**Smart Excavator Based on ADI Technology**

**Individual Report – 19/8/2016**

Benjamin Withers – Imperial College London

**Preface**

This report covers what was completed in the last week of the IROP. This is by no means a final report. A separate final report will be written as part of the Imperial IROP Bursary requirements. Another smaller report will be written to cover personal matters and opinions of my stay at Tsinghua University.

**Tasks Completed**

All 3 mounting plates were tested and the smallest one (48x48x7mm) fit perfectly and did not suffer from bending when the robot arm was fully extended, an issue that both the 58 and 68 millimetre square plates had.

PLA plastic certainly is not the best material to use, a 3D printing filament like ABS or Nylon would be ideal due to their toughness and durability. In this case, making the plate smaller decreases the forces applied to it when the centre of mass of the arm is way over its pivot point. The larger plates would bend when this occurred, due to the larger force (for the same weight, longer distance to pivot point increases the turning force applied).

With the robot arm now mounted properly and securely to the top mounting platform of the vehicle, the next issue was to control it. Sadly before testing could be done, the power supply for the motor HAT failed (due to overloading the servo motors or attempting to control too many at once), meaning that until a replacement arrived, no testing could be done on the arm.

In the meantime, after some researching online, I came across a repository containing Python code intended for the Raspberry Pi and motor HAT (the Adafruit 16 channel servo motor HAT, somewhat similar to ours). This code uses inverse kinematics, a mathematical process of determining the motion required from a given outcome, in this case, taking xyz Cartesian coordinates as input and providing servo control commands to move the arm to the input given. However, the code is intended for use on a more primitive robotic arm with only 4 degrees of freedom. In order to make it compatible with our arm, the code has to be changed considerably. Nevertheless, if it works, it would make future arm control much easier.

**Plan**

**Conclusion**