SUBMISSION OF PROPOSALS UNDER "PROJECT RELATED GRANT (PRG)" PROGRAMME OF DST (GOI)

A. IDENTIFICATION

1. Project title: **IOT ASSISTED SOLAR POWERED SMART IRRIGATION SYSTEM FOR EFFECTIVE WATER AND ENERGY MANAGEMENT IN AGRICULTURAL SECTOR**

2. State : **Telangana**

3. Broad Area
   - i. S&T studies / surveys (St)
   - ii. **Location Specific Research & Technology Development (LSR)** √
   - iii. S&T Demonstration Projects (DP)
   - iv. Replication of Successful Models (RP)
   - v. Joint S&T Programmes on specific theme (please specify) (JP)
   - vi. Information Exchange & Experience Sharing (IE)
   - vii. Awareness & Training on specific topic (Please specify) (TRG)

4. Duration: **12 Months**

5. Total Cost : **5 Lakhs**

6. Principal Investigator:
   - 6.1 Name : **Dr. T. Rajesh**
   - 6.2 Department : **Electrical and Electronics Engineering**
   - 6.3 Designation : **Professor**
   - 6.4 Organisation / Institution Name: **Malla Reddy Engineering College (Autonomous)**
   - 6.5 Address : **Maisammaguda, Dhullapally, Secunderabad – 500 100**
     Phone: +91 **9942988173**
     E-mail : **rajeshpradha@gmail.com**, Website: **www.mrec.ac.in**
   - 6.6 Date of Birth : **02-07-1978**
   - 6.7 Sex (M/F) : **Male**

7. Co-Investigator:
   - 7.1 Name : **Dr. Ezhil Vignesh K**
   - 7.2 Designation : **Associate Professor**
   - 7.3 Department : **Electrical and Electronics Engineering**
   - 7.4 Organisation / Institution Name: **Malla Reddy Engineering College (Autonomous)**
   - 7.5 Address : **Maisammaguda, Dhullapally, Secunderabad – 500 100**

Phone: +91 **9843267056**

E-mail: **ezhilvigneshk@gmail.com**,Website: **www.mrec.ac.in**

7.6 Date of Birth : **10-11-1986**

7.7 Sex (M/F) : **Male**

8. Capability of the Organization:

(a) Expertise available

Malla Reddy Engineering College (Autonomous) is one of the premier engineering colleges in Hyderabad, Telangana. MREC(A) is part of Malla Reddy Group of Institutions (MRGI), founded by Sri. Ch. Malla Reddy, currently Hon'ble Minister, Labour and Employment, Factories, Women and Chile Welfare and skill development, Govt. of Telangana State, who has invaluable insights into technical education of highest quality. The college is situated in a serener, lush green environment on Kompally-Bahadurpally Road, Opposite Forest academy, Mechal l- Malkajgiri District, Telangana State.

The college was established in 2002 and is an autonomous institution approved by UGC and affiliated to JNTUH. The college is re-accredited by NAAC with 'A' Grade (II Cycle) and was conferred autonomous status by JNTUHF in 2011 and by UGC in 2014 for a period of 6 years. Our eligible UG and PG programs received NBA accreditation and some of them received reaccreditation too.

The college caters to wide ranging aspirations and goals of student communities by offering relevant courses and programs in various streams of Engineering & Technology and Management. It boasts of world-class infrastructure and well equipped laboratories in all departments and received more than 50Lakhs amounts projects from various funding agency.

Sl.No	Name of the Lab	Major Equipment/Components	Purchase year	Cost
1.	Innovation Lab	3D Printing, PCB Fabrication, DSO, Cadence design software, FPGA kit, Various Sensors and High end systems	2018	15,00,000.00

2.	LabView Industry Sponsored Laboratory (National Instruments (NI) Bangalore)	My RIO, Core i5 or i7 processor @ 2.6GHz (64-bit), 8 GB, 1024 x 768 pixels, Dell OptiPlex 7010 Desktop PC - Intel Core i5-3470 3.2GHz 8GB 1TB H	2017	40,00,000.00
3.	Computer Lab with Amazon Web Service (AWS) – You can change as per your proposal	High configuration system with server	2017	23,00,000.00

(b) List of on-going and completed projects giving the following details

1. Details of Minor Research Projects funded by UGC

Sl. No.	**Name of the Project**	**Department**	**Amount sanctioned Rs**	**Status**	**No. of Papers Published**
1)	Hybrid Power transmission through Fluid coupling	Mechanical Engg.	2,60,000	**Completed**	2
2)	Load Flow contingency analysis, state estimation and optimal operation	EEE	1,80,500	**Completed**	2
3)	Image and gesture based single user transportation system	ECE	97,000	**Completed**	2
4)	Single phase bidirectional PWM converter for microgrid systems	EEE	2,60,000	**Completed**	2
5)	Environmental impacts on soil and water quality with special reference to pharma industry using remote sensing and geographical investigation systems	Civil Engg.	2,40,000	**Completed**	1
6)	Degradation of some of the Usepa listed recalcutrants using nano size semi conductors	Civil Engg.	2,50,000	Ongoing	4
7)	Synthesis characterization of Cu, Co and Au moxifloxacin nano metal complexes by eco-friendly methods and their biological applications	Chemistry	3,10,000	**Completed**	3

8)	Tunnable white light luminescence properties of rare earth ions doped $MnAl_2O_4$ Hybrid nano particles	Physics	1,50,000	Ongoing	1
9)	Green synthesis of gold nano particles used in Tumor targeted drug delivery system	Chemistry	2,59,000	Ongoing	1
TOTAL FUNDS Rs.			**20,06,900/-**		

2. Details of UBA (Unnat Bharat Abhiyan) funded by AICTE AQIS

Sl.No	Title of the Project	Department	Amount in Rs	Status
1)	Unnat Bharat Abhiyan	Institution	**50,000.00**	Completed

3. Details of Funds by AICTE AQIS

Sl.No	Title of the Scheme	Department	Amount in Rs	Status
1.	MODROBS – Software Defined Radio	EEE	12,71,000.00	In Process
2.	FDP- Big Data Analytics Using R, Hadoop and Spark	CSE	3,90,000.00	February 2020 (Completion date)
3.	STTP- LabView for Measurements and Data Analysis	EEE	2,73,000.00	Completed
4.	STTP- Research Methodology in Engineering and Technical writing using Latex	CSE	2,92,000.00	Completed
5.	**TOTAL in Rs.**		**22,26,000.00**	

4. Details of ISTE Refresher Programme funded by AICTE

Sl.No	Title of the Project	Department	Amount in Rs	Status
1.	AICTE-ISTE Sponsored 6-Day Refresher Programme on "Engineering Drawing-An Effective Teaching Methodology	Mechanical	3,00,000.00	Completed

5. Details of Research Promotional Scheme (RPS) funded by AICTE

Sl.No	Title of the Project	Department	Amount in Rs	Status
1.	RPS- Power Electronics	EEE	15,00,000.00	Provisionally selected and Recommended

B. TECHNICAL DETAILS

1. Background

1.1 Description of problem

Although water, in some parts of the world is as abundant as the air that we breathe, it is still a precious resource in dry regions. Such regions must use it carefully and efficiently because of its scarcity. However, the irrigation systems are still wasteful as they unnecessarily flood the farms. This results into wastage of water and energy that is used for pumping the water. With the improvement of the technological infrastructure, effective management of water usage and power consumption of irrigation systems by powering the circuits by solar power can be achieved. This can be done by enabling the irrigation system to identify specific areas to irrigate and also cost-effective solar power can be the answer for all our energy needs. Solar powered smart irrigation systems are the answer to the Indian farmer. This system will consist of solar powered water pump along with an automatic water flow control using a moisture sensor. It is the proposed solution for the present energy crisis for the Indian farmers. This system conserves electricity by reducing the usage of grid power and conserves water by reducing water losses. Water is an essential thing for crops and plants in agriculture. In traditional agriculture systems are take large amount of time to watering the crops lands and also have a lots of water wastes.

1.2 Review of work already done

A lot of research has been done to address this. ***S. Odara*** and his team developed an approach for integrating precision agriculture and smart grid technologies. This aims at balancing consumption and generation in the farmland, which increases the sustainability of energy supply. The coordination with the SmartGrid operator enables farmers to save on energy costs and support grid at peak hours. However, there is need for minimizing the amount of energy and water that is used in the farm. Furthermore, the tools and equipment used in the implementation of this approach make it rather costly which compromises its feasibility.

H. Jayasuriya and his team proposes a central smart irrigation system that controls several farms. Each farm has a data collection node that is connected to a computer installed in the farmland. Communication is done through a TCP/IP protocol over internet and it limits its applicability.

N. Sales, presents a cloud based control system for smart irrigation using wireless sensor networks. The environmental parameters are collected by sensors and uploaded to the cloud for evaluation. The actuator network is controlled remotely from the cloud after evaluation of the sensor data. This system also requires internet connectivity.

B. Khelifa, also addresses the challenge of power and water wastage in water constrained regions using an irrigation system that is based on the Internet of Things concept. The system collects environmental information and sends it to the farmer for easy decision-making using internet, which limits its feasibility in developing regions. The operating costs are also quite high as it involves labor and internet costs.

The research done ***L. G. Paucar*** proposes a monitoring and actuation system. It collects environmental parameters such as temperature, relative humidity and rainfall, as well as plant status like truck size and leaves' humidity. This is done using wireless devices that are spread over the land. The statistical data is sent to the central unit where the decision strategy is hosted. This control unit communicates with actuators that activate the water pumps for a specific period. The major difference with that system and the system proposed in this paper is the control units in the latter are decentralized. Each unit of implementation is self-sufficient.

N. Kaewmard focused on the use of remote switching and monitoring of irrigation systems using smart phones to address the need for automatic control of water near the vegetable roots is presented. The data about soil moisture, temperature and humidity is collected and sent to the smart phone for the user to make the decision. Switching of the irrigation system is remotely done by the user sending a command to the irrigation controller. However, this is not an automated approach since it involves deployment of human workforce. Hence, it highly increases the operation costs especially for large smart farms. Also, it requires ownership of a smartphone and skills to use it, posing some challenges for developing world.

Another smart system is proposed by ***A. Kumar***. It has a customized moisture sensor to collect moisture information and send it to a central server through Xbee communication. It enables farmers to monitor the moisture of the soil using a user-friendly interface. This ensures effective monitoring of the farm. However, automation of irrigation is important since it reduces on the operation costs of the smart farm. This has not been incorporated in the proposed solution.

P. Alagupandi, R. Ramesh, and S. Gayathri introduced ***a low*** power cost effective platform for use in irrigation is presented. It is called TinyOS. The OS has three essential layers that facilitate the development of smart irrigation applications. These layers include actuating, sensing and communication. This OS can be used to develop systems that can solve the challenge of power and water wastage in irrigation.

According to the survey conducted by the Bureau of Electrical Energy in India in 2011 there are around 18 million agricultural pump sets and around 0.5 million new connections per year is installed with average capacity 5HP. Total annual consumption in agriculture sector is 131.96 billion KWh (19% of total electricity consumption). As cited by ***Garg, H.P.*** solar powered smart irrigation technique is the future for the farmers and a solution for energy crisis. So, the solar powered system proposed by ***Halcrow, S.W. & K. K. Tse*** uses Sine PWM technique inverter for minimizing harmonics which further increases the efficiency of the system

1.3 Rationale for taking up the project

The rise in energy demand has outpaced power generation capacity due to the high increase in population and industries. This calls for management of demand to optimize the usage of the limited generated power. One of the areas where power is so essential is irrigation. There is always need to pump water to the water tanks and operate the irrigation system such as sprinklers. However, two scarce and valuable resources of irrigation, i.e. water and energy, are not efficiently utilized by the current irrigation systems. They do not have the means to determine where and when irrigation is required. Consequently, irrigation is sometimes performed when it is not necessary or delayed when required. This leads to water/energy waste and low-crop yield, respectively. These challenges can be mitigated if the irrigation system was able to determine precisely when and where to irrigate.

1.4 Relevance to State priorities

Smart village makes the relevance to any place. First we implement in one village that can be further utilized all over the state or country.

1.5 Financial resources committed at State level

After implementation of this project the prototype is going to commercialized. Because of commercialization the revenue is increased.

2. Challenge & Constraints

- During diffused sunlight time the availability of solar power is limited.
- The main challenge includes the integration of these sensors (environmental, soil moisture, temperature and pH) and tying the sensor data to the analytics driving automation and response activities. When integrated, the use of data analytics can reduce the overall cost of agriculture and contribute to higher production from the same amount of area through precise control of water, fertilizer and light. Smart methods allow for farming on smaller and more distributed lands through remote monitoring, whether indoor or outdoor.
- The communications network for integrating the plugged-in sensors is critical due to the reliability of the network. Topology of the land, wind and rain can affect point-to-point communications technologies for some private network types.
- Software integration with sensors and agricultural equipment is a time-consuming activity, but also one where seasonal conditions and crop expertise need to be considered.
- Sensors are easy to be fixed, but, unless the sensors are placed correctly in the fields, the ‘decisions’ taken by the smart irrigation network can very well be erroneous.

3. Description of Proposal

3.1 Objectives of the project

The Objectives of the Project is To Design and Develop the Following.

- Harvesting of solar energy using PV cells for irrigation.
- A farmer friendly drip irrigation system which can be easily integrated into existing fields.
- A mechanism to analyze the soil moisture patterns.
- Architecture for interaction between various components.

- User friendly Application Program Interface(API) on the mobile device to
- display the recognized sensor data.
- Controlling of the system remotely using the GSM internet facility.

3.2 Preliminary Investigations done by organization

In our organization we have the RND lab and LabVIEW academy which contains the basic sensors used for testing the results of the project. By using that Lab we completed more number of sponsored research projects from AICTE and DST. Already this project separately investigated at different levels and the testing was done.

3.3 S&T component in the project

- In this project the float sensors, Liquid Level sensor, Temperature and Humidity sensor, Ambient sensor, Moisture Sensor, Ultrasonic Sensor, IR Sensor and ACS 712 Current Sensor are used.
- PIC 16F877
- Solar Panels.
- Servomotor
- The Wi-Fi network is used for collecting information from the sensors.
- The Mobile is used for mobile Application.
- Raspberry Pi 4 is used for processing of the input and to generate the control signals.

3.4 Linkage with S&T Instts./NGOs/ resource persons / R&D organization / Industry for technical back-up

- The institution has a well established LabVIEW Academy installed by NATIONAL INSTRUMENTS, Bangalore.
- LabView and its related modules such as FPGA module, Real-Time Module, Embedded module, Wireless sensor modules, C generator modules and digital filter design toolkit found extensive applications in modern electronic system designing. Upon completion of the course, the participants are able to explore concepts with accelerated learning, and seamlessly apply their knowledge to design various real-life projects /experiments.
- MREC LabVIEW Academy Specification

  NI My RIO, Quanser Qube Servo 2.0, Pitsco My Quake, Pitsco My VTOL, Pitsco My TEMP, Emona my DSP, Emona my GLCD DSP, NI USRP – 2901, Tri Band V, Pitsco Tetrix Prime, NI My DAQ, etc., are available in our LabVIEW Academy.

- Resource Person: Prof. K.Jayaraman, Director, Industry Academia Relationship, United Electronics Bengaluru

3.5 Other organizations working in this area

National Instruments

3.6 Methodology detailing stepwise activities and sub-activities

The smart irrigation system consists of an aggregated network of water sprinklers and sensors. To enable the communication, the sprinkler is controlled by a microcontroller through the servo motor. The microcontroller sets the angles between which the servo motor should rotate, which enables the sprinkler to irrigate only within those angles. The microcontroller communicates with the sensors by Bluetooth. In this research, the integrated system of microcontroller, servomotor and sprinkler, and Bluetooth is called Smart Sprinkler (SSP). The architecture of the SSP is shown in the Figure 1.

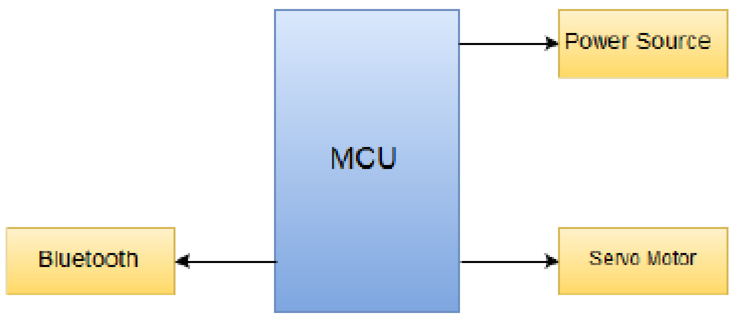

Figure 1 Smart Sprinkler (SSP) Architecture

On the other hand, a microcontroller that collects the readings from each of them and evaluates the data to determine whether a given region requires irrigation manages the sensors. This setup is called the Sensor Data Analyzer (SDA) and its architecture is shown in Figure 2.

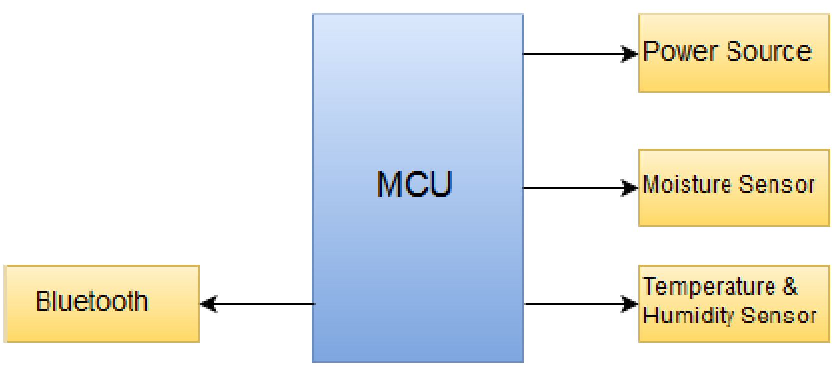

Figure 2 Sensor Data Analyzer (SDA) Architecture

The sensor information collected is from three sensors including moisture, temperature and humidity sensors. The moisture sensor gives moisture values between 0 and 900, the temperature gives value in Celsius and the humidity gives values in percentages. These individual sensor values are categorized into Low (L), Medium (M), Normal (N), and High (H). To increase the accuracy of the evaluation, the Medium category can further be broken down into Extremely Medium Low (ML), Medium Average (MA), and Medium High (MH) whenever it is necessary. The value is considered ML if it is tending towards Low, MA if it is tending towards neither Low nor High, and MH if it tends towards High. From these categories, a truth table was generated as shown in shown in Figure 3 to be used by the SDA during evaluation.

Sensor	Low	Medium	Normal and Above
Moisture	TRUE	TRUE	TRUE
Temperature	X		X
Humidity	X		X
Action	Irrigate		Don't Irrigate

Moisture	Medium Low				Medium Average				Medium High			
Temperature	H	H	L	L	H	H	L	L	H	H	L	L
Humidity	H	L	H	L	H	L	H	L	H	L	H	L
Is Irrigation REQUIRED?	T	T	F	T	T	T	F	F	F	T	F	F

Figure 3. Truth table for sensor data evaluation

As shown in the truth table, irrigation is not required when the temperature is Low and humidity is High, the state of moisture state. However, if the temperature is High and humidity is Low, irrigation is required even for Mild low Moisture values.

When irrigation is required, the microcontroller sends a request to the SSP, which turns the sprinkler to irrigate around that region from where the request has come. Each SSP has several SDAs surrounding it depending on the resolution (i.e. Sensor distribution that is needed for accurate evaluation) that is appropriate for a given piece of land. Each SDA is placed at a specific angle and it is programmed in such a way that the angle in which it is placed is its identification. Hence, the SSP identifies the region to irrigate by checking the ID of the SDA that sent the request. The flowchart in figure 4 shows how the SPP operates when it receives a request from the SDA.

The design in Figure 1 requires eight SDAs to realize accurate evaluation of the need for irrigation. As shown, the SSP is surrounded by eight SDAs placed 45 degrees away from each other. When the SSP receives a request from the SDA placed at angle A, the region that shall be irrigated is defined by the equation (1).

$$\left(\frac{nA-180}{n}\right) \leq A \leq \left(\frac{nA+180}{n}\right) \qquad (1)$$

where n is the number of SDAs connected to a given SSP, and A is the angle from which the request was received. For example, when an SDA positioned at 90 degrees sends an irrigation request to an SSP that is controlling eight SDAs, the SSP shall project the sprinkler to irrigate the area within 67.5^0 and 112.5^0as shown below.

$$\left(\frac{(8*90)-180}{8}\right) \leq 90 \leq \left(\frac{(8*90)+180}{8}\right) \qquad (2)$$

$$= 67.5^0 \leq 90 \leq 112.5^0$$

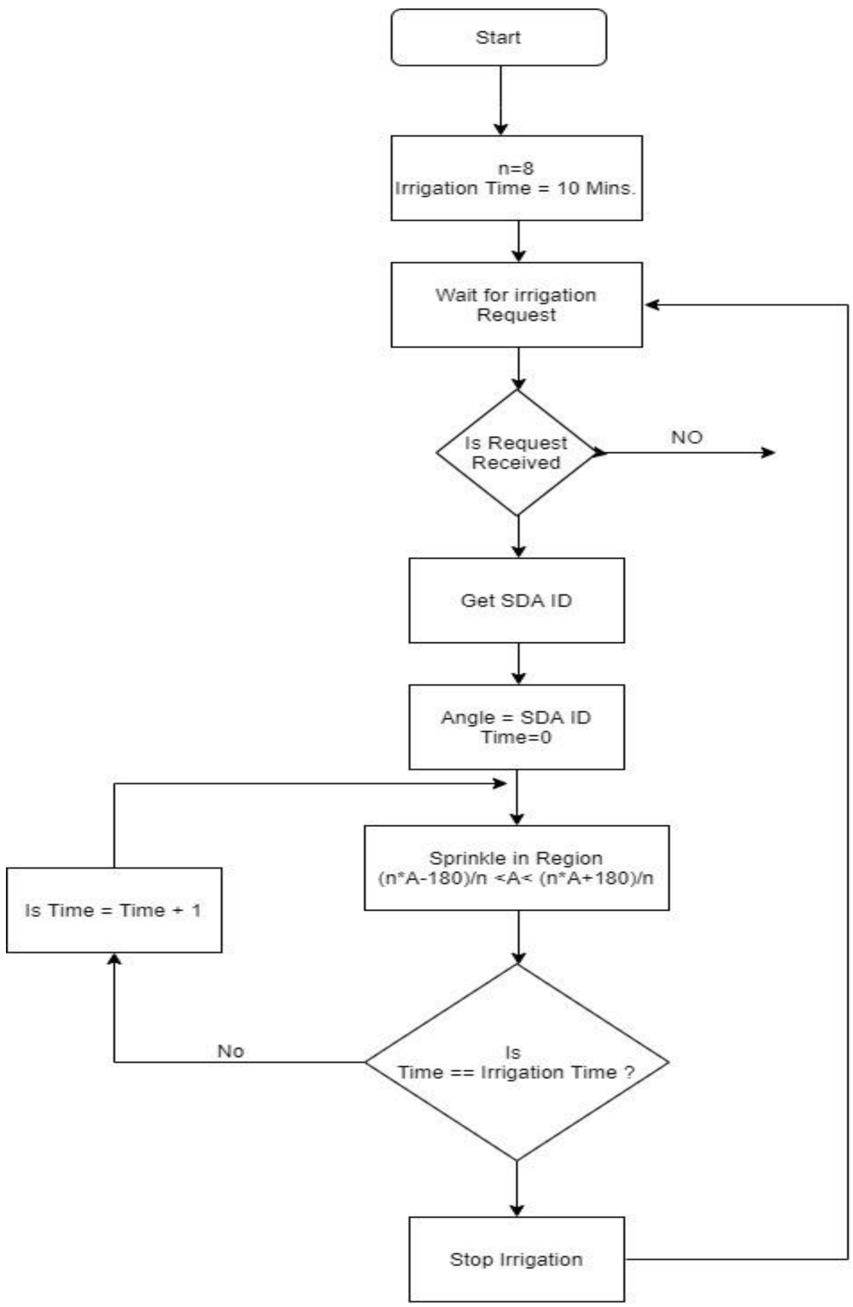

Figure 4 Flow Chart Showing Operation of SSP

4. Work Plan:

Sl. No.	Name of the Milestone	I Year (Months)					
		1-2	**3-4**	**5-6**	**7-8**	**9-10**	**11-12**
1.	Sanction of project						
2.	Investigation of nature of field and Literature survey						
3.	Investigation of suitable Controller of the project and selection of suitable sensors for the location and Literature survey						
4.	Implementation and Testing the control mechanism						
5.	Implementation and Testing of data acquisition from sensors through LabVIEW models.						
6.	Develop a prototype model for the combined model and patent registration						
7.	Project Documentation & Presentation						
8.	End of Project						

5. Output of the Project

- Smart irrigation was driven by IoT.
- The problems in irrigation system and effective utilization of natural resources (Solar Energy) can be solved.
- Sustainable technology with low cost sensors and Artificial Intelligence networks.
- Reduce the man power.
- Identification of optimal mix for better utilization.
- Mechanization strategies in the water system and empowering ranchers

6. Likely Impact

By implementing the proposed system there are various benefits for the government and the farmers. For the government a solution for energy crisis is proposed. By using the automatic irrigation system it optimizes the usage of water by reducing wastage and reduce the human intervention for farmers. The excess energy produced using solar panels can also be given to the grid with small modifications in the system circuit, which can be a source of the revenue of the farmer, thus encouraging farming in India and same time giving a solution for energy crisis. Proposed system is easy to implement and environment friendly solution for irrigating fields. The system was found to be successful when implemented for bore holes as they pump over the whole day. Solar pumps also offer clean solutions with no danger of borehole contamination.

The system requires minimal maintenance and attention as they are self-starting. To further enhance the daily pumping rates tracking arrays can be implemented. This system demonstrates the feasibility and application of using solar PV to provide energy for the pumping requirements for sprinkler irrigation. Even though there is a high capital investment required for this system to be implemented, the overall benefits are high and in long run this system is economical.

7. Parameters for monitoring effectiveness of project

Pre Intervention (Bench Mark)	Anticipated Outcome (likely deliverables)
IoT and AI	➢ Optimization of improved Quality of the system. ➢ Provides users knowledge anyplace and at anytime. ➢ Minimize man power and make the village smart.

8. Suggested Post Project Activities

- ➢ Research will be continued to refine the findings.
- ➢ User's entrepreneurs will be trained and supported.
- ➢ Trained beneficiaries will be followed, given financial and industrial linkages.
- ➢ Awareness on usage of these smart system alternatives and their benefits.
- ➢ Product production requirement of University, Companies and Constituent colleges.

C. BUDGET ESTIMATES : SUMMARY

Sl.No	**A .Recurring**	Budget (Rupees)	
	Item	Ist Year	Total
1	Salaries / Wages	120000.00	120000.00
2	Consumables	180000.00	180000.00
3	Travel	60000.00	60000.00
4	Other Costs	140000.00	140000.00
	B. Non Recurring		
1	Permanent Equipment	NIL	NIL
2	GRAND TOTAL (A+B)	500000.00	500000.00

* Financial Year: April to Match

* Count six months from submission of the proposal to arrive at expected time point for commencement of the project

* Please provide brief justification for each head of expenditure (100 words for each)

A.1 BUDGET FOR SALARIES / WAGES

Designation (No. of Persons)	Monthly Emoluments	Budget (Rupees)	
		Ist Year (m.m)	Total (m.m)
Part-time Assistant (01)	10000.00	12000.00	120000.00

A.2 BUDGET FOR CONSUMABLES

(In Rupees)

Item	BUDGET 1st Year	Total
1. Liquid Level Sensor	25100.00	25100.00
2. Float Sensor	11800.00	11800.00
3. Gas Detecting Sensor	22000.00	22000.00
4. Ambient Sensor	15500.00	15500.00
5. PIR Sensor	4800.00	4800.00
6. Moisture Sensor	5800.00	5800.00
7. Ultrasonic Sensor	15500.00	15500.00
8. IR Sensor	5000.00	5000.00
9. ACS 712 Current Sensor	2500.00	2500.00
10. Smart Mobile	10000.00	10000.00
11. Wi-Fi Module	25000.00	25000.00
12. Raspberry Pi 4	12000.00	12000.00
13. Personal Computer	25000.00	25000.00
Total	180000.00	180000.00

A.3 BUDGET FOR TRAVEL

(In Rupees)

Item	BUDGET 1st Year	Total
Travel 1. Local * (For Field Visits)	35000.00	35000.00
2. Out Station* (For attending Conference and Workshop)	25000.00	25000.00
Total	60000.00	60000.00

* Please specify

A.4 BUDGET FOR OTHER COSTS

(In Rupees)

Item	BUDGET	
	1st Year	Total
a. Contingencies	80000.00	80000.00
b. Others	60000.00	60000.00
Total	140000.00	140000.00

B. 1 BUDGET FOR PERMANENT EQUIPMENT

(In Rupees)

Sl.No.	Name of equipment *	Estimated cost
1.	NIL	
Total		

* Please give justification for each equipment

D. PROFORMA FOR BIO-DATA OF INVESTIGATORS (PI)

A. Name : **Dr. T.RAJESH**

B. Date of Birth : **02-07-1978**

C. Institutions : **Malla Reddy Engineering College (Autonomous)**

D. Whether belongs to SC/ST : **Yes**

E. Academic career : **Ph.D (EEE)**

Professional career **: Professor**

F. Award/prize/certificate etc won by the investigator: Best Faculty and Best Researcher Award

- Received Certificate of "Best Faculty Coordinator" for organizing Robo-Zest '15 in association with Sportech'15, IIT Delhi in the year 2015
- Received the Certificate of Appreciation for successfully coordinating Robo-Zest'17 in association with CEAFEST'17, IIT Madras in the year 2017
- Received "Innovative Scientific Researcher and Dedicated Professor Award" from Innovative Scientific Research Professional Malaysia (ISRPM) On 21st October 2018

G. Publication (Numbers only): 49

Books : 00 Research Paper : 24 General articles : 00
Patents : 03 Conference Paper : 25

H. Projects Completed:

Sl. No.	Title of Project	Duration		Total cost	Funding Agency
		From	To		
NIL					

I. Projects submitted

Sl. No.	Title of Project	Name of Organisation	Status
1	IoT, Wireless sensor Networks and Robotics	**DST**	**Submitted – Under Process**

Date: 29-01-2020
Place: Maisammaguda

(Dr. T. RAJESH)

D. PROFORMA FOR BIO-DATA OF INVESTIGATORS (CO PI)

A. Name : **Dr. K. Ezhil Vignesh**

B. Date of Birth : **10.11.1986**

C. Institutions : **Malla Reddy Engineering College (A)**

D. Whether belongs to SC/ST : **No**

E. Academic career : **Ph.D (EEE)**

Professional career **: Associate Professor**

F. Award/prize/certificate etc won by the investigator: Best Teacher Award, Best Researcher award

G. Publication (Numbers only): 18

Books : 02 Research Paper : 14 General articles : 0

Patents : 02 Others (please specify)

H. Projects Completed

Sl. No.	Title of Project	Duration		Total cost	Funding Agency
		From	To		
NIL					

I. Projects submitted

Sl. No.	Title of Project	Name of Organisation	Status
NIL			

Date : 29-01-2020

Place : Maisammaguda

(Dr. K. EZHIL VIGNESH)

ENDORSEMENT FROM THE HEAD OF INSTITUTION

“IOT ASSISTED SOLAR POWERED SMART IRRIGATION SYSTEM FOR EFFECTIVE WATER AND ENERGY MANAGEMENT IN AGRICULTURAL SECTOR”

1. Certified that the Institute welcomes participation of **Dr.T.RAJESH** as the Principal Investigator and **Dr.K.Ezhil Vignesh** as the Co-Investigator for the project and that in the unforeseen event of discontinuance by the Principal Investigator, the Co-Investigator will assume the responsibility of the fruitful completion of the project (with due intimation to DST (GOI)).

2. Certified that the equipment, other basic facilities and such other administrative facilities as per terms and conditions of the grant, will be extended to investigator(s) throughout the duration of the project.

3. Institute assumes to undertake the financial and other management responsibilities of the project

Name and Signature of Head of Institution

Date : 28-01-2020
Place : Maisammaguda