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Smart Mirror using Raspberry

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ABSTRACT: As technologies are increasing day by day, there's also an increase in various requirements that ease the work of humans. Smart Mirrors or intelligent mirrors are one such piece of technology that provides valuable information to the users by acting as an interface between the users and computer-aided services. Smart Mirror as the name suggests is used to perform smart operations which are majorly used to save a lot of human time and effort. In this scope of the study, the developed Smart Mirror is used to display all the necessary information such as Date and time, Weather forecasts and temperature, Calendar as well as Indian Public holidays, News Headlines, display Spotify songs that are played on the Spotify account and last but not least it also displays live Cryptocurrency Market. All the above modules can be displayed on the mirror using various web services and Raspberry Pi 3 microcontroller card. The smart mirror can also be controlled by connecting various devices to Raspberry Pi like the microphone or web camera to pass the voice commands from the user and the Google Assistant responding to those voice commands.

KEYWORDS: Smart Mirror, Internet Of Things (IoT), RaspberrPi, Cryptocurrency, Acrylic Mirror

I. INTRODUCTION

Everyone knows what a mirror is. It is an object found in most people's homes. In mirrors we see our reflections. But what happens when you combine the idea of a mirror with technology? What possibilities are there and how smart could a mirror be? These are some of the questions that inspired my choice of final year project, a project which aimed to develop a smart mirror and a small operating system to power it. The device was to go beyond an ordinary mirror, to have a screen inside that you would be able to interact with by using voice commands, hand gestures and smartphones or other devices. Multimedia is a very broad area and I like every aspect of it so it was difficult to choose a specific area and I had many ideas. However, I finally decided to build a smart mirror because it is a great combination of many of the things we have studied: web technologies, electronics, UI design, etc. The smart mirror is a popular project among DIY enthusiasts and it usually consists of a one-way mirror with a screen attached to it that displays a static web page. However, what I wanted to achieve was something you could interact with. My goal was to learn how a Raspberry Pi worked and to understand how to combine the software and the hardware components to create a multimedia project. I started by obtaining a Raspberry Pi and creating the software. At the same time, I began documenting everything and I also searched for a suitable one-- way mirror and a computer screen, as well as some sensors to physically interact with the device. I then spent a long time calibrating the sensors to work with the software. Once the software was almost finished, I started designing the frame and finally I built the smart mirror and attached all the components. 6 Developing this project has been a great experience. I have learned a diverse range of skills in different fields, such as DIY, Linux, electronics and web development. To obtain the final result I've had to work with many different technologies. I used Photoshop and Illustrator for the UI designs, web development tools for the software and electronics for the hardware. Not sticking to just one field has made this project a really fun one and I would recommend it to anyone who is passionate about creating things.

II.RELATED WORK

[1] Microsoft's Magic Mirror: This mirror is proposed by Microsoft in 2016. This smart mirror works on Windows 10 IoT Core on Raspberry Pi 3. This is powered by Windows Hello cognitive services. This was an open source project. Its web app was made open to GitHub repository so that anyone can build its own smart mirror. The mirror shows traffic updates, weather and supports voice recognition.

[2]. Ekko Smart Mirror This smart mirror runs on their own Linux based platform on Raspberry Pi and it required an installed app on the user's smartphone. It also has sensors which could recognize the gestures of the user. Other than highlighting news, weather and time, the user can also play videos and music.

[3] Apple Mirror (Rafael Dymek) This smart mirror prototype is based on iOS 10 that mirror the iPhone display. The mirror can launch all the mobile apps desired by the user. This mirror sleeps after every 45 seconds of ideal situation. This is a touchscreen smart mirror.

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[4]Nuovo Smart Mirror This android based smart mirror required an android application on the user's smartphone. The mirror supports music and videos playback. This mirror also supports features like weather, maps and the social networking like Twitter, Facebook, etc. The auto sleep mode is also supported by the mirror.

III. SYSTEM DESCRIPTION

The entire project is divided into four major sections which are

- The Raspberry Pi
- Acrylic Mirror/Two-way Mirror
- Web Camera
- LED Monitor
- Speakers for output

The above sections are briefly described as follows:

1 Raspberry Pi Raspberry Pi is a low-cost mini-computer with the physical size of a credit card that runs on Linux and can perform almost all tasks that a normal desktop computer can do. The following are the configurations of the Raspberry Pi 3 used in the project: ● Processor & RAM: Quad-Core 1.2GHz Broadcom BCM2837 64bit CPU, 1GB RAM BCM43438 wireless LAN. ● Graphics: 400MHz Video Core IV multimedia ● Expandability: 40 general purpose input-output pins ● USB: Four USB 2.0 with 480Mbps data transfer ● Camera Serial Interface (CSI) ● Display Serial Interface (DSI)

Fig. 1. Raspberry Pi

2 Web Camera A web camera is another important part of the project wherein the user voice commands are taken as input by the web camera via the Raspberry Pi. Without the Web Camera, the Raspberry Pi can neither take the commands as input nor can even process it.

3 Two Way Mirror A two-way mirror is typically used as an apparently normal mirror in a brightly lit room, with a much darker room on the other side. People on the brightly lit side see their own reflection—it looks like a normal mirror. It is used to depict the image of the person or an object in the project apart from showing the functionalities of the Screen on the other side.

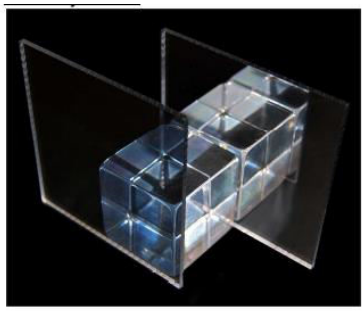

Fig. 2. two-way mirror

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4 LED Monitor An LED display is a flat panel display, which uses an array of light-emitting diodes as pixels for a video display. Their brightness allows them to be used outdoors where they are visible in the sun store signs and billboards, and in recent years they have also become commonly used in destination signs on public transport vehicles, as well as variable-message signs on Highways.

Fig. 3. LED Monitor

5 Speakers for output A 3.5mm audio jack speaker is required in order to get the output to the voice commands from the Google Assistant.

IV. IMPLIMENTATION DETAILS

In the system, the user can directly interact with the Google Assistant with the voice commands and apart from getting access to the news, date and time, temperature uses can also get access to the financial information like the Cryptocurrency details value of Bitcoin, Ethereum and Ripple. This information wouldn't be thrown directly on the face of the user but displays the information on the edges of the screen to allow the user to use it as an actual mirror. It also allows the user to note down the notes or to remind any daily tasks via the Google Assistant irrespective of day, time and night. This mirror provides very common information that is available on the smartphones and also used to display the playlist of the user's Spotify account. It performs all the tasks with a cinch.

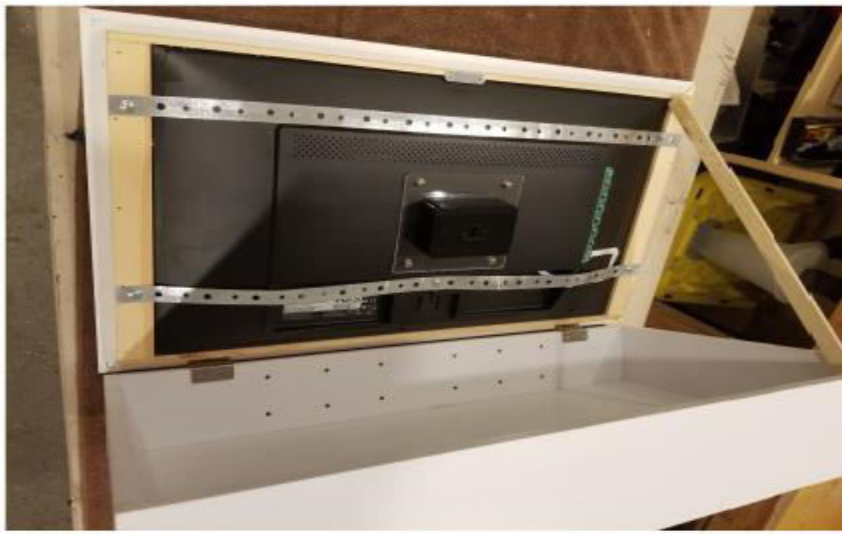

Fig. 4. In-progress picture without cables

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We started by removing the bezel on the monitor and replacing it with black electrical tape that ensured that we couldn't see the outline of the monitor through the glass. We then pulled out the little circuit board for the buttons to adjust brightness, turn monitor on, etc. We taped this to the back of the monitor for occasional future use if necessary. Next we broke the old glass that was included in the frame housing and replaced it with the new two way glass that we purchased. We then cut out several pieces of wood that were used to surround the monitor and keep it in place. After doing so, we glued these pieces to the frame housing/monitor and put it in place. Next we painted the outside of the frame to clean up any blemishes done in the process. We grabbed some bolts and placed them on top and bottom of the wood pieces and put flexible metal strips running across the back of the monitor to ensure it doesn't move too much. Lastly we cut a piece of plexiglass and screwed it onto the back of the monitor and screwed our raspberry pi into it. After hooking all the cables, we completed the construction of the monitor.

V. RESULT AND DISCUSSION

The following are the images that depict the output from the smart mirror displaying the date, time, calendar, news, Cryptocurrency details and current song playing on Spotify.

Output

Fig. 5. Smart mirror output

The following image depicts the date, time and Spotify song modules

Fig. 6. Date, time and Spotify Song modules

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VI.CONCLUSION

The goals of the smart mirror are to ease the work of the user by saving time and effort and to retrieve all the useful information by skipping the daily chores. The smart mirror did the thinking for the user with intelligent, commonly used applications. Apps like calendar, music, news, cryptocurrency, to-do lists and weather will be available. The apps were unobtrusively displayed on the screen, hidden by the two-way mirror, as to look like a seamless experience. A good project can't be produced without proper research first. Similar projects and products were analyzed for similarities, improvements, and flaws. Proper research was done and later the project was implemented with all the required devices (hardware and software) as well as an estimation of project expenses and the time to complete the project.

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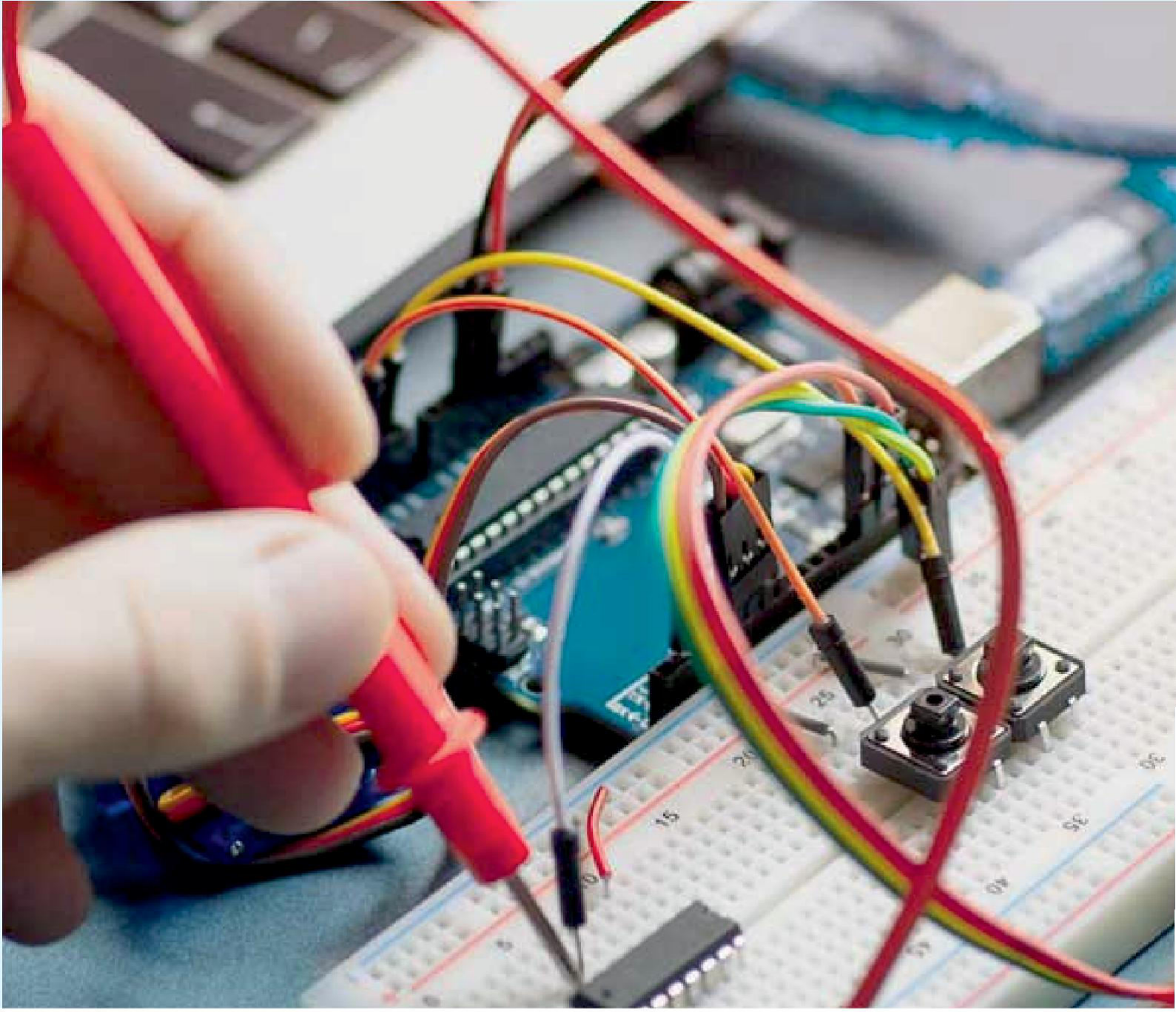

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