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DEVELOPMENT OF AN INTERACTIVE PLANT MONITORING DEVICE BY USING ARDUINO MICROCONTROLLER

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ABSTRACT

Gardener conveys a wide range of plants which will have fluctuating watering requirements for each plant must get the perfect measure of water. An unreasonable measure of water may keep the plant's underlying foundations from oxygen and thought to process them to decay; too less water and the plant will now not get hold of the nutrients in wishes to keep on existing. Besides, gardener mostly do not know how was the character shown by plant instead of pets where they could show their feeling when they are threatening. This experiment concentrated on the best way to build up a framework utilising Arduino that controls all the parameter required of plants life at the ideal time. Besides that, this project proposed as no automation needed as we want it to be interactively fun like playing a "Pou" game for real in terms of plants.

Keywords: plant, monitoring device, interactive.

1. INTRODUCTION

Nowadays, people become busy with their daily routine and human will not conscious towards the numerous plants. It became challenging for them to hold their plants healthy and alive. Other than that, individuals not constantly able to estimate the significant level of water wished through the plant to restores the needs required by a plant.

This project discusses about the monitoring system for the plant as a remoting system and gets the measurements of the observing system for a user. The procedure software will be used in this research by utilising the Arduino as a microcontroller. These undertakings incorporate essential information which is a temperature sensor and a clock set on MIT Apps while identified with the Arduino for conveying the signal to hit upon the plants. At the point when the sensor detects the condition surrounding of the plants, for example, if the temperature reaches more than the parameter set which is more than 29 degree Celsius, Arduino will send the signal and the emoji on Android MIT Apps will change. The subsequent relay will contact to send data to the fan to launch it and cooling down the temperature until it returns to its normal condition which is below 29 degree Celsius and above 5 degree Celsius.

According to previous study which attempt on creating a plant monitoring proposed by Elangovan R. *et al.* [1], it was focus on mechanises plant observing and keen cultivating using IoT in the Raspberry Pi arrange. The purpose of the guidelines behind robotisation is to provide comfort to people with manual work and for general use of the system without customer participation. Also, by Jayashri K. *et al.* [2], which proposed IoT based smart plant monitoring system we can screen and control utilising IoT. It is hard to keep dissipated without a remote domain checking framework. As of late, there seemed a shelter remote observing framework dependent on Ethernet. Besides that, according to Kumar P. S. *et al.* [6], as Technology is creating, there is the chance to make work done by electronic applications. Arduino processor understands a few issues. The point of convergence is spare the water; no work obliged and spare the time. This model uses sensor innovation with Arduino to make keen exchanging gadget. According to Pati P. [9], water framework is one of the procedure to watering the plant and also to improve the idea of harvests. Modified water framework is a propelled technique used for watering vegetables and nourishments development starting from the earliest stage. This endeavour paper will delineate "modified plant irrigator" arranged by using microcontroller. The essential inspiration driving this endeavour is to structure a customised watering device by recognising the earth conditions. Additionally, the endeavour similarly plans to structure an earth soddenness sensor that can be viably consolidated with a microcontroller. As indicated by Kishore L. K. *et al.* [4], the programmed plant observing framework has as of late pulled in enormous enthusiasm because of the potential application in rising innovation. All the more critically, this method is utilised to improve the presentation of existing procedures or to create and structure new systems for the development of plants. The plant observing framework is useful for watering the plants and to screen not many parameters for development of plants. This framework is utilised in scarcely any zones like nursery ranches and in farming. This aids in watering the field in any event, during evening time, so doesn't require the rancher to turn ON the engine physically.

The main objectives of this project are to develop an interactive system gardening for people by using an Arduino. This project also a way to implement a remote controlling system using multi-sensors hence analysing its performance in controlling the plants as a plant monitoring system by using Arduino. This project will be useful to the

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society especially for those who are occupied with tight schedule that don't have the time to water their plant, the people that generally overlook to water the plant and the people that always pass travelling and outstation. Except that, this project proposed a solution via imparting a way and system to encourage human in watering plants.

2. METHODOLOGY

The connection of the main electronic components of the proposed plant monitoring can be illustrated in a block diagram. The block diagram consists of a controller, inputs, and outputs. The I2C LCD and Android phone are used to display the value as for temperature and humidity and the status for plants based on triggered sensors parameter. The I2C module is attached as an interface between Arduino Mega and 16 x 2 LCD. They are used to reduce the number of pins connected to Arduino Mega. The water pump motor, 5v fan, sound module, and RGB LED is an output in which the parameter is controlled by using the MIT Apps implanted into the Android phones to control them remotely in Arduino Mega. There are three inputs to Arduino Mega. The first one is the sound sensor which is a sensor that senses the sound from the sound module, then manipulate it to LED as it blinking. The second one is LDR sensor which used to measure the light intensity to trigger the RGB LED as it wants to turn on or off. The third one is DHT sensor used to measure the temperature and humidity value as well as trigger the user at a specific parameter where a 5v fan needs to be turned on. Arduino Mega is used as the controller that will accept inputs and produces related output. Arduino Mega stored the program and data generated while running the plant monitoring device. Figure-1 shows the project design of water pump Motor. It used for both watering and fertilising action. It will pump and gives visual confirmation to the user on results the emoticon return to its normal condition. Figure-2 shows the block diagram of the plant monitoring system connection between the components. It can be seen that most of the pins are utilised.

Figure-1. Project design.

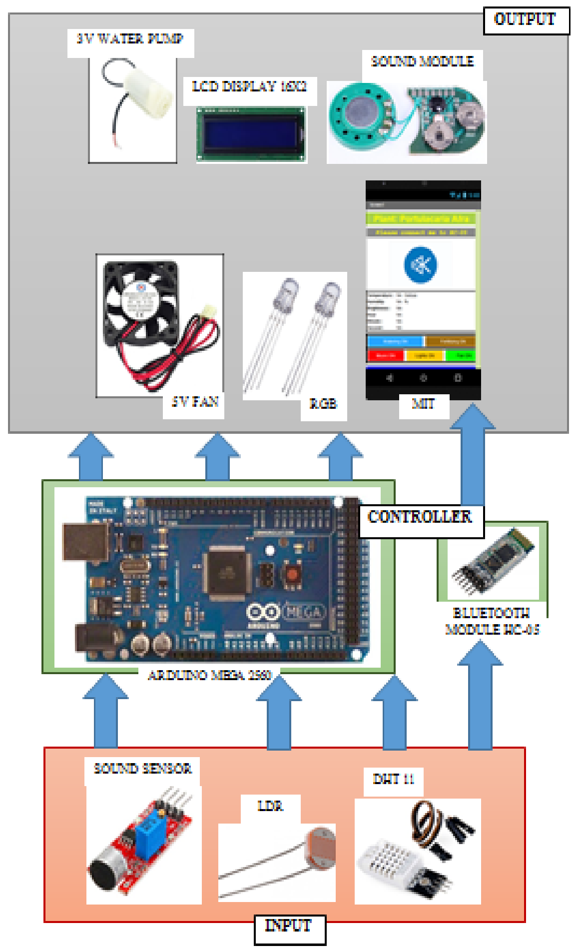

Figure-2. Block diagram of plant monitoring device system.

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Table-1. Schedule timer for the plant's condition.

Status	Scenario	Action Taken	Results
Hungry At 08:00	Emoticon change from "I am good" to "I am hungry"	Click on button 2 for fertilising.	Emoticon return to "I am good"
Thirsty At 08:15 & 17:00	Emoticon change from "I am good" to "I am thirsty"	Click on button 1 for watering.	Emoticon return to "I am good"
Boring At 10:00 & 14:00 & 18:00	Emoticon change from "I am good" to "I am boring"	Click on button 3 for music.	Emoticon return to "I am good"
Sleeping At 21:00 - 06:00	Emoticon change from "I am good" to "I am sleeping"	-	Emoticon return to "I am good" after 05:59
Lazy Ldr<300 At 06:00 - 20:00	Emoticon change from "I am sleeping" to "I am lazy"	Click on button 4 for lights on	Emoticon return to "I am good" or "I am sleeping"
What's happening Ldr>300 At 06:00 - 20:00	Emoticon change from "I am sleeping" to "what's happening"	Click on button 4 for lights off	Emoticon return to "I am sleeping" or "I am good"

Table-2. Parameter setup for temperature and light sensor.

<table>
<tr><th colspan="5">Parameter Setup</th></tr>
<tr><th colspan="5">Temperature</th></tr>
<tr><td colspan="2">< 5 c
"I am feeling cold"</td><td><= 6 c,
>= 28 c
"I am good"</td><td colspan="2">> 29 c
"I am feeling hot"</td></tr>
<tr><th colspan="5">Light intensity</th></tr>
<tr><td>< 300 AT 21:0 - 05:59</td><td>"I am sleeping"</td><td>-</td><td>>= 300 AT 21:00 - 05:59</td><td>"What's happening"</td></tr>
</table>

Figures 3 to Figure-5 show the scenario that might occur while running the plant monitoring. Figure-4 shows the example of emoticon display based on parameter setup for sensors to be trigger at a particular parameter. It can be seen from the same figure, the value of the LDR brightness shown on Android phone is low. Then after the RGB led being turn on by click on the Lights ON button, the LDR brightness value slightly increases which then change the emoticon statement from "I am lazy" to the "I am OK".

Figure-3. I2C 16 x 2 LCD display temperature and humidity value.

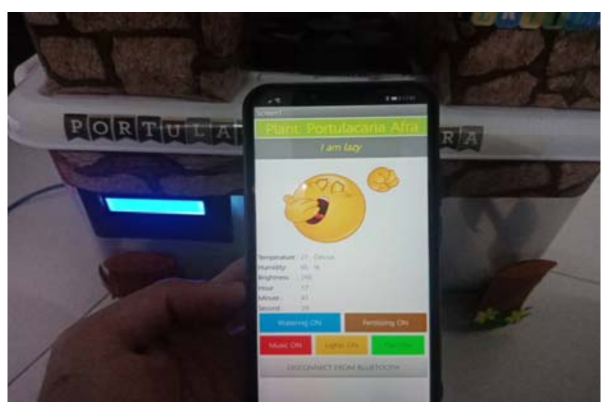

Figure-4. LDR brightness value <300 at a day.

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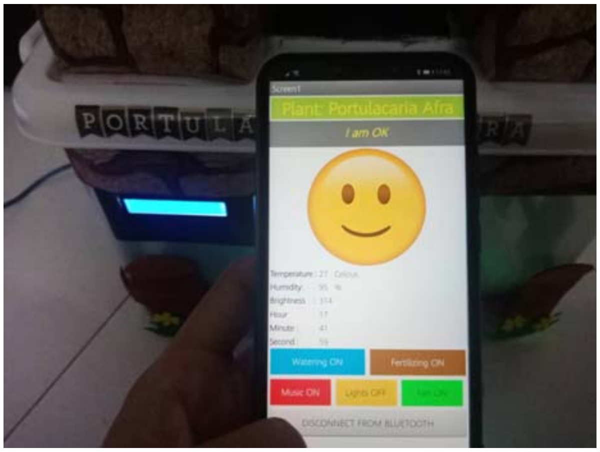

Figure-5. LDR brightness value >300 at a day (Button 4 been clicked).

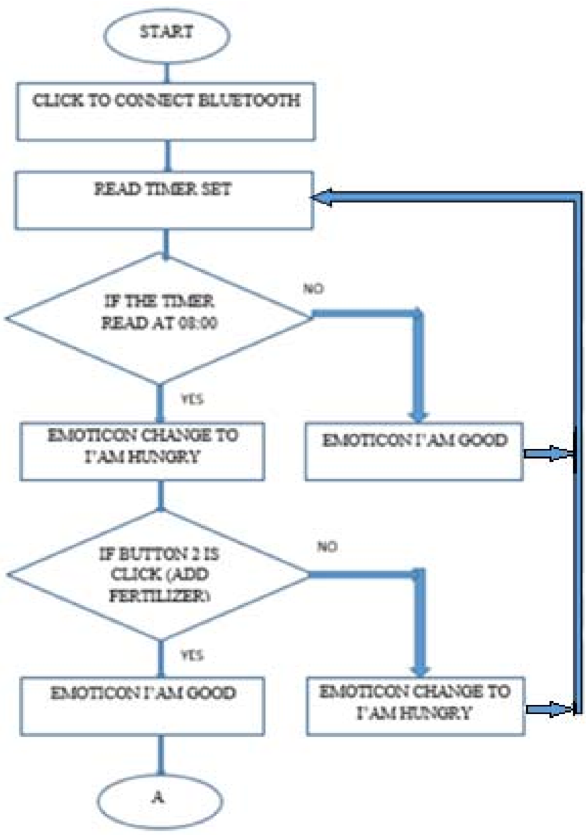

Figure-6. Flowchart of the project (HUNGRY).

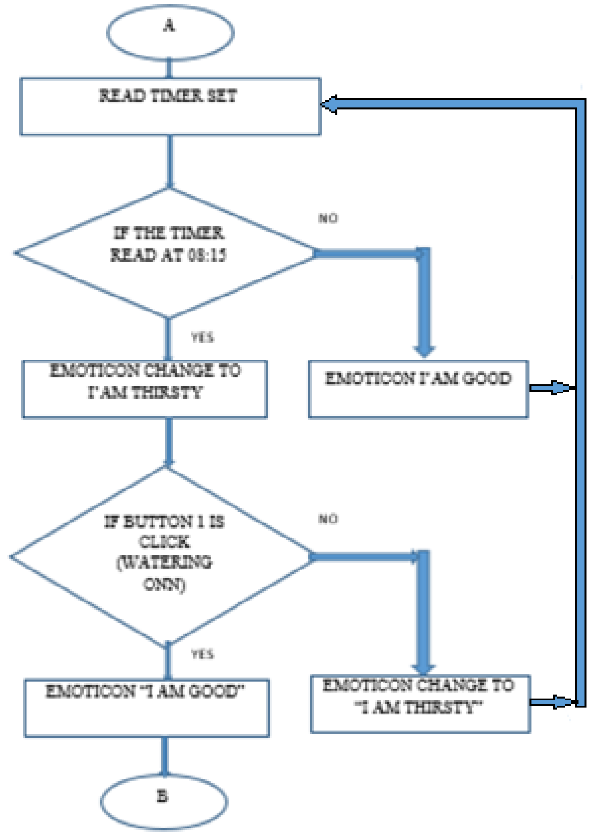

Figure-7. Flowchart of the project (THIRSTY).

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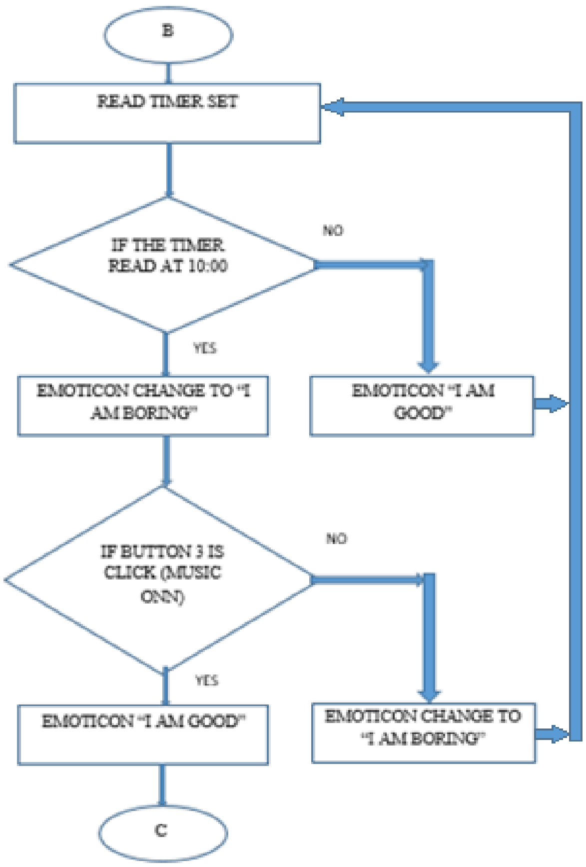

Figure-8. Flowchart of the project (BORING).

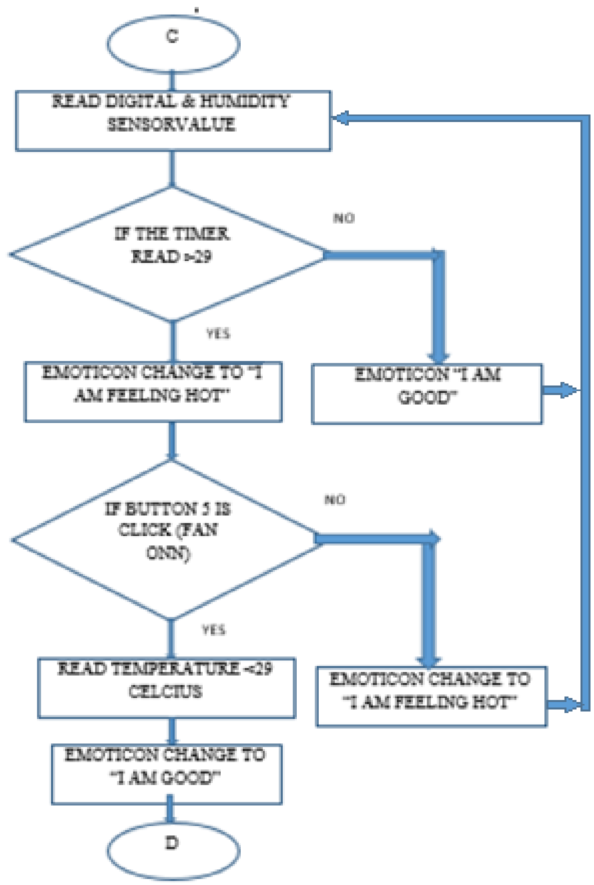

Figure-9. Flowchart of the project (TEMPERATURE).

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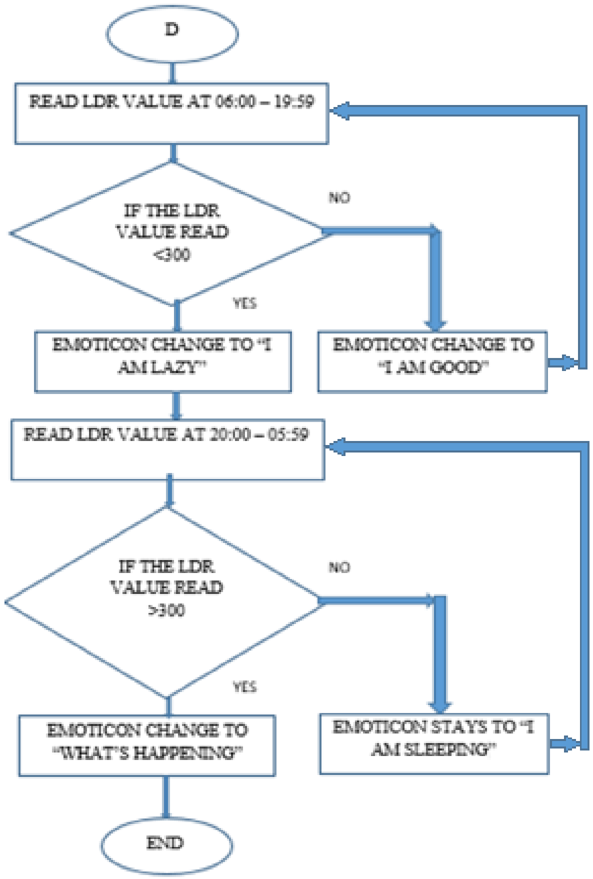

Figure-10. Flowchart of the project (LIGHTS).

3. RESULTS AND DISCUSSIONS

The outcomes are given as follows. The diagrams as in Figure-6 to Figure-8 shows the light intensity, temperature and humidity levels of a houseplant outside a room. Various sorts of charts are created by the framework used to screen the plant details, for example, Line outline, Column graph, bar outline and Spline diagram. These outcomes were produced after the effective implementation and deployment of the framework. While analysing the chart firmly, it would distinguish the unexpected rise in temperature, humidity and light intensity levels at a high rat. It will be appearing at the last readings. The system was pre-customised to respond when the triggered levels reach underneath a specific level. In this situation, it was viewed that a light intensity level below and above 300 which implies that the framework should trigger some activity when the readings are low and high, respectively. Here, the framework consequently would let user turn "ON" or "OFF" the RGB LED based on the expression shown by emoticon as in Android MIT Apps, such that the light intensity readings are high again which is shown as in the diagram.

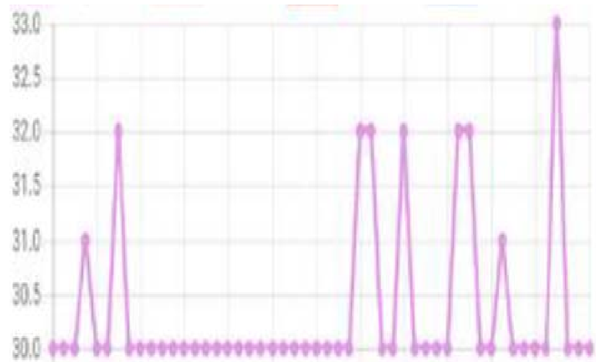

Figure-11. Graph for temperature.

Figure-12. Graph for humidity.

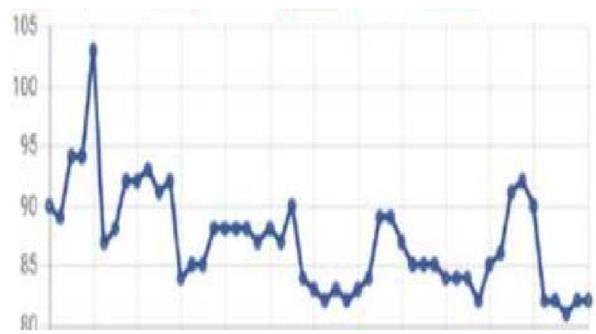

Figure-13. Graph for LDR.

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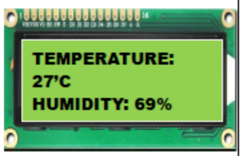
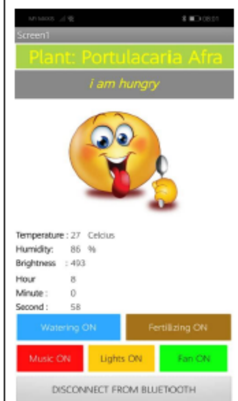
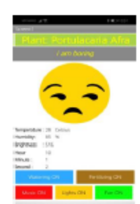
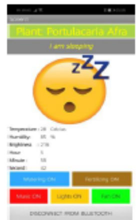
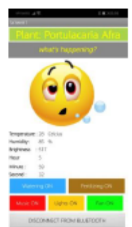
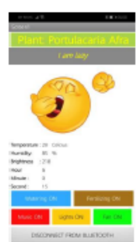
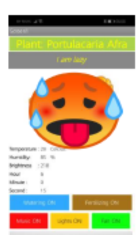
Table-3. The expected and actual results based on the scenario.

No	Scenario	Expected Result	Actual Result
1	The plant monitoring connected with the power source.	- The I2C will display the temperature and humidity of the surrounding.  Expected I2C LCD display Temperature and Humidity Value.	 Actual I2C LCD display Temperature and Humidity Value.
2	The condition changes from 'I Am Good' change to another.	- As for the condition for hungry, an emoticon from 'I Am Good' will suddenly change to 'I Am Hungry' condition. At this moment, a user need to click on the button 2 (Add Fertilizer) as to feed the plants so that, the emoticon will return back to its normal condition ('I Am Good').  Expected 'I Am Good' → 'I Am Hungry' Condition - Same goes to another else condition, the reaction would still be the same.	 Actual 'I Am Good' → 'I Am Hungry' Condition
		 Expected 'I Am Good →' I Am Thirsty' Condition  Expected 'I Am Good' → 'I Am Boring' Condition	 Actual 'I Am Good'→' I Am Thirsty' Condition.  Actual 'I Am Good' → 'I Am Boring' Condition

		 Expected 'I Am Good' →' I Am Sleeping' Condition	 Actual 'I Am Good' →' I Am Sleeping' Condition
		 Expected 'I Am Sleeping' → 'What's Happening?' Condition	 Actual 'I Am Sleeping' → 'What's Happening?' Condition
		 Expected 'I Am Good' →' I Am Lazy' Condition	 Actual 'I Am Good' →' I Am Lazy' Condition.

		 Expected 'I Am Good' → 'I Am Feeling Hot' Condition	 Actual 'I Am Good' → 'I Am Feeling Hot' Condition

The outcomes created are given beneath and imagined utilising graphs. The diagrams show the light intensity, temperature and humidity levels of a houseplant outside a room. Various sorts of diagrams are created by the framework used to screen the plant details, for example, Line outline, Column graph, bar outline and Spline diagram. These outcomes were produced after the effective implementation and deployment of the framework. While analysing the diagram firmly, one would distinguish the unexpected rise in temperature, humidity and light intensity levels at a high rate just before the last any readings. As in fact, playing music for plants also helps in their growth through sound vibrations. The system was pre-customised to respond when the triggered levels reach underneath a specific level. In this situation, it was viewed as that a light intensity level below and above 300 which implies that the framework should trigger some activity when the readings are low and high respectively. Here, the framework consequently would let user turn on or off the RGB LED based on the expression shown by emoticon as in Android MIT Apps, such that the light intensity readings are high again which is clearly as shown as in the diagram

4. CONCLUSIONS

This project presented a plant monitoring system that helps the user on control and taking care of their plant-based on the emoticon shown on Android apps MIT Apps Inventor that changed based on the multi-sensors implemented on this project. This project is essential because modern gardeners don't have much time to take care of their plants. As a result, this project able to help and improve gardener understanding and ability to control the system throughout learning object.

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