"AQUA DRONE: An Unmanned water-body-garbage cleaning Robot"

Introduction/Motivation:

The most alarming 21st century problem faced by the world is clearing and disposing off the hazardous pollutants from a water body. Government of India is taking great steps in this regard. But the already existing waste which is dumped in the various water bodies like tanks/ponds/lakes/canals (nalas)/rivers and sea, needs dire attention. The biggest recent mishap that Pune city witnessed, during the cloudburst and thunder showers in the last week of September 2019 was the flash floods of the blocked canals and encroachments on the banks of the water bodies that took a toll of nearly 21 people and huge damage to vehicles and property.

And as we all know that as long as humans have walked on the Earth, water has been shaping their lives, growing crops, generating power for and sustaining life. With water resources going scarce, its never been more important to keep these resources garbage free. The garbage in the water bodies makes the environment more stingy and risky to live. It just doesnt allow the water to move freely and keeps harming the aquatic life too. In order to solve this societal problem, it is proposed to design an autonomous system that collects the garbage in a still water body and disposes at a defined location.

Market Research / Literature Survey:

From the literature survey it is observed that some systems exist for cleaning garbage. Existing systems are:

1) Concept 1:

- System 1 is a robot that detects the waste with the help of camera and eventually collects the waste in its net-like structure.
- It keeps collecting the waste unless and until its tank becomes full.
- Once the tank is full we need to unload the tank at a suitable place.

2) Concept 2:

- System 2 swallows the waste and dumps into the collector in the back.
- Sensors are used to detect the waste.

3) Concept 3:

- System 3 has two extensions which swivel around pivoted point one after the other there by collecting waste.
- At the end of V-extension collector is placed which collects all the waste.

4) Concept 4:

- System 4 is an ideal machine for civil engineering, construction and dredging companies as well as municipalities and governments who have projects in shallow waters.
- It is an amphibious multipurpose concept.
- Its smart operating principles allow very accurate and efficient environmental dredging-the right amount from the right place.

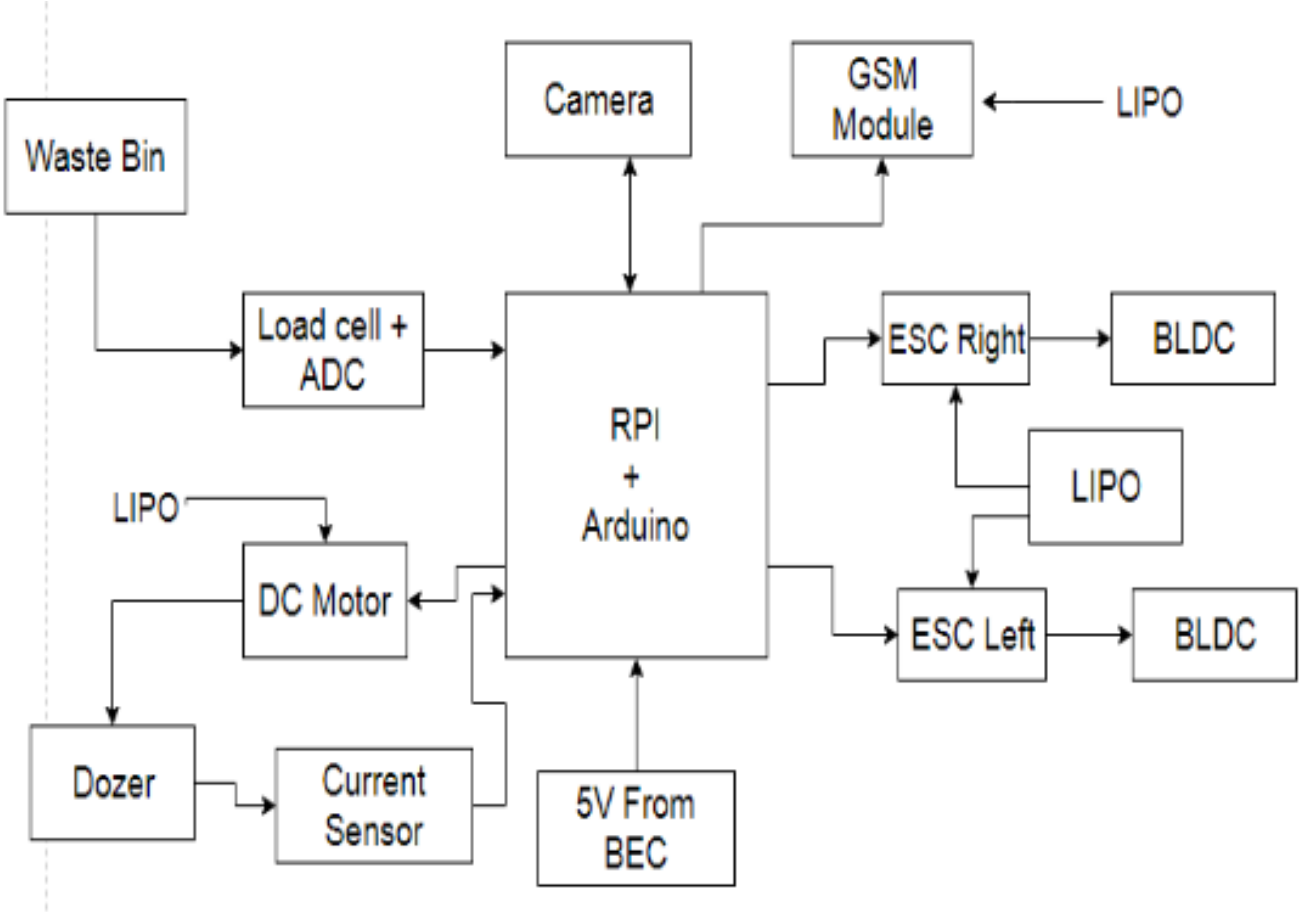
Hardware requirements:

- Raspberry pi: For our project the main requirement is fast processing of microprocessor for image processing. As camera will be interfaced with this to detect the floating garbage in the water bodies, which will be done by image processing algorithms.
- Atmega 328p:In our project there will be a dozer mechanism for the collection of garbage so for that DC motor is used which will be controlled by this controller and also GSM, load cell is also controlled by this particular controller.
- ESC(Electronic Speed Controller): Basically this controls the speed of motor. As we are using BLDC (Brushless DC motor) so esc is best for this motor.
- GSM: To notify the officials that garbage is being collected by a robot and it will be unloaded at some particular place.
- Current Sensor: Basically it is used to measure current draw of DC motor which will be connected to dozer. So that robot can decide that whether to abort the operation or not.
- Load cell+Hx711: Load cell is used to monitor the weight of garbage in a bin.

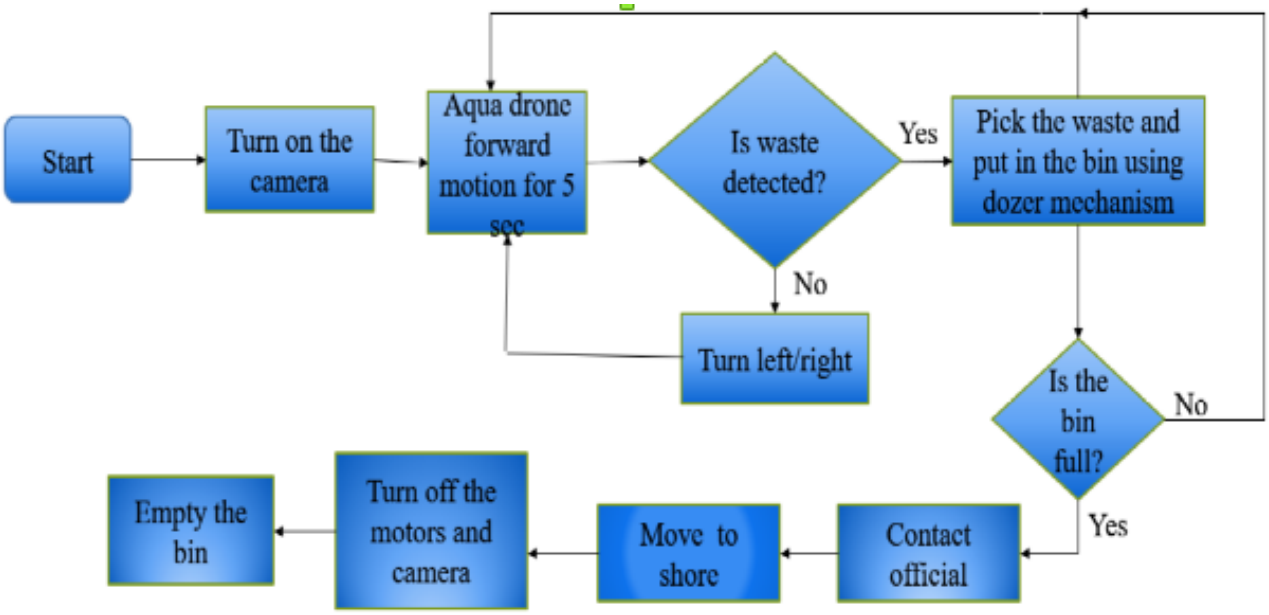
Software requirements:

- Arduino IDE
- Anaconda
- TinkerCad

Block diagram of proposed system:

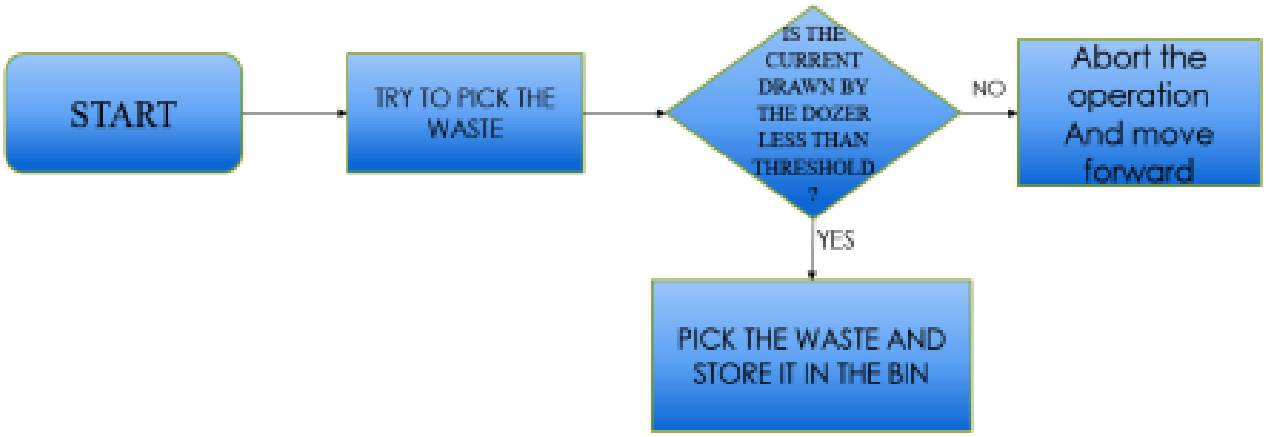


Flow diagram of the system:



- This robot will detect the waste with the help of camera which will eventually be collected in its basket like structure.
- It will keep collecting the waste unless and until its tank becomes full.
- Once its full we need to unload the tank at a suitable place (For this we can define a limit which when exceeded will alert the operator that the tank is full).
- The idea is to allow the aqua drone to collect waste on its own till its bucket (waste holding container) is full.
- Once full, it will inform the nearby official by simply sending a message using the GSM Module.
- The mechanism which we are going to use for collection of garbage is called as a Dozer mechanism. The idea behind that is to use this dozer as that in a bulldozer to collect the waste from the water body at the surface.

Dozer mechanism:



- We will be using a current sensor in this part of the system.
- It will be mainly connected to the DC motor connected to the dozer.
- As we can see from the flow chart of the dozer mechanism, we can say that if the current drawn by the dozer at any point would be more than the threshold value given, the robot will abort the operation and move to another location to collect more floating garbage from the still water-body.

Feasibility:

In todays world, it is observed that the garbage dumping in the still water bodies has increased. And to clean these water bodies, the most technically and economically feasible solution would be an unmanned autonomous robot that does this cleaning job without much human interference. Considering the economical study of the existing project i.e. concept 1 which is mentioned in the literature survey above, it is just not economically affordable due to its heavy technological budget. The idea we propose is comparatively a much cheaper solution to the problem. And talking about the technical feasibility, the components being used in this project idea are easy to operate and modify according to the users requirements.