

IoT Based Smart Projectors

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Abstract— This paper advances a thought by applying the idea of IoT which concentrates on cost lessening and upgrading the nature of administration in the field of innovation supported educating. It proposes the utilization of Raspberry Pi and its web interface, to store records that have been sent from remote sources and view these power point records or Portable Document Files (PDF) on the projector. The proposed framework intends to substitute portable PCs with Raspberry Pi which won't just radically decrease the cost included, additionally will accomplish nature of administration as the framework will expend a littler measure of energy, yet will give an indistinguishable usefulness from whatever other comparable framework does.

Index Terms— Raspberry Pi, Projector, Server, Remote Access, Storage, Cost- Reduction, Security, Mounting

1 INTRODUCTION

In this paper, first the issue has been characterized, and after that a cost-effective answer for that issue utilizing Raspberry Pi has been proposed. The specialized point of interest of Raspberry Pi and explanation of how they will be utilized as a part of the proposition has been specified. Further, every progression of the proposition has been specified in detail including the OS establishment and the Linux summons to be taken after for setup of the Raspberry Pi. Towards the end, the cost of this proposition, which is the most indispensable range of our worry, has been evaluated.

2 OVERVIEW OF THE PROPOSED SYSTEM

2.1 Motivation

Innovation has become the dominant focal point in schools and universities, with understudies being shown utilizing PowerPoint slides and Portable Document Files (PDF), giving better bits of knowledge into the topic. For this, essentials incorporate tablets that should be associated with projectors and compact gadgets like pen drive. One notification the accompanying wasteful aspects in this practice:

1. Requirement of a tablet for every last class, bringing about expanded cost.
2. Mandatory to convey a convenient gadget each time.

Along these lines, there emerges a need to make a gadget which guarantees to decrease the general cost and additionally disposes of the need to convey a convenient gadget each opportunity to the class.

2.2 Problem Scenerio

To better comprehend the issue, consider the present situation in any one bureau of a foundation. On the off chance that the Division has five classes and educator in each of this class utilizes projector, this gets the necessity of one portable PC for each class. Presently, if five classes in the meantime require tablets, add up to be contributed by the office would.

The roughly record of the money to be utilize is equivalent to Pakistani Rupees 3, 00,000 ($60K * 5 = 3$ Lac Rupees). This is an immense sum that the division contributes. Today, any school, college or university has no less than 5 departments. So the cost totals up to Rupees 1,500,000. Therefore, school, college or university spends such enormous measure of cash which when contrasted with the expectation behind it doesn't appear to be productive. On the off chance that this sum is diminished it would help spare a lot of cash, which could be additionally utilized by the office for some examination or some other advantageous undertaking.

This paper is a push to address this issue. The framework proposed here is alluded to as "Cost-effective projectors utilizing Remote controlled Raspberry Pi". It makes utilization of a Raspberry. Pi - a Visa measured PC which would give financially savvy and vitality effective answer for the above expressed issue. Practical as Raspberry Pi costs just a single tenth of a tablet (35-40 USD) [1] and vitality effective as it devours significantly less power (5V) when contrasted with required by a portable PC.

2.3 Solution of Scenerio

General goal of this venture is to utilize Raspberry Pi and its SD storage and web interface to store documents that have been sent from remote sources, server and view these records on the projector. When Raspberry Pi has been set up and is prepared to be utilized like an ordinary PC, applications can be introduced in this manner empowering to view all the Portable Document Files (PDF) and control point introductions.

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The following is to utilize a device to control these applications. Controlling of Raspberry Pi can be accomplished utilizing a PDA which practically everybody conveys today. An external mini-keyboard UKB-500-RF is also attached with the Raspberry Pi to allow amendments in the documents at the spot.

The Raspberry Pi has a HDMI port and an Ethernet opening alongside IEEE 802.11g. This encourages transferring documents and introductions from neighborhood and additionally remote goals to the Raspberry Pi. There is also four USB ports are present in the Raspberry Pi which allows the students to display their data by using the proposed device to the projector.

3 DETAILS ABOUT RASPBERRY PI

Raspberry Pi is a MasterCard estimated PC. It's essentially a little PC which gives all the fundamental capacities that are given by a desktop PC. For instance, it gives capacities like word handling, gaming and playing sound/video. It has turned into a broadly utilized gadget for learning programming since most recent few years. [1]

Now-a-days, with the launching of new technology of IoT the use of Raspberry Pi has been enhanced in the field of technology. In our proposed system raspberry Pi plays the role of Heart in the device.

3.1 Specifications of Raspberry Pi

The Raspberry Pi is a 4 X ARM Cortex-A 53 64 bit CPU with a 1.2 GHz Processing speed and a Broadcom video core four GPU. It has Broadcom BCM 2837 SoC and 1 GB RAM with 900 MHz speed. The Ethernet LAN port and wireless 2.4 GHz 802.11n is available for web and remote get to. It likewise has a HDMI port, through which it can be associated with any show gadget, similar to the screen or the projector. Camera serial Interface and Bluetooth 4.1 Classic module is also present in the Raspberry Pi 3 B module. Another awesome office which Raspberry Pi gives is the nearness of four USB ports, where one can associate his pen drive or USB mouse/Keyboard. Broadly useful 40 Input/output (GPIO) is an arrangement of non specific sticks on a Raspberry Pi whose conduct can be controlled and additionally customized through programming. The Raspberry Pi additionally has a SD card space, which can go about as an inner stockpiling and can likewise store a picture of Operating System. [2]

3.2 Model of Raspberry Pi 3 B

Raspberry Pi model 3 B is to be used for this purpose. It comprises of a 1 GB RAM model with four USB ports and a 10/100 Ethernet controller. The figure 1 below shows the model.

The Raspberry Pi model 3 B consists of a 1 GB RAM. It exhibits the Broad com BCM2837 ARM 1.2Ghz 'System on Chip' Processor. One can play Full 1080p High Definition Blu-Ray Quality Videos on Raspberry Pi due to the presence of Integrated Video core 4 Graphics Processing Unit (GPU). One can program as well as learn programming conveniently due to the presence of the free, versatile, and highly developer

friendly Resbian GNU/Linux Operating System. It consists of 4 USB ports, 1 HDMI Video output, RCA Video output, 3.5mm Audio Jack output. Raspberry Pi Model 3 B is powered by a 5V Micro USB Power Input Jack. It is pretty energy-efficient as it requires only about 700mA current to operate. It also consists of an SD, MMC, SDIO Flash Memory Card Slot as well as a 26-pin 2.54mm Header Expansion Slot. [3]

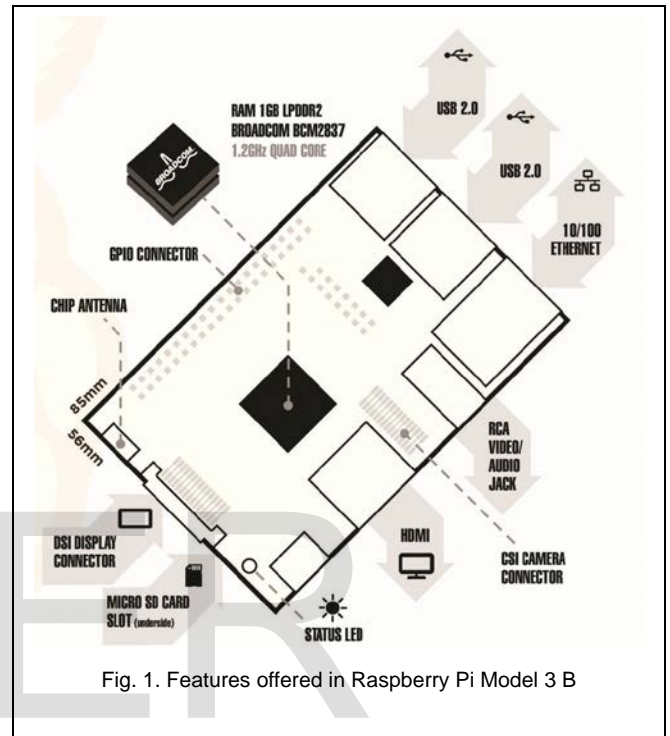


Fig. 1. Features offered in Raspberry Pi Model 3 B

3.3 Raspberry Pi: A Cost-Effective Solution

The issue which is tended to by the proposed framework includes cost decrease. This will be accomplished when we consider the cost of all the equipment and programming parts involved in this framework.

According to the feasibility study conducted, the aggregate cost included would record to a most extreme of \$140 which is equivalent to about Pakistani Rupees 13000 to 14000. Presently, on the off chance that we consider an indistinguishable situation for an office from expressed above, the aggregate cost brought about would be Rs. 70,000 (5 x max (13000, 14000)).

This infers the present cost will be cut by 80%, which would without a doubt turn out to be a fruitful endeavor to spare gigantic measure of cash for any organization. In this way, thinking about cost the proposed framework turns out to be significant. Moreover, it gives an indistinguishable administrations from the present framework does. Accordingly, the working model of the proposed framework would diminish the general cost required without trading off on the administrations it offers.

TABLE 1
COST INVOLVED FOR THE PROPOSAL

Sr. No.	Items Descriptions	Cost Rs
1.	Raspberry Pi Controller	6,000/-
2.	Mini Keyboard	2,500/-
3.	Cables	1,000/-
4.	Serial Ports	100/-
5.	Casing	1,500/-
6.	Power Supply	200/-
7.	Raspberry Pi Casing	1,500/-
8.	Micro 16 GB SD Card	1,200/-
Total Cost		14,000/-

4 ARCHITECTURE OF THE PROPOSED DEVICE

The Framework design for the most part involves three blocks:

- Raspberry Pi
- Network access layer
- Security Verification Application

4.1 Raspberry Pi

The HDMI port on Raspberry Pi will permit interfacing a projector to the palm beat. This additionally helps dispensing with the need a LCD screens, accordingly decreasing the cost included. The following segment is the SD card stockpiling, which will store every one of the documents which are exchanged to the Pi from nearby/remote areas and also from the server through mounting of data the image of the files also save in the memory of the Raspberry Pi. [4]

4.2 Network Access Layer

The system get to layer incorporates the utilization of remote Zong Mi-Fi 4 G device or Ethernet to interface with the system. This layer enables transmission of documents to the Pi and also enables the way of communication between the device and the server. By using the same networks users also put up their data on the server by using home group sharing data topology.

4.3 Security Verification Application

The security verification application will also be available on the Raspberry Pi terminal and will basically be utilized for the authentic user to access the respective data folder on the server. More about the application has been examined later.

The user name and password is assigned to each specific Professor of the Organization. By using mini key board UKB-500-RF the specific user can login to the student portal and also can made amendments in the documents on the spot. Mini keyboard UKB-500-RF is a powerful wireless handheld

keyboard with a touchpad mouse. Its operational voltage is 3.3 Volts and current is 50 mA. Its transmission range is up to 10 meters, it has 2.4 GHz wireless keyboard with touchpad and supports HTPC, Business lectures and video conference systems. [5]

Our product simulation starts from the specific user authentication. On the Raspberry Pi we have code our specific app, as to interface all of the data on one single platform. The coding of each step and authentication app is mention in the next page.

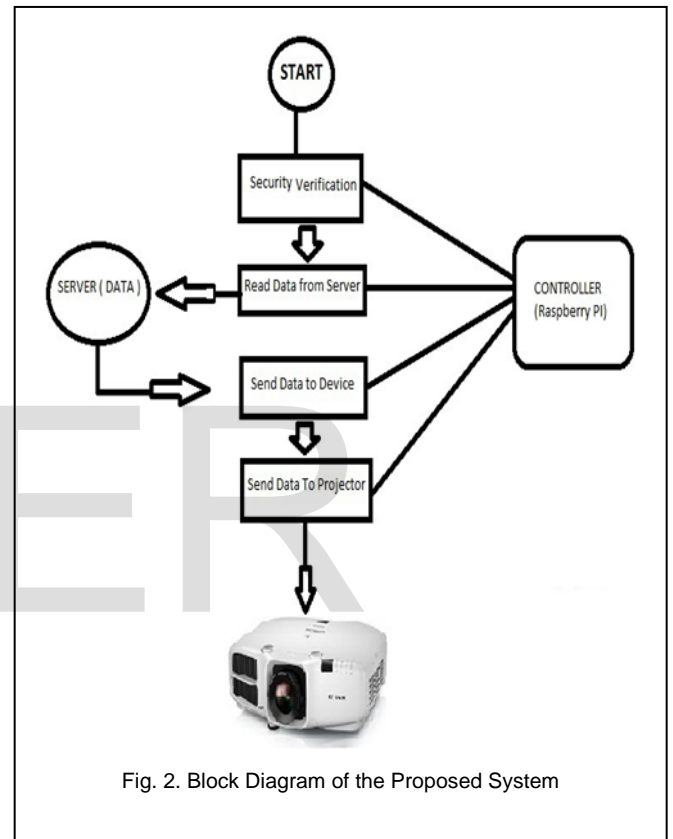


Fig. 2. Block Diagram of the Proposed System

To make this whole product you have to use Win 32 disk Imager, Xming, VNC_Viewer, Putty and Raspbian-Jessie and Python 3.4. On the Raspberry Pi window, you have displayed the graphical app for the user authentication and accessibility of data. First of all install Raspbian software in the 16 GB microchip card and insert in into the Raspberry Pi and after that the controller automatically executes the software. Then create a server on our laptop and access the specific folder which contain thr required data through Raspberry Pi and display the data on the projector screen.

4.4 Network Topology on CISCO Packet Tracer

For the better understanding of the project the simulation of the proposed system is shown on the CISCO Packet tracer in Figure 3. As there are three teachers' PC's which are connected to the Zong Mi-Fi device with the help of switch.

There are three different Vlan's 10, 20 and 30 present in

the topology implementation, for teacher PC-1, teacher PC-2, and teacher PC-3 respectively. These Vlan's are created with the help of switch so that all the PC's cannot communicate with each other. In router 2811 stick for Vlan's is created. While EIGRP protocol is used in this router for the effective communication of teacher laptops with the server. All the laptops can send their data to the server via Zong Mi-Fi Device. Our device (SELLADO) which is connected with the server by using wireless Zong internet can receive the data from server and send it to the projector to display.

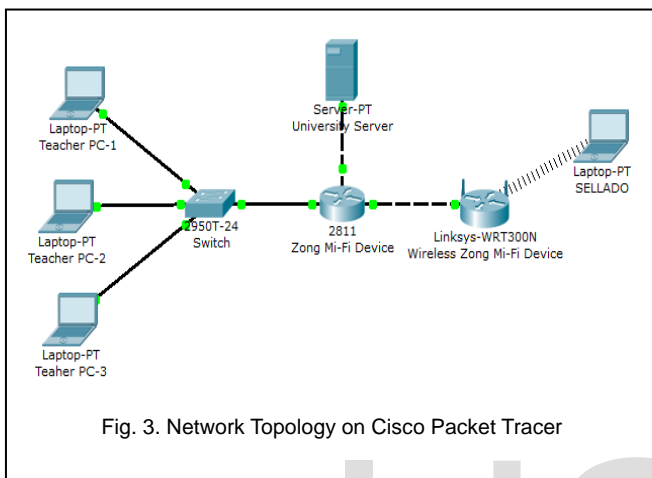


Fig. 3. Network Topology on Cisco Packet Tracer

The following commands are used to create Vlan's, routers on a stick and implementation of the EIGRP Protocols:

- a) `Switch(config)#vlan 10`
`Switch(config-vlan)#int fa0/1`
`Switch(config-if)#sw m a`
`Switch(config-if)#sw a vl 10`
- b) `Router(config-subif)#en`
`Router(config-subif)#encapsulation d`
`Router(config-subif)#encapsulation dot1Q 10`
`Router(config-subif)#ip add 192.168.1.2`
`Router(config-subif)#ip add 192.168.1.2 255.255.255.0`
`Router(config-subif)#int fa0/0.20`
- c) `Router(config-if)#rou e 11`
`Router(config-router)#net 192.168.0.1 0.0.0.255`
`Router(config-router)#net 192.168.1.1 0.0.0.255`
`Router(config-router)#net 192.168.2.1 0.0.0.255`
`Router(config-router)#net 192.168.3.1 0.0.0.255`
`Router(config-router)#net 192.168.4.1 0.0.0.255`
`Router(config-router)#net 192.168.6.1 0.0.0.255`

`Router(config-router)#exit`

The class C IP adresses is defined to each of the respective PC's and server in this proposed system for the effective usage of the addresses.

5 STEPS INVOLVED IN SYSTEM CREATION

5.1 Setting up the Raspberry Pi for the first time

To utilize Raspberry Pi, an Operating System (OS) should be introduced onto a SD card. These directions to be taken after include:

1. Embed a SD card that is 8GB or more noteworthy in size in the PC.
2. Organize the SD card so that the Pi can read it.

Now download the SD Association's Formatting Tool 1. Install and run the Formatting Tool on the machine. And then set "Organize SIZE ADJUSTMENT" alternative to "ON" in the "Choices" menu check that the SD card embedded matches the one chosen by the Tool. In the last click the "Format" button. Then Download the New Out Of Box Software (NOOBS). NOOBS makes setting up a Raspberry Pi surprisingly considerably less demanding. Points of interest are that one won't require arrange get to, and won't have to download any extraordinary imaging programming. NOOBS gives a rundown of Operating Systems to choose from when booting interestingly. [6] Now follow the following steps:

- Unzip the downloaded document. Right tap on the document and pick "Concentrate all" in Windows.
- Copy the extricated documents onto the SD card that was recently organized.
- Insert the SD card into Pi and interface the power supply.

Pi will now boot into NOOBS and ought to show a rundown of working frameworks that one can introduce. In the event that the show stays clear, one ought to choose the right yield mode for the show by squeezing one of the accompanying number keys on the console:

- HDMI mode: this is the default show mode.
- HDMI experimental mode: select this mode on the off chance that you are utilizing the HDMI connector and can't see anything on screen when the Pi has booted.
- Composite PAL mode: select either this mode or composite NTSC mode in the event that you are utilizing the composite RCA video connector.

5.2 Setting up wifi in Raspberry Pi

The Raspbian OS offers Wi-Fi setup utility. An alternate route exists for Wi-Fi Configuration on the desktop of RPi. For

the setting of Raspberry Pi with the Wi-Fi, one should take after the accompanying straightforward strides:

1. Filter for the Wi-Fi get to focuses in the region. Another window will open giving insights about the get to focuses.
2. Locate the remote get to point in the rundown, and correctly insert the specific password of the wireless internet device.
3. One can check the Wi-Fi network in the primary window. IP address on Raspberry Pi is shown as well. Presently the Raspberry Pi is associated with the respective wireless network. Now when you restart the Pi it automatically connects with the pre-defined wireless internet device. [7]

5.3 Setting up the Server and Mounting of Data on the Raspberry Pi

To remotely receive the data on the Raspberry Pi from the respective teacher PC's the Server/Client method is used in the proposed system. According to this method the teacher place their data on the server by creating a home group on the specific internet. And then by the technique of mounting of the data the Pi receive the data and then send the data to the projector screen.

Following commands are used in the Terminal of the Raspberry Pi for the mounting of the data, checking of mounting data, auto mounting, refreshing and adding some delay respectively.

```
pi@raspberrypi:~ $ sudo mkdir /mnt/Directory
pi@raspberrypi:~ $ sudo mount -t cifs -o
pi@raspberrypi:~ $ df -h
pi@raspberrypi:~ $ sudo nano /etc/fstab
pi@raspberrypi:~ $ sudo mount -a
pi@raspberrypi:~ $ sudo crontab -e
```

5.4 Python coding for APP development in Raspberry Pi

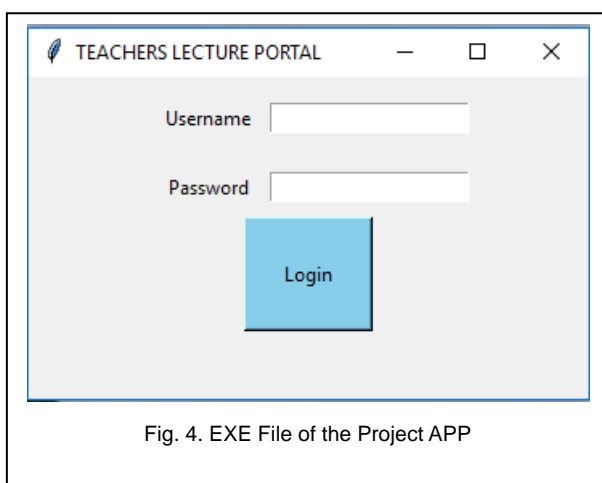


Fig. 4. EXE File of the Project APP

already pre-installed. For the ease for the teachers and the successful implementation of the security verification a user friendly APP is already installed in the Pi configuration of the Sellado device.

This APP allows the teachers to login to their specific folder which is located on the server via Wireless internet and access to the respective data. This data is then showed by the Raspberry Pi on the Projector screen.

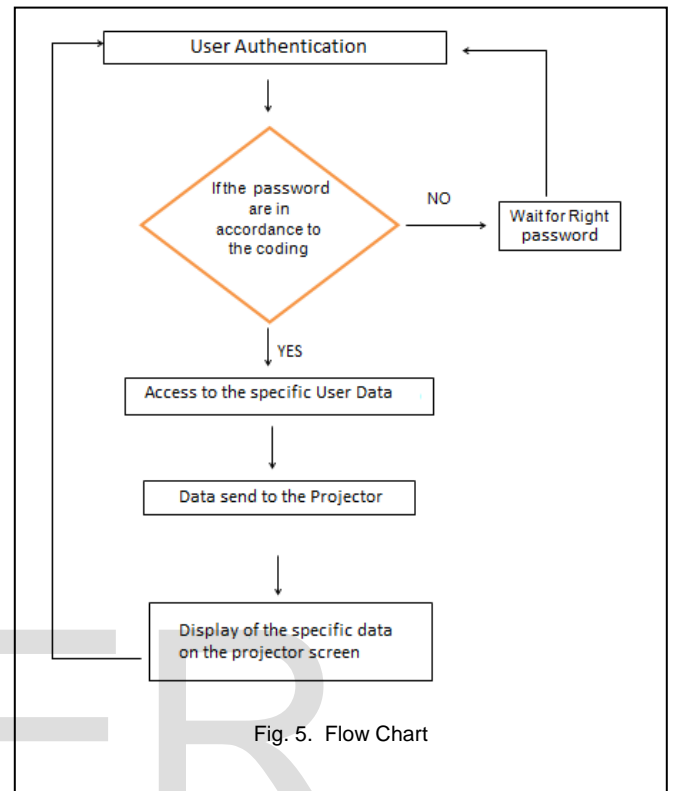
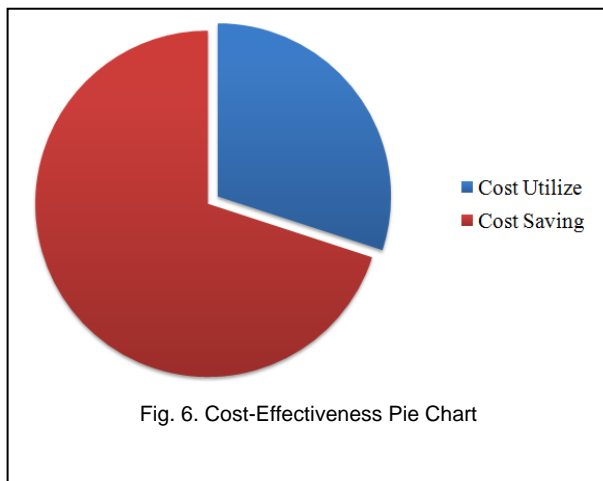


Fig. 5. Flow Chart

6 CONCLUSIONS AND FURTHER SCOPE

6.1 Conclusions

The present training framework depend a ton on technology aided teaching. Thus there is a prerequisite of numerous tablets. In any case, one understands that a large portion of the usefulness of these tablets is under-used as the sole reason for these portable PCs is putting away and anticipating slides. Portable workstations expend a considerable measure of energy, and in addition are exorbitant. Along these lines, this paper proposes supplanting of laptops and mobile devices with a minimal effort and additionally low-control devouring capacity gadget, which can be outlined utilizing Raspberry Pi. A user interface APP can be intended for this gadget for remote get to, therefore adding to teachers' benefit. Besides, this gadget can likewise be controlled by utilizing advanced mobile phone applications for simple route. This gadget can be utilized for introductions utilized as a part of classes, or for instructive purposes in schools or universities, or for diversion purposes. Additionally, this gadget can be utilized to for putting away information which has been sent from remote areas. All things considered, this gadget offers every one of the components that a tablet offers, however at a value which is not as much as a large portion of the value we pay for tablets.



6.2 Further Scope

1. Until further notice, this paper proposes supplanting tablets with the new stockpiling gadget for a division. This can be stretched out over a huge scale as well, say for every one of the bureaus of the school and then likewise over many foundations everywhere throughout the nation. This item undoubtedly has enormous capability of supplanting portable workstations, particularly for the specific use of capacity and anticipating.
2. Another future degree is driving the Raspberry Pi utilizing a battery. Until further notice, the Raspberry Pi should be associated with the power supply by means of the USB control port. However, in the event that the power goes off, it would kill the Pi unexpectedly. Along these lines, it would be better if the Raspberry Pi is associated with a reinforcement battery control supply.

ACKNOWLEDGMENT

We are eternally indebted to our advisor Assistant Professor Haris Mohsin for all the help, invaluable guidance and generous support throughout while writing this research paper. We have been very fortunate to be associated with such a kind and good person and it would take more than a few words to express our sincere gratitude.

REFERENCES

- [1] About Raspberry Pi. This is the official website of the Raspberry Pi project [Online]. Available: www.raspberrypi.org.
- [2] Membrey, Peter, and David Hows. Learn Raspberry Pi with Linux. Apress, 2012.
- [3] J. Rauch, (2016, January). The Magpy Magazine: The Official Raspberry Pi Magazine. Raspberrypi.org/magpi [Online]. Available: <https://www.raspberrypi.org/magpi/raspberry-pi-3-specs-benchmarks/.2016>.
- [4] Raspberry Pi Foundation. UK Registered Charity [Online]. Available:

<https://www.raspberrypi.org/downloads/>.

- [5] UKB-500-RF mini wireless keyboard with touchpad. Android Smart TV [Online], Available: URL (<https://androidtvbox.eu/ukb-500-rf-is-a-2-4ghz-mini-wireless-qwerty-keyboard-with-touchpad-promo/>).
- [6] Dhaval Cheeda, Diviyesh Darde and Shraddha, S. (16, November 2013). Smart Projectors Using Remote Controlled Raspberry Pi. International journal of Computer Applications, Volume 82, 1-10.
- [7] Setting up Raspberry Pi Server. Blog of Jeremy Morgan, who is a Silicon Forest Hacker / Developer writing about Tech, Programming, SEO and Marketing. [Online]. Available: www.jeremymorgan.com/tutorials/raspberry-pi/how-to-raspberry-pi-web-server.