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A SMART MUSEUM USING INTERNET OF THINGS

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Abstract - *In today's world everything is extended to be smart and smarter through the development of technologies. To match these smart things, our environment needs to become smarter because environment speaks to people and people speak to the world at a point through a technology that is we called IoT. Internet of Things (IoT) provides the way of working with smart Environment for smart People. Nowadays, People are more interested to follow our ancient culture and the future generations also have to follow our cultural heritage. Museum is one of the places where objects of historical, scientific, artistic, or cultural interest are stored and exhibited. To get the attention of visitor I propose the smart museum using IoT device. A smart museum based on IOT relies on a wearable device that acts as guides of museum. This wearable device will capture the video of users movements and has the capability to do image processing and sends only the matched images to the cloud processing center to increase the performance of the whole system and localization information is obtained by a Bluetooth low energy (BLE) which is installed in the museum. Moreover, the system interacts with the Cloud to store multimedia contents produced by the user. Finally, everyone can easily access the arts profile and history through smart device by using mobile application.*

Keywords – Smart Museum, Bluetooth Low Energy (BLE), Wearable Device.

1.INTRODUCTION

Art and Cultural have constantly assumed a critical part in human being lives. Particularly a museum is an institution that cares for a collection of artifacts and other objects of artistic, cultural, historical, or scientific importance and some public museums make them available for public viewing through exhibits that may be permanent or temporary. According to the Washington Post, there are 35,000 museums in the US alone. Museums are nowadays a tool for entertainment such cinemas/theaters and museums and art galleries usually provide with paper booklet or human guides. Visits at galleries are frequently viewed as exhausting, in light of the fact that it is hard for historical center's keepers to get the consideration of vacationers. Specifically, it is hard to characterize ahead of time a visit for all the visitors, since interests may change from individual to individual. Therefore, a smart museum needs to be created for intuitive and customized historical center visits.

Smart environment aims to satisfy the experience of individuals from every environment by replacing the physical labor, hazardous and repetitive tasks with automated agents. In this point of view, a critical commitment can be given by the following Internet of Things (IoT), which includes the augmentation of the Internet to little and minimal effort "things" that are thought to realize smart environment with a specific end goal to provide new services to the users. IoT expects to make a superior world for individuals, where smart articles around us comprehend what we like, what we need and act in like manner without unequivocal motions. To accomplish this objective, the modern world is emphatically centered on receiving low-power and minimal effort implanted innovations in ordinary objects, which turn out to be real smart object.

Considering every one of these contemplations, we propose a framework ready to address all the above-portrayed issues. More in point of interest, the arrangement displayed in this paper empowers wearable device, connecting with an IoT-based smart environment, to go about as exhibition hall guides, providing a real attractive cultural experience. The entire framework turns into a generator of events, which can be utilized to improve the client experience. For instance, at the point when a user is before a work of art, a several subtle elements, for example, title, craftsman, chronicled setting, and basic survey can be effectively and automatically provided. The data can allude not just to the worldwide fine art additionally to points of interest or to the whole room. For example, specific countenances or sub scenes of huge painting or frescoes can be distinguished. The cultural content could be sent independently to a particular user or made accessible through sight and sound dividers in the museum room. The data gathered from the environment could additionally be utilized for the administration of the whole facility by the Museum supervisor.

To provide all these features, the user is furnished with a wearable device able to catch videos and images. The wearable device fulfills two primary tasks: it ceaselessly tracks the client by utilizing a Bluetooth low Energy (BLE) framework and recognizes the artwork in front of the user by using localization information. The result of this twofold are sent to the clouds' processing center and that is in charge to provide all the features of the system. Specifically, they 1) provide cultural contents to the visitors 2) communicate

information with other users 3) interact with different technologies that controls the status of the environment.

2. LITERATURE SURVEY

In the literature, there are a several works tending to the previously mentioned issues, yet none of them gives an adaptable and adaptable arrangement that can take care of the considerable number of issues in one framework. One of the key features of the proposal is represented by the indoor localization mechanism, which currently is an important and challenging research topic. In [1] authors proposed the architecture that automatically manages the home environment basing on users-defined rules and on people movements, by exploiting an indoor location service based on Bluetooth Low Energy. Another example of location aware services in smart environment is reported in [2] and [3]. Here, author proposed a software ecosystem that allows different-skilled users to develop location-aware services able to autonomously manage the Smart Home by exploiting an indoor localization mechanism. In [3] the user can choose the appliances that he wants and control them by touching the screen of the mobile device. In [4] the author proposed a lightweight IoT device for managing home. In [5] the author presented technique for provide location of the reader antenna with high accuracy using RFID and meets the requirements of low complexity and cost. In [6], the author presented an IoT device for smart museum that device able to support a static cultural space that becomes intelligent thanks to the definition of an innovative model of sensors and services. Here [7] author deployed and tested the installation of some sensors that, using Wi-Fi technology, allow to the users' mobile devices to detect the closest artwork in a museum. [8] A smart electronic guide for museums and has the capability of providing the visitors of a museum with pictorial, scripted, and vocal information about each object. The author developed [9] a location aware protocol for localization. Finally in reference [10] the author presented the solution as Bluetooth Low Energy and using smart phone and cloud server to collect and calculate Bluetooth data respectively.

3. SYSTEM ARCHITECTURE

An Administrator of a museum uploads images of all the artworks, statues and also uploads information content (text, audio, and video) related to those images in a cloud. Each visitors/users provided with one wearable device which is paired with users mobile. The wearable device is able to capture an image and video of user movements and also perform localizations and image recognitions. Localization is done by using BLE which is installed in each room of a museum and Image recognition will be done by doing image processing algorithm. Then the processed image will be sent to the processing center where the image is compared with images saved in cloud. If match found, then the information or details related to that artwork will be sent to users' smart mobile.

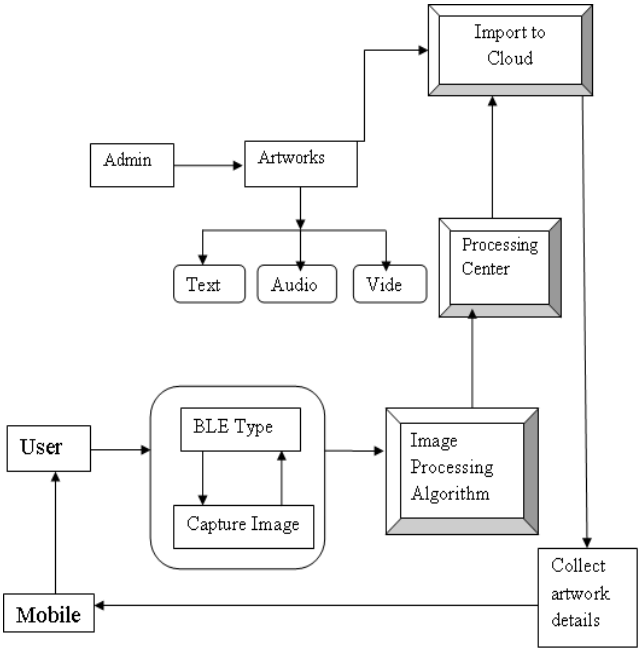

Fig -1 Architecture Diagram

4. MODULE DESCRIPTION

Fig. 1 shows the overall structure of the proposed system architecture. It is composed, as described below, of four main building blocks.

1) Updating Cloud Contents

The museum administrator has login credentials and they can update the art works for each rooms based on the Bluetooth low energy type. First we start a new room with assigning new BLE Id in a particular art works. We can create a next room to add a same way. Each and every room has many number of artwork and we can classify room names like (Historical room, Technical rooms).

2) Uploading Media with Localization service

We can update the multimedia content for each artworks with particular room based on BLE id. For each art works they can upload the video, audio and the textual information and then content will be uploaded in a cloud. This multimedia is based on artwork content and no size limit is fixed for uploading video, audio, text files. We can upload to n number of sizes. Media content uploading is based on room name and then BLE id. Localization service is done by using Bluetooth Low Energy. BLE is mainly used for identify the location by interacting with nearby devices or internet connected devices. In our system, each room is equipped with BLE and each has id. Based on BLE id, the wearable device will identify the user's position in a museum.

3) Image-processing

It is distributed between the wearable device and the processing center. The first we can detects the current user's position and communicates it to the processing center. In a user mobile device to pairing with the particular room BLE to aware the android device. Here, the localization information is stored and made available to other services. The information is also used locally to speed up the image-processing algorithm. . It can quickly analyze the video frames captured by the wearable device and identify the target object with high accuracy. We are using background subtraction algorithm which identifies moving objects from the portion of a video frame that differs significantly from a background model. An image's foreground is extracted for further processing. The result of the processing activity is then sent to the processing center.

4) Artwork content Delivery

It is the core of the business logic. It accesses in the Cloud, get an image from artwork and then comparing to particular art and then cultural contents required by the users and smartly provide such contents on several interactive platforms. Then, it allows the execution of several location-aware services by providing them with the positioning information coming from the localization infrastructure. These services enrich the cultural experience of the users by immersing them in a real interactive. To get an artwork Documents like that audio, video, text, author name to proceed given user mobile device. User can see the given artwork media content.

A. Indoor Localization Service

Several framework segments depend on the localization service. It comprises of three primary components: 1) a base of remote historic points that occasionally send location information 2) a service introduced on the wearable shrewd gateway that gathers the data of the historic points to decide its area 3) the service running on the cloud processing center gets the area of the user and gives it to the other services. All the more particularly, the system of wireless landmark consists of inserted gadgets outfitted with BLE interface and put independently in the distinctive rooms of the building. The decision of BLE is principally because of its low vitality utilization in front of a correspondence range similar with that of the conventional Bluetooth. Every gadget of the BLE framework sends its area (ID) together with the transmission (TX) power esteem. The service running on the user's wearable device gathers area information from every one of the points of interest inside its listening territory and after that decides the room in which it is found. To do so, it computes a proximity index d, for each area, using the corresponding value of the RSSI. The equation is as follows,

$$RSSI = - (10n\log_{10}d + A) \qquad (1)$$

Where A is the received signal strength at 1 m, n is signal propagation constant and d is the distance from the sender.

B. Image Recognition

Prior to any endeavor at perceiving a work of art, a helpful preprocessing step ought to be made. Truth be told, an average self image vision trademark is that the user with the camera can have quick head movement, e.g., when s/he is glancing around for something. This prompts high obscure in that part of the video succession, which brings about a low quality. Therefore, evacuating obscured outlines from the preparing can enhance the quality as well as keep the framework from giving the user data s/he is most certainly not interest on.

This is done analyzing the amount of gradient in the image. An equation that recognizes the blur degree in a frame *f* has been defined

$$\text{Blur}(f, \Theta_B) = \sum_I \sqrt{\nabla S_x^2(f) + \nabla S_y^2(f)} \qquad (2)$$

where $\nabla S_x(f)$ and $\nabla S_y(f)$ are the x and y components of gradient in frame. A threshold Θ_B, learned by computing the average amount of gradient in a sequence is used to discard frames with blurriness.

5. RESULT

The artwork / image recognition method was tried on the real and unconstrained dataset procured with a head-mounted camera at MUST exhibition hall, Lecce, Italy. The dataset contains more than 2000 casings at 640 × 480 resolution commented on with the current noticeable works of art and their room area. This amount of frames represents a testing arrangement portrayed by various sorts of works of art, diverse levels of light, and blur because of movement and impediments. The recognition ability was assessed as far as recognition exactness also, review, and arrangement precision. The initial two measurements speak to the recognition ability: a high exactness implies that frames containing artwork are accurately distinguished, though a high review implies that few frames containing works of art are missed.

The precision metric measures the coordinating execution, indicating what number of craftsmanship are accurately characterized. Since the proposed strategy depends on two distinctive thresholding steps, the outcomes concerning identification and recognition are demonstrated independently. This permits examining how diverse qualities can impact the performances of the proposed approach.

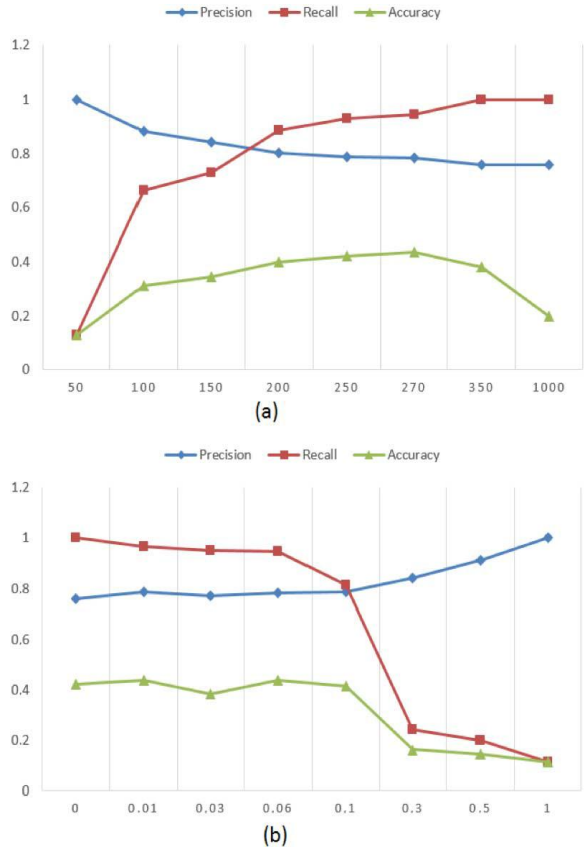

Fig - 2. Precision, recall and accuracy of our image recognition solution under different threshold values

6. DISCUSSION

As highlighted by the condition of-craftsmanship investigation proposed in Segment II, not very many solutions address the issue of conveying customized content amid a museum visit.

To provide an examination between the proposed system and these arrangements, specifically Smart Museum [2] and Museum Wearable a depiction of the received advances is initially given. Since a key component of each smart museum framework is the capacity to follow the tourist during their visit, every one of the solutions examined in this area abuse versatile advances. Either PDAs or wearable devices are utilized keeping in mind the end goal to give the guest a little and light-weighted device. Past this basic element, the analyzed models demonstrate profound contrasts in the advances assigned to distinguish artworks, localize the user and implement communication. Besides, they give distinctive extra services to users.

The architecture displayed in this paper has a few similarities to the previously mentioned approaches, however shows some critical contrasts. All solutions depend on mobile phones and are fit for giving customized data in light of a few kind of location awareness. All things considered, these elements should be the center parts of any smart museum device proficient of advancing a visitor's experience.

7. CONCLUSION

In this paper, an indoor location aware architecture for smart museum was composed. The proposed framework depends on a wearable device outfitted with image recognition and confinement capacities to automatically furnish users with cultural contents identified with the observed arts. The capacity to recognize the user's position is ensured by a base of BLE devices. The design likewise comprises of a handling focus, where the real business rationale is in control to: 1) access from the Cloud the cultural information identified with the observed artworks and 2) oversee the status of the indoor environment in understanding to users' position. Finally, the framework gets to the Cloud to store interactive media substance created by the user.

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