IMPLEMENTING INTERNET OF THINGS (IOT) USING RASPBERRY PI

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Abstract : **This paper mainly presents the basic level of IOT implementation, It involves remote control and remote sensing, which requires connectivity between the host and the remote devices. The "things" in IOT are connected via a Control Board, which acts as an interface, to the Raspberry Pi. The host (a computer or a mobile phone) and the remote Pi are connected via a network. The weaved services are used to interact with Raspberry Pi wirelessly. The application software on the host helps us to initiate a command. The application software on the Pi is designed to respond to these commands. It generates meaningful output that drives the Control Board, which in-turn drives the "things" that we intend to control. Operations like adjustment control, ON/OFF control and remote sensor's output acquisition are observed and controlled by application software and commands. IOT is aiming to take hold on the future, Implementing it involves bringing the "things" of our interest into the computer world and giving them power to communicate with us. To facilitate a connectivity of that order for communication, this paper implemented by using Raspberry Pi 2 Model B.**

IndexTerms **- IOT, Internet of Things, Raspberry Pi.**

I. INTRODUCTION

The Internet of Things (IoT) is the network or interfacing of physical objects to controlling devices, now a day's smart vehicles, software, sensors, and embedded electronics uses network connectivity which enables these objects to collect and exchange data. The IOT allows objects to be sensed and controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit; when IOT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart grids, smart homes, intelligent transportation and smart cities. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure. Experts estimate that the IoT will consist of almost 50 billion objects by 2020. The term"Things" in the IOT sense, can refer to a wide variety of devices such as heart monitoring implants, electric clams in coastal waters, automobiles with built-in sensors, DNA analysis devices for environmental/food/pathogen monitoring or field operation devices that assist firefighters in search and rescue operations. Legal scholars suggest to look at "Things" as an "inextricable mixture of hardware, software, data and service". These devices collect useful data with the help of various existing technologies and then autonomously flow the data between other devices. Current market examples include smart thermostat systems and washer/dryers that use Wi-Fi for remote monitoring.

However, the application of the IoT is not only restricted to these areas. Other specialized use cases of the IoT may also exist. An overview of some of the most prominent application areas is provided here. Based on the application domain, IoT products can be classified broadly into five different categories: smart wearable, smart home, smart city, smart environment, and smart enterprise. The IOT products and solutions in each of these markets have different characteristics.

This paper is organized as Section I gives the introduction to IOT, Section II will discuss the implementation mechanism and the operations,

II. BASIC IMPLEMENTATION OF IOT USING RASPBERRY PI

The basic implementation of IOT includes usage of a host device, a Remote Controllable Device and connectivity between them. In this paper, the host device can be a computer or a mobile phone and the remote controllable device is a Raspberry Pi, which executes the commands given by the master host. The implementation mechanism can be understood by the following figure

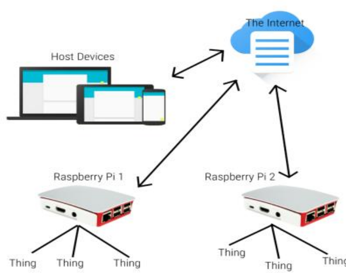

Fig 1: Block diagram of implementing the Internet of Things

The implementation requires a close association with both hardware and software. We will now discuss them briefly.

2.1 HARDWARE IMPLEMENTATION:

The system that implements the Internet of Things includes clusters of hardware components that we are familiar with. Firstly, we need a host like a Personal Computer or a mobile phone that can be used to pass commands to a remotely operable device. As the brain of the system we are using a Raspberry Pi that can be used to control and obtain a desired result from a device. The “things” that we use here are basically day-to-day objects like a bulb, a fan, a washing machine etc., Our intention is to show the operation of the Internet of Things in a concise way.

As the Raspberry Pi is more like a compact computer itself, it cannot control “things” directly. It needs an interface to communicate the with them. Fortunately, Raspberry Pi comes with a 40-pin GPIO set that could efficiently be utilized to communicate with the “things”. As we need an interface between them, a “Daughter Board” is to be designed.

This Daughter Board will enable us to dim and glow a light source. Switch ON/OFF electrical devices and receive feedback from sensors.

2.2 SOFTWARE IMPLEMENTATION:

Hardware without proper software is nothing but a piece a brick. When it comes to Raspberry Pi, an OS must be installed to control and configure it. And in the case of the Daughter Board, python scripts are to be coded to work with the “things”. We have, a communications platform for IOT devices that enables device setup and user interaction from mobile devices and the web, can be used to accomplish communication between Host device and the Raspberry Pi.

2.3 OPERATIONS TO DEMOSTRATE

The operations to demonstrate include:

- Remotely dim and glow a light source (an LED).
- Switch electrical devices ON/OFF based upon their state remotely (Staircase Control).
- Receive feedback from sensing elements connected to the daughter board.

III. PURPOSE OF SELECTING A RASPBERRY PI

Since a Raspberry Pi is basically a mini, credit card-sized computer, These are the few positive aspects that we got to learn while working with the Raspberry Pi, they are:

- low power consumption
- No moving parts
- Compactness
- Cost effective
- No noise
- Status lights
- Built-in HDMI
- The GPIO ports
- Remote control
- Over-clocking capability
- Multiple uses
- Networking

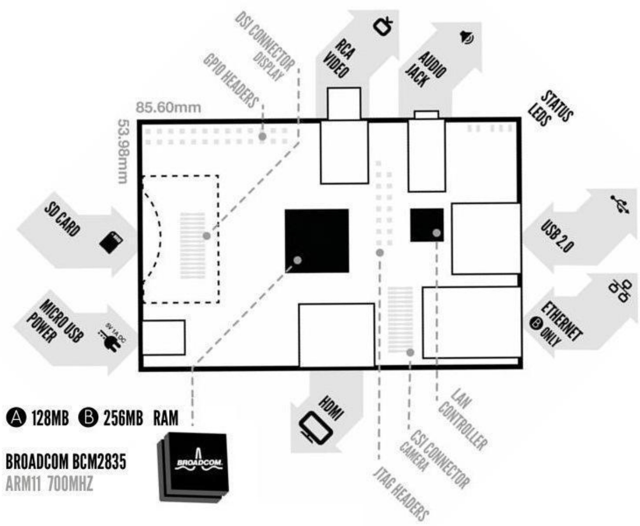

Fig 2: Raspberry Pi 2 setup

IV. INTERFACING MODULES TO RASPBERRY PI

In this paper we have presented the

- Remote controlling the dimmer LED.
- Remote controlling the stair-case switched devices connected to the daughter board, along with their feedback.
- Interfacing the sensors and Sensing the state of the several sensors as feedback.
- Interfacing the camera module.

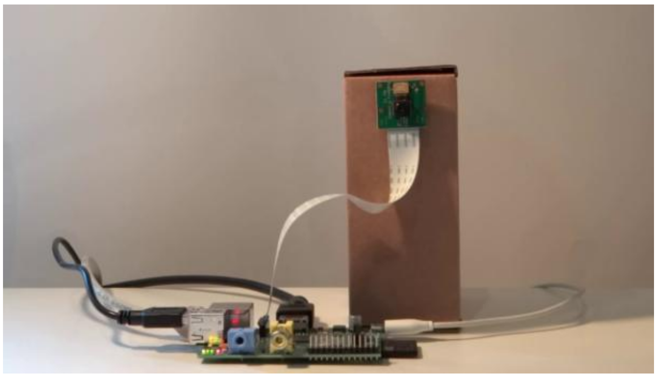

Fig 3. Camera Interfacing

- And power saving by solar energy

Fig 4: The Raspberry Pi board connected to a power supply and mounted GPIO ports

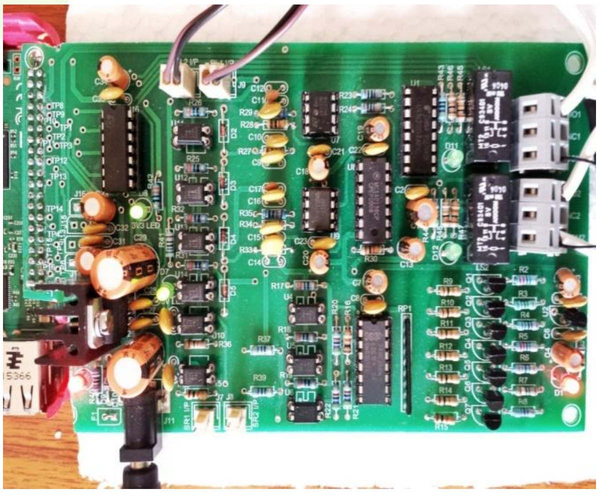

Fig 5: The mounted daughter board

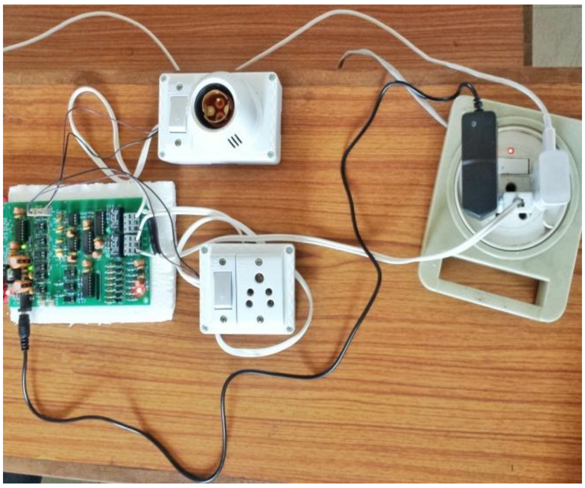

Fig 6: The daughter board connected to a power supply

- Solar powered Raspberry Pi – Instead of using a power supply adaptor we can charge the Raspberry Pi from the stored solar energy.

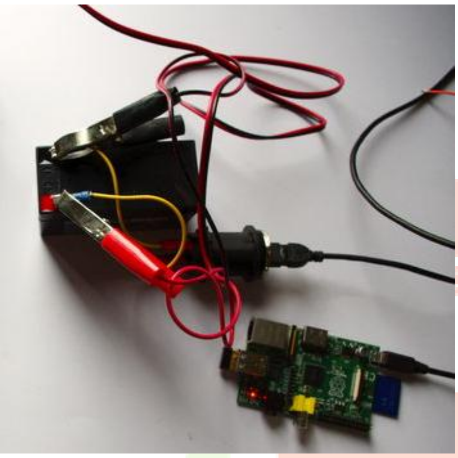

Fig 7: Solar power setup

The Raspberry Pi apparatus connected as shown below.

Fig 8: Raspberry Pi physical connections

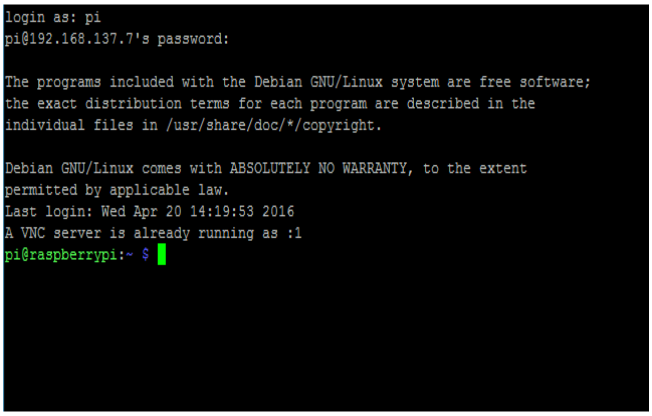

Fig 9: Screenshot from Linux terminal called SSH

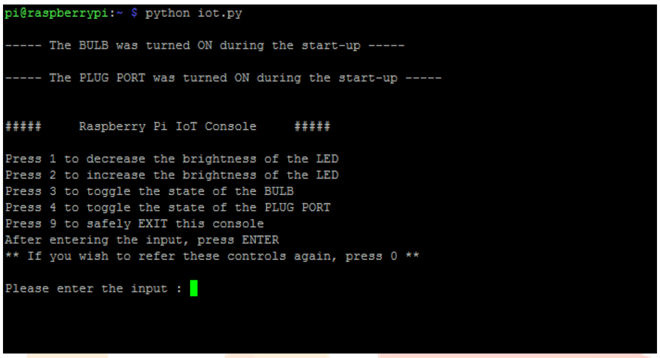

Fig 10: Screenshot showing the Raspberry Pi IoT console

Fig 11: The output after executing the python code

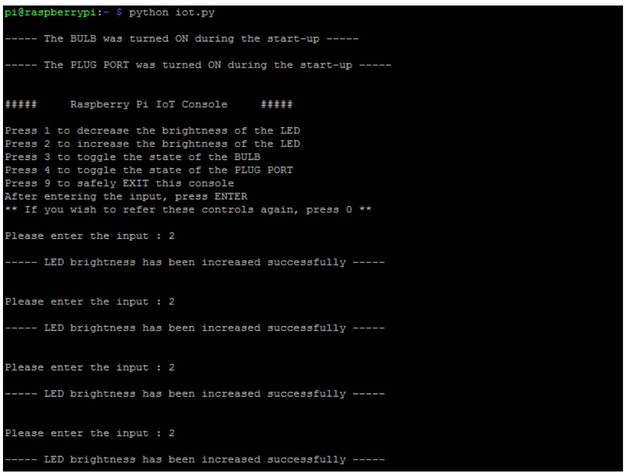

Fig 12: Screenshot showing incrementing the brightness of LED

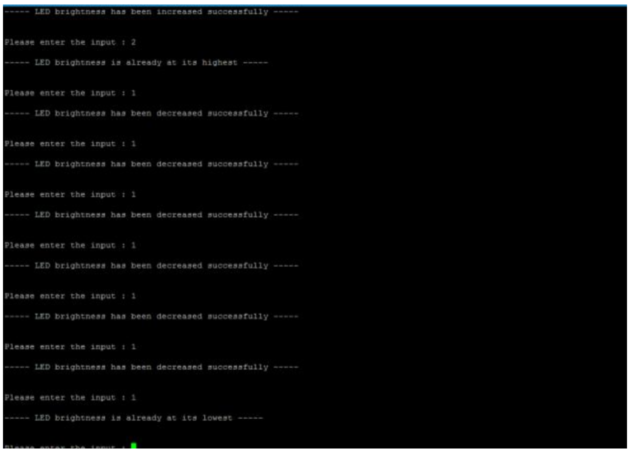

Fig 13: Screenshot showing decrementing the brightness of LED

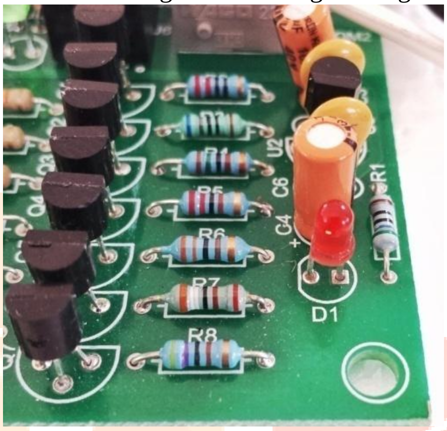

Fig 14: The output showing level 0 of the dimmer circuit

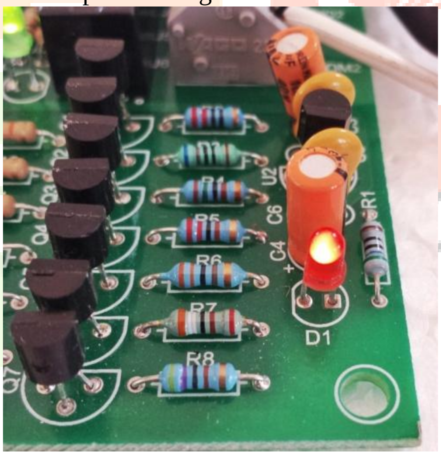

Fig 15: The output showing level 1 of the dimmer circuit

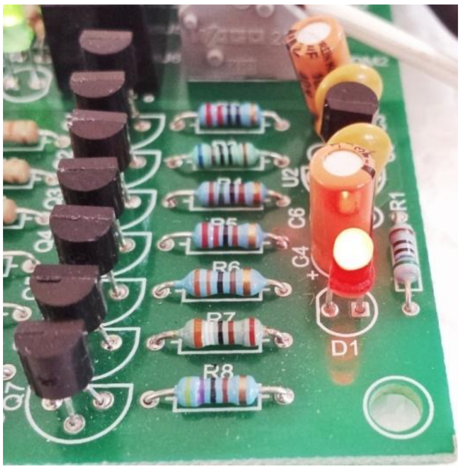

Fig 16: The output showing level 2 of the dimmer circuit

V. CONCLUSION AND FUTURE SCOPE

In this paper we presented the Remote controlling of the dimmer LED, Remote controlling the stair-case switched devices connected to the daughter board, along with their feedback, Interfacing the sensors and Sensing the state of the several sensors as feedback. Interfacing the camera module. Hence, We can operate or have a check on any device's state that we wish to control with absolutely no human intervention and raspberry pi camera is low power consumptive system which can stream same quality images and videos for security purposes and this is how we can interface many sensors and can make many automated applications as a things as a project of IOT using raspberry pi.

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