

Effective Communication and Security Powered by 3-Dimensional Comtrid Device

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Abstract - In this epoch of digitization and modern world, we have aids to facilitate communication through different ways. But due to the pandemic lashed re-ality that we are facing presently, we can very well socialize effectively without meeting them physically and maintain distant socializing. With all the virtual meeting applications, we manage to establish connections just giving the feel of meeting having them under the same roof. Though this epidemic shattered many lives but still is a golden opportunity to keep the development process going amid the lockdown blues. This has paved the way for positive changes for greater society. The proposed ComTriD device serves the main purpose of 3D magnification. This can be used in two ways - 3D video calling and security purposes. The usage of ComTriD is facilitated through dual phases as ComTriD for 3D video calling and for security purpose. When we can't physically be in touch, our new sparky idea introduces a unique way for active mental connectivity, staying aware of the existence in all degrees. It delivers the feeling of presence as if we are right there next to each other achieved effectively through the device – ComTriD.

Keywords - ComTriD, 3 Dimension, Communication, Digitization

I. INTRODUCTION

Human evolution is always a continuous process. In that process at every stage of evolution, man has dug in new ways to express his/her ideas. These revolutionized and resulted in a variety of methods through which we communicate today. Though they started as very basic means to convey ideas, now have paved ways to go ahead in technological advancements.

Computerization [1] has become stronger and has given us the ability to cope up with changes to help to be more innovative. Right from education, health facilities are

made digital and on the other side companies are still working through effective communication. In order to make communications more effective we need some enhancements to the existing technologies. Having said that the existing video calling and web conferencing applications we are not able to achieve best possible outcomes. In order to face these challenges advancements in the existing technologies are needed. So, to satisfy this 2-D video calling does not suffice our needs.

As much of our learning process depends on our interaction with our surrounding environment. This helps one unfold and explore beyond horizons and provide a healthy contribution to the developmental process. But to do that is not rationally possible with the present day's advancements.

As our generations tend to grow, in that pace technology as needs to grow to fit in the requirements for a greater society. This in turn would be beneficial to make communication to a higher level. The expressing of human emotions and interaction with the external environment always has been a source of change for a better society. The prevailing applications for virtual meetups are specialized to use for different applications. But it would be better if any one virtual tool is capable of carrying out all these processes with ease. Communications at many instances are driven by expression of emotions which helps in conveying ideas with ease. The information that we try to deliver does not reach its full value when done virtually where the absence of real-time communication is experienced. Starting from professional to personal works they meet their full form only through direct and in-person meetups. Challenges to attain effective communication always remains as a matter of quest.

Having direct and in-person meet-ups plays a vital role in expressing the views, ideas, emotions and to maintain internal connection with the person interacting with. Today we are relying more on global communications. As technology helps us to be more productive, it also aids in maintaining relationships across geographical boundaries.

Work from home (WFH) is another new norm that revolutionized the re-cent past. Though it requires advanced technology it opens a brand new door to myriads of healthy changes in the society. This includes hiring employees with WFH normalcy will help in engaging in time management and prevents delays in project progress. In future also virtual interviews can re-place real time interviews with an aim enhancing the freshers to be employed.

In the process of communication through technological aids, security and privacy are always a matter of concern. Delving deep into the process, at times this leads to exposure of confidential credentials of the user being hacked or exposed unnecessarily. This work is prearranged based on the following sections. The various literature related to the communication are discussed in Section 2. The proposed research methodology and the working mechanism with typical examples are discussed in Section 3. The results of the planned system and the corresponding inferences are deliberated in Section 4. The conclusion part is provided in Section 5.

II. RELATED WORKS

A number of survey contents are available in establishing communication in different applications. Accordingly, in this mass connectivity, Cloud Computing aids in accessing different services including data storage, servers, data servers, networking and software. It serves to address access public and private clouds allowing easy access.

The Ain Shams Engineering Journal proposed the implementation of 3D videocall using Cloud Computing Infrastructure. The evolution of communication started with conventional telephone calls, chatting through text messages, voice messages and then the recent video calling systems. Cloud computing plays a vital role by serving for the purpose of storage, database, software and other services performed over cloud. Cloud has different deployment models namely hybrid, private and public cloud. Google., Microsoft and Amazon widely use public clouds for easy access.[11] Open stack is a private cloud which can be accessed by many solutions available through Apache license. Real time applications can easily be achieved by utilizing WebRTC which is a free, opensource project that provides browsers and mobile applications.

The word '3D' first evolved in 1850's . The method of 3D anaglyph was presented by W. Rollman by blending red and blue lines on black field. Zafran has proposed the " Real Time Information and Communication Center based in webRTC "[2].

Modern day technology has paved way for various Communities ap-plications, videos and online Television to enhance communication and networking. WebRTC allows global communications with low cost and highly efficient experience avoiding third party plug dependency. This is

utilized to achieve desired communication features used in browser and communication without any server interference encrypted by Datagram Transport Layer Security (DTLS) protocol to ensure security of data.

In recent times voice-over-IP (VoIP) technologies as they offer high flexibility compared to conventional ones. Streaming data transmission and reception, streaming data transfer, working with a web browser, application of streaming reception and transmission from web browser are achieved by WebRTC. The reason for its wide usage is that it can overcome differences in networks and devices, screen size problems and processing power issues in an efficient way. In videoconferencing the web browsers cannot handle everything and this is satisfied by WebRTC [12]. Asterisk an open source project, which is a virtual PBX can handle SIP calls from internet as well as Analog phones. It can send dual DTMF (Dual Tone Multi Frequency) input to the computer serving as commands for execution of different programs. This Asterisk based voice exchange helps people to fix their phones either fixed or mobile to call others within the country and internationally.

III. METHODS AND MATERIALS

The methodology of ComTriD focuses on giving a realtime experience both physically and mentally in a secure manner. Materials utilized in this research are of utmost value and cost efficient suitable for this current generation. The outcome of ComTriD is highly expected and will prove as a fruitful way for skilled technicians. This would act as a source of study material for research students innovatively. This would act as a device which would be time saving and help in skill development so, it is important to handle this carefully by employing suitable principles.

A. ComTriD workflow

ComTriD can find its use in two ways. The first one is where it is utilized for [14] 3D video calling for giving a real time experience to the users. This constitutes 3 ToF cameras and 1 projection vital to carry out the processes. This helps in making video calling, web conferencing for official purposes with more like a face-face and direct meetup. This also requires internet of reasonable bandwidth for efficient video calling and conferencing experience.

The second one is completely for a security purpose capable of detecting suspects. This also acts as an indirect way to prevent crimes. In the security part, the number of ToF cameras can be chosen based on the user's convenience. In this process, the captured video can be used as evidence and can be projected if needed. The ComTriD device communicates with our phone and with that input it instructs the Tof cameras to work further. The workflow is narrated in figure 1.

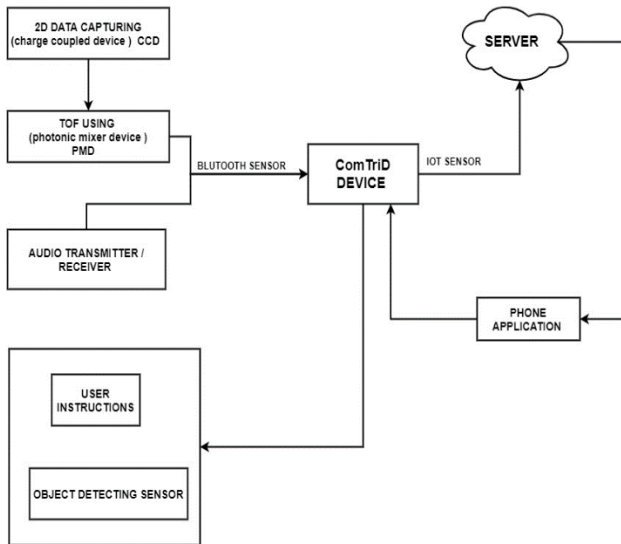


Fig.1. ComTriD General Workflow

B. ComTriD for 3D Video Calling

The materials used here include ToF cameras, sensors specialized for object detection, checking battery levels, IOT, projection, bluetooth chips, wheel motor and audio transmitter or receiver. Variety of sensors are embedded in the device for carrying out and detecting certain activities and to prevent possible wear and tear. They include gesture recognition, for automated navigation and localization, external environment scanning and 3D re-modelling, general simultaneous localization and mapping (SLAM) and obstacle avoidance. The above mentioned are some simple process but of major significance.

This ToF based depth camera as shown in figure 2, is a cost- effective camera which uses TI opt8320 sensor to pass all the depth data point cloud via USB cable. This arrives at an amazingly tiny and portable size utilizing USB 2.0 interface. This provides point cloud and RAW depth data. The camera embedded sensors measure the phase with QVGA (80 * 60) resolution. It maintains some programmable features with frame size and up to 1000 fps frame rate. It also has an Infrared (IR) pass filter.

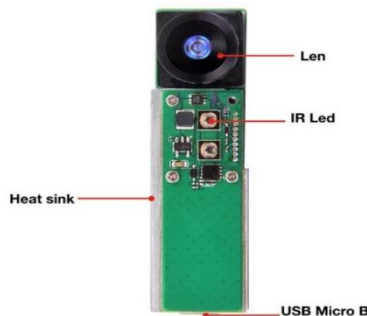


Fig. 2.ToF based depth Camera.

A multimedia projector is used to project the captured data with an apparatus constituting a system of lenses for projecting slides onto a screen. This projector is shown in figure 2, that has 720p resolution and up to 381 screen size available in four versions namely standalone, dev kit, Raspberry Pi HAT and an RPi-Zero W based “Monster Ball”.



Fig.3. Multimedia projector

Bluetooth chips [6] are used in devices comprising a personal area network (PAN). It can have single to multiple users. It provides a high performance- ratio that can easily be embedded to other products. It supports strong functionality with LWIP protocol, Freertos by supporting three modes namely AP, STA and AP+STA which is easy to develop. It is efficient and flexible to use. The IOT sensor is a full speed - 12 Mbps with a micro USB 2.0. It also has an integrated Li-Po charging and battery connector and JTAG connector with reset and mode buttons. An Euclion 11.1 V battery has been used with its capacity as 2.6 Ah which has a cycle life of 800 on an average. This can be re-charged easily when needed. It has a maximum discharging rate of about 10Amp. The Audio transmitter/receiver is 433 M super regenerative module which acts as a wireless transmitter and receiver module. It is employed as an Anti-theft alarm transmitter for Arduino.

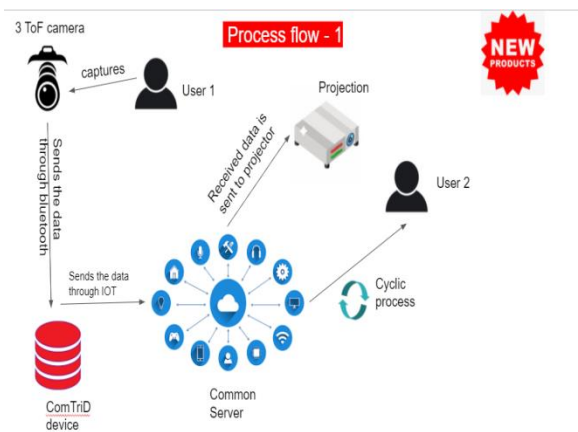


Fig.4. The process flow for Video Calling

This flow process, as shown in figure 4, gives an insight of [17] 3D video calling using PMD technology which determines the time of flight depth for the images. The sub parts are capable of detecting obstacles based on the

instructions that are fetched from phone to the ComTriD device through the application. This application receives data from server side to project 3D vision.[15][16] The server receives the data through IOT both users. In this case a minimum of 3 ToF cameras are required to give clear vision. For instance, if we take the three cameras as x, y and z then these 3 cameras receive instructions from the main device automatically or manually.[7] They are free to move in any direction. If any one of these three cameras have low battery levels then it automatically reaches the ComTriD for charging [8].

C. ComTriD for Security

When ComTriD is employed for security purposes, it includes several parts namely camera, bluetooth chip, sensor, battery, IOT, wheel motor and audio transmitter/receiver. The Camera is a Raspberry Camera providing Night Vision Sensitive Infrared Light with a capacity of 3W as shown in figure 5. It operates at a voltage of 5V and with 2 - 2.2A current. It is a small sized and a light weight module.



Fig.5. The view of Raspberry Camera

The battery is an Euclion 11.1 V battery. Its capacity is 2.6 Ah which has a cycle life of 800 on an average. This can be recharged easily when needed. It has a maximum discharging rate of about 10Amp. The Audio transmitter/receiver [3] is a 433 M super regenerative module which acts as a wireless transmitter and receiver module. It is employed as an Anti-theft alarm transmitter for Arduino. Bluetooth chips are used in devices comprising a personal area network (PAN). It can have single to multiple users. It provides a [9] high performance-ratio that can easily be embedded to other products. It supports strong functionality with LWIP protocol, Freertos by supporting three modes namely AP, STA and AP+STA which is easy to develop. It is efficient and flexible to use. Variety of sensors [10] are embedded in the device for carrying out and detecting certain activities and to prevent possible wear and tear. They include gesture recognition, for automated navigation and localization, external environment scanning and 3D re-modelling, general simultaneous localization and mapping (SLAM) and obstacle avoidance. The above mentioned are some simple process but of major significance.

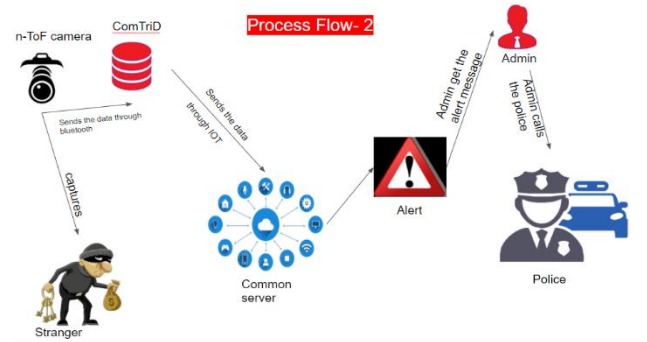


Fig.6. The Process Flow of Security

When ComTriD acts as a security weapon, then it can have a number of ToF cameras based on user's convenience. The process flow is narrated using figure 6. The cameras capture user-1 image and send it to the ComTriD through bluetooth. This image is then transmitted to the common server [5] of the phone. The received data of user-1 from server is accessed by user-2 through phone. Once the data is received it is sent to the projector and finally projector. The admin will be alerted in this case about the risk suspect. This can act as a source of evidence at time. This method can be helpful to replace security guards at large commercial places.

IV. RESULTS AND DISCUSSION

The 3-D technology is one of the finest advancements aiming at giving a real-time experience to the user. It tops the list of future technologies. This could best possibly be employed in wide aspects including education, industrial, entertainment, animations and other related fields. Though connected virtually having a depth of perception and enjoying full fledged view of everything. As it is expected to be one of the future technologies, it will surely have a good reach. Its onset in the upcoming days tends to have more expectations among the people. When this 3-D technology is put into use it will improve face-face interaction and make virtual meetings lively which can't be experienced with the present day 2D technology.

Finally, we set up cloud projection to handle and test the performance of the 3D video call. The above mentioned ComTriD device serves the main purpose of 3D magnification. This can be used in two ways - 3D video calling and security purposes. The usage of ComTriD is facilitated through dual phases.

ComTriD device is controlled by 3 ToF cameras and 1 projection. The ComTriD finds its connectivity to phone through a mobile or web application. The charging of this device takes place through bluetooth for 3 ToF cameras and projection. By infusing the ComTriD's input which communicates by moving and rotating. The projection is connected to the smartphone through mobile application. The working proceeds with capturing done by the 3 ToF camera and directing to the ComTriD through bluetooth. Then this image is transferred to the common server of the phone. The received data of user 1 from server

is accessed by user-2 through phone. After the data is received it is sent to the projector and it is projected.

In metropolitan cities, commercial centers are the places where more security is needed. At those places' security guards take care of the security services and managing large crowds and taking suitable steps at the time of hazards seems much difficult. So if safety and security is ensured with less human intervention in an automated way then it will aid in solving hazards with ease. ComTriD will help in solving this issue by suspecting it by ToF cameras, by sending the data through IOT to the common server and thereby alerting the admin.

When our workplace is designed in an interconnected environment, preventing unauthorized access will help in preventing risk. We are in need of a scalable method to act as a solution to increasing security threats. The next generation will overcome this by utilizing the available technology which would serve as an evolution for 3D and security purpose.

V. CONCLUSION

This proposed ideation spins around the ComTriD device with dual usage modes for 3D video conferencing and for security purposes. This works by employing concepts of IoT and bluetooth technology. The ComTriD device is mount with 3 ToF [13] Cameras. It can communicate with its sub devices through a sensor chip. This device directly communicates to the phone through IoT in ToF camera. When ComTriD acts as a security device, it captures the image and transfers it via bluetooth to the ComTriD device. The audio and video are recorded and used as a source of evidence. This information can be accessed only by the admin for security purposes. To achieve a real-time experience and to connect across geographical boundaries with efficient performance and workability, this device proves it to be a terrific fit in the upcoming industrial revolution of machines in Industry 4.0.

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