Safeway for Sugarcane using IoT: Indian Agriculture

Anuradha Badage
Assistant Professor
Department of Computer Science & Engineering
Sapthagiri College of Engineering, Bengaluru-57 Karnataka, India

Abstract— Agriculture is the back bone of India. Nearly 70% of population lives in rural or the remote area that's with lack of all basic facilities. Here is an attempt to provide the safety way to transfer crops from source to the destination where it will be processed. Solar street light in rural area has huge impact as it provides reliable outdoor lighting which improves the living condition by providing safety to rural people. The proposed concept talks about making the road lights as "things" of IoT. By using Solar panels, microcontroller and PIR sensors and LoRa technology, automated road lights can be made as Smart Road Lights which reduces the risk of travels.

Key words: LoRa, Renewable Source, Sensor, Microcontroller

I. INTRODUCTION

During the harvesting period the farmers need to transfer their crop to processing sector that may be a market or factories. In India majority of the population's income by any means depend on agriculture. So it is of cardinal importance to effectively use the technology to enhance vita resources.

Sugar industries development is backbone to economic development of the nation. In India, Sugar industry is the second largest agro-based industry and it contributes significantly to the socio economic development of the nation. Indian sugar industry is also a major sector to create employment probably 7.5 per cent in Indian economy. The sugar industry plays a leading role in global market being the world's second largest producer after Brazil, producing nearly15 and 25 per cent of global sugar and sugarcane respectively

Providing the safe and secured life to the backbone on India is higher prioritized. During the harvesting period of sugarcane November to March, the farmer needs to transfer their sugarcane to the factories through some means of transportation which will be travelling both in day and night time.

Krishna Kittur is a village situated in Belgaum District, Karnataka with 16.6662 Latitude and 74.89535 Longitude (16.6395° N, 74.9180° E). Nearby Sugar processing factories are Ugar Sugar Works Ltd which is 15 km away, Krishna Sugars Pvt Ltd which is 45 Km away and Sri Renuka Sugars Pvt Ltd which is 45 Km away from the village Krishna Kittur.

During the harvesting period, Ugar Sugar Works Ltd. itself processes 15,97,964 metric tons of sugar cane (2018-19 season). Because of this high crushing capabilities and good returns, surrounding farmers approaches this factory for processing. They transfers their sugarcane to factory day and night and joins the queue.

Night travelling in Indian villages is very critical. Many parameters we need to consider like- road structure, width of the path, light facility throughout the path. Many villages are having the deficiency of basic facilities. Many villages are facing power scheduling problems and in such a situation we cannot expect the fully fledged electricity throughout the road from farmer field to Sugar factory. Most of the time we have seen that streetlight in ON state even after the sunrise in the urban area. and on the other side we have also seen that rural people are still with darkness.

We need to save or conserve energy because of most of the energy source we depend on like coal and natural gas cannot be replaced. As we know the major source of energy to produce electricity is hydroelectricity energy, which is having high production cost. Instead of this we can go for Solar energy which is cost efficient. So it is necessary for efficient and renewable energy system that has greater advantages. If we utilize the existing electricity in a proper way then we can provide same lighting facility for all around the India.

We need a smart lighting system that will help us to save energy, reduce maintenance costs, get real time reports, full controllability over the light intensity and reduce CO2 emissions. Here is an attempt to propose automatic system to provide a safe and secure way for sugar cane to processing sectors.

II. CONNECTING FIELD TO FACTORY

A. *LoRa Technology*

LoRa technology is used to connect the road lights throughout the way from village to the processing sectors.

LoRa (short for long range) is a spread spectrum modulation technique derived from chirp spread spectrum (CSS) technology. Wireless radio frequency technology (LoRa Technology) is a long range, low power wireless platform that has become the de facto technology for Internet of Things (IoT) networks worldwide. LoRa Technology enables smart IoT applications that solve some of the biggest challenges facing our planet: energy management, natural resource reduction, pollution control, infrastructure efficiency, disaster prevention, and more. LoRa Technology is the DNA of IoT, creating a Smarter Planet.

LoRa Technology offers compelling features for IoT applications including long range, low power consumption and secure data transmission. The technology can be utilized by public, private or hybrid networks and provides greater range than cellular networks. LoRa Technology can easily plug into existing infrastructure and enables low-cost battery-operated IoT applications.

LoRa Technology has revolutionized IoT by enabling data communication over a long range while using very little power. When connected to a non-cellular LoRaWAN network, As shown in the Fig1, LoRa devices accommodate a vast range of IoT applications by transmitting packets with important information. LoRaWAN fills the technology gap of cellular and Wi-Fi/BLE based networks that require either high bandwidth or high power, or have a

limited range or inability to penetrate deep indoor environments. In effect, LoRa Technology is flexible for rural or indoor use cases in smart cities, smart homes and buildings, smart agriculture, smart metering, and smart supply chain and logistics.

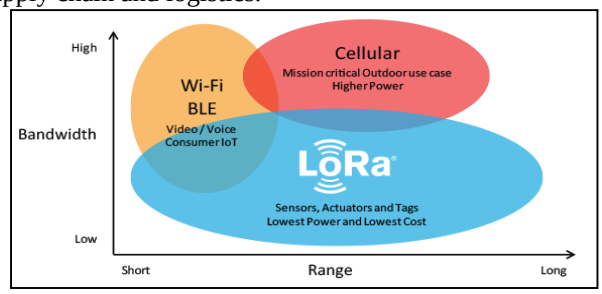

Fig. 1: LoRa Access Technology

B. *LoRa Complements Wi-Fi, Bluetooth and Cellular:*

Like Wi-Fi, LoRa operates in the unlicensed band and supports indoor applications; like cellular, LoRa Technology is highly secure from end devices to the application server, and is suitable for outdoor applications. LoRa Technology combines these features of Wi-Fi and cellular networks to offer an efficient, flexible and economical connectivity solution ideal for IoT applications whether indoor or outdoor and installed in public, private or hybrid networks (Fig 2). Simple sensor data can fuel analytics platforms, such as those for artificial intelligence and machine learning. These require data diversity which is made possible by low-cost LoRa-enabled sensors.

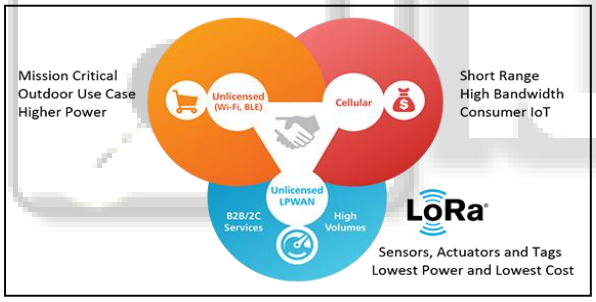

Fig. 2: LoRa Complements Wi-Fi, Bluetooth and Cellular

C. *LoRaWAN*

The LoRaWAN open specification is a low power, wide area networking (LPWAN) protocol based on LoRa Technology. Designed to wirelessly connect battery operated things to the Internet in regional, national or global networks, the LoRaWAN protocol leverages the unlicensed radio spectrum in the Industrial, Scientific and Medical (ISM) band. The specification defines the device-to-infrastructure of LoRa physical layer parameters and the LoRaWAN protocol, and provides seamless interoperability between devices.

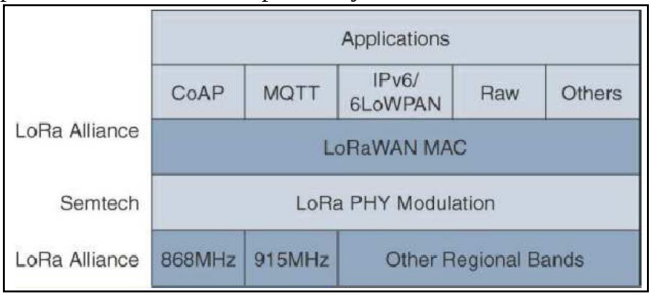

Fig. 3: LoRaWAN Layers

D. *Solar Panel*

A solar panel works by allowing photons, or particles of light, to knock electrons free from atoms, generating a flow of electricity. Solar panels actually comprise many, smaller units called photovoltaic cells.

1) Merits:

- Solar street light is independent of grid as a result of this operating cost is much low.
- Maintenance cost is much low compared to conventional street light.
- Intensity of LED can be controlled effectively without changes in its light color which is not possible in case of HPS.
- Risk of accidents is very low.
- It is environmental friendly, no harmful emissions.
- Longer life compared to conventional street lights.
- Power consumption is much lower.
- Solar street lights are independent of the utility grid, hence operation costs are minimized
- Since external wires are eliminated, risk of accidents is minimized.
- This is a non-polluting source of electricity.

2) Demerits:

- Initial investment is very high.
- Rechargeable batteries have to be replaced from time to time
- Non-availability of sunlight during rainy and winter sea- sons is a problem.
- Dust accumulation on the surface of panel creates a problem.

III. PROPOSED METHOD

Solar energy is used for both lightening the lamp and also to charge the microcontroller. The proposed system processes in two stages: First stage is about using the natural resource of light. Sun rays are converted into electrical energy which will be used for lightening the lamp and to power the microcontroller. Second part is about decision support system. This subsystem is responsible for taking the decision about three different states of light.

The proposed system works with the following steps:

- -Sensed light intensity is processed by the microcontroller
- -If the light intensity is higher than the threshold then Condition will be set as DAY that means the light will be in the OFF state.
- If the light intensity is less than the threshold then the condition will be considered as NIGHT.
- If the condition is NIGHT then next work is to switch on the light. But for this again decision should be followed by two more conditions. System is with IR sensor which will help out to identify any vehicle approaching near to the light pole. If any vehicle is coming near to the light pole the light-State will be made as HIGH. This state will be retained to some period of time that means until it is the range of that sensor. Once the vehicle passes away from the range of presence IR sensors range then the light-state will be DIM.

The electrical pole itself is made as a "thing" in the IoT by connecting it through internet. "Things" are connected using LoRa access technology. The system keeps the track of number of objects passed on the road. this count will be stored and analyzed for taking or providing different types of services.

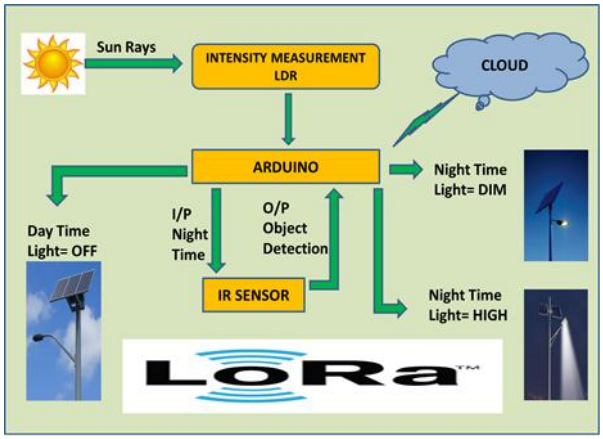

Fig 4: System Architecture

The system architecture (Fig 4) gives the complete picture of proposed system. Solar panels are used for efficient usage of electricity. LoRa access technology is used to connect the sensors for communication. The sensed data is stored in the cloud for further propose. Microcontroller is responsible for taking decision about three different states of light.

IV. Conclusion

The proposed system provides a safe and secured transformation of Sugarcane to the processing sectors. It addresses the rural area deficiencies of basic facilities. The attempt of using technology for Indian rural area is addressed by using LoRa access technology for communication and making road side lights as "thing". Renewable energy Source is used in order to reduce power consumption, cost and manual controlling method. This system is an attempt to save the back bone of India by providing the safe and bright path from the field to the processing factory by reducing the road accidents.

References

[1] An Automation System for Controlling Streetlights and Monitoring Objects Using Arduino, www.mdpi.com/journal/sensors, Published: 20 September 2018
[2] Aron D'souza, Omkar Bhosale, Miheer Bhilare, Shubham Sawant,"Arduino Based Solar Street Lighting", International Journal of Scientific & Engineering Research, Volume 9, Issue 2, February 2018.
[3] Parkash, Prabu V, Dandu Rajendra,"Internet of Things Based Intelligent Street Lighting System for Smart City", IJIRSET, vol 5, issue 5,May 2016.
[4] Adetiba, E.; Matthews, V.O.; Awelewa, A.A.; Samuel, I.A.; Badejo, J.A. Automatic electrical appliances control panel based on infrared and Wi-Fi: A framework for electrical energy conservation. Int. J. Sci. Eng. Res. 2011, 2, 1–7.
[5] F. J. Nogueira, L. A. Vitoi, L. H. Gouveia, C. G. Casagrande, D. P. Pinto and H. A. C. Braga. "Street lighting LED luminaires replacing high Pressure sodium lamps: Study of case". IEEE/IAS International Conference on Industry Applications (INDUSCON), Juiz de Fora, Brazil, 2014.
[6] Abdul Latif Saleem, Raja Sagar R, Sachin Datta N S, Sachin H S,Usha M S "Street Light Monitoring and Control System" International Journal of Engineering and Techniques - Volume 1 Issue2, Mar – Apr 2015.

