Project Synopsis

On

Advanced Assistive Automation

Submitted in the partial fulfillment of the requirement for the degree

Of

Bachelor of Technology

In

Electronics and Communication Engineering

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INTRODUCTION

As a part of the curriculum, and for the partial fulfillment of the requirements for completion of degree of Bachelor of Technology from Guru Tegh Bahadur Institute of Technology, We, students of Electronics and Communication Engineering made this project entitled Advanced Assistive Automation.

We are living in the world of automation where most of the systems are getting automated, such as industrial automation, homes and other business sectors. Automation systems are advancement to the mechanization processes wherein human efforts are needed with the machinery equipments to operate various loads. It involves automatic controlling of appliances using different technologies and controllers over desktops, laptops or smart phones.

In concise, Automation is the use of one or more computers to control basic functions and features automatically and sometimes remotely.

The form of automation called assistive automation focuses on making it possible for people with disabilities and older adults to remain at workplace or home, safe and comfortable. This field uses much of the same technology and equipment as industrial automation or home automation but tailors it towards people with disabilities and older adults.

All this is done in this project by employing:-

a) Voice Commands (which can be a normal conversation) to initiate any tasks

b) Automated Electrical Appliances including lights

c) Password Interface for automated entry and exit doors

d) Automatic doors and windows

e) Motion Sensor and Intruder Alarm or Anti-Thievery Alarm

f) Fire Sensor and Fire Alarm

g) Gas Sensor and Gas Alarm

h) Project can work without Internet

i) Control Everything from any Android Smartphone

j) Voice Feedback Assistance for your general duties like – controlling music, volume, news, radio, doors, switching on/off any appliances, etc.

k) Uses features of existing smartphone and linux system.

This project also attempts to implement limited parts of a few IEEE research papers.

Provided in this project is – All program codes present in different programming languages used, Schematics of complete automation system implemented, Project Report, and the Project (implemented on Hardware) itself.

SOFTWARE

- Python 3 (Python IDLE)
- Linux Bourne Again Shell Script (LX-Terminal)
- Sublime Text 3, Vim, Nano, etc (Text Editors)
- Java and XML (Android Development)

HARDWARE

- Raspberry Pi 3 Model B (using Raspbian)
- Battery Charger (with minimum 2 Amp Output)
- Keypad Module (4x3)
- PIR Sensor (Motion Sensor)
- 2 Servo Motors (Automatic Doors)
- Flame Detection Sensor and Lighter (Fire Alarm)
- Gas Sensor (Gas Alarm)
- 4 Relay Switch (Interfacing with High Voltage)
- 2 Light Bulb White and Red with Bulb Holders
- AC 220V to DC 5V converter (Mobile Charger)
- Modular Switch Board (Smart Switch Board)
- Wireless Speakers (Voice Synthesis & Feedback)
- PCB Solder Board or Breadboard (Connections)
- Soldering Toolkit and Drilling Toolkit
- More Electronics Components like NPN (BC547) & PNP (BC557) Transistors, etc
- Power Source AC with Wires

REQUIREMENTS

Things not mentioned here are already present on the software platform used or in hardware, even most of the things mentioned below might be already present.

- xclip (command line clipboard manager)
- ogg123 (ogg command line player)
- alsa (for aplay command) (wav command line player)
- procps (for pgrep command)
- chrome / chromium (for clipbrd extension)
- PicoTTS (for pico2wave command)
- JSch (library in java for SSH service) (Already present on Eclipse)
- Some in built library in Java Android Studio like ClipboardManager, Window Manager, AsyncTask, Context, etc
- Some in built library in Raspbian Python like Rpi.GPIO, subprocess, time, etc

WORKING

Code for this project which runs on the hardware (specifically Raspberry Pi 3) is written in Python 3 and Bourne Again Shell using Text Editors like Vim, Nano and Sublime Text 3, which is then executed on Python IDLE (Integrated Development Environment) and LX-Terminal (Default Shell for Linux/Raspbian) respectively. Open Source and Linux supported, Electronics CAD Software (Computer Aided Design) (No Student License Required to submit work) is used (like KiCAD and Fritzing) to draw Schematics of whole Automation System including all the electronics components used. An online platform for the same is also used https://circuits.io/ . Code for this project which runs on mobile (specifically Android Smart-phone) is written in Java and XML using IDE (Integrated Development Environment) like Android Studio which is then simulated on kvm based virtual environment of android system and then tested on some android smart phones.

Described Below is all the functions of this Project (May increase in future):-

- All tasks are done by voice commands which can be a natural conversation (like commanding a servant).
- When an intruder enters the building without entering password, the motion sensor detects it and raises the Theft Alarm with Red Light.
- When (at any instance of time or executed program) a fire is ignited, the Flame detection sensor detects it and raises the Fire Alarm with Red Light.

- When (at any instance of time or executed program) a gas is present (specifically LPG, butane, propane, methane, alcohol, hydrogen and smoke), the Gas Sensor detects it and raises the Gas Alarm.
- Alarm Stop button is present to shutdown all alarms after successfully alerting user(s).
- Pin code interface is present with Keypad and LED Notification. The user have to enter 4 digit pin. Voice feedback is provided for authentication status.
- When correct pin code is entered, the doors will be unlocked and opened automatically by servo motors and Light Bulb will be switched ON. The user can now access the building. The door can be locked again through voice command or lock button.
- Security system can be enabled again with voice commands when leaving the building.
- Internal Area has general automation controlled by voice, to control music, volume, online radio, news, doors, and switch on/off any appliances.

ADVANTAGES

- Voice controlled activities (similar to commanding servants in normal conversation)
- Uses the features of a Android Smartphone and Linux System
- Reduces Human Efforts
- Assists disabled
- Saves Time, Money and Electricity
- Increases Convenience, Security and Privacy
- Alerts user in case of Fire, Gas, Intruder and Theft or other Urgent Alarms
- Adds Safety through Appliance and Lighting Control
- Secures Home Through Automated Door Locks
- Improved appliance functionality
- Increased energy efficiency
- Contributes to Economy

DISADVANTAGES

Automation System is a target to Hackers and Criminals. Once the Intruder gets access to smart device or gets inside the building then his/her activities should be monitored and enough evidence should be collected to catch and locate the wrongdoer(s). This action system which initiates after failure of security system is yet absent.

Note that the emphasis of this security system is to prevent any undesired circumstances (like Theft) by offering protection, but once undesired circumstances have occurred it doesn't take any resolving actions and shifts the problems to manpower who can handle things intelligently. Actions like calling police during/after incident of robbery, starting water sprinkler system in case of fire, etc is not implemented in this project.

Any Automation System suffers from platform fragmentation and lack of technical standards a situation where the variety of home automation devices, in terms of both hardware variations and differences in the software running on them, makes the task of developing applications that work consistently between different inconsistent technology ecosystems hard. Customers may be hesitant to bet their IoT future on proprietary software or hardware devices that use proprietary protocols that may fade or become difficult to customize and interconnect.

Automation System amorphous computing nature is also a problem for security, since patches to bugs found in the core operating system often do not reach users of older and lower-price devices. One set of researchers say that the failure of vendors to support older devices with patches and updates leaves more than 87% of active devices vulnerable.

The Automation Systems are very expensive. Since most of the systems are customized, technicians are needed to install them.

REFERENCES

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