Group 11
EEL 4914
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DeskBot

'Divide and Conquer'
Initial Project and Group Identification

University of Central Florida
Department of Electrical Engineering and Computer Science

Dr. Samuel Richie
Senior Design I

Group 11
Mohammad Rizeq, EE
Dennis Gebken, CpE
David Jaffie, CpE

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Project Narrative

For those of us who spend a large portion of our day sitting at a desk, zoned in on the computer – whether it be doing professional work or browsing Twitter, it can get boring and repetitive. We wanted to provide a product that can assist with our daily needs but be fun, interactive, and easy to use.

We got a lot of influence from Amazon's Alexa and Apple's Siri. Both of those products have a fun, interactive personality that can assist you with pretty much any needs you may have, but they are both missing one thing – a character and physical embodiment. Providing a physical character for the user helps bring the product to life and helps build more of a relationship with the user. Alexa and Siri are just a voice and we feel that having a physical assistant 'robot' to go with the voice will bring that next level of interaction and satisfaction to the user.

We got the idea of bringing the physical 'robot' to the personal assistant products that are so popular in the market after seeing a personal project on the internet by Abhishek Singh. He created a small robot named Peeqo that can listen to the user and respond in GIFs. His project brought a new twist on personal assistant that we haven't seen in the market, but was a bit incomplete since it was just a small project of his. We wanted to bring a complete package of this project with our own twist.

We want a product that is a small robot with a touchscreen interface that brings life and interaction to the desktop for users of all ages and for any needs they may have. Our product should be small enough to fit on a desk and be a fun, goofy friend for the user. It will be able to hear and process their commands, draw information from the internet, link social media accounts, activate smart products in the household, access applications on their phone, play music, have many camera functionalities, and many more endless possibilities. We also want to bring a personality to this personal assistant 'robot' – it is going to have a facial display and have motors and a flexible body to be able to move and react to the environment and the voice of the user.

Requirements Specifications and Constraints

- The device shall weigh less than 5 lbs.
- The device shall have dimensions less than 7" by 7" by 15".
- The device shall have a display with multi-touch capabilities.
- The 3D-printed body shall be made of plastic.
- The device shall have a battery life of at least an hour.
- The device shall have a power consumption of 50 watts.
- The device shall have a boot up time of less than 5 minutes.
- The device shall have a set up time of less than 15 minutes.
- The device shall respond with voice within 3 seconds of being spoken to by the user.

- The device shall understand 80% of what is spoken to it.
- The device shall be able to fully understand and process the spoken English language.
- The device shall be able to recognize faces 80% of the time under normal lightning.
- The device shall be able to track a person's face.
- The device shall be capable of wirelessly connecting to the internet.
- The device shall have a fully-functional GUI capable of changing settings, setting up profiles, and otherwise interacting with the product.
- The device shall have the capability of setting up user profiles.
- The device shall have LEDs on the body which shall light up when the device is listening to the user for voice input.
- The device shall be able to rotate 90 degrees both left and right from its center position.
- The camera shall be able to tilt 15 degrees each way from its center position.
- The device shall have a switch or button to turn the device on and off.
- The device shall follow all copyright and patent laws.
- All software used shall be free or open-source.

Applicable Standards

- **ANSI C63.4-2014 (Revision of ANSI C63.4-2009)** – American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

- **FCC 47 CFR Part 15, Subpart B** – Subpart B deals with unintentional radiators – devices for which the purpose is not the produce radio waves, but which do anyway, such as computers

Project Diagrams and Illustrations

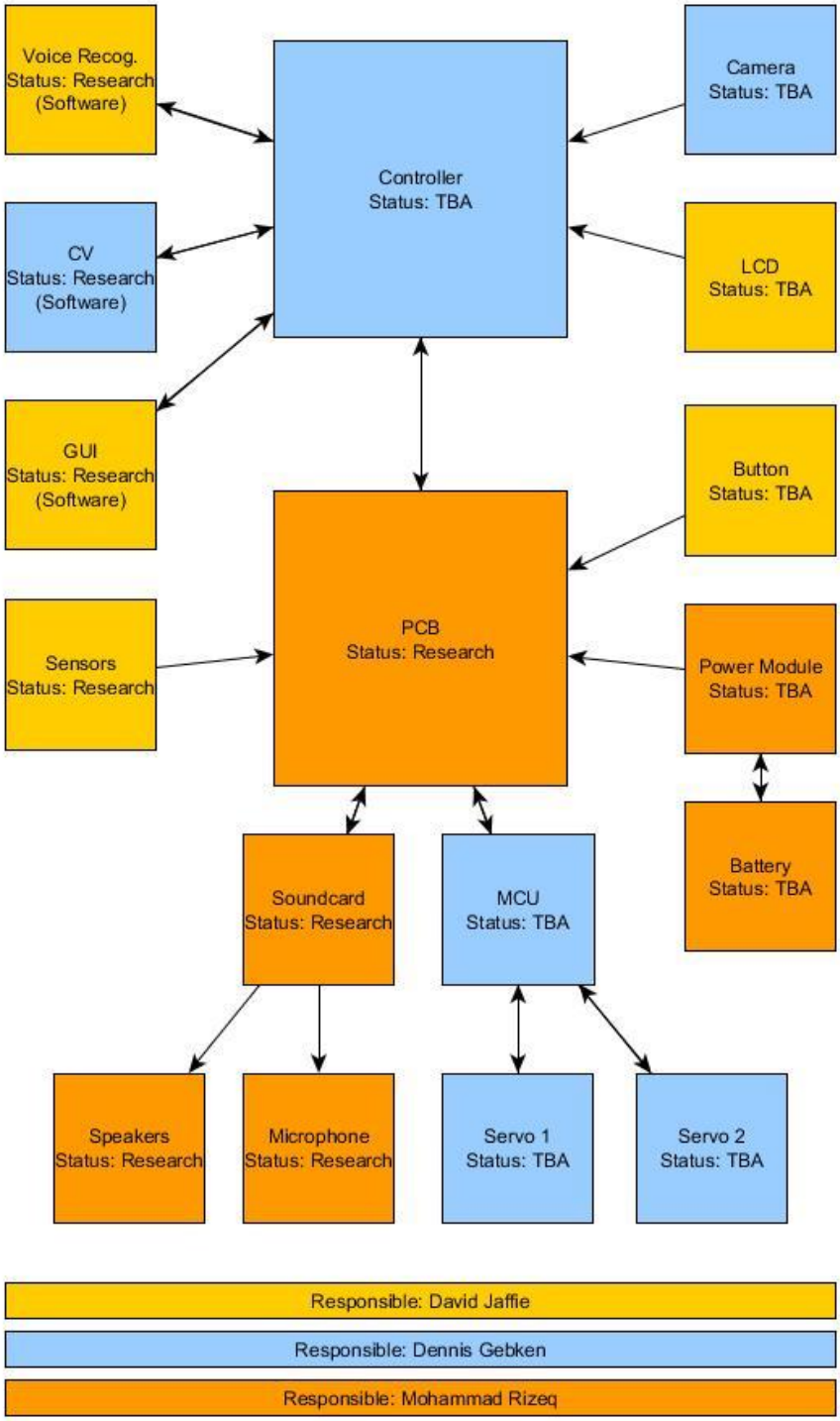

Diagram 1: Project Scope and Responsibilities Block Diagram

Description of components

Controller:
Raspberry Pi 3B. The controller is the main computing unit, responsible for processing digital signals.
Digital inputs: Video, sound, power button, battery charge level, user commands.
Digital outputs: Video, sound, servo movement, LEDs.

Camera:
A raspberry pi compatible camera.

LCD:
A Raspberry Pi compatible touchscreen LCD.

Voice Recog.:
Voice recognition software that translates user commands into actions for the controller. Most likely programmed in python, using the open source jasper library.

CV:
Computer vision program to enable he device to detect faces. This will be used to identify the user and rotate the device towards the user. The CV program will most likely be programmed in python using the OpenCV library.

GUI:
Graphical user interface. The GUI will be a secondary means of interfacing with the device via touch commands. The GUI will most likely programmed in python using the Kivy library.

PCB:
Printed circuit board. The PCB will house the sound card, MCU, power module, and various sensors. Its main purpose is to convert between analog and digital signals and relay them to the controller.
Digital inputs: Sound (from Controller), Servo control, Power button.

Soundcard:
The soundcard is responsible for filtering noise from sound recorded by the microphone and converting the filtered analog signal into a digital signal. The soundcard is also used to convert digital sound signals generated by the controller into analog signals for the speakers. An amplifier will amplify the analog output of the soundcard.

Microphone:
Provides the soundcard with analog signal (user commands).

Speakers:
Passive speakers that require an amplified analog signal.

MCU:
Motor control unit. Th MCU will actuate the two servos when commanded by the controller.

Servo 1, servo 2:
These servos are responsible for rotation and bending of the device.

Power Module and Battery:
This unit will be bought Based on the finally determined power needs of the device. The battery and power module may be integrated into the battery, or the PCB.

Sensors:
To be determined. A placeholder in case it is decided to add additional functions such as temperature/light sensing to the device.

Project Budget and Financing

Estimated Component Costs and Budgeting

Component/Item	Cost
Microphone	$10
Speakers	$20
LCD Touchscreen	$100
Raspberry Pi	$30
Camera	$15
PCB(s)	$70
3D-printed body	$50
Buttons, switches	$10
Resistors, capacitors, etc.	$10
LEDs	$20
Sensors	$30
Arduino(s)	$50
Servo(s)	$30
Tools and Equipment	$75
Total	**$520**

Table 1: Estimated Component Costs and Budgeting

Milestones

Milestone	Week Due
Approval of project	4
Research components	5
Establish rough architecture	5
Program GUI	7
Program Voice Recognition	8
Program Face detection	8
Order components necessary for prototype	9
Design Control system for robot motion	12
Finish final Documentation	14
Build prototype	16
Design final architecture 1st draft for PCB	18
Build and test PCB 1	19
Refine architecture and design PCB 2	21
Build PCB 2	22
Test and adjust PCB 2	23-end

Table 2: Project Milestones