Abstract—Automation is not a new idea in our modern life. Large businesses and wealthy homeowners have used this technology for years now [1]. This automation concept can benefit our daily lives through many ways. The aim of this project is to develop a Home Automation System that focused on helping handicapped and elderly people to perform their chores routine such as turn on or turn off fan and light, so that it can be done wirelessly by using handheld devices such as Smartphone. This system will be based on Raspberry Pi, and is designed to be an affordable and reliable home automation system yet, easy to setup and use. It is hoped that it will provide a better living environment, and also to reduce wastage of electricity by giving user the power to control, conserve and react according user needs, that can be done using the scheduling function for automatic operation of home appliances [3].

I. INTRODUCTION

This system provides a wireless remote control solution for controlling the lights and fan via Wi-Fi capable handheld devices such as Smartphone, adding convenience and also reducing electricity wastage. In this project, the appliances such as light and fan that connected to the Main Control Unit (MCU) can be remotely accessed by using Graphical User Interface (Graphical User Interface, GUI) from a computer screen or a smart phone. This system can also be equipped with the monitoring function by an addition of a web camera to the MCU. If an internet static IP available for the MCU, it can be accessed and controlled anytime, from anywhere via the internet connection.

II. RELATED WORKS

Home automation, also referred to as a smart home concept, and has been an expanding technology in these modern days with a lot of solutions has been introduced [4–8]. According to R. A. Ramlee [5], smart home system via Wireless Bluetooth is the introduction of technology that is focusing more on motivating disable person by making it possible for them to carry out the daily activity, safely and comfortably. In the research by G. Khusvinder [6], ZigBee–based home automation system is introduced which can be controlled either through the Internet or by remote controller. The concept of project presented by Muhammad Fahim [8] include a daily life tracking application for smart home using Android Smartphone to assists elderly people for independent living in their own home and avoids certain accidents. Thus, home automation system have become popular where nowadays many researcher are very keen on using automation system, remote monitoring and online monitoring methods in healthcare industries and also towards home nursing.

III. SYSTEM OVERVIEW

Figure 1 shows the architecture of the system that consists of the main units; the MCU which includes Raspberry Pi and Input/Output Interface (IOI) unit. Rasberry Pi, which is the sized of a credit card, equipped with ARM microprosser and has all the common ports of a normal PC or laptops, such as video and audio out, HDMI port for high definition display, two USB host port and a RJ-45 Local Area Network (LAN) port. The USB port is connected to a Wi-Fi dongle to add wireless connectivity to the MCU. What differentiates the Raspberry Pi with normal everyday computer is that the availability of a general purpose input-output port (GPIO) which allows easy connectivity with external hardware that makes home automation easier. The GPIO are then connected to the IOI unit which contains the switching circuit and power ports for easy appliances installation.

The GUI is designed and then created using Python Tkinter. It act as the medium between the user and the MCU for both control and monitoring the current status of the home appliances connected to the IOI unit, and also for surveillance and security monitoring using the web cam. In this prototype system, it has two different outputs, which is the light, fan and one input, which is a webcam. For the light, user are able to turn it on or off while for the fan, user can also control the speed either speed 1, speed 2 or speed 3 according to his requirements. Moreover, a web camera is also placed in the system for monitoring purposes and can be placed at any desired point location later on.
IV. METHODOLOGY

Figure 2 shows a flowchart of the system programming for the overall process to turn on, off and control the speed of the output device by using the GUI. The GUI can be accessed from a PC/Laptop or Smartphone using several option, remote networking application or virtual desktop apps or using web browser, making this a pretty flexible system.

V. RESULT AND ANALYSIS

This section will discuss the results for the whole system and analysis to these outcomes. The results of this project are divided into three parts, hardware, graphical user interface and web camera monitoring result.

A. Hardware Result

In order to test the functionality of the developed system, the MCU of this prototype were connected to a lamp and a fan. The IOI unit consist of several DC 6V relay switching circuit to control 240V output AC, but only two are used for the demonstration. The GPIO pins used to connect the Raspberry Pi to the IOI unit, and the pin assignment are such as shown in table 1.

<table>
<thead>
<tr>
<th>Input</th>
<th>Button</th>
<th>GPIO</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light</td>
<td>On Light</td>
<td>18</td>
<td>The lamp has change its state</td>
</tr>
<tr>
<td></td>
<td>Off Light</td>
<td></td>
<td>On to Off and Off to On</td>
</tr>
<tr>
<td>Fan speed 1</td>
<td>Fan : Speed 1</td>
<td>7</td>
<td>Speed 1 has been activated</td>
</tr>
<tr>
<td>Fan speed 2</td>
<td>Fan : Speed 2</td>
<td>4</td>
<td>Speed 2 has been activated</td>
</tr>
<tr>
<td>Fan speed 3</td>
<td>Fan : Speed 3</td>
<td>23</td>
<td>Speed 3 has been activated</td>
</tr>
<tr>
<td>Turn off fan</td>
<td>Off fan</td>
<td>-</td>
<td>Deactivate fan</td>
</tr>
<tr>
<td>Turn off fan</td>
<td>Shut Down System</td>
<td>-</td>
<td>Light and fan in the off state</td>
</tr>
<tr>
<td>and light</td>
<td></td>
<td></td>
<td>simultaneously</td>
</tr>
<tr>
<td>Exit from GUI</td>
<td>Quit</td>
<td>-</td>
<td>Deactivate GUI display</td>
</tr>
</tbody>
</table>

Each pin represents each control button to turn on and off the lights and fan plus also for fan speed control. Figure 3 shows the prototype of the system.
B. Graphical User Interface Result

Figure 4 shows the interface that will be displayed on the smartphone when the user uses the Home Automation applications.

![GUI developed for the system interface](image)

C. Web Camera Monitoring Result

Web camera is used as monitoring device and can be placed at any desired point as the user wish to locate. This potentially enabled security function and safety values to this system. Figure 5 show the camera web display. Web camera in this prototype is connected to the USB port of the Raspberry Pi.

![Example of web camera display](image)

VI. DISCUSSION

This proposed solution, which allows the user to monitor and control different appliances connected over a wireless network in home environment has been demonstrated to be functioning by developing an on and off control system. With the explosion internet and related technologies, and the entire supporting internet framework, the home system looks ready and capable to enter this arena. Efforts in such direction will help realize a truly wireless, fully automated home automation system in the current technological environment.

VII. CONCLUSION AND RECOMMENDATION

Overall the development for this project has been discussed covering hardware design and software development. Theoretically, the development has enabled user to control the home appliance and monitor the process using the smartphone and which were used as an example or pilot project in this study.

This project demonstrated the possibility of implementing a system that will helps especially the elderly and also people with disability, thus, not focusing just normal home owner. Furthermore, this system can also be used in the increasingly popular Small-Office-Home-Office (SOHO) environment. When the user touches the icon from the GUI on their smartphone, lights and fans will switch ON and OFF in uniformly and fan’s speed can also be remotely controlled.

For a more reliable system for future use, several improvements could be made to the current system. Addition of infra-red (IR) transmitter that can support several different protocol, can make it possible for the MCU to control appliances with IR remote control, such as television, radio and air conditioner, which eliminates the need of carrying several different remote control around. A timer function could also be added In which the timer can control the appliances time to switch ‘ON’ and ‘OFF’. This will give expandable option to the consumer in controlling their home appliances. Furthermore, addition of sensors, magnetic door locks and alarms can enhance the function of this project even more. In short, this project provides a flexible and customizable design and implementation for many potential applications.

VIII. ACKNOWLEDGMENT

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IX. REFERENCES

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