

## **Chapter 6**

### **Conclusion**

#### 6.1 Summary

This project had been proven to be challenging and it had given the author the opportunity to experience the entire process of building a product from scratch. This project took 6 months to finish and it manages to reach the objectives of this project. To sum it up further, this project are divided into the hardware and software part. Both the parts are equally important as it need each other to operate and to reach its objectives. Before the hardware and software implementation, researches were done and projects that are directly or indirectly link to this project were review and studied. Few of the projects were chosen as the main inspiration and source of information for this project. One of the examples is the Wireless Roaming Webcam project; its concept and application are similar to this project.

The hardware part can be mainly divided into three main parts, namely, the camera subsystem, the microcontroller and the PC ground based station. The camera subsystem job is to capture the image and send it to the microcontroller. Using the data from the camera, the microcontroller relay the data to the PC ground based station through its RF link. Once the PC ground based station received the data, its job is to display the image data out to the user. Even though this project didn't use any air vehicle to proof its reliability, it was proven that it can achieve its objective by sending the data through the RF link. The camera and the microcontroller can be mounted on an air vehicle and data can still be received by the PC ground based station through the RF link.

The software parts are mainly consist of Visual basic, though the Assembly language used to program the microcontroller are consider as part of the software part. The Interface for this project was created using this VB. In VB, the interface had display that can display both the ASCII and the binary code. Using these codes, user can used it to convert it to image.

There are some shortcomings in this project. One of the obvious one is the fact that the camera used in this project is the CCTV type. It was actually planned to use the serial port camera in the beginning but due to shortage and limitation in budget, the serial port camera was changed into a CCTV. By using a CCTV, the data that were received are in video form, this make it impossible to convert it back to image form since the data go through an ADC and the operating frequency is not the same. Another of the shortcomings is the fact that the RF can only communicate up to 20 meter. Range that is above 20 meter might cause inaccurate data received due to disturbance and noise, if the range is further increased, the RF cannot communicate at all.

All in all, the project is a success in term of the objective, as it manages to reach the objective that was set. Though the result is satisfactory, it would have been a much better result if the serial port camera was used in the place of the CCTV, as it would not only show the image data but the image out as well. Still, this project needs a lot of improvement, and further discussion can be seen from the next subchapter

## 6.2 Recommendation for Future Project.

There are a lot of rooms for improvement as this project still left much to be desire. There are actually no end to the development and improvement to this project. Below are a few recommendations to make this project more appealing.

- Serial camera to be used instead of the CCTV, this will enable image processing

- Data to be presented together with the image, which mean that the image processing are also done at the same time the image data was displayed
- The user interface had more option to make it more user friendly
- Neural network are used for object recognition
- Use a better RF module, as the current one cannot communicate at range more then 20 meter, this will enable the air vehicle to travel further if a better RF module were used and this will also enable a higher frame transfer rate.
- Global Positioning System can be embedded into the microcontroller as well to enable location of the air vehicle to be known.
- A remote control encoder and decoder to be used, this will reduce the noise level in the data that was sent.

### 6.3 Commercialization Potential

In general, this product can be commercialized because its application is very vast. It can be use on a lot of area and fields. For example, this product can be incorporated into an air vehicle and use it for surveillance purpose. It can also be use for number plate recognition purposes provided future improvement such as neuron network are added in. Robotic application are also possible, with this product added in, controlling the robot from afar with the camera as the guidance is possible.

Currently, there are a lot of cameras on the market that can communicate using RF. One of the examples is the normal CCTV or security camera. Those cameras communicate with a receiver module, ant the receiver module is usually connected to the television. This project is different from the market because it uses a cost effective microcontroller. Using a microcontroller, add on or improvement to the product is easily available to the buyers. A microcontroller is also small in size and this allows it to be embedded into other product easily without putting a lot of weight into other product. Multiple tasks can also be done with the microcontroller, as the buyers can add more system into it without disturbing the normal operation of the camera. System such as GPS

can be added in. Further more, this product use the computer as a based station instead of a normal television; this will allow more improvement made available to the customer as the interface can be change to the customer preference.

Normal consumers might find it troublesome to use a microcontroller, as not everyone knows how to use or program a microcontroller, but this product can be market to the industry or company that do related work using microcontroller. In other word, technology based company are the targeted consumer. This product is actually can be lower if it was mass produced.

It is not easy to transform to opportunities as not a lot of companies might be interested in this product. The only way to persuade them is to show them the benefits by working out a prototype that can work in excellent condition as soon as possible. By giving the potential companies the demonstration of the product will make them more interested in the project. The product needs to prove its strong point to the company by showing the companies the different between normal CCTV and the embedded type camera.

One of the ways to turn this idea into real product is to join venture with companies that had experience in image processing and capturing. This will ensure that the product is marketable. Companies that had experience in this field, also normally can persuade potential customers more easily. More ever, if this idea is going to the market, a lot of improvement needs to be done, and companies that had experience can easily do that. It is not easy to find a company to invest into new product such as this, to persuade those companies, the benefits of the microcontroller needs to be outline properly.

In conclusion, this idea cannot be turn into product that easily unless more effort and improvement are done. There are still a lot of rooms for improvement for this project and also the idea is still in its infancy stage. The author would like to suggest that the more research and more improvements are done to it before put it to test on the market. This can be done by joining venture with companies that can provide research lab and had vast experience in research and development department.