISSN: 2278-0181

[10] Cheung, S.-C. And C. Kamath, "Robust techniques for background subtraction in urban traffic video," Video Communications and Image Processing, SPIE Electronic Imaging, San Jose, January 2004, UCRL-JC-153846-ABS, UCRL-CONF-200706

[11] Aseema Mohanty and Sanjivani Shantaiya, “A Survey on Moving Object Detection using Background Subtraction Methods in Video”, 2015

[12] Mahamuni P. D, R. P. Patil, H.S. Thakar, “Moving object detection using background subtraction algorithm using Simulink.”Vol.3, Issue.6, June 2014

[13] Picture taken from, https://en.wikipedia.org/wiki/Google_Glass

[14] Picture taken from, http://thrivewire.com/stories/tiny-owl-doubles-as-a-surveillance-system