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Home Automated Smart Mirror as an Internet of Things (IoT) Implementation - Survey Paper

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Abstract: The future of Home Automation depends on Internet of things or IoT. Though the applications of IoT are diverse, the one that concerns the common man is how it can be used to make day to do life easier and faster. This is where Home Automation using IoT comes into the picture. In this paper, we demonstrate the function and working of a smart home mirror. The mirror will possess the ability to display date and time, the current weather condition and outside temperature, reminders, to-do lists and traffic conditions. These features of the mirror will be scraped from the Internet and implemented using the raspberry pi board. The pi board is programmed with the Raspbian operating system which is part of Linux. The mirror will also be lightweight, adjustable, durable and aesthetic. This paper presents the implementation and application of the smart mirror and how it is an integral part of home automation.

Keywords: Internet of Things, Raspberry Pi, Home Automation, Mirror, Networks, User Interface, Machine Learning.

I. INTRODUCTION

The world around us is constantly changing. With the advancement of science and technology, we are moving towards a more automated way of life. We have smart cities, smartphones, smart cars, and more. This fast way of life requires the development of Home Automation projects. Home Automation systems are mainly created using intelligent IoT devices. IoT is an integrated system of communicating devices in which each device is capable of carrying out tasks by themselves. IoT is an interconnection of Wireless Sensor Network (WSN) devices which includes embedded devices with wireless sensors.

Using IoT for home automation has many real-world applications, for example, we can build a smart home which will automatically close or open the windows based on the weather conditions outside. This paper presents the implementation of a smart mirror using IoT. A smart mirror is one that is capable of displaying the date, time, weather and traffic conditions on it reflecting surface. These features will be scraped from the Internet and implemented using the raspberry pi board. The Pi board is programmed using Linux OS. We use the mean stack method to create the display page and JavaScript is used both at the client and server side.

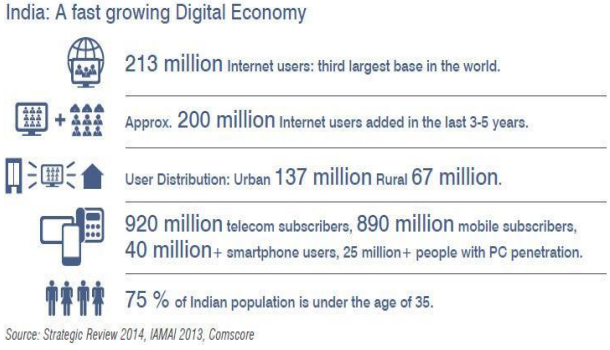
There are many benefits of using a smart mirror. It makes life easier as the need to look at phones every time we need to check the date or weather, is reduced. We have all the information that we need right in front of us. The smart mirror can also be upgraded to display browsers and social media websites. Adding a motion sensor to the mirror will further increase the speed and ease of use. Now we can get dressed and read the news or watched YouTube videos at the same time at the same place. Realizing the potential benefits of the smart mirror companies like Microsoft and Apple have come up with their own prototypes of the mirror.

II. STATE OF THE ART

With the Government of India setting an objective of creating an IoT industry of USD 15 billion, the entire country is soon to be connected to the internet regardless of their location. In the near future, regular homes will be equipped with plentiful devices with an NIC that lets them connect to the internet and interact with each other to cater to the user.

The genesis of the idea lies in creating a commercially viable device (viz. in this case, a mirror), to render basic available open source information to the customer. In an age of information, the user requires necessary data to be delivered as an integrated part of daily activities. A mirror being an excessively common appliance used in most middle class homes, we choose it as a starting point for a broader implementation in the future for the delivery of customizable information.

Table 3: The IoT landscape in India



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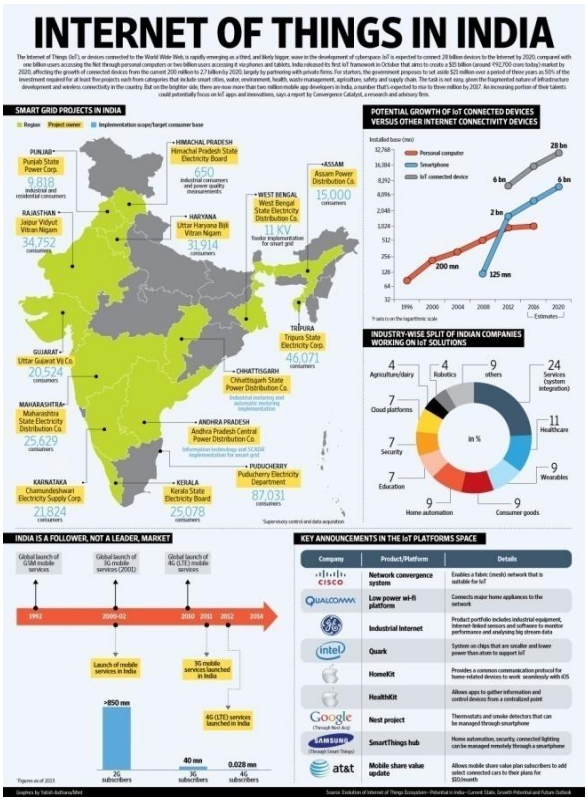
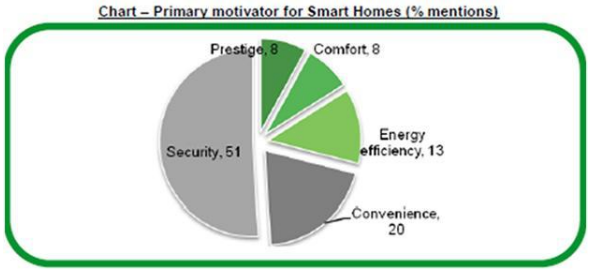
The ideal SAM would, in this case, equal the TAM only when this project is taken up as a full-fledged implementation. However, in the current scenario, the ideal SAM covers the upper middle class households interested in and aware of the benefits of integrating automation in their home. Those interested in implementing said project in their homes will generally be a consumer base involved in the building of a new home, which further narrows the current market. However, the feasibility and simplicity of the final product can endear undecided potential customers.

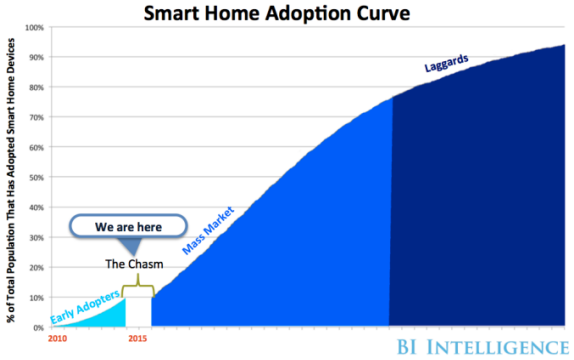


In 2014, the smart home industry generated a revenue of USD 79.4 billion, making one of the fastest growing and most beneficial industries under the IoT domain. It is no wonder that Samsung's SmartThings, Apple's HomeKit, and Alphabet's Nest are already exploiting the market. With the numbers expected to rise each year, it wouldn't be too distant in the future when a smart mirror is integrated into the regular human's daily life as his 'unsmart' mirror is today. When that happens, it would be lovely to be placed at the helm of it all.

VanityVision and Microsoft's MagicMirror pose as the two primary competitions to the current project. With both products having achieved unparalleled implementations of the idea in themselves, both fall short in one aspect or another. Both products require the users to implement a DIY which implies that users have a basic knowledge in coding and connection. Also, the products use a relatively expensive motion-sensing device accompanied by a two-way mirror that augments the price to infeasible levels.



What the project in question attempts to develop is a finished basic interface piece that can be installed in a home or in a commercial space that renders basic data to its users which can be expanded upon later. The idea is supported by the understanding that the consumer does not necessarily grasp the programming of the devices used, and is therefore, merely an end user. The project implements acrylic mirror sheets placed on a monitor - a deviation that drastically reduces costs.



III. RELATED WORK

Microsoft's Magic Mirror: Microsoft demoed their first Magic Mirror prototype in 2016, which is powered by a Hosted Web App on Windows 10 IoT Core installed on a Raspberry Pie 3. This project was built with the concept of personalized experience that recognizes users using Windows Hello technology powered by Microsoft's Cognitive Services. Microsoft has open – sourced the web app in their GitHub repository which can be used by anyone to build their own smart mirror. The mirror is built to be useful to a person getting ready in the morning who is likely to be on a time crunch and wants to be well prepared for the day and is interested in weather and traffic updates.

CMUcam5 Pixy: This tiny image sensor is a partnership between Carnegie Mellon Robotics Institute and Charmed Labs that started as a Kickstarter campaign. It is small, easy to use and programmable sensor that outputs what it detects 50 times every second and supports programming languages such as C++ and Python. Running on NXP processor that clocks at 204 MHz and has dual core has 264K bytes of RAM and memory of 1M bytes. Output data can be captured using several buses such as UART serial, SPI, I2C, USB, analog, and digital.

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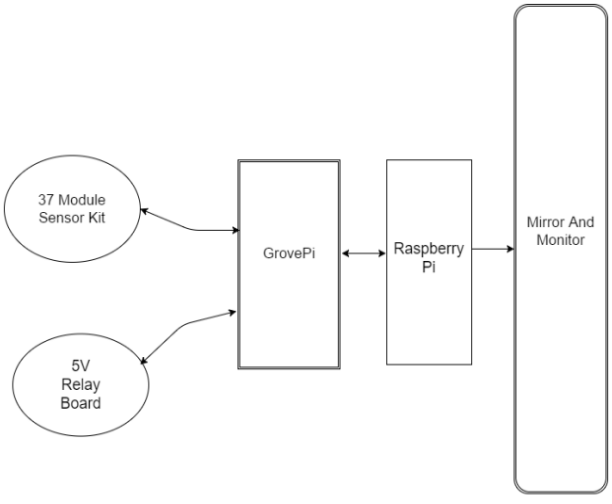
Ekko Smart Mirror: This project is created by a company that produces fashionable furniture. Other than displaying weather and news feeds in real time this smart mirror can also play music and videos. The mirror communicated to the user's smartphone using an app that has to be installed to give the user a personalized experience. Mirror control is achieved using gestures which are read by sensors on each side.

Apple Mirror – Rafael Dymek : A fully functional smart touchscreen mirror based on Apple's iOS 10 that mimics iPhone display and can launch apps that are preferred by the user. Apps cannot be launched in full screen due to rescaling issues as for now. The Apple mirror goes to sleep after 45 seconds of inactivity and can be turned on by tapping the screen. This product has not been commercialized yet.

The Naked 3D Fitness Tracker: This is essentially a mirror packed with sensors that takes 3D scan of your body on a rotating scale and checks for any structural abnormality. The product is claimed to keep tabs on all body vitals including the information on how the workout is affecting your body. It can also judge which part of your body is prone to an injury and suggests you to change your workout plan accordingly. Thus product of Naked Labs is part of an ecosystem of fitness trackers and all of them syncs to a Mirror.

IV. GENERIC ARCHITECTURE (PROPOSED MODEL)



Mirror and Monitor: The Monitor is the primary display that the device uses and it is the only end of interaction for the user. The user remains unaware of the rest of the functionality and therefore interacts primarily with the monitor itself. An acrylic sheet is placed on top of the Monitor to turn it into a reflective surface. Apart from being inexpensive, the sheet may also be replaced in the event of any damage, thus making it a more feasible option as compared to a double-sided mirror.

Raspberry Pi: All of the mirror's functionality, its connection to a wireless network, and the programming of its sensors are coded onto the Pi Board. The Pi acts as the brain of the architecture and is the primary interface between the user and the rest of the architecture.

GrovePi: The GrovePi helps add multiple modules to the pre-existent Pi Board. The availability of more modules allows the addition of more sensors in the case of this architecture.

5V Relay Board: The Relay Board helps separate the Modules from the Pi itself which helps in programming, testing, and debugging.

37 Module Sensor Kit: A complete sensor kit set provides 37 Sensor Modules for use with the Raspberry Pi, each of which can be used individually or in combination to deliver different features to the smart mirror.

V. CONCLUSION

We have discussed the basic implementation of a Smart Mirror with the use of Raspberry Pi accompanied by a 37 Module Sensor Kit to Scrape the Internet and deliver a feasible and serviceable module for Home Automation to its users through IoT.

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