

Development of Internet of Things using Augmented Reality

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Abstract— IoT (Internet of Things) involves electrical, mechanical, or any connected network and sharing the data using the network. IoT is now becoming the booming technology of today, and it has a bright future. The most famous implementation of IoT involves Home Automation Systems. IOT's most recent converging is IOE, acronymically called as Internet of Everything. With the help of this automation, each device, equipment, and machinery can be accessed within its surroundings through any application or "middleware system". Every home will become a smart home in the future, where users will have remote access to every appliance of his/her house. The augmented reality (AR) is among the top trending technology of today i.e. creating visual solutions to digital problems and experiencing and visualizing them in the real world. AR enables us to view digital data placed over the physical environment to bridge the Digital and Physical World gap. AR only uses the camera of any smartphone, and the application will display the digital information related to the environment in front of the user by using the phone camera. Significant Research works are done in the field of IoT. Some researchers have worked on Security to improve the encryption process of data sharing. Some have tested multiple wireless systems available to create IoT. However, the interaction paradigm has remained unfocused. Considering the concept of IOE, there will be millions of IoT devices; think about interacting with them using the old paradigm of a middleware application. Users will be unable to remember which particular interface is controlling which device. Furthermore, the IOT's full potential is still unknown. Although IoT is available and being used still it is not entirely digitized to incorporate more features.

Our Research aims to combine the powerful digitizing feature of Augmented Reality with IoT. The Augmented Reality provides a way for presenting digital information over physical objects; using this approach,

we have created a new interface paradigm for IoT. The IoT device will be having its particular interfaces mapped on the physical IoT device using AR. Instead of searching for the interface, the user will be just placing his smartphone camera over the object and interacting directly with it using AR interfaces. Our Research also aims to add another digitized feature in IoT, and that will be the concept of digital wires instead of physical wires. The IoT device can be connected using digital wires through AR; using this approach, inputs can be attached to one or more outputs by connecting computerized Input/output points that we have created in our work. This additionally permits to proportion the bodily characteristic of any tool with different bodily tool like splitting the characteristic of timer transfer of the oven with any tool like fan or bulb or the usage of fan regulator now no longer simply to govern the rate of fan however to attach it digitally with light bulb and manipulate the brightness/mild depth via the regulator.

Keywords: Augmented Reality, Home Automation, Internet of Things and Mobile Application.

I. INTRODUCTION

To deal with populace movements, government and private areas in developing markets trust "smart cities" are what is to come. A year ago, India declared its "100 Smart Cities" plan to redesign its urban territories while China propelled its "Smart Cities – Smart Growth" activity. A smart city is a vital undertaking. However, it additionally must be a safe city. More than 54 percent of the worldwide population lives in urban focuses, with that number anticipated that it would take off to 66 percent by 2050. Many individuals move to urban areas consistently, and the speed and size of urbanization introduce new difficulties in lodging, transportation, and vitality. Fuelling urban communities is a transnational test as urban communities devour 70 percent of created vitality and deliver up to 80 percent of worldwide ozone-depleting substance outflows. When we need to show off the cool smart lighting system machine to our friends, we pull our phone out of our pocket, search for the App, then select the name we gave the light from a drop-down menu, and then operate some controls. The phone's number of applications and drop-down menus will grow to the point where it will be hard to remember which app and menu name corresponds to which device. When the user is in the kitchen and all you want to do is turn on a light, this is the situation. Is it the light with the number 10? With our hands, we govern the physical world. We have fashioned the forms and capacities of items through muscle memory for thousands of years without thinking about them in our heads.

Suppose. The current scenario, in which we run the world using a touch screen, offers a significant advantage over previous paradigms for operating physical objects. In that scenario, it must be as easy as turning on a light switch. All of the objects we wish to link must go through a similar process. All of the relationships between programmes, drop-down menus, and physical objects must be memorised by the user. When a user's to-do list grows too big, he

or she rapidly hits the limit of what can be recalled. Internet of Things has been executed the use of more than one stressed out or wi-fi connections of gadgets to proportion statistics and turn out to be a part of the network. These strategies encompass GSM, Bluetooth, Wi-Fi, Ethernet, and Zigbee. There are many types of Research in IoT; some have researched on connecting techniques, some on Security related to IoT, some on infrastructures. However, the researcher has avoided chiefly the interaction method as they think this does not need improvements. There is another trending technology of Augmented Reality (AR) which is now becoming the latest topic for Research as it has introduced a new aspect in the field of Computer Vision (CV). Interaction method for IoT and making it completely digital is a big challenge. The current status is that only Smartphone Application Development is done to make the IoT mature, but this is not enough for the future of IoT.

The System is based on the micro-controller, and a GSM Module, which uses a radio signal to send and receive data, and the micro-controller controls the connected devices. This System has brought simplicity to the IoT. Since the GSM system is older it has raised many issues regarding the portability, accessibility, and enhanced feature to add in IoT. Users have to write a text message in order to switch on the light. If there is no security in the mobile phone, there will also be no security available for the IoT device. Smart Home Automation described in [4] can be used locally within a small area of a room. Using this System, the user has to connect his smartphone with the Bluetooth of the device he wants to control, an application developed for the smartphone works as a middleware for the System. The Security of this System is based upon the version of the Bluetooth device. The Security is too much lower for the lower version and can be easily accessed as it does not encrypt the data while sending and receiving information.

Implementation of IoT using the Wireless Local Area Network and Android app for accessing all the devices. The System described in is the latest than the Bluetooth-based IoT. This System presented in REF also enables the user to communicate or control up to 10 devices using a single WLAN router system. This System is also limited to small scale, and it is a low cost too. The limitation of the WLAN range also arises an issue that users should have to be present in the premises of the WLAN signals. The speed and accuracy of the System is high due to short-range. The study has two objectives. To begin, the term "augmented reality" (AR) is defined above this new artificial and augmented environment. The features of augmented reality systems are implemented, and the technologies utilised in this system are categorised. Second, there is educational potential in this setting. The study described represents the implementation of AR as Head-Up Displays. Two applications include a projection of optical paths followed via simulated elements on a virtual optical bench and a remote user using a laser pointer worn by another user to point out objects of interest.

The literature survey has been carried out in two different directions. The goal is to first identify current IoT implementation approaches that are functioning, and then to emphasise the relevance, applicability, and future of AR. Many IoT implementations exist, according to this literature study, including Bluetooth, GSM, WLAN, and Over the Internet. All these implementations have used either old technologies and have short-range or limitations of devices. IoT over the Internet is one of the best solutions present. However, the

interaction paradigm is still the hectic thing that has to be resolved, and wholly digitalizing the IoT is required. After analyzing the current IoT systems, we then presented the AR implementation and IoT as an interface medium to improve the interaction and switch the paradigm for the IoT so that it can become easy access for the IoE of the future. AR is famous for representing digital information such as interfaces in a more sophisticated and easily accessible manner. AR provides a way to identify objects more efficiently, and users do not have to memorize these objects. This same solution needs to be done with IoT as users have to avoid memorizing the objects and interacting with them directly, just like we interact with the physical world objects. AR also provides a solution for digitalizing the information of IoT to enhance and extend features.

II. TOOLS & TECHNOLOGIES

A. *Software Tools*

A.1 *Unity 3D*

Unity is a cross-platform game engine advanced with the aid of using Unity Technologies, that's mainly used to create pc video games and recreations for PCs, consoles and mobileular phones. In the first place declared only for OS X, at Apple's Worldwide Developers Conference in 2005, it has when you consider that been stretched out to goal 27 platform.

A.2 *Vuforia SDK*

Vuforia is an Augmented Reality Software Development Kit (SDK) for mobile phones that empowers the formation of Augmented Reality applications. It makes use of Computer Vision innovation to understand and track planar photographs (Image Targets) and easy 3-d objects, for example, boxes, progressively. This photograph enlistment cap potential empowers engineers to place and situate digital articles, which include 3-d models and different media, in connection to actual photographs while those are visible through a cell phone camera. The virtual question at that point tracks the position and introduction of the picture progressively so the viewpoint on the protest compares with their point of view on The Image Target gives the idea that the virtual question is a piece of this present reality scene.

B. *Hardware Tools*

B.1 *Node MCU*

NodeMCU is an open-source Lua-based firmware and development board peculiarly used for IoT-based Applications.

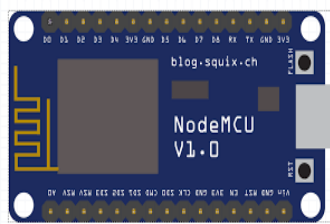


Fig.1. NodeMCU V1.0

It consists of firmware that runs at the ESP8266 Wi-Fi SoC from specific if Systems and hardware this is primarily based totally at the ESP-12 module.

B.2 Single Channel Relay

Relay is an electromechanical tool that makes use of an electric powered present day to open or near the contacts of a switch. The single-channel relay module is a great deal extra than only a simply relay. It consists of additives that make switching and connection extra available and act as signs to reveal if the module is powered and if the relay is active or not.

Any entry tool that does not utilise a voltage law device, such as fan, or other tool, will typically function on a similar range of current value.

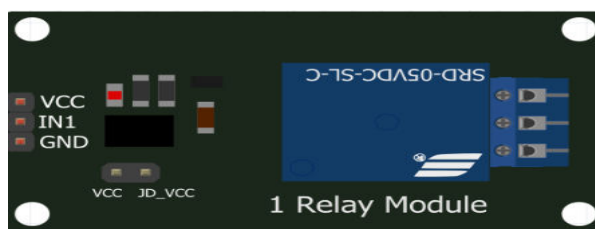


Fig.2.Single Channel Relay

C. Hardware Design

There are two major parts of Hardware Design. One is creating an IoT device from micro-controller and second is to control the DC device using that IoT enabled micro-controller. The Circuit Schematics of both designs given below.

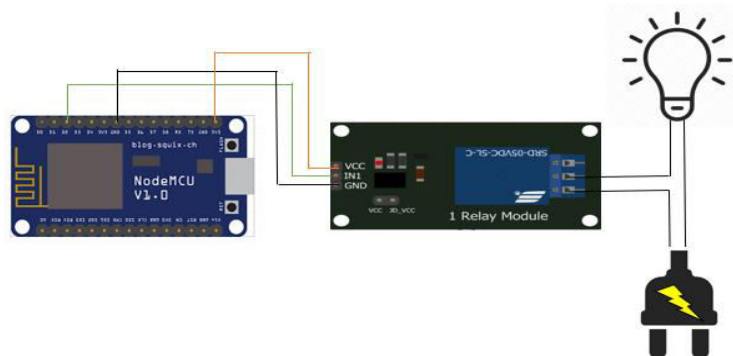


Fig.3. Hardware circuit diagram

C.1 Arduino Flow Chart

Arduino process is divided into two parts. One is controlling of Input Devices and other is controlling of Output Devices. Both processes are being shown in below flowcharts.

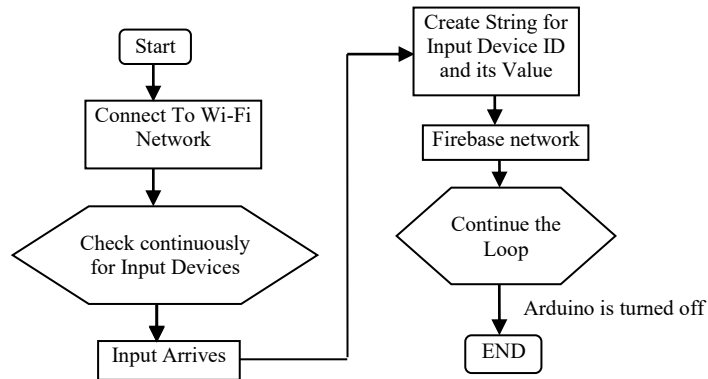


Fig.4.1. Input points Flowchart

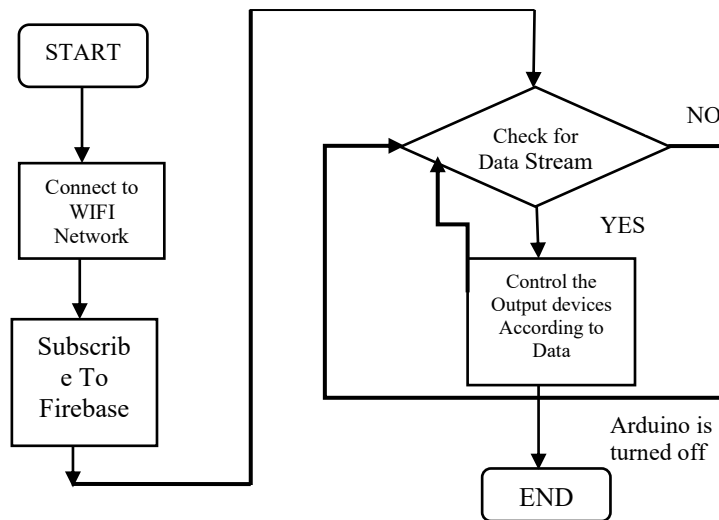


Fig.4.2. output points Flowchart

C.2 DC Device

An electric powered circuit's DC solution is the one in which all voltages and currents remain constant. Any table-bound voltage or current waveform may be decomposed into a sum of a DC element and a zero-imply time-variable element; the DC element is defined as the voltage or current's average value over all time. It may be proven that any desk bound voltage or current waveform may be decomposed right into a sum of a DC element and a zero-imply time-various element; the DC element is described to be the average value of the voltage or current over all time.



Fig.5.Object Placement in Unity 3D environment

D. Software Design

The Mobile Application has been developed using cross platform development tool Unity 3D. The Designing part includes design of tracker and objects that are mapped using Augmented Reality SDK. The controlling objects are placed on tracker plane in Unity 3D as shown in Fig. 5.

D.1 Unity 3D Program Flowchart

Mobile Application is developed using this platform. The overall working process of the application is shown in Fig. 6.

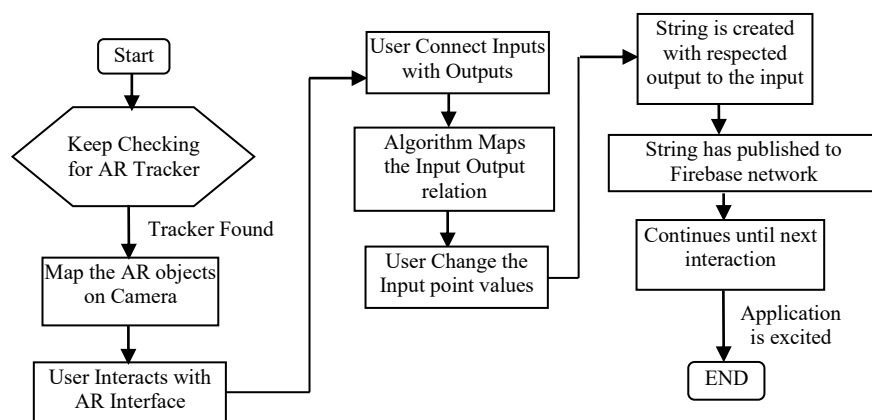


Fig. 6. Mobile application Flow chart

E. Total System Process Design

The Overall proceeding is been broken into three parts, one is hardware part, second is software and the third is networking part. The Networking part is been done using the PubNub api. The process has been illustrated in Fig. 7.

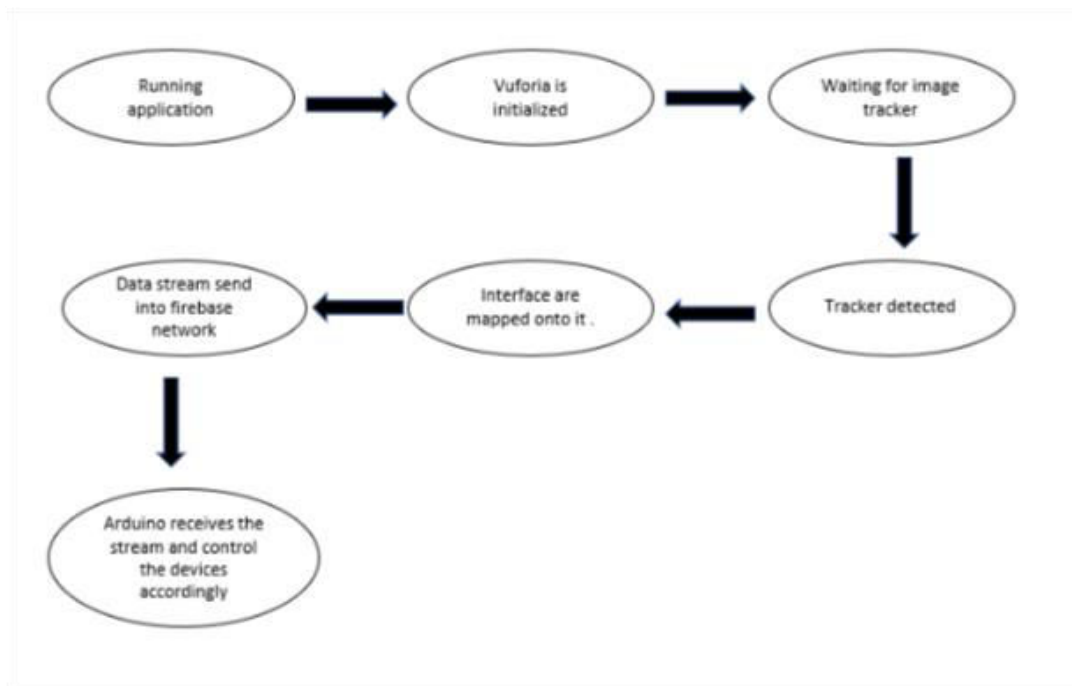


Fig.7.Complete process of the application

III. CONCLUSION

We have correctly used the AR as a brand new interplay paradigm for the Internet of Things. The AR can be easily used for interacting with any device whether it is an appliance or any object. Our proposed research work has been implemented as the concept of Digital Wires. The digital wires have been created not only as part of software but also as network programmed and hardware device also working as re programmable digital connections.

There are multiple things that can be improved in this System. Few of these future works are using Tracker less AR instead of tracker based AR. This improvement will help removing the requirement of tracker being placed on the object itself. Another development may involve the improvement of feature sharing concept into an Omni-object concept which will enable user to share each and every feature of every object whether it is electrical or any physical or digital device. Final result of both hardware and software has been shown in the image Fig. 8 and 9 below.



Fig.8. Hardware Result



Fig.9. Software Result

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