Remote control drone project idea

Overview:

As a team we decided to shift our project idea to something more simple to understand with a hope to learn more about the basics of information technology.
We agreed to work on form factor computing in particular Raspberry Pi to see its potential and how it could be used in our everyday lives.

The raspberry pi(Rpi) is a series of single-board computers developed in the UK. Each has microprocessors, memory, input/output and other features. It was designed for use in educating, demonstrating and promoting computer science in developing countries. (Wikipedia)

Form factors, which are found in any computer, is the name given to the specifications of the motherboard. It is the dimensions, type of power supply, the number of ports, the location of mounting holes etc (Wikipedia).
Standard form factors across the IBM PC compatible industry make sure that parts are interchangeable across the different generations of technology and across the different vendors. Form factors in enterprise computing make sure that server modules fit into the existing rackmount systems (Wikipedia).

Our team endeavours to create an autonomous drone using the raspberry Pi controlled remotely via wireless networks. We aim to navigate through the various software and hardware challenges this involves. The reason for using the Raspberry pi is for the versatile GPIO connector. With drones becoming an important tool for people whose jobs cover a wide area geographically, the versatility of a Raspberry pi and in particular the GPIO can add great potential to what a drone can do in the field.

The big picture as seen by our group is a Raspberry Pi (RPi) setup to control a drone using a Wan (wide area network) with a camera to help with navigation.

Motivation:

Our groups motivation is to have a project that will teach us a wide range of skills within the IT field. This includes but is not limited to; alternative operating systems, networking, file transfer, programming, and some html. As we break down the different aspects of the technologies used to achieve our project goals our knowledge of these technologies will become greater and we will have more understanding going forward in our careers/studies.

Of course we are also motivated by the endless uses that an autonomous drone could have to assist in the community. Some of the uses we thought about were using the drone in conjunction with government authorities such as CFA, SES and police where some types of remote areas are not accessible by foot, a drone could come into play to see the damage of a fire or locate missing people.

The project chosen will not be finished because of our current knowledge but has motivated us to come back to the project once we acquire the relevant skills. It is also a project that once we had successfully made an autonomous drone could be continued making it better and more cost effective, and adding features eg: infrared cameras and other sensors.

Landscape:

At this stage this type of project is quite common for other university students to take on.
There is plenty of information on youtube and a wealth of github repositories to look at where groups have completed similar projects.
There are also more advanced projects in progress with America starting to test autonomous drones for use in border security (defense One) and Australia training our army troops to use unmanned drones. (Australian Defense Force)

Aim:

The aim of our project was to use a Raspberry Pi to control a drone remotely, with the end result being a fully autonomous drone.

A more detailed description of what we are trying to achieve is to get rid of the traditional transmitter and receiver from the standard remote control and replace it with the Pi and wireless networking. Using a 4g lte device tethered to the pi will mean the range will be greatly increased. This is not groundbreaking in the area of remote controls however highlights the potential of raspberry Pi.

The drone will be equipped with a tilt pan servo control camera that will aid in surveillance and control of the drone. We aim to have gps tracking of the drone to give accurate information on the position of the drone and also aid in control.

With the advances in battery innovation lipo batteries we will also aim to power the drone, as well as the raspberry pi and the LTE device with one battery source.

This project is simple in its intent, but along the way we as a team will equip ourselves with the necessary tools to enter the world of information technology.

Plans and progress

We, as a team, decided to start by making a remote control car, equipped with camera, fully controllable using a WAN (wide area network) to start with.

The raspberry pi was purchased, along with an SD card. There are many kits available that come with a power supply (ac adapter), SD card and box to house the Rpi.
The one we bought was a Raspberry Pi3b+ (Pi Australia). The specifications on this model are as follows:
SoC: quad-core A53 (ARMv8) 64-bit @ 1.4GHz
GPU: Broadcom Videocore-IV
RAM: 1GB LPDDR2 SDRAM
Networking: Gigabit Ethernet (via USB channel), 2.4GHz and 5GHz 802.11b/g/n/ac Wi-Fi
Bluetooth: Bluetooth 4.2, Bluetooth Low Energy (BLE)
Storage: Micro-SD
GPIO: 40-pin GPIO header, populated
Ports: HDMI, 3.5mm analogue audio-video jack, 4x USB 2.0, Ethernet, Camera Serial Interface (CSI), Display Serial Interface (DSI)
Dimensions: 82mm x 56mm x 19.5mm, 50g

The official operating system for the RPi is Raspbian so we installed this onto the SD card.There is plenty of software for education, programming and general use. It has Python, Scratch, Sonic Pi, Java and more.

There are a few secondary apps needed to unzip the iso image and to format the sd card.

https://www.7-zip.org/download.html
7-zip is need because of how the Raspbian iso is compressed.

https://www.sdcard.org/downloads/formatter/
An sd card formatter was suggested before flashing the ISO image to the sd card.

https://www.balena.io/etcher/
Flash OS images to SD cards & USB drives, safely and easily.
Used this app to flash the sd card used to boot the operating system for the RPi.

Configurating

Following is the configuration of the RPi including the enabling of ssh, vnc and the i2ctools feature of the Pi to control the GPio.

Ssh - Secure Shell
One essential tool to master as a system administrator is SSH.
SSH, or Secure Shell, is a protocol used to securely log onto remote systems. It is the most common way to access remote Linux and Unix-like servers.

Secure Shell (**SSH**) is a cryptographic network protocol for operating network services securely over an unsecured network.[1] Typical applications include remote command-line, login, and remote command execution, but any network service can be secured with SSH.

SSH provides a secure channel over an unsecured network in a client–server architecture, connecting an SSH client application with an SSH server.[2] The protocol specification distinguishes between two major versions, referred to as SSH-1 and SSH-2. The standard TCP port for SSH is 22. SSH is generally used to access Unix-like operating systems, but it can also be used on Microsoft Windows. Windows 10 uses OpenSSH as its default SSH client.[3]

SSH was designed as a replacement for Telnet and for unsecured remote shell protocols such as the Berkeley rlogin, rsh, and rexec protocols. Those protocols send information, notably passwords, in plaintext, rendering them susceptible to interception and disclosure using packet analysis.[4] The encryption used by SSH is intended to provide confidentiality and integrity of data over an unsecured network, such as the Internet, although files leaked by Edward Snowden indicate that the National Security Agency can sometimes decrypt SSH, allowing them to read the contents of SSH sessions.[5]

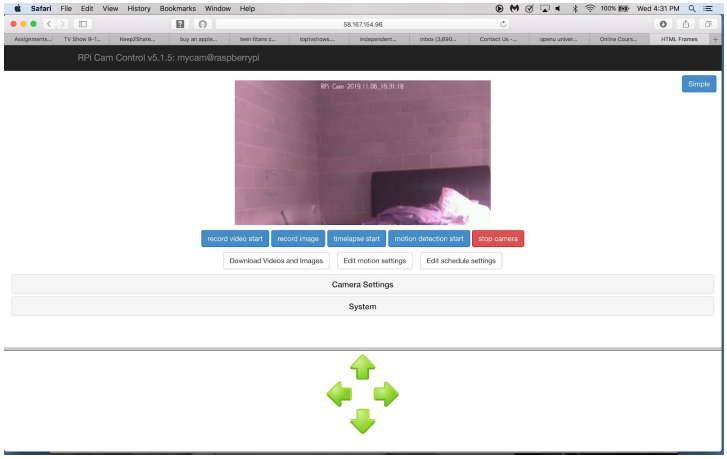
I2c
The Inter-integrated Circuit (I^2C) Protocol is a protocol intended to allow multiple "slave" digital integrated circuits ("chips") to communicate with one or more "master" chips. Like the Serial Peripheral Interface (SPI), it is only intended for short distance communications within a single device. Like Asynchronous Serial Interfaces (such as RS-232 or UARTs), it only requires two signal wires to exchange information.
^^is basically used to monitor attached devices.(the servos that tilt and pan the camera)

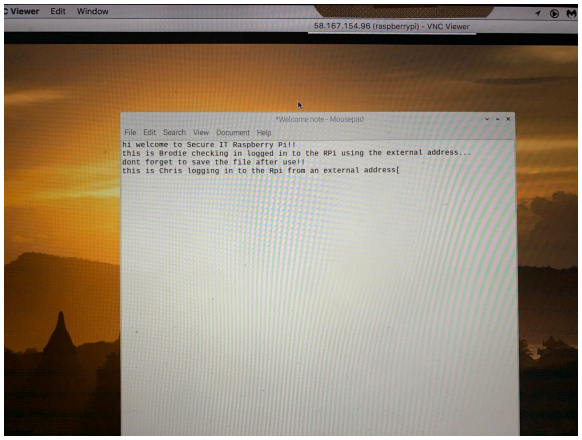
The vnc was the next thing to organise. We needed a vnc so the Pi could be remotely connected to from anywhere on the internet.
Realvnc is necessary for multiple remote connections to a single device.
This is helped by the fact my internet connection has a static ip. Others in the group can join the pi and navigate their way around the new operating system
https://www.realvnc.com/en/connect/download/viewer/

At this stage we got everything working and connected to the network

Some linux commands
raspi-config
Sudo command

Screen shots of Brodie and Chris being able to log the Rpi.





Scope and Limitations

We agreed it would be easier and more practical to start using the RPi to control an rc car instead of a drone, and we had a car available to use so didn't have to purchase one.
Our lack of knowledge of Python creates some limits on how much we can program the Pi to do. We would need more time to learn Python commands and program the pi to perform basic functions.

Obviously time constraints play a big part in the limitations of this project. Our team changed members and projects from assignment two and have had five weeks to work on the new project. It will take much longer to accomplish a fully autonomous drone.

We want to show how we have accessed the Rpi remotely.

Tools and technology

Remote control car/drone
Camera with video capabilities
Raspberry Pi
VNC viewer

Testing
We have been able to test the camera and the ability to use it remotely. We have also been able to test the accessability of the Pi from two different locations, all wirelessly.
Future testing will involve being able to use the car remotely to drive it.

Time Frame

Week No.	Brodie	Chris	Jenny
1	Watching videos on the raspberry pi	Reading about the raspberry pi and getting familiar with its capabilities	Reading about the raspberry pi and getting familiar with its capabilities
2	Bought the raspberry pi and installation of software	Reading about the raspberry pi and getting familiar with its capabilities	Reading about the raspberry pi and getting familiar with its capabilities
3		Watching videos on the raspberry pi	Watching videos on the raspberry pi
4	Camera installation	Installation of software - VNC	

5	Logging into Pi remotely	Logging into Pi remotely	
6	Writing report Photos and videos	Organising Presentation Report Writing	
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			

Risks

Risks associated with this project are :

Group processes and communications

Previous to this assignment our team had six members of which three of them did not have much, if any, communication at all. This made it hard to accomplish much of the second assignment as it was left to just three of us to do.

This time we had three members in our team. Unfortunately one of our team members in this assignment was hard to get hold of.
The remaining two teams members did communicate effectively throughout this assignment. We used discord and spoke almost everyday, not always about our project, which helped to build a rapport (and a friendship) between the two of us.
We used google docs to share our project work and discord for chatting and sharing web addresses for research.
We have also been able to access the Pi together and used file transferring software to share bigger files.

Raspberry Pi Picture
By Miiicihiaieil Hieinizilieir / Wikimedia Commons, CC BY-SA 4.0,
https://commons.wikimedia.org/w/index.php?curid=80140656

Pi Australia
https://raspberry.piaustralia.com.au/raspberry-pi-3-model-b-plus

Defense One
https://www.defenseone.com/technology/2019/09/cbp-test-autonomous-drones-use-border/159604/

Australian Defense Force
https://www.australiandefence.com.au/defence/unmanned

Raspbian Download
https://www.raspberrypi.org/downloads/raspbian/