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Dynamic Domotics and Voice Control using Raspberry Pi

Athul Pramod
B.Tech Information Technology
Dept. of IT
CUSAT, Kochi-682022
Kerala, India

Athul Naveen
B.Tech Electronics and Communication
Dept. of Electronics & Communication
CUSAT, Kochi-682022
Kerala, India

Abstract:- The aim of this project is to build a Home Automation system, which encompasses the features like voice and face recognition, home appliances smart control and home security. The system ensures security of the home in the absence of the owner by detecting motions using motion sensors, enables the owner to control the appliances present without the need for his/her presence and also smart monitoring and updation of the natural factors affecting the environment like humidity and temperature. The main focus of the project is to minimize the manpower and to maximize the convenience without incurring any additional cost in an efficient and optimal way.

Keywords:- *Nomenclature, PIR Passive Infrared Sensor, RFID Radio Frequency Identification Device, LCD Liquid Crystal Display, LED Light Emitting Diode.*

I. INTRODUCTION

The notion of making our life easier and convenient is evident in any field, be it Cars, Smart phones, Electronic Gadgets and so on. The word "Smart" now plays a major role in almost everything we use. From Smart phones to smart watches, from smart bands to smart cars, SMART is something which is almost ineluctable. "Smart" applies to houses too. When even the trivial aspects of a house are automated and monitored, that leads to making the home smarter and thus this process of making home automated and smarter is called Home Automation. Humans usually inside their home interact with the environment settings like light, air, and regulate accordingly. If the settings of the environment can be made to respond to human behavior automatically, then there are several advantages. The automation of home settings to act according to the inhabitant requirements is termed as the intelligent home automation system. Ambient intelligence responds to the behavior of inhabitants in the house and provides them with various features and facilities [1].

This Domotics will include control lighting, climate, entertainment systems, and appliances control. Domotics also includes home security such as access control and alarm systems. It also provides the owner live updation about the temperature and humidity aspects surrounding their home. The interconnection of all the smart devices used forms the basis for IoT. The home automation in many ways will be helpful and Serves a variety of people with different needs and wants. For instance, Domotics will be very helpful for old age People to operate certain appliances using their smartphones Itself without actually requiring them to search for the Individual remote control of the appliances or going near to The appliances for operating them manually. It will be more convenient if they can operate all the appliances, everything in just one finger touch. The voice recognition based home automation, for example, can, in fact, be very useful for paralyzed people, who would need to manipulate a device in the absence of any personal caretaker. It will in one way or the other, will enhance their convenience and thus their living standards.

II. PROPOSED SYSTEM

The system consists of both the software as well as hardware integrated together to perform the functions of a demotic system. The software includes the programming language used, i.e. Python. The hardware includes a microphone for voice recognition, RFID, PIR for motion detection, DHT11 for relative humidity and temperature sensing, relays, power supply and etc. Both the hardware and software is unified to perform the trivial tasks occurring in our day to day life and thus making everything more easy and convenient, which henceforth satisfies the basic goals of a demotic system.

III. LITERATURE SURVEY

Here we describe an in-depth analysis and survey on the existing developments and problems that had been tacked on in the case of Domotics using the Raspberry Pi. Although home appliances aren't what we'd consider "smart" they were an incredible invention in the early twentieth century. These achievements began with the first engine-powered vacuum cleaner which was invented in 1901. Another advanced, as well as practical electricity-powered vacuum, was made in 1907. Throughout two decades refrigerators would be invented, as well as dishwasher, clothes dryers, washing machines, toasters, ovens, induction cookers, electric chimney and so much more. During 1966 - 1967: ECHO IV and the Kitchen Computer was the first smart device. This device could compute shopping lists, control the home's temperature and could even turn appliances on and off [2].

There are several examples of intelligent home automation or "Smart Home Monitoring" in research labs

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around the world, such as the Gator Tech Smart House, Casas Smart Home, iDorm, Georgia Tech Aware Home, Place Lab, etc. [3]. Most of the latest systems are dynamic and highly user friendly which tackles and positively handles almost all the issues to be taken care of by a smart do user friendly motic system like the Amazon Alexa which is a virtual assistant developed by Amazon, performs an essential part of the modern home automation systems. is capable of doing many tasks which includes voice interaction, music playback, making to-do lists, setting alarms, streaming podcasts and etc. It can also provide us with updated weather information and temperature information as well. Another home automation product which is very much similar to Alexa is Home Pod, designed and manufactured by Apple Inc. The Home Pod has a rounded, cylindrical shape, and has a small touch screen on its top. It has seven tweeters in its base and a four-inch woofer towards the top, as well as six microphones used for voice control and acoustic optimization [4].

We have gone through a couple of papers like Implementation Of Smart Home Automation Using Raspberry Pi [5] where it is solemnly focusing on controlling almost all electronic devices and providing basic security for devices in a good manner or other works like RASPBERRY PI HOME AUTOMATION WITH WIRELESS SENSORS USING SMART PHONE [6] where the same domotic automated is done with the aid of a mobile app and this controlling the devices via a smart phone is an efficient method. Now as the above illustrates some of the existing works and developments have already taken place in the field of domotics compared to existing works, we are providing extra protection and features to the same with the help of face recognition unit as well as RFID that can be used in offices and industrial zones which involves workers in a humongous amount. It also provides an additional feature of sending SMS as well as a main availing good usage of subsequent platforms to enhance the instructiveness of the system. And hence, it provides a good upgrade to the existing systems in a highly interactive and secure manner.

IV. SALIENT FEATURES OF RASPBERRY PI

The Raspberry Pi is a series of single-board computers that are small in size. Several generations of Raspberry Pis have been released. All models feature a Broadcom system on a chip with an integrated ARM-compatible central processing unit (CPU) and on-chip graphics processing unit (GPU). Processor speed ranges from 700 MHz - 1.4 GHz for the Pi 3 Model B+ and on-board memory ranges from 256 MB to 1 GB RAM. Secure Digital (SD) cards are used to store the operating system and program memory in either SDHC or Micro SDHC sizes. The boards have one to five USB ports. For video output, HDMI and composite video are supported, with a standard 3.5 mm tip ring sleeve jack for audio output. Lower-level output is provided by a number of GPIO pins. The B-models have an 8P8C Ethernet port and the Pi 3 and Pi Zero W have on-board Wi-Fi 802.11n and Bluetooth. The Raspberry Pi may be operated with any generic USB computer keyboard and mouse. It may also be used with USB storage, USB to MIDI converters, and any other device/component with USB capabilities. Other peripherals can be attached through the various pins and connectors on the surface of the Raspberry Pi.

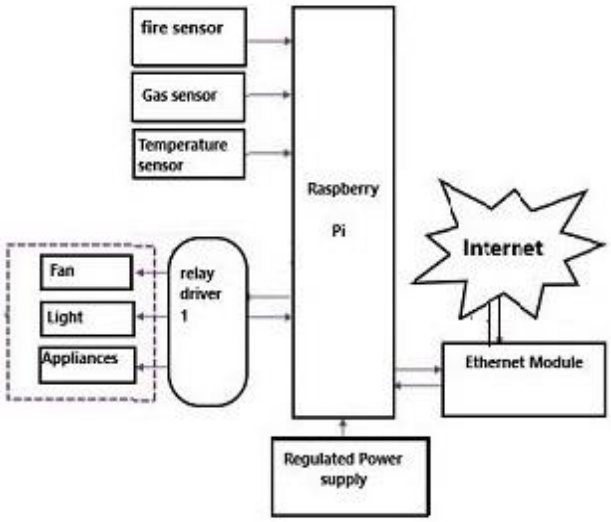

Fig 1:- Raspberry Pi block diagram

Fig 2:- Raspberry Pi

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V. SENSORS USED

The following are the sensors used:

➢ *RFID*

Radio Frequency Identification sensor (RFID) is a sensor which uses electromagnetic fields to identify and track tags attached to objects. The tags usually store electronically-stored information. There are basically two types of tags. The Passive tag and Active tag. Passive tags usually collect energy from nearby incoming radio waves, whereas Active tags have a local power source and can operate by keeping a distance from the RFID reader. RFID is used in many fields. RFID is used in automobile manufacturing and production purpose for tracking the process of an individual vehicle being manufactured. RFID is also used for pets. The chip is inserted in the animal's ears or other parts and thus enables the tracking of the animal.

➢ *DHT11*

DHT11 is a Humidity and Temperature Sensor, which digitally provides the information regarding temperature and humidity. DHT11 can be interfaced with microcontrollers like Arduino, Raspberry Pi, etc. and get instantaneous results. DHT11 is a low-cost humidity and temperature sensor which provides high reliability and long-term stability [7]. A humidity sensor senses, measures and reports the relative humidity in the air in a regular interval of time. It measures both moistures as well as air temperature.

Fig 3:- DHT 11

➢ *PIR*

Passive InfraRed sensor (PIR) sensor is a pyroelectric device that detects motion of objects via varying infrared radiation emitted by nearby objects. It produces a single bit output that is fed as an input to the I/O pins of the Raspberry Pi. It's compatibility with almost every microcontroller make its a salubrious sensor to be configured with any platform. It produces a logic high (3v) when a motion is detected and continues to operate in a logic 0 or a digital low when no motion is observed. The pulse with solemnly depends on the capacitors and resistors being used in its design [8].

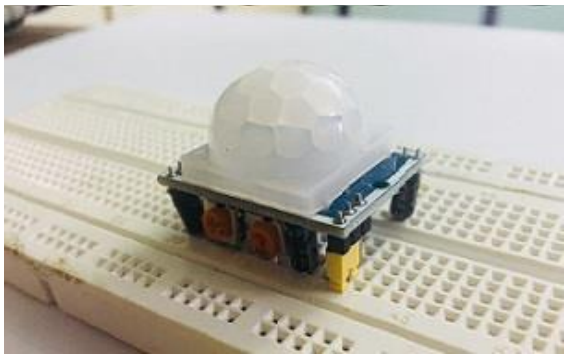

Fig 5:- PIR

➢ *LDR*

Light Dependent Resistor sensor module detects measures the intensity of light and thus detects the presence of light. It produces a single bit output that is fed as an input to the I/O pins of the Raspberry Pi. The Output becomes a logic high when the presence of light is detected and a logic 0 during the absence of light. The main advantage of this sensor being that the sensitivity can be adjusted via the help of a potentiometer tuned as per the requirements. The output produced is given to the analog input of the Raspberry Pi [9].

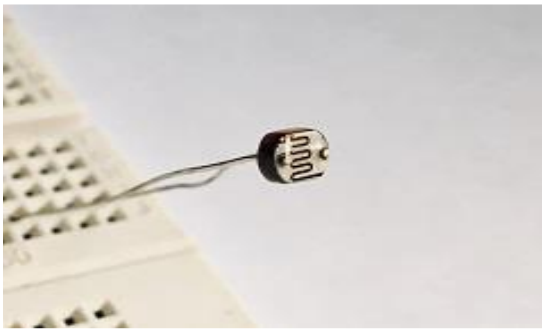

Fig 6:- LDR

➢ *LCD*

LCD module is a device that produces an image using liquid crystals. It is one of the common display units used in circuits. It can display 16 characters per line and comprises of 2 lines that's why the name 16x2 LCD. The contrast of the image obtained can be adjusted via a potentiometer that can be connected.

Fig 7:- LCD

VI. SOFTWARE DESIGN

Download the Raspbian OS from the authorized website followed by downloading win32 disk Imager. Now insert the SD card in the card reader and connect it to a suitable PC. Format it first followed by imaging the specified files to the card using the win32 disk imager. Now withdraw the SD card from the PC and connect the raspberry pi with the SD card inserted to give power to the device. Now obtain the IP address of the raspberry pi using the fing app that can be downloaded for free from the play store/App store. Download putty and type the IP address of the Pi in it. Now finally the Pi can be operated via laptop using VNC viewer application.

VII. PROGRAMMING LANGUAGE

Python is the programming language that is being used for coding in the Pi. It is a general purpose highly interactive, dynamic high-level language used in a wide range of applications from web designing like Django to mathematical computing like Orange. It has grown in significance within embedded devices whilst permitting developers to create apps which are capable of providing informative data mining results. These days, most of the famous microcontroller use Python.

VIII. METHODOLOGY

The system incorporates the feature of voice command action. The voice command is received with the help an android app called AMR. The feedback is received from Raspberry Pi using Festival Module which can be customized so as to give the feedback in either male or female voice. For registering the presence of occupants in the house, the inmates are provided with RFID tags. Whenever the RFID tag is tapped or kept near to the RFID card reader, the presence of the person is registered. The same process of tapping the RFID tag on the reader is performed for signing out as well. The DHT-11 sensor, which measures the relative temperature and humidity, is used for updating the temperature and humidity status. The system is tuned in such a way that whenever the temperature exceeds a particular point, an SMS, as well as an e-mail, is sent to the house owner. The system also encompasses the feature of interior motion detection. When all the registered members are signed out from the house and if the PIR sensor detects any motion inside the house, an email, as well as an SMS, is sent to the owner. The SMS is sent with the help of way2sms website. The Domotics system also incorporates a water flow monitoring system. The YF-S 201 water flow sensor (flow meter) will detect the amount of water used per day in the house. The amount is monitored and it is displayed on the LCD screen module. The whole system is monitored by Raspberry pi thus enabling the systematic control and monitoring of the whole Domotics system without the need for any human intervention.

IX. RESULT

The various sections and utilities of the dynamic Domotics system were tested as per the requirements and were found to be working properly in every point and domain of its implementation. The various relevant screenshots corresponding to the step-wise checking of the system on its working perspectives are as per mentioned below. The first step includes the proper interfacing of the raspberry pie and laptops using the VNC viewer. The second step includes the simulation and to test the working of various programs relevant to the system which includes the simulation of the RFID program, webcam program way2sms program etc. The third step includes a part of the wiring that corresponds to the hardware implementation of the system and the output obtained from various sensors being shown with the help of the LCD module. This system was thus, finally a success and an improvement to the currently existing domestic systems.

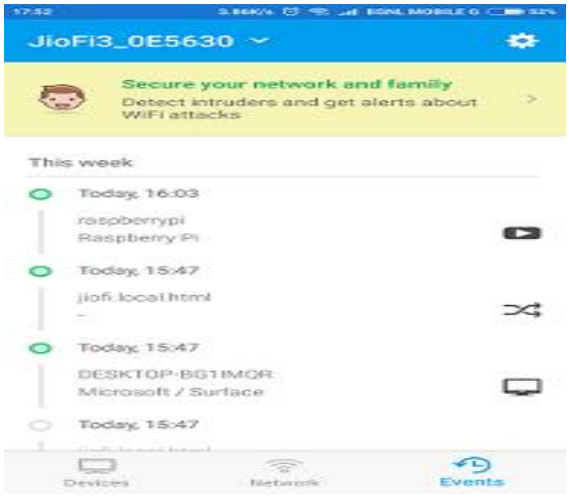

Fig 8:- Screenshots of Fing App

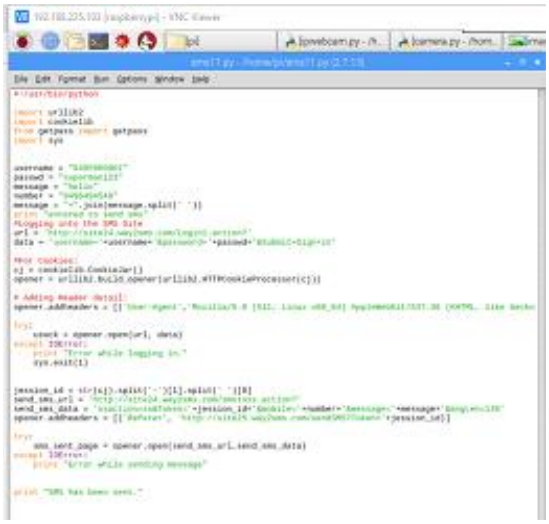

Fig 9:- Screenshots of way2sms program

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Fig 10:- Screenshots of photo taken by webcam

Fig 11:- Screenshots of rfid program

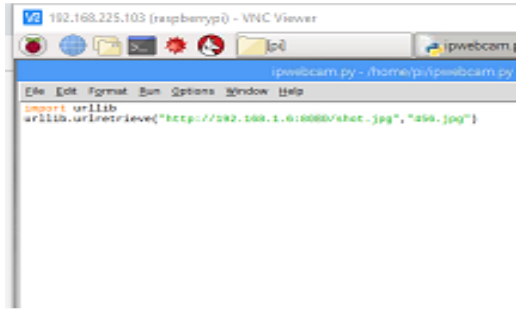

Fig 12:- Screenshots of ip webcam program

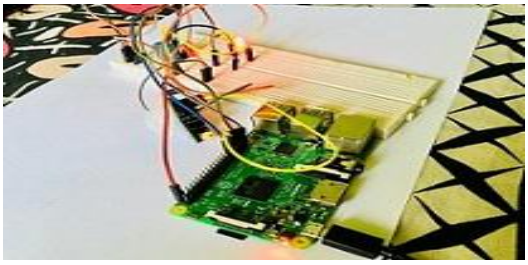

Fig 13:- Circutary and wiring

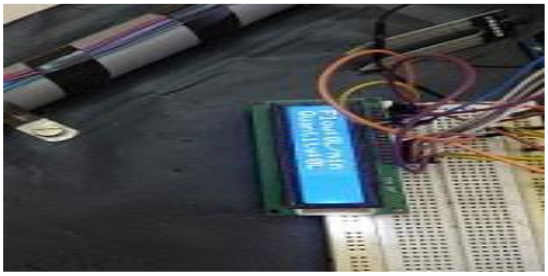

Fig 14:- Display of water flow sensor output

X. CONCLUSION

A home automation system which incorporates features like security, water flow management, and electricity management can definitely be helpful in making the everyday life of a person more easy and convenient. The security features which includes intruder checking and notification sending to the owner is a very efficient and convenient method which can provide them a good security to the home. The water flow measuring system also caters the need for utilizing the minimum amount of water for normal usage without leading to any wastage. The LDR sensor used thus provides another efficient way of utilizing light energy so as to make the energy consumption to the minimum.

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REFERENCES

[1]. M. Eisenhauer, P. Rosengren, P. Antolin, “A Development Platform for Integrating Wireless Devices and Sensors into Ambient Intelligence Systems”, Proceedings of the 6th Annual IEEE Communications Society Sensor, Mesh and Ad Hoc Communications and Networks Workshops, SECON-2009, pp.1-3.
[2]. https://www.iotevolutionworld.com/m2m/articles/376816- history-smart-homes.htm.
[3]. Towards implementation of IoT for Environmental Condition Monitoring in Homes -S.D.T.Kelly, N.K.Suryadevara, S.C.Mukhopadhyay.
[4]. https://en.wikipedia.org/wiki/HomePod.
[5]. https://www.ijrter.com/published special issues/28-03-0218/implementation-of-smart-home-automation using- raspberry-pi.pdf.
[6]. https://www.ijcsmc.com/docs/papers/May2015/V4I5201599a70.pdf.
[7]. https://www.electronicshub.org/dht11-humidity-sensoradu ino/.
[8]. https://learn.adafruit.com/pir-passive-infraredproximity-motion-sensor? view=all.
[9]. https://www.electronicscomp.com/ldr-light-sensormodule-india?gclid=CjwKCAjwio3dBRAqEiwAHWsNVQA5JxuzndWepCqloIQCyDeMRJw8bp6U8ltW8LwsHoA24m-FxOapRoCXXMQAvD BwE.