Tele Environment Controller

Details of the team

- Group Name: Team Fusion
- Group Leader: Bandara D.R.K.W.M.S.D.
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Mentors:

- Mr. Sandushan Ranaweera
- Mr. Imdaad Muhammad

Resource persons

- Mr. Shameera Anuruddha Mahawattage

Problem Description

- We have selected **Food production and Preservation** as the area of development of our project.
- Most plants need specific weather and physical conditions to grow. Those plants can grow only in several areas. It is one of the main reasons for the world food shortage and malnutrition. Also, it causes high food wastage and high costs for foods.
- What does the tele environment machine do is, implement a weather of place A at a place B. So, it can grow plants that need conditions from place A at place B. Also, can implement conditions without seasonal and regional boundaries.

Solution description

- We came up with a real time IoT solution. We collect data from specific areas where those different plants can grow in real time(once a interval) and transmit them to our servers. For an example, the properties of soil and weather information. Then our IoT devices can access the server and implement those conditions in other places. When comparing this solution with other alternatives, this solution can be considered as a low-cost solution.

- To come up with this idea, we did research about how weather and other factors can be controlled for get an optimized harvest. In this procedure, we could get great support from our mentors, and we contacted some resource persons from the agricultural industry and academic areas to get a clear idea about what factors we can control, how we can control those factors, and other technical things.

- The project solution consists of three sub-units. Weather sampling unit, Weather Implementors and IoT Server are those three units. Though the implementor and IoT server is mandatory units, the live weather forecast can be obtained using already available APIs. But those APIs do not provide sufficient information about the soil and macro-environment of the plant. Therefore, the sampler is also mandatory.

- As we experience, many trees and plants have a seasonal cycle in the yield of trees. Because of that, the world experiences a shortage of some food during some seasons. Using our technique, anyone can replicate the ideal weather for those plants to increase the yield during off-seasons. In addition, plants cannot grow everywhere in the world due to climate requirements. As I mentioned above, this project can provide the ideal weather and soil conditions for any plant anywhere.

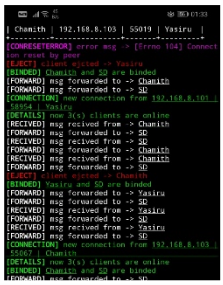
- A large-scale implementation is needed for a noticeable impact on food shortage. But anyone can install this system in their backyard greenhouse to maintain a food supply.

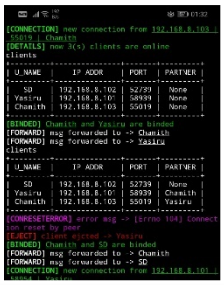
- The implementing system needs an active internet connection and a continuous power supply. And the weather sampler also needs an internet connection and a power supply. Since the sampler is designed for low power, continuous power is not mandatory. Most importantly, the samplers must withstand extreme weather conditions. Therefore, our team has come up with robust designs for enclosure, cooling, and heating systems.

- Since there is a server for the data analyzation and management, we can use that for analyze and weather prediction for future agricultural plans. This is another advantage of our solution when comparing already existing automatic greenhouse systems.

Proof of concept

- We fully implemented the IoT server. The Server can handle up to 50000 connections (sampling units and implementors). We have tested the server for only 10000 connections, and it can receive, process, and send required information in under 100ms. The server receives information from samplers and uploads it to an online MySQL server. If an implementor requires some weather information, the server goes through the database and sends the information.





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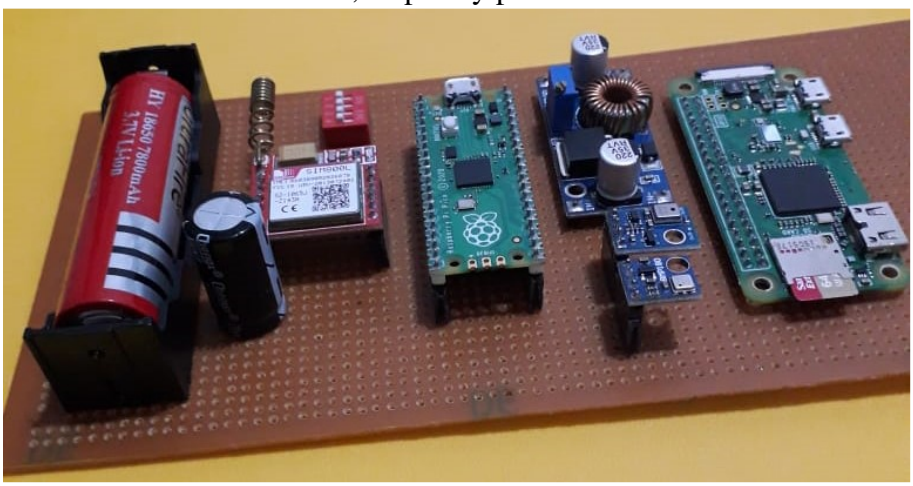
- We have partially implemented the weather sampling unit. In our implementation, we have a separate power supply, three temperature sensors, a humidity sensor, a pressure sensor, a soil moisture sensor, a pH sensor, a light intensity sensor, a rain-drop sensor, and a GSM module for communication, raspberry pi for control actuators.



- In a discussion session with an agriculture expert, we came to know that the soil architecture cannot be restored once it breakdown. Therefore, it is impossible to implement the exact soil architecture inside the greenhouse. But we are planning to build an algorithm to provide the near ideal conditions.

Sustainability

- Purpose of our project is increasing the effectiveness of food production and decrease the delay and wastage during the food transportation because plants can be grown anywhere at an artificial environment with our solution. This is directly aligned with sustainable development goal, zero hunger, and this will be a good and cost-effective solution with necessary modifications for some other areas like animal farming and zoos for provide real time synchronized artificial environments when needed. Since there are many development areas for our project, this project can support many areas and sustainability of the project is at good level.

Social and Environmental Impact Assessment

Plant growth affects the climate changes in a direct way. As plants contribute to the production of O2 and reduces global warming. As it affects the climate changes in a good way.

For come up with a better idea more than we had initial stages of this project, we discussed about this idea with our mentors and some resource persons who are working in agricultural industry to find the correct technical things and issues we should solve in this procedure.

This is a solution for world food shortage and malnutrition. The society can have a stable food supply throughout the year without even seasonal and regional limitations. This product can also use to provide exact conditions for animals in the zoos after some developments. Also, this solution can be used to study the climate changes and the effect of those changes for the harvest of the plants and can be identified some patterns of those changes.

From our discussions with resource persons from the industry, we could get very positive feedbacks about our solution and some of them suggested us to introduce this solution to the market and beneficiaries (Farmers) in different scales.

Logistics

Task breakdown and time frame

Task	Time Frame
Background and agricultural research	August 2021 continuing
IoT server implementation	April 2022- May 2022
Sampler Implementation	May 2022 – June 2022
Weather implementer Implementation	June 2022 -July 2022

Contribution to Pi-Mora and the Raspberry Pi-related activities

- Ranatunga R.A.C.D: Co-chair of Pi mora jam 1.3
- Bandara D.R.K.W.M.S.D: Event Coordinator RPi SIG, SPARK Branch, Electronic Club.
- Karunanayake Y.S: Resource person for Pi Mora Jam 1.3

In addition of that, all our team members have participated in Pi Mora jams and workshops done by E club SPARK Branch.

Budget Allocation

- Weather station to collect data (With all sensors and backup power module) – 37000
- Tele environment machine main unit – 38000 + 30000 (Equipment's need to implement weather condition with sensors and actuators for maintain the air quality and humidity)
- Total Approx. = 105,000