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BSc in Computing
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Motorcycle Dashcam

Technical Report

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Executive Summary

From my personal use of dashcams, I feel like they are lacking for the user and their safety. A lot of the cameras have their SD cards attached to their device and there is no way of tracking if it is lost. They also have no backup or a solution for the saving of their data if the SD card is destroyed or even lost during an accident. Some have capabilities to connect to the user's phone and for the user to upload the data manually but there is no fall-back program for if the user is in a crash which is a situation where the recording would be invaluable.

After careful research I came up with the following solution for these problems. To make the SD card a part of the RP which is hidden inside the bike, already giving it a better chance of withstanding a crash. It will be encased in a black box which will be very durable keeping the RP safe. The RP will also be aware if an accident/crash occurs, which would result in it uploading the video footage either by connecting to the users phone or if it has its own network it will upload the videos as soon as it can and automatically overwrite the SD card with a minute of video before and anything after the crash has occurred.

Overall the project has the potential to compete on the market place, the design just needs to be more focused on this specific job, allowing it to be built cheaper and made efficient in its daily tasks. Right now the technology just isn't there and can't adapt well enough with other technologies to make it durable and trustworthy to the user but as a prototype it does the tasks required of it.

1 Introduction

The project was created with the user in mind, as other products currently out are very expensive and don't have a great range of functions when operating the device. This dashcam is unique as its intended effect is to be upgradable. There will be available upgrades that will add better quality options for the user. The user has the option of having it fitted by professionals in a shop or being able to do it themselves. The only other item needed would be the webapp to connect with the device and use it to make any necessary changes needed such as delete, or view which can be accessed from the computer. It's all to help the user in all cases.

1.1 Definitions, Acronyms, and Abbreviations

MD Motorcycle Dashcam

RP Raspberry Pi

1.2 Background

The motivation behind my project, is I am familiar with the area as I drive a motorcycle myself and I feel that the technology that could be implemented for a motorbike user's own safety could be much more effective than the current models. As I can drive for hours on end, I require good quality footage for safety and my own peace of mind, I use an ekken(Eken.com. (2018). *Original EKEN H9R Action Camera | Waterproof action camera, 4k video camera, best budget action camera, Sports cam, helmet camera | EKEN Official Website*. [online] Available at: https://www.eken.com/H9R [Accessed 13 May 2018].) which is a version of a go pro(Gopro.com. (2018). *GoPro - Cameras*. [online] Available at: https://gopro.com/ [Accessed 13 May 2018].The big problem that arises first off is the battery life. To always be recording, I'm required to carry two spare batteries but as I've mentioned, there is also no way to tell when the battery has depleted itself other than a beeping noise or a red flashing light on the camera itself but as the engine drowns out all sound, there would be no way to hear the beep and the camera itself is attached to the helmet so there is no way to see the blinking red light. The second problem with the go pro style cameras is the placement of the camera, when an actual crash occurs, the camera is located in a vulnerable

position on the helmet, if your helmet hits anything, the attachment holding the camera will snap. Now the case that currently protects the go pro whilst being quite durable if it was a high-speed crash, you run the risk of the camera breaking off the helmet and disappearing as there is no tracker on it, which could result in a loss of any important footage that had been recorded.

Go Pro:

Advantage-

- High Quality footage.
- Ability to be placed on bike or helmet.
- Large storage.
- Lower quality for longer battery life.
- Easily removed or detached.

Disadvantage-

- Detaches in case of a crash.
- Short battery life.
- If attached to side helmet, high speeds can cause wind friction to constantly move helmet to side of camera.
- Very large and noticeable.
- Expensive

For cameras mounted such as garmin verb(Athleteshop.ie. (2018). *Garmin Virb X Action Cam with GPS online - Athleteshop.ie*. [online] Available at: https://www.athleteshop.ie/garmin-virb-x-action-cam-with-gps?as=athlete&kwd_id=22985-AGI-49513900314-ASI-382460625073-ASM68T8MXU&gclid=CjwKCAiA9f7QBRBpEiwApLGUii8LHjSga4bS0sG_kzy7BuTqr6zuFSLFUgGYnFMeWCgY6vHHE6vBrRoCBGQQAvD_BwE [Accessed 13 May 2018].) to the motorcycle, these have the capability to be connected to the battery of the bike meaning if the bike is running, the camera will be recording also. They can be placed on the front or back of the bike narrowing the view depending where the camera is placed. In the case of a collision, there wouldn't be as high a risk of the camera getting damaged as it would be safely hidden on the bike. In the case of a crash and the bike being destroyed, the rider would need to be weary as the SD cards are usually inside the cameras, so they could easily be broken. They are usually much smaller size making them easier to hide on the bike. The more expensive cameras include

GPS, but they will have a much larger size. They also have cameras with a sensor to detect the vibrations of a bike, so it will know if a crash has occurred. If a crash does occur, there is an external battery so if the bike cuts out suddenly from the crash, the camera will recognize this and keep the camera recording for safety purposes.

Mounted-cameras:

Advantages-

- Connected to battery of bike.
- Easily hidden.
- Large storage.
- Connects to cloud.
- GPS capabilities

Disadvantages-

- Expensive
- More narrowed view
- SD card inside camera
- No protective case

1.3 Aims

My objective for this project is to build a motorcycle dashcam to record/document the travels of the user through pictures. My projects main priority is safety as I will be adding license plate recognition software to capture a license plate in a crash. It will be saved to an SD card in the raspberry pi. To make it more efficient I will have attached a vibration sensor so if the user is ever involved in a crash, the data has a higher chance of being saved.

Added features to help achieve my objective to a better standard would be multiple cameras to capture all angles to provide the most safety to the user after the crash.

If the user also tours or documents their travels for scenery, better quality cameras can be used that will still have the same safety features but will provide the user

with high quality footage throughout his journey. It will also have the capability to be uploaded to their phone or computer as soon as the raspberry pi connects to the internet via a sim that can be added per the users request so it can be uploaded easier. One of the cameras will have the capacity to be attached to the helmet which gives it a better view in terms of safety but will also provide a better-quality video for users documenting their travels. It will also be connected to the raspberry pi meaning if the vehicle is turned on, the camera will be recording. A feature may be included so when the vehicle is idle, the camera will stop recording and restart as soon as the bike starts moving again.

For certain users who travel frequently, there will be user friendly add-ons such as a touch screen which can view each camera that will also have GPS integrated and will show the map on the screen. A pair of earphones may also be added as to keep the user from taking their eyes off the road, so the directions will be re-laid to them through the earphones.

For users that are on long distance drive and require the need of their phones, the touch screen or raspberry pi will be able to sync with the phone giving the capabilities to have phone calls or even listen to music.

1.4 Technologies

Starting off, I will have one raspberry pi which will have the one camera attached to it. The camera will be placed at the front end of the bike. The pi will take pictures every 6 seconds as the camera requires a minimum of 6 seconds to prepare for a photo. There will also include a raspberry pi GSM/GPSR shield which will allow a sim to be added to the pi for internet connectivity.

The raspberry pi itself will be placed inside of a black box. This will keep it protected if there ever is a collision as it will be attached to the back of the motorbike. It will keep the raspberry pi intact throughout a crash and can easily connect to the battery of the bike from this position. To keep the raspberry pi from overheating, a case with a fan attached will be used inside the Blackbox. The box is built in such

a way that it allows air to travel in from beneath but will stop water from getting in unless the box is turned upside down.

The cameras are not waterproof, so a small acrylic case will be used to protect them from the weather. As it will only be taking pictures rather than video, it will be alot less likely for the raspberry pi or camera to overheat unless there is a problem with the RP. The cameras will be held to the bike with relative ease as they are quite small and light. This will make it simple to latch them to the handle bar or the side of the motorbike.

The SD card will also be protected inside the Blackbox so that when a collision occurs, it will remain intact. The pi will be surrounded by a sponge or foam that will absorb the brunt of the impact and if the raspberry pi was to come loose, will keep it from getting damaged.

1.5 Structure

Introduction:

The introduction talks about the project itself and explains how it will work. It is a basic description of all the functions that will be involved with the process such as the webapps interaction to the RP and what the user does to initiate certain procedures. The background explains how the idea formed and the reasons behind it. It showcases other types of dashcams and go pros to compare their advantages and disadvantages that come with each one. This will highlight how this dashcam will differ from those currently on the market. The aims are for the project and where I want it to go as a developer. It is the objectives I have set for myself till the due date and what I hope to have built at the end. The technologies explain what will be used and how each technology will be prepared for any problems that may lay ahead. They explain how far the application will be taken in terms of development.

System:

The system explains the requirements used for the project, showing each functional requirement that the RP is capable of. It then shows a use case for each displaying it in a diagram to show how the user interacts with the system. The use cases are also explained in how they function. It explains the interaction with the environment and the usability requirements explaining what the user can do and how they can access the RP. The design and architecture explain the project and all its interactions through a class diagram. It allows one to understand the project better in terms of having no prototype to view if that is the case. The implementation is the code explained, all the libraries and algorithms that may be used in terms of building the prototype. The GUI explains the ui of the webapp and how the user interacts with the webapp and RP. It shows the main pages that are used in the webapp.

2 System

2.1 Requirements

There is little technical knowledge needed to know how to run the equipment, if the equipment is set up properly, the only thing you must do is turn the motorcycle on. The equipment will know what to do automatically, if you're using your phone or the computer for its features, the webapp is self-explanatory and will give all the help needed to use it in the instructions on the webapp itself. The main job the user will have to do when first using the RP is getting it setup with a sim card which will be permanently attached to the RP.

2.1.1 Functional requirements

User activation – High ranked Function. The user switching their motorcycle on which activates their RP.

Picture recording – High ranked Function. As soon as the RP is activated, it is programmed to switch all cameras on and start recording.

Deleting – Medium ranked Function. This is completed on either the phone or the computer files after they are uploaded.

Uploading – Medium ranked Function. This occurs after all the pictures have been taken, RP connects to known network to upload files.

2.1.2 Data requirements

Use Case Diagram

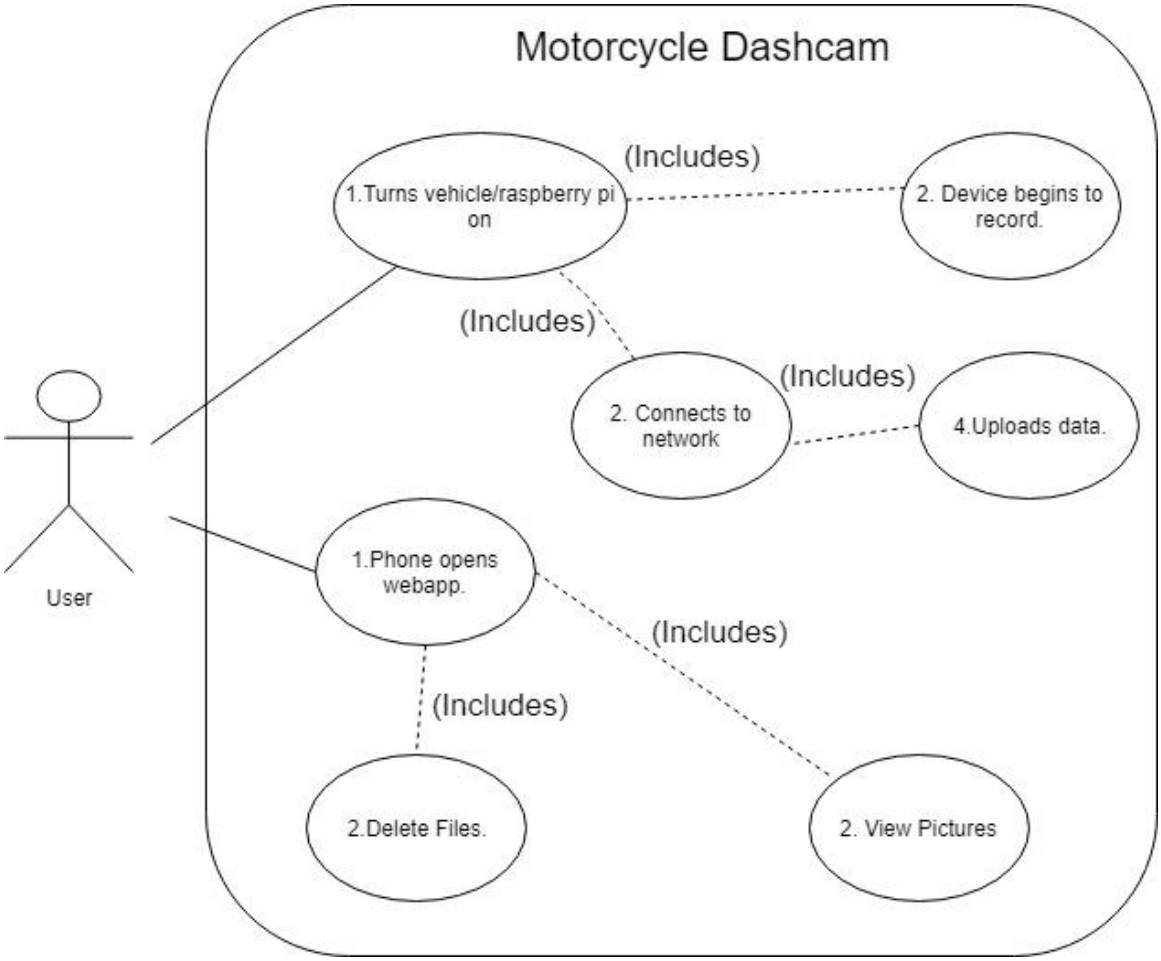


Figure 1

2.1.2.1 Requirement 1 Switching On

Description & Priority

The requirement is to switch on the overall system to start the necessary functions that will be needed. This is a high-level priority as the system is non-functional without this requirement.

Use Case

Scope

The scope of this use case is to switch on the device, to allow the system to begin recording from the camera.

Description

How this is done, is the user switches on their motorcycle which will immediately turn the RP on. It has been programmed to begin recording on all cameras.

Use Case Diagram

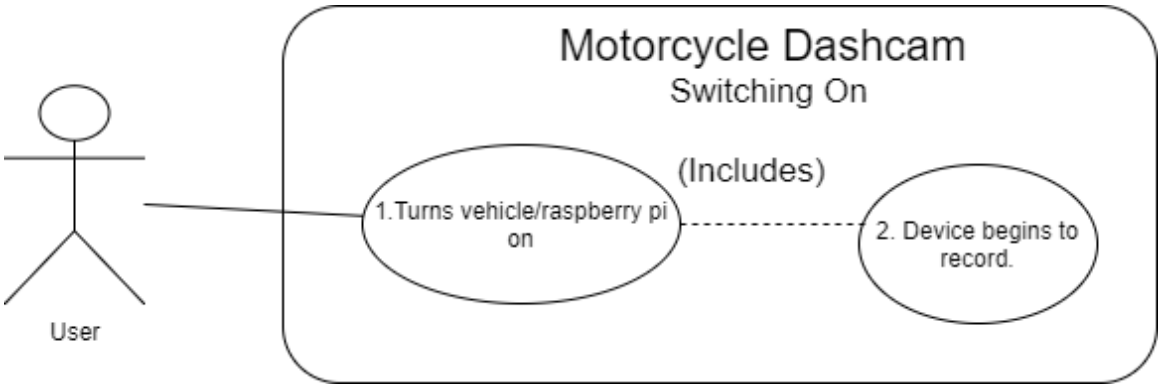


Figure 2

Flow Description

The user initiates the flow when switching on the motorcycle which starts the RP, this then starts recording automatically.

Precondition

The motorcycles battery is in a healthy condition to switch the RP on.

Activation

This use case starts when the user switches on the motorcycle which will turn on/activate the RP.

Main flow

1. The user switches on the motorcycle turning on the RP.
2. The RP automatically turns on.
3. The RP then starts recording.

Alternate flow

A1: Remote Switch in app

4. The user turns on external battery using app which turns on the RP.

Exceptional flow

E1 : Battery's

5. Motorcycle battery and external battery have run dry.

Termination

The following process is the activation of the camera.

Post condition

The RP is powered and ready for the next step.

2.1.2.2 Requirement 2 Recording

Description & Priority

This is the main function of the RP which is to record the surroundings of the journey for the user. The priority is high as without this, there is no system needed.

Use Case

Scope

The scope of this use case is to record the full journey that the users takes.

Description

This is done with the SD card holding the data until it hits capacity and is then looped for the use of the cameras to continue recording.

Use Case Diagram

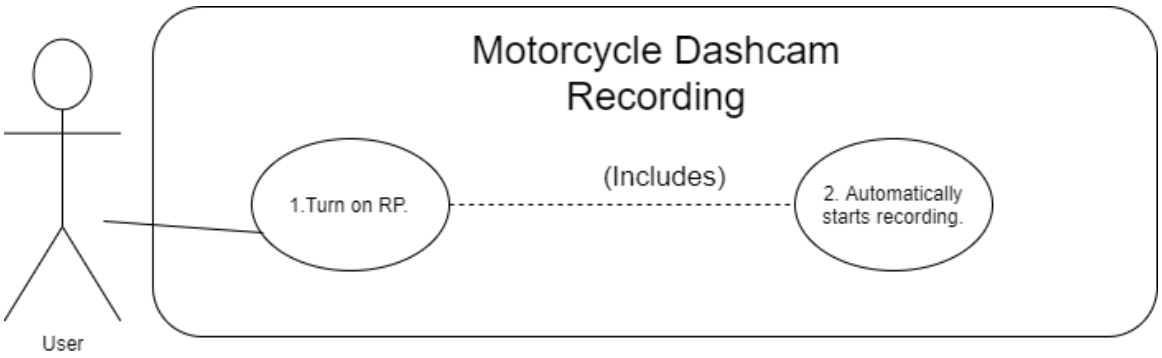


Figure 3

Flow Description

The user initiates the flow when switching the motorcycle on which activates the RP. On boot the camera will automatically start recording.

Precondition

The RP needs to be switched on for the recording to be successful.

Activation

This use case starts when the user turns the motorcycle on, as soon as the RP is fully booted, it will begin recording.

Main flow

1. The system identifies that the RP is switched on.
2. The RP continually records.
3. The RP records until switched off.

Alternate flow

A1: Choosing Cameras

4. The user connects phone.
5. The user navigates to the recording page to switch or turn off cameras.

Exceptional flow

E1: Video Storage Full

6. The RP recognises when SD card is full.
7. The RP will delete the oldest data.
8. The RP will continue recording as a result.

Termination

The following functions can be uploading, deleting, viewing, editing or user can switch it off.

Post condition

The recording is available to the user after the journey has been completed.

2.1.2.3 Requirement 3 Upload

Description & Priority

The upload is automatically done by the RP or if the journey is completed, the user can pick and choose what they wish to upload to save time or make it easier when editing later. The priority is medium as it doesn't stop the system if there are any problems.

Use Case

Scope

The scope of this is to upload the recorded data of each journey online for safety purposes and the user's entertainment to view for scenery. It is needed as a safety precaution for a crash as well.

Description

This is done by the RP connection to the user's phone or if at home their WIFI which can connect the RP to their computer in order to upload the data to a safe location other than the SD card and then can delete the data from the SD card.

Use Case Diagram

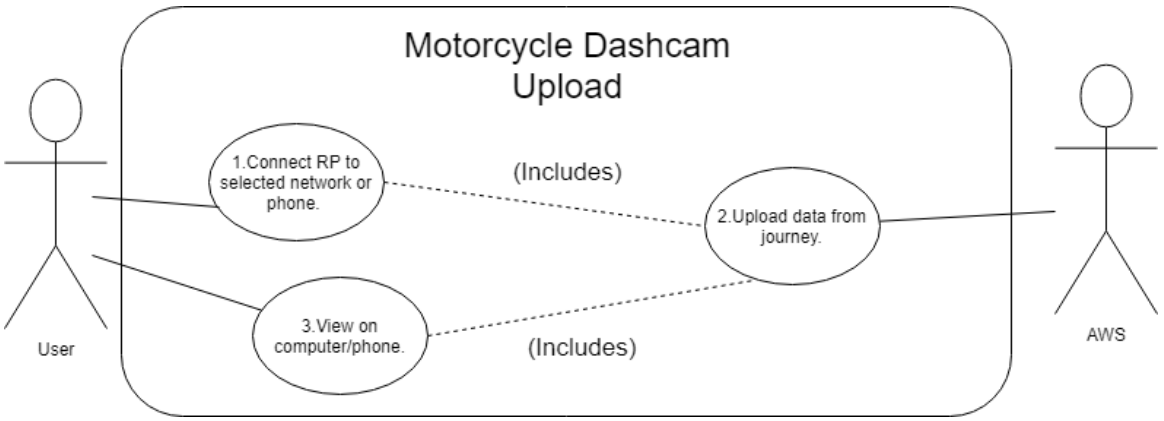


Figure 4

Flow Description

The user initialises the flow when connecting the phone to the RP, then the user chooses files to view on the computer/phone.

Precondition

The system needs to have recording working in order to upload actual data to the user's devices.

Activation

This use case starts when the user has completed their journey and the raspberry pi uploads all the data.

Main flow

1. The system connects to the WIFI.
2. The RP will upload through phone without user doing it manually.

Alternate flow

A1 : Known WIFI network.

3. The RP recognises a network which can connect it to users computer.
4. The RP uploads directly.

Exceptional flow

E1 : No Internet connection

5. The RP has no access to a network/Phone of the user.

6. The RP will lock the data to SD card if it has right requirements.

Termination

The following functions can be uploading another file or deleting, viewing or user can switch it off.

Post condition

The upload is complete, and user has access from their phone or computer.

2.1.2.4 Requirement 4 Delete

Description & Priority

The deletion is done on the server and any files being uploaded or that have been uploaded already. It is also to do with any video files that are locked by the RP for reasons over a journey. It is a medium priority as it can affect other more prominent functions of the device.

Use Case

Scope

The scope of this is to enable the user to delete any and all files either on the RP or their phone/computer freeing up space, so it leaves the RP with all the space it requires and isn't taking any room making the RP slower in any way or form.

Description

This is done by the user, they have access to the files on the server from there phone or computer. The files uploaded to the computer can be deleted by the user from any platform capable of internet connection and once they have their login and password.

Use Case Diagram

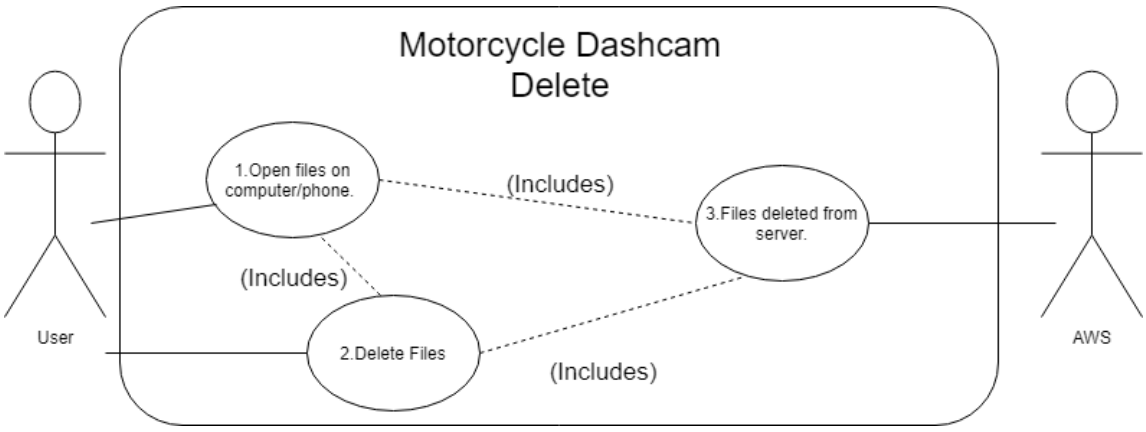


Figure 5

Flow Description

The user initiates the flow by navigating to files on app and then deleting a file.

Precondition

The user has a valid connection to make changes permanent.

Activation

This use case starts when the user deletes files on the server or any files associated with it.

Main flow

1. The user will delete any files they deem unnecessary.
2. The server will have its files changed as soon as connection is made.

Alternate flow

A1 : Deleted by RP

3. The RP will delete the oldest files when SD card is full

Exceptional flow

E1 : Corrupted File

4. The RP recognises a corruption in a picture file and notifies the user.
5. The user chooses to keep or delete the file.

Termination

The following functions can be deleting another file or uploading, viewing, editing or user can switch it off.

Post condition

The server will delete files on told to.

2.1.2.5 Requirement 5 Crash

Description & Priority

A vibration sensor is used to recognise a crash occurring, the RP is programmed to overwrite the SD card and upload the files if possible. It is a high Priority as it is one of the main reasons for this device.

Use Case

Scope

The scope of this use case is for the RP to know a crash has occurred and overwrite the SD card.

Description

The RP activates when the vibration sensor goes above its normal requirements. The SD card is overwritten with the previous minute of footage.

Use Case Diagram

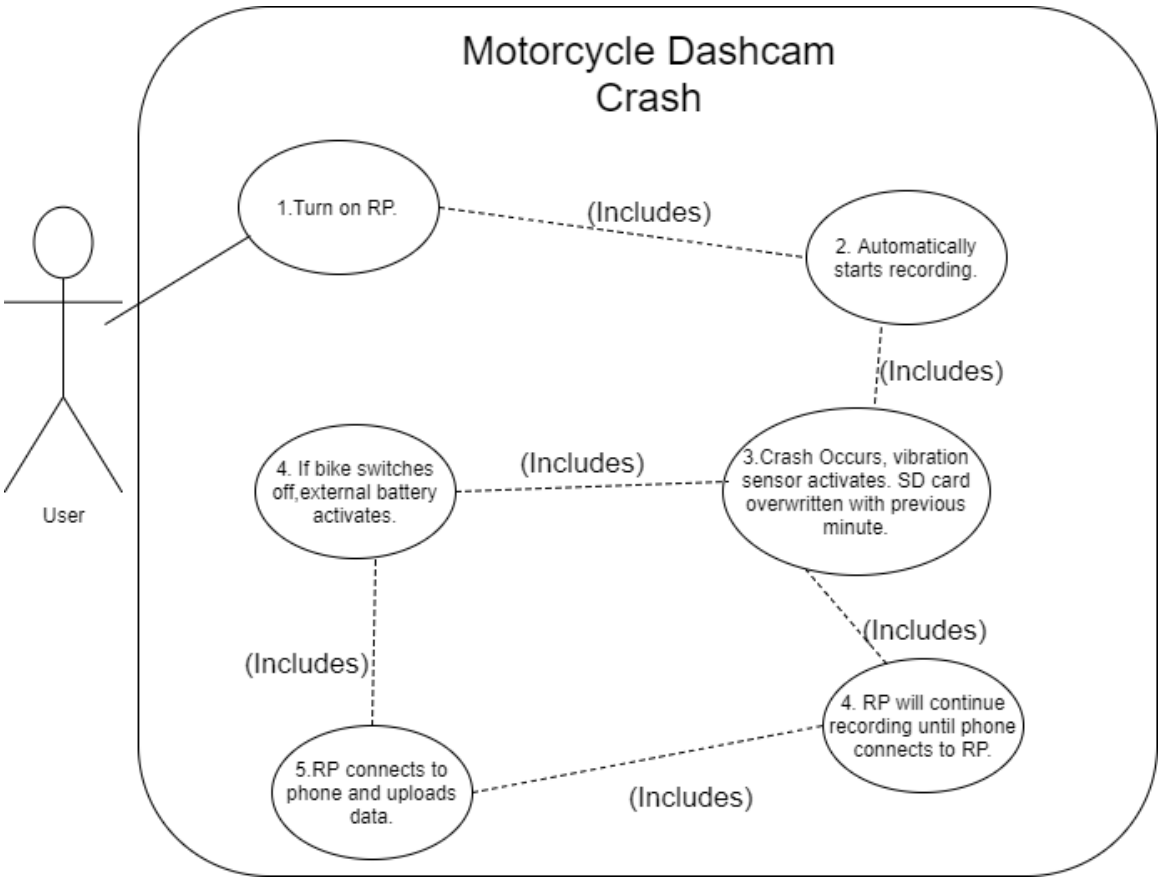


Figure 6

Flow Description

Precondition

The users motorcycle is hit or damaged which activates the vibration sensor.

Activation

When the vibration sensor activates, the RP is programmed to activate its functions for a crash.

Main flow

1. The vibration sensor activates.
2. The RP overwrites SD card.

Alternate flow

A1 : Uploading

3. The vibration sensor activates.
4. The RP overwrites SD card.

5. The RP connects to phone
6. Uploads files online

Exceptional flow

E1: Vibration sensor broken

7. The vibration sensor doesn't work properly.
8. The RP cant recognise a crash occurring.
9. The RP functions as normal.

Termination

The following process is the user accessing the app to switch of RPs external battery.

Post condition

The selected video files from the crash are saved to SD card.

2.1.3 User requirements

The user does not have much interaction with the Raspberry Pi, except when they turn on the motorbike which will then power the RP and activate its functions. The user can access the webapp on their phone or laptop depending where they are. They will have a log in to access their own information and their raspberry pi will be linked to their log in. When the user is logged in, they can access the contents page to provide more information about the device and how to use it. They will also have access to any pictures taken by the raspberry pi and will have the capabilities to delete the information. Depending on how many cameras are on the device, they can stream the information to ensure the camera is active. Lastly the raspberry pi will have a dedicated sim, this will keep the RP connected to the internet as long as its in range, but the credit will need to be topped up by the user.

2.1.4 Environmental requirements

As the app is now a webapp, any device can be used but android users will be able to access the webapp as it is produced for android alone. All other users can

access the application over any browser using either a smartphone or laptop/pc. All system's platforms can be used from windows to apple and likewise on phone systems. The only requirement needed from the user is to have access to the internet.

2.1.5 Usability requirements

The interface of the app is created to be easily navigable, as when your on each page, if any requirements are necessary of the user they are clearly marked and visible on the page. There is no previous training required, each page will have a maximum of two-four buttons all labelled clearly so the user will know what they can do. It would benefit the user greatly if they have used browsers or an app before as this would make the use of the app/website a lot simpler for them. The operability of the webapp is very user friendly with the user having the ability to keep the app on their phone or having the website saved in their browser of choice. The only fall back being that the app is unusable if they have no connection to the internet.

2.2 Design and Architecture

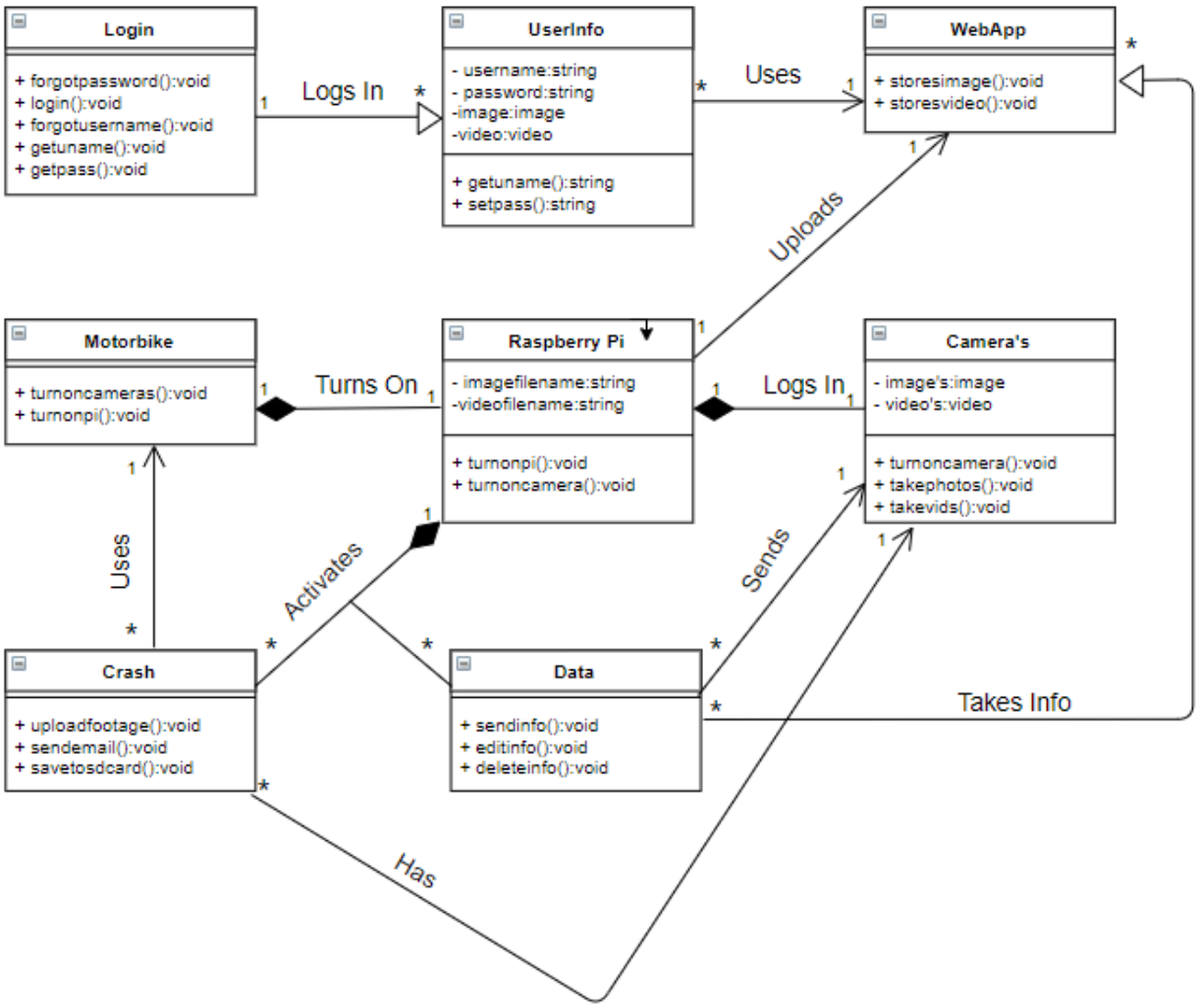


Figure 7

The class diagram (figure 7) above states the architecture for the interaction between the raspberry pi and the webapp. It states for the webapp that the user's information is grabbed when their username and password are used allowing them access to data from the raspberry pi. The raspberry pi cannot be used until the motorbike is switched on, the camera will start taking photos immediately on start up. The data will then be uploaded to the webapp at a specified time to ensure safety of the recordings. The crash is activated by the raspberry pi when the

motorbike is in an accident and will activate the camera to start recording video which is then uploaded.

2.3 Implementation

2.3.1 EC2 and Website

```
sudo apt-get update

sudo apt-get install lamp-server^

sudo apt-get apache2

sudo /etc/init.d/apache2 restart
```

Figure 8

The above code in figure 8 is used after a private key is generated using puttyGEN so a connection can be generated between the computer and the EC2 on AWS. After logging into the putty as ubuntu, I then install the above which is the lamp stack so that apache can then be installed to use php in my website. It is restarted to reset itself.

```
locate php.ini

sudo nano /etc/php/7.0/apache2/php.ini

(display_errors = off) changed to (display_errors = on)
```

Figure 9

Stated in figure 9 is code to help when using PHP. The first two lines are used in the command line to find the php.ini in apache. Then I located the third line in the code and switched it like the above states. What this does is enable errors to make PHP easier to work through.

```
sudo apt-get install phpmyadmin php-mbstring php-gettext

sudo phpenmod mcrypt

sudo phpenmod mbstring
```

Figure 10

The commands in figure 10 are done in the ubuntu server to allow access to phpMyAdmin. The first command installs it and the second two commands are too enable extensions that are needed to run it.

```
$files = glob("../webcam/*.*");

    for ($i=1; $i<count($files); $i++){

      $num = $files[$i];

     echo '<li class="image"><img src="'.$num.'" alt="Image" />
/></li><span></span>';
```

Figure 11

This code in figure 11 is from recording.php and is what displays the images uploaded by the raspberry pi. The files is used to grab the folder that holds all the images. This way it allows all the images to display rather than a single image. The i will grab all of the images to display, and the raspberry pi is set to save images.

```
<?php
session_start(); // Starting Session
$error=''; // Variable To Store Error Message
if (isset($_POST['submit'])) {
if (empty($_POST['username']) || empty($_POST['password'])) {
$error = "Username orphpinfo(); Password is invalid";}
else{
$username= ($_POST['john']?? 'john');
$password= ($_POST['1234']?? '1234');
$connection = mysqli_connect("localhost", "root", "joker1997");
$username = stripslashes($username);
$password = stripslashes($password);
$username = mysqli_real_escape_string($connection,$username);
$password = mysqli_real_escape_string($connection,$password);
$db = mysqli_select_db( $connection,"company");
$query = mysqli_query($connection, "select * from company where password='$password' AND username='$username'");
$rows = mysqli_num_rows($query);
if ($rows == 1) {
$_SESSION['login_user']=$username; // Initializing Session
header("location: profile.php"); // Redirecting To Other Page
} else {
$error = "Username or Password is invalid";}
mysqli_close($connection); }}
?>
```

Figure 12

Displaying in figure 12 is the connection code in login.php that communicates from the webapp to the SQL database that is held on phpmyadmin. It has the set password and username already capable but has the capasity to be able to have multiple users accessing the webapp. For the else statement that is holding the connection, if it is true it will bring the user to their profile page. This will then allow them access to any information they uploaded from the raspberry pi or are currently uploading.

Open CV

```
sudo raspi-config (Then advanced options and expand filesystems)
sudo reboot
sudo apt-get purge wolfram-engine
sudo apt-get purge libreoffice*
sudo apt-get clean
sudo apt-get autoremove
```

Figure 13

In figure 13 above, its getting rid of any unnecassary files and it is expanding the system as the open cv can take up a lot of storage when compiling and also when it is being downloaded. It purges the files from the system completely removing them.

```
sudo apt-get update && sudo apt-get upgrade
sudo apt-get install build-essential cmake pkg-config
sudo apt-get install libjpeg-dev libtiff5-dev libjasper-dev libpng12-dev
sudo apt-get install libavcodec-dev libavformat-dev libswscale-dev libv4l-dev
sudo apt-get install libxvidcore-dev libx264-dev
sudo apt-get install libgtk2.0-dev libgtk-3-dev
sudo apt-get install libatlas-base-dev gfortran
sudo apt-get install python2.7-dev python3-dev
```

Figure 14

In figure 14, dependencies are being installed that are necessary for open cv to run. This includes Cmake which can help when configuring the build process of open cv. Image i/o packages are needed to load different images such as png and jpg. GTK is installed as when open cv is running, it uses a sub module called highgui which creates a frontend or a basic gui for the data.

```
cd ~
wget -O opencv.zip https://github.com/Itseez/opencv/archive/3.3.0.zip
unzip opencv.zip
wget-Oopencv_contrib.zip
https://github.com/Itseez/opencv_contrib/archive/3.3.0.zip
unzip opencv_contrib.zip
```

Figure 15

Next, figure 15 is downloading the source code for open cv and unzipping it.

```
wget https://bootstrap.pypa.io/get-pip.py

sudo python get-pip.py

sudo pip install virtualenv virtualenvwrapper

sudo rm -rf ~/.cache/pip

sudo nano ~/.profile

export WORKON_HOME=$HOME/.virtualenvs (added to bottom line)

source /usr/local/bin/virtualenvwrapper.sh (added to bottom line)

source ~/.profile

mkvirtualenv cv -p python2

source ~/.profile

workon cv

pip install numpy
```

Figure 16

Next in figure 16, pip is installed as it is needed later for installs in open cv. Next is the virtual wrapper which is a handy tool for collecting separate dependencies and creating Python enviroments for each of them. source ~/.profile should be used everytime you reboot the raspberry pi to guarantee that the variables have set up correctly. Then you create the virtual environment itself which is called cv. Then you can enter it using workon cv. Then numpy is installed for numerical processing when using open cv.

```
cd ~/opencv-3.3.0/

mkdir build
cd build
cmake -D CMAKE_BUILD_TYPE=RELEASE \
    -D CMAKE_INSTALL_PREFIX=/usr/local \
    -D INSTALL_PYTHON_EXAMPLES=ON \
    -D OPENCV_EXTRA_MODULES_PATH=~/opencv_contrib-3.3.0/modules \
    -D BUILD_EXAMPLES=ON ..

Sudo nano /etc/dphys-swapfile

# CONF_SWAPSIZE=100 (comment)
CONF_SWAPSIZE=1024(write)
sudo /etc/init.d/dphys-swapfile stop
sudo /etc/init.d/dphys-swapfile start
make -j4
sudo make install
sudo ldconfig
```

Figure 17

In figure 17, while still in the virtual environment. You can then build the above as stated which is beginning the build for open cv. It will also bring up the python 2 section paths, so you can ensure everything you need has been installed. For Raspbian Stretch, to get open cv to work and compile properly you need to swap the config size to compile with multiple cores or else it may not run. You then stop and restart the file to ensure its switched. Then finally you can compile open cv using make -j4 which can take up to 4 hours. Then just install after.

```
cd ~/.virtualenvs/cv/lib/python2.7/site-packages/

ln -s /usr/local/lib/python2.7/site-packages/cv2.so cv2.so

sudo nano /etc/dphys-swapfile

CONF_SWAPSIZE=100
# CONF_SWAPSIZE=1024

sudo /etc/init.d/dphys-swapfile stop
$ sudo /etc/init.d/dphys-swapfile start
```

Figure 18

The Final step in figure 18 is to install open cv is then sym-link the open cv bindings to the virtual environment cv. Then edit the swapfile again as the memory card can damage if it isn't done. Then finally stop and start the file again.

Tesseract

```
source ~/.profile

workon cv

pip install pillow
pip install pytesseract
```

Figure 19

The commands in figure 19 allow us to install the necessary components for tesseract and its python bindings. This needs to be done in the virtual environment created with open cv. It allows us to access tesseract while using python.

```
if args["preprocess"] == "thresh":
        gray = cv2.threshold(gray, 0, 255,
                cv2.THRESH_BINARY | cv2.THRESH_OTSU)[1]
```

Figure 20

The lines of code in figure 20, are used to separate the background and foreground such as the writing that will be layered on top.

```
text = pytesseract.image_to_string(Image.open(filename))
os.remove(filename)
print(text)
```

Figure 21

In figure 21, the pictue is converted from an image to a string. We then delete the temporary file and print the leftover text to the terminal. It can be handled as such that we can load the text in another image leaving the user with only the text.

```
ap.add_argument("-i", "--image", required=True,

python ocr.py --image images/example_01.png
```

Figure 22

The first line in figure 22 will send the image to ocr to be compiled. The second is the command line which locates the image you want and runs the file while putting the image grabbed through ocr to compile. Ocr will remove any background noise from the image, leaving the text intact.

Pi Camera and SCP

```
sudo apt-get install python-picamera

FRAMES = 2

TIMEBETWEEN = 6

frameCount = 0

while frameCount < FRAMES:

    imageNumber = str(frameCount).zfill(7)

    os.system("raspistill -o /home/pi/Pictures/image%s.jpg"%(imageNumber))

    frameCount += 1

    time.sleep(TIMEBETWEEN - 6)

else:

    os.system(“scp -I /home/pi/Downloads/newubuntu.pem -r /home/pi/Pictures/* ubuntu@34.240.84.151:/var/www/html/webcam/”)

    os.close
```

Figure 23

In figure 23, the command is to install the pi camera on the raspberry pi. The following code is in the picupload.py file. So it states the frames to be 2 so that means it will take two pictures. The time between being how long it takes between each photo. For the picamera it takes a minimum of 6 seconds to prepare for a picture. The count is 0 and in the while loop, as long as the count is less than the frame it will continue to take photos. Raspistill is what will activate the camera and place the image in the directory specified. Now as multiple images are being taken, the framcount is used to number each photo.

The else is run after the last frame is taken by the camera, it will then use scp which is secure contain protect. It allows files to be transferred or copied to and between different hosts. The -i is used to identify a specific file. It is grabbing the newubuntu.pem which is the key that allows a connection to aws. The -r is recursively allowing the command to grab the entire folder to upload.

Database

```
pip install mysql-connector
```

Figure 24

The command in figure 24 is what allows the raspberry pi to connect to the database.

```
try:
   conn = mysql.connector.connect(host="pdb.cxfg2y94di8m.eu-west-
1.rds.amazonaws.com",
                  user="johnakasean",
                  passwd="joker1997",
                  db="mc4pdb")

except mysql.connector.Error as err:
   if err.errno == errorcode.ER_ACCESS_DENIED_ERROR:
      print("Something is wrong with your user name or password")

   elif err.errno == errorcode.ER_BAD_DB_ERROR:
      print("Database does not exists")

   else:
      print(err)
```

Figure 25

The code in figure 25 from picupload.py shows the connection being made to the mysql database which is held on AWS. This connection is being made from the raspberry pi to the database on aws. There is also error handling to ensure the user why the and if there is any problems when connecting or using the database.

```
imgname = (imageNumber,)

cur = conn.cursor()

cur.execute("""INSERT INTO image (imgname)VALUES (%s)""",(imgname))

conn.commit()

cur.execute("SELECT * FROM image")

rows = cur.fetchall()

for eachRow in rows:

   print eachRow

conn.close()
```

Figure 26

The code in figure 26 from picupload.py, shows the statement linking to ‘conn’ which is the connection. It then executes the sql statements which has its value as the imgname which is linked to imageNumber which is used on a photo is taken so its grabbing the created name and linking it with the id and timestamp created in the database. It then commits the execute and then shows the results in the terminal. Lastly the connection is then closed.

```
  $dbc=mysqli_connect('pdb.cxfg2y94di8m.eu-west-
1.rds.amazonaws.com','johnakasean','joker1997','mc4pdb')
    or die('Error connecting to MySQL server');
```

Figure 27

The code in Figure 27 found at recording.php shows the connection established through php from the webapp to mysql on aws. It has error handling to notify user if there is any problems.

```
$query = "select * from image ORDER BY id";
$result = mysqli_query($dbc,$query)
    or die('Error querying database');
$count=mysqli_num_rows($result);
<td bgcolor="#FFFFFF"><?php echo $row['id']; ?></td>
<td bgcolor="#FFFFFF"><?php echo $row['imgname']; ?></td>
<td bgcolor="#FFFFFF"><?php echo $row['created']; ?></td>
```

Figure 28

The code in figure 28 found at recording.php is grabbing the information from the database using the connection at ‘dbc’. Then is prints the results out by rows to display all the necessary data together with the image it is assigned to. This is all done through php.

Login system webapp

```
$username= ($_POST['john']?? 'john');

$password= ($_POST['1234']?? '1234');

// Establishing Connection with Server by passing server_name, user_id and password as a parameter

$connection = mysqli_connect("localhost", "root", "joker1997");

// To protect MySQL injection for Security purpose

$username = stripslashes($username);

$password = stripslashes($password);

$username = mysqli_real_escape_string($connection,$username);

$password = mysqli_real_escape_string($connection,$password);

// Selecting Database

$db = mysqli_select_db( $connection,"company");

// SQL query to fetch information of registerd users and finds user match.

$query = mysqli_query($connection, "select * from company where password='$password' AND username='$username'");
```

Figure 29

The code in figure 29 is the connection to the phpMyAdmin found at login.php which holds the users name and password. I have the user and password being defined so that they can login. There is then the connection established using the server, user and password to connect. The user and password are then passed to see if they are in the database, and the name of the database is given to point it in the correct path. Then the final query to make give the user access is when it send the username and password and if returned true they enter and if false told they're username and password are incorrect.

```
<?php
// Establishing Connection with Server by passing server_name, user_id and password as a parameter
$connection = mysqli_connect("localhost", "root", "joker1997");
// Selecting Database
$db = mysqli_select_db($connection, "company" );
session_start();// Starting Session
// Storing Session
$user_check=$_SESSION['login_user'];
// SQL Query To Fetch Complete Information Of User
$ses_sql=mysqli_query( $connection, "select username from company where username='$user_check'");
$row = mysqli_fetch_assoc($ses_sql);
$login_session =$row['username'];
if(!isset($login_session)){
mysqli_close($connection); // Closing Connection
header('Location: ../index.php'); // Redirecting To Home Page
}
?>
```

Figure 30

The code in figure 30 is found at session.php which is used for pages that are only accessible if the user is logged in. On any page it is needed, an 'include('session.php');' would be added in php to ensure only valid users can enter. ~/.config/lxsession/LXDE-pi/autostart

Login and start file

```
sudo python ~/.config/lxsession/LXDE-pi/autostart

@sudo /usr/bin/python /home/pi/pictureupload/picupload.py
```

Figure 31

In figure 31, first enter the file by the first command and edit it and enter the second line at the bottom and this will allow the pi to start the script as soon as its switched on.

Internet with GPRS Shield

```
sudo systemctl stop serial-getty@ttyS0.service
sudo systemctl disable serial-getty@ttyS0.service
sudo systemctl stop serial-getty@ttyAMA0.service
sudo systemctl disable serial-getty@ttyAMA0.service
sudo nano /boot/cmdline.txt

sudo nano /boot/config.txt

Adding “enable_uart=1”

sudo apt-get install minicom


minicom -s
```

Figure 32

In figure 32 the first commands install the necessary components to use the device. Then after enabling uart you can install minicom to set it up.

Delete button

```
 <td align="center" bgcolor="#FFFFFF"><input name="checkbox[]" type="checkbox" value="<?php echo $row['id']; ?>"></td>


if(isset($_POST['delete']))
   {
      $checkbox = $_POST['checkbox'];

   for($i=0;$i<count($checkbox);$i++){

   $del_id = $checkbox[$i];
   $sql = "DELETE FROM image WHERE id in ";
   $sql.= "('".implode("','",array_values($_POST['checkbox'])).")";
   unlink("/var/www/html/webcam/image1.jpg");
   $result = mysqli_query($dbc,$sql);
   }
   // if successful redirect to delete_multiple.php
   if($result){
   header('Location: recording.php');
   }
    }
```

Figure 33

Shown in figure 33 is the deletion code for the row in the database and the image in the server. When button is pressed it uses the ‘name=”checkbox”’ that is assigned to the table which holds the id, imgname and also the timestamp included in the database. So, when the box is ticked on the webapp, the sql query will then remove it from the database while the unlink will delete the photo from the server. If it is completed, the page is then refreshed which will show the image has been deleted.

2.4 Graphical User Interface (GUI) Layout

2.4.1 Before

Home Page:

This is the home page of the app. You can access all the applications from this location. To connect this app with your RP, the user will need to have a connection to the RP using the phone. This will link the two once there is a vaild connection to both. Then the user will be able to view the RPs cameras, files or the location of the user or RP. If they are connected to facebook, they will have the option to stream from one of the cameras. This will require a good connection for it to work smoothly.

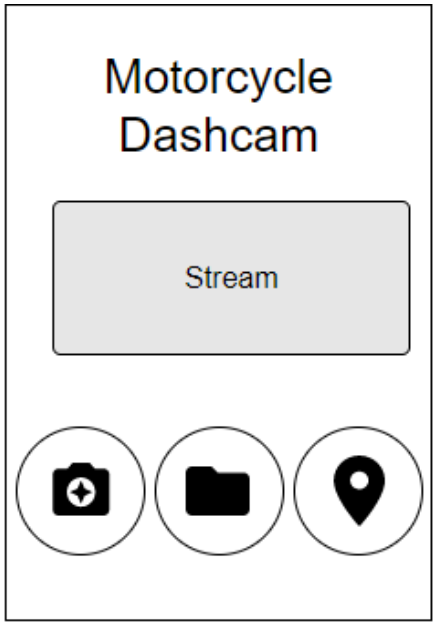


Figure 34

Camera's:

This page will display each of the camera's on your motorcycle. Before begining your journey, you can check to make sure that the camera's are on as any errors that occur will show them appear as off. The user can click on each of the pictures displaying which camera it is and it will stream a life feed from the selected camera to the users phone.

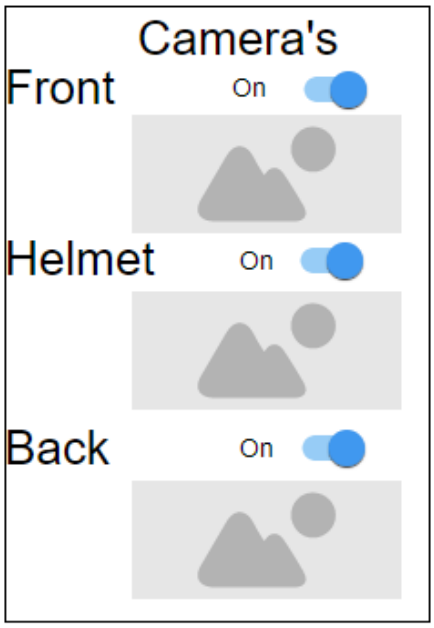
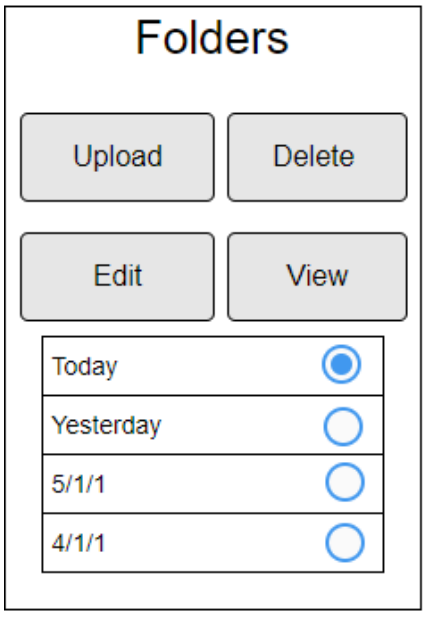


Figure 35



Folders's:

The folders page, will display all the files still saved on the SD card. This page gives the user the capabilities to upload the selected file so the user may view/edit on the computer. It also allows them to delete any files as shown by selecting them. You may edit the video to a certain degree such as deleting some footage from the file or changing the quality of the video.

Figure 36

2.4.2 After

Home Page:

As you can see, this is now a webapp instead of an app. The appearance has changed completely also. The reasons for this is when testing it and comparing it to competitors I felt the design needed to be simple and elegant to catch the users eye when they came upon the page. The reason of switching to a webapp is it gives access to all users now on all platforms, gaining a larger audience making it better when going against any competitors from the beginning.

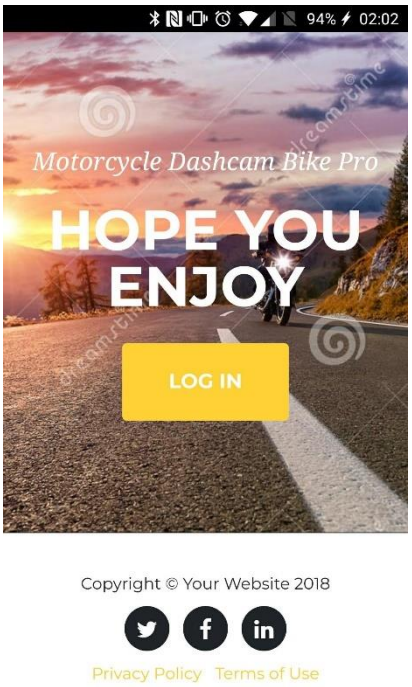


Figure 37

Login:

This is a simple login page, allowing the user to access their data on the next page. Again the layout is kept simple and to the point, no real information needed on what to do or how to do it with the username and password clearly labelled. The design was used as to make it clear and precise to everything that is needed.

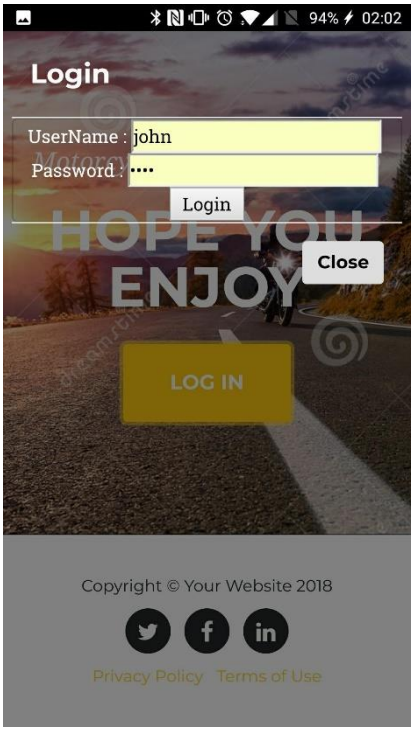


Figure 38

Services:

From testing, I felt this page needed to be the easiest to navigate and know what the user could do when logged in. I felt when comparing to other companies such as ekken, their app lacked in simplicity and they made it to complicated to navigate. This is all you can see when sent to this page so users wont miss out on what they can do. I felt the colour scheme highlighted the background quite nicely and would make it pleasent for the user.

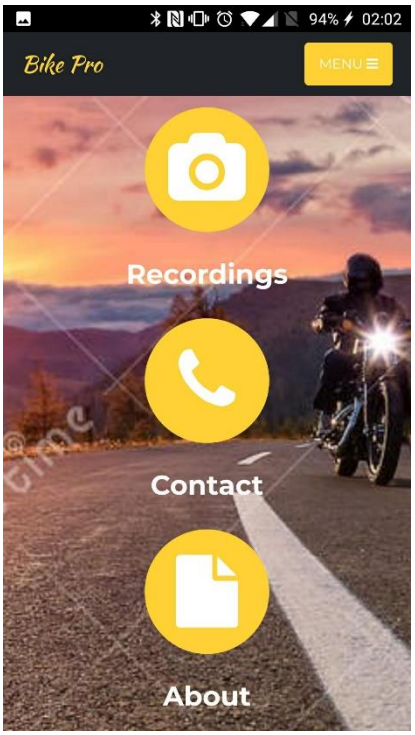


Figure 39

Recordings;

This is the page that has the most information which is owned by the user. They will be able to easily view their pictures or if they wish, they can simply click them and then delete them. The idea being with this design that no real training would be needed once you had used a phone a handful of times. It would make this page simple to use.

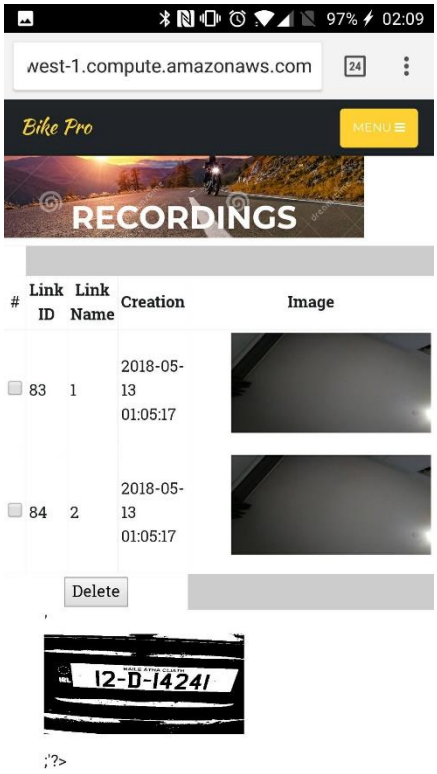


Figure 40

2.5 Testing

The testing of this project was done in parts, as a majority of the project works on independently. It needed to be able to do the work immediately once turned on. This means I kept the raspberry pi and webapp separate for testing to give better information on errors and to help understand what wasn't working on an individual level.

The first testing was done on the raspberry pi. I tested to make sure the pi could run the code automatically when switched on and if any errors occurred that it wouldn't just stop the script.

The second test was to ensure the raspberry pi wouldn't overheat if left active inside the blackbox while taking pictures or videos.

I tested the raspberry pi to ensure that when it was taking pictures the necessary information was being sent to the database and the server. Also, to ensure it displayed on the webapp.

When testing the recognition software, you must be in a virtual environment to have access to the necessary imports. This would interfere with the script starting on boot as there is no work around for entering the virtual environment without entering the necessary code into the terminal.

Testing done on the webapp, was making sure the login was grabbing the correct information and that user's contents. To also ensure that the proper pages were occurring.

Finally on the webapp, was to ensure that when the user deleted any pictures, that the information for that picture was also deleted from the database and the image from the server itself.

2.6 Customer testing

The testing was done using one customer to completely test the device while using my own motorcycle to get accustomed to how the device worked. She had used previous dashcams before having an idea for how go pros and dashcams differ and what he thought of Bike Pro.

The results of the testing went quite smoothly, the most time being taken for getting the website link typed in and loaded up. She was able to enter her login details in less than a minute having previous experience using ekken application. While the bike was switched on and taking pictures, she was able to login and get to the recordings page with the results already appearing on the webapp. The only issue she had was that there weren't more options available but other than that it worked quickly and smoothly to her liking.

Testing:

-Accessing site: 30-80 seconds(depending on internet)

-Logging in: 30-70 seconds

-accessing different parts of site: 10-40 seconds

-deleting picture: 20 seconds

After logging in all she needed to do, was switch the motorcycle on and when it came to the webapp, she stated it was very simple to use and easy to navigate and that the design was very pleasing to look at. The following images taken, are the project being tested with the customer.

Shown in figure 41 is the blackbox created for the raspberry pi.

Figure 41

Shown in figure 42 is where the raspberry pi would be placed inside the blackbox.

Figure 42

Shown in figure 43 is the position of where the blackbox is held on the bike, which can be easily secured to the bars.

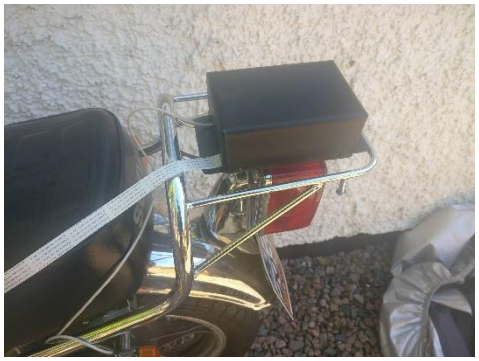


Figure 43

In figure 44, is the cable connecting the raspberry pi to the battery of the bike which will automatically switch on once the ignition is started.

Figure 44

In figure 45, is the position of the camera if permanently attached to the bike.

Figure 45

In figure 46, you can see the customer accessing the app.

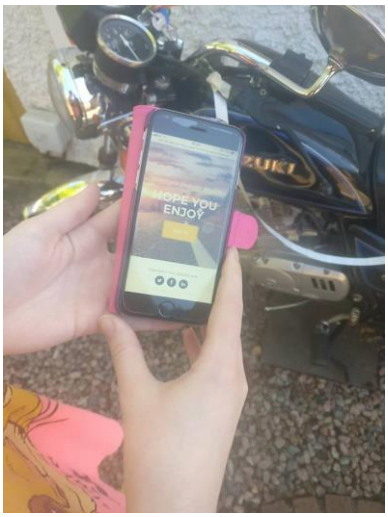


Figure 46

In figure 47, she is entering the username and password to access the site.

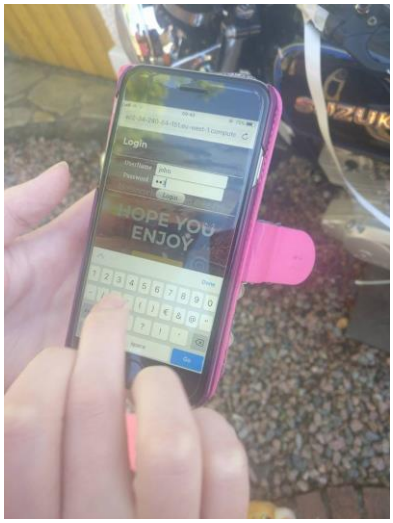


Figure 47

In figure 48, it shows the user then accessing their service page.

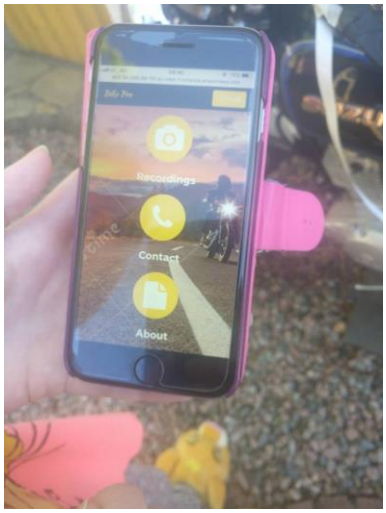


Figure 48

In figure 49, they have then accessed the recordings page were all images are displayed when uploaded by the raspberry pi.

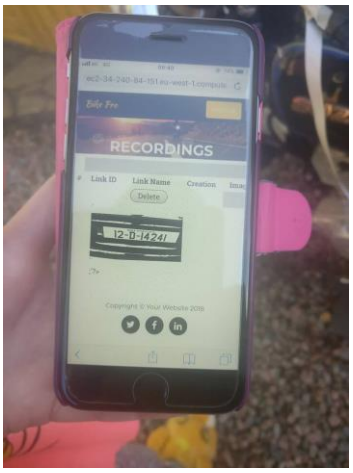


Figure 49

In figure 50, the motorcycle is then switched on by the customer.

Figure 50

In figure 51 she taps both buttons and presses the delete button.

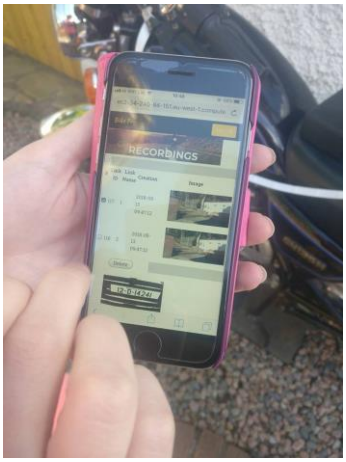


Figure 51

In figure 52, you can then see the images where removed and the testing is completed.

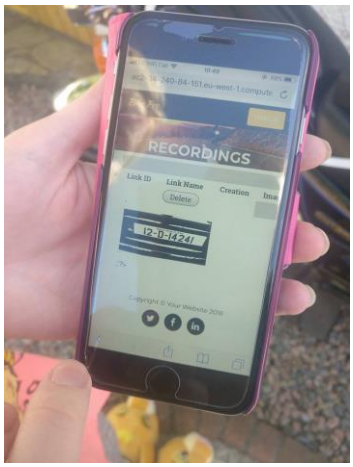


Figure 52

2.7 Evaluation

The results of the testing were useful as they highlighted some problems that would have ceased the project from performing to its best standard. One such problem led to the creation the loop for the internet so the script will continue taking pictures and upload them as long as there is a viable connection to do so.

After letting the raspberry pi run for over an hour, a solution was needed as when I ran the following code in figure 53, it was returning 50.1'C when on average it would run at 40.1'C. To solve the problem I made an adjustment to the blackbox which would allow more air in. A decision was also made to use a fan that is attached to the case of the raspberry pi.

```
import os
import time
def measure_temp():
    temp = os.popen("vcgencmd measure_temp").readline()
    return (temp.replace("temp=",""))
while True:
    print(measure_temp())
    time.sleep(1)
```

Figure 53

When testing the raspberry pi and app in sync, the issues revealed helped to implement more error handling to show the user what mistakes are being made or what problems have occurred.

The result of the recognition software, it turned out to be a major flaw that maybe the Raspbian update will eventually correct but until then there is no way to activate in the virtual environment rendering the software useless. The only result being, a camera which has the capabilities for license plate recognition software installed already.

For the login and delete, same as before it was just ensuring proper error handling to provide the best and most efficient system to the user.

3 Conclusions

The conclusions I have come to while building this project is that most of my problems occurred with the technology available and its limitations. One such example; as the camera's I used, if one had been accessed with a higher quality resolution and license plate recognition, I wouldn't need to rely on the current software not being able to provide ways to conduct these scripts. The better-quality camera being able to take pictures every second rather than every six seconds for the pi camera. The reason that is important it when driving, a lot can occur in six seconds especially if driving at a fast speed.

The advantage of this device to users is its safety aspects when a crash occurs. Not only is the SD card hidden away and protected in an almost unbreakable case. It also uploads its data without user interaction, giving the user peace of mind that their footage of the resulting crash will be recorded and saved.

There are disadvantages to this project such as how easily damaged items can get. Such as the raspberry pi if running too many things at once, and overheating could be an issue. Another issue was the camera only having capabilities to take pictures every six seconds and having no type of stabilisation to them resulting in some blurry images on the bike. Only resulting in clear when the bike is at a standstill.

I also found that, the technology can be quite finicky, as when installing open cv, it needed to be done multiple times before finding the correct one and as such, the image on the SD card has become damaged. If damaged the SD card has a tendency to overheat and then freeze if running too many things at once. I have had to reinstall the data once when the SD card was corrupted and even when reinstallation was done correctly, the amount of information needed to do all the work takes up the majority of the 32gb SD card and it still encounters issues when running certain jobs. Errors mainly occured when dealing with the recognition software making me lean even more towards using a camera with the software already installed.

4 Further development or research

With more time put into this project, there are aspects which could be improved, or devices added to improve the performance. As I had to use a GSM/GPRS Shield which used a majority of the GPIO pins, I was unable to add a multi-adapter which would allow for multiple cameras to be used on the device. An added battery would be beneficial to the raspberry pi allowing it to continue to record if the bike has suddenly cut out or switched off from a crash. It would also be convenient if the user has switched the bike off before the uploading has been completed.

On the webapp it could be improved with as the capabilities to stream from each camera for social activities or just to ensure the cameras are working correctly. The ability to edit videos on the webapp and that when deleting the picture or video, it would also delete from the raspberry pi.

The areas this could be improved in is on the commercial side by being able to add categories such as Tour, Race, or just your average rider. This would improve the quality of the product and make it a more unique experience depending on what style of rider you are. To further improve this the user could have a more individual style to suit themselves if they do more than one style they can narrate the device around their motorcycle and themselves. The cameras could also be further developed allowing for better quality video footage giving the user better memories depending on their journeys.

When it comes to the legality of the recognition software, there are things that could be issues such as with the Gardai, they hold their data in databases, but they are legally only allowed to have them for a year before deleting. Now as dashcams aren't considered personal data, its how the information is held that is the risk as to it being online and accessible to people if it is hacked.

5 References

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6 Appendix

6.1 Project Proposal

Project Proposal

Motorcycle Dashcam

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BSc (Hons) in Computing

Internet Of Things

20/10/2017

Objectives

My objective for this project is to build a motorcycle dashcam to record/document the travels of the user including pictures and videos. Its main priority is safety as I will be adding photo to capture a licence plate if in a crash. It will be saved to an SD card in the raspberry pi. To make it more efficient I will have a vibration sensor so if the user is ever involved in a crash, the data has a better chance of being saved.

Added features to help achieve my objective to a better standard would be multiple cameras to capture all angles to provide the most safety to the user after the crash.

If the user is also tours or documents their travels for the scenery, better quality cameras can be used that will still have the same safety but will provide the user with good quality footage at the end of his drive. It will also have the capability to be uploaded to their phone or computer as soon as the raspberry pi connects to the internet through Bluetooth or via a sim that can be added per the users request so it can be uploaded easier. One of the cameras will have the capabilities to be attached to the helmet which gives it a better view in safety matters but will also provide a better-quality video for users documenting. It will also be connected to the raspberry pi meaning if vehicle is turned on, the camera will also be recording. A feature may be included so when the vehicle is idle, the camera will stop recording and restart as soon as the bike starts moving again.

For certain users who travel more, there will be better add-ons such as a touch screen which can view each camera but will also have GPS integrated and will show the map on the screen. A pair of earphones may also be added as to keep the user from taking their eyes off the road, so the directions will be re-laid to them through the earphones.

For users that are on long distance drive and require the need of their phones, the touch screen or raspberry pi will be able to sync with the phone giving the capabilities to have phone calls or even listen to music.

Background

The motivation behind my project, is I am familiar with the area as I drive a motorcycle myself and I feel that the technology that could be implemented for your own safety could be much more effective than the current models. As I go for hours on end, I require a good quality footage for safety and my own frame of mind, I use an ekken which is like a go pro. The big problem that shows first off is the battery life. To always be recording, I carry along two spare batteries but as I've mentioned, there is also no way to tell when the battery as depleted itself other than a beeping noise or a red flashing light on the camera itself but as the engine drowns out all sound, there would be no way to hear the beep and the camera itself is attached to the helmet so no way to see the blinking red light. The second problem with the go pro style cameras is when an actual crash occurs, to protect the camera, if your helmet hits anything, the attachment holding the camera will snap in order to try protecting it. Now the case around the go pro would be very durable but if it was a high-speed crash, you not only have to worry about the camera damaging on impact but also about losing the actual footage as it would be easy for it to disappear on a backroad or even a main road.

Go Pro:

Advantage-

- High Quality footage.
- Ability to be placed on bike or helmet.
- Large storage.
- Lower quality for longer battery life.
- Easily removed or detached.

Disadvantage-

- Detaches in case of a crash.
- Short battery life.
- If attached to side helmet, high speeds can cause wind friction to constantly move helmet to side of camera.
- Very large and noticeable.
- Expensive

For cameras mounted to the motorcycle, these have the capability to be connected to the battery of the bike meaning if the bike is running, the camera will be recording also. They can be placed on the front or back of the bike making the view narrowed depending where it is placed. In the case of a collision, there wouldn't be as likely a case of the camera getting damaged as it is usually hidden on the bike. In case of crash of the bike being destroyed, the rider would need to be weary as the sd cards are usually inside the cameras, so they can easily be broken. They are usually much smaller size making them easier to hide on the bike. The more expensive ones include GPS, but they will have a much larger size. They also have cameras with a sensor to detect the vibrations of a bike, so it will know if a crash has occurred. If a crash does occur, there is an external battery so if the bike cuts out suddenly from the crash, the camera will recognise this and keep the camera recording for safety purposes.

Mounted-cameras:

Advantages-

- Connected to battery of bike.
- Easily hidden.
- Large storage.
- Connects to cloud.
- GPS capabilities

Disadvantages-

- Expensive
- More narrowed view
- SD card inside camera
- No protective case

Technical Approach

Starting off, I have yet to test how reliable the raspberry pi will be when I have it recording a video for longer than an hour. For this reason, more than one raspberry pi will be needed. I'm also looking to use a multiadapter to use up to four cameras. They will be placed on the front and back of the bike and also on the helmet. A touchscreen will be implemented for the other applications such as GPS and video capabilities. It will also connect to mobile phone for more applications.

The raspberry pi itself will be placed underneath the seat. This will keep it protected if theirs ever a collision as it will be in the most cantered position. To keep the raspberry pi from overheating, a liquid cooling system will be added but as the amount of space varies depending on how many raspberry pi's are used, an air cooling system might be next best option. So, the two-raspberry pi's will be in some form of containment under the seat with a pipe to the outside sucking air in to maintain the temperature of the raspberry pi's.

The cameras are not waterproof, so I will need to 3d print some form of a case or create one to suit it. It will also need to be sufficient in size as to keep the cameras from overheating from overuse. How I fit the cameras to the bike will also be improvised on the case created to make an attachment I can latch/fit the cameras into and then attach to the bike. The camera connected to the helmet will have slightly different attachment to make it easily removable. Depending on the rider, they can attach the camera to a chest piece also. The wire connecting the camera will need to be fixed through the jacket so when you sit on the bike, you simply connect it to the multiadapter and check touchscreen to make sure camera is working correctly.

The touchscreen will be placed on the tank of the motorcycle, so the rider can interact with it. It will be able to detach from the bike for safety. This will also need some form of a cover as it is not water resistant. The touchscreen will have either a Bluetooth feature or earphones connected to the helmet.

The SD card will have some form of protection that will lock down on impact/collision to save the SD card from being damaged. This will be connected to raspberry pi as it will need to have some link with the vibration sensor to know when to shut.

Special resources required

Raspberry pi x2

Touchscreen for raspberry pi

Multi adapter for cameras

3-4 raspberry pi cameras.

Air intake for raspberry pi.

Technical Details

The language I will be using is python as it works best with the raspberry pi and will be the easiest to implement. I will also be using python for the photo recognition software that will detect the license plate. This is the location for a face detection for the code I hope I can implement or change for the license plate.(https://pythonprogramming.net/raspberry-pi-camera-opencv-face-detection-tutorial/)

I will also be using android studios to develop the app and in order to connect both the raspberry pi to android studios I will be using dweet to make a connection for all the functions of my app. (http://dweet.io)

Evaluation

The first few tests I will initiate will be how much the raspberry pi can handle in terms of different processes. I will attempt to have the three-four cameras recording at the same time to see how long it will take to overheat. I will then implement my cooling system to prevent overheating and to see how much processes it can handle with the added cooling system.

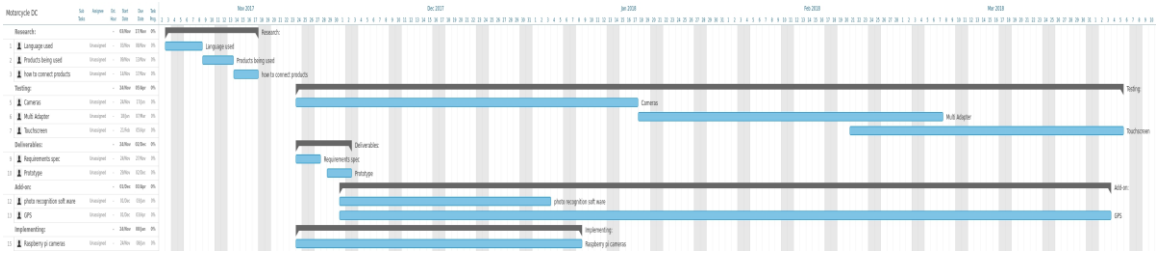
Then, if two are required a test to see how best to split the processes between the two-raspberry pi's will be done. With the two being used and the cooling system most likely added, I don't think overheating will be an issue. I will then perform integration tests as the camera's will be connected to one raspberry pi and the touchscreen will be to the other. I will use Bluetooth to connect the two in other to show the video of the cameras on the touchscreen.

The vibration sensor will be used to conduct drop tests to ensure that the correct results occur when a vibration reaches a certain range. The information that is developed from the drop testing will be used to initiate the reaction of the mechanism around the SD card that encloses for protection in the case of a detected collision. The raspberry pi will also use that information to start the external battery if the bike suddenly cuts out. This helps ensure that the cameras will continue recording and will also automatically record the previous two minutes before the collision. Also, when it happens, the information is authomatically saved to the SD card as it is considered top priority and will over-write any previous information.

When testing the touchscreen, I will be testing it with elements such as earphones in the helmet be it, Bluetooth earphones or cabled ones. It will need to connect to my phone so that google maps can be accessed or phone calls and even the capabilities of music being played through them. When first starting the bike, it will can check each camera to make sure there up and running before you start off on your journey.

Depending on the driver, there will be more capabilities with the cameras such as when the bike is in motion, you can have to take pictures at certain intervals throughout the drive such as when driving past a landmark. For drivers on the road longer than a few hours, to save the SD cards memory, when the bike has remained in a spot for longer than a minute, the recording will stop to save 1 the SD card and to make the drivers life easier if there looking to edit it as they won't have to delete out all the stops. For safety reasons, you can have it so only the camera on the helmet switches off, but the cameras mounted to the bike will continue as a collision can still occur even when at a standstill.

6.2 Project Plan



6.3 Monthly Journals

Reflective Journal

Student name: John Cahill

Programmed (e.g., BSc in Computing): Internet of Things

Month: September

My Achievements

This month, I was able to create the design and idea of the project and propose it. My idea was accepted which is a motorcycle dashcam with added features such as gps integration, using multiple cameras on the bike at once. Also having a mini screen for the different applications such as google maps or connecting to my phone in order to listen to music or phone calls.

My contributions to the projects included so far are ordering the different parts I need such as the camera to start recording. I have also researched the different applications I'll be using. I have tried to further the scope by researching a vibration sensor so if there was a crash on the bike, the video up to 1 minute before it happened and up till video stops is recorded automatically for safety reasons.

My Reflection

I felt, it worked well to get the scope of my idea and keep it as broad as possible when doing my research on the different applications. So depending on how well the project is progressing, I will never be stuck on what to do next.

However, I was not successful in doing very much with the raspberry pi as I couldn't configure until the end of the month.

Intended Changes

Next month, I will try to start coding on the raspberry pi and using small jobs with it in order to get used to using it and try understanding the way I'll be using it later

with the camera and the touchscreen at a later date. I will also be trying to get an external battery as this will be the same as when I connect it to the battery of the bike.

Reflective Journal

Student name: John Cahill

Programmed (e.g., BSc in Computing):

Month: October

My Achievements

This month, I was able to research the equipment I will be using and how I will test it when it is set up. I have also finished the proposal so the project details, I have a better concept for my project now.

My contributions to the projects included the project proposal that needed a technical heading so research for my project was completed to figure out how it would be implemented. It gave me more insight to what I need to do next and has given me a timeframe for my project and what I should start on first to get the project going.

My Reflection

I felt, it worked well to research and review what needs to be done. I also felt that my work ethic to try and have a set plan has helped me to get a better view on my next few steps of the project.

However, I was not successful in getting much done in terms of the raspberry pi itself as I have not begun using anything with it. I have also yet to get the camera in order to try and test it and see the applications that can be done with it.

Intended Changes

Next month, I will try to get the camera and start the project to see what I can do and test the capabilities of the raspberry pi itself. I want to see how the camera runs on full recording and how it effects the raspberry pi and if it will overheat it.

Supervisor Meetings

Date of Meeting:13,20,27/10/2017

Items discussed: Project Proposal

Action Items: How and what to talk about in the proposal and how to tackle the headings and different ways to talk about my project and how I can implement different items for it.

Reflective Journal

Student name: John Cahill

Programmed (e.g., BSc in Computing): Internet of Things

Month: November

My Achievements

This month, I have worked on and completed both the requirements document and the technical document building more on the development of the project and where it is headed. I have also started coding of the UI for the app for the user to interact with the Raspberry pi and some functionality with the Raspberry Pi and the camera such as it immediately recording as soon as the Raspberry Pi is switched on.

My Reflection

I felt, it worked well to get the documents and the direction I want this project to head in. There is a much better standard to the work quality I feel I will complete over the next few months while developing the project,

When working with the Raspberry Pi, I find it to be quite unstable at times, such as working when it wants to. Example is when an error occurs and if I switch everything off including WIFI and leave it for a certain time. It will start working again as soon as it is switched back on. In saying that I still feel the progress I made with the camera is on the right track and know where I want to go next when programming it.

Intended Changes

Next month, I will try to continue developing the raspberry pi and developing the app to a better quality. Next, I want to try using dweepy to connect the raspberry pi and as soon as a video has ended, it being uploaded to the phone or to a database connected using SQL.

Supervisor Meetings

Date of Meeting:6,15,23/11/2017

Items discussed: Requirements document and Technical Document

Action Items: Discussed what to write for each, and how to revolve it around my project and where I want the project to go and what direction for it to take, such as what sections of the device to develop first and what to leave till a later date.

Reflective Journal

Student name: John Cahill

Programmed (e.g., BSc in Computing): Internet of Things

Month: December

My Achievements

This month, I have worked on and completed both the requirements document and the technical document building more on the development of the project and where it is headed. I have also started coding of the UI for the app for the user to interact with the Raspberry pi and some functionality with the Raspberry Pi and the camera such as it immediately recording as soon as the Raspberry Pi is switched on.

My Reflection

I felt, it worked well to get the documents and the direction I want this project to head in. There is a much better standard to the work quality I feel I will complete over the next few months while developing the project,

When working with the Raspberry Pi, I find it to be quite unstable at times, such as working when it wants to. Example is when an error occurs and if I switch everything off including WIFI and leave it for a certain time. It will start working again as soon as it is switched back on. In saying that I still feel the progress I made with the camera is on the right track and know where I want to go next when programming it.

Intended Changes

Next month, I will try to continue developing the raspberry pi and developing the app to a better quality. Next, I want to try using dweepy to connect the raspberry pi and as soon as a video has ended, it being uploaded to the phone or to a database connected using SQL.

Supervisor Meetings

Date of Meeting:6,15,23/11/2017

Items discussed: Requirements document and Technical Document

Action Items: Discussed what to write for each, and how to revolve it around my project and where I want the project to go and what direction for it to take, such as what sections of the device to develop first and what to leave till a later date.

Reflective Journal

Student name: John Cahill

Programmed (e.g., BSc in Computing): Internet of Things

Month: January

My Achievements

This month, I have worked on trying to install open cv to try make a start on the recognition software. I have also changed my idea from a app to a webapp in order to produce a better quality product. I have also changed the information in the technical document.

My Reflection

I felt, it was a waste as I got no where with the open cv application, trying many different ways and no success. Also damaging my sd card in the process.

While I changed to a webapp, I feel like I have a better ui design for the webapp and it is more appealing. The update to the technical report also let me try and start on a few other sections also.

Intended Changes

Next month, I will try to continue developing the open cv and I also want to make a start on trying to get the website on EC2 on an ubuntu server.

Supervisor Meetings

Date of Meeting:17,22/01/2017

Items discussed: Open CV

Action Items: Discussed what to try do next month and where I can go next it I cant figure it out as planned. Also how to make a head start on the technical report.

Reflective Journal

Student name: John Cahill

Programmed (e.g., BSc in Computing): Internet of Things

Month: February

My Achievements

This month, I have worked on open cv and got it working but still havnt gotten a license plate recognition software file working as of yet. The EC2 is up and running and am now working on a php login with the webpage. I got a image going onto the server also.

My Reflection

I still have to try bide my time better as spent a lot wasting it on open cv and when I got it installed, I still couldn't get any code to work with it as of yet. I'm also having difficulty trying to get a id linked to the image taken in a database so I can then delete one and it will delete the other.

Intended Changes

Next month, I will try to continue developing the open cv and I also want to make a start on trying to get the website on EC2 on an ubuntu server.

Supervisor Meetings

Date of Meeting:11,25/02/2017

Items discussed: Open CV

Action Items: Discussed what how to try get the delete button in sync with the database and the image being held on the server.

Reflective Journal

Student name: John Cahill

Programmed (e.g., BSc in Computing): Internet of Things

Month: March

My Achievements

This month I got the database working with phpMyAdmin on the ubuntu server and also got the raspberry pi uploading the link to the database so the image now has a connection inside the database.

My Reflection

I felt I got a good head start this month but felt I could of tried to do some more for the open cv as It would be considered a complex part of the project.

Intended Changes

I can now move on to try get the delete button working and to delete both the image and database row that is linked. I want to make another go at the recognition software also as I feel I have the time.

Supervisor Meetings

Date of Meeting:3,15/03/2017

Items discussed: Open CV

Action Items: Helped with sting out the phpMyAdmin and trying to get it so it would only show the users images if there are two users.

Reflective Journal

Student name: John Cahill

Programmed (e.g., BSc in Computing): Internet of Things

Month: April

My Achievements

This month I got the tesseract working as a recognition software. I also got it so its taking picture on boot and uploading everything in a single script.

My Reflection

I struggled trying to get the delete button working and to get more work done in the technical report.

Intended Changes

I can now try to finish the delete button and get the site looking nicer. I also want to continue trying to get the login so the user can view there own images.

Supervisor Meetings

Date of Meeting:4,15/02/2017

Items discussed: Open CV

Action Items: Discussed how to get the login working and also went over the technical document and what else I need to have done for it.

Reflective Journal

Student name: John Cahill

Programmed (e.g., BSc in Computing): Internet of Things

Month: May

My Achievements

I got the delete button working to a point and also most of the technical document finished.

My Reflection

I felt I got enough done just in time for my project to be uploaded.

Intended Changes

Supervisor Meetings

Date of Meeting:5,11/05/2017

Items discussed: Open CV

Action Items: Helped me with the delete button and also reviewed my technical document.

6.4 Other Material Used

A survey was completed showing most users being older than 30. Most stated they would be purchasing this device for a specific reason making them more agreeable to figure out how to use the device properly. Most said they would prefer to just have it working but if having the app gives them the access to view and control

items they’d be willing to learn. They also said the idea of having a device that can do more than one function and also has the capabilities of having devices added or replaced easy is very appealing. As most complained about battery’s and how they’re would be no issue with the RP.