What can we achieve through our medical drone project –- AirLife?

Group Name: AirLife

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2.1) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety and welfare.

As drones is more widely used nowadays, it has become a very useful tool for entertainment, photographing, and monitoring. However, it has never been used in providing immediate medical service. Drones have great flexibility and can travel a distance of half a kilometer in a few minutes. When an urgent medical situation occurs, a drone can reach the scene and carry a moderate amount of medical supplies in a few minutes. Meanwhile, an ambulance may take 15-20 minutes to reach the scene and provide help. There is a huge potential for drones to help dealing with simple but urgent medical situation like heart attack, asthma, epilepsy. When facing a complex medical situation, drones are not capable of delivering better help than ambulances do, but in other cases, drones can provide more instant service than ambulances do, which may be crucial in saving peoples life. Instead of replacing the current ambulances distribution system, we plan to build a medical drone system that aims to be a supplement to the ambulances distribution system, which can remarkably reduce the workload of system and provide more effective service. The system is great for places like schools, park, shops malls and can provide medical supply (mainly medicines) for medical situations including heart attack, asthma, epilepsy, etc.

The AirLife project is a medical drone system which can provide the users with the medicine they need with the access of 200 meters and in a fast speed. It's a convenient method for users to get the medicine by using a mobile phone application and a drone. Our project applies engineering principles to meet its technical needs while safeguarding public health, safety and welfare. We build this project by using the DJI drone to deliver medicine, Android application to control the drone and receive the picture and locations of the drone, and cloud servers to communicate the drone and the controller. Since this project is mostly used in the in-door environment, the path could be very complexed. The most important part of the medical drone system is the computer vision of it.

Considering the public health and safety, we use a high-developed DJI drone and a drone landing pad for the testing. In this way, the drone can land properly without any security concern. And in the further landing test, our team will do more flying tests to make sure that the drone is stable during the delivery and won't cause any harm to the users.

By using this kind of self-navigated medicine delivery drone, those patients who are disabled can get the medicine conveniently by sending the message through the mobile application.

2.2) An ability to apply engineering design to produce solutions that meet specified needs with consideration of global, cultural and social factors.

In our AirLife medical drone delivery system, we used products and service in the world. First we used DJI drone. DJI is a Chinese technology company which provides high quality drones. And our server is built on Google cloud server, which is an American company. And the mobile application platform we use is Android, which is developed by Google. These various collaborators from around world contributed to this application according to their unique abilities.

We plan to use DJI drone as our primary device. DJI is the world's leader in commercial and civilian drone industry, accounting for over 70% of the drone market (Wikipedia, 2018). DJI`s drone product is widely considered to be safe and reliable, with a mature developer's toolkit for developers to deploy their application. DJI provides us a mature developer's toolkit-MobileSDK, providing full access to all DJI drone`s capabilities. With MobileSDK we can simplify low level functionality developing such as flight stabilization, battery management or signal transmission and focus on our application. (DJI Company, 2018)

And the cloud server we choose is Google Cloud Platform. GCP, offered by Google, is a suite of cloud computing services that runs on the same infrastructure that Google uses internally for its end-user products, such as Google Search and YouTube. Alongside a set of management tools, it provides a series of modular cloud services including computing, data storage, data analytics and machine learning. Google Cloud Platform provides Infrastructure as a service, Platform as a service, and Serverless computing environments. By using GCP, we can build a better and more stable connection between the medicine delivery drone and the user application.

As for the user application, we use Android as our platform. Android is a mobile operating system developed by Google, based on a modified version of the Linux kernel and other open source software and designed primarily for touchscreen mobile devices such as smartphones and tablets. Initially developed by Android Inc., which Google bought in 2005, Android was unveiled in 2007, with the first commercial Android device launched in September 2008. The operating system has since gone through multiple major releases, with the current version being 9.0 "Pie", released in August 2018. We choose Android because it is convenient to build and test. It's the best platform for us to build this open source medicine delivery system.

2.3) An ability to apply engineering design to produce solutions that

meet specified needs with consideration of environmental and economic factors.

Emergent medical situations happen every day and everywhere and require proper treatment. However, the current ambulance distribution system is far from effective on providing emergent medical service due to the restriction of time, location, traffic situation, etc. In this case, many people who encounter emergent medical situations do not receive proper treatment and may face threats to their lives. A more effective way to provide urgent medical service is required.

Because the AirLife project is built with a drone, a user application and a cloud server, we can say it is very environment-friendly. This system is an electric-driven system; thus, this system will cause no waste or pollution problems. The user application will only cause a little battery during the usage and the charge of drone is also very quick and efficient. Furthermore, the medicine delivery drone sometimes can reduce the call of an ambulance, thus it may be a good way to save a lot energy and human force.

As for the economic aspect, the medicine delivery drone system is affordable for most of the family and it's also very necessary for those families which have disabled people. In a reasonable price and intelligent way, people may save a lot of money on hiring a people focusing on the medicine care. The user only need a smart phone which has the controller application installed to get the medicine.

4.1) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments considering the impact of engineering solutions in a global and societal context.

AirLife is a drone system of mostly ethical use. What we want to achieve is to save people's life with professional knowledge about autonomous drone and its control. Whenever people's life is at risk,

AirLife is likely to be there before an ambulance does. On the other hand, it is important that the users' information collected by AirLife is not used by evil, with the help of the controller system handled by upright user and the smart identification system included in the cloud service. It is also important that the public will only enjoy the product after its trial version is experimented in a scientific way and the improved version is acceptable. No unsound prototype is allowed for public use. Finally, feedback after its initial appearance in market is highly valued. To better the product as well as make our land a better place to live, honestly listening to people's heart is a must-do.

Every year, more than 795,000 people have a stroke in USA, half of which are first time patients. Among them, 1 out of 20 patients dies (cdc.gov, 2017). It is conceivable that the lack of time to get a proper medical aid can lead to death caused by stroke. To solve this problem, apart from optimizing the reaction and dispatch of medical service, domestic gadgets can also help in a great way. AirLife actually helps. By tipping fingers on the screen of their smart phone, patients can send an automatically controlled drone to them. carrying necessary medicine. We estimate that with the success of AirLife, the rate of death caused by these fatal diseases can be greatly reduced.

In conclusion, taking into consideration the whole picture of current medical situation, AirLife is a professional and ethical solution to late arrival of ambulances.

4.2) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in an economic and environmental context.

AirLife is the project involving the use of unmanned flying objective, with respect to Treaty on Open Skies. Although AirLife may mainly cover indoor flying, it still can fly in the open air. Therefore, it needs to

follow rules given by Treaty on Open Skies. To get away with disturbing the flying courses of other aircrafts, the drone has to fly low, keeping the speed under control as well. It would be unethical to let AirLife fly with the possibility to cause an air disaster. Also, to minimize the cost of power used for driving, a special design to use solar panels to recharge the drone will be seriously considered. To save energy as well as reduce cost, fossil fuels will not be considered as one way to drive the system.

"On February 14, a helicopter crashed on Daniel Island in Charleston, South Carolina in the US. Reportedly, the crash was caused by a drone that was flying nearby." (Neuray, 2018) This is not unusual in every major newspaper, and every time the issue is caused by a single drone. To prevent similar accidents, a firm obeisance to treaty on open skies is evitable. Apart from prevention of accidents, it is also important on the ethical level to save energy and make our own contribution in environmental protection. To achieve this goal, we will try to use renewable energy to fuel the drone, which of course, in this case, the solar energy. It is acknowledged that fossil fuel is limited, and it can take a long time before its natural reborn. Therefore, we will use electricity instead of gas to make everything work.

In conclusion, AirLife, in accord to the code of environment and economics, is a professional choice.

7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

AirLife, as its name indicates, is a life-long process of practicing what we have learned and improving what is yet to be found. Since the project is basically about the control and design of a drone, team members have to learn knowledge about how to control the flying course of the drone, which is far beyond the design of hardware or software as we have known before. Apart from the use of drone, what we also have to be aware of is that we have to take into account the economical and global impact.

For the economical aspect, we must find ways to measure the cost, both financially and environmentally, which all the team members have never seen before. In the following section, detailed measurements will be determined in a scientific way, and probably a gauge for measuring parameters will be designed. It is also possible that there is a model we can later build to simulate the problem based on various platform, for example, MATLAB. For the global aspect, we have to make sure that the design is geared to reality and fact that ambulance may not be quick enough to save people's life.

In conclusion, this project will give us a chance to acquire new knowledges that we have seldom be exposed to before, and a great platform to apply those knowledges to something really meaningful, both to the society and to us. The project will also increase our abilities in acquiring and applying new knowledges to real-life issues later when we become real engineers.

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