ESANSKAR INNOVATION DRIVE PHASE- I

Team Name: Plant monitoring robot

Name of Team Member/s:

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1. Introduction

Internet of Things (IoT) is a small electronic device which senses and collects data from around the world and shares this data with backend applications. It communicates with any object, environment, and infrastructure.

Introduction to Robotics

1. What is a robot?

A robot is an automatically guided machine capable of making decisions required to do a task, by monitoring, navigating through and manipulating its environment.

2. History of Robotics

The word Robot is derived from a Czech word Robota' which means 'forced labor or a slave'.

3. Asimov's Laws

Asimov's Three Laws of Robotics:

- A robot may not injure a human being or through inaction, allow a human being to come to harm.
- A robot must obey the orders given to it by human beings except where such orders would conflict with the First Law.
- A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.

Objective

The aim for this project is to design a Plant monitoring robot which targets the energy saving and autonomous operation on economical affordable for residential and commercial.

Objectives of this project are to:

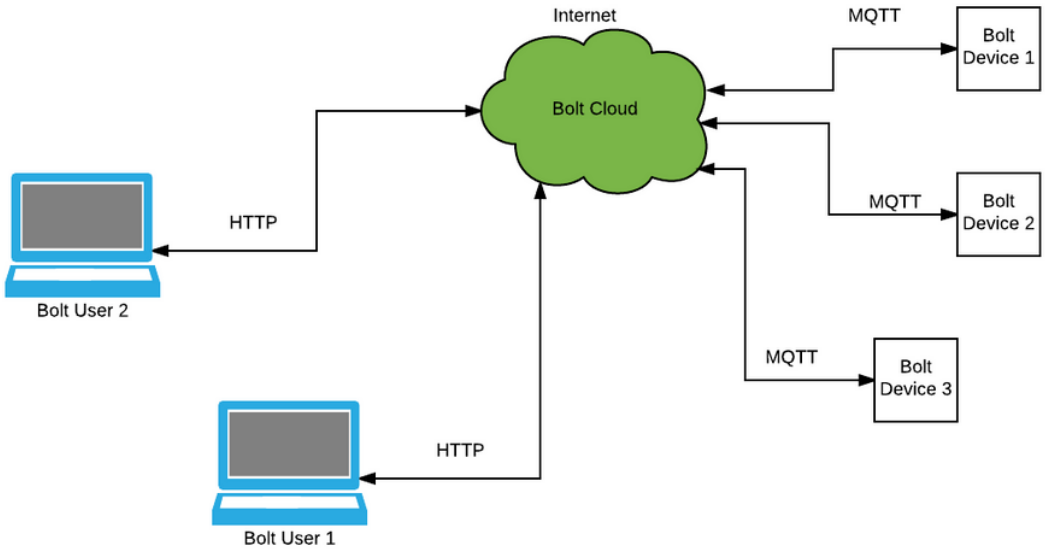
- Build an energy saving Plant monitoring robot with integrated sensors and controllers
- Design a Plant monitoring robot with modular approach design, which makes the system scalability and expandability.
- Design a Plant monitoring robot which compatibility and scalability with other commercial product and automation system, which might include more than lighting systems.

2. Problem Definition

Understanding the IoT cloud architecture

The Bolt Cloud is one of the major component in providing the IoT capabilities to the Bolt device. All the Bolt devices connect to the Bolt Cloud out of the box. The Bolt devices are shipped with a firmware that helps it understand how to connect to the Bolt Cloud over the Internet.

Communication of Bolt Devices with Bolt Cloud



What is a plant monitoring robot?

what if you had a big garden with lots and lots of plants in it? In such a case you would have to set up a Bolt WiFi module for each location where you wanted to monitor the light intensity. This would be very cumbersome and because you have to have a separate hardware for each location, it would also be expensive. This is where the plant monitoring robot comes to the rescue.

The plant monitoring robot carries with it all the sensors required to monitor the environment, sampling the environment data at different pre-determined locations. It then transmits this data via the Bolt WiFi module to the Bolt Cloud. With this robot you can monitor upto 6 different locations for, light/temperature or any other environment variable.

Plant monitoring algorithm

The plant monitoring algorithm is not very difficult to understand, but may sometimes be difficult to implement.

The robot's primary job is to move around the garden, collecting light intensity values. While collecting data using the A0 pin of the Bolt WiFi module was pretty easy, we can't just use the same system here. There are 2 reason for this.

1) There is no way to tell the Bolt WiFi module when a certain location is reached.
2) The data collection is triggered by the Bolt Cloud. This can happen at any time, even when the sensor is not in the right position to collect the data.
3) The A0 pin will only allow you to log data to 1 storage variable in the Bolt Cloud.

To solve this problem, we have to do the following 3 things.

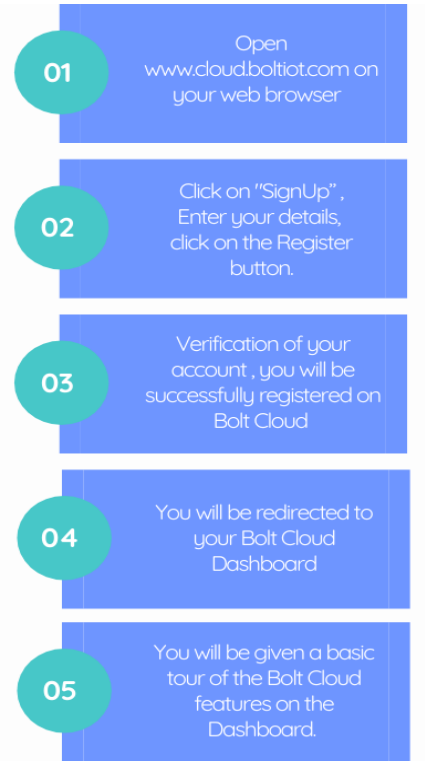
1) The data should be collected by the Boltduino, as it will know whether the robot has reached the right location for data collection.
2) The Robot will move in a fixed path moving to different location. We have done this when we built our first robot.
3) The Boltduino will have to take data readings from different locations and store them in local variables. This will allow the Boltduino to send the data to the Bolt WiFi module, even if the Boltduino is not in the right location to collect the data.
4) If the Bolt Cloud asks for data when the robot, is moving from 1 location to another, the robot will have to be able to answer. Since the robot is not able to do anything when the delay function is called, we cannot use the delay function as we used earlier.

3. Description of Project

Creating an account on the IoT cloud service

Bolt cloud is a server which lets you communicate with your Bolt WiFi module over the internet. It offers features like receiving and storing the data collected by Bolt Modules, Storing the data, Analysing it via Data visualisation and Machine Learning as well as it lets your program your Bolt modules.

Registration Process



Installing the Bolt-IoT-Arduino-Helper library.

Before we can start building the plant monitoring robot, we must first learn how to send data from the Boltduino to the Bolt using UART. Remember we talked about libraries when we talked about robot software? Well to simplify the programming required, to send data from the Boltduino to the Bolt Could, we have developed the BoltIoT-Arduino-Helper library. Use the following steps to install the library into your Arduino IDE.

01 go to the download page for the BoltIoT-Arduino-Helper library.

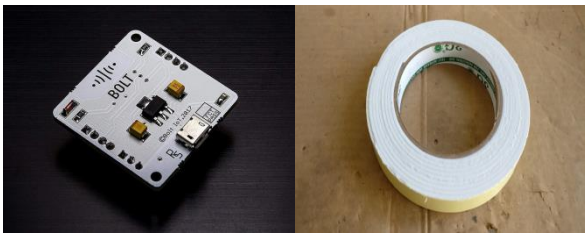
02 Click on the download button in the page to download the library file.

03 In the Arduino IDE to go sketch>import library> add .zip file.

04 Wait for the library to be installed. The Arduino IDE will display this message once it is done installing the library.

Hardware Requirement

1. **Micro USB cable**
2. **1 Light sensor modules**
3. **1x 3 pin female to female berge pin connector**
4. **DC power supply**
5. **The Bolt WiFi module**
6. **Mechanical components box to place the robot on**
7. **Double sided tape**



Software Requirement

Operating system	**Windows 7 or above**
Technology	**Javascript**
Browsers	**Google chrome**
Editor	**Cloud.boltiot.com**

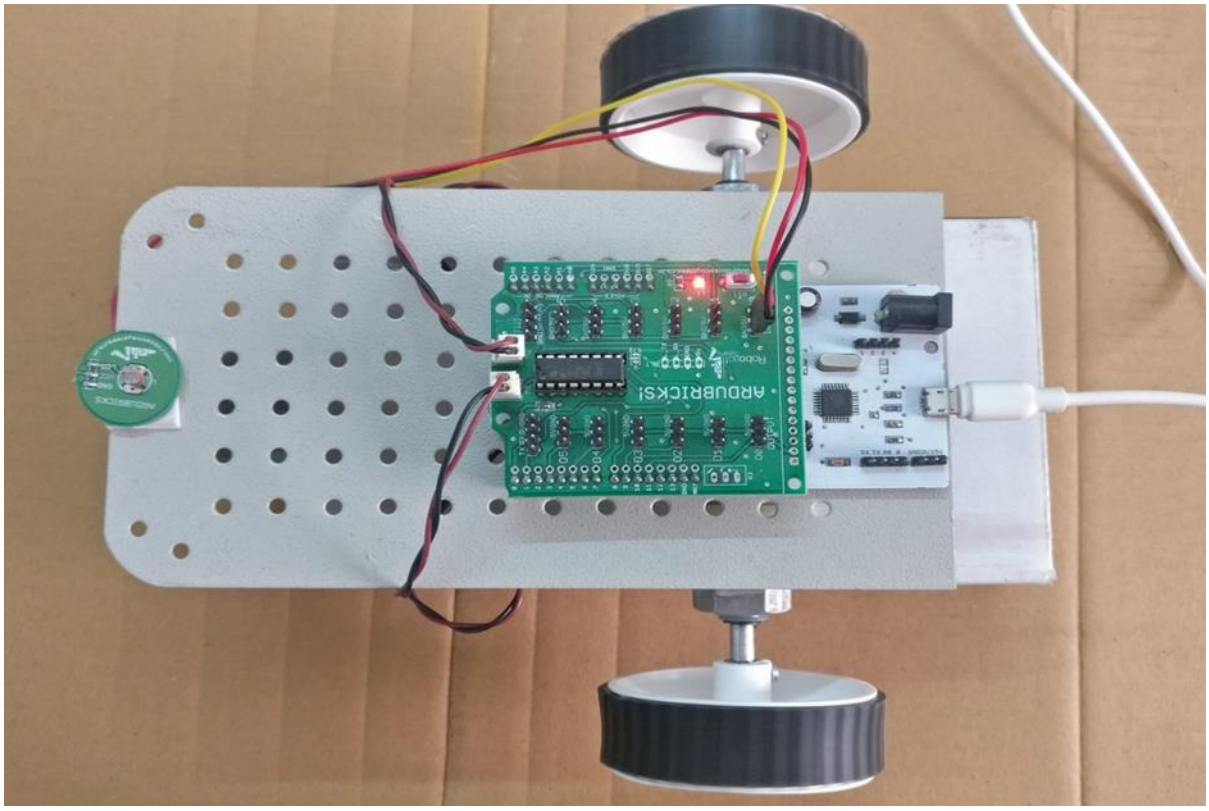
Coding the robot

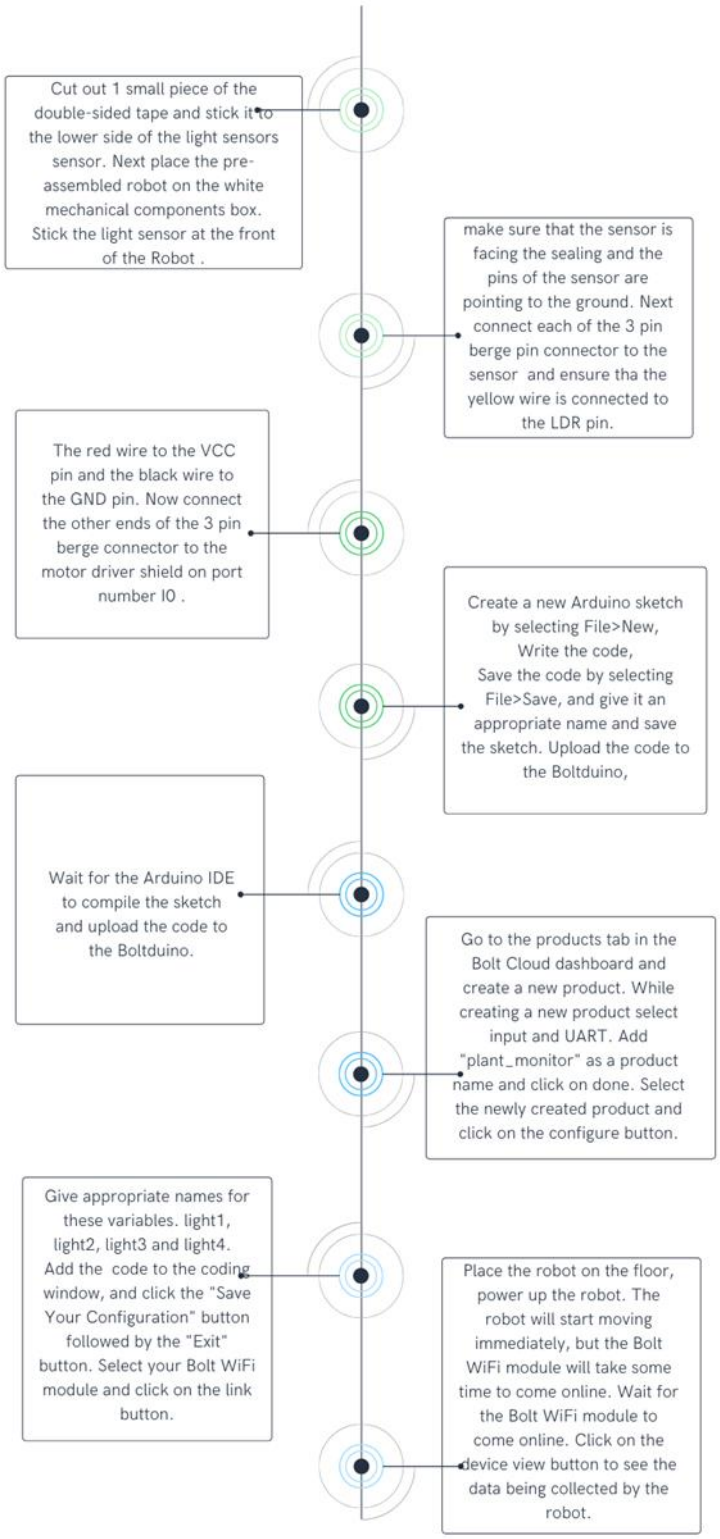
To code this robot, we will first have to tell the Botlduino to use the BoltIoT-Arduino-Helper library that we installed in the previous chapter. This can be done using the instruction "#include" followed by the name of the "header" file which defines the function we need from the library.

Configuring a UART product

We may have finished building and coding the robot, but a plant monitoring robot is not complete without it's cloud dashboard where you can see the readings being logged.
Let's configure a Bolt Cloud product to collect this data from the Boltduino and log it to the Bolt Cloud.

Assembling the components




Cut out 1 small piece of the double-sided tape and stick it to the lower side of the light sensors sensor. Next place the pre-assembled robot on the white mechanical components box. Stick the light sensor at the front of the Robot .
make sure that the sensor is facing the sealing and the pins of the sensor are pointing to the ground. Next connect each of the 3 pin berge pin connector to the sensor and ensure tha the yellow wire is connected to the LDR pin.
The red wire to the VCC pin and the black wire to the GND pin. Now connect the other ends of the 3 pin berge connector to the motor driver shield on port number I0 .
Create a new Arduino sketch by selecting File>New, Write the code, Save the code by selecting File>Save, and give it an appropriate name and save the sketch. Upload the code to the Boltduino,
Wait for the Arduino IDE to compile the sketch and upload the code to the Boltduino.
Go to the products tab in the Bolt Cloud dashboard and create a new product. While creating a new product select input and UART. Add "plant_monitor" as a product name and click on done. Select the newly created product and click on the configure button.
Give appropriate names for these variables. light1, light2, light3 and light4. Add the code to the coding window, and click the "Save Your Configuration" button followed by the "Exit" button. Select your Bolt WiFi module and click on the link button.
Place the robot on the floor, power up the robot. The robot will start moving immediately, but the Bolt WiFi module will take some time to come online. Wait for the Bolt WiFi module to come online. Click on the device view button to see the data being collected by the robot.

Output :

You can then wait for about an hour for the robot to collect upto 12 readings. While the robot is doing that, change the lighting conditions at the corner location to check whether changes in the lighting conditions get reflected in the data collected online. You can use a flashlight or something of the sort.

Well that it! You now have a plant monitoring robot.

4. Advantages, Disadvantages & Applications

Advantages:

1. Using this project, you will be able to build a light monitoring system to collect the data and send it to the cloud.
2. You will also learn to visualise the data in form of graphs.
3. This project can then be extended to Predict the future sensor values via machine learning over the Bolt Cloud.
4. You may also send alerts over SMS and email using the features of Bolt Cloud Pro.

Disadvantages:

1. We have to buy hardware kit.
2. You have to keep checking result every 5 min.
3. You need Good internet connectivity.

Applications:

This project is based on the principle that whenever the light falling on the sensor changes, the resistance of sensor changes which is then converted into a change in voltage. The ADC pin on Bolt WiFi Module converted this analog voltage level into digital values which are shown on the graphs.

We connect the LDR between 5v pin and the analog input pin (A0), so that when light intensity increases, the resistance of LDR decreases so the voltage across the LDR decreases and as a result, the voltage on the analog input pin increases.

This means that as the light intensity increases, the voltage on the analog input pin also increases. The Bolt then converts that the voltage a 10 bit (10 places in binary number system) digital value that varies from 0-1024 (0 to 2 raised to 10).

This digital data is then sent to the cloud where it is plotted for visual representation.

Project Link : Click Here