USER CONTROLLED PRECISION IRRIGATION SYSTEM

Guided by	Task done by
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INSPIRATION FOR THE PROJECT.....

- The Student's Grandma, who has partial movement capabilities, wanted to water her Tulsi plant personally.
- We wanted to build it such that she could reach out to her backyard (an approximate distance of 50 mts or so), and achieve the task without support of any other family member using her Smartphone only.
- This inspired us to build up this DIY and we further extended it to an IEEE contribution as well.

INTRODUCTION

- Agriculture sector is the most significant contributor to Indian Economy. It provides a means of livelihood not only to 2/3rd part of the country's population, but also makes up about 1/6th of the total GDP of India. Apart from being the major source of food, it also provides raw material and employment to a large section of the population. The central lifeline of agriculture is the irrigation system apart from good soil and quality seed.

- Surface water available across 185 river basins of Gujarat is the major contributor. However, a meagre 2% of India's total surface water (i.e. 38,100 million cubic meters) is available to Gujarat, which is also non-uniformly distributed in the state. The underground water is 17,508 million cubic meters.

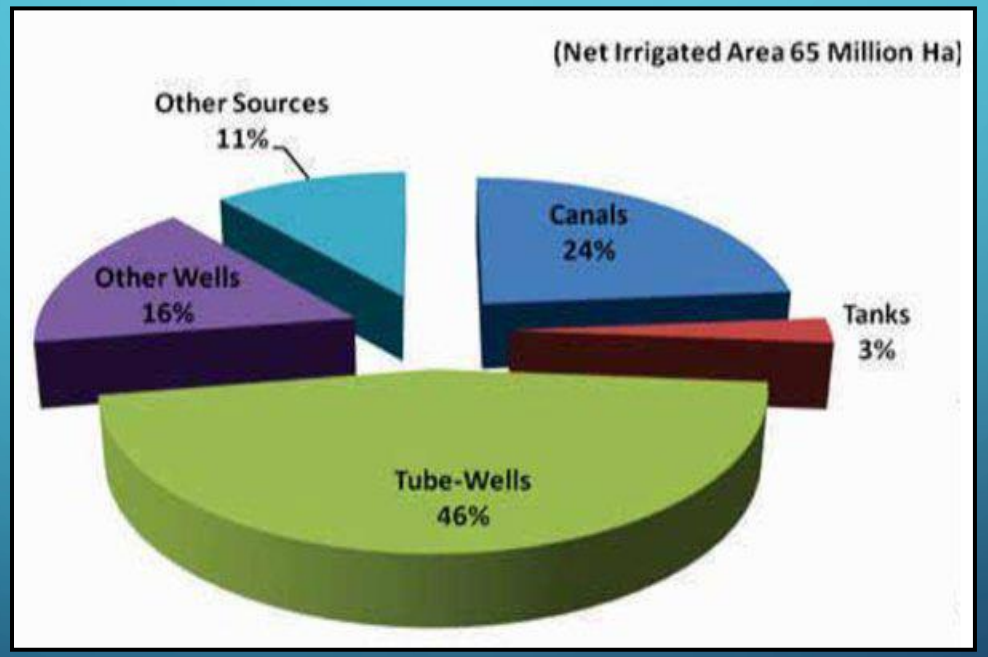


Fig. 1. Pie Chart showing distribution of Irrigation Sources across India

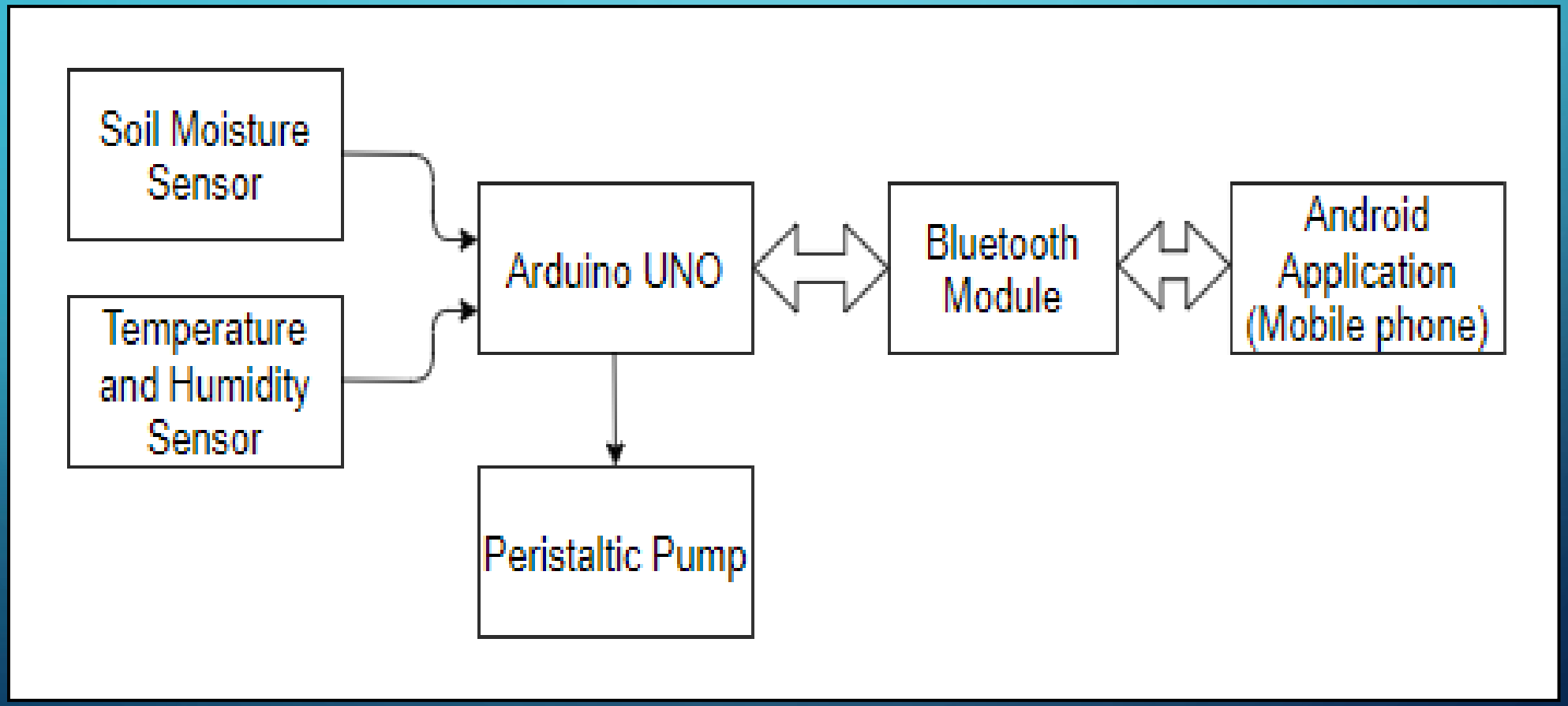
- According to the latest available report of 2014-15, 1,61,82,000 hectare area in India is irrigated by canals, while 17,23,000 hectare by tanks, 3,16,06,000 hectare by tube-wells, 1,13,54,000 hectare by other wells and 75,19,000 hectare by other sources.

TABLE I
AREA UNDER IRRIGATION IN GUJARAT

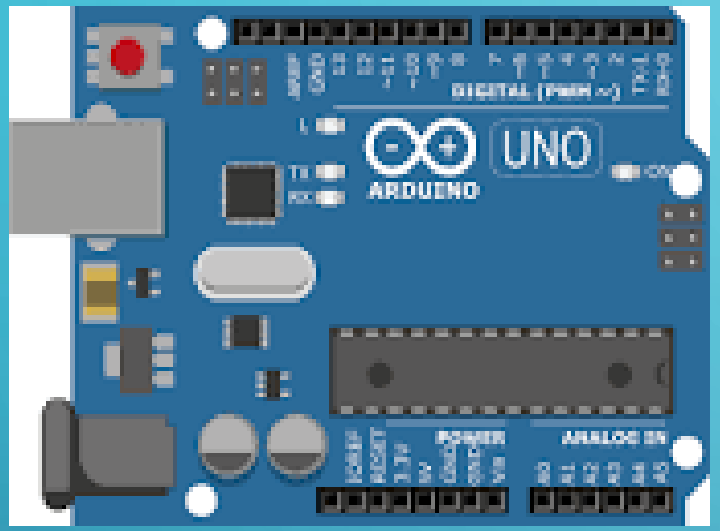
Details of Geographical Area of Gujarat and Irrigation	
Details	**Lakh Hectares**
Total geographical area	196
Area under cultivation	125
Area Under Irrigation	
Irrigation area covered by surface water	18
Irrigation area covered by ground water	20
Area under Sardar Sarovar Yojana	18
Area benefitted by Sujalam Suflam Project and check dams	09
Area depends on rainfall	60

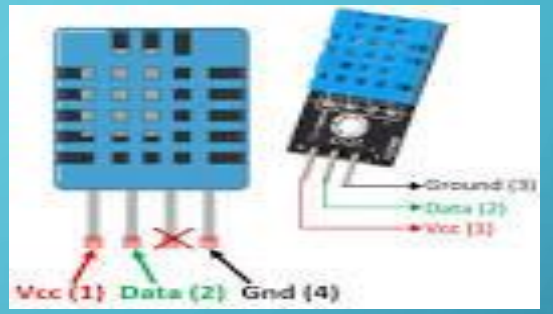
- In October 2018, Gujarat Government declared 51 talukas, comprising of 3,291 villages as scarcity hit, because of less rain that includes 10 talukas of Kutch, 9 talukas of Banaskantha, 8 talukas of Patan, 7 of Surendranagar and 4 of Ahmedabad and Mehasana districts.

CONTROL SYSTEM



The components used in the project





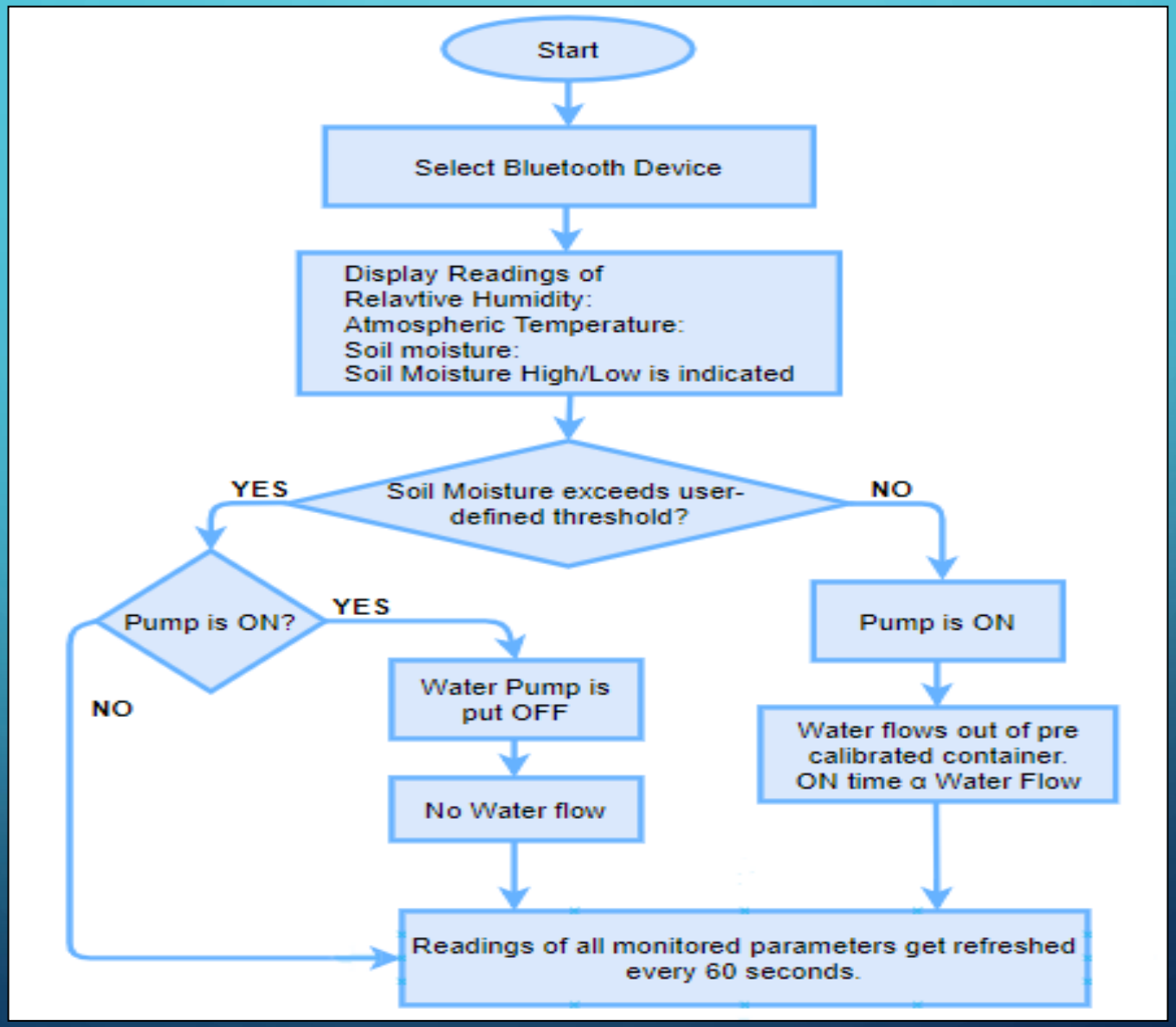
DHT11; Soil moisture sensor

Peristaltic Pump

FC28 ; Temperature and Humidity Sensor

SETUP OF PROPOSED PROJECT

FLOWCHART OF PROPOSED SYSTEM



ANDROID APPLICATION "FARMER_FRIEND"

Figure shows the main screen of "Farmer_Friend" Android application.

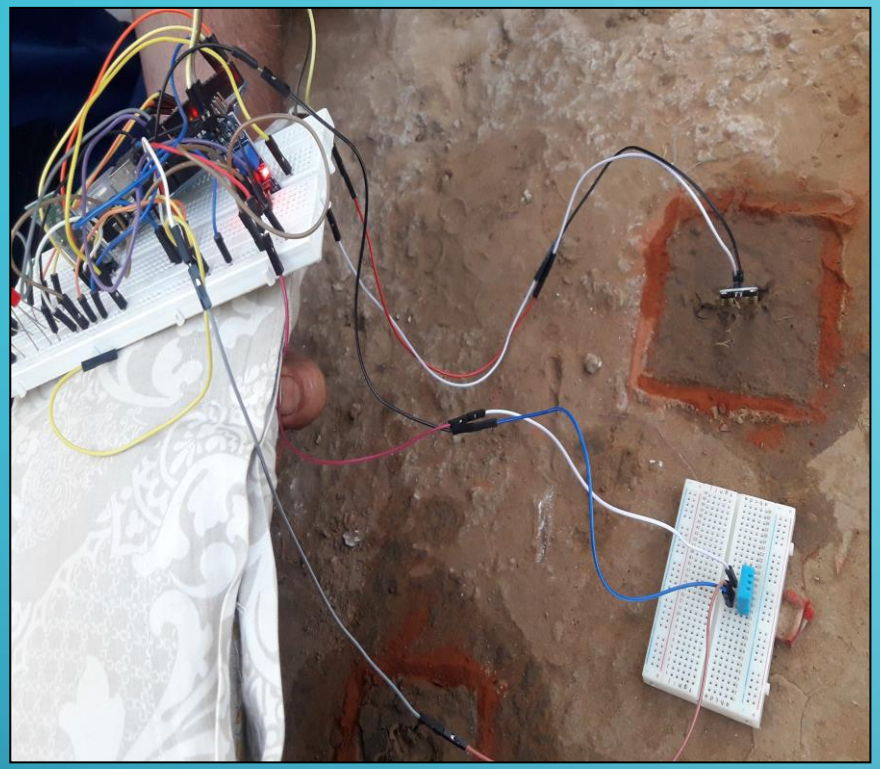
RESULT ANALYSIS

TABLE II
SOIL MOISTURE SENSOR RANGE COMPUTATIONAL TABLE

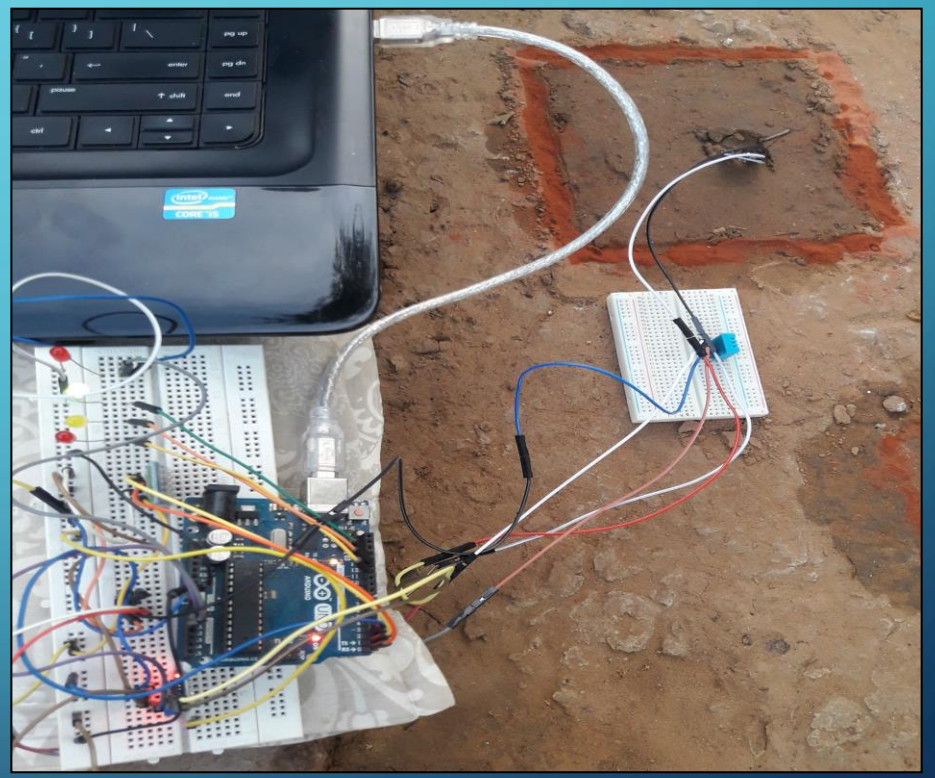
Area under check	Detection
5 cm x 5 cm	Yes
7 cm x 7 cm	Yes
10 cm x 10 cm	Yes
15 cm x 15 cm	Yes
20 cm x 20 cm	No

TABLE III
RECORDED VALUES OF PUMP CAPACITY

Pump ON time (min.)	Water Displaced (ml)		
	8-Jan-19	9-Jan-19	10-Jan-19
1	36	35	37
2	67	65	67
3	110	108	106
5	197	193	195



Soil Moisture sensor testing in 10cm x 10cm area



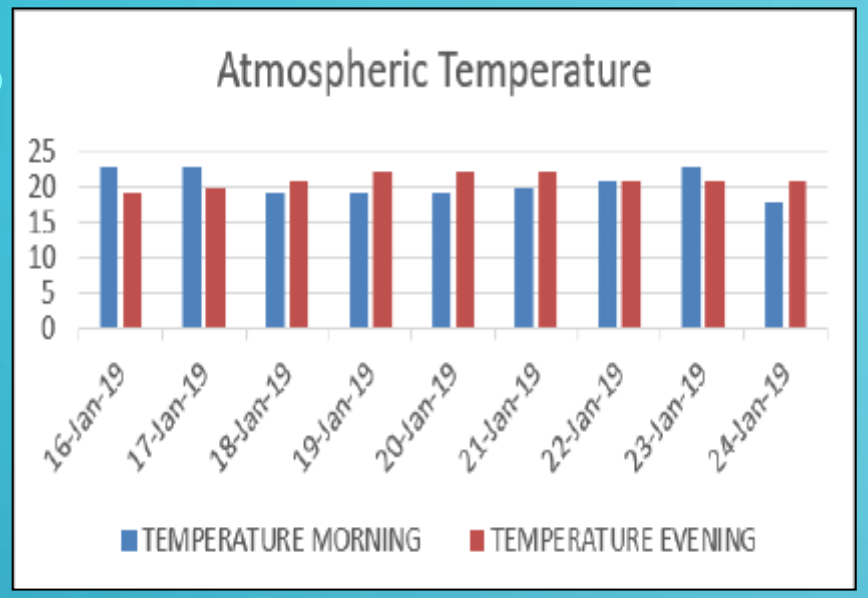
Soil Moisture sensor testing in 15cm x 15cm area

TABLE IV

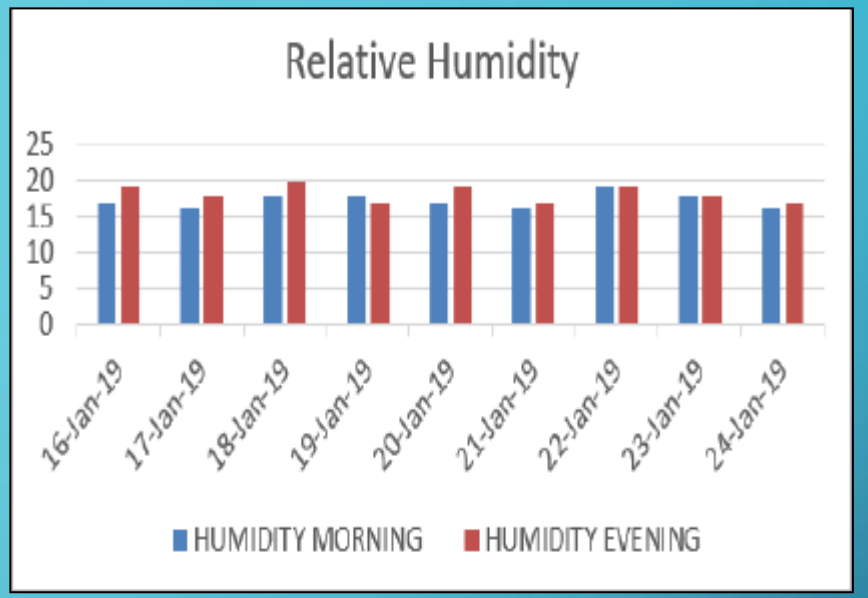
READINGS OF TEMPERATURE, HUMIDITY AND MOISTURE OF PERIWINKLE

Date	Morning			Evening		
	AT (°C)	RH (%)	SM (%)	AT (°C)	RH (%)	SM (%)
16-Jan-19	23	17	40	19	19	57
17-Jan-19	23	16	37	20	18	54
18-Jan-19	19	18	30	21	20	50
19-Jan-19	19	18	33	22	17	52
20-Jan-19	19	17	38	22	19	59
21-Jan-19	20	16	36	22	17	50
22-Jan-19	21	19	37	21	19	62
23-Jan-19	23	18	28	21	18	50
24-Jan-19	18	16	33	21	17	59

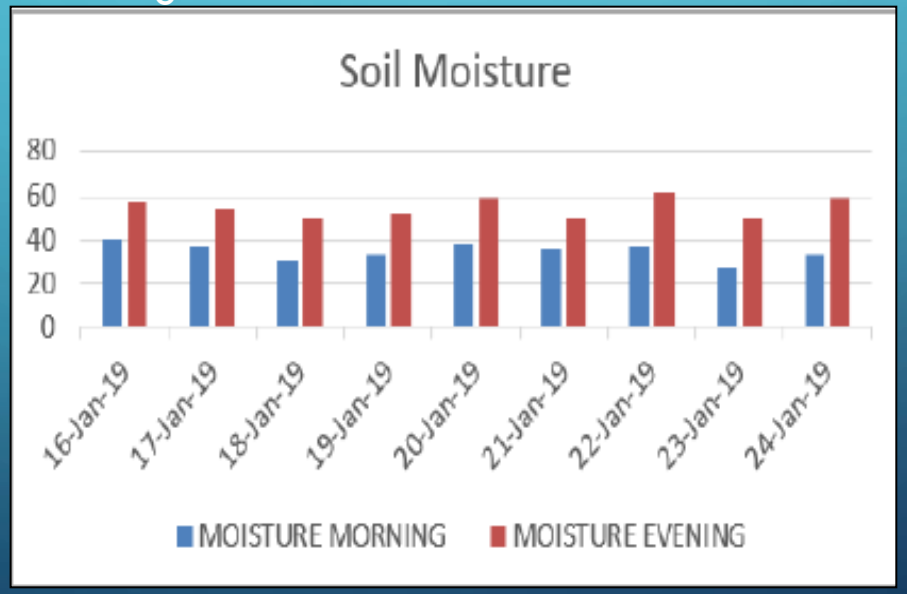
AT=Atmospheric Temperature, RH=Relative Humidity and SM=Soil Moisture



Graph showing Atmospheric Temperature readings in morning and evening



Graph showing Relative Humidity readings in morning and evening

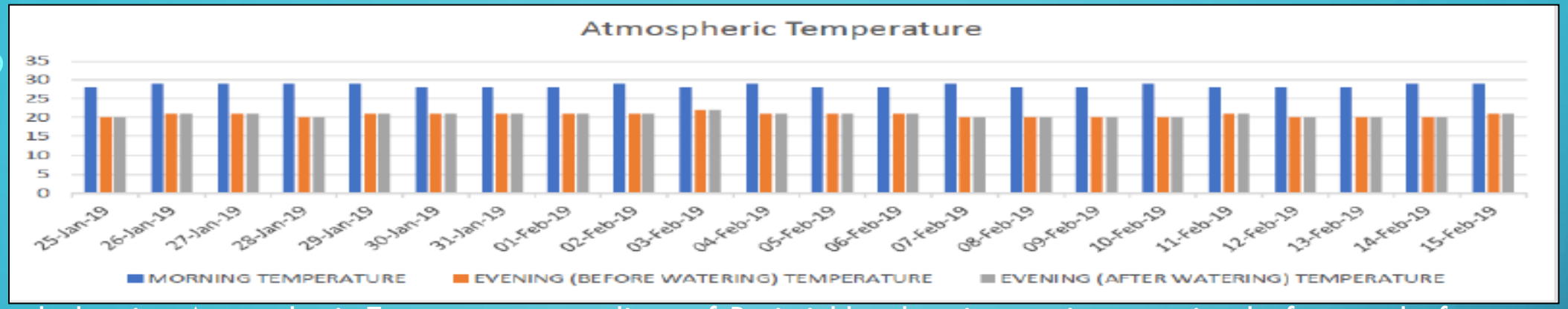


Graph showing Soil Moisture readings in morning and evening

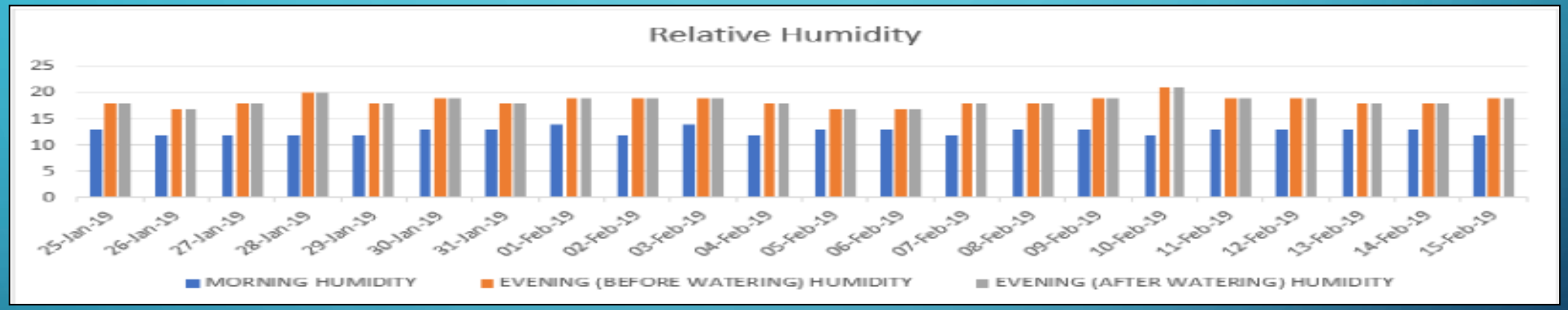
TABLE V
READINGS OF TEMPERATURE, HUMIDITY AND MOISTURE OF PERIWINKLE

Date	Morning			Evening (Before Watering)			Evening (After Watering)		
	AT(°C)	RH(%)	SM(%)	AT(°C)	RH(%)	SM(%)	AT(°C)	RH(%)	SM(%)
25-Jan-19	28	13	37	20	18	28	20	18	53
26-Jan-19	29	12	38	21	17	29	21	17	54
27-Jan-19	29	12	39	21	18	27	21	18	55
28-Jan-19	29	12	31	20	20	26	20	20	56
29-Jan-19	29	12	30	21	18	25	21	18	56
30-Jan-19	28	13	37	21	19	27	21	19	55
31-Jan-19	28	13	38	21	18	25	21	18	57
01-Feb-19	28	14	37	21	19	27	21	19	62
02-Feb-19	29	12	37	21	19	28	21	19	61
03-Feb-19	28	14	37	22	19	26	22	19	62
04-Feb-19	29	12	37	21	18	25	21	18	60
05-Feb-19	28	13	36	21	17	28	21	17	54
06-Feb-19	28	13	35	21	17	27	21	17	55
07-Feb-19	29	12	32	20	18	26	20	18	53
08-Feb-19	28	13	32	20	18	26	20	18	54
09-Feb-19	28	13	33	20	19	24	20	19	57
10-Feb-19	29	12	33	20	21	26	20	21	58
11-Feb-19	28	13	35	21	19	25	21	19	56
12-Feb-19	28	13	34	20	19	26	20	19	57
13-Feb-19	28	13	39	20	18	27	20	18	60
14-Feb-19	29	13	36	20	18	26	20	18	61
15-Feb-19	29	12	34	21	19	28	21	19	61

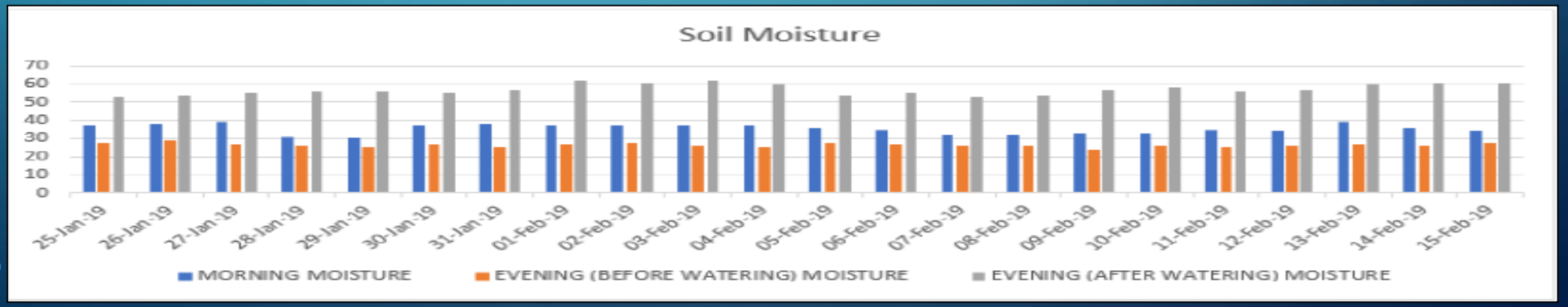
AT=Atmospheric Temperature, RH=Relative Humidity and SM=Soil Moisture



Graph showing Atmospheric Temperature readings of Periwinkle plant in morning, evening before and after watering



Graph showing Relative Humidity readings of Periwinkle plant in morning, evening before and after watering



Graph showing Soil Moisture readings of Periwinkle plant in morning, evening before and after watering

Result displayed on Android Application "Farmer Friend"

TABLE VI
COST OF COMPONENTS USED IN PROJECT

Component name	Quantity	Cost(₹)
Arduino Uno	1	400
Bluetooth Module (HC-05)	1	240
Peristaltic Pump (AB11)	1	750
Soil Moisture Sensor (FC-28)	1	80
Temperature and Humidity Sensor (DHT11)	1	80
Other small components	1	100
	Total	₹1670

CONCLUSION

A prototype for user based precision irrigation control of a potted Periwinkle plant is implemented and tested from 16th January to 15th February, 2019. Sensors (DHT11 and FC-28) are deployed on the potted plant and the monitored parameters are Atmospheric Temperature, Relative Humidity and Soil Moisture. Using Farmer Friend App these parameters are available to our registered mobile phone. When soil moisture goes below the threshold value, the user is updated to put the motor pump ON. Readings are taken every 60 seconds. Once the desired moisture level is achieved, the motor pump can be switched OFF. More number of sensors can be added and interfaced using Wireless Protocols for larger environment.

LINK TO THE IEEE PAPER PRESENTED:

-]“User Controlled Precision Irrigation System” by Rajnandini Tiwari, Yatri Patel and Geetali Saha, Accepted and Presented at VIT, Vellore, “IEEE International Conference on Innovations in Power and Advanced Computing Technologies”, **i-PACT-2019**, on 22-23 March'19.
  https://ieeexplore.ieee.org/document/8959516

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THANK YOU…!!!!