5.3. User Manual for GUI (Graphical User Interface):

Before running the User Interface, one should have connected the laptop WIFI as described in the Camera section of Machine vision, also should connect the both Arduino board in the corrected port.

The User Interface has four section as seen in the figure, at the top most section, are the button used for automation, at the bottom most section, different kinds of information displayed. At the right most section, user can have manual control of the whole system using the buttons available there. And at the middle there two windows available from the left window one can see through the robot camera used for automation, and from the right camera one can see through the front camera for looking into the outer environment in order to control mobile vehicle.

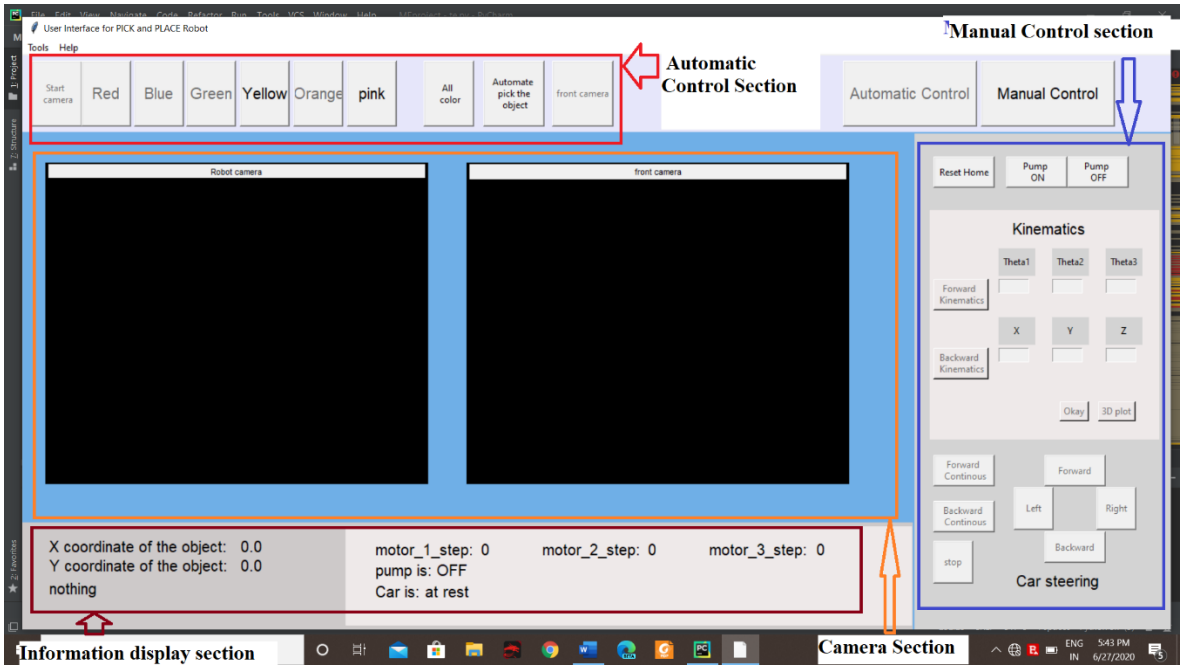

Figure: Basic structure of the User Interface

Now, there are certain steps, one should look into in order get the best understanding of this User interface.

1) After opening the User Interface one may see that in figure many buttons are clearly not visible or we can say disabled (not functioning right now), it is because we need to define IP address of the camera first in order get any automatic control or in order to visually see the environment. First go to the **Tools** on menu bar and select **Camera Settings**, then a window will pop-up where one has to write the IP address of robot camera correctly in the format **"/shot.jpg"**. after that click **OK** button to close the window.

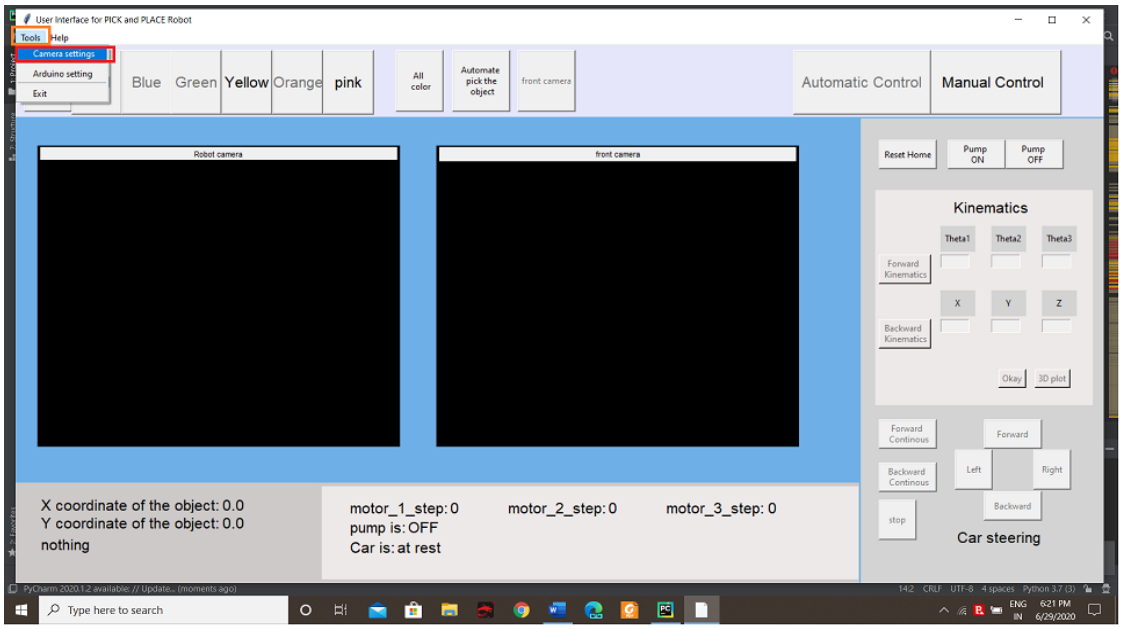

Figure: Tools

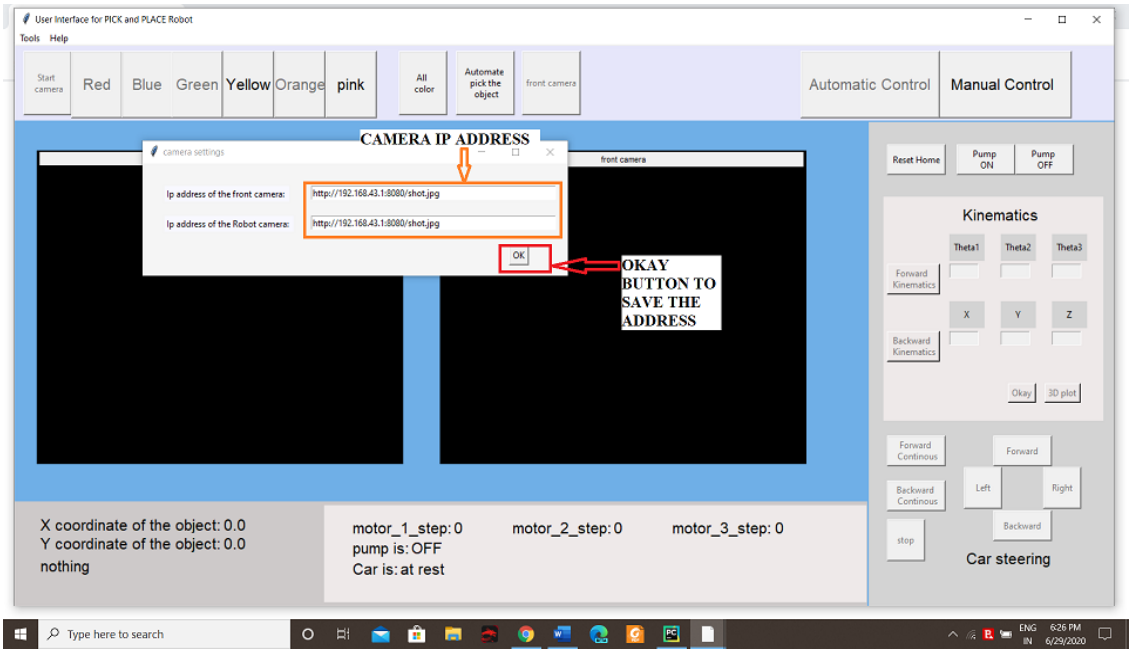

Figure: Camera settings

2) Following step 1 "**Start Camera"** and "**Front Camera"** buttons will be activated. By pressing "**Start Camera"** one can look through the robot camera in the left window and by pressing front camera one can look through the front camera to see the outer environment in the right window.

On thing has to be noted the user can not see through both the camera simultaneously so whenever one camera starts other stopped.

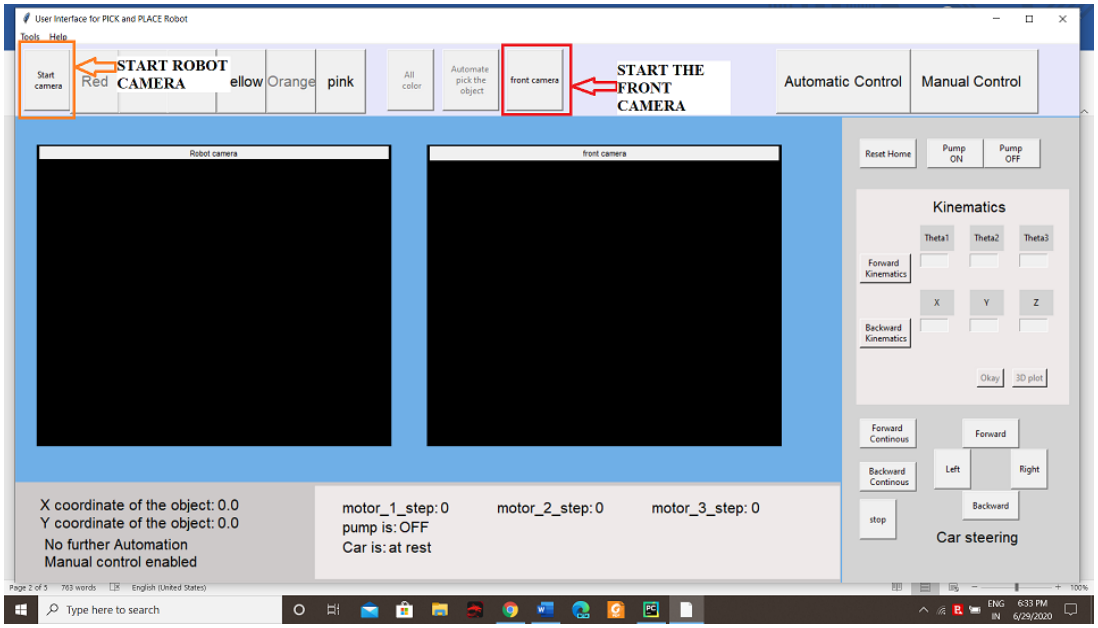

Figure: Start camera and robot camera

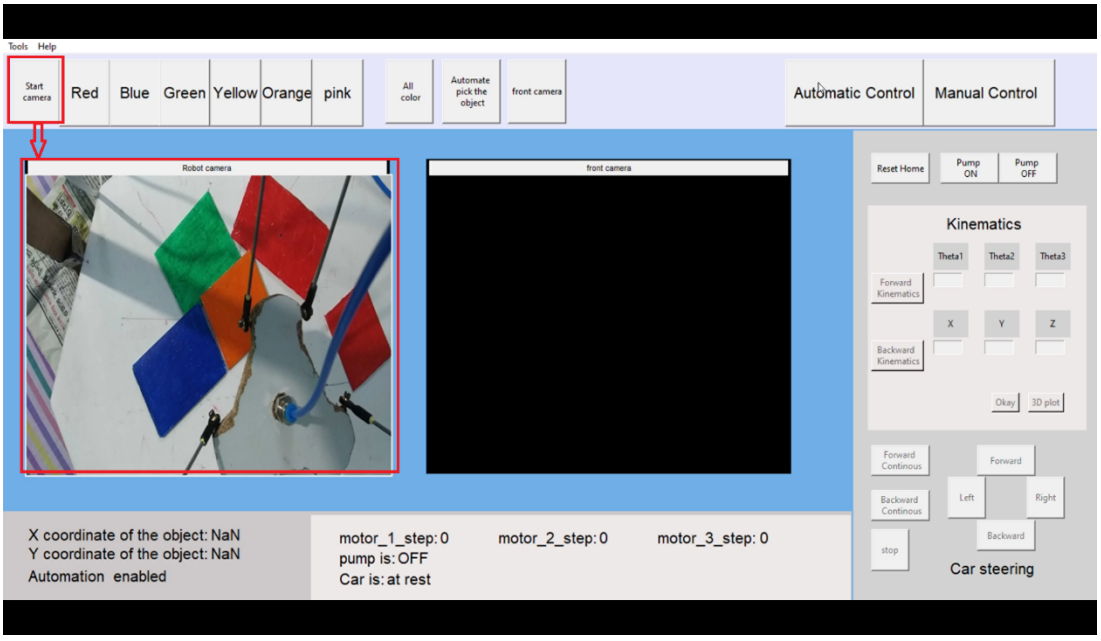

Figure: Robot Camera

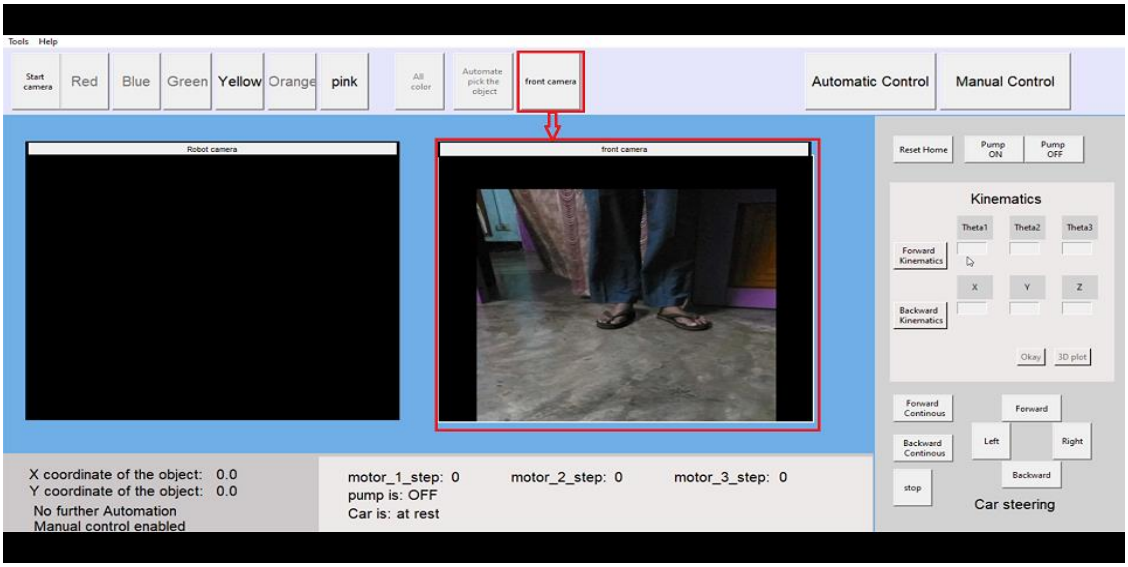

Figure: Front Camera

3) After step one **Automatic control** button will be activated, so now user can either allow robot to ick up the required colour or object or manually control the system. For accuracy and precision as well as stability of system it is better to manually control the vehicle (step 7) to positioning of the object along the workspace of the ROBOT so that it can easily do pick and place operation with no unitality or failure. User Interface two section dedicated to Automation and manual control; we will discuss them accordingly.

4) By pressing the automatic control button, Automation will be enabled and the subsection **Kinematics** of the manual section will be disabled to avoid any unnecessary serial data corruption.

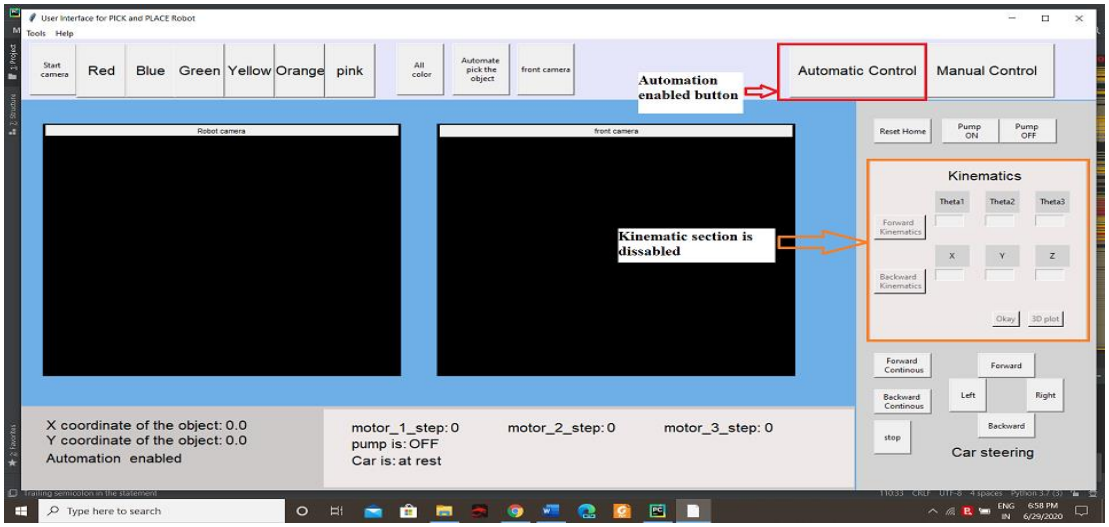

Figure: Automatic control

5) User can now detect the object based on its colour by pressing the required colour button. By doing so the color object will be detected on left window of the camera section, and its position will be displayed on the information section bottom.

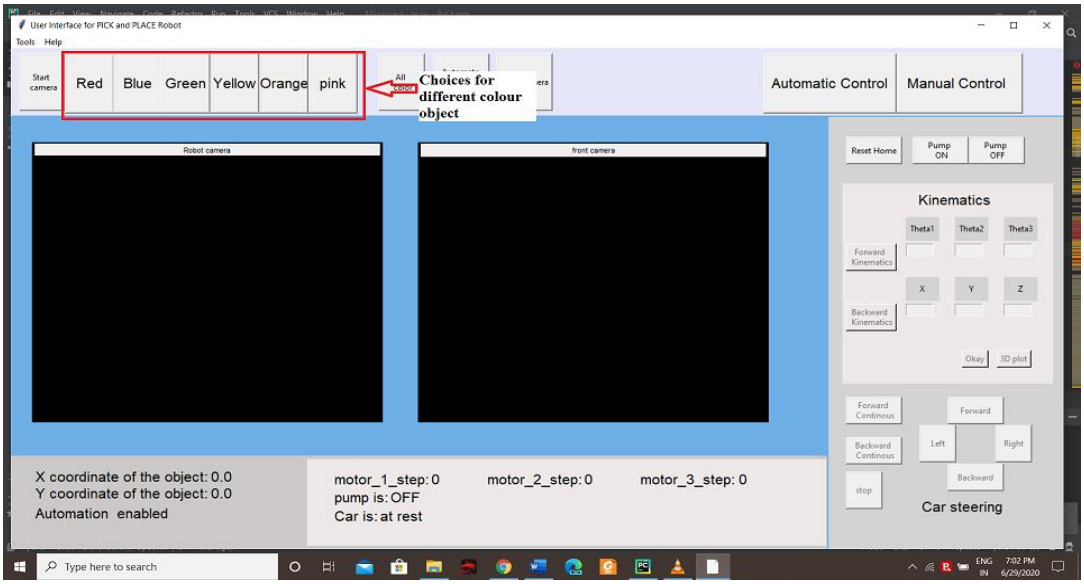

Figure: Different colour option for object detection

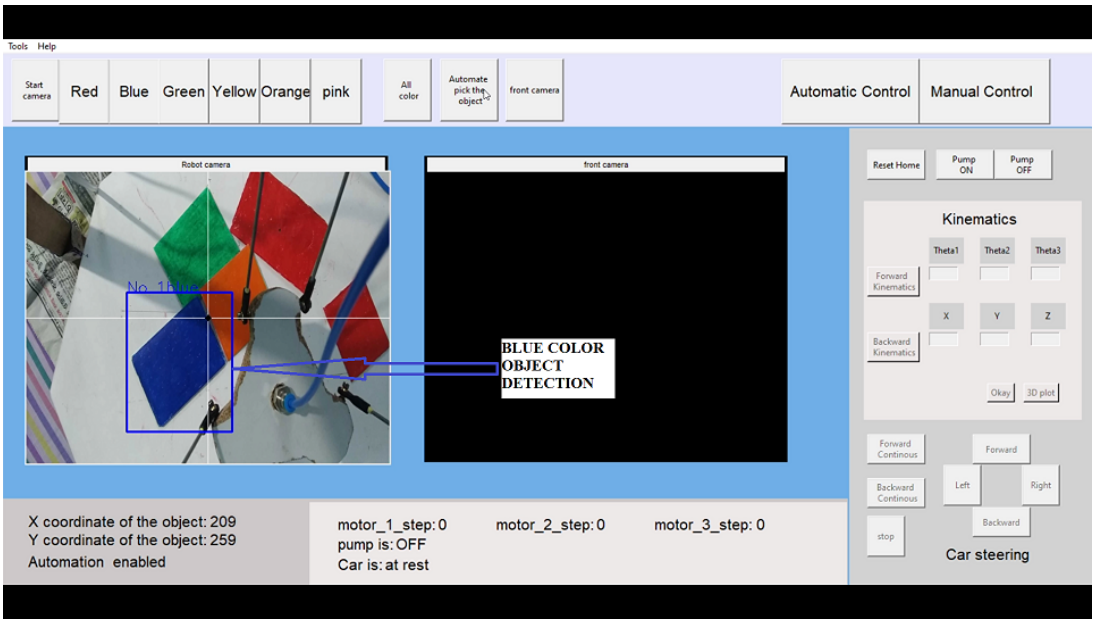

Figure: Blue colour detection

6) After finding the object location user can now press the "**Automate and pick the object"** button to pick the coloured object automatically, after that a image will popup showing where the end effecter is going the pick the object, by closing the image the automation will start. The process will continue until it pick and place all the required coloured object available in the screen, user can change the requirement colour by pressing other colour button, by doing so, after placing the present object in the destination, in the next operation it will pick object based on the new colour. One can also stop the automation by pressing the manual control button so that it will no pick any further object.

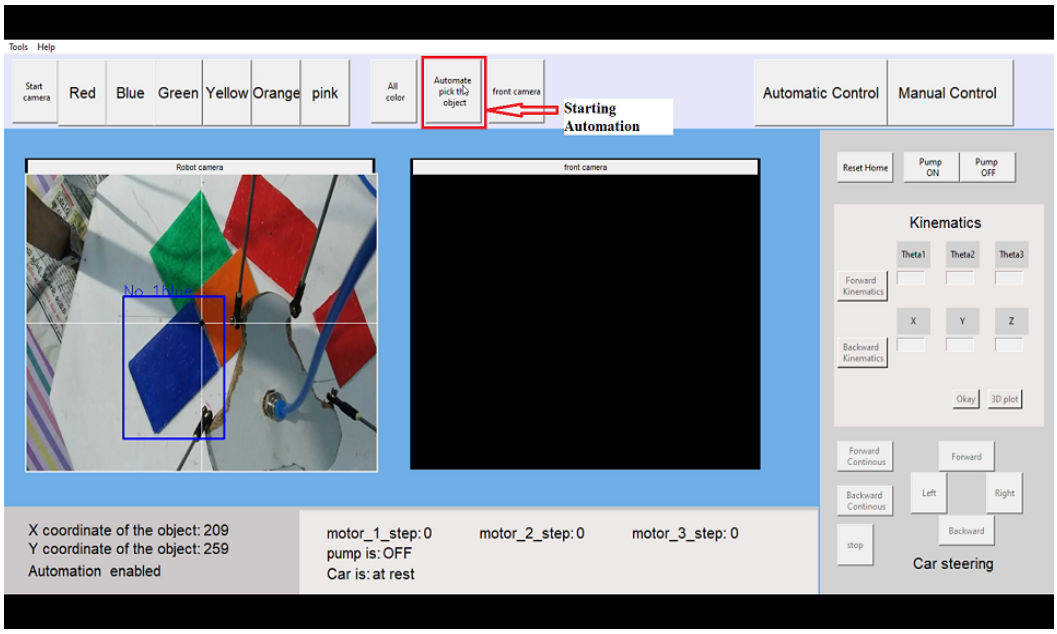

Figure: Automation

7) Now when the **Manual control** is pressed the automation buttons will be disabled to avoid any unwanted operation. Here user can reset the home configuration, make pump off and on and give any position to robot so that end effector can go or give any angle.

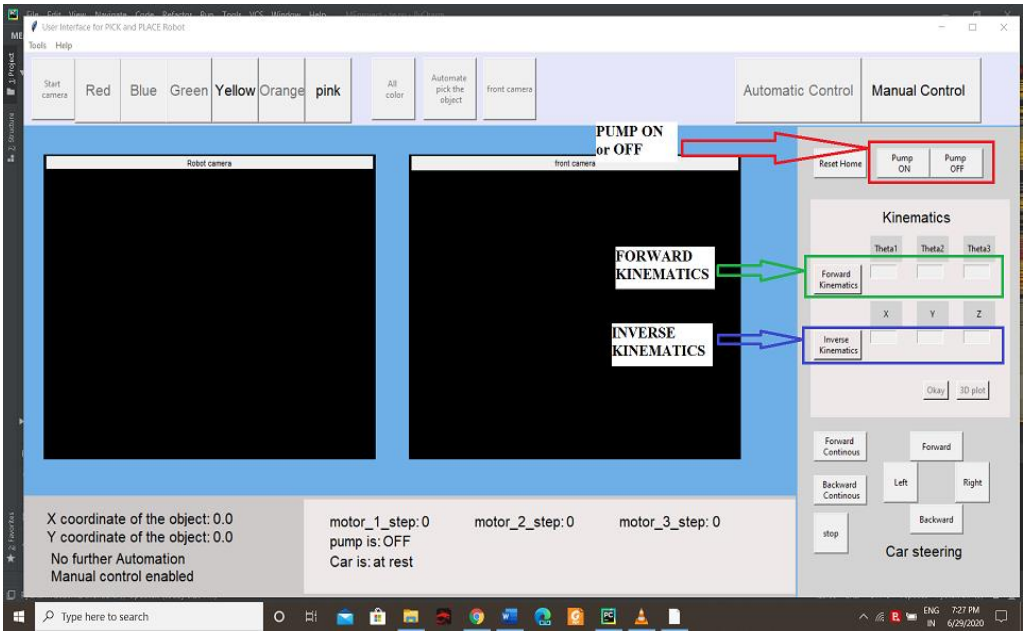

Figure: Manual control

8) User mat also control the vehicle using the button available in the steering subsection. User can either chose to continuously move the robot (by pressing **FORWARD continuous** or **BACKWARD continuous**) until the certain distance reached then stop (by pressing **stop** button) or user can adjust the vehicle in order to make the object within the workspace of the robot (by pressing **FORWARD**, **LEFT**, **RIGHT** and **BACKWARD**).

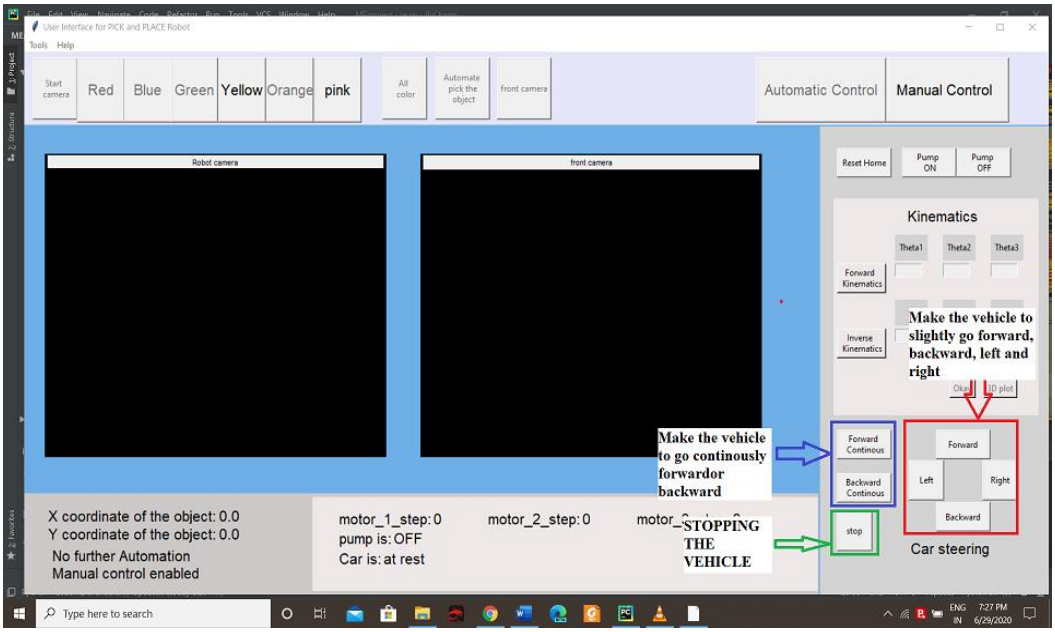

Figure: Vehicle control

9) All the information like what steps motor is taking, whether pump is on or OFF, state of vehicle moving or at rest. Automation enabled or not are displayed in the display section.

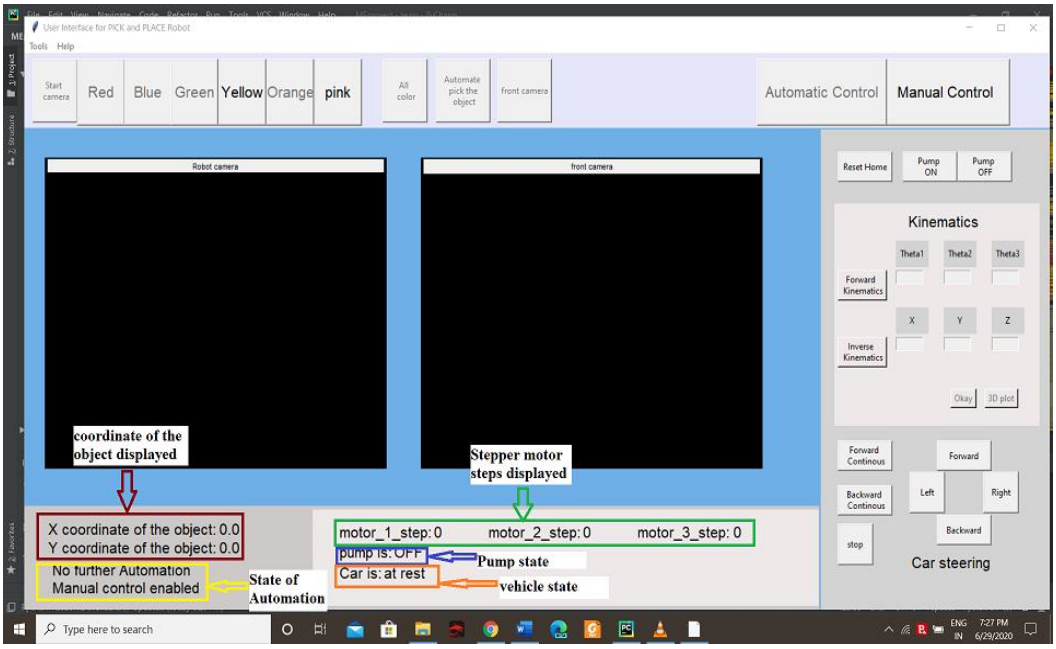

Figure: Information display