International Journal of Scientific Research and Engineering Development-– Volume 3 - Issue 4, July - Aug 2020
Available at www.ijsred.com

RESEARCH ARTICLE OPEN ACCESS

SMART BUS STAND

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ABSTRACT:

A bus stand or bus stop is a public infrastructure where buses stop for passengers to get on and off the bus. The construction of bus stops tends to depend upon the level of usage, where stops at busy locations may have shelters, seating & possibly power supply, less busy stops may use a simple pole and flag to mark the location. Many times, the passengers have to wait for their ride. A sanitation system is required for maintaining proper hygiene which in turn arises a need for water supply. However, it takes a notable amount of energy to lighten up every bus stop in a city, and providing even more for a water abstraction system is not an option.

This paper tends to resolve this issue by bringing together different new innovations in energy harnessing using a solar module, optimal utilization of yielded power & a water abstraction module.

KEYWORDS: Sanitation, Hygiene, Solar Power, Abstraction

INTRODUCTION:

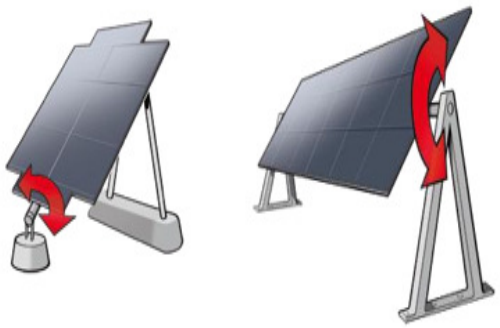
A bus stop enhances public safety by preventing passengers from trying to board or alight in hazardous situations such as at intersections or where a bus is turning and is not using the curb lane. Moreover, any bus driver cannot be expected to continuously look for intending passengers. A bus stop means that the driver only needs to look for intending passengers at the approach to each bus stop. This also saves time since the bus picks up groups of people and not one individual at a time from any random places.

However, there is always scope for improvisation and optimization for better functioning of a system. This project employs a solar tracking system that increases the duration of exposure of the panel to solar energy and therefore, storing maximum capacity for usage. Also, this power drives the water abstraction system that aids the operations of the urinal attached to the bus stop.

Our main aim is to innovate an infrastructure that has been around since the 17th century when horse-drawn stagecoaches ran regular services between many European towns, starting and stopping at designated coaching inns where the horses could be changed and passengers board or alight, in effect constituting the earliest form of a bus stop. The Angel Inn, Islington, the first stop on the route from London to York, was a noted example of such an inn.

METHODOLOGY:

The operation of this project is divided into two modules. The first one is for energy harnessing and storage. Solar energy is an inexhaustible alternative for power generation. But the typical stationary solar panel model does not get that much exposure to the sun throughout the day to create enough energy for the operation of the bus stand. To maximize the absorption of sun rays we are suggesting a single axis solar tracking system that moves the panel along with the position of the sun in the sky which is determined by a light



detecting resistor in the solar module.

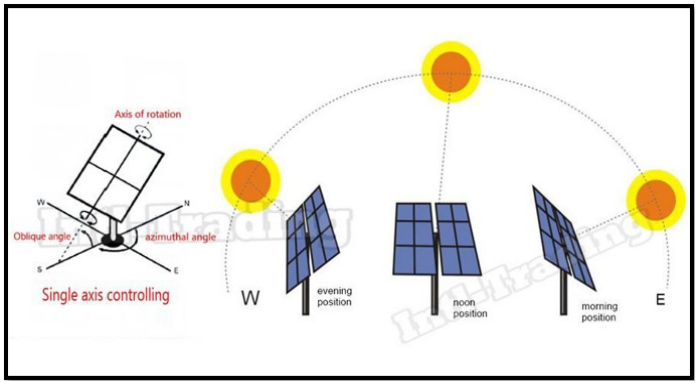


Figure1 *illustrates the single-axis panel and its movement along with the position of the sun from facing east at dawn and west at dusk.*

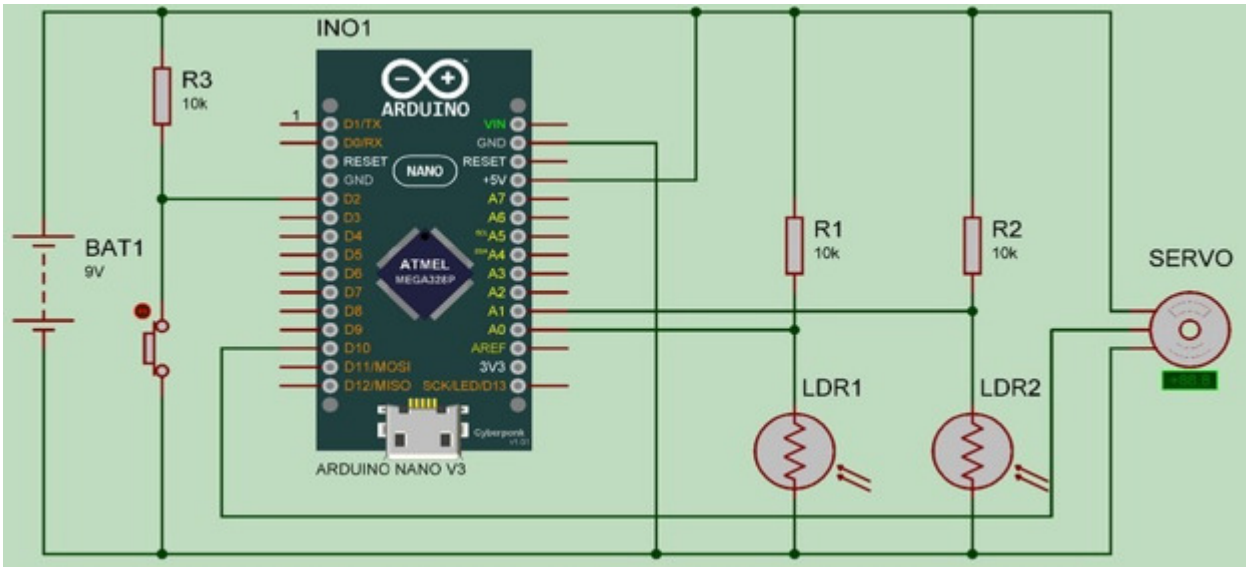


Figure2 *Circuit Diagram of Solar Tracking System*

The servo motor is fixed with the axis of the panel which adjusts it so as to track the position of the sun using LDRs. A dual-axis/dynamic solar tracking system may be employed in order to increase the power yield for bigger bus stands such as the roadways bus stand.

Now, this energy is fed to a 12V battery which stores it for other operations in this model. The stored power is used by the controller and LDRs in the above circuit to function and even the motor driver system is driven by it.

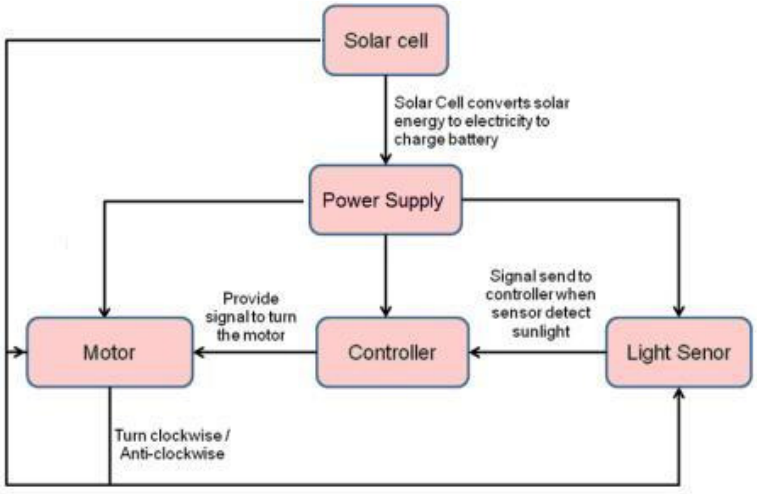


Figure3 *illustrates different operations (of LDRs, ArduinoNano, Motor Driver) being driven by the same power supply.*

The second module is that of a water abstraction system which uses a moisture sensor to detect the water present under the ground and motors to draw this groundwater for the urinals. The amount of water required for a functioning urinal will be accounted for by a soil moisture sensor made from very easily and cheaply available Gypsum.

The use of single-axis tracking can increase the electricity yield by as much as 27 to 32 percent. To ensure the optimal utilization of this energy is critical to the functioning of this model. A passive infrared (PIR) motion detector is installed in the bus stand that senses the presence of any passenger and switches the lights and fans on and off, accordingly. The microcontroller is preprogrammed to coordinate all these operations by receiving different signals from the LDRs and the moisture and PIR sensors. Relay is used where several circuits must be controlled by one signal.

PROPOSED ARCHITECTURE:

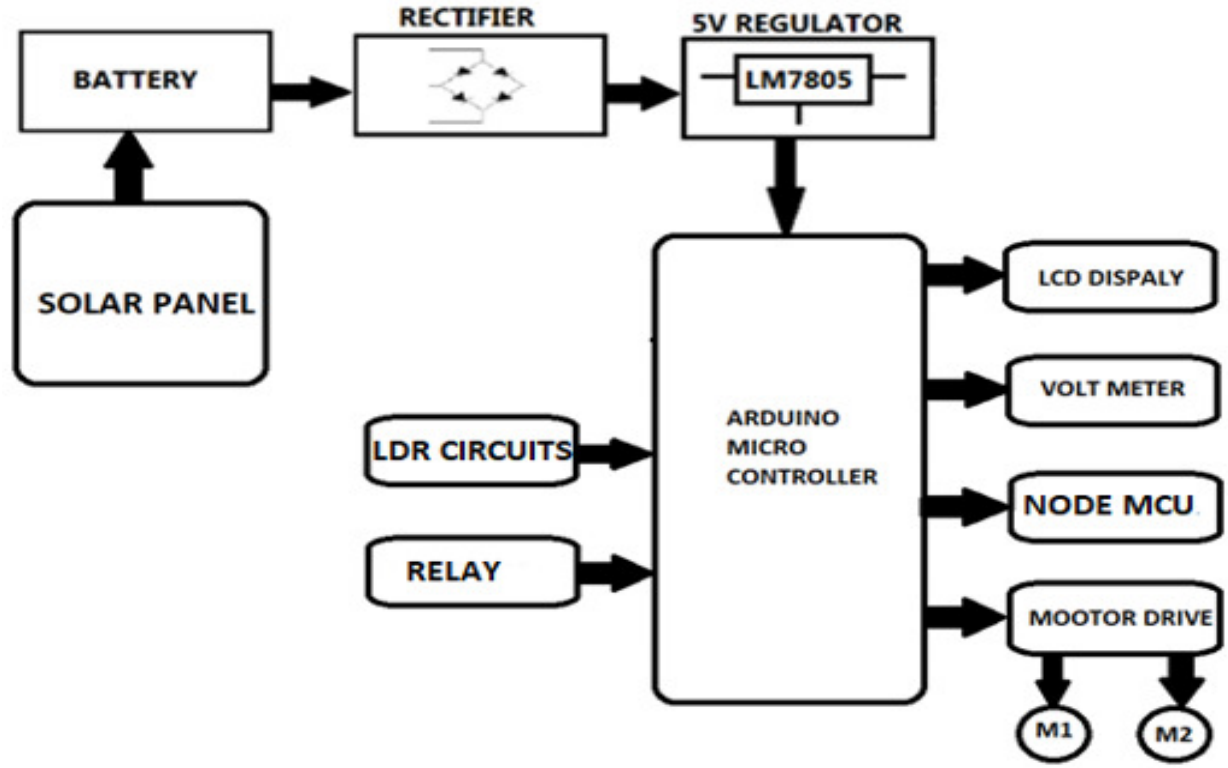
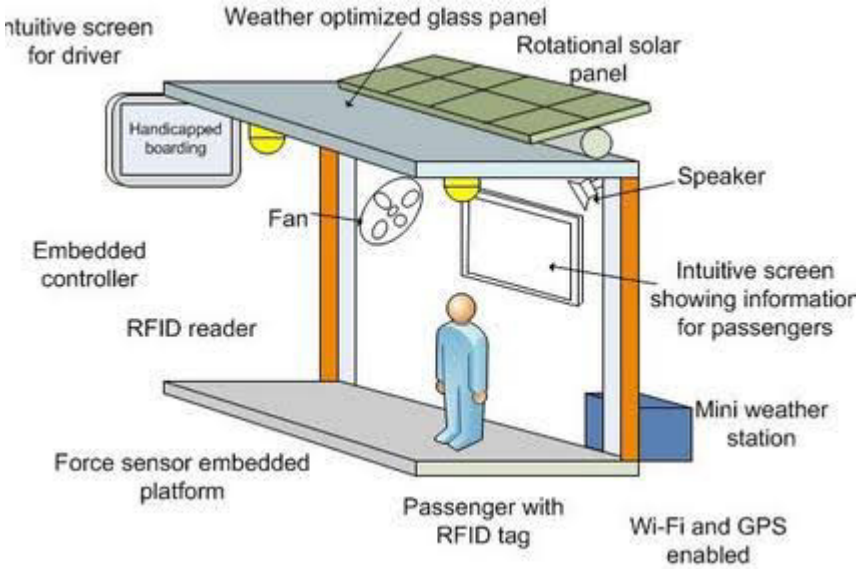


Figure4 *This is the proposed architecture which gives some overview of the Smart Bus Stand.*

In this architecture, we have the solar tracking panel, battery, Arduino controller, and L293D motor driver IC. M1 and M2 are pumps that are driven by this IC to draw groundwater. This water is stored and supplied for usage on the bus stand.



RELATED WORK:

A. **Power Generation**: The essence of this project is to utilize renewable sources of energy instead of consuming grid power. The tracking system in the heliostat makes sure to capture the maximum intensity of sun rays and hence provides us with an increased yield for the overall operation of the model.

B. **Water Abstraction**: When the battery is charged by solar energy, it can be used to drive the irrigation setup accompanied by the sensor circuits to fetch the water underneath the ground which is to be stored and supplied to the urinals complemented with the bus stand.

C. **Basic Amenities**: The bus stand provides other basic amenities like lighting, fans, and charging sockets for travelers all of which are being automated by the use of sensors to determine whether the bus stop has passengers or is vacant.

EXPERIMENTAL HARDWARE:

Here, we have some images of the hardware that we used to implement the prototype for this project-

Figure5 *shows the value of moisture in soil on the LCD display*

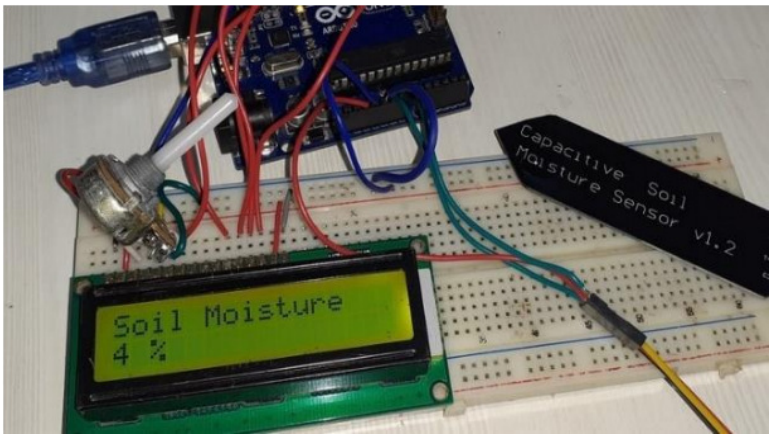
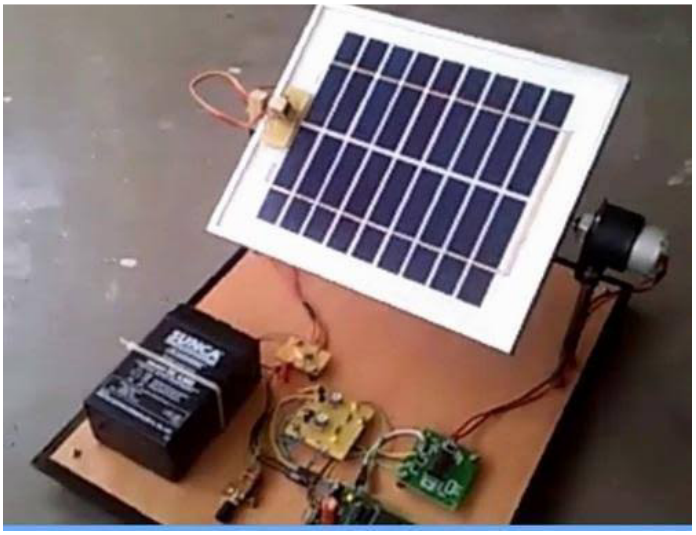


Figure6 *is the solar panel used to capture the sunlight*



RESULTS & DISCUSSION:

The main objective of this project is to modify the facilities in any bus stop infrastructure to meet the rising standards of hygiene and sanitation without any need for an operator to regulate the controls in the bus stand while utilizing the natural sources of energy in a well-optimized manner.

There are some results which come under this:

- The system is completely automated with the use of microcontrollers and sensors.
- The groundwater is used in the operation of the sanitary module.
- No energy is wasted since the lighting and fan system shuts itself off when the stop is vacant.

CONCLUSION:

In this Smart Bus Stand system which is controlled by Arduino microcontroller with the help of LDR, PIR & moisture detecting sensors we have eliminated the requirement for grid power by using solar power in its stead. We have also minimized the need for human control

since the model is fully automated. Due to this, we can achieve a better environment in this public infrastructure.

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