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Smart Village for Rural Development

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Abstract- This paper presents different methods to implement GSM based smart village. Smart villages are rural communities which use innovative solutions to enhance their sustainability, built on local strengths and opportunities. The idea of smart village would help villages become self-reliable that can encourage foreign and domestic investors. Various techniques are also discussed, such as smart irrigation, safety, and soil testing, automatic street lights which are used for implementation of smart village.

Keywords- IoT, soil moisture, level sensors, waste management cloud computing, real time monitoring using GSM systems.

INTRODUCTION

Some of India's greatest challenges are growing growth and rapid urbanization. This urban growth is inevitable to such an extent that the economic interests and aspirations of the population are shifting and expanding.

It will be reversed and managed properly by a variation of the "Smart City" standard of life between rural and industrial would include long-term social, economic and environmental development initiatives for rural populations that would be willing to inspire greater involvement in municipal government systems, promote creativity to create more diverse neighbourhoods.

"Smart Village" would ensure proper schooling, improved services, effective sewage systems, utilities, green health facilities, electricity, environmental control of waste, safe drinking water, resource quality, etc.

II. METHODOLOGY

The overall block diagram of the smart village system. The enormous IT infrastructure is required by rural development along with the huge financial support which is to be incorporated. Sensors, thousands of networking equipment and computing devices are built in this complex network. Operational and maintenance cost of such a complex real time system will be much higher which is evident to meet stringent reliability and efficiency improvement.

In case of smart irrigation management system each field has to be fitted with a sensors and data control unit which are highly efficient and reliable. The paramount importance should be given to develop an economically viable and culturally sensitive ecosystem in villages. The challenges remain the same; direct access to the global market has been a major challenge largely due to multiple intermediaries and lack of skilled workforce. The large population lives in villages, we always fail to improve economic potential and basic services by creating smart village.

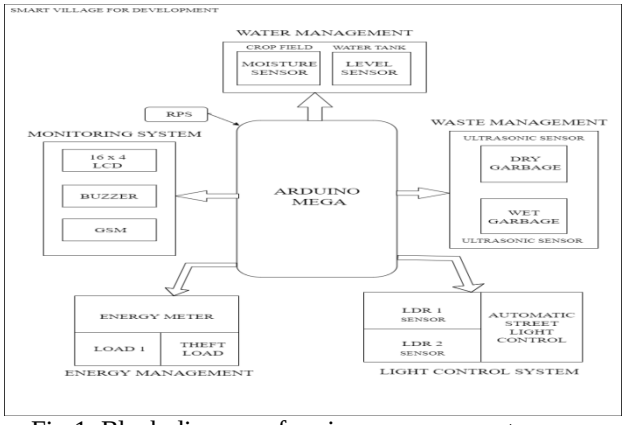


Fig 1. Block diagram of various management.

II. HARDWARE DESCRIPTION

1. What is an Arduino Mega 2560?

The microcontroller board like “Arduino Mega” depends on the ATmega2560 microcontroller. It includes digital input/output pins-54, where 16 pins are analog inputs, 14 are used like PWM outputs hardware serial ports (UARTs) – 4, a crystal oscillator-16 MHz, an ICSP header, a power jack, a USB connection, as well as an RST button. This board mainly includes everything which is essential for supporting the microcontroller. So, the power supply of this board can be done by connecting it to a PC using a USB cable, or battery or an AC-DC adapter. This board can be protected from the unexpected electrical discharge by placing a base plate.

Fig 2. Arduino Mega 2560

2. LDR:

An LDR or light dependent resistor is also known as photo resistor, photocell, and photoconductor. It is a one type of resistor whose resistance varies depending on the amount of light falling on its surface.

This resistor works on the principle of photo conductivity. It is nothing but, when the light falls on its surface, then the material conductivity reduces and also the electrons in the valence band of the device are excited to the conduction band. These photons in the incident light must have energy greater than the band gap of the semiconductor material. This makes the electrons to jump from the valence band to conduction.

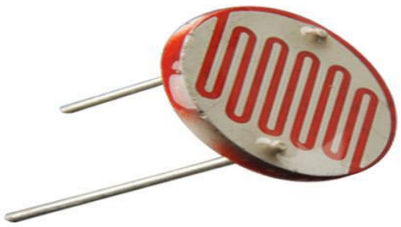


Fig 3. LDR.

3. 16*4 LCD Display:

WH1604B is a Character 16x4 LCD module which is built in with ST7066 controller IC; its default interface is 6800 4/8-bit parallel. These 16x4 LCD display modules are also available in SPI and I2C interface by using RW1063 controller IC. The LEDs can be driven by pin 1, pin 2, or pin 15 pin 16 or A/K. This type of module can be operating at temperatures from -20℃ to +70℃; its storage temperatures range from -30℃ to +80℃.

Fig 4. 16*4 LCD Display.

4. GSM:

GSM (Global System for Mobile communication) is a digital mobile network that is widely used by mobile phone users in Europe and other parts of the world. GSM uses a variation of time division multiple access (TDMA) and is the most widely used of the three digital wireless telephony technologies: TDMA, GSM and code-division multiple access (CDMA). GSM digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own time slot. It operates at either the 900 megahertz (MHz) or 1,800 MHz frequency band.

Fig 5. GSM module.

5. Buzzer:

The working principle of a buzzer depends on the theory that, once the voltage is given across a piezoelectric material, then a pressure difference is produced. A piezo type includes piezo crystals among two conductors. Once a potential disparity is given across these crystals, then they thrust one conductor & drag the additional conductor through their internal property. So this continuous action will produce a sharp sound signal.

Fig 6. Buzzer.

6. Energy Meter

The meter which is used for measuring the energy utilises by the electric load is known as the energy meter. The energy is the total power consumed and utilised by the load at a particular interval of time. It is used in domestic and industrial AC circuit for measuring the power consumption. The meter is less expensive and accurate.
The energy meter has four main parts. They are the

The detail explanation of their parts is written below.

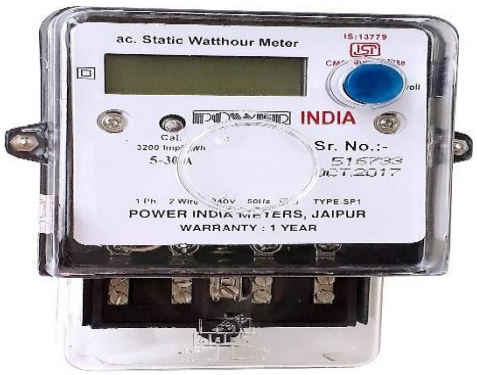
6.1 Driving System: The electromagnet is the main component of the driving system. It is the temporary magnet which is excited by the current flow through their coil. The core of the electromagnet is made up of silicon steel lamination. The driving system has two electromagnets. The upper one is called the shunt electromagnet, and the lower one is called series electromagnet.

6.2 Moving System: The moving system is the aluminium disc mounted on the shaft of the alloy. The disc is placed in the air gap of two electromagnets. The eddy current is induced in the disc because of the change of

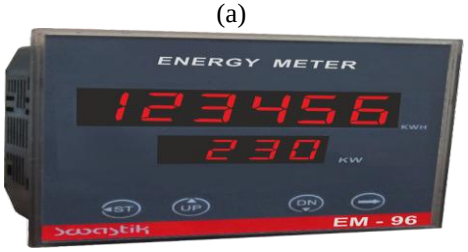
the magnetic field. This eddy current is cut by the magnetic flux. The interaction of the flux and the disc induces the deflecting torque.

6.3 Braking system: The permanent magnet is used for reducing the rotation of the aluminium disc. The aluminium disc induces the eddy current because of their rotation. The eddy current cut the magnetic flux of the permanent magnet and hence produces the braking torque.

6.4 Registration (Counting Mechanism): The main function of the registration or counting mechanism is to record the number of rotations of the aluminium disc. Their rotation is directly proportional to the energy consumed by the loads in the kilowatt hour. The rotation of the disc is transmitted to the pointers of the different dial for recording the different readings. The reading in kWh is obtained by multiply the number of rotations of the disc with the meter constant. The figure of the dial is shown below.



(a)



(b)

Fig 7. Electric Meter and Energy meter.

7. Load:

The specification for the lamp load allows for the fact that the switch-on current of a filament lamp is n times greater than the rated current. The resistance only rises sharply as a result of the filament heating up. The lamp load is characterized in the data sheets by a wattage specification.

Fig 8. Lamp Load.

8. Ultrasonic Sensor:

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e. the sound that humans can hear). Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target).

Fig 9. Ultrasonic Sensor.

III. RESULT

We got a model village, in which we used modern technologies to reduce the man power and to spread awareness about the modern technologies to villagers.

1. Light Control Management:

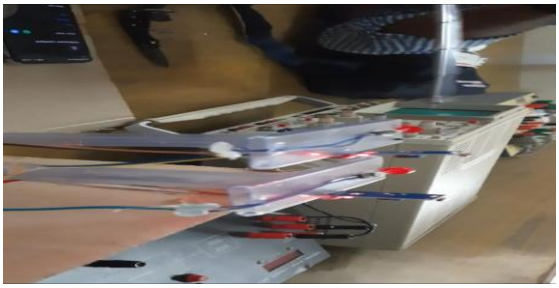


Fig 10. Automatic Street Light Control management system.

This management is helpful in controlling the street light without manually performing. The street lights are automatically switched ON when the sunlight goes below the visible region of our eyes.

2. Water Management:

As shown in figure 11, water level sensor and soil moisture sensor performs the same function i,e as water level exceeds or decrease the sensor send the signal as an indicator, thus pump will ON/OFF respectively as per requirement. As same soil moisture, if soil is dry, its sense that there is no moisture hence it makes pump ON and vice-versa

(a)

(b)

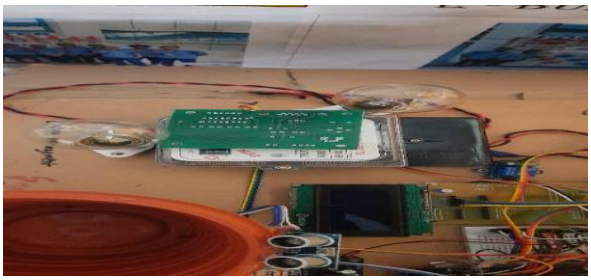
Fig 11. (a) Water level sensor (b) Moisture Sensor used in wet and dry soil.

3. Waste Management:

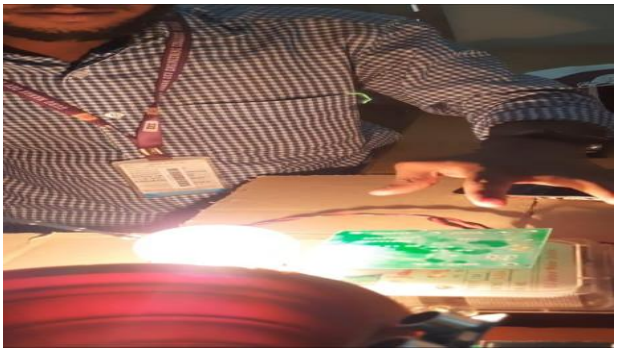
Fig 12. Two bins separated with dry and wet wastage.

In this, Ultrasonic sensor has a limit/distance which is set and when the waste is full up to that limit, thus sensor senses that the respective bins are full and it immediately send a message to the respective cleaning department to clean the waste.

4. Energy Management:



(a)



(b)

Fig 13. Supply with theft and normal load.

This management is completely operated manually, when we send a message as “A” then the load will be ON and the its start consuming electricity till the unit, which is set already once it reaches the limit, the user receives a message that the user had consumed electricity. We have an external load which is theft load, once the theft load is activated or attached with an actual load then sensors gets activated and an alarm starts beeping and both the loads will get OFF immediately.

5. Monitoring System:

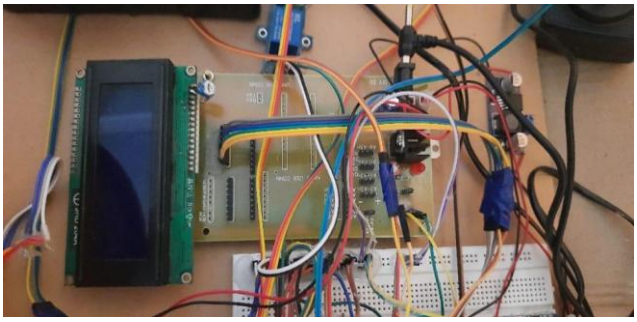


Fig 14. All management working details are displayed on this LCD display.

All the information from stating to ending about each management are displayed on the screen about their working, we can get to know that what is happening in the project.

6. Overall project:

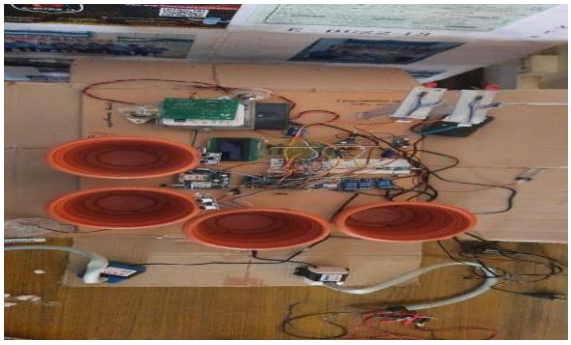


Fig 15. Overall project view.

IV. CONCLUSION

Smart village that aims to empower villages with advance rural connectivity through web server, measurement of environment factors like soil moisture, level sensors, waste management and implementation of cloud computing along with real time monitoring using GSM systems.

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